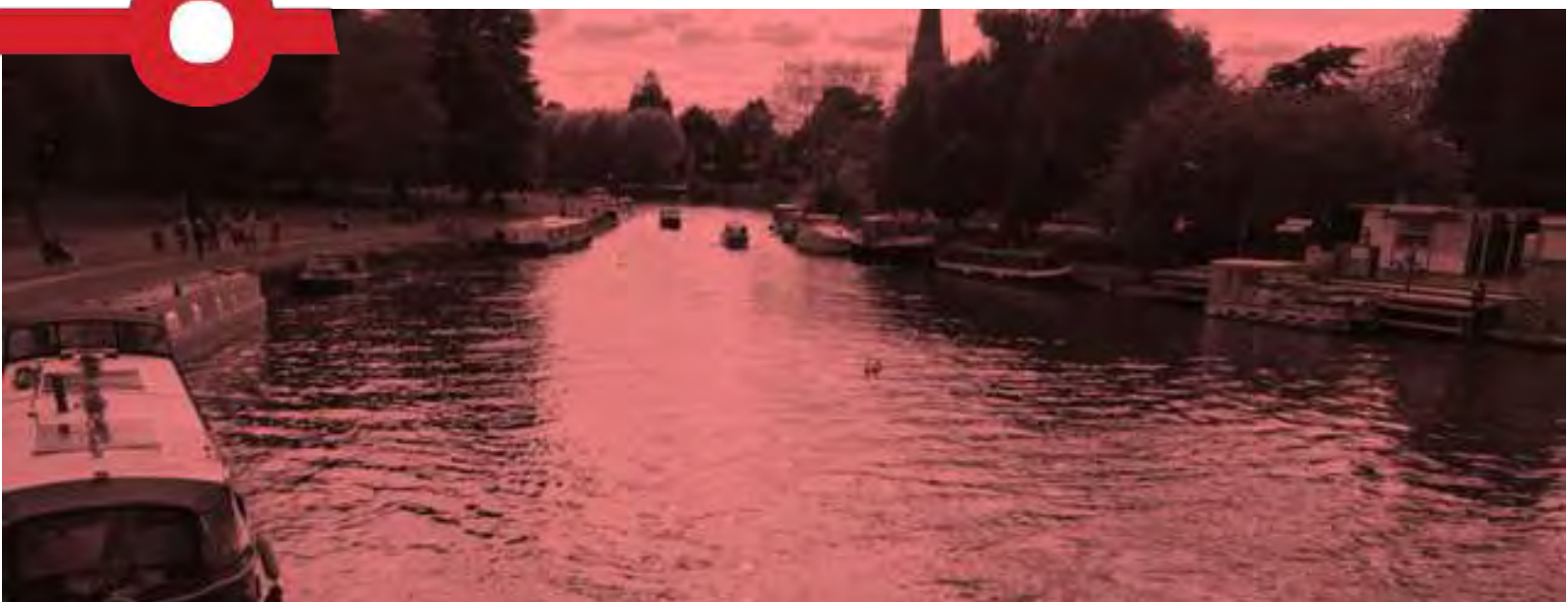




## FINAL REPORT



**SYSTRA**

# SUSTAINABLE TRANSPORT STUDY FOR THE ABINGDON TO OXFORD CORRIDOR

## FINAL REPORT

### IDENTIFICATION TABLE

<b>Client/Project owner</b>	Vale of White Horse District Council
<b>Project</b>	Sustainable Transport Study for the Abingdon to Oxford Corridor
<b>Study</b>	Final Report
<b>Date</b>	09/10/2017
<b>Reference number</b>	106380
<b>Number of pages</b>	98

### APPROVAL

Version	Name		Position	Date	Modifications
1	Author	JW	ATP	16/08/2017	
	Checked by	JB	PM	17/08/2017	
	Approved by	AS	PD	17/08/2017	
2	Author	JW	ATP	05/09/2017	Revision 1
	Checked by	JB	PD	05/09/2017	
	Approved by	JB	PD	05/09/2017	
3	Author	JW	ATP	09/10/2017	Revision 2
	Checked by	JB	PD	09/10/2017	
	Approved by	JB	PD	09/10/2017	

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## 0. EXECUTIVE SUMMARY

### 0.1 Introduction

0.1.1 SYSTRA Ltd has been commissioned by the Vale of White Horse District Council (VoWHDC) to undertake a sustainable transport study for the Abingdon to Oxford corridor. The study considers a number of sustainable transport options to support development growth, focusing primarily on three main corridors:

- Abingdon-A34-Oxford;
- Abingdon-Cumnor-Botley-Oxford; and
- Abingdon-Dalton Barracks-Fox Lane-Hinksey Hill-Oxford

### 0.2 Development Context

0.2.1 The level of development considered within this study comprises the following proposed allocations which are located within the Abingdon-on-Thames and Oxford fringe sub-area:

- **Local Plan Part 2 (LPP2) 2031** – Dalton Barracks (1,200 dwellings during the Plan period and potentially in excess of 4,000 dwellings in total), Marcham (90) and Kingston Bagpuize (600).

0.2.2 Consideration is also given to the following allocations from Local Plan Part 1 (LPP1) 2031:

- **Local Plan Part 1 (LPP1) 2031** – Didcot (3,350 dwellings), North Abingdon (1,000)<sup>1</sup>; Kennington (270), Radley (240) and Kingston Bagpuize (280).

### 0.3 Study Approach

0.3.1 The study has been completed in the following stages:

- **Stage 1** – A detailed review of the existing transport infrastructure within the Abingdon to Oxford corridors (Stage 1a), with a further assessment of the potential impacts of planned sustainable transport improvements (Stage 1b), prior to an option development process (Stage 1c) to identify measures to improve access to Abingdon and Oxford, in relation to planned growth areas;
- **Stage 2** – A desktop assessment of potential Park & Ride locations at Marcham interchange and Appleton as alternatives to those proposed within the Oxford Park & Ride Future Strategy Development Report<sup>2</sup> at Lodge Hill and Cumnor; and
- **Stage 3** – An appraisal of the transport interventions identified in Stage 1 to identify strong performing measures.

### 0.4 Stage 1a Existing Infrastructure

0.4.1 The existing sustainable transport conditions in the vicinity of the proposed development sites is summarised as follows:

- Bus services are currently provided across the Sub-Area, with radial routes serving Oxford and Abingdon having particularly frequent services. Kingston Bagpuize is well

<sup>1</sup> Note: The LPP1 allocation for North Abingdon was for 800 homes, however planning permission for a combined total of 950 homes has been granted.

<sup>2</sup> Oxford Park & Ride Future Strategy Development Report, Oxfordshire County Council, (May 2016)

served by the existing 66 bus service; currently services to Dalton Barracks and Marcham are less frequent, although all of the proposed LPP2 sites are close to existing bus services. The quality of bus stop facilities and the lack of real time passenger information have been identified as areas which require improvement across all three sites;

- For many rural settlements, particularly along the Fox Lane/Hinksey Hill corridor, unfavourable terrain for cycling and walking, coupled with limited bus services currently limits the use of sustainable transport;
- The existing Park and Ride facilities at Seacourt and Redbridge are well utilised and provide a direct route into Oxford, however they are subject to congestion issues on the approaches and are unlikely to be able to accommodate further planned growth without junction improvements or the addition of further remote facilities;
- The potential for cycling within the Sub-Area is currently limited to the Abingdon area; and
- The location of the proposed development sites highlights Dalton Barracks as a location where walking could be a key mode of travel for commuter and regular leisure trips. Shorter pedestrian trips to local bus stops at all three development sites should be incorporated into the development masterplans to ensure that walking can readily form the first and last mile of sustainable multi-modal trips.

## 0.5 Stage 1b Planned Improvements

0.5.1 To address potential constraints identified as part of the **LPP1**, and ensure future development will not have a significant impact on the issues identified, a number of land safeguarding schemes have been identified to support the delivery of the following identified transport schemes:

- South Abingdon-on-Thames Bypass linking the A415 to the west and south of the town, including a new River Thames crossing;
- Diamond Interchange at the A34 Lodge Hill Junction; and
- Land for improvements to Frilford Lights.

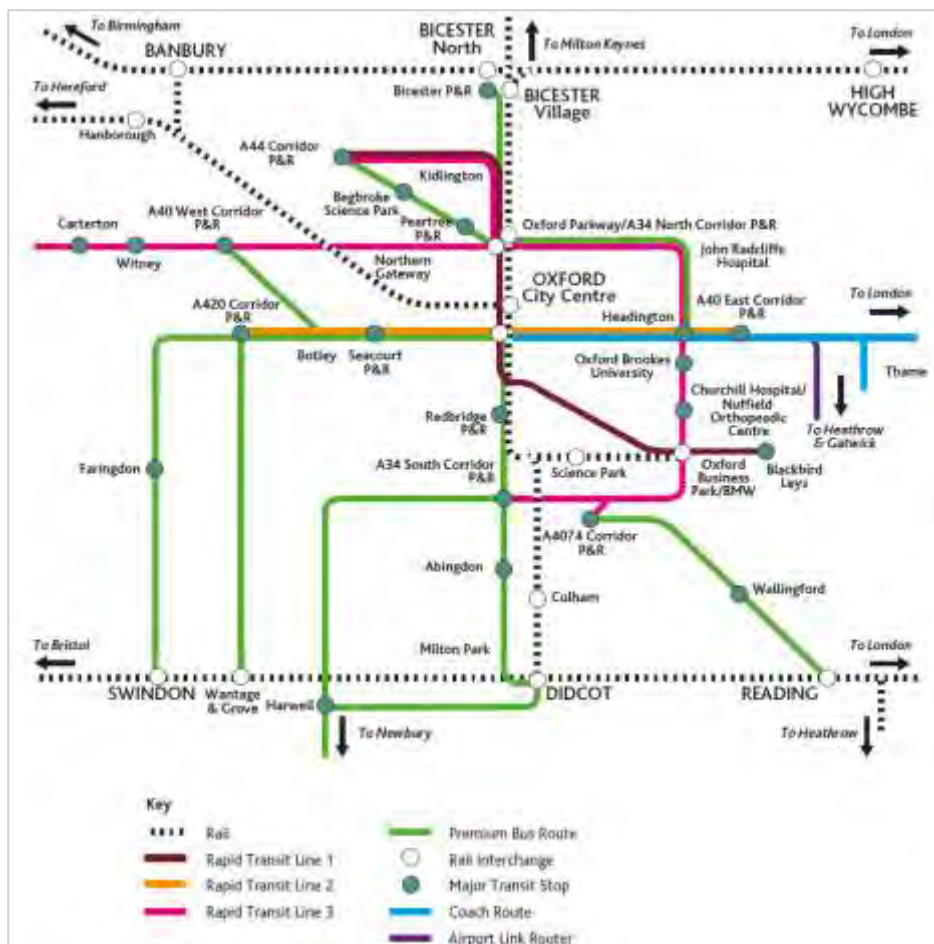
0.5.2 The **LPP2** is currently under preparation and will sit alongside the LPP1. It will set out the development management policies to complement the strategic policies included in LPP1 and policies and locations for housing to meet the Vale's apportionment of Oxford City's Unmet Need. As part of the on-going process the following schemes are also safeguarded in the Preferred Options version of LPP2, in accordance with CP12:

- Park and Ride site for accessing Oxford from the A420 corridor at Cumnor;
- Park and Ride site for accessing Oxford from the A34 corridor at Lodge Hill;
- Single carriageway north-bound bus lane between the Lodge Hill A34 Interchange and Hinksey A34 Interchange; and
- South Marcham Bypass linking the A415 to the west of Marcham and east of Marcham.

0.5.3 **Connecting Oxfordshire** is Oxfordshire County Council's (OCC) Local Transport Plan (LTP4) which sets out a number of proposed transport solutions for the county up to 2031 and beyond. Four key documents which outline OCC's position in relation to the development of sustainable transport improvements are summarised below:



- **The Science Transit Strategy**, which defines the high-level vision and outline roadmap for the development of better-integrated, high-quality mobility systems across Oxfordshire. An indicative future network map is shown in the figure below.



Source: Science Transit Strategy, Oxfordshire County Council, (June 2016)

- **The Bus & Rapid Transit Strategy**, which sets out how OCC will work to improve the main countywide bus network, developing rapid transit services, upgrading Premium services in the county and developing the commercial bus network;
- **The Rail Strategy**, which sets out OCC's ambition and priorities for rail investment, outlining the capacity and train services necessary to support growth in the county; and
- **The Active & Healthy Travel Strategy**, sets out OCC's ambitions for walking, cycling and Door to Door integrated travel.

0.5.4 Other potential future interventions for which assessment work has been carried out include:

- Oxford – Cambridge Expressway
- Future expansions of Park and Ride

## 0.6 Stage 1c Option Development

0.6.1 Based upon the outputs from Stage 1a and 1b, a full scheme optioneering process was carried out which identified an initial long-list of scheme measures that addressed the strategic objectives for enhancing sustainable transport provision across the Abingdon to Oxford



corridors. Utilising the outcomes of a gap analysis and preliminary appraisal process, improvement options were grouped into the following 10 packages:

- Package A – Access to Rail (Radley Station)
- Package B – Park & Ride (5 variants options)
- Package C – A34 Corridor
- Package D – Fox Lane/Hinksey Hill Corridor (3 elements)
- Package E – Dry Sandford to North Hinksey
- Package F – B4017 Corridor Enhancements
- Package G – A420 Corridor Enhancements
- Package H – Access to Abingdon
- Package I – Demand Management
- Package J – Improve ease of travel by Sustainable Travel

0.6.2 These were subject to a stakeholder ‘check and challenge’ process and refined into the following packages, representing the key priorities for improving the sustainable transport links within the Abingdon – Oxford corridor:

- Package A – Traffic Management
- Package B – Bus Improvements (focusing along 3 key spines together with P&R services)
- Package C – Active Travel
- Package D – Smart Mobility

## 0.7 Stage 2 Park & Ride Assessment

0.7.1 An assessment of the two Park and Ride Sites that currently serve the Abingdon – Oxford corridor (Redbridge and Seacourt) was carried out. This analysis was then compared to alternative sites proposed by OCC at Lodge Hill and Cumnor, and then further additional potential sites at Marcham, Appleton, and Kingston Bagpuize.

0.7.2 Whilst most of the sites offered a range of different potential positive benefits, that analysis concluded that, on the A34 corridor, the Lodge Hill site represents the most significant opportunity to encourage sustainable travel to/from the site and capture the most potential trips to alleviate highway congestion issues further north along the A34. In addition, with regard to the A420 corridor, the development of a park and ride facility at Cumnor will represent the most viable option to intercept trips travelling into Oxford whilst also serving as a key interchange hub for pedestrians, cyclists and public transport users to make use of the proposed BRT network.

## 0.8 Stage 3 Improvement Packages

0.8.1 The four packages identified in Stage 1c were developed in detail to ensure they provide immediate infrastructure enhancements but future proof the corridor by making preparation for technological advances on the near horizon. Whilst there are some key opportunities to improve infrastructure in the corridor through the traditional approaches of traffic management, public transport and active travel there is also the growing potential for smart mobility to provide solutions within the Local Plan period.

0.8.2 A number of the schemes within the Active Travel Package offer excellent value for money and have the advantage of being readily deliverable. This package should generally be prioritised for early delivery. The only exceptions would be the proposed new cross-county

cycle routes (AT6, AT10, and AT12) where land ownership issues and landscape environmental impacts are likely to make these more challenging to deliver, and so they should be scheduled accordingly.

- 0.8.3 Many of the high scoring measures within the bus package are conditional upon working in partnership with bus operators and/or OCC but all of these should be pursued at an early stage as bus provision will be an important element of overall sustainable travel offer for the Local Plan 2 development sites. The improved frequency of bus services (B1) will deliver significant benefits; however, it is acknowledged that this has notable on-going operational cost implications. As such, this enhancement will need to match the phasing of development to ensure sufficient demand, albeit ensuring that provision is in place prior to occupancy rather than lagging behind, when new residents may have already settled into alternative (less sustainable) travel patterns.
- 0.8.4 The Dalton Barracks to Lodge Hill busway (B2) could offer significant potential, particularly when considered alongside the wider delivery of BRT routes across Oxford. Whilst there could be challenges in terms of deliverability, this would clearly provide a direct and efficient route to a public transport interchange at Lodge Hill, into Oxford itself and employment sites to the east of Oxford, as well as on to other connective services.
- 0.8.5 The SMART mobility package generally engenders good performing measures, many of which require relatively low investment. Again, these schemes mainly require partnership working to deliver but they will work well with new development sites that provide a targeted market with which to apply the measures.
- 0.8.6 The traffic management measures focus primarily on Frilford junction, providing benefits to the Kingston Bagpuize development (and some benefits to Marcham). However, further work is required in relation to the specific requirements of development sites to ensure that traffic management improvements are carried out in line with local needs.

# 1. INTRODUCTION

## 1.1 Context

1.1.1 SYSTRA Ltd has been commissioned by the Vale of White Horse District Council (VoWHDC) to undertake a sustainable transport study for the Abingdon to Oxford corridor. The study considers a number of sustainable transport options to support development growth within the Abingdon-on-Thames and Oxford fringe sub-area, focusing primarily on three main corridors:

- Abingdon-A34-Oxford;
- Abingdon-Cumnor-Botley-Oxford; and
- Abingdon-Dalton Barracks-Fox Lane-Hinksey Hill-Oxford.

1.1.2 The study considers the implications of the proposed allocation of housing development within the Vale of White Horse Local Plan 2031 Part 2 and the interaction with key employment hubs, including Oxford City Centre, Oxford Business Park, Abingdon Town Centre, Milton Park, Culham Science Centre, Abingdon Science Park and Harwell Campus.

1.1.3 In order to provide a robust assessment of the existing and potential sustainable transport infrastructure within the corridor the following stages have been completed:

- **Stage 1** – A detailed review of the existing transport infrastructure within the Abingdon to Oxford corridors, to identify the main constraints (Stage 1a), followed by a further assessment of the potential impacts of planned sustainable transport improvements, including public transport service enhancements and Park and Ride improvements (Stage 1b). An option development process (Stage 1c) to identify a range of potential measures to improve access to Abingdon and Oxford, in relation to planned growth areas;
- **Stage 2** – A desktop assessment of remote Park & Ride locations at Marcham interchange and Appleton as alternatives to those proposed within the Oxford Park & Ride Future Strategy Development Report<sup>3</sup> at Lodge Hill and Cumnor. This includes an assessment into the feasibility of linked trips with other public transport improvements; and
- **Stage 3** – An appraisal of the transport interventions identified in Stage 1 to identify strong performing measures. A key aspect is ensuring that the measures are in line with the aspirations of the Local Plan Part 1, Local Plan Part 2, and Connecting Oxfordshire (LTP4).

## 1.2 Study Report

1.2.1 This report has been produced following the completion of Stage 1, Stage 2 and Stage 3 of the study and provides a summary of the existing opportunities and constraints surrounding the provision of sustainable transport solutions in the Sub-Area. In addition to outlining the existing baseline conditions within the study region this report also includes a number of improvement measures that have been designed to create and enhance sustainable transport opportunities for the residential developments outlined in the Vale of White Horse emerging Local Plan Part 2.

<sup>3</sup> Oxford Park & Ride Future Strategy Development Report, Oxfordshire County Council, (May 2016)

## 1.3 Development Context

1.3.1 The level of development considered within this study comprises the following proposed allocations which are located within the Abingdon-on-Thames and Oxford fringe sub-area:

- **Local Plan Part 2 (LPP2) 2031** – Dalton Barracks (1,200 dwellings during the Plan period and potentially in excess of 4,000 dwellings in total), Marcham (90) and Kingston Bagpuize (600).

1.3.2 Consideration is also given to the following allocations from Local Plan Part 1 (LPP1) 2031:

- **Local Plan Part 1 (LPP1) 2031** – Didcot (3,350 dwellings), North Abingdon (1,000); Kennington (270), Radley (240) and Kingston Bagpuize (280).

1.3.3 In addition to the proposed allocation of development as part of the Local Plan, key employment hubs for people living within the Vale such as Oxford Business Park, Abingdon Town Centre, Milton Park, Culham Science Centre, Abingdon Science Park and Harwell Campus have been included within this analysis.

1.3.4 A summary of the key planned developments in addition to key employment sites is provided in Figure 1.

**Figure 1 Planned Developments & Current Key Employment Sites**



1.3.5 The Oxfordshire Strategic Economic Plan<sup>4</sup> identifies Science Vale as a key growth area on the 'Oxfordshire Knowledge Spine' with the potential to generate approximately 15,850 or 70% of the 23,000 new jobs forecast for the district up to 2031<sup>5</sup>. The Science Vale, an area to the south-east of Vale of White Horse District which extends east-west from Culham and Didcot

<sup>4</sup> Oxfordshire Local Enterprise Partnership (LEP) (2014) Strategic Economic Plan- <http://www.oxfordshirelep.org.uk/>

<sup>5</sup> Economic Forecasting to Inform the Oxfordshire Strategic Economic Plan and Strategic Housing Market, Assessment' (Cambridge Economics February 2014)

to Wantage and Grove, will provide scientific and research jobs at the two Enterprise Zone sites at Harwell Campus and Milton Park as well as general business employment growth in Grove, Didcot and Wantage. Further to this, the concentration of high-tech industries within the Science Vale attracts employees from a wide catchment area, in addition to national and international business trips.

- 1.3.6 The Oxfordshire Bus & Rapid Transit Strategy has indicated that the Science Vale area generated approximately 47,000 commuter journeys in 2011. Although a high proportion of employees live within the area, over 62% of internal commuters and 82% of external commutes were car drivers, with bus travel accounting for only 4% of employees journeys to work. Despite key employment centres at Harwell Campus, Culham Science Centre and Milton Park being located outside of the Abingdon and Oxford fringe sub-area, commuting trips will be made to them from residential developments within the sub-area including Dalton Barracks, Marcham and Kingston Bagpuize, therefore sustainable transport options should be provided to ensure an enhanced modal choice for commuting trips to these key employment areas.
- 1.3.7 Further to this, as identified in the Oxfordshire Bus & Rapid Transit Strategy, the majority of travel demand within the Knowledge Spine tends to be dispersed and complex, ranging from a wider number of origin locations which makes it difficult to serve with single-stage bus services. With substantial employment and residential growth planned up to 2031, travel patterns are likely to become increasingly decentralised as they stem from a wider number of origin points to an increased number of destinations both within the Vale and further afield. In order to serve this growth in demand and cater for the dispersed travel patterns, the inter-urban bus network plays a crucial role alongside other potential sustainable transport solutions to adapt and capture these non-radial patterns.



## 2. STAGE 1A - EXISTING INFRASTRUCTURE

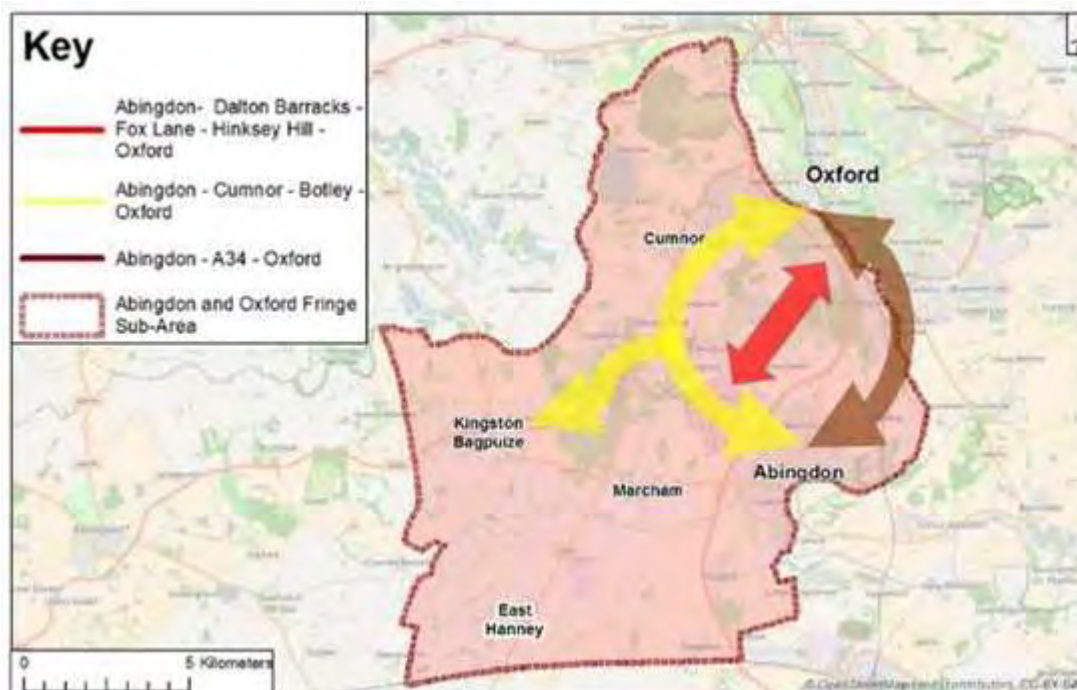
### 2.1 Introduction

- 2.1.1 This section of the report outlines the existing or baseline transport conditions within the Abingdon–Oxford corridor. The baseline conditions need to be established to fully understand the strengths and weaknesses of the existing sustainable transport infrastructure and to fully understand the associated transport impacts in line with the proposed level of growth within the area.

### 2.2 Study Area

- 2.2.1 As mentioned, the study shall assess the existing sustainable transport infrastructure within the Abingdon-on-Thames and Oxford fringe sub-area, focusing specifically on the three main strategic corridors as shown in Figure 2.

Figure 2 Study Area



#### Abingdon-on-Thames and Oxford Fringe

- 2.2.2 This area, which will provide the outline focus for this study, covers the northern and north eastern parts of the Vale of White Horse District. The area contains the market town of Abingdon, the local service centre of Botley, several larger villages including Cumnor, Drayton, East Hanney, Kennington, Kingston Bagpuize and smaller villages including Southmoor, Marcham, Radley, Steventon and Wootton. The area has strong linkages to Oxford from the south and west through the A420 and A34 as well as the Great Western Rail (GWR) line which routes along the eastern boundary of the study area from Didcot in the south to Oxford in the north.

## 2.3 Highways Infrastructure

- 2.3.1 As outlined in LTP4 Science Vale Area Strategy, the ‘Knowledge Spine’, which connects Science Vale to Oxford and Bicester will be the focus of considerable employment and residential growth in Oxfordshire up to 2031. The A34, which underpins this corridor, is already heavily congested, especially during the AM and PM peak hours. However, with the exception of the A420 it remains the only suitable strategic road to provide adequate connectivity to the main growth areas within the Vale. Whilst the current road network will make it difficult to accommodate more vehicle movements within the corridor, a strategically planned public transport network will help alleviate the development growth on the corridor and limit further issues of congestion and road safety.
- 2.3.2 The A34 provides access to Birmingham, and Southampton ports, placing it as a strategic route to facilitate the transfer of knowledge and services within and across the region. Reliable access to and along key routes such as this are crucial to develop the growth within Science Vale and support the global nature of business within the region. There has already been significant investment to improve key junctions of the A34 in order to enhance access to the Vale at Chilton Interchange and Milton Interchange. In addition, an upgrade to the Lodge Hill Interchange, to introduce south-facing slips, has recently been approved for funding by Central Government, with a provisional delivery date by 2020.
- 2.3.3 The Evaluation of Transport Impacts report, prepared for Part 2 of the VoWH Local Plan, tested three Local Plan Options to indicate any highway performance and network capacity issues. Option 2, which comprised the development of 3,450 new dwellings (including 1,200 at Dalton Barracks, 120 at Marcham and 600 East of Kingston Bagpuize) provided the most representative Option for this study.
- 2.3.4 Between the 2013 Base Year and the 2031 Do Minimum Option, overall travel demand for all districts is forecast to grow by 36% over a 12-hour period. Between the 2031 Do Minimum Option and Local Plan Option 2, overall demand is estimated to increase by 0.7% and overall delay per passenger car unit (pcu) is forecast to increase by less than ten seconds.
- 2.3.5 Specifically in relation to the A34 the growth in Option 2 would lead to a 7% increase in delays on the A34 corridor during the AM peak and a 9% increase during the PM peak when compared to the 2031 Do-Minimum scenario.
- 2.3.6 The ETI report provides a robust assessment into the scale of development trips that will be generated within the corridor. Highway capacity issues have been identified at key interchange points, even in the Do Minimum scenario, such as Botley Interchange, Hinksey Hill Interchange which would further increase journey times for private car, Park & Ride and non-Park & Ride bus users at these locations. The transformation of Lodge Hill to provide south-facing slip roads (now a committed scheme), alongside the provision of a northbound bus lane on the A34 (route safeguarded within the LPP2), are examples of schemes that can help to alleviate these issues.
- 2.3.7 As outlined in the Science Vale Transport Strategy (2016) the transformation of Lodge Hill into a full movement interchange will help to accommodate the additional traffic generated through housing growth to the north of Abingdon in addition to improving accessibility to the trunk road network and reducing congestion in Abingdon town centre.



## 2.4 Public Transport Infrastructure

### Bus Services

- 2.4.1 Oxford currently has one of the most highly-developed and successful commercial bus networks in the country, with one of the highest rates of bus patronage growth in England and the South-East region. Through major priority improvements to the inter-urban bus network in addition to an integrated ticketing scheme, bus patronage within Oxford currently accounts for 17% of trips; 9% higher than the national average. However, in the more rural districts the bus network is much less developed, with bus patronage being substantially lower outside of Oxford.
- 2.4.2 Oxfordshire County Council no longer provide financial support for bus routes, which has led to the withdrawal of most routes previously reliant on this support. These withdrawn routes tend to be less frequent local and rural routes, and although only used by a small proportion of bus passengers, have left some areas no longer accessible by bus.
- 2.4.3 Within the Vale of White Horse District alone, bus usage accounts for a relatively small proportion of journeys to work with only 6% of trips undertaken by bus; 2% lower than the national average and 11% lower than the average for Oxford. Whilst the modal share is lower than Oxford, the Vale comprises a large number of rural settlements such as Wootton, Dry Sandford and Sunningwell where bus services are currently limited to a single service or non-existent. As such, private car use remains the most convenient and accessible mode of travel for rural settlements due to the limited accessibility to public transport and the variety and frequency of services.
- 2.4.4 However, there are large variations in the level of bus usage across the Vale, especially amongst larger towns such as Abingdon and Faringdon, which are served as part of a wider bus network (as shown on Figure 3). As outlined in Table 1, an analysis of 2011 Journey to Work data indicates that Abingdon has a higher modal share for bus users when compared to the Vale as a whole. Whilst private car use remains the most common mode of choice for commuters, Abingdon is served by a higher number of bus services which provide more frequent and direct services to Oxford, Didcot, Grove and wider Science Vale, therefore making it a more attractive and viable mode of choice.
- 2.4.5 A summary of the travel patterns for Journeys to Work from Abingdon is summarised in Table 1.

**Table 1 Abingdon Journey to Work Data**

MODE	ALL DESTINATIONS	WITHIN ABINGDON	TO OXFORD CITY	TO SCIENCE VALE
Total Trips	15,280	4,902 (32%)	3,673 (24%)	1,539 (10%)
% Car	63%	44%	62%	78%
% Car Passenger	5%	5%	4%	6%
% Bus	9%	3%	25%	8%

MODE	ALL DESTINATIONS	WITHIN ABINGDON	TO OXFORD CITY	TO SCIENCE VALE
% Rail	2%	0%	1%	0%
% Walk	10%	28%	1%	1%
% Cycle	10%	19%	5%	5%
% Other	1%	1%	2%	2%

2.4.6 Table 1 highlights the three most common employment destinations by Abingdon residents according to 2011 Journey to Work data. The data indicates a significant proportion of trips from Abingdon to Oxford City region (25%) are carried out by bus which would be likely to utilise existing services such as the X2 and X3 bus services. This data is reflective of the well-established radial routes which already serve this corridor with frequent and direct services throughout the day. In comparison, only 8% of total trips to Science Vale are carried out by the existing bus services, representing a significantly lower modal share when compared to commuter trips into Oxford. Although Abingdon represents a significant employment catchment for the Science Vale, public transport connections between key employment hubs and the Town are not reflective of this demand with services limited to the 32A service which operates on an hourly frequency, the 34 service which only operates during peak hours and the X2 service which operates two services per hour. Existing services are in operation between Abingdon and Science Vale, however the proximity via the A34 coupled with the provision of parking spaces at key employment sites such as Milton Park and relatively low existing bus services make private car use the most attractive and convenient mode of travel for journeys between these two points.

2.4.7 Building on the modal share for bus users across the Vale, Table 2 summarises the existing bus services in operation within the Abingdon to Oxford Fringe sub-area. The sub-area is currently served by numerous bus routes which provide connections to Oxford, Abingdon, Swindon and Didcot in addition to local and less frequent local services. The X3 and X13 service between Abingdon and Oxford via Redbridge Park and Ride is the highest frequency route in the area operating up to every ten minutes. The frequency of other routes is lower, ranging from every 20 minutes to hourly with certain connector services such as the 34 and X34 providing AM and PM peak services only.

**Table 2 Existing Key Bus Services**

NO.	ROUTE	WEEKDAY			WEEKEND	
		Approx. Frequency	Service Times		Approx. Frequency	
			First Bus	Last Bus	Sat	Sun
4/4B	Abingdon - Cumnor - Oxford City Centre - Wood Farm	30 mins	05:57	23:30	Hourly	Hourly
15	Abingdon - Marcham - Kingston Bagpuize - Witney	2 Hours	08:30	17:55	2 Hours	No Service

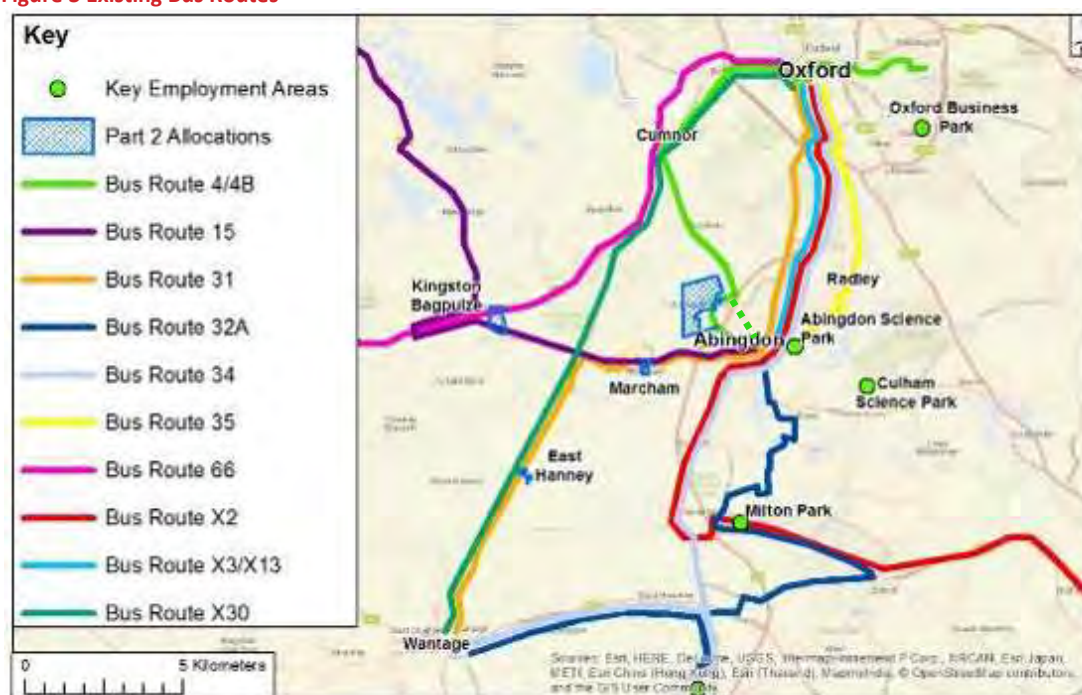
NO.	ROUTE	WEEKDAY			WEEKEND	
		Approx. Frequency	Service Times		Approx. Frequency	
			First Bus	Last Bus	Sat	Sun
31	Oxford - Abingdon - Grove - Wantage	Hourly	06:15	00:00	Hourly	Hourly
32A	Abingdon - Didcot - Wantage	Hourly	06:21	19:23	Hourly	No Service
34	Oxford - Abingdon - Harwell Campus - Wantage	2 AM & 2 PM Peak services	06:55 (outbound)	17:40 (Return)	No service	No service
35	Abingdon - Radley - Kennington - Oxford	20 mins	05:40	00:03	20 mins	40 mins
66	Swindon - Faringdon Kingston Bagpuize -Oxford	20 mins	05:05	22:00	20 mins	30 mins
X2	Oxford - Abingdon - Milton Park - Didcot - Wallingford	30 mins	04:40	23:30	30 mins	Hourly
X3/X13	Abingdon - Oxford City Centre - Oxford Rail Station	10 mins	05:30	00:00	10 mins	15 mins
X30	Wantage - Grove - Cumnor - Oxford	30 mins	06:45	19:05	30 mins	Hourly
X34	Oxford – Harwell Campus connector	2 AM & 2 PM Peak services	08:07 (outbound)	18:25 (return)	No service	No service

- 2.4.8 As aforementioned, radial routes between Abingdon and Oxford are currently well served through services such as the X2 and X3 which route via the A34 in addition to the 35 service which routes via Radley and Kennington. As identified in Table 1, this high level of service is well utilised; reflected through the high percentage modal share for bus users travelling from Abingdon to Oxford for commuter purposes. However, services to key employment areas within Science Vale such as Harwell Campus and Milton Park operate on a much lower frequency with the former requiring interchange for regular routes originating from outside Oxford or Didcot.
- 2.4.9 Harwell Campus is served by direct buses from Didcot and Oxford through the Connector X32 and Connector 98 services which run every 15 minutes from Didcot and hourly from Oxford. Direct access from Abingdon is largely restricted to the 34 and 32A bus services. The 34 bus provides a relatively short end-to-end bus journey of approximately 21 minutes, however frequency is limited to two outbound services in the AM peak and two return services in the PM peak. The 32A bus service does operate in-between the peak periods and operates on an hourly frequency, however end-to-end journey times are up to 60 minutes, making the 32A an unattractive option for journeys originating in Abingdon. Services such as the 31 and X2 can be used to access Harwell Campus, however these require an interchange at Oxford City Centre or Didcot Parkway, making their use an unattractive and inconvenient mode of travel for journeys to Harwell Campus. It should be noted that a more direct route from Abingdon/Dalton Barracks to Harwell could be developed but this would require significant demand from Harwell Campus due to its remote location. Further local analysis into employee

travel behaviours and bus patronage levels would be needed to justify an enhancement to the level of service, including additional travel surveys to ascertain the existing and potential demand be undertaken).

- 2.4.10 Milton Park, a key employment hub within the Science Vale, is also served by the 32A and X32 bus services which provide a direct bus route from Abingdon. Both services provide end-to-end journey times of approximately 20 minutes from Abingdon and have a combined frequency of 3 services per hour. Milton Park is also served by the M10 shuttle bus service which provides a ‘turn up and go’ frequency between 10-15 minutes between Didcot Parkway and Milton Park as well as the X32 service which provides hourly services from Oxford.
- 2.4.11 Further to this, Thames Travel, Oxford Bus Company and Stagecoach are now adopting innovative technologies in the form of contactless payment, mobile ticketing and smart cards in line with national developments. These improvements provide an opportunity to improve the overall journey time reliability by reducing boarding times for bus users.

### Figure 3 Existing Bus Routes



- 2.4.12 As shown in Figure 3, the Abingdon – Oxford Fringe sub-area has a number of bus services operating on radial routes between Abingdon and Oxford which utilise the A34 to provide direct services such as the X2, X3 and 34 bus services. To the west of the sub-area, the 66 bus service provides a route from Swindon to Oxford via the A420, incorporating Faringdon, Kingston Bagpuize and Cumnor through a frequent 20 minute service. Cross corridor movements are largely restricted to the 15 and 31 bus services which route along the A415 from Abingdon to Marcham, however as identified in Table 2 these services are of low frequency which further promotes the use of the private car for cross corridor movements.

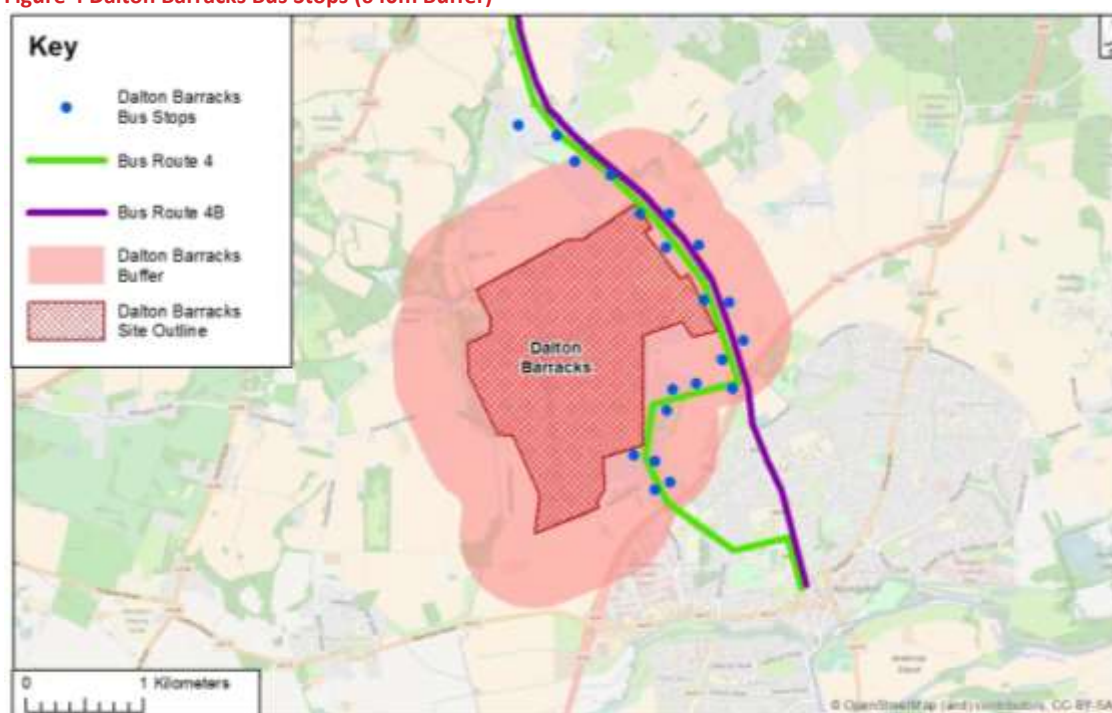
## Dalton Barracks

- 2.4.13 The number 4/4B service, which is operated by Oxford Bus Company, provides a combined frequency of two services per hour between Abingdon and Oxford via Wootton Road. As shown on Figure 4, the 4 service incorporates the Dalton Barracks site via existing bus stops

on Long Tow and Cholswell Road before routing on to Faringdon Road for access into Abingdon. The 4B service routes along Wootton Road, avoiding the Long Tow/Cholswell Road/Faringdon Road circular route to provide a more direct route between Abingdon and Oxford. The 4 and 4B routes run alternatively on a 30 minute frequency, however the variation in routes surrounding Dalton Barracks means that the site itself is served on an hourly frequency. As shown on Figure 4 (Dalton Barracks), Figure 5 (Marcham) and Figure 6 (Kingston Bagpuize), 640m catchment areas have been produced around each site to demonstrate the extent to which current bus provisions will serve the site. For Dalton Barracks, there are four existing bus stops on Long Tow within the 640m buffer of which three are bus flag facilities and one is provided with a poorly maintained concrete shelter. There are two further bus stops on Cholswell Road, both of which are provided with shelters. Real time passenger information is not provided at any of the stops serving the Dalton Barracks site. It is of note that these stops would not support the increase in demand stemming from further development and would require additional capacity measures in the form of enhanced waiting area facilities and RTI to make them suitable for use.

- 2.4.14 To the north of Long Tow, additional bus stops are provided in both directions along B4017 Wootton Road. These stops are served by the 4 and 4B service which provides a combined frequency of two services per hour in either direction. For the purpose of this assessment it has been assumed that the phasing of development at Dalton Barracks will stem from the south and make use of the Barrow Road and Long Tow existing accesses for the first phase of development.

Figure 4 Dalton Barracks Bus Stops (640m Buffer)



## Marcham

- 2.4.15 The proposed development for 90 dwellings at Marcham is currently supported by the 31 bus service which routes from Wantage and Grove to Oxford via Marcham and Abingdon. As indicated in Table 2, the 31 service currently operates on an hourly frequency which provides



connections to Wantage, Abingdon and Oxford. The Village is also served by the 15 service which operates on a lower frequency (every 2 hours Mon-Sat) and routes north to Witney via Kingston Bagpuize and east to Abingdon via Marcham Road. As shown on Figure 5, Marcham currently has 10 bus stops (five inbound and five outbound) of which two are located within 150m from the centre of the site on Howard Cornish Road. The existing stops are in the form of bus flags, provided with timetabling information.

- 2.4.16 Due to the close proximity of the development to the existing bus stops, pedestrian and cycle links to Howard Cornish Road should be incorporated into the development masterplan at Marcham to create a permeable route for residents to travel sustainably door-to-door. The provision of a further bus stop facility to the south of the carriageway on A415 Marcham Road should also be considered for within the detailed masterplan of the site to ensure future residents can access bus services without the need to cross the carriageway. In addition, frequency improvements to the 15 and 31 bus services and bus stop enhancements in the form of waiting area shelters, real-time information and service branding would need to be explored to facilitate the development at Marcham.

**Figure 5 Marcham Bus Stops (640m Buffer)**



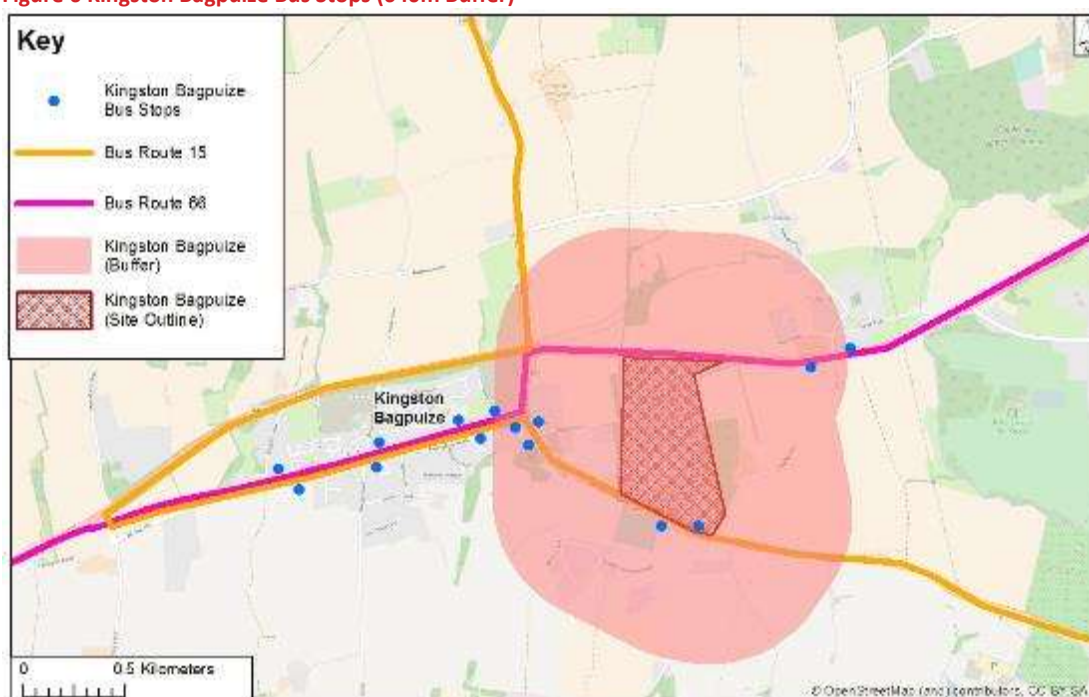
### Kingston Bagpuize

- 2.4.17 Further development for 600 homes in Kingston Bagpuize is currently supported by the number 15 and 66 bus services which connect the site to Swindon, Abingdon, Oxford and Witney. The closest bus stops for the 66 service are on Faringdon Road (approximately 640m from the centre of the site); connections to these bus stops would route along Oxford Road which currently has no footway facilities on either side of the carriageway. These bus stops are currently in the form of bus flags and have no formal waiting areas or real time passenger information. In addition, they are in excess of 400m from the development site which does not comply with The Institute of Highways and Transportation's (IHT) Guidance for Providing for Journeys on Foot (2000). Alternatively, there are two existing bus stops along the A420 (approximately 700m and 850m) from the centre of the site. These stops are in excess of IHT

guidelines, and are of low quality in the form of a bus flag (westbound) and a small wooden shelter (eastbound). Although the westbound bus stop could be reached via an existing track adjacent to the A420, this route would require infrastructure improvements in addition to a formal crossing facility for access to the bus stop on the northern side of the carriageway. The potential to route buses through the Site should be explored with the bus operator.

- 2.4.18 The closest bus stops for the 15 bus service are located adjacent to the site boundary on the A415. These stops are in the form of bus flags and have no formal waiting area, shelter or real time passenger information. Although the 15 bus service provides a lower frequency than the 66 service (every 2 hours), the existing bus stops could easily be incorporated into the site through the inclusion of pedestrian and cycle links as part of the development masterplan.

**Figure 6 Kingston Bagpuize Bus Stops (640m Buffer)**



### Further Developments

- 2.4.19 Development proposals for 900 dwellings and 50 retirement homes to the north of Abingdon (P17/V0050/O)<sup>6</sup> have recently been approved, subject to the delivery of the south-facing slip roads at the A34 Lodge Hill Interchange. At the time of writing, S106 and S278 proposals were subject to conditions but proposed a developer funded extension of the existing 35 bus service to provide a revised route covering Dunmore Road and Twelve Acre Drive to the north of Abingdon. Proposals also included additional bus shelters on Oxford Road, Dunmore Road and Twelve Acre Drive in addition to real time information boards for all associated bus stops.

### Rail Services

- 2.4.20 Due to the location of Local Plan Part 2 allocations at Dalton Barracks, Kingston Bagpuize and Marcham, rail is unlikely to be considered as a high priority mode of travel for journeys within

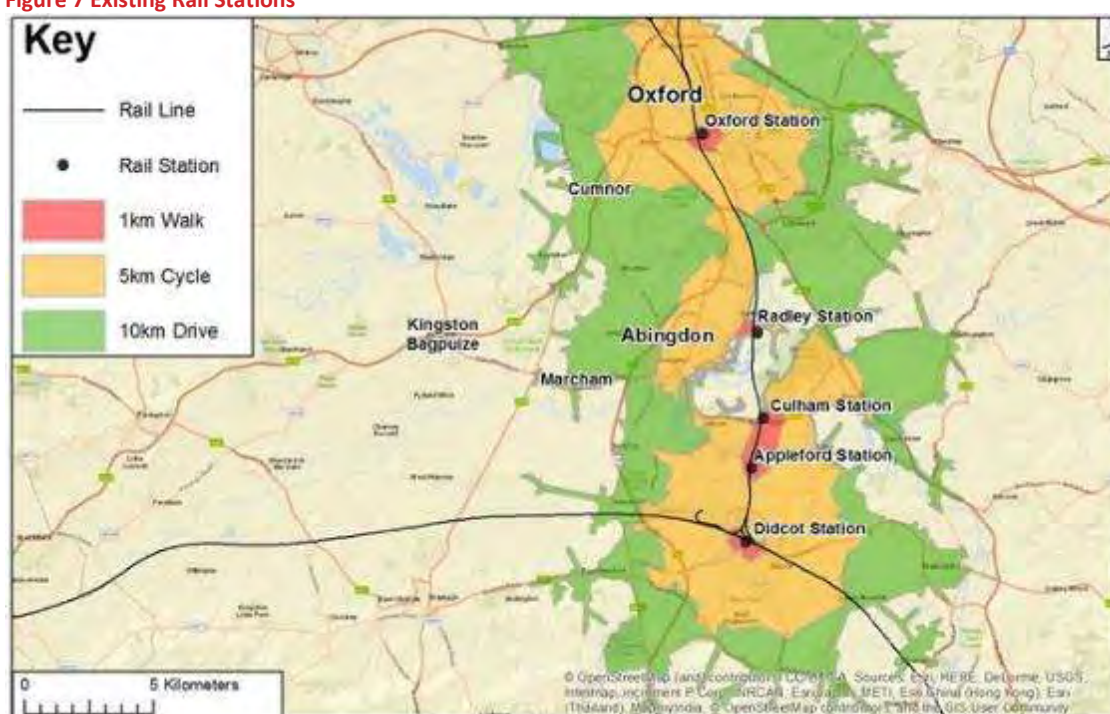
<sup>6</sup> Note: The LPP1 allocation for North Abingdon was for 800 homes, however planning permission for a combined total of 950 homes has been granted.



the sub-area. However, for longer distance journeys to London and Reading, rail is considered a viable option that can form part of a multi-modal trip, linking to existing bus, cycle and pedestrian routes that form the first and last mile of the overall trip.

- 2.4.21 As shown in Figure 7, Radley Station serves as the only rail station within the Abingdon and Oxford fringe sub-area. However, within the vicinity of the sub-area are Oxford and Didcot Parkway stations which both serve as main interchange hubs for the region. Culham and Appleford Stations are also located within the vicinity of the sub-area, however services from these stations are irregular outside of weekday peak periods. Further to this, data from The Office of Rail and Road estimated a total of 59,958 journeys were made from Culham in 2015/16 whilst only 7,750 journeys were made to or from Appleford which indicates that neither station provides an attractive service for commuting. For the purpose of this assessment the role of Culham and Appleford Stations have not been considered as key targets to improve opportunities for sustainable transport across the sub-area.

**Figure 7 Existing Rail Stations**



### Radley Station

- 2.4.22 Radley Station is located within the centre of the village of Radley and provides services to Oxford and London Paddington via Didcot Parkway. Data from The Office of Rail and Road estimated a total of 145,900 journeys were made to or from Radley in 2015/16, up approximately 7,000 trips when compared to 2014/15. A summary of the services operating at Radley Station is provided in Table 3.

**Table 3 Existing Rail Services**

Destination	Service Frequencies (Direct)						
	MONDAY TO FRIDAY					SATURDAY	SUNDAY
	AM PEAK	OFF PEAK	PM PEAK	FIRST SERVICE	LAST SERVICE		
<b>London Paddington</b>	2 per hour	1 per hour	2 per hour	05:07	22:56	1 per hour	1 per hour
<b>Oxford Station</b>	1 per hour	1 per hour	2 per hour	05:48	23:09	1 per hour	1 per hour
<b>Didcot Parkway</b>	2 per hour	1 per hour	2 per hour	05:07	00:33	1 per hour	1 per hour

- 2.4.23 As shown in Table 3, services from Radley station are provided to London Paddington which provides a viable commuter and leisure route into London for future residents at Dalton Barracks, Marcham and Kingston Bagpuize. However, the journey time for direct trains from to London from Radley Station is longer than the more direct services from Oxford and Didcot. Further to this, as shown in Figure 3, with the exception of the 35 bus route Radley Station is poorly served by the wider bus network and there are no direct bus routes between the development Sites at Dalton Barracks, Marcham or Kingston Bagpuize to Radley Station.
- 2.4.24 As shown on Figure 7, Radley Station is within a 1km walk from the residential areas of Radley in addition to the existing bus stops which are located on Foxborough Road, adjacent to the station. Both of these bus stops are provided with a shelter in addition to timetable information and real time passenger information display boards. However, these bus stops are currently only served by the 35 bus service which provides 3 services per hour to Abingdon, Kennington and Oxford. As such, the potential for linked trips through the use of bus services is currently restricted to these larger settlements with the development sites at Dalton Barracks, Marcham and Kingston Bagpuize requiring a bus interchange to access Radley Station.
- 2.4.25 The Dalton Barracks development site is within a 15 minute cycle of Radley Station. The journey from Dalton Barracks would currently route along Wootton Road and Dunmore Road/Twelve Acre Road via existing designated cycle/pedestrian footways. This route benefits from flat topography and segregates cyclists from the main carriageway, however the route is of poor quality and has a low level of cyclist priority, requiring users to cross numerous side roads and private driveways. In addition, development to the north of Abingdon (P17/V0050/O ) will provide an opportunity to increase the viability of this route as a main cycle route that connects Radley Station to Dalton Barracks. Particular attention will need to be paid to Radley Road whereby a narrow footway is currently provided between Twelve Acre Drive and White's Lane. This footway is segregated from the carriageway by a grass verge and foliage, and is suitable for cycle access to Radley Station. Alternative routes are discussed later in the report which provide a more viable and attractive cycling route between Dalton Barracks and Radley Station to encourage cycle/rail trips for future residents travelling to London, Reading and other destinations that are not easily accessible by existing bus routes.

- 2.4.26 Radley Station is located on the National Cycle Route 5 which provides a signed cycle route to Oxford, Abingdon and Didcot. Further to this, Radley Station currently provides approximately 40 cycle parking spaces in the form of Sheffield stands, half of which are covered. At the time of the site audit on Friday, 11<sup>th</sup> August 55% of the cycle storage facilities were occupied, of which 19 out of 20 cycles were stored under the covered facilities. Cycle storage infrastructure in addition to proposed cycling routes to and from Radley Station will need to be addressed to increase the number of people cycling to the station.

## 2.5 Park & Ride Facilities

- 2.5.1 As shown in Figure 8, Oxford currently benefits from a number of Park and Ride facilities which provide a direct and attractive mode of travel for commuter and leisure trips into Oxford.

**Figure 8 Park and Ride Facilities**



- 2.5.2 The Park and Ride system in Oxfordshire has been hugely successful with many of the existing sites now operating close to capacity. However, as highlighted in the Oxford Park and Ride Future Strategy Development Report (May 2017), the growth in park and ride usage has meant that many of the sites within the ring road such as Seacourt and Redbridge are experiencing considerable peak hour congestion on the approaches to the sites. Not only is this increasing journey times, the level of congestion indicates the limitations in dealing with further growth associated with future residential and employment development.
- 2.5.3 Redbridge Park and Ride is located approximately 8.5km from the centre of Abingdon, equating to a 10-15 minute drive in free flow conditions. Commuters using the Redbridge Park and Ride from Abingdon would typically route along the A34 northbound towards the Hinksey Hill Interchange, however during peak hours Oxford Road/Hinksey Hill experiences a significant increase in traffic movements as users attempt to avoid congestion issues on the A34.

- 2.5.4 Further to this, Oxford Seacourt Park and Ride is located approximately 14km from Kingston Bagpuize which equates to a 15-20 minute drive. Users of this park and ride facility would typically route along the A420 before entering the park and ride facility via the Botley Interchange.
- 2.5.5 As outlined in the ETI Stage 1 report, the interchanges at Hinksey Hill and Botley are expected to exceed junction capacity during both the AM and PM peaks by 2031 under existing growth conditions. As such, significant junction improvements are required in order to facilitate future growth and mitigate further congestion and journey time delays on the approaches to the existing sites. Further park and ride sites are also explored in Chapter 5 of this report to mitigate congestion and journey time delays both at the existing park and ride sites and key interchanges. Further details, including the location, bus service provision and capacities of the existing park and ride sites are included in Table 4.

**Table 4 Park & Ride Facilities**

SITE	LOCATION	BUS SERVICE	CAPACITY
Seacourt	East of Botley Interchange (A34/A420)	400 service to Thornhill P&R via Oxford City Centre	786
Redbridge	East of Hinksey Interchange (A34/Southern Bypass)	300 service to Pear Tree P&R via Oxford City Centre	1070
Thornhill	South of A40 and M40 to the east of Oxford	400 service to Seacourt P&R via Oxford City Centre	1335
Pear Tree	South of Peartree Interchange (A34/A44)	300 service to Redbridge P&R via Oxford City Centre	1070
Water Eaton	East of the Peartree Interchange (A34/A44)	500 service to Oxford City Centre and Oxford Rail Station	850

## 2.6 Cycling Infrastructure

- 2.6.1 Cycling is considered an important mode of sustainable travel and is generally considered suitable for distances of up to 3 miles (4.8km) for regular journeys in urban areas (source: LTN 2/08, Cycle Infrastructure Design). Oxford City Centre has a good level of formal cycle facilities and designated infrastructure which makes cycling a viable mode of transport in itself or part of a multi-modal trip. However, in this study area, cycling facilities are less frequent and although designated shared pedestrian/cycle routes and designated cycle lanes are provided in places, these are not continuous across the sub-area which limits the permeability of the network for cyclists.



Table 5 Oxfordshire Journey to Work Data

MODE	VALE OF WHITE HORSE		WEST OXFORDSHIRE		OXFORD CITY		CHERWELL DISTRICT		SOUTH OXFORDSHIRE	
	Total	Modal Split	Total	Modal Split	Total	Modal Split	Total	Modal Split	Total	Modal Split
Private Car	33,992	67%	31,260	70%	20,392	35%	40,452	66%	37,125	69%
Car Passenger	2,252	4%	2,232	5%	1,890	3%	3,595	6%	2,322	4%
Bus	3,511	7%	2,310	5%	10,583	18%	3,502	6%	2,052	4%
Cycle	3,797	7%	2,214	5%	11,483	20%	2,487	4%	2,412	4%
On Foot	5,013	10%	4,873	11%	11,373	20%	7,926	13%	6,375	12%
Train	1,268	3%	869	2%	1,542	3%	1,928	3%	3,035	6%
Other	851	2%	691	2%	872	1%	989	2%	812	2%
Total	50,684	100%	44,449	100%	58,135	100%	60,879	100%	54,133	100%

2.6.3 As shown on Table 5, 2011 Census data for the five districts within Oxfordshire highlights significantly different modal patterns across the County. Whilst private car is the predominant mode of travel for journeys to work across all five districts, Oxford has a significantly lower proportion of private car use than the other four districts, accounting for 35% of trips compared to 67%, 70%, 66% and 69% respectively. Further to this, the uptake of cycling as a method of travelling to work is considerably higher within Oxford, accounting for 20% of trips in comparison to modal shares of between 4% - 7% for the other four districts. Whilst this is largely due to the respective distances that residents would have to travel by bicycle in the more rural districts of Vale of White Horse and West Oxfordshire to access key employment areas within Oxford and Science Vale, the wider cycling network is sparse and un-continuous across the Vale.

2.6.4 In towns such as Abingdon, the uptake of cycling is much higher when compared to the rest of the Vale, accounting for 10% of all journey to work trips. Within Abingdon itself, cycling infrastructure in the form of shared pedestrian/cycle routes are provided on Dunmore Road, Twelve Acre Drive, Audlett Drive, Copenhagen Drive and Colwell Drive, however these are of low quality and require cyclists to cross multiple side roads and private driveways owing to the lack of cycling priority. In addition to Town Centre access, these routes can be used for access to Radley Station from the residential areas to the north of Abingdon, however this would require cyclists to route along a poorly maintained, off-carriageway route adjacent to Radley Road before joining the NCN5 in Radley Village for access to the Station. Further shared pedestrian/cycle routes are provided on Boxhill Walk, linking residential areas within Northcourt to key cycling routes on Wootton Road and the Town Centre.

- 2.6.5 Access from Dalton Barracks to Abingdon is currently provided via two routes; Wootton Road and Faringdon Road, both of which provide formal cycling infrastructure through a combination of on-carriageway and off-carriageway routes. Access via Wootton Road takes the form of a shared cycle/footway from Long Tow Road to the Wootton Road / Dunmore Road / Copenhagen Drive roundabout. The roundabout provides access to further cycling routes along Dunmore Road and Copenhagen Drive, however this requires the use of refuge island crossing facilities which have narrow capacities and provide a low level of cyclist priority. Off-road provision is provided from the roundabout up to the Wootton Road / Trendell Road junction, at which point narrow on-carriageway cycle lanes are provided on both sides of the carriageway for access into Abingdon via Bath Street. An alternative route is provided along Faringdon Road, whereby on-carriageway cycle lanes are provided on either side of the carriageway from Shippon to the Faringdon Road / Wootton Road junction, however highway constraints mean that these lanes are of narrow width and are generally poorly maintained.
- 2.6.6 Further to this cycle access from Marcham to Abingdon is provided in the form of a shared cycle/footway to the south of the A415 Marcham Road carriageway. This route has a width of approximately 1.6m which creates potential for user conflict from passing cyclists. Further to this, the route is poorly maintained with limited formal route markings and is subject to seasonal narrowing through foliage overgrowth to the south. To the west of the A34 / A415 Marcham Road junction, the shared cycle/footway has no street lighting and is directly adjacent to the carriageway which makes it an unsuitable and unattractive route for inexperienced cyclists and schoolchildren accessing Abingdon in particular. Further shared pedestrian / cycle footways are provided on either side of the carriageway to the east of the A415 / A34 junction, however these offer a low degree of cyclist priority and require cyclists to dismount at key junctions which further reduces the attractiveness and suitability of the route.
- 2.6.7 As shown in Figure 9, The Hanson Way, which forms part of the NCN5 offers an easy and attractive leisure route for cyclists between Abingdon and Oxford. With the exception of short stretches of on-road cycling infrastructure in Radley and South Kennington, the route makes use of purpose built off-road tracks and is approximately 15km which equates to a 45 minute cycle. It is of note that NCN5 is not of a high enough quality to facilitate commuter cycling within the corridor, therefore on-carriageway routes such as Kennington Road and Abingdon Road provide more favourable and direct commuter routes into Oxford. As such, the NCN5 should be targeted by improving existing surfaces and maintaining overgrown foliage adjacent to the rail line in order to encourage levels of cycling in the corridor. In doing so, the NCN5 could form part of a viable leisure route for cycle trips into Oxford from Dalton Barracks (via cycling infrastructure on Dunmore Road/Twelve Acre Drive) in addition to Marcham (via A415 Marcham Road).

Figure 9 NCN5 (Hanson Way)



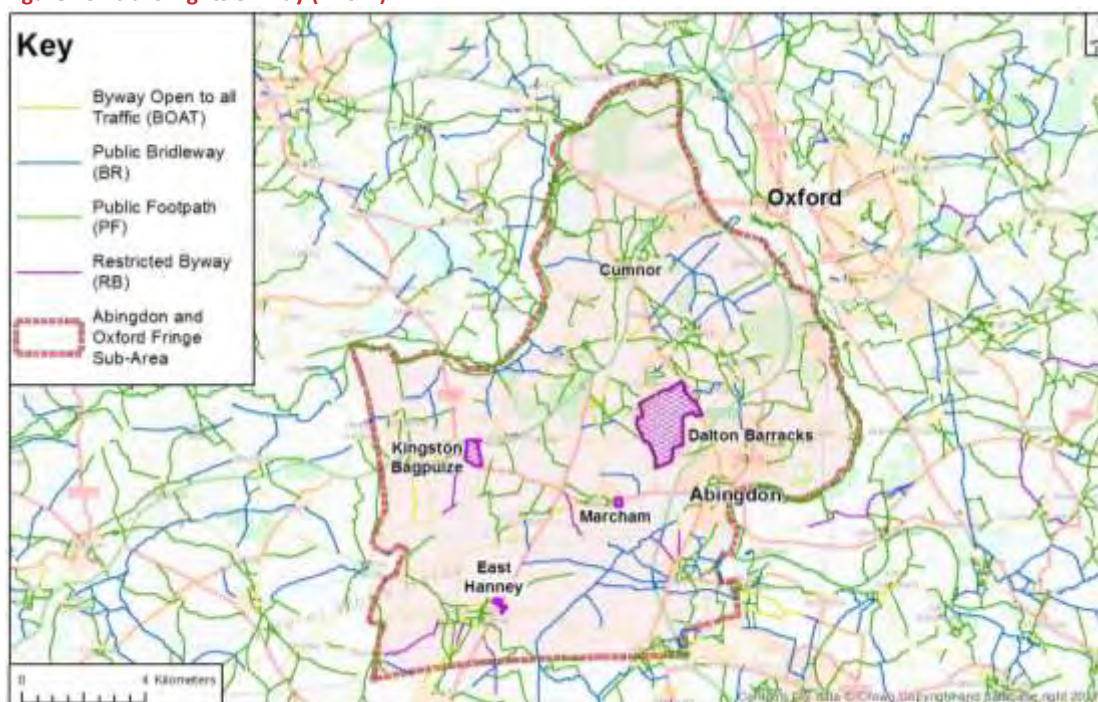
- 2.6.8 In a bid to increase the viability of cycling within Oxford, the OXONBIKE scheme provides the opportunity to hire pedal or electric bikes. Although the provision of the OXONBIKE scheme does not extend to areas outside of Oxford, the provision of shared pedal and e-bikes throughout wider parts of the sub-area would promote the uptake of cycling, especially for shorter commuter journeys that would have otherwise been taken by private car.
- 2.6.9 Further to this, e-bikes provide a suitable and innovative solution to encourage the uptake of cycling across the sub-area. Within MSOA Vale of White Horse 003 where Dalton Barracks and Marcham are located, the Propensity to Cycling Tool (PCT) (<http://pct.bike>) suggests that through the provision of e-bikes, the proportion of cycle to work journeys could increase from 8% to 29% which would remove 593 drivers from the local road network. In addition, for Kingston Bagpuize which is within MSOA Vale of White Horse 007, the increase could be from 2% to 15%, removing 325 drivers from the road network. The e-bikes scenario models the additional increase in cycling that would be achieved through the widespread uptake of electric cycles ('e-bikes'). This scenario is particularly useful for examining cycling potential in hilly areas and/or where trip distances are longer (e.g. in rural areas such as Kingston Bagpuize and Marcham) as it accounts for the increased willingness of e-bike users to cycle long distance, hilly and simultaneously long distance and hilly routes.

## 2.7 Pedestrian Infrastructure

- 2.7.1 As shown in Figure 10 the Abingdon and Oxford fringe has an existing network of public rights of way in the form of footpaths, bridleways, restricted and un-restricted byways.



Figure 10 Public Rights of Way (PROW)



Source: Oxfordshire County Council, 2017

- 2.7.2 Towards the south east of the Abingdon and Oxford Fringe sub-area, the region is supported by a network of public footpaths which include the Thames Path and The Ridgeway National Trails. In total, access to Oxfordshire's countryside includes approximately 2,600 miles of public rights of way, however the distribution and density of the network differs to a great extent over the region. For example, a high concentration of footpaths and bridleways are currently provided to the south of Abingdon adjacent to the River Thames and to the west of East Hanney which serve as scenic leisure routes within the region. However, as shown in Figure 10, these routes are significantly more sporadic in relation to key development sites at Dalton Barracks and Marcham. It is of note that these clusters can become integrated with the development at these key sites through the provision of relatively small links or status upgrades, however these would be subject to private land ownership and should be incorporated into the development plans through S106 contributions.
- 2.7.3 Walking is considered to be a viable mode of choice for trips made from Dalton Barracks to key employment, education, leisure and retail facilities within Abingdon. Pedestrian routes are provided from Wootton Road and Faringdon Road, both of which provide a footway on at least one side of the carriageway. Access via Wootton Road takes the form of a shared cycle/footway from Long Tow Road to the Wootton Road / Dunmore Road / Copenhagen Drive roundabout. Pedestrian footways are provided from the roundabout into Abingdon via Bath Street, these are of sufficient width and have adequate street lighting along the route. An alternative route is provided along Faringdon Road, whereby cyclists are segregated from pedestrians through the provision of on-carriageway cycle lanes. The footways are of sufficient width, ranging between 1.5 – 2m, however they are poorly maintained and subject to overgrowth from the adjacent grass verge which limit their capacity and attractiveness for pedestrians. Further to this, there are currently no footways provided on either side of the carriageway on Barrow Road which would prevent pedestrians accessing the Dalton Barracks site from the south of Shippon. The footways on Faringdon Road would require phased resurfacing subject to the higher user flows from Dalton Barracks.

- 2.7.4 Due to the remote location and distance from key employment and leisure hubs in Abingdon, Oxford and Science Vale, the development site in Kingston Bagpuize is unlikely to generate a significant number of active travel trips. However, as noted above, Kingston Bagpuize is well supported by the frequent 66 bus service which provides connections to Oxford to the east and Swindon to the west. In order to promote sustainable travel within Kingston Bagpuize, infrastructure improvements should build upon the strength of the existing bus network by focusing active travel improvements on the ‘first’ and ‘last’ mile of trips, whereby walking and cycling can actively form part of a multi-modal trip.

## 2.8 Intelligent Mobility

- 2.8.1 New technologies and service models are providing the opportunity to transform the way in which sustainable transport services are provided by incorporating multi-modal trips through the use of bus, train, bike, bike share, car clubs and car share into daily travel patterns. Within the Abingdon and Oxford fringe sub-area, intelligent mobility provides a prime opportunity to satisfy the travel needs of commuters, especially to and from key innovative employment hubs such as Harwell Campus, Culham Science Park and Abingdon Science Park.
- 2.8.2 Intelligent mobility is evolving throughout Oxfordshire as part of work being undertaken by the County Council’s Innovation Team. OCC supports the use and development of a wide range of data and new technologies to assist in managing the network and influencing travel behaviour. It is recognised that providing people with public transport, cycling and walking facilities, as well as general information about travel options, will not be enough to bring about the shift that is required from private car use to other forms of transport. Oxfordshire’s LTP4 discusses the development of an Oxfordshire Journey Planner and ‘Zip2’ will be released in late 2017 to help inform travel choices allowing more seamless travel. ‘Zip2’ will offer a personalised multi-modal journey planner (initially to employees in Science Vale) to encourage people to take the quickest option for them which also optimises the capacity of transport networks.
- 2.8.3 Going forward, the development of intelligent mobility solutions will link to the development of apps, not only to benefit the end user but also to enhance an understanding of the network conditions within the Vale through the collection and monitoring of UTMC, bus and rail RTI and Twitter feeds. Liaison should take place with the developers of existing apps e.g. City Mapper, Roadworks.org, Highways England’s Traffic Information apps and Hövding’s ‘Give a Beep’ campaign in London to understand the role of journey planners, how they work and the impact they could have on transport planning in the corridor as developments grow. The Smart Mobility Package detailed in Section 6 provides specific smart mobility measures for the corridor.

## 2.9 Summary of Existing Infrastructure

- 2.9.1 This section of the report evaluates the existing sustainable transport conditions in the vicinity of the proposed development sites and has identified that:
- Bus services are currently provided across the Sub-Area, with radial routes serving Oxford and Abingdon having particularly frequent services. Kingston Bagpuize is well served by the existing 66 bus service; currently services to Dalton Barracks and Marcham are less frequent, although all of the proposed LPP2 sites are close to existing bus services. The quality of bus stop facilities and the lack of real time passenger

information have been identified as areas which require improvement across all three sites;

- For many rural settlements, particularly along the Fox Lane/Hinksey Hill corridor, unfavourable terrain for cycling and walking, coupled with limited bus services currently limits the use of sustainable transport;
- Radley Station is unlikely to be used as part of a multi-modal trip for journeys towards Oxford or Didcot from any of the developments. However, further significant improvements, specifically through bus service and cycle route access enhancements will increase the attractiveness of using Radley Station for access to longer distance trips to London and Reading;
- The existing Park and Ride facilities at Seacourt and Redbridge are well utilised and provide a direct route into Oxford, however they are subject to congestion issues on the approaches and are unlikely to be able to accommodate further planned growth without junction improvements or the addition of further remote facilities;
- The potential for cycling within the Sub-Area is currently limited to the Abingdon area; and
- The location of the proposed development sites highlights Dalton Barracks as a location where walking could be a key mode of travel for commuter and regular leisure trips. Shorter pedestrian trips to local bus stops at all three development sites should be incorporated into the development masterplans to ensure that walking can readily form the first and last mile of sustainable multi-modal trips.

### 3. STAGE 1B – PLANNED IMPROVEMENTS

#### 3.1 Vale of White Horse Local Plan 2031 Part 1 – Adopted Plan

- 3.1.1 The Local Plan Part 1 (LPP1) identifies a number of key challenges and opportunities that are faced by the district in relation to existing infrastructure and planned housing and employment growth. Specific to transport, LPP1 recognises the need to support sustainable transport and accessibility and address transport related constraints in the area including access to the A34 at Abingdon-on-Thames and Botley, and the Drayton Road (B4017) accessing Abingdon-on-Thames from the south.

**Core Policy 12: Safeguarding of Land for Strategic Highway Improvements within the Abingdon-on-Thames and Oxford Fringe Sub-Area**

- 3.1.2 The LPP1 suggests that the Sub-Area benefits from excellent public transport connectivity, particular to the nearby city of Oxford. As identified in Table 2 Existing Key Bus Services, this is very apparent through the existing provision of frequent bus services such as the X2, X3 and 31 bus services. However, LPP1 also identifies a number of transport related constraints, specific to the Sub-Area:

- Abingdon-on-Thames and Botley are constrained by congestion from traffic accessing Oxford via the A34, the Botley Interchange, including traffic accessing Oxford from the A420 and Botley Road; and
- Drayton Road (B4017) is a key route into Abingdon-on-Thames from the south. This road already suffers from significant congestion in both the morning and evening peak periods, which results in long and unreliable journey times. The River Ock bridge and the double mini-roundabouts at the junction with Marcham Road/Ock Street are also physical pinch-points which restrict vehicle flow.

- 3.1.3 In order to address these constraints and ensure future development will not have a significant impact on the issues identified, a number of land safeguarding schemes have been identified to support the delivery of the following identified transport schemes:

- South Abingdon-on-Thames Bypass linking the A415 to the west and south of the town, including a new River Thames crossing;
- Diamond Interchange at the A34 Lodge Hill Junction; and
- Land for improvements to Frilford Lights.

- 3.1.4 It is of note that planning permission will not be granted for development that would prejudice the construction or effective operation of the transport schemes identified under Core Policy 12.

#### 3.2 Vale of White Horse Local Plan 2031 Part 2 – Preferred Options

- 3.2.1 The Local Plan Part 2 (LPP2) is currently under preparation and will sit alongside the Local Plan Part 1. Local Plan Part 2 will set out the development management policies to complement the strategic policies as set out in LPP1 and policies and locations for housing to meet the Vale's apportionment of Oxford City's Unmet

- 3.2.2 Vale of White Horse District Council is already working in partnership with Oxfordshire County Council to plan for substantial highway and public transport improvements within

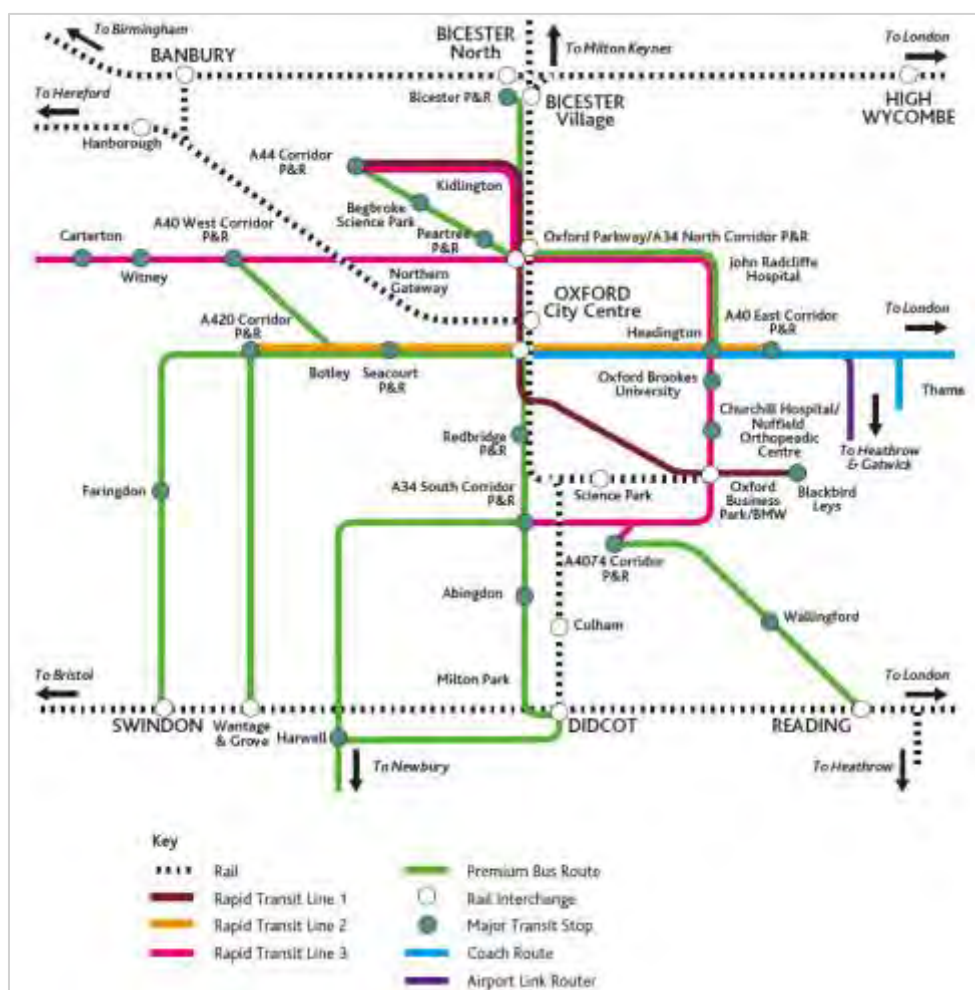
this Sub-Area. Therefore, in addition to land safeguarded for identified transport schemes set out in CP12 (Local Plan 2031: Part 1) the following schemes are also safeguarded in the Preferred Options version of LPP2 in accordance with CP12:

- Park and Ride site for accessing Oxford from the A420 corridor at Cumnor;
- Park and Ride site for accessing Oxford from the A34 corridor at Lodge Hill;
- Single carriageway north-bound bus lane between the Lodge Hill A34 Interchange and Hinksey A34 Interchange; and
- South Marcham Bypass linking the A415 to the west of Marcham and east of Marcham.

### 3.3 Oxfordshire Local Transport Plan: Connecting Oxfordshire (LTP4)

- 3.3.1 Connecting Oxfordshire is Oxfordshire County Council's (OCC) Local Transport Plan (LTP4) which sets out a number of proposed transport solutions for the county up to 2031 and beyond.
- 3.3.2 The Plan outlines the OCC's intention to improve the functionality of key junctions through the implementation of junction improvement schemes and traffic management strategies, specifically along the A34. The LTP4 also notes that a longer-term solution is needed to address the congestion associated with the planned development and trip growth, this is largely formed through the development of key schemes such as Bus Rapid Transit (BRT), remote park and ride sites, the introduction of the intelligent mobility solutions and the integration of the Oxford – Cambridge expressway.
- 3.3.3 Specific to this study, four key documents which outline OCC's position in relation to the development of sustainable transport improvements are summarised below:
- **The Science Transit Strategy**, which defines the high-level vision and outline roadmap for the development of better-integrated, high-quality mobility systems across Oxfordshire, while promoting projects promoting innovation in mobility, healthy and sustainable travel (e.g. cycling, walking and Door to Door integrated travel) and integrated transport delivery, including the Oxfordshire Journey Planner. The Strategy includes an illustrative future transit network, incorporating rail, Bus Rapid Transit, premium bus routes, as well as coach and airport links, which is presented below for reference.





Source: Science Transit Strategy, Oxfordshire County Council, (June 2016)

- **The Bus & Rapid Transit Strategy**, which sets out how OCC will work to improve the main countywide bus network, developing rapid transit services along the busiest routes, upgrading Premium services in the county and developing the commercial bus network;
- **The Rail Strategy**, which sets out OCC's ambition and priorities for rail investment in partnership with Network Rail and train operators, providing the capacity and train services necessary to support growth in the county and developing the rail network to provide inter-regional links. This includes better integration of rail and strategic bus networks and enhancing access to local rail stations; and
- **The Active & Healthy Travel Strategy**, which sets out OCC's ambitions for walking, cycling and Door to Door integrated travel. This includes better integration of rail/bus and cycling/walking as well as developing a network of cycling routes and improving walking options.

#### Oxford – Cambridge Expressway

- 3.3.4 Highways England is currently undertaking a study, focusing on highway options that can plug the strategic gap in the road network between the M40 near Oxford and the M1 near Milton Keynes. Specific to the study area, significant growth around Science Vale, Oxford, Bicester

and Milton Keynes create a strong opportunity to enhance the knowledge spine through the provision of upgraded transport infrastructure. The expressway will require significant improvements to the A34 corridor in order to create an enhanced orbital network outside of London; a key strategic ambition for Oxfordshire and the wider South East region. The expressway will enable a more efficient passage for knowledge and experience to be shared across the UK, linking the UK's globally recognised Universities to create further opportunities for significant employment and residential growth along the expressway. For the Sub-Area in particular, the A34, which currently operates at or above capacity at key junctions, will need significant improvement work to ensure that journey times are reduced and the proposed expressway offers a viable and attractive route for commuter trips from within the Sub-Area and beyond.

### Bus Rapid Transit

- 3.3.5 OCC's bus and rapid transit (BRT) strategy outlines the Council's focus to continue to work alongside key bus operators to continue to refine and expand the existing network. New rapid transit services are proposed along the busiest routes in Oxford in addition to the upgrading of premium bus services in the county and the integration of new Park & Ride sites. Further services such as the 66 bus service which provide important links across the Oxfordshire boundary to growing markets such as Swindon are key premium routes to target for bus service growth.
- 3.3.6 OCC aim to develop three rapid transit routes which will be centred on Oxford to secure an exceptionally high level and quality of service across the County. It is of note that these routes will require substantial investment in the form of bus priority measures and on-board passenger facilities in addition to high quality pedestrian and cycle links to bus stops to ensure users can easily complete the first and last mile of their trip sustainably. It is anticipated that higher density developments, such as Dalton Barracks, will take maximum advantage of the investment at key hubs located within relatively close proximity, such as the Lodge Hill Park and Ride, to encourage sustainable travel behaviour amongst future residents.
- 3.3.7 Table 6 and Figure 11, three BRT routes have been identified for Oxford which link a network of proposed park and ride sites with key employment and residential growth areas across the city centre, North Oxford and the Eastern Arc. As shown in Table 6, each of the routes is close to significant resident and workplace populations.

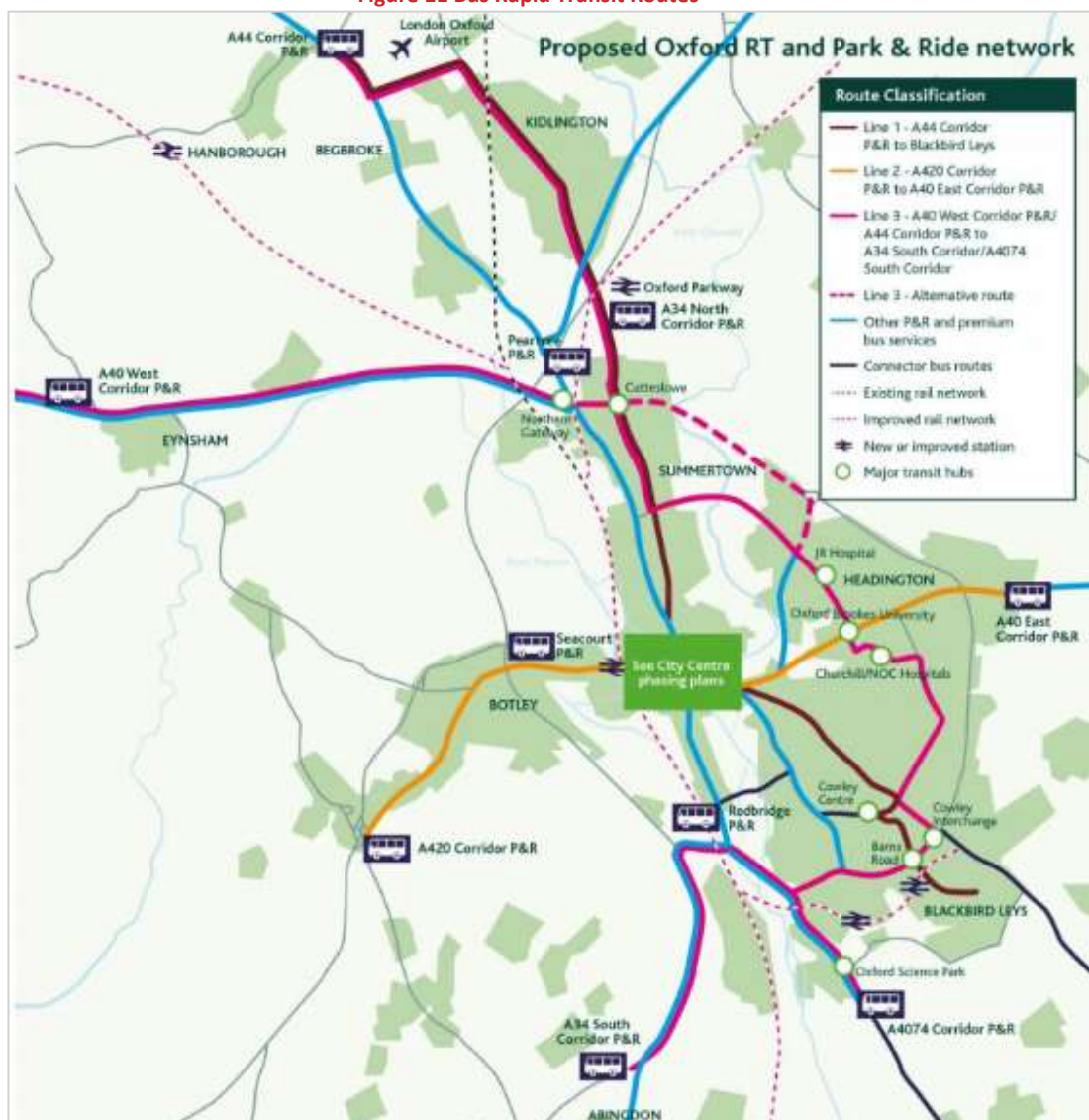
**Table 6 Bus Rapid Transit Routes**

LINE	LENGTH (KM)	CATCHMENT WITHIN 400M OF PROPOSED ROUTE	
		Resident Population	Workplace Population
1 A44 Corridor P&R to Blackbird Leys	18.435	64,251	54,499
2 Thornhill P&R to A420 Corridor P&R	13.289	38,916	35,567
3a A40 Corridor P&R to A4074 Corridor P&R	23.248	45,022	32,091



LINE	LENGTH (KM)	CATCHMENT WITHIN 400M OF PROPOSED ROUTE	
		Resident Population	Workplace Population
3b A44 Corridor P&R to A34 South Corridor P&R	25.547	53,473	37,418

Figure 11 Bus Rapid Transit Routes



Source: Connecting Oxfordshire vol 8 part i - Oxford Transport Strategy

## The Future of Park and Ride

- 3.3.10 As previously mentioned, Oxford's existing Park & Ride sites have been successful in reducing traffic in the city centre by providing an easy and attractive option for people entering the city. However, there are currently substantial delays on the approaches to the facilities on the ring road, in particular junction and network delays to the west (A420, A40), north-west (A44) and south (A34, A4074) during the AM peak period. As a means to reduce this level of

congestion and journey time delays, the viability of intercepting these trips further away from the ring road is becoming a key improvement option that can reduce the level of congestion at the existing approaches and reduce the capacity constraints at the existing facilities.

- 3.3.11 In particular to the Sub-Area, arrivals during the AM peak at the Peartree, Water Eaton, Redbridge and Seacourt P&R sites contribute, in particular, to traffic routing along the three A34 interchanges to the west of the Oxford, contributing to increased congestion and journey time delays. By intercepting these trips further outside the inner ring road, it is likely that a significant majority of the demand would be captured further from the city which would have an immediate positive impact on the operation of the A34 in addition to the other intersecting roads.
- 3.3.12 Due to the existing capacity constraints and congestion at the current city-edge Park & Ride sites, forecast levels of increased demand would add substantially to traffic levels on already congested routes. Therefore, as shown in Table 7, additional remote park and ride sites have been proposed to serve the A40, A44, A34 and A420 corridors. Each of the proposed corridors will have direct access to the ring road and Oxford City Centre and will incorporate additional residential areas, creating wider potential catchments than the existing park and ride sites.

**Table 7 Proposed Park and Ride Sites**

P&R CORRIDOR	MAIN CATCHMENT	CAPACITY
A40	Witney, Carterton, Cheltenham, Gloucester	1,000
A44	Chipping Norton, Banbury, Worcestershire, Warwickshire	1,100
A34 (north)	Bicester, Banbury, Milton Keynes, Bedfordshire	1,700
A420	Cumnor, Farringdon, Swindon, Wiltshire	1,200
A34 (south)	Abingdon, Didcot, Science Vale, Newbury, Hampshire	1,600
A4074	Wallingford, Didcot, Henley, Reading, Berkshire	1,000

- 3.3.13 Through linking the proposed park and ride facilities to BRT routes, more efficient journeys to and from Oxford will be developed despite the increase in distance travelled from the remote park and ride sites. The proposed sites will serve as key modal interchange points for drivers to transfer from their cars to mass transit services across the city either through direct services or efficient transfers at key interchange points. Therefore, the facilities at the Park & Ride sites will need to allow passing services to interchange efficiently and seamlessly. Further to this, the proposed facilities will need to provide for those users wishing to cycle for part of the journey, both from their point of origin to the bus service (Cycle & Ride), or from the Park & Ride site to their destination (Park & Cycle).

## 3.4 Summary of Planned Improvements

- 3.4.1 The **Connecting Oxfordshire** LTP4 documents highlights a range of potential improvements within the Science Transit Strategy, Bus & Rapid Transit Strategy, Rail Strategy, and Active and Healthy Travel Strategy. These identify a range of overarching concepts for enhancing transport connectivity and levels of bus, rail, and active travel provision.

### 3.4.2 Specific planned improvements have been identified as follows:

- South Abingdon-on-Thames Bypass linking the A415 to the west and south of the town, including a new River Thames crossing;
- Diamond Interchange at the A34 Lodge Hill Junction;
- Single carriageway north-bound bus lane between the Lodge Hill A34 Interchange and Hinksey A34 Interchange;
- Land for improvements to Frilford Lights;
- South Marcham Bypass linking the A415 to the west and east of Marcham;
- Oxford – Cambridge Expressway
- Expansion of Park and Ride, including proposed sites at Lodge Hill and Cumnor
- Bus Rapid Transit, including Line 3 serving a potential P&R site at Lodge Hill and Line 2 serving a P&R site at Cumnor

## 4. STAGE 1C – OPTION DEVELOPMENT

### 4.1 Option Development

4.1.1 Based upon the outputs from Stage 1a and 1b, a full scheme optioneering process was carried out which identified an initial long-list of scheme measures that addressed the strategic objectives for enhancing sustainable transport provision across the Abingdon to Oxford corridors. All potential options were considered at this stage with a particular focus along the following transport corridors:

- Abingdon-A34-Oxford Corridor;
- Abingdon-Dalton Barracks-Wootton-Cumnor-Botley-Oxford Corridor; and
- Abingdon-Dalton Barracks-Fox Lane-Hinksey Hill-Oxford Corridor.

4.1.2 An immediate option sifting process was carried out to eliminate any schemes that would be undeliverable or that would be extremely challenging to deliver with estimated low returns. This process was carried out using a PESTLE-type analysis which provided a high-level examination of the political, economic, social, technological, legal, and environmental impacts of each scheme. Each of the elements were scored on a Red, Amber, Green rating to identify deliverability constraints, the results of which are included in **Appendix A**.

### 4.2 Preliminary Appraisal

4.2.1 The refined list of scheme options was taken forward for more detailed consideration which included the development of a preliminary magnitude of scheme costs and assessment of their feasibility. This process included an initial evaluation of financial self-sustainability of schemes over time, in particular in relation to public transport provision.

4.2.2 A preliminary option appraisal process was then undertaken of the short-listed schemes using a multi-criteria prioritisation matrix. Whilst this remained relatively high-level, it was used to assess the ability of each scheme to deliver against the agreed objectives of supporting LPP2 development growth and deliverability, as well as against standard industry measures of economic, social and environmental impact.

4.2.3 The appraisal scored each metric on a quantitative scale, each scored against a 7-point scale (+3 to -3). The scores were then considered within the overarching context of the outline capital costs and on-going operational costs to provide an assessment of value for money from investment.

4.2.4 The outputs of the initial appraisal process were used to provide an initial basis upon which to prioritise individual scheme options.

### 4.3 Scheme Packages

4.3.1 Based upon the outcomes of the gap analysis and the preliminary appraisal process, improvement options were grouped into the following 10 packages:

- Package A – Access to Rail (Radley Station)
- Package B – Park & Ride (5 Variants)
- Package C – A34 Corridor
- Package D – Fox Lane/Hinksey Hill Corridor (3 elements)

- Package E – Dry Sandford to North Hinksey
- Package F – B4017 Corridor Enhancements
- Package G – A420 Corridor Enhancements
- Package H – Access to Abingdon
- Package I – Demand Management
- Package J – Improve ease of travel by Sustainable Travel.

4.3.2 A breakdown of the packages, including the initial improvement options is included in **Appendix B**.

## 4.4 Check and Challenge Workshop

4.4.1 SYSTRA held a check and challenge workshop on Tuesday, 11<sup>th</sup> July to sense check the high-level options that had been identified and prioritised through the preliminary appraisal with the following key stakeholders:

- Joanne Fellows (Vale of White Horse District Council)
- Andrew Maxted (Vale of White Horse District Council)
- Ed Webster (Oxfordshire County Council)
- Will Pedley (Oxfordshire County Council)
- David Taylor (Oxfordshire County Council)
- Mark Gregory (Oxfordshire County Council)
- Roger O’Neil (Oxfordshire County Council)
- Paul Harris (Oxfordshire County Council)
- Patrick Blake (Highways England)
- Paul Walker (Oxford Bus/Thames Travel)
- Abbey Pettigrew (Stagecoach)
- Martin Wilson (Sustrans)
- Simon Adams (Oxfordshire Cycling Network)

4.4.2 The stakeholders represented a range of viewpoints in relation to the existing sustainable transport issues as well as the proposed high level options for the corridors. SYSTRA moderated discussions to engage with different stakeholders and understand the different perspectives and priorities for each of the packages. Moderating the workshop in this way enabled stakeholders to be exposed to the many competing views held as well as the different priorities presented through the initial improvement packages.

## 4.5 Stakeholder Feedback on Potential Improvement Packages

4.5.1 The following feedback was received from stakeholders on the initial proposed packages of measures.

### Package A – Access to Radley Station

4.5.2 Real time information (RTI) is already present along key routes across the Sub-Area, including stops along the 35 bus route. The successful introduction of RTI to form part of an overarching ‘information box’ at key public transport stops should be replicated and broadened in line with the key development sites. In terms of cycling, it was suggested that access to Radley Station is largely restricted by the existing cycling network and that an alternative route connecting the existing infrastructure on Twelve Acre Drive to White’s Lane should be explored.



- 4.5.3 The strategic importance of Radley Station for serving longer distance trips was highlighted as the most likely solution; whilst the likelihood of new residents travelling to Radley Station for access to Oxford and Didcot is relatively low, Radley Station presents a significant opportunity to promote multi-modal trips for longer distance journeys to destinations such as London and Reading.

#### **Package B – Park & Ride**

- 4.5.4 The introduction of lorry parks as part of the Marcham park and ride scheme was largely supported through its ability to reduce congestion and minimise the number of HGVs stopping in laybys on A34. However, the park and ride site at Marcham was largely dismissed as it would generate further traffic movements in South Abingdon; an area that already experiences a high level of congestion, especially during the AM and PM peaks. The proposed park and ride facilities at Lodge Hill and Cumnor were the favoured alternative options. However, it was agreed that additional park and ride facilities would only create a significant modal shift if they coincide with the introduction of complimentary bus priority measures to reduce the overall journey times for potential park and ride users.

#### **Package C – A34 Corridor**

- 4.5.5 The provision of an A34 northbound bus lane between Lodge Hill and Hinksey Hill would provide considerable bus priority improvements for the A34 corridor. It was noted that there may be political and social considerations to factor in to the delivery of this scheme. Further to this, enforceability along the A34 for bus priority may need to be well maintained (which could generate financial constraints) in order for it to be effective. It was suggested that the size of the Dalton Barracks development was not large enough to justify an additional egress/exit lane on to the A34.

#### **Package D – Fox Lane/Hinksey Hill Corridor**

- 4.5.6 Cycling along Fox Lane is largely unfeasible due to the terrain and steep incline for cyclists coupled with the restricted carriageway widths and lack of existing formal cycling infrastructure. Although the issues could be addressed through the provision of e-bikes for example, cross corridor movements along the Fox Lane / Foxcombe Road / Hinksey Hill corridor was not deemed a significant priority. Instead, packages should focus on developing and connecting existing infrastructure to create a seamless and attractive network of cycling infrastructure across the Sub-Area. A key route which attracted significant attention was the existing NCN5 cycle network which was not considered to be currently of a high enough quality to be used as a suitable cycling route between Abingdon and Oxford.
- 4.5.7 In terms of the feasibility of services across the corridor, it was noted that the 44 bus route had previously routed along this corridor via Sunningwell and Bayworth (every 3 hours); however, low patronage and insufficient funding meant it was not a cost effective option. Further to this, it was evident that operating two-way bus movements, with full size buses, would be challenging along this route due to the existing carriageway widths.

#### **Package E – Dry Sandford to North Hinksey**

- 4.5.8 The enhancement of existing public rights of way was well supported as a viable option to increase the cycling network across the Sub-Area. It was suggested that these provide a prime opportunity for low cost cycling routes by utilising and improving existing bridleways. In addition, where possible and practical, opportunities for upgrading existing

public footpaths into public bridleways should be explored to enable the existing cycling network to grow, especially across areas that are poorly served by the existing highway network.

- 4.5.9 Specific to the Dry Sandford to North Hinksey corridor, a proposed cycling route was suggested for the existing 311/2/30 bridleway from Harcourt Hill to B4017 Wootton Road. Whilst this route would provide a suitable leisure route for cross-corridor movements, the terrain and relief of the land limits the viability of the route as an attractive ‘commuter’ route. Further to this, it was identified that routes such as this should be considered to be less of a priority than improving the existing infrastructure surrounding Dalton Barracks, Marcham and Abingdon due to the limited catchment that it would serve.

#### **Package F – B4017 Corridor Enhancements**

- 4.5.10 The current frequency of the existing 4/4b was identified as a key limitation to the initial development for up to 1,200 homes at Dalton Barracks. Whilst the 4/4b service provides a combined frequency of two service per hour, the existing bus stops on Long Tow and Cholswell Road are served on an hourly frequency. Further to increasing the frequency, the integration of RTI at key bus stops within the Dalton Barracks site were a favourable option that would be likely to increase the attractiveness and overall reliability of bus services within the site. In terms of cycling, improving existing routes on Faringdon Road and Wootton Road for access to Abingdon was considered to be a key challenge that needed to be addressed. Further to this, cycling routes between Dalton Barracks and Oxford would need to be explored that account for the terrain and relief of the area, the provision of existing infrastructure and the likely travel to work patterns for new residents.

#### **Package G – A420 Corridor Enhancements**

- 4.5.11 The A420 was recognised as a key route into Oxford, serving the Swindon and Faringdon catchment areas in addition to the proposed development at Kingston Bagpuize. The frequency of the 66 bus service makes bus travel a viable mode of transport for access into Oxford along this route, however congestion on the approach to the Botley interchange was raised as a key point to address to further promote bus usage along this corridor. In addition, the introduction of RTI and live tracking information was largely supported for key bus stops along this route. OCC have already introduced RTI at many bus stops across the Vale, however solutions should be provided that target additional key bus stops whereby RTI would be beneficial.

#### **Package H – Access to Abingdon**

- 4.5.12 Access to Abingdon was identified as a key priority for the study in order to link the proposed development to the existing employment, education, health, retail and leisure facilities within Abingdon. The existing A338/A415 junction was identified as a key congestion hotspot for journeys into Abingdon, specifically during the AM and PM peak periods. It was noted that the introduction of demand responsive traffic lights in particular could help to alleviate significant tailback on the A415 Frilford Road/Kingston Road for eastbound and westbound traffic. In addition to the improvement of existing pedestrian and cycle routes from Dalton Barracks into Abingdon, it was noted that cycle links between Marcham and Abingdon could be further enhanced to promote the likelihood of future residents cycling into Abingdon for leisure and work purposes. The provision of sufficient pedestrian and cycling infrastructure could ultimately reduce the reliance on the private car for short trips into Abingdon which could further reduce existing issues of

congestion, specifically towards the south and east of Abingdon in addition to Oxford Road.

#### **Package I – Demand Management**

- 4.5.13 Higher education and residential travel plans could be targeted at key development sites such as Dalton Barracks and will help to provide initial measures to influence travel behaviours. It was acknowledged that these might be difficult to enforce in the longer term due to issues of funding and resourcing. Initial, and on-going, funding was also identified as a critical element for the promotion of car sharing/car-pooling schemes at key employment hubs, as they require proactive support to establish and maintain. In terms of bus services, introductory offers in the form of bus vouchers could be introduced as a condition of planning applications to encourage sustainable travel at first occupation. Further to this the marketing of existing bus routes is currently limited which suggests a significant opportunity to promote accessibility to key bus routes to new residential developments.

#### **Package J - Improve ease of travel by Sustainable Travel**

- 4.5.14 It was noted that the promotion of cashless payment systems could create issues of exclusion amongst potential users of public transport, especially amongst elderly users if the introduction of mobile ticketing (m-ticketing) and contactless payment was made the predominant payment method. It was noted that the majority of current bus passengers within the area prefer cash payments and engagement with bus drivers; therefore, the promotion of a wholly cashless payment system could be seen as a deterrent to travelling via public transport modes. However, the flexibility and convenience of m-ticketing and contactless payment was identified as a key factor that could encourage younger users to use public transport as their primary mode of transport. Further to this, it was suggested that bus operator zones should be reviewed to facilitate the expansion of the proposed park and ride options and allow a simple ticketing system that simplifies fares, mapping, core routes and travel zones. Further discussion identified the existing provision of electric vehicle charging points at Redbridge and Seacourt Park and Ride facilities; the provision of these facilities should be considered as a base for understanding the charging requirements for potential users at the proposed park and ride facilities.

### **4.6 Scheme Refinement**

- 4.6.1 The initial scheme refinement process utilised the information and viewpoints provided at the 'Check and Challenge' workshop to enhance scheme options and help eliminate any unfeasible options. The 'Check and Challenge' process enabled the development of the following packages as key priorities in improving the sustainable transport links within the Abingdon – Oxford corridor:

- Package I – Traffic Management
- Package II – Bus Improvements (focusing along 3 key spines together with P&R services)
- Package III – Active Travel
- Package IV – Smart Mobility

- 4.6.2 The packages mentioned above were then developed through an appraisal framework to assess the likely cost-benefit of the different packages.

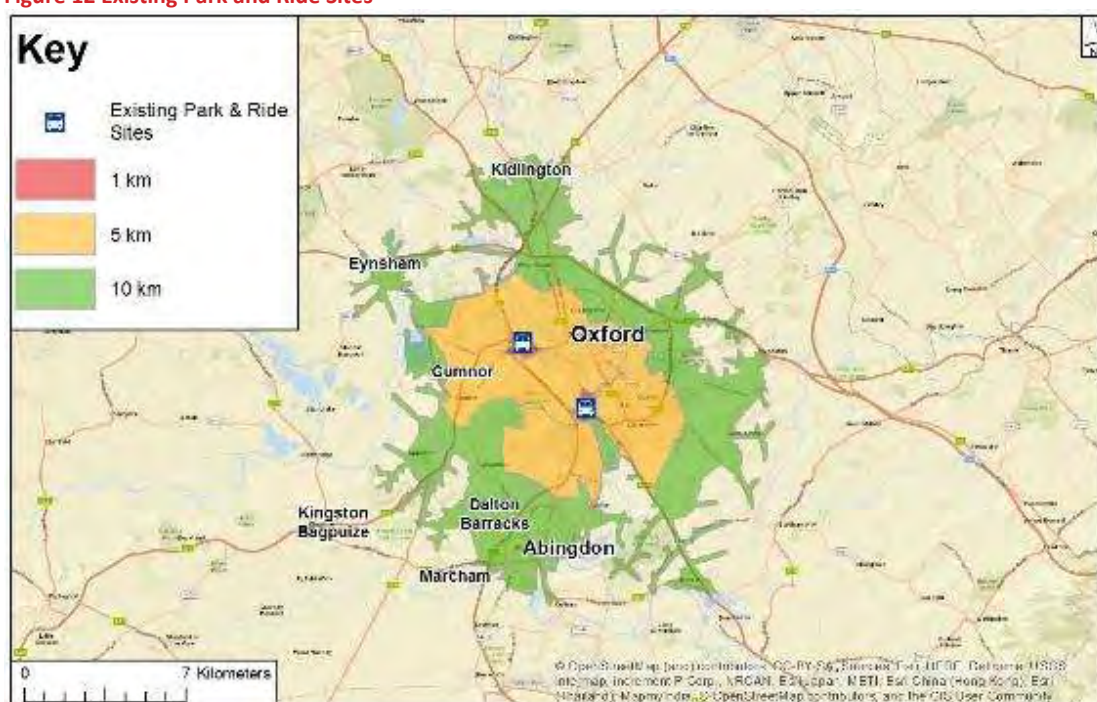
## 5. STAGE 2 – PARK AND RIDE ASSESSMENT

- 5.1.1 The LTP4 states that the Park & Ride sites have been incredibly successful in reducing traffic in Oxford City Centre and supporting the city's economic growth by providing an easy and attractive option for visitors entering the city. However, there are already delays at all approaches to the ring road, with particular hotspots located to the west (A420, A40), north-west (A44) and south (A34, A4074) during the morning peak period.
- 5.1.2 Specific to the Sub-Area, arrivals during the AM peak at the Peartree, Water Eaton, Redbridge and Seacourt P&R sites contribute, in particular, to traffic routing along the three A34 interchanges to the west of Oxford, contributing to increased congestion and journey time delays. Further to this, housing and employment growth within Oxfordshire is set to further exacerbate this level of congestion in the corridor, specifically within the Oxford inner ring road.
- 5.1.3 By intercepting these trips further outside the inner ring road, a significant majority of the demand would be captured further from the city which would have an immediate positive impact on the operation of the A34 in addition to the other intersecting roads. Therefore, as shown in Table 7, additional remote park and ride sites have been proposed, including at Lodge Hill and Cumnor, to serve the A40, A44, A34 and A420 corridors, each with direct access to the ring road and Oxford City Centre. In conjunction with the existing facilities, the proposed sites have the potential to create an overall wider catchment area for future park and ride users by encompassing additional residential areas.
- 5.1.4 The development of sites on the 'outer ring' could provide an opportunity for some of the existing 'inner ring' sites to be redeveloped or used for parking in alternative ways such as to cater for shorter stay shopper or visitor parking as opposed to all-day commuter use.

### 5.2 Existing Sites

- 5.2.1 As shown on Figure 12, the existing park and ride facilities at Seacourt and Redbridge have been considered within the scope of this assessment. Both of these facilities are within the Abingdon and Oxford fringe Sub-Area, however their location within the ring road and the existing highways infrastructure has contributed to increasing levels of congestion and journey time delays.

Figure 12 Existing Park and Ride Sites



### Seacourt P&R

- 5.2.2 Seacourt P&R is located to the north of the A420 Botley Road which provides access to Oxford from key residential catchments in the west such as Witney, Swindon and Faringdon. The site is served by a dedicated bus service (400 service) in addition to a number of commercial bus services, including the 4/4b, 66 and X30, serve the bus stops adjacent to Seacourt Park and ride. The 400 service provides a 15 minute journey time into Oxford City Centre which operates on a 13 minute frequency. The service routes via stops at Oxford Rail Station, New Road and Speedwell Street before serving Oxford City Centre, Headington and Thornhill Park and Ride.
- 5.2.3 Within the vicinity of the site, the A420 is in the form of a single carriageway, street lit road with an eastbound dedicated bus lane spanning approximately 750m towards the City Centre. In 2016, the A420 had an annual average daily flow (two-way) of approximately 17,055 vehicles, placing the site adjacent to a high number of daily traffic movements into Oxford.
- 5.2.4 In terms of cycling infrastructure, wide shared pedestrian cycleways are present on both sides of the carriageway in the vicinity of existing facility, covering approximately 750m in an eastbound direction towards the City Centre and 425m in a westbound direction westbound on the A420 Botley Road. Further on-carriageway cycle lanes are provided on both sides of the carriageway for the remainder of the journey to Oxford Railway Station which is located on the western edge of the city centre. The existing facility is approximately 2.1 km to the west of Oxford City Centre which equates to a 6-7 minutes cycle journey via the existing infrastructure on the A420 Botley Road.

### Redbridge P&R

- 5.2.5 Redbridge P&R is located to the south of Oxford, adjacent to the A34 Hinksey Hill Interchange. In addition to the dedicated bus service serving the facility (300 service), several commercial



services operate within the vicinity of the site, including the 31, 34 and 35 services which stop on Old Abingdon Road to the north of the site in addition to the X3 service which serves the park and ride facility itself. The 300 service provides a 8 minute journey time into Oxford City Centre (stop G1) and operates on a frequency of approximately every 10 minutes. The service routes into Oxford City Centre via Abingdon Road, where several bus stops are provided for journeys to and from the Redbridge facility.

- 5.2.6 The facility is located on the A4144; a street lit single carriageway road with wide footways on both sides of the carriageway. In 2016, the A4144 had an annual average daily flow (two-way) of approximately 13,036 vehicles within the vicinity of the facility, situating it within a key commuter hotspot for access to Oxford.
- 5.2.7 Cycling access to Redbridge P&R is provided in the form of segregated bus/taxi/cycle lanes which extend to the north of the site for approximately 250m for southbound traffic and 350m for northbound traffic. The facility is approximately 2.8km to the south of Oxford City Centre which equates to a 8-9 minute cycle journey via National Cycle Route 5 and Abingdon Road.

### Summary

Table 8 (below) summarises the key characteristics of the existing Seacourt and Redbridge P&R sites.

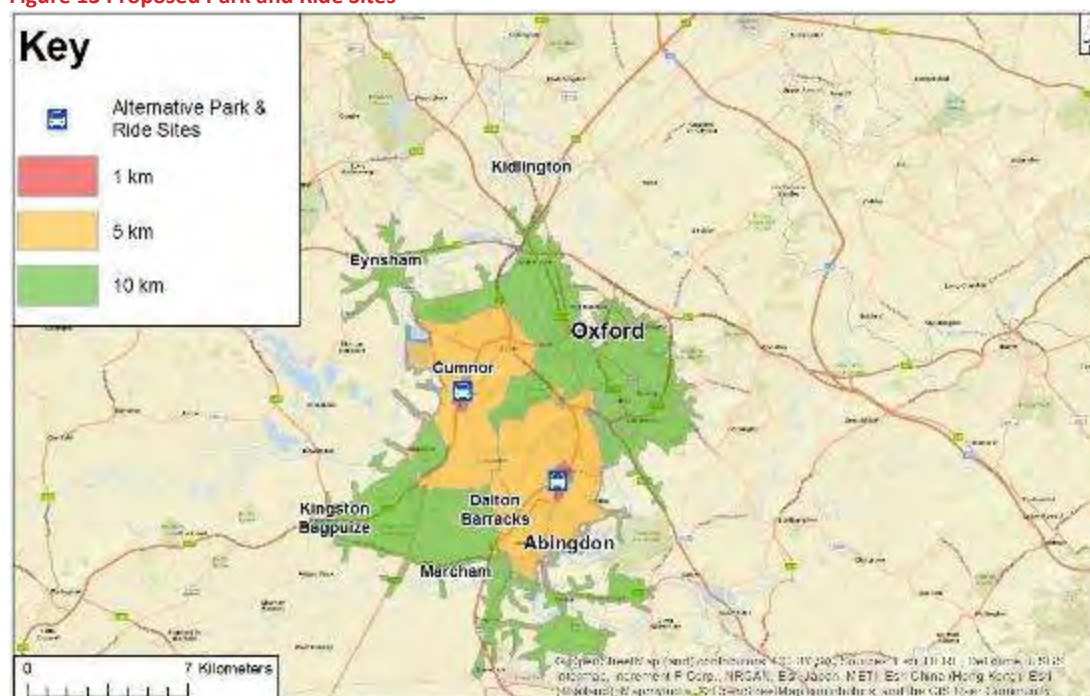
**Table 8 Existing Park and Ride Sites**

P&R	TOTAL PARKING BAYS	APPROX SITE AREA (HA)	DISABLED BAYS	ELECTRIC VEHICLE POINTS	CYCLE STANDS	CYCLE HIRE BIKES	APPROX CYCLE JOURNEY TIME (MINS)	BUS FREQUENCY (MINS)	APPROX BUS JOURNEY TIME (MINS)	REAL TIME P&R INFO
Seacourt	786	2.4	8	2	40	0	6-7	12	15	Yes
Redbridge	1070	3.6	20	2	70	5	8-9	10	10	Yes

## 5.3 OCC Future Strategy Development Sites

- 5.3.1 As previously mentioned, OCC have proposed additional remote park and ride sites to serve the A40, A44, A34 and A420 corridors, each with direct access to the ring road and Oxford City Centre. Two of the proposed sites are within the Oxford – Abingdon fringe Sub-Area; the Cumnor facility to the west of Oxford and the Lodge Hill facility to the south.
- 5.3.2 The Oxford Park and Ride Future Development Strategy indicates that a two-tier park and ride system, including the proposed facilities at Cumnor and Lodge Hill (Figure 13) as well as the existing facilities at Seacourt and Redbridge, would be unlikely to generate sufficient demand to support facilities on the inner and outer Oxford ring. However, the study does not account for weekend and off-peak usage whereby park and ride facilities become a viable mode of transport for leisure users as opposed to solely commuter purposes. As such, the development of these sites on the outer ring could provide the redevelopment opportunity for the existing Seacourt and Redbridge sites to be used primarily for shorter stay shopper or visitor parking as opposed to all-day commuter use.

Figure 13 Proposed Park and Ride Sites



#### Potential Cumnor P&R Site

- 5.3.3 The proposed P&R site at Cumnor would be located off Cumnor Hill by the existing all movements A420 junction. In the vicinity of the proposed access, Cumnor Road is street lit with speed restricted to 40mph. A narrow, overgrown footway is present on the north side of the carriageway, however cycling and public transport facilities are currently not provided. A summary of the existing bus services which operate within the vicinity of the site is provided in paragraphs 5.3.8 – 5.3.9.
- 5.3.4 The proposed Cumnor P&R site would cover the main A420 catchments of Cumnor, Faringdon, Swindon and Wiltshire. Cumnor P&R would be located approximately a 5.5 km's (16-17 minutes) cycle journey to the west of Oxford city centre on the A420 Botley Road, however this route encompasses a number of steep inclines which may be undesirable for cyclists.
- 5.3.5 Due to the location of the existing Seacourt facility, it is unlikely that vehicles, pedestrians and cyclists would travel to Cumnor from within the ring road. The Cumnor site would however serve as an intercept hub for the A420 corridor and would attract the previous users of the Seacourt P&R facility that travel from origin points outside of the inner ring road. In doing so, the interception of these trips at the remote Cumnor site would help alleviate congestion at the Botley interchange by capturing traffic on the A420 before the ring road.
- 5.3.6 Further to this, the proposed Cumnor site would be served by the BRT Line 2 which would route west to east from Cumnor via the A420 into Oxford before serving Oxford Brookes University and the A40 East Corridor Park and Ride facility to the east of Oxford. This route would provide a direct cross corridor movement that would enable access into Oxford from key corridors including trips from Swindon and Faringdon to the west and Aylesbury and High Wycombe to the east.

- 5.3.7 Alternatively, the existing 400 bus route which currently serves the Seacourt park and ride facility to the west of Oxford and the Thornhill park and ride facility to the east of Oxford could be extended to incorporate the proposed facility at Cumnor. It has been assumed that this service would route down Cumnor Hill before merging onto the B4044 West Way / A420 Botley Road for access into Oxford via the existing Seacourt Park and Ride facility.
- 5.3.8 In addition to BRT Line 2 and the possible extension of the 400 bus route, a number of commercial bus services currently serve the vicinity of the proposed Cumnor P&R site. Specific to the development sites in the context of this study, these include the 66 bus service which routes from east to west, connecting the development site at Kingston Bagpuize to Oxford via the A420. The 66 bus service, which operates on a 20 minute frequency, currently doesn't serve any bus stops within Cumnor, however the proposed park and ride facility would serve as a key interchange hub for the corridor, therefore the possible diversion of the 66 service could be integrated as part of the proposed park and ride development to enable users to seamlessly access the BRT network and a number of further bus services from this key interchange point.
- 5.3.9 Further to this, the existing 4/4b service which routes from south to north, connecting Abingdon and Dalton Barracks to Cumnor and Oxford could be further developed to create a higher frequency route to and from the proposed Cumnor Park & Ride site. Approximately 300m to the south of the proposed site on B4017 Wootton Road there are currently two bus stops which are served by the 4/4b service which would equate to a 3-4 minute walk to the Cumnor facility for interchanges onto the BRT network. Alternatively, the 4/4b service currently routes through Cumnor via the B4017, additional bus stops adjacent to the proposed park and ride site would enable the route to continue to serve the village of Cumnor whilst also allowing users to interchange at the park and ride facility.
- 5.3.10 In the vicinity of the site in 2016, the A420 had an annual average daily flow (two-way) of approximately 21,705 vehicles, which highlights the strategic importance of the route for access into Oxford. The proposed facility would not only intercept users who are currently routing towards the Seacourt facility, it will also provide a strategic interchange hub, linking development at Kingston Bagpuize and Dalton Barracks to a key interchange hub.
- 5.3.11 There are a number of key issues which must be considered with the proposed development of the Cumnor park and ride site:
- There is a complex existing junction arrangement at the A420 which may require additional signage/lane markings;
  - The site would need to be released from the Green Belt;
  - Traffic priority for northbound traffic leaving the A420 may need addressing; and
  - Suitable footway/cycleway should be provided between the proposed site and the existing Seacourt P&R (c3.8km). This would promote Cumnor and Seacourt P&R as a possible park and cycle hub for some regular cyclists travelling to Oxford.

#### **Potential Lodge Hill P&R Site**

- 5.3.12 The proposed P&R site at Lodge Hill would be located off Oxford Road by the existing A34 junction. Access to the proposed facility is currently provided via Oxford Road in both directions in addition to A34 southbound, however there are currently no slip roads provided at the Lodge Hill junction, making the park and ride facility inaccessible for vehicles travelling northbound along A34. As part of LPP1, land has been safeguarded for the delivery of slip

roads to form a diamond Interchange at the A34 Lodge Hill Junction which will facilitate northbound movements accessing the Lodge Hill park and ride facility. This scheme has recently been approved by the Central Government, with a provisional delivery data by 2020.

- 5.3.13 To the north of the proposed site, a narrow footway is present on the west side of the carriageway, however this is subject to capacity issues due to overgrowth from the adjacent grass verge and foliage. A shared cycle/footway is provided for approximately 750m to the south of the Oxford Road / south-facing slip road junction towards Abingdon. However, this route is not continuous as cyclists and pedestrians are required to cross Oxford Road, approximately 215m to the north of the Dunmore Road / Oxford Road / Twelve Acre Drive junction for access to the shared cycle footway on the eastern side of the carriageway. This crossing point has no formal pedestrian or cycle facilities and is without dropped kerbs, tactile paving and appropriate signage. Significant improvements would be required in the form of pedestrian/cycleway widening and maintenance in order to connect the proposed Lodge Hill site to the wider pedestrian and cycle network on Dunmore Hill and Twelve Acre Drive for access to Abingdon and Dalton Barracks in particular.
  
- 5.3.14 The development of the Lodge Hill park and ride site would be located approximately 4.2km (12-13 minute cycle journey) to the north east of Dalton Barracks. This trip would route along Wootton Road, where a shared footway cycleway is provided, before routing onto Dunmore Road and Oxford Road for access to Lodge Hill. This shared pedestrian cycle way terminates just south (c200m) of the potential Lodge Hill P&R. It would benefit from an extension of the current provision up to the site to provide a continuous and attractive route from Dunmore Road to facilitate movements from key residential areas to the north of Abingdon, as well as Dalton Barracks, although the latter would benefit even more from a direct east-west link from the development site across to the Park & Ride.
  
- 5.3.15 The proposed P&R site at Lodge Hill would cover the main A34 catchments of Abingdon, Didcot, Science Vale, Newbury and Hampshire, specifically reducing the capacity strain on the existing Redbridge park and ride facility. As such, this site would be crucial in helping to alleviate congestion at the key Hinksey Hill interchange by capturing traffic on the A34 before it reaches the ring road.
  
- 5.3.16 The proposed Lodge Hill site would be served by the BRT Line 3 which would route from Lodge Hill to the proposed A44 corridor park and ride site via key employment areas to the east of Oxford including Oxford Science Park, Oxford Brookes University and Headington. The BRT Line 3 would also integrate the existing park and ride sites at Redbridge and Peartree to provide a viable route for access into the east of Oxford from the south and north.
  
- 5.3.17 A number of existing commercial bus services currently stop at the Lodge Hill bus stops, which are located on either side of the carriageway, approximately 330m and 415m from the site. Frequent services are provided through the X2 and X3/X13 bus services which would connect the site to areas of the Science Vale to the south and Oxford to the north. Further services are provided through the 31 and 34 which provide less frequent connector services into Oxford.
  
- 5.3.18 In the vicinity of the site in 2016, the A34 had an annual average daily flow (two-way) of approximately 60,868 vehicles, which highlights the strategic importance of the route for access into Oxford. The proposed facility would intercept trips which are currently routing towards the Redbridge facility, further reducing the vehicle impact and levels of congestion to the north of the A34 Lodge Hill interchange. Further to this, through the development of small scale improvements to existing pedestrian and cycling infrastructure, the site will serve

as a key multi-modal interchange hub, including access to BRT line 3 in addition to frequent commercial routes through the X2 and X3/X13 services.

5.3.19 There are a number of key issues which must be considered with the proposed development of the Lodge Hill park and ride site:

- Access via an enhanced new all movement junction from the A34 is required, therefore the viability of the scheme is largely reliant on the provision of additional slip roads. This scheme has recently been approved by Central Government and so should now be delivered by 2020;
- Cycle and pedestrian access from Dalton Barracks and Abingdon would need to be improved to provide a viable and continuous route linking key residential areas to the proposed interchange hub;
- Cycling infrastructure should also be explored to facilitate park and cycle movements for users accessing Oxford from Lodge Hill. Whilst this could largely build upon the existing NCN5 network, more direct and improved routes with a greater degree of cyclist priority need to be explored to encourage the uptake of cycling to and from the site.

#### Summary of OCC Proposed Park & Ride Sites

5.3.20 Table 9 (below) summarises the key characteristics of the proposed P&R sites in the vicinity of Cumnor and Lodge Hill. The estimated bus journey times from the proposed new P&R sites are based on a worst case peak hour network journey times (taken from google traffic on a Friday during peak hours). These estimates do not make an allowance for existing or potential future bus priority infrastructure (such as bus lanes/bus gates) and so represent a guideline worst case scenario. In reality, these journey times are likely to be much shorter.

5.3.21 The additional buses required is an estimation of number of buses needed to maintain the existing level of service (assuming buses on the route currently continuously loop) on the route taking into account the increase in journey times. Again this is based on the worst case journey time estimations and therefore represents a worst case scenario.

**Table 9 Summary of Proposed Facilities**

PROPOSED P&R	SUGGESTED PARKING CAPACITY	APPROX SITE AREA (HA)	CYCLE STANDS	CYCLE HIRE BIKES	APPROX CYCLE JOURNEY TIME (MINS)	APPROX BUS JOURNEY TIME (MINS)	ADDITIONAL BUSES REQUIRED	TOTAL COST (M)
Cumnor (Site 5)	1,200	3.3	Yes	Yes	16-17	24	1	£11.3
Lodge Hill (Site 3)	1,600	8.1	Yes	Yes	23-24	25	1-2	£14.1

## 5.4 Potential Alternative Sites

### Potential Appleton P&R Site

5.4.1 A potential P&R site at Appleton would be located off of the A420 by the construction of a new arm on the A420/A338 roundabout junction. In the vicinity of the proposed access, the



A420 is a street lit, de-restricted dual carriageway with two running lanes in both directions. No footways or cycleways are present in the vicinity of the proposed access.

- 5.4.2 The proposed Appleton P&R site is likely to cover the same key A420 catchment as the potential Cumnor P&R, with the exception of residents of Cumnor and possibly Dry Sandford. It has been assumed that the Dalton Barracks site would make use of the alternative Lodge Hill facility due to its proximity. Appleton P&R would be located approximately a 9.7km to the south west of Oxford City Centre, however there are currently no formal cycling routes adjacent to the A420 that would enable potential users to cycle from Appleton. This site would also relieve congestion at the busy A420 Botley Interchange junction by capturing traffic on the A420 before the ring road.
- 5.4.3 Stagecoach Gold service 66 stops at bus stops adjacent to the site on the A420 (three services per hour weekdays) with service X30 (2 services per hour weekdays) stopping approximately 300m north east of the site boundary.
- 5.4.4 The potential Appleton P&R site would be located approximately 4.4km north east of the Kingston Bagpuize development site on the A420. The A420 between Kingston Bagpuize and the potential Appleton P&R varies between a de-restricted dual carriageway and 50mph single carriageway road. However, a lack of existing formal cycle and pedestrian routes would prevent residents of Kingston Bagpuize in using active travel modes to complete the first and last mile of their trip. Further to this, the existing 66 service routes via the A420 towards Kingston Bagpuize, therefore the development of a park and ride facility at Appleton would be unlikely to attract demand from the development site at Kingston Bagpuize.
- 5.4.5 In the vicinity of the site in 2016, the A420 had an annual average daily flow (two-way) of approximately 19,361 vehicles, indicating a well utilised route, predominantly for vehicles accessing Oxford from the west. The proposed facility could potentially intercept users who are currently routing towards the Seacourt facility, however the distance away from Oxford City Centre could create extensive journey times which could increase the likelihood of users continuing past the Appleton site in favour of the existing Seacourt facility. Further to this, without the inclusion of a BRT line, the Appleton site would be isolated in its location and would be served by the commercially run 66 bus service in addition to a possible extension of the 400 park and ride service.
- 5.4.6 There are a number of key issues which must be considered with the alternative development of the Appleton park and ride site:
  - The site is not integrated with the proposed BRT network which creates an immediate accessibility disadvantage when compared to the Cumnor park and ride site;
  - The location of the site would increase the distance from the facility into Oxford when compared to the Cumnor site, leading to an increased overall journey time and a reduction in the attractiveness of park and ride for access into Oxford;
  - A new arm would be required on the A420/A338 roundabout;
  - In order to provide a new access a number of trees will need removing adjacent to the A420/A338 roundabout;
  - There are no formal pedestrian or cycling routes within the immediate vicinity of the site which, in conjunction with the site's distance from main residential areas, limits the viability of walking and cycling to and from the site.

## Potential Marcham P&R Site

- 5.4.7 The potential P&R site at Marcham would be located off of A415 Marcham Road where an existing weighbridge is present on the western approach to the A34 Marcham interchange. In the vicinity of the proposed access, Marcham Road is street-lit with speed restricted to 30mph. Vehicle speeds are de-restricted directly to the west of the existing weighbridge access. Footways are present on both sides of Marcham Road with a grass verge separating them from the main carriageway near the proposed Marcham P&R site.
- 5.4.8 Marcham P&R would be located approximately 14.16km from the Centre of Oxford. Due to the site's proximity to the A34 and A420, the site could make use of two routes into Oxford; firstly via the A338 and the A420 for access into Oxford from the west and secondly via the A34 for access into Oxford from the south. For the scope of this study, it is assumed that park and ride users will route via the A34 into Oxford which provides the shortest network path. As such, this site could help to alleviate congestion at the A34 Hinksey Hill and Lodge Hill junctions by intercepting traffic routing northbound on the A34 in addition to vehicles travelling from Wantage and Grove via A338 Wantage Road.
- 5.4.9 The site also provides the potential to integrate a lorry park as part of the development which will further enhance the potential site as a wider transport hub, further expanding its potential user base. However, due to the location of the site, onward cycle trips from the facility would not be likely given the distance from Oxford. However, through the widening of parts of the existing shared cycle footway and the provision of a formal pedestrian/cycle crossing facilities for users to access the site, Marcham park and ride facility would be well positioned to attract a number of users from Abingdon and the development site at Marcham who would wish to walk or cycle to the site in order to catch bus services into Oxford City Centre.
- 5.4.10 The proposed Marcham P&R site would be likely to cover the same key A34 catchments as the potential Lodge Hill P&R with the exception of much of northern Abingdon. Notwithstanding this, there are a number of frequent bus services which already serve northern Abingdon (such as X2, X3 and X13) which are likely to be more attractive options to many individuals than travelling by car.
- 5.4.11 No existing bus services currently stop in the immediate vicinity of the potential Marcham P&R site. However, several bus services, including the 31 service which operates on an hourly frequency, route to Oxford City Centre via existing stops located approximately 500m to the east of the proposed site, to the east of the Marcham Interchange.
- 5.4.12 The Marcham site is not included within the proposed BRT network, therefore if the site were to come forward it would be reliant on the expansion of commercial bus routes. Further to this, due to the site's isolation from Oxford City Centre, end-to-end bus journey times for access into Oxford would be longer than at Lodge Hill for example, making Marcham a relatively unattractive modal interchange for access into Oxford.
- 5.4.13 There are a number of key issues which must be considered with the alternative development of the Marcham park and ride site:
- Cycle routes are provided from Marcham and Abingdon in the form of shared cycle/footways, however these would require significant widening and maintenance improvements to facilitate additional use by potential park and ride users;

- An improved access would be required on A415 Marcham Road to facilitate the inbound and outbound movements of cars in addition to new bus movements;
- Improved pedestrian and cycle crossing facilities would be required at the Marcham Interchange to facilitate pedestrian and cycle flows from Abingdon;
- The site would not be integrated within the wider BRT network, therefore it would be heavily reliant on the expansion of the commercial bus services;
- There are a number of frequent bus services from Abingdon such as the X2 and X3 which provide more convenient routes to Oxford for Abingdon residents; and
- The location of the site would increase the distance from the facility into Oxford when compared to the Lodge Hill site, leading to an increased overall journey time and a reduction in the attractiveness of park and ride for access into Oxford;

5.4.14 Table 10 (below) summarises and compares the key characteristics of the proposed P&R sites at Cumnor, Appleton, Lodge Hill and Marcham with Table 11 summarising the potential site constraints. The estimated bus journey times from the proposed new P&R sites are based on a worst case peak hour network journey times (taken from google traffic on a Friday during peak hours). These estimates do not make an allowance for existing or potential future bus priority infrastructure (such as bus lanes/bus gates) and so represent a guideline worst case scenario. Therefore, these journey times are likely to be much shorter.

5.4.15 The additional buses required is an estimation of number of buses needed to maintain the existing level of service (assuming buses on the route currently continuously loop) on the route taking into account the increase in journey times. Again this is based on the worst case journey time estimations and therefore represents a worst case scenario.

**Table 10 Summary Comparison Table of A420 and A34 P&R Site Statistics**

P&R SITE	PARKING CAPACITY	APPROX SITE AREA (HA)	PARKING SPACES PER HA	CYCLE STANDS	CYCLE HIRE BIKES	APPROX CYCLE JOURNEY TIME (MINS)	APPROX BUS JOURNEY TIME (MINS)	BUS FREQUENCY (MINS)	ADDITIONAL BUSES REQUIRED
<b>Seacourt (existing)</b>	786	2.4	328	40	0	6-7	15	12	-
Cumnor	1,200	3.3	364	Yes	Yes	16-17	24	-	1
Appleton		16.8	71			29-30	28	-	1-2
<b>Redbridge (existing)</b>	1,070	3.6	297	70	5	8-9	10	10	-
Lodge Hill	1,600	8.1	198	Yes	Yes	23-24	22	-	1-2
Marcham		6.5	246			46-47	24	-	1-2

Table 11 Summary Table of Potential P&R Issues

P&R	POTENTIAL ISSUES
<b>Cumnor</b>	<ul style="list-style-type: none"> <li>Complex existing junction arrangement at A420 (Additional signage may be required);</li> <li>Traffic priority for northbound traffic leaving the A420 may need addressing;</li> <li>Suitable footway/cycleway should be provided between the proposed site and the existing Seacourt P&amp;R (c3.8km);</li> <li>Approximately 1 extra bus required.</li> </ul>
<b>Appleton</b>	<ul style="list-style-type: none"> <li>New arm on roundabout at A420/A338 junction;</li> <li>Walking / cycling facilities from Appleton on Oakmere Road (no footway or cycleway);</li> <li>Walking / cycling facilities to oxford (none on A420 north of P&amp;R);</li> <li>A number of trees will need removing for access;</li> <li>Cumnor area unlikely to be served without a bus stop; and</li> <li>Approximately 1-2 extra buses required.</li> </ul>
<b>Lodge Hill</b>	<ul style="list-style-type: none"> <li>Access via enhanced new all movement junction from the A34. Therefore the viability would be significantly affected if this scheme is not implemented;</li> <li>Cycling facilities from Abingdon (Oxford Road);</li> <li>Cycling facilities to oxford (to intercept with NCR 5); and</li> <li>Approximately 1-2 extra buses required.</li> </ul>
<b>Marcham</b>	<ul style="list-style-type: none"> <li>Cycle routes in need of improvement for access from Marcham and Dalton Barracks;</li> <li>New, improved access onto Marcham Road required (new signal controlled/roundabout junction likely);</li> <li>Improved crossing facilities may be required across Marcham Interchange;</li> <li>Significantly reduced area of Abingdon potentially served by P&amp;R without bus stops/ additional hubs;</li> <li>Approximately 1-2 extra buses required.</li> </ul>

## 5.5 Additional Locations

### Kingston Bagpuize – A420

- 5.5.1 Potential opportunities have also been identified to link in Kingston Bagpuize and the new residential development identified for this area. There are two core options which may provide viable alternatives.
- 5.5.2 The first option is to move the P&R on this corridor to Kingston Bagpuize, to interlink with the new development planned for this area. Additional bus stops for the park and ride service could then be introduced at Appleton and Cumnor to ensure these areas are still served. These additional stops would serve as small interchange hubs and should be designed with the intention to allow cyclists to store or hire bikes at the proposed bus stops.

5.5.3 There are a number of key issues which must be considered with this first alternative option for a park and ride site at Kingston Bagpuize:

- The location of the site would increase the distance from the facility into Oxford when compared to the alternative sites at Cumnor or Lodge Hill. This would lead to an increased overall journey time which may reduce the attractiveness of using park and ride as opposed to private car use for access into Oxford;
- The location of the Site would limit the viability of users cycling to/from the Site due to the lack of formal cycling infrastructure and distance into Oxford (circa 14.5km) in addition to the isolated location of the facility; and
- The site would not be integrated within the wider BRT network, therefore it would be heavily reliant on the expansion of the commercial bus services, specifically the 66 premium bus route.

5.5.4 The second potential option involves improvements to the key 66 bus service to provide small hubs around key stops on the route. This could involve construction of secure cycle stands at bus stop/s at Kingston Bagpuize, Appleton and Cumnor which would enable a number of smaller tributary routes to feed into the existing high frequency 66 bus service which operates along the A420 corridor.

5.5.5 The key issues to be considered with the second alternative option for a Kingston Bagpuize park and ride site include:

- The scheme would rely on significant pedestrian and cycling improvements to enable residents at Kingston Bagpuize, Appleton and Cumnor to access to key bus stops via active travel modes;
- The scheme would be reliant on commercial bus services and would not link with the proposed BRT Line 2 until Cumnor.

## 5.6 Summary of Park and Ride Assessment

5.6.1 This report outlines the transport constraints for potential P&R sites to serve Oxford City Centre along the key A420 and A34 corridors. A direct comparison for both corridors of the potential sites at Cumnor or Appleton and Lodge Hill or Marcham, is provided in order to contextualise the potential catchment areas and sustainable transport links for each of the sites.

5.6.2 With regard to the additional sites that will serve the A420 corridor in addition to the Seacourt park and ride site, the Cumnor site is well positioned to encourage cycling to and from the site. Further to this, the facility will directly link with BRT line 2, further promoting its position as a key interchange hub for seamless transfers into Oxford, especially for journeys routing along the A420 which would help to alleviate congestion within the inner ring road and at Botley Interchange. However, the delivery of the site is reliant on of the introduction of additional signage and carriageway markings in addition to the expansion of the existing pedestrian and cycle networks.

5.6.3 Alternatively, the Appleton potential P&R site is less viable for cycle and ride use due to the distance into Oxford and lack of formal cycling routes. The site itself is remote and has a much smaller local residential catchment than the Cumnor site which further diminishes the likelihood of users performing the first and last mile of their trip via active travel modes. The



delivery of the site is also reliant on the provision of an additional arm at the existing roundabout junction for access.

- 5.6.4 For the A34 corridor, the development of a facility at the Lodge Hill interchange provides the most viable and accessible location for a new park and ride facility that would be integrated as part of BRT line 3 for access to key employment areas to the east of Oxford including Oxford Business Park and Oxford Brookes University. Existing commercial bus routes such as the X2 and X3/13 could also be integrated with the site to enhance the overall frequency of bus movements into Oxford. The site would be within close vicinity to the Dalton Barracks development site, however significant pedestrian and cycle links would be required to connect Dalton Barracks to the facility and the wider bus network. The facility reduce levels of congestion and improve overall journey times by intercepting trips accessing Oxford prior to the Hinksey Hill junction. The deliverability of the scheme is dependent on the provision of A34 slip roads which has recently received Central Government approval and so should be delivered by 2020.
- 5.6.5 Improvements to the existing shared cycle footway on A415 Marcham Road would increase the level of accessibility to the alternative Marcham site via active modes of travel, specifically from Abingdon and the development site at Marcham. However, the site would not be integrated within the proposed BRT network, thus creating a reliance on the expansion of the existing commercial bus network. However, the site is unlikely to develop significant demand from Abingdon itself due to the existing provision of services such as the X2 and X3/13 which route from Abingdon to Oxford. The Marcham site could help to alleviate issues of congestion along the A34 corridor; however, potential users that travel via the A34 would be forced to deviate away from their desire line towards Oxford which further promotes the Lodge Hill facility as a favourable and more convenient site for a park and ride facility.
- 5.6.6 The most sustainable park and ride facilities are those that can serve as multi-modal interchange hubs, whereby opportunities for cycling and walking are maximised and the integration of wider bus networks such as BRT are included as part of the design process. The development of remote park and ride facilities provides the potential to alleviate congestion at key hotspots on the approaches to the existing park and ride facilities at Seacourt and Redbridge. However, the location of additional facilities, their level of accessibility by foot, bike and commercial bus routes in addition to their connection with the BRT network are key points that have been considered when assessing the most suitable sites.
- 5.6.7 As such, it is recommended that the Lodge Hill site on the A34 corridor represents the most significant opportunity to encourage sustainable travel to/from the site and capture the most potential trips to alleviate highway congestion issues further north along the A34. In addition, with regard to the A420 corridor, the development of a park and ride facility at Cumnor will represent the most viable option to intercept trips travelling into Oxford whilst also serving as a key interchange hub for pedestrians, cyclist and public transport users to make use of the proposed BRT network.

## 6. STAGE 3 – IMPROVEMENT PACKAGES

### Packages for the Abingdon to Oxford Sustainable Transport Corridor

#### 6.1 Introduction

- 6.1.1 The previous sections have identified a range of issues and opportunities for the Abingdon to Oxford Corridor. Residential development and employment growth both within and adjacent to the corridor requires a strategy to manage the pressures that existing infrastructure will face. Therefore, this section outlines a vision for the corridor that will maintain and improve access and movement and support the current and future needs of residents, employees and visitors who travel to and through the area.
- 6.1.2 Taking account of the issues and opportunities faced by the corridor, 4 packages have been developed that both provide infrastructure enhancements and that also seek to future proof the corridor through making preparation for technological advances on the near horizon. Whilst there are some key opportunities to improve infrastructure in the corridor through the traditional approaches of traffic management, public transport and active travel there is also the growing potential for smart mobility to provide solutions within the Local Plan period.

#### 6.2 Traffic Management Package

- 6.2.1 Access to key employment, education, health, leisure, retail and public transport facilities are crucial to integrate and support the development outlined in Local Plan Part 2. A 'Traffic Management' package is therefore proposed with the associated measures set out in the sections below.
- 6.2.2 The development of a package of measures has been designed to facilitate the movement of people, routing towards key employment areas in Abingdon, Science Vale and Oxford whilst specifically focussing on addressing the existing issues of congestion and delayed journey times within the corridor. The 'Traffic Management' package comprises of the following measures:
- Capacity Improvements to the A338/A415 Junction at Frilford;
  - Introduction of demand/queue responsive traffic lights at Frilford lights;
  - Introduction of bus priority signals at Frilford lights.
- 6.2.3 In the short term, these measures aim to address the existing issues of congestion, specifically at the key Frilford Lights junction. This package of measures will specifically target new development at Marcham and Kingston Bagpuize through the provision of highway capacity improvements to enhance journey times and reduce the impact of additional development trips on the network. However, further work is required in relation to the specific requirements of development sites to ensure that traffic management improvements are carried out in line with local needs.
- 6.2.4 This package specifically targets the future residents of Marcham and Kingston Bagpuize and their associated travel patterns and modal choices. Journey to work data (2011) indicates Abingdon as a key commuter location for trips originating in Vale of White Horse 007 and Vale of White Horse 003; two Middle Layer Super Output Areas that cover Kingston Bagpuize and

Marcham respectively. As such, it is anticipated that a high proportion of trips generated from the development sites would mirror the existing commuting patterns in addition to trips to Oxford and key employment growth within the Science Vale. This package therefore aims to facilitate the expected commuter trips from Kingston Bagpuize to Abingdon via A415 Abingdon Road/Frilford Road, in addition to trips from Marcham to Oxford via A338 Oxford Road and the A420.

6.2.5 An outline of the scope of the Traffic Management Package is included in Figure 14.

**Figure 14 Scope of Traffic Management Package**



#### **TM1: Capacity Improvements to the A338/A415 Junction at Frilford**

6.2.6 Capacity improvements to facilitate the high proportion of vehicles routing through the A338/A415 signalised junction. Additional width on the A338 left turn lane into A415 Kingston Road will enable the staggered junction to facilitate northbound movements along the A338 without delay caused by vehicles turning left along A415 Kingston Road. Further to this, an additional left-turn lane for eastbound traffic on the A415 Kingston Road arm will facilitate left turn movements on to A338 northbound in addition to right turners accessing A415 Frilford Road and A338 southbound. The capacity improvements would require highway widening schemes, however if introduced, the improvements could significantly reduce the congestion, especially for eastbound vehicles on A415 Kingston Road and Westbound vehicles on A415 Frilford Road.

6.2.7 The performance of this junction will need to be considered in a high level of detail within the final appraisal, accounting for the feasibility of capacity improvements as well as demand responsive traffic lights to mitigate the likelihood of further congestion issues.

#### **TM2: Introduction of demand/queue responsive traffic lights at A338/A415 junction at Frilford**

6.2.8 Use of demand responsive technologies that allocates additional green time at sections of the staggered A338/A415 crossroads that are over capacity, enabling the junction to adapt to

likely changes in transportation network conditions and accommodate the fluctuation in traffic routing on A415 Frilford Road/Kingston Road and the A338 Oxford Road.

- 6.2.9 Such technologies allow the timings of signals to reflect demand on real-time basis, and allows for reduced delays, reduced stops and increased average journey speed to mitigate the likelihood of further congestion issues. Should this technology prove to be effective at the Frilford junction, there is potential for it to be implemented at other key junctions on the approach to Abingdon, Science Vale and Oxford in particular where commuter patterns are high.

### **TM3: Introduction of bus priority signals at Frilford lights**

- 6.2.10 Bus priority signals provide a viable measure to improve the reliability of services. Use of bus priority signals reduces the delay time for buses at traffic lights by either timing phases to make it more likely that a bus will arrive during a green phase or by shortening the red phase on their approach arm. This measure will rely on the availability of real time information, specifically for the 15, 31 and X30 bus routes which would feed into the signal system to reduce the delay for buses at the A339/A415 Frilford junction.
- 6.2.11 Although the frequency of bus movements using the A338/A415 junction is relatively low, the introduction of bus priority signalling at Frilford lights should be used as a base for the growth of bus priority measures across the Vale. Should the technology prove effective in reducing the delays and overall journey times of the existing bus services that route through the A338/A415 junction, further areas of high concentrated bus movements within Abingdon and at the proposed Lodge Hill Park and Ride could be targeted with a similar approach to improve the service for mass transit vehicles at key intersections.

## **6.3 Bus Improvements Package**

- 6.3.1 As indicated in Section 1, Oxfordshire has a strong commercial bus network focussed on urban and inter-urban routes. Oxfordshire County Council no longer provide financial support for bus routes, which has led to the withdrawal of most routes previously reliant on this support. These withdrawn routes tend to be less frequent local and rural routes, and although only used by a small proportion of bus passengers, have left some areas no longer accessible by bus.
- 6.3.2 This package of measures has been designed to enhance opportunities for bus travel across the Vale, both for leisure and commuter purposes, and to incorporate residential development sites in Local Plan Part 2 as part of the wider bus network through a series of enhancements to specific routes, facilities and ticketing options. The 'Bus Improvement' package will comprise the following measures:
- Service enhancements through frequency improvements;
  - Safeguarding of land for BRT extension and/or new bus routes to Dalton Barracks;
  - Promote cashless payment system across all viable modes;
  - Support bus operators in the provision of e-ticketing;
  - Improved information of public transport routes and frequencies at workplaces and residential developments;
  - Work with operators to extend the SmartZone ticket to Park and Ride routes;
  - Introduction of RTI at key bus stops;

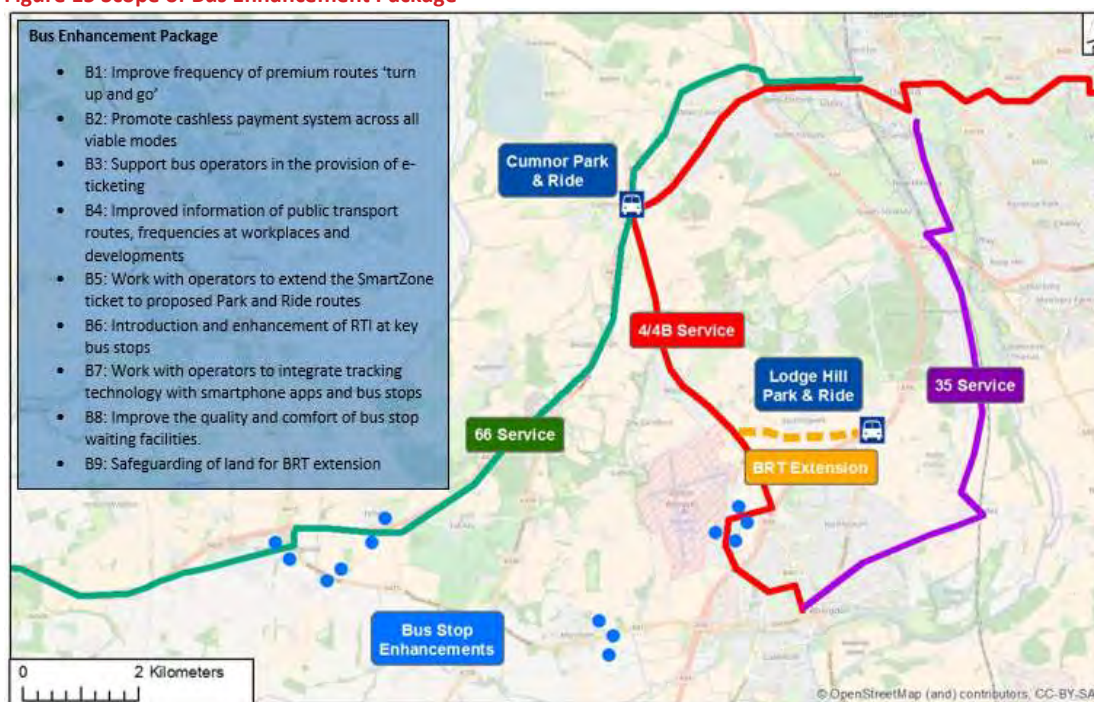


- Work with operators to integrate tracking technology with smartphone apps and bus stops; and
- Improve the quality and comfort of bus stop waiting facilities.

6.3.1 These measures aim to address the existing issues of accessibility across the Vale by creating opportunities to promote bus usage as a more attractive mode of travel for existing residents as well as for residents of new developments at Dalton Barracks, Marcham and Kingston Bagpuize. By developing a set of bus improvement measures prior to occupation of the new development sites, future residents will be more likely to utilise the newly developed infrastructure for journeys to work (e.g. services to Abingdon, Science Vale and Oxford) as well as connector services as part of a sustainable linked trip to Park and Ride sites such as Lodge Hill and Cumnor.

6.3.2 The scope of the bus enhancement package, including bus stop improvements, route enhancements and ticketing improvements is shown in Figure 15.

**Figure 15 Scope of Bus Enhancement Package**



#### **B1: Improve frequency of bus services to Premium Routes ‘turn up and go’**

6.3.3 The frequency of bus services determines the level of confidence and dependence that potential users will have with the bus network. ‘Turn up and go’, or Premium Route, services operate on frequencies between 10-15 minutes. Key bus routes to target will be the 35 and 66 bus services which already operate on a 20 minute frequency. In addition, improved frequency of the number 4 bus service would also enable development at Dalton Barracks to be at the forefront of a ‘turn up and go’ bus service which would encourage the likelihood of new residents favouring public transport over private car use for daily commuter trips. Additional routing options would need to be explored and incorporated within the detailed masterplans of the Dalton Barracks development to ensure the service is easily accessible to as many of the new residents as possible. The phasing of additional routing options that would serve the Dalton Barracks site would need to coincide with the phasing of the Dalton Barracks scheme to ensure that extended services serve the maximum number of new residents. Trials



of the timetabling extensions should be promoted during peak hours to determine the level of bus patronage and understand the likelihood of turn up and go services becoming a permanent fixture following occupation.

- 6.3.4 Further to this, development in Marcham may provide an opportunity to improve the existing frequency of public transport routes within the local area, specifically the 15 route between Abingdon and Witney. Due to the proposed allocation quantum of 90 dwellings in LPP2, service enhancements to key routes such as the 4, 35 and 66 service should be seen as priority routes, however, where possible through development contributions service enhancements within Marcham should also be considered.

## **B2: Safeguarding of busway from Dalton Barracks to Lodge Hill Park and Ride**

- 6.3.5 In addition to building on the frequencies and quality of service for existing routes, a more direct busway provides an opportunity to further enhance Dalton Barrack's position in relation to the Lodge Hill Park and Ride and proposed BRT Line 3. This measure involves the safeguarding of two routes that would facilitate cycle and bus movements between Dalton Barracks and the Lodge Hill facility. Further work will be required to identify the most cost-efficient delivery and phasing of these routes.
- 6.3.6 The safeguarding of this land will future proof the development at Dalton Barracks, enhancing its location by integrating with Oxford's wider BRT network, including a direct service to Oxford's Eastern Arc. In addition to the proposed cycleway suggested in AT12, detailed masterplans of proposed routes should be requested as part of the planning application process, whereby contributions towards or the provision of sections of the route would be requested.

## **B3: Promote cashless payment system across all viable modes**

- 6.3.7 Contactless payment systems provide an opportunity to streamline public transport systems by reducing bus boarding times and developing opportunities for linked public transport trips across the Vale. Bus companies operating within the Vale have recently adopted innovative technologies by facilitating payment from bank cards, smartphones and smart watches as well as cash. It is of note that most areas outside of London are yet to develop this level of ticketing. Whilst the current usage of the cashless system is low, it is anticipated to grow in the same way that cashless systems have been accepted in London, where contactless methods have been available for much longer and have also been incentivised.
- 6.3.8 These systems need to be further supported and marketed to raise awareness of the ease of contactless payments for users and to ensure that certain social groups are not excluded from public transport usage as a result of the change. In particular, cashless payment systems provide the opportunity to increase bus patronage amongst younger users through the integration of smartphone and smartwatch payment systems, however the marketing and awareness of this technology needs to be promoted and incentivised for it to become common use throughout the existing bus services.

## **B4: Support bus operators in the provision of e-ticketing**

- 6.3.9 In conjunction with the promotion of cashless payment systems, enhanced provision of e-ticketing develops a greater opportunity for users to benefit from carnet tickets and other schemes similar to the Oxford SmartZone pass which operates in and around the city of

Oxford. Through conjunction with the smart mobility package, specifically SM6 in relation to the development of a journey planner app, e-ticketing should be specifically focused for linked trips, whereby a user may make use of more than one bus or park and ride service as part of their journey. By targeting these trips, users will become more aware of the public transport interchanges that may not necessarily be within 400m of their home, therefore increasing the likelihood of people using existing bus services for longer commuter trips.

#### **B5: Improved information of public transport routes, frequencies at workplaces and developments**

- 6.3.10 Targeting future employees and residents prior to occupation is an effective way to influence travel behaviours before a reliance on private car use can be developed. This measure should make use of Travel Plans to distribute information relating to the frequencies, routes and pricing of existing routes from Dalton Barracks, Marcham and Kingston Bagpuize to Abingdon, Science Vale and Oxford to directly target likely commuter and school travel patterns. This process should also be developed through the growth of key employment areas within the Science Vale in particular, which currently has a low proportion of commuter trips being carried out by bus travel.
- 6.3.11 In addition to Travel Plan ‘Welcome Packs’ which are currently required through the planning application process, detailed information of the journey planning app, proposed through SM6, should be provided to enable future residents and employees to make personalised sustainable travel choices that could account for unique behaviour such as routing via a retail centre or restaurant on certain days of the week.

#### **B6: Work with operators to extend the SmartZone ticket to proposed Park and Ride routes**

- 6.3.12 The Oxford SmartZone currently covers the 4, X2, X3, 31, 35 and 66 bus routes up to and including Cumnor to the west and Kennington to the south. By integrating the proposed Park and Ride facilities at Cumnor and Lodge Hill within the SmartZone, the potential for these facilities to become key multi-modal interchanges will be enhanced through the availability of the simplified SmartZone Pass which would integrate the Park and Ride facilities with Oxford City Centre.
- 6.3.13 Further to this, Abingdon and Dalton Barracks are currently within the ‘South Oxfordshire Zone’ which incorporates the X2, X3, 4, 32A and 35 bus routes. Dual zone tickets are already available in weekly, monthly and annual passes which allow users to travel from Abingdon and Dalton Barracks to the Oxford SmartZone area as well as key employment hubs within Science Vale including Harwell Campus and Milton Park. The integration of the 31 and 66 bus routes into the South Oxfordshire Zone would incorporate development at Marcham and Kingston Bagpuize with the wider Oxfordshire bus network, further encouraging the promotion of linked trips through the use of dual zone tickets for access to Oxford, Science Vale and Abingdon.

#### **B7: Introduction and enhancement of RTI at key bus stops**

- 6.3.14 Real-time Passenger Information Systems (RTPIS) provide a significant benefit to customers through accurate timetabling information which could further increase users’ confidence in the reliability of the existing bus network. Real time automated vehicle location (AVL) data can be generated by buses serving key routes across the corridor and through the integration of this data with the journey planning app proposed in Smart Mobility measure SM6. It is of note that all significant routes in the area are currently equipped with real time information which is accessible through web or mobile platforms. However, street displays, such as the information screen displayed in Figure 16 are only provided at some bus stops, including stops

along the 35 and 66 bus services. Where multiple bus routes may pass through a bus stop, RTI display boards such as the example provided on the left would be more suitable, enabling users to view multiple approaching services. However, as the development sites at Dalton Barracks, Marcham and Kingston Bagpuize will be served by 1-2 bus services, the introduction of RTI (as shown on the image on the right) would be more suitable, forming part of a wider 'information box' with conventional physical timetabling boards and an NFC or QR code to access timetabling information via a smartphone. The information boxes should have clear service branding and bus route colour coding schemes to allow potential users to easily identify their desired route.

**Figure 16 Existing RTI (Fairacres, A415 Marcham Road and Radley Station, Foxborough Road)**



- 6.3.15 Key routes to target will be the 66 service routing through Kingston Bagpuize and the 35 service via Radley Station, both of which operate a 20 minute frequency and provide direct services to Oxford on either side of the A420/A34 channel.
- 6.3.16 The 66 bus service in particular is likely to generate significant demand from development at Kingston Bagpuize and should be targeted as a priority measure for the integration of RTI to influence the travel patterns of these future residents accessing Oxford and Swindon. However, as shown in Figure 17 the existing timetabling and waiting infrastructure is of a low quality and has no existing RTI provided. The integration of RTI as part of a wider 'information box' could be introduced to the existing bus flag on Faringdon Road, providing live public transport information for the 66 and 15 bus services which use this stop.



**Figure 17 Existing School Lane Bus Stop, Kingston Bagpuize**



6.3.17 For additional routes such as the 4/4b service which serves the Dalton Barracks site, RTI could provide a low-cost and effective solution at key bus stops within the centre of the site. As shown on Figure 18, the existing infrastructure would need to be upgraded to provide a small display screen to display the RTI.

**Figure 18 Existing Cholswell Road Bus Stop, Dalton Barracks**



**B8: Work with operators to integrate tracking technology with smartphone apps and bus stops**

6.3.18 The integration of real time automated vehicle location (AVL) technology with the journey planning app proposed through SM6 and the introduction of RTI displays develops a solution that could be used to alleviate high private car usage during peak congested hours. Through the development of a smart phone app that allows users to gain real-time information on current wait times for public transport, recommendations can be provided to commuters prior to leaving their house which may indicate a faster or more convenient route to work or school via public transport due to delays currently being faced with private car users.

**B9: Improve the quality and comfort of bus stop waiting facilities.**

6.3.19 Well-designed bus stops enhance the transit experience by minimising the ‘perceived’ waiting times for bus services which, could, promote higher bus patronage through targeted and strategic investment. In contrast, poorly designed and unattractive bus infrastructure is likely to decrease customer satisfaction, increase potential personal safety concerns which make bus transit a significantly less attractive alternative for new potential customers at key development sites at Dalton Barracks, Marcham and Kingston Bagpuize. For example, as shown in Figure 19, the existing bus stops on either side of the carriageway on A415 Kingston Road are of low quality with limited timetabling information, no shelter facilities and inadequate waiting area capacities. Further to this, there are no pedestrian footways or formal pedestrian crossings within the vicinity of the bus stops, making them largely inaccessible for current users from Kingston Business Park and future residents from the Kingston Bagpuize development site. Significant improvements to bus stops such as these which may serve the Kingston Bagpuize site, should be incorporated within the detailed masterplans, including enhancements to the waiting areas, sheltering facilities and through the provision of uniformed information boxes as highlighted in measure B5.

**Figure 19 Existing Kingston Business Park Bus Stops, A415 Kingston Road**



6.3.20 As well as being placed in convenient and safe locations, bus stops need to be visible and easily identifiable for new potential residents with a strong brand identity to increase the awareness of key routes serving new developments such as the 66 bus service for Kingston Bagpuize, the 4 bus service serving Dalton Barracks and the 31 service serving Marcham.



Potential users should feel familiar with the elements at each stop, despite the exact facilities varying between locations, this should include uniform timetabling information at stops.

- 6.3.21 Further to this, bus stop improvements should be designed to integrate the first and last mile of journeys from new residents, specifically through the provision of infrastructure for pedestrians and cyclists to safely and easily access bus stops. For high frequency routes facilities to safely store bicycles should be implemented to promote the uptake of active travel for the first and last mile of commuter trips from these bus stops.
- 6.3.22 The ultimate goal of this measure is to invest in high quality bus stop improvements to generate a low-cost, high-reward strategy for bus operators and potential users.

## 6.4 Active Travel Package

- 6.4.1 The provision of suitable and locally targeted cycling and pedestrian infrastructure is crucial to encourage the uptake of active travel as part of existing travel patterns and in addition to influencing the likely modes of transport that future residents will use upon occupation at Dalton Barracks, Marcham and Kingston Bagpuize. As aforementioned, infrastructure in the form of on-carriageway cycle lanes and shared cycle/pedestrian footways is currently provided at various points within Abingdon in addition to routes along Marcham Road and Wootton Road. However, currently the continuity and permeability of the overall cycling network across the Vale is relatively poor leading to the isolation of existing infrastructure which creates an unattractive and largely unsuitable route for cyclists.
- 6.4.2 The development of a package of measures has been designed to enhance opportunities for cycling and walking from key development sites, both for leisure and commuter purposes, by identifying key infrastructure improvements to connect existing infrastructure and create a continuous cycling and pedestrian network. The 'Active Travel Package' will comprise the following measures:
  - Improved pedestrian footway between Dalton Barracks and Abingdon via Faringdon Road;
  - Increased signage and widening of advisory cycle lanes on Faringdon Road between Abingdon and Dalton Barracks
  - Widening of Long Tow footway and the provision of advisory cycle lanes to provide access from Dalton Barracks to Abingdon via the existing infrastructure on Wootton Road;
  - Improvements to the Oxford Road cycle route from Dunmore Road to A34;
  - Quality and maintenance improvements to the NCN5 between Kennington to Oxford via the rail track;
  - Proposed cycle route connecting Twelve Acre Drive and White's Lane for access to Oxford;
  - Improved cycle access to Radley Station;
  - Improve Cumnor Hill for cyclists from A420 to A34;
  - Improve B4017 for cyclists from Dalton Barracks to A4280;
  - Enhancements to public rights of way for leisure cycle use;
  - Improved signage, marking and widening of the cycle infrastructure linking Marcham and Abingdon; and
  - Safeguarding of route from Dalton Barracks to Lodge Hill Park and Ride

Figure 20 Scope of Active Travel Package

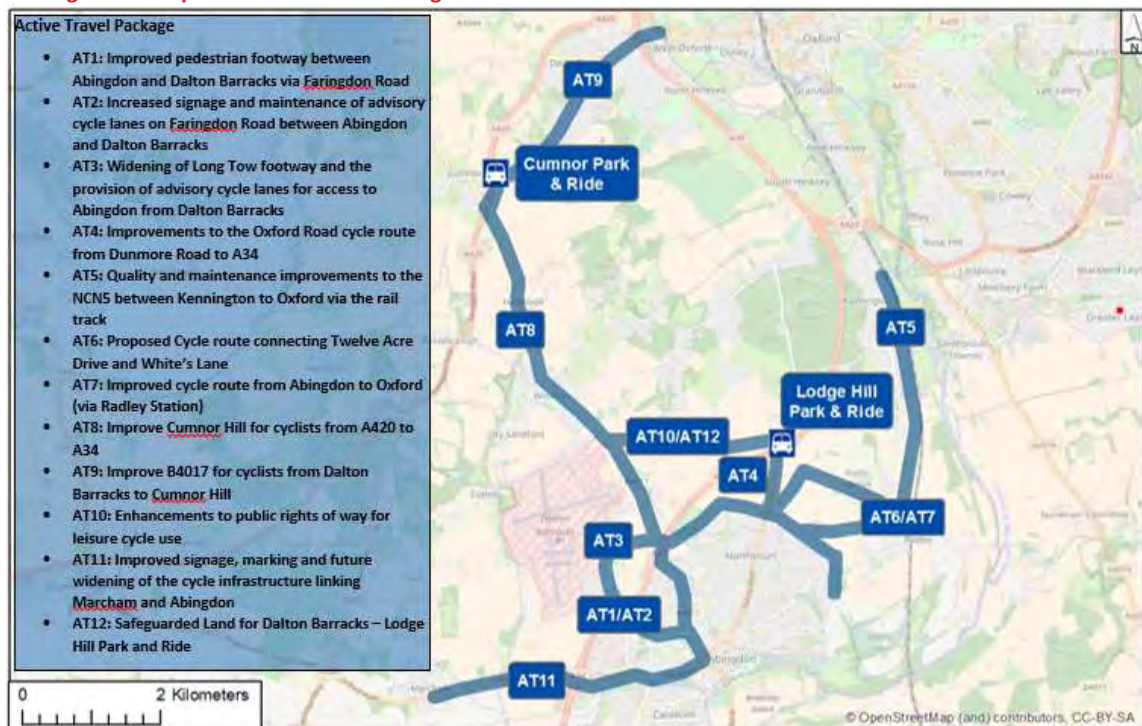


Figure 21 Scope of Active Travel Package (Existing Context)



6.4.3 These measures seek to address the existing barriers to cycling across the Vale whilst also identifying key opportunity areas that will require significant infrastructure improvements in order to facilitate the future commuter and leisure demands of new residents at Dalton Barracks, Marcham and Kingston Bagpuize. Specific target areas have been identified to connect and develop existing infrastructure in order to create continuous and viable routes for cyclists accessing Abingdon and Oxford. For example, as shown on Figure 20 and Figure 21,

AT3 – AT7 create a continuous cycle route from Dalton Barracks/North Abingdon to Oxford whilst also incorporating key public transport interchanges including the proposed Lodge Hill Park and Ride and Radley Station.

## Dalton Barracks – Abingdon

### AT1: Improved pedestrian footway between Abingdon and Dalton Barracks via Faringdon Road

- 6.4.4 For residents of Dalton Barracks to access key employment, education, health, retail and leisure facilities within Abingdon as well as enhanced public transport connections, pedestrian infrastructure improvements along Faringdon Road will provide a more attractive route for pedestrians whilst also significantly improving the safety of the route. As shown on Figure 22, the existing footway is narrow (approximately 1.8m) and is subject to foliage overgrowth on both sides. Although the footway is well-lit and segregated from cyclists throughout its entirety, the quality of surfacing is low and is provided with no tactile information to aid users with mobility and visual impairments.

Figure 22 Existing Footway on Faringdon Road



- 6.4.5 The route from Dalton Barracks (Faringdon Road/ Cholswell Road junction) to the centre of Abingdon is approximately 2.0km which equates to a 24 minute walk, making walking a viable option from Dalton Barracks for commuters, school children and for general leisure uses. Proposed pedestrian infrastructure improvements should include the following:

- Formal pedestrian crossing facilities at key junctions to the north of the A34 overpass;



- Footway resurfacing and possible widening for a stretch of approximately 280m between the Faringdon Road/Barrow Road junction to the Faringdon Road/Cholswell Road junction; and
- Upgrading of existing dropped kerbs with tactile paving.

6.4.6 The improvement measures mentioned above would create a more attractive and accessible route whilst also making it more accessible for people with mobility and visual impairments.

**AT2: Increased signage and maintenance of advisory cycle lanes on Faringdon Road between Abingdon and Dalton Barracks**

6.4.7 As shown on Figure 23, cycling infrastructure is already provided in the form of on-carriageway advisory cycle lanes along Faringdon Road between Abingdon and Dalton Barracks. Although highway widths restrict the ability to widen the existing advisory cycle lanes, the provision of signage and enhanced road markings with colour contrasting techniques across junction mouths would significantly increase the awareness that road users have of cyclists along this route. Further to this, drain covers towards the side of the carriageway and parked cars currently create barriers to cyclists using this route, cyclist-friendly cross hatched drain covers could be introduced to provide a more user friendly and comfortable route for cyclists. An extension of this provision should be extended up to the Faringdon Road/Cholswell Road as well as along both sides of the carriageway on Cholswell Road, where wide carriageway widths would be able to facilitate additional advisory cycle lanes.

**Figure 23 Existing Faringdon Road Cycle Lanes**



6.4.8 Improvements to the cycling infrastructure along Faringdon Road will serve as a main artery route into Abingdon, providing a direct and safe route to encourage the uptake of cycling for journeys to work, school and leisure purposes. This route should be incorporated into the development masterplan at Dalton Barracks by ensuring a suitable number of tributary routes from within the new development feed in to Faringdon Road with adequate cycling infrastructure to create a permeable network of cycling links through the development.

### AT3: Widening of Long Tow footway and the provision of advisory cycle lanes for access to Abingdon from Dalton Barracks

6.4.9 It should be noted that Faringdon Road and Wootton Road provide similar routes into Abingdon from Dalton Barracks, therefore the individual constraints and merits of both routes will need to be addressed. It has been assumed that the majority of cycle and pedestrian trips associated with Dalton Barracks will turn right out of the existing Long Tow junction onto Wootton Road. As such, the 150m stretch of footway to the north of the Long Tow/Wootton Road junction which leads to Dunmore Farm bus stop should not be considered an immediate priority for improvement unless detailed designs for the cycle/busway (AT12 and B2) are produced that integrate the existing stop. Instead, the existing shared pedestrian/cycle footway to the south of the Wootton Road/Long Tow junction should be incorporated into the development masterplan at Dalton Barracks by ensuring that suitable tributary routes for cyclists and pedestrians connect with the existing cycle footway on Wootton Road to create an attractive and permeable route for cyclist and pedestrians into Abingdon.

6.4.10 A key tributary route to address is Long Tow which will provide direct access to the Dalton Barracks site. As shown on Figure 24, the footway to the north of the carriageway is narrow (approximately 1.3m), however reductions to the foliage and grass verge on either side of the footway would create an immediate opportunity for footway capacity improvements that would create a more attractive and accessible route for pedestrians. Further to this, the widening of the footway would make it more accessible for people with mobility and visual impairments and would mitigate the likelihood of user conflict along this route.

Figure 24 Existing Footway on Long Tow



6.4.11 Cycle improvements along Long Tow should take the form of on-carriageway advisory cycle lanes that would benefit from the wide carriageway widths (6.75m), low vehicle speeds and flat topography of the road. It should be noted that these advisory lanes could also be supported by traffic calming measures to maintain vehicle speeds within the vicinity of the



development to ensure favourable cycling conditions are provided. These cycle improvements would connect the network of cycle routes within the proposed Dalton Barracks site to the existing shared cycle/pedestrian footpath on Wootton Road (shown in Figure 25) to create a seamless route for cyclists into Abingdon. In addition, the provision of on-carriageway advisory cycle lanes would avoid user conflict issues along the adjacent footway which will also allow safer bus boarding at bus stops along Long Tow without the presence of cyclists.

**Figure 25 Existing Shared Cycle Footway on Wootton Road**



## **Dalton Barracks – Abingdon – Oxford**

### **AT4: Improvements to the Oxford Road cycle route from Dunmore Road to A34**

- 6.4.12 Integration of cycling with the proposed park and ride facility at Lodge Hill is a crucial measure to introduce in order to increase the viability of park and ride sites becoming full modal interchange hubs across the County. As shown on Figure 26, Dunmore Road currently benefits from a shared pedestrian/cycle route to the southern side of the carriageway, however this will need significant improvements through cycle priority measures to increase the viability of this route from Dalton Barracks to Lodge Hill Park and Ride.
- 6.4.13 Cyclists are currently required to stop at numerous side roads along the Dunmore Road / Twelve Acre Drive route which significantly reduces the viability of the route as a continuous and attractive route. The extension of cycle lane markings across these minor junction would raise drivers awareness of cycling movements, giving cyclists a level of priority at these side junctions to allow a more continuous route between Dalton Barracks and the Dunmore Road/Twelve Acre Drive/Oxford Road roundabout for access to Lodge Hill Park and Ride.

Figure 26 Existing Shared Cycle Footway on Dunmore Road



- 6.4.14 However, to the north of the Dunmore Road/Twelve Acre Drive/Oxford Road roundabout on Oxford Road, significant cycle route enhancements will be required to increase the safety and viability of this route for users of the Lodge Hill Park and Ride from Dalton Barracks and Abingdon. The existing off-carriageway cycling route is not continuous and has significant gaps in the provision between Twelve Acre Drive and an informal crossing point approximately 215m to the north of the roundabout. Increasing the width of the existing footway to the east of the Oxford Road carriageway should be considered in addition to improved cycle lane markings and signage to create a more attractive and viable cycling route to Lodge Hill Park & Ride.
- 6.4.15 Further to this, approximately 215m to the north of the roundabout, the introduction of dropped kerbs complete with tactile paving and appropriate signage should be considered to create a formal and suitable crossing point for access to the existing off-carriageway cycling infrastructure on the western side of the carriageway. Similar to C2, this would provide a relatively low-cost solution that develops existing infrastructure to create a continuous and permeable route from Abingdon and Dalton Barracks to the proposed Lodge Hill Park and Ride to further promote the likelihood of cycle trips for the 'first and last mile' of journeys using the Park and Ride site.

#### **AT5: Quality and maintenance improvements to the NCN5 between Kennington to Oxford via the rail track**

- 6.4.16 The Hanson Way, which forms part of the NCN5 offers an easy and attractive leisure route for cyclists between Abingdon and Oxford. With the exception of short stretches of on-road cycling infrastructure in Radley and South Kennington, the route makes use of purpose built off-road tracks and is approximately 15km which equates to a 45 minute cycle. It is of note that NCN5 is not suitable for higher speed cycling, due to its low specification and poor maintenance, therefore on-carriageway routes such as Kennington Road and Abingdon Road provide more favourable and direct commuter routes into Oxford. As such, the NCN5 should

be targeted by improving existing surfaces and maintaining overgrown foliage adjacent to the rail line in order to encourage levels of cycling in the corridor. In doing so, the NCN5 could form part of a viable leisure route for cycle trips into Oxford from Dalton Barracks (via cycling infrastructure on Dunmore Road/Twelve Acre Drive) in addition to Marcham (via A415 Marcham Road).

#### **AT6: Proposed cycle route connecting Twelve Acre Drive and White's Lane**

- 6.4.17 Connecting existing stretches of cycling infrastructure between Oxford and Abingdon is essential to encourage levels of cycling for commuter and leisure purposes. In doing so, an extension of the cycle infrastructure on Twelve Acre Drive to provide an off-carriageway link to White's Lane would create a direct and attractive route for access into Oxford. This could route through Radley College via the existing 326/5/10 Public Footpath to avoid the need to deviate along Radley Road to access White's Lane/Kennington Road.
- 6.4.18 If developed, this route would serve as a main artery for cyclists between Abingdon and Oxford and could create an overall more attractive corridor for cycling between these two locations. In addition, an alternative route via the existing infrastructure through Peach Croft Farm would provide a direct route to White's Lane, connecting the North of Abingdon with the NCN 5 network. However, the upgrading of this route to serve as a public cycleway would be subject to land ownership and would be subject to agreement with the existing land owners.

#### **AT7: Improved cycle route from Abingdon to Oxford (via Radley Station)**

- 6.4.19 Radley Station provides a suitable solution to promote the attractiveness of cycle/rail trips from Dalton Barracks to key employment destinations outside of the Vale such as Reading and London Paddington. As aforementioned, the proposed southern access for Dalton Barracks on Long Tow is within a 15 minute cycle of Radley Station, routing via Wootton Road and Dunmore Road/Twelve Acre Road. Although cyclists are segregated from the main carriageway through the provision of designated shared cycle/pedestrian footways the permeability of the route is poor and crosses numerous side roads and driveways with limited cyclist priority which results in low utilisation from cyclists.
- 6.4.20 Planning applications have been submitted to the north-west of Radley in addition to land north of Dunmore Road and Twelve Acre Drive to provide a viable cycling route to Radley Station. These applications would provide cycle access to Radley Station without the need to route along Radley Road where carriageway width constraints and lack of lighting infrastructure present unfavourable conditions for cyclists. Integrating Dalton Barracks within this planned infrastructure route will be key in creating opportunities for promoting cycling as part of longer distance rail trips to London via Radley Station.

### **Dalton Barracks – Cumnor Hill – Oxford**

#### **AT8: Improve Cumnor Hill for cyclists from A420 to A34**

- 6.4.21 Cumnor Park and Ride facility will provide a significant opportunity to promote cycling across the Vale, specifically for relatively short commuter trips into Oxford. In addition to the provision of sufficient cycling facilities at the Park and Ride facility in the form of bike maintenance facilities, cycle parking and options for bike hiring schemes, high quality cycling infrastructure should also be introduced along Cumnor Hill to create an attractive and continuous cycling route for journeys into Oxford. Footways are provided on both sides of the carriageway along Cumnor Hill, however these are narrow and subject to pedestrian flows

from the built up residential areas surrounding the road. Therefore, to avoid potential user conflict with pedestrians and to make use of the wide carriageway widths, on-street cycling infrastructure in the form of advisory cycle lanes should be provided along Cumnor Hill between the proposed park and ride facility and the A34 underpass on B4044.

Figure 27 Cyclist on Cumnor Hill



- 6.4.22 As shown on Figure 27, on-carriageway cycling is currently the most suitable option for access into Oxford which makes use of the smooth surfacing and wide carriageway widths. As aforementioned, Cumnor Hill does encompass several inclines that may discourage some cyclists from using this route but it would still represents an option for access into Oxford. The introduction of advisory cycle lanes along this stretch of Cumnor Hill would provide a continuous route into Oxford from the park and ride facility that should mirror the approach suggested for Faringdon Road (AT2) whereby colour contrast lane markings should be introduced across junction mouths in conjunction with cross hatched drain covers to provide a continuous and attractive route for cyclists. This measure will connect to the existing provision on both sides of the carriageway on B4044 to promote the uptake of cycling as a viable option for access into Oxford for potential users of the Park and Ride facility and surrounding residents in Cumnor.



#### **AT9: Improve B4017 for cyclists from Dalton Barracks to Cumnor Hill**

- 6.4.23 The B4017 Wootton Road provides a direct route from Dalton Barracks to the proposed Cumnor Park and Ride facility. The route is approximately 5.2km which equates to a 15 minute cycle and makes use of relatively flat terrain, however a lack of cycling infrastructure and narrow carriageway widths currently prevents Wootton Road from being a viable option for cyclists travelling to the proposed park and ride facility from Dalton Barracks.
- 6.4.24 A combination of on-carriageway cycle lanes and shared pedestrian/cycle footways would extend the existing and proposed provision on Wootton Road to create a seamless route into Oxford to the north and Abingdon to the south. To the south, improved infrastructure adjacent to the Dalton Barracks site will connect to the existing off-carriageway cycle lane that routes along Wootton Road into the north of Abingdon. To the north, infrastructure improvements would connect Dalton Barracks to Cumnor park and ride facility which will serve as a main modal interchange point. Whilst on-carriageway provision will be suitable in certain built-up areas, through Wootton for example, the carriageway widths and vehicle speeds in other areas highlight the need for off carriageway infrastructure in the form of shared footway/cycleways. Given the length of the route, a continuous shared footway/cycleway would be very costly and difficult to achieve. Therefore a combination of on-carriageway and off-carriageway provisions should be considered in line with traffic calming measures to provide the most cost-effective solution.
- 6.4.25 The improvements will also connect Wootton Road to the cyclist infrastructure improvements on Cumnor Hill which are being proposed under measure C4 to serve as a continuous possible route into Oxford. Ultimately, this measure seeks to address the permeability of Wootton Road for cyclists by connecting existing infrastructure with proposed improvements to provide a continuous multi-purpose route from Dalton Barracks.

#### **AT10: Enhancements to public rights of way for leisure cycle use**

- 6.4.26 In addition to improvements to enhance the cycling infrastructure for commuter routes, leisure routes in the form of Public Bridleways are open to walkers, horse riders and cyclists and provide a significant opportunity to promote the uptake of cycling as part of a healthy lifestyle in addition to targeting tourist and weekend visitors to Oxford.
- 6.4.27 Several cross-corridor Public Bridleways such as routes 184/9/40 and 311/2/30 provide viable cross-corridor leisure cycling routes that connect the B4017 to Hinksey Hill. Although it would be difficult to develop these existing Bridleways into suitable commuter routes for high-speed cycling, low-cost maintenance combined with the promotion of these route through Travel Plan welcome packs and journey planning apps, specifically for new residents at Dalton Barracks, would encourage the uptake of weekend and leisure cycling across the sub-region. It should be noted that high-level resurfacing would incur significant costs and may cause objections from other users such as equestrians and pedestrians. However, small scale improvements and bridleway maintenance should be considered to create more desirable routes for all potential users.

#### **Marcham - Abingdon**

#### **AT11: Improved signage, marking and future widening of the cycle infrastructure linking Marcham and Abingdon**

- 6.4.28 As shown on Figure 28, A415 Marcham Road provides a direct cycling route from Marcham to Abingdon in the form of off-carriageway shared pedestrian/cycle footways. The route is



approximately 4km which equates to a 12 minute cycle but is subject to conflicting user flows, overgrown foliage and a lack of cyclist priority which limit the overall attractiveness of the route both for leisure and commuter purposes.

Figure 28 A415 Marcham Road Shared Cycle Footway



- 6.4.29 Clear cycle route markings and improved signage along the route would help to improve the overall attractiveness and awareness whilst also minimising the levels of user conflict between pedestrians and cyclists using this route. In addition, as shown on Figure 28, reductions to the foliage and grass verge on either side of the shared cycle footway would create an immediate opportunity for capacity improvements that would create a more attractive and accessible route for pedestrians and cyclists.
- 6.4.30 Further to this, cycle priority measures, particularly at key dismount junctions such as the A34/A415 junction would create a more permeable route for new residents at Marcham to access Abingdon by bike. The ultimate goal of this measure would be to develop a low-cost solution that develops and enhances the existing infrastructure to provide an attractive and safe cycling route between Marcham and Abingdon prior to occupation. With the infrastructure in place, monitoring of the number of cyclists using this route should be undertaken to justify footway widening measures for two-way cycle lanes in the future.

#### AT12: Safeguarding of route from Dalton Barracks to Lodge Hill Park and Ride

- 6.4.31 Whilst improvements to the existing route from Dalton Barracks to Lodge Hill Park and Ride were outlined in AT3 and AT4, a more direct cycleway provides an opportunity to further enhance Dalton Barrack's position in relation to the Park and Ride site and proposed BRT Line 3 at Lodge Hill. Land could be safeguarded for two potential routes between Dalton Barracks and Lodge Hill. In order to develop and incorporate existing infrastructure as part of this measure, the northernmost option would route via the existing Public Bridleway (415/29/10)

which routes west to east from Wootton Road to the south of Sunningwell. The remainder of the proposed link would route through existing private land to the south of Sunningwell and connect with the southernmost route stemming from Sunningwell Road before connecting with the Lodge Hill Park and Ride facility from the west. Both routes would make use of the relatively flat terrain to the south of Sunningwell, however significant enhancements would be required through the provision of appropriate re-surfacing, signage and cycleway markings to ensure the routes are attractive and safe for cyclist use. As aforementioned in B2, it would be the intention to further develop this channel into an extension of the BRT network, lengthening BRT line 3 to incorporate the Dalton Barracks site.

- 6.4.32 The safeguarding of this land will future proof the development at Dalton Barracks, providing the potential for it to become fully integrated into Oxford's wider BRT network through an attractive and direct cycling route for faster, more reliable transit routes across the Vale. Detailed masterplans of proposed routes should be requested as part of the planning application process.

## 6.5 Smart Mobility Package

- 6.5.1 The development of a package of Smart Mobility measures is proposed that build towards a smart mobility corridor that aims to help the public improve the timing, mode choice and routing of their journeys. This approach should involve close working with Oxfordshire County Council to enable the corridor to become a test bed for other corridors in Oxfordshire. The Smart Mobility package will have the following components:

- Smart Mobility Forum - focused on partnership working and stakeholder collaboration working towards the development of a data management strategy.
- VMS signs at key locations;
- Multi-modal travel options including public transport (or demand responsive transport) deployment options, to cover peak requirements;
- Travel planning at employment and residential locations focused on 'future proofing' e.g. embracing new technologies, communicating multi-modal options, real-time information through message boards at key hubs to publicise expected corridor journey times and the benefit of delaying your journey;
- Monitoring social media feeds to identify major and common issues;
- Communication strategy to feedback to users e.g. a Twitter Feed to broadcast traffic network updates and advance alerts which is also used by radio stations;
- A journey planner app to inform residents and employees of journey options;
- A platform for users to feedback on the network;
- Incentivisation.

- 6.5.2 In the longer term, Mobility as a Service will be influencing residents and employees in the corridor and therefore should be a key consideration for new developments such as Dalton Barracks. Delivering the Smart Mobility package could become part of a wider longer term vision to roll out of Smart Mobility across Oxfordshire, building towards the concept of Mobility as a Service (MaaS).

- 6.5.3 MaaS is a relatively new concept within transport planning which recognises the increasing influence of mobile data, real-time information, and associated 'Apps' on the way people make decisions about travel and the opportunity this interface offers transport (and non-transport) organisations to promote additional services. A basic example is when an individual

searches for the best way to travel from point A to point B then they are also offered the opportunity to buy their ticket for the journey or pay for their parking. The ultimate goal of MaaS is that residents/employees subscribe to a city/region-wide service that allows easy access to public transport, car sharing and bike sharing through a universal payment system accessed through an app on smartphones. To attract subscribers the mobility service will have to be reliable, cost-effective and easy to use.

- 6.5.4 MaaS could transform towns and cities. One scenario points towards streets with less traffic making them pedestrian friendly and making cycle lanes more possible. Air quality improves because traffic congestion has reduced. The streets are no longer lined with parked cars and local authorities no longer spend so much money to maintain and build infrastructure for cars and is able to invest in cycle lanes, paths and parks with pedestrian walkways. MaaS will emerge over time and increase as people appreciate the benefits. The greater the number of travel options and the greater the number of subscribers the more comprehensive and valuable is the information collected. The information drives service improvement that in turn attracts more people. By analysing the data, providers of mobility services can predict usage and maintain the necessary supply of bikes, autonomous/shared cars and public transport to meet demand in specific locations.
- 6.5.5 By starting with a small-scale pilot on the Abingdon to Oxford Corridor the journey to MaaS can evolve across Oxfordshire. An illustration of how MaaS can be applied by the travelling public is set out below:

Mary - an early adopter of Mobility as a Service	
It is 2018...	
<p>Mary lives in Abingdon and is a junior doctor at the Oxford John Radcliffe Hospital. She has downloaded the Abingdon to Oxford Mobility App. It is 6.30am on Monday morning and Mary is going to work – it is raining. The mobility app on her phone (through which Mary has specified her parameters for timing), suggests Mary should catch the 7.30am bus to work. At the end of her shift the weather is forecast to be dry and so the app suggests bike share for her commute home. She clicks yes on her phone and a bike is automatically reserved for her at the hospital. On the bus, Mary taps her phone on the sensor to pay for her ticket via Apple Pay. At the end of her workday, Mary cycles home on the dedicated cycle lane and drops the bike at the bike share hub nearest her home. At the weekend, Mary travels by car to Cambridge to visit friends. VMS signs along the A34 provide travel information about current traffic congestion and advise her of the route she should take.</p>	
It is 2025...	
<p>Mary is now a consultant at the Oxford John Radcliffe Hospital. She has subscribed to Oxfordshire's Mobility app. She pays a subscription fee that gives her access to all modes of shared transport in Oxfordshire and therefore she has calculated that the convenience means she no longer needs to own a car. Mary travels to work based on the advice provided by the app on her phone – this can vary depending on her shift, the weather or any incidents in the area. She does not incur additional costs because her travel is included in her subscription fee and GPS on her phone tracks how she is travelling so that</p>	

real-time data is collected of her travel around Oxfordshire. At the weekend Mary travels to Cambridge to see her friends. The car share feature on her mobility app notifies her that two others are travelling from her area of Abingdon to Cambridge. The fee for the car share is automatically split among the three subscribers. The app chooses a route for them and directs them to available parking spaces when they arrive at Cambridge.

- 6.5.6 Small and intentional steps need to be taken now to ensure that the corridor is ready for this vision of MaaS. Therefore, the following measures are proposed for the Smart Mobility package.
- 6.5.7 Further case study examples detailing how neighbouring areas are taking forward smart mobility concepts has been included in Appendix C.

#### **SM1: VMS signs at key locations**

- 6.5.8 Variable-messages signs (VMS) provide motorists with real-time information about localised traffic congestion, incidents, roadwork zones and temporary speed limits in addition to parking guidance and capacity information at public car parks and Park and Ride facilities. VMS can be used at key congestion hotspots such as Hinksey Hill Interchange, Marcham Interchange and Lodge Hill to encourage drivers to make use of nearby Park and Ride facilities such as Lodge Hill and Redbridge when delays are likely as a result of a road traffic incident or during peak hours. This approach will intercept vehicles that would have otherwise routed along the A34 in order to reduce the number of private car users travelling towards highly congested or accident prone areas.
- 6.5.9 In addition, VMS can be introduced along key routes into Oxford such as the A420 to inform potential Park and Ride of their fastest route to a facility. For example, Redbridge Park and Ride currently attracts a large proportion of trips from Swindon due to congestion issues along the A420 and Botley Interchange. The provision of VMS as far out as Faringdon will advise motorists of their fastest and most convenient Park and Ride facility on their particular day of travel that would account for current parking capacity, congestion delays and information of any incidents within the vicinity of either site.

#### **SM2: Intelligent Traffic Signalisation**

- 6.5.10 Use of emerging new technologies that allocates additional green time at signals to public transport, cyclists and pedestrians depending on real-time demand and usage will be key to promoting sustainable travel choices in the corridor. Some of these measures have been discussed in earlier packages but it will be key to implement these new technologies in existing urban areas such as Abingdon as well as plan them into the new developments at Dalton Barracks, Marcham and Kingston Bagpuize.
- 6.5.11 In June 2015, TfL trialled two types of new cycle priority technology that detected the number of cyclists travelling along Cycle Superhighway 3 on Cable Street, enabling signal timings to be adjusted to give extra green time during peak times when cycle flows are at their highest. Two types of technology can be used for such purposes:
- Radar based technology; and
  - Thermal based technology, which detects the heat of riders as they pass a detection zone.

- 6.5.12 Such technologies allows the timings of signals to reflect demand on a second-by-second basis, and allows greater priority to be given to users of active travel ahead of vehicular road users. If such technology is proven to be successful, there is potential for it to be implemented on key cycle routes and corridors.
- 6.5.13 Pedestrian Split Cycle Offset Optimisation Technique (SCOOT) could improve pedestrian flow in areas where pedestrian footfall is highest. Similar to vehicular SCOOT, Pedestrian SCOOT makes use of video camera technology to automatically detect how many pedestrians are waiting at crossings, and automatically adjusts signal timings to reflect real-time demand.
- 6.5.14 Such technology could help to overcome issues at areas of existing conflict between pedestrians and other road users, as with the cycle signal timing technology detailed above, Pedestrian SCOOT provides a greater level of priority to active travel users ahead of vehicular travel.
- 6.5.15 Weather Dependent Signal Timing are signal timings that are influenced by the weather. The phasing of these signals varies depending on the real-time weather information. For example, in wet weather conditions, a greater length of green time is given to cyclists. Such technology is currently implemented in the Netherlands and could be trialled within in the Abingdon to Oxford corridor.
- 6.5.16 Increasingly, signals infrastructure can be used to communicate to in-vehicle technology and vice versa – known as Vehicle to Infrastructure (V2I). Ensuring this infrastructure is in place will ensure the corridor is resilient for future technological developments. For example, Newcastle have trialled an in-vehicle communication system linked directly with the city's Urban Traffic Management Control (UTMC) centre - the infrastructure 'talks' directly to motorists, so that the system can advise a driver that if they travel at 24 miles an hour they will hit the next four sets of traffic lights on green. In more congested areas or particularly busy times of the day, then vehicles on key roads might be given priority in order to keep the traffic flowing

### SM3: Travel Options

- 6.5.17 For MaaS to function, customers require options. If only the car is available for journeys then the need for MaaS diminishes as a journey cannot be 'optimised'. SM3 includes the implementation of travel options in existing and new developments, including the consideration of CAV infrastructure needs in key developments. It will therefore be important to plan and prioritise for a future corridor that is increasingly multi-modal. The following modes need to be considered as part of the Smart Mobility package for key growth areas in the corridor:
  - Public transport (majority of measures in Bus Enhancement Package)
  - Walking (majority of measures in Active Travel Package)
  - Shared bikes including e-bikes at key locations e.g. Abingdon, Dalton Barracks and Science Vale. For example, the Propensity to Cycle Tool indicates that the provision of e-bikes in MSOA Vale of White Horse (VOWH) 003 could stimulate a 21% increase in the proportion of people cycling to work. The VOWH 003 area covers key development sites including Dalton Barracks and Marcham, therefore the introduction of shared e-bikes at these key developments could generate a significant modal shift across the MSOA, reducing the number of drivers using the private car as their main mode of travel by 593.
  - Car clubs



- Demand responsive transport e.g. role of Uber
- Connected and autonomous vehicles e.g. provision of sufficient future funding at Dalton Barracks to assist with implementation of the next generation of autonomous vehicles. This could include possible utilisation of segregated routes and provision of infrastructure for communications and operation of CAVs;
- Home working e.g. access to high speed broadband both at home and in communal work hubs to encourage more community based working. At Dalton Barracks this could include a Communal Work Hub that provides work space, meeting areas and support facilities to enable home or community working, reducing commuter travel and fostering a local business community atmosphere;
- Freight e.g. planning for a Micro Consolidation Centre at Dalton Barracks could take receipt of home deliveries for the Abingdon area, and arrange for their onward delivery by simple and sustainable means. This provides significant efficiency relating to the last mile of travel. Cargo bikes can act as an effective solution to last mile deliveries; cargo-bikes are able to carry payloads of up to 250kg. They are particularly effective in compact and congested towns and cities, as well as being emission-free. Cargobikes can also be adapted to use electric-assist technology for further vehicle power.

#### **SM4: Travel Planning**

- 6.5.18 Travel planning is key to promoting smart mobility, specific new technologies and multi-modal options to employees and residents living and working in the corridor. Travel planning should be re-invigorated in existing developments and focus on innovation and the future of mobility to capture attention. Via the planning process travel plans should be key for new developments and the outputs and outcomes monitored as developments become occupied. Additionally, Delivery and Servicing Plan and Freight Forums should be a focus for existing and new business and industrial developments.
- 6.5.19 Multi-modal options and new technologies (electric vehicles, autonomous vehicles, journey planner apps, MaaS) should be marketed to residents and employees through travel plan communication strategies. Travel plans are an opportunity to channel real-time information to people and demonstrate the potential of MaaS e.g. real-time information through message boards at key hubs to publicise expected corridor journey times and the benefit of delaying your journey or changing your mode of travel. At Thames Valley Park in Berkshire, the travel plan team hold an annual 'EV Fest' for employees to test drive electric and hybrid vehicles. Similar travel plan events in Science Vale offer the opportunity to promote smart mobility.

#### **SM5: Social Media Feed & Feedback**

- 6.5.20 A Twitter Feed can broadcast traffic network updates and advance alerts which is also used by radio stations. The Abingdon to Oxford corridor could harness social media to provide real-time information on particular transport issues, suggesting alternative routes where feasible (similar to TfL's social media usage at present).
- 6.5.21 Social media tools can also be used to provide user feedback on the network, for example motorists can log details about pot holes, which can then be logged into asset management tools and cyclists and pedestrians can pinpoint areas where they have concerns and mitigating actions can be planned. Mobile phone data can also be used to map the movement and place interaction of individuals, particularly linked to railway stations. Monitoring social media feeds can help to identify major and common issues at a local level, including the frequency of congestion or delays at particular pinchpoints.

#### **SM6: A journey planner app to inform residents and employees of journey options;**

- 6.5.22 There are existing journey planners e.g. CityMapper which offers A to B journey planning incorporating real time information for all modes of transport in London including: underground, rail, bus, cycling, walking and taxi. City Mapper uses open data from Transport for London as well as geolocation to provide users with accurate journey times straight to their smart phone. OCC have developed a journey planner app called 'Zip2'. It will be launched in late 2017 to employees in Science Vale.
- 6.5.23 In the short term, development of 'Zip2' will allow users to gain real-time information on current wait times for public transport and provide recommendations on alternative travel routes that may provide both a quicker and more comfortable journey. The implementation of such technology and provision of this information would be of particular use on routes within the corridor that experience high levels of congestion during peak periods. Such an application could be tied in to the promotion of active travel as an alternative mode (for example providing information on the walk or cycle time to a destination). VoWHDC should work closely with OCC to maximise the impact of 'Zip2' within the corridor.

#### **SM7: Gamification and Incentivisation**

- 6.5.24 Gamification is a useful tool in travel behaviour change and monitoring. Gamification applies game oriented approaches such as scoring or leaderboards to non-game contexts such as travel planning. The gamification aspect is used to transform simple, everyday tasks to encourage active travel behaviours such as walking and cycling, it gives new purpose and incentivises those everyday tasks to make it challenging and fun. These tools also have an added benefit of creating social connections and promoting community cohesion. Such tools could be employed in the Vale to encourage and reward Active Travel behaviour. For example, the BetterPoints app is used in Reading to promote sustainable travel behaviour ([www.betterpoints.uk](http://www.betterpoints.uk)). BetterPoints is a Smartphone application and web platform using GPS to track user's movements and rewards them with pre-decided prizes (i.e. shopping/restaurant vouchers) for walking, cycling, car sharing or using public transport. Spending points can be targeted at local towns to support the local economy. BetterPoints also provides rich data to help monitor the travel that has been carried out by the apps users. Other challenges focus on specific modes e.g. European Cycle Challenge ([www.cyclechallenge.eu](http://www.cyclechallenge.eu)).

#### **SM8: Smart Mobility Forum & MaaS**

- 6.5.25 SM1 to 7 outline measures that involve a number of stakeholders who will be key to the development of the smart mobility package. Stakeholders include; Oxfordshire County Council, bus operators, cycle providers, signal experts, developers, mobile network operators. Forming a Smart Mobility Forum would enable partnership working, sharing of ideas and collaboration as well as identification of funding streams.
- 6.5.26 A key objective of the Smart Mobility Forum should be the development of a Data Management & Communication Strategy for medium to long-term implementation. Combined data from smart card ticketing, mobile phone usage, parking and permits, Vehicle to Infrastructure (V2I) communication and Vehicle to Vehicle (V2V) communication will provide rich layers of data that can inform when and how people move around during both normal and abnormal periods, e.g. major events. In addition a further layer of data can be added and communicated to users that encompasses feelings and thoughts e.g. Twitter can be used to provide heat maps of problems alerting residents of any major or common issues. All of this data will require a clear Data Management & Communication Strategy and VoWHDC

should liaise closely with OCC to ensure this strategy is developing and the corridor is a key part of OCC's developing approach.

- 6.5.27 The Smart Mobility Forum would have an overarching vision of enabling the delivery of Mobility as a Service (MaaS) to residents and employees who live and work in the corridor.

## 6.6 Spatial Influence of Proposed Measures

- 6.6.1 A summary of the proposed measures indicating the spatial areas of influence is included within Table 12.

**Table 12 Summary of Spatial Influence of Proposed Measures**

MEASURE		DALTON BARRACKS	MARCHAM	KINGSTON BAGPUIZE
TM1	Capacity Improvements to Frilford Junction		✓	✓
TM2	Demand responsive traffic lights at Frilford light		✓	✓
TM3	Bus priority signals at Frilford lights		✓	✓
B1	Improve frequency of bus services	✓	✓	✓
B2	Dalton Barracks to Lodge Hill (Busway)	✓		
B3	Promote cashless payment systems	✓	✓	✓
B4	Support provision of e-tickets	✓	✓	✓
B5	Improved Public Transport Information	✓	✓	✓
B6	Extend SmartZone ticket	✓		
B7	RTI at key bus stops	✓		✓
B8	Real-time tracking (Apps/Bus Stops)	✓	✓	✓
B9	Bus stop waiting facilities	✓	✓	✓
AT1	Pedestrian footway on Faringdon Road	✓		
AT2	Cycle lanes on Faringdon Road	✓		
AT3	Long Tow Footpath + Cycle Lanes	✓		
AT4	Oxford Road cycle route	✓	✓	

MEASURE		DALTON BARRACKS	MARCHAM	KINGSTON BAGUIZE
AT5	Improvements to the NCN5	✓		
AT6	Twelve Acre Drive and White's Lane (Cycling)	✓	✓	
AT7	Abingdon to Oxford (via Radley Station) (Cycling)	✓	✓	
AT8	Cumnor Hill (Cycling)	✓		
AT9	Dalton Barracks to Cumnor Hill (Cycling)	✓		
AT10	Enhance Public Rights of Way (Cycling)	✓	✓	✓
AT11	Marcham to Abingdon - Improved Signage		✓	
AT12	Dalton Barracks to Lodge Hill (Cycling)	✓		
SM1	VMS signs at key locations	✓	✓	✓
SM2	Intelligent Traffic Signalisation	✓	✓	✓
SM3	Travel Options	✓	✓	✓
SM4	Travel Planning	✓	✓	✓
SM5	Social Media Feed & Feedback	✓	✓	✓
SM6	Journey Planner App	✓	✓	✓
SM7	Gamification and Incentivisation	✓	✓	✓
SM8	Smart Mobility Forum & MaaS	✓	✓	✓

## 6.7 Ranking of Scheme Costs

- 6.7.1 Whilst none of the schemes have been developed to a sufficient level of detail to produce outline costings, an initial evaluation of the likely magnitude of scheme costs has been undertaken. This permits an overarching ranking of scheme costs, as outlined in Table 13, where 1 = low cost scheme and 5 = high cost scheme.

Table 13 Ranking of Costs

MEASURE		RANKING OF COSTS
TM1	Capacity Improvements to Frilford Junction	4
TM2	Demand responsive traffic lights at Frilford light	2
TM3	Bus priority signals at Frilford lights	2
B1	Improve frequency of bus services	4
B2	Dalton Barracks to Lodge Hill (Busway)	5
B3	Promote cashless payment systems	2
B4	Support provision of e-tickets	1
B5	Improved Public Transport Information	1
B6	Extend SmartZone ticket	2
B7	RTI at key bus stops	3
B8	Real-time tracking (Apps/Bus Stops)	2
B9	Bus stop waiting facilities	3
AT1	Pedestrian footway on Faringdon Road	1
AT2	Cycle lanes on Faringdon Road	2
AT3	Long Tow Footpath + Cycle Lanes	2
AT4	Oxford Road cycle route	2
AT5	Improvements to the NCN5	2
AT6	Twelve Acre Drive and White's Lane (Cycling)	4
AT7	Abingdon to Oxford (via Radley Station) (Cycling)	2
AT8	Cumnor Hill (Cycling)	3
AT9	Dalton Barracks to Cumnor Hill (Cycling)	3
AT10	Enhance Public Rights of Way (Cycling)	3
AT11	Marcham to Abingdon - Improved Signage	2
AT12	Dalton Barracks to Lodge Hill (Cycling)	4



MEASURE		RANKING OF COSTS
SM1	VMS signs at key locations	2
SM2	Intelligent Traffic Signalisation	2
SM3	Travel Options	3
SM4	Travel Planning	1
SM5	Social Media Feed & Feedback	1
SM6	Journey Planner App	3
SM7	Gamification and Incentivisation	1
SM8	Smart Mobility Forum & MaaS	1

## 6.8 Scheme Benefits

6.8.1 A more detailed assessment of the potential benefits that could be derived from the refined packages of measures has been undertaken.

6.8.2 The following appraisal criteria have been applied, reflecting the role of the measures in supporting the Local Plan Part 2 development growth, as well as standard measures of economic benefit, and evaluation of deliverability:

### ○ Support for Local Plan Part 2 Development

- Weighted assessment of the impact of each proposed measure upon the proposed development sites, taking into account the scale of the individual sites (e.g. Dalton Barracks = potentially in excess of 4,000, Marcham = 90 dwellings, Kingston Bagpuize = 600 dwellings)

### ○ Economic Benefits

- Direct transport impact of each proposed measure in terms of journey time benefits, vehicle operating cost savings, user charges, and reliability
- Wider impacts in terms of the ability for each proposed measure to facilitate regeneration and development growth

### ○ Social Benefits

- Accident saving and safety benefits engendered by each proposed measure
- Accessibility enhancement in terms of access to employment, education and facilities engendered by the proposed measure, incorporating reduction of severance and option values

### ○ Environmental Benefits

- Impact of proposed measures upon air quality, carbon emissions, and noise

- Impact of proposed measures upon townscape, landscape, heritage and water courses

#### ○ Deliverability

- The delivery agents required to take the proposed measures forward, in particular whether the powers for delivery are beyond the VoWHDC.
- The physical constraints relating to the delivery of proposed measures and the extent to which delivery would entail substantial physical works
- The likely extent of available funding for delivering the proposed measures, in particular whether this would be beyond the VoWHDC planning mechanisms.

6.8.3 For each individual element a qualitative score has been applied based upon information provided by stakeholders and knowledge gained from site visits. For each individual element a ranking score of between 0 and 5 has been applied, where 0 represents no benefit and 5 represents high benefits. The exception to this is for the environmental assessments where a -3 to +3 scale has been applied, acknowledging the potential negative impact of some proposed measures upon the environment.

6.8.4 For each of the five main categories of benefits, the individual sub-scores have been combined to produce an overarching ranking. In some case weightings have been applied to reflect the relative level of importance of individual elements. All overarching scores maintain a 0 to 5 ranking scale, with the exception of Environment, which maintains the -3 to +3

6.8.5 A summary of the overarching benefits rankings is presented within Table 14. A more disaggregated breakdown is provided in Appendix D.

**Table 14 Ranking of Benefits**

MEASURE		SUPPORT LPP2	ECONOMIC	SOCIAL	ENVIRONMENTAL	DELIVERABILITY
TM1	Capacity Improvements to Frilford Junction	2	4	3	-1	4
TM2	Demand responsive traffic lights at Frilford light	2	3	2	-1	4
TM3	Bus priority signals at Frilford lights	2	2	2	1	4
B1	Improve frequency of bus services	4	3	3	2	3
B2	Dalton Barracks to Lodge Hill (Busway)	3	5	4	1	3
B3	Promote cashless payment systems	5	1	1	1	4
B4	Support provision of e-tickets	5	1	1	1	4
B5	Improved Public Transport Information	5	1	2	1	4

MEASURE		SUPPORT LPP2	ECONOMIC	SOCIAL	ENVIRONMENTAL	DELIVERABILITY
B6	Extend SmartZone ticket	3	1	2	1	4
B7	RTI at key bus stops	4	2	2	1	4
B8	Real-time tracking (Apps/Bus Stops)	5	2	2	1	3
B9	Bus stop waiting facilities	5	1	3	0	4
AT1	Pedestrian footway on Faringdon Road	3	1	3	1	5
AT2	Cycle lanes on Faringdon Road	3	1	3	1	5
AT3	Long Tow Footpath + Cycle Lanes	3	1	3	1	4
AT4	Oxford Road cycle route	4	2	3	1	4
AT5	Improvements to the NCN5	3	2	4	1	4
AT6	Twelve Acre Drive and White's Lane (Cycling)	4	2	3	0	2
AT7	Abingdon to Oxford (via Radley Station) (Cycling)	4	1	4	1	4
AT8	Cumnor Hill (Cycling)	3	1	3	1	5
AT9	Dalton Barracks to Cumnor Hill (Cycling)	3	1	3	1	4
AT10	Enhance Public Rights of Way (Cycling)	5	2	3	0	3
AT11	Marcham to Abingdon - Improved Signage	1	1	3	1	5
AT12	Dalton Barracks to Lodge Hill (Cycling)	3	4	5	2	3
SM1	VMS signs at key locations	2	2	2	0	4
SM2	Intelligent Traffic Signalisation	5	3	2	1	3
SM3	Travel Options	3	3	4	1	3
SM4	Travel Planning	5	2	4	1	5
SM5	Social Media Feed & Feedback	5	1	2	1	5
SM6	Journey Planner App	5	1	2	1	3

MEASURE		SUPPORT LPP2	ECONOMIC	SOCIAL	ENVIRONMENTAL	DELIVERABILITY
SM7	Gamification and Incentivisation	5	1	2	1	5
SM8	Smart Mobility Forum & MaaS	5	1	3	1	5

## 6.9 Overall Net Benefits

- 6.9.1 Whilst the metrics we have for costs and benefits of proposed measures are qualitative assessments in nature, they still provide an opportunity to evaluate the potential overall net benefits of each scheme and to develop an assessment of the potential value for money. This provides a mechanism to assist in the prioritisation of proposed measures.
- 6.9.2 Table 15 provides a summary of the rankings of costs, overall net benefits, and an assessment of value for money.

**Table 15 Summary of Costs, Benefits and Value for Money**

MEASURE		RANKING OF COSTS	RANKING OF BENEFITS	VALUE FOR MONEY
TM1	Capacity Improvements to Frilford Junction	4	6	Average
TM2	Demand responsive traffic lights at Frilford light	2	5	Good
TM3	Bus priority signals at Frilford lights	2	5	Good
B1	Improve frequency of bus services	4	9	Good
B2	Dalton Barracks to Lodge Hill (Busway)	5	8	Good
B3	Promote cashless payment systems	2	9	High
B4	Support provision of e-tickets	1	9	Very High
B5	Improved Public Transport Information	1	10	Very High
B6	Extend SmartZone ticket	2	7	Good
B7	RTI at key bus stops	3	8	Good

MEASURE		RANKING OF COSTS	RANKING OF BENEFITS	VALUE FOR MONEY
B8	Real-time tracking (Apps/Bus Stops)	2	10	High
B9	Bus stop waiting facilities	3	10	Good
AT1	Pedestrian footway on Faringdon Road	1	7	Very High
AT2	Cycle lanes on Faringdon Road	2	7	High
AT3	Long Tow Footpath + Cycle Lanes	2	7	Good
AT4	Oxford Road cycle route	2	9	High
AT5	Improvements to the NCN5	2	7	High
AT6	Twelve Acre Drive and White's Lane (Cycling)	4	8	Good
AT7	Abingdon to Oxford (via Radley Station) (Cycling)	2	9	High
AT8	Cumnor Hill (Cycling)	3	7	Good
AT9	Dalton Barracks to Cumnor Hill (Cycling)	3	7	Good
AT10	Enhance Public Rights of Way (Cycling)	3	10	Good
AT11	Marcham to Abingdon - Improved Signage	2	4	Good
AT12	Dalton Barracks to Lodge Hill (Cycling)	4	8	Good
SM1	VMS signs at key locations	2	5	Good
SM2	Intelligent Traffic Signalisation	2	10	High
SM3	Travel Options	3	7	Good
SM4	Travel Planning	1	11	Very High
SM5	Social Media Feed & Feedback	1	10	Very High
SM6	Journey Planner App	3	9	Good
SM7	Gamification and Incentivisation	1	10	Very High
SM8	Smart Mobility Forum & MaaS	1	10	Very High



- 6.9.3 The outcomes demonstrate that nearly all of the scheme measures are forecast to generate good, high or very high value for money. This is to be expected given the previous option sifting process that sought to eliminate poor performing scheme elements. Only TM1 scores as average value for money, as it only benefits the smaller development sites of Kingston Bagpuize and Marcham and potentially engenders some negative environmental impacts through encouraging additional private vehicle trips and land-take requirements.
- 6.9.4 All of the 'very high' ranking schemes are low cost, engendering good benefits for limited investment. In this context, the 'Good' and 'High' value for money scheme still represent a good case for investment, but simply reflect the higher levels of funding required and greater associated uncertainty and risk.

## 6.10 Summary of Improvement Packages

- 6.10.1 On the basis of the appraisal of costs and benefits, a scheme prioritisation process has been undertaken.
- 6.10.2 A number of the schemes within the Active Travel Package offer excellent value for money and have the advantage of being readily deliverable. This package should generally be prioritised for early delivery. The only exceptions would be the proposed new cross-county cycle routes (AT6, AT10, and AT12) where land ownership issues and landscape environmental impacts are likely to make these more challenging to deliver, and so they should be scheduled accordingly.
- 6.10.3 Many of the high scoring measures within the bus package are conditional upon working in partnership with bus operators and/or OCC but all of these should be pursued at an early stage as bus provision will be an important element of overall sustainable travel offer for the Local Plan 2 development sites. The improved frequency of bus services (B1) will deliver significant benefits; however, it is acknowledged that this has notable on-going operational cost implications. As such, this enhancement will need to match the phasing of development to ensure sufficient demand, albeit ensuring that provision is in place prior to occupancy rather than lagging behind, when new residents may have already settled into alternative (less sustainable) travel patterns.
- 6.10.4 The Dalton Barracks to Lodge Hill busway (B2) could offer significant potential, particularly when considered alongside the wider delivery of BRT routes across Oxford. Whilst there could be challenges in terms of deliverability, this would clearly provide a direct and efficient route to a public transport interchange at Lodge Hill, into Oxford itself and employment sites to the east of Oxford, as well as on to other connective services.
- 6.10.5 The SMART mobility package generally engenders good performing measures, many of which require relatively low investment. Again, these scheme mainly require partnership working to deliver but they will work well with new development sites that provide a targeted market with which to apply the measures.
- 6.10.6 The traffic management measures focus primarily on Frilford junction, providing benefits to the Kingston Bagpuize development (and some benefits to Marcham). However, further work is required in relation to the specific requirements of development sites to ensure that traffic management improvements are carried out in line with local needs.



## APPENDIX A – INITIAL LIST OF MEASURES

Scheme Description	Political	Economic	Social	Technological	Legal	Environmental	Ranking
<b>Bus</b>							
Create Route Action Plans to improve punctuality of rural services	1	0	1	0	1	0	HIGH
Work with operators to integrate development into existing bus routes	1	1	1	0	1	0	HIGH
Improved cross-corridor bus movements through integration, possibly routing through Fox Lane/Hinksey Hill	0	0	1	0	1	0	MEDIUM
Complement bus and cycle use by introducing cycle parking along key stops of premium routes	0	0	1	0	0	1	MEDIUM
Work with operators to extend bus frequency to/from Radley Station	0	-1	1	0	1	1	MEDIUM
Improve integration of bus stops and active travel modes	0	0	1	0	1	1	HIGH
Improve frequency of premium routes 'turn up and go'	1	-1	1	0	1	1	HIGH
Improve the quality and comfort of bus stop waiting facilities	0	0	1	0	1	1	HIGH
Introduce real time passenger information (RTPI) at key bus stops	1	0	1	1	1	0	HIGH
Work with operators to provide 'premium buses' (WIFI, CCTV, audible and visual info)	1	0	1	1	1	0	HIGH
Work with operators to integrate tracking technology with smartphone apps and bus stops	1	0	0	1	1	0	HIGH
Work with operators to improve the quality and comfort of buses	0	0	1	0	1	1	HIGH
Work with operators to promote awareness of bus services	0	0	0	0	1	1	MEDIUM
Work with operators and key businesses to promote bus season tickets	0	0	0	0	1	0	MEDIUM
Work with operators to revise 'young person' tickets	0	0	1	0	1	0	MEDIUM
Work with operators to promote electric and hybrid buses	1	0	0	1	1	1	HIGH
Engage with key employers and operators to encourage off-peak travel	0	1	0	0	1	0	MEDIUM
Engage with operators to help market the currently under-utilised mobile ticketing	0	0	0	1	1	0	MEDIUM
Enhance partnerships with local authority and operators	0	0	0	0	1	0	MEDIUM
Explore alternative funding sources to S106 pump priming	1	0	0	0	0	0	MEDIUM
Target modal shift at existing residential areas in addition to new developments	0	0	0	0	1	1	MEDIUM
Encourage bus operators to share ticketing data to identify key future infrastructure improvement hotspots	0	0	0	1	1	0	MEDIUM
Enhancement of existing bus stops to encourage door-to-door travel	0	0	1	0	1	1	HIGH
Integrate demand responsive transport with high frequency bus routes	0	0	0	1	1	1	HIGH
<b>Rail</b>							
Work with National Rail/GWR to enhance Radley Station approach	0	0	0	0	0	1	MEDIUM
Work with GWR to promote cycle storage on board trains	0	-1	1	0	1	1	MEDIUM
Work with GWR to promote young person ticketing options	0	-1	1	0	1	0	MEDIUM
Work with National Rail/GWR to provide further secure cycling facilities at Station	0	0	1	0	1	1	HIGH
Enhance partnerships with bus operators to provide a 'plusbus' service at Radley Station	0	0	1	0	1	1	HIGH
Installation of 'slow' electric vehicle chargers (circa £400 per facility)	0	0	0	1	0	1	MEDIUM
<b>Park and Ride</b>							
Promote cycling and ride strategy	0	0	1	0	1	1	HIGH
Promote lift-share strategies to park and ride sites	1	1	1	0	1	1	HIGH
Provide enhanced public realm at mode change hubs (similar to Gloucester services) to include attractions	0	1	1	0	0	1	HIGH
Provision of click and collect services at the hub	0	1	1	1	0	1	HIGH
Create sites as permeable places for cyclists and pedestrians	0	0	1	0	1	1	HIGH
Extend Oxonbike scheme to promote mode change points	0	0	1	0	0	1	MEDIUM
Work with operators to integrate rural services such as 4 and 15 for door-to-door travel	1	0	1	0	1	1	HIGH
Work with operators to extend the SmartZone ticket to Park and Ride routes	0	-1	1	0	1	0	MEDIUM
Adapt ticketing to promote off-peak travel	0	0	1	1	1	0	HIGH
Provide facilities for electric vehicle charging	0	0		1	0	1	MEDIUM
Provide communal/member cycle maintenance tools	0	0	1	0	1	0	MEDIUM
Provide real time parking information signs on approach to new facilities	0	-1	1	1	0	0	MEDIUM
Provide parking guidance system	0	-1		1	0	1	MEDIUM
<b>Highways</b>							
Capacity Improvements to the A338/A415 junction at Frilford	1	1	0	0	0	-1	MEDIUM
Capacity Improvements to the Hinksey Hill Interchange	1	1	0	0	0	-1	MEDIUM
Introduction of demand/queue responsive traffic lights at Frilford lights	1	0	1	1	1	0	HIGH
Introduction of bus priority signals at Frilford lights	0	0	1	1	1	1	HIGH
Provision of a Bus Lane in safeguarded land along A34	0	0	1	0	0	1	MEDIUM
Provision of Marcham Bypass routing from A415 to Frilford lights	0	1	1	0	0	0	MEDIUM
Improved highway access to Shippon/Dalton Barracks to A34	0	1	0	0	0	0	MEDIUM
Balance the need for capacity improvements and bus lane priority on A34, west of Kennington	1	0	1	0	0	0	MEDIUM
<b>Walking</b>							
Develop existing footway on Radley Road into a shared cycle/footway	0	0	1	0	1	1	HIGH
Ensure quality pedestrian links to key bus stops from existing residential areas and new development	0	0	1	0	1	1	HIGH
Public realm improvements surrounding key bus stops to promote linked trips	0	0	1	0	1	1	HIGH
Widening of the footway adjacent to A34 between North and South Hinksey	0	0	1	0	0	1	MEDIUM
Improved signage provision for The Thames Path, south-east Abingdon	0	0	1	0	1	0	MEDIUM
Improved pedestrian footway between Abingdon and Dalton Barracks via Faringdon Road	0	0	1	0	1	1	HIGH
<b>Cycling</b>							
Expand provision of OXONBIKE to local service centres	0	-1	1	0	0	1	MEDIUM
Increased provision of cycle parking at Radley Station	0	0	1	0	1	1	HIGH
Provision of basic cycle maintenance vending machines at mode change hubs	0	0	1	0	0	0	MEDIUM
Introduction of traffic calming near Radley Station for cycle safety	0	0	1	0	0	1	MEDIUM
Improve cycle route from Abingdon to Radley Station via Radley Road	0	0	1	0	0	1	MEDIUM
Improve quality of NCN5 between Kennington to Oxford via rail track	0	0	1	0	1	1	HIGH
Increased signage along Thrupp Lane to alert HGV drivers of NCN5	0	0	1	0	1	0	MEDIUM
Cycle priority on Audlet Drive to be provided across driveways/accesses	0	0	1	0	0	1	MEDIUM
Promotion of cycle and ride scheme (mode change hubs)	0	0	1	0	1	1	HIGH
Exploring feasibility of public bridleways as leisure cycle routes	0	0	1	0	1	1	HIGH
Provide dedicated signage on local routes across the corridor	0	0	1	0	1	0	MEDIUM
Engage with key employers to provide changing facilities in the workplace	0	0	0	0	1	1	MEDIUM
Promote workplace/school multi-modal challenge	0	0	1	0	1	1	HIGH
Make use of existing route data for children to map their own routes to school	0	0	1	0	1	0	MEDIUM
Develop a cycling widget on website that provides route information and user experience	0	0	1	1	1	1	HIGH
Explore funding options for cycle hire rewards scheme at key public transport interchanges	0	0	1	1	1	1	HIGH
Provision of Milton Heights pedestrian and cycle bridge	0	0	1	0	0	1	MEDIUM
Promote public cycle share schemes	0	0	1	0	0	1	MEDIUM
Increased signage and widening of advisory cycle lanes on Faringdon Road between Abingdon and Dalton Barracks	0	0	1	0	1	1	HIGH
<b>Sustainable Travel Planning</b>							
Workplace travel plans	0	0	1	0	1	1	HIGH
Innovation Travel Plans for Harwell Campus, Culham Science Park etc	0	0	1	1	1	1	HIGH

Higher education travel plans	0	0	1	0	1	1	HIGH
Residential travel plans	0	0	1	0	1	1	HIGH
Station travel plans	0	0	0	0	1	1	MEDIUM
Walking & Cycling promotional campaigns	0	0	1	0	1	1	HIGH
Road safety education and cycle training	0	0	1	0	1	0	MEDIUM
Improved information on active travel routes through online widgets/app	0	0	1	1	1	1	HIGH
Improved information on public transport routes, frequencies at workplaces and developments	0	0	1	1	1	1	HIGH
Sustainable travel events	0	0	1	0	1	1	HIGH
Bus-driver eco-training	0	0	1	0	1	1	HIGH
Promote car sharing/car pooling schemes at key employment hubs	0	0	0	0	1	1	MEDIUM
Promote the uptake of electronic communications/video-conferencing	0	0	0	1	1	1	HIGH
Charging and Payment systems							
Promote cashless payment system across all viable modes	0	0	1	1	0	1	HIGH
Support bus operators in the provision of e-ticketing	0	0	0	1	1	0	MEDIUM
Create rewards schemes for bike hire at key public transport interchanges	0	0	1	1	1	1	HIGH
Intelligent Mobility							
Work with bus operators to integrate demand responsive transport with high freq routes	1	0	1	0	1	1	HIGH
Investigate potential demand for car clubs	0	0	1	0	1	1	HIGH
Promote the use of electric and hybric cars amongst hackney carriages	0	0	1	1	0	1	HIGH
Use of small vehicle shuttles between Oxford and the Science Vale	0	0	1	0	0	1	MEDIUM
Develop a partnership between demand responsive transport and high frequency bus routes to/from key employment sites	1	0	1	1	1	1	HIGH
Parking							
Review Radley Station car park usage	0	0	0	0	0	1	MEDIUM
Introduction of a Workplace Parking Levy (WPL)	-1	1	0	0	-1	1	FAIL
Consider opportunity for further electric vehicle charging points in public car parks	0	0	0	1	0	1	MEDIUM
Freight							
Development of lorry parks with new potential P&R facilities	0	0	0	0	0	1	MEDIUM
Provision of enhanced Public Realm at Lorry Parks	0	0	0	0	1	1	MEDIUM
Integrate lorry parks within overall transport 'hubs'	0	0	0	0	0	1	MEDIUM
Introduction of CMPs as an initial step towards Low Emission Zones (LEZ) for delivery/freight vehicles	0	0	0	1	-1	1	MEDIUM
Provide infrastrustructure for active travel from Lorry Parks to key leisure destinations	0	0	1	0	0	1	MEDIUM



## APPENDIX B – INITIAL PACKAGES

<b>Package A</b>	<b>Access to Rail (Radley Station)</b>
C2	Increased provision of cycle parking at Radley Station
C5	Improve cycle route from Abingdon to Radley Station via Radley Road
B5	Work with operators to extend bus frequency to/from Radley Station
B9	Introduce real time passenger information (RTPI) at key bus stops
B13	Work with operators to promote awareness of bus services
R1	Work with National Rail/GWR to enhance Radley Station approach
R2	Work with GWR to promote cycle storage on board trains
R3	Work with GWR to promote young person ticketing options
R4	Work with National Rail/GWR to provide further secure cycling facilities at Station
R5	Enhance partnerships with bus operators to provide a 'plusbus' service at Radley Station
R6	Installation of 'slow' electric vehicle chargers (circa £400 per facility)
STP5	Station travel plans
P1	Review Radley Station car park usage
<b>Package B1</b>	<b>Park &amp; Ride (Option 1)</b>
P&R1	Lodge Hill Park & Ride Site
P&R2	Cumnor Park & Ride Site
C6	Improve Oxford Road cycle route from Dunmore Road to A34
C7	Improve Cumnor Hill from for cyclists from A420 to A34
P&R6	Promote cycling and ride strategy
P&R7	Promote lift-share strategies to park and ride sites
P&R8	Promote park and cycle
P&R9	Provide enhanced public realm at mode change hubs (similar to Gloucester services) to include attractions
P&R10	Provision of click and collect services at the hub
F1	Development of lorry parks with new potential P&R facilities
<b>Package B2a</b>	<b>Park &amp; Ride (Option 2a)</b>
P&R1	Lodge Hill Park & Ride Site
P&R4	Appleton Park & Ride Site
C6	Improve Oxford Road cycle route from Dunmore Road to A34
P&R6	Promote cycling and ride strategy
P&R7	Promote lift-share strategies to park and ride sites
P&R9	Provide enhanced public realm at mode change hubs (similar to Gloucester services) to include attractions
P&R10	Provision of click and collect services at the hub
F1	Development of lorry parks with new potential P&R facilities
<b>Package B2b</b>	<b>Park &amp; Ride (Option 2b)</b>
P&R1	Lodge Hill Park & Ride Site
P&R5	Kingston Bagpuize Park & Ride
C6	Improve Oxford Road cycle route from Dunmore Road to A34
P&R6	Promote cycling and ride strategy
P&R7	Promote lift-share strategies to park and ride sites
P&R9	Provide enhanced public realm at mode change hubs (similar to Gloucester services) to include attractions
P&R10	Provision of click and collect services at the hub
F1	Development of lorry parks with new potential P&R facilities
<b>Package B3a</b>	<b>Park &amp; Ride (Option 3a)</b>
P&R3	Marcham Park & Ride Site
P&R2	Cumnor Park & Ride Site
C8	Improve Faringdon Road for cyclists from Dalton Baracks to Marcham Road
C9	Improve Marcham Road for cyclists from Marcham to A34
C10	Improve B4017 for cyclists from Dalton Baracks to A4280
P&R6	Promote cycling and ride strategy
P&R7	Promote lift-share strategies to park and ride sites
P&R9	Provide enhanced public realm at mode change hubs (similar to Gloucester services) to include attractions
P&R10	Provision of click and collect services at the hub
F1	Development of lorry parks with new potential P&R facilities
<b>Package B3b</b>	<b>Park &amp; Ride (Option 3b)</b>

P&R3	Marcham Park & Ride Site
P&R5	Kingston Bagpuize Park & Ride
C8	Improve Faringdon Road for cyclists from Dalton Baracks to Marcham Road
C9	Improve Marcham Road for cyclists from Marcham to A34
P&R6	Promote cycling and ride strategy
P&R7	Promote lift-share strategies to park and ride sites
P&R9	Provide enhanced public realm at mode change hubs (similar to Gloucester services) to include attractions
P&R10	Provision of click and collect services at the hub
F1	Development of lorry parks with new potential P&R facilities
<b>Package C</b>	<b>A34 Corridor</b>
H5	Provision of a Bus Lane in safeguarded land along A34
H7	Improved highway access to Shippon/Dalton Barracks to A34
H8	Balance the need for capacity improvements and bus lane priority on A34, west of Kennington
<b>Package D1a</b>	<b>Fox Lane / Hinksey Hill Corridor Bus Enhancement</b>
H9	Improve capacity of highway on narrow lanes
B3	Improved cross-corridor bus movements through integration, possibly routing through Fox Lane/Hinksey Hill
<b>Package D1b</b>	<b>Fox Lane / Hinksey Hill Corridor Cycle Enhancement</b>
H9	Improve capacity of highway on narrow lanes
C11	Improve Fox Lane / Hinksey Hill for cyclists
C12	Provide dedicated cycle facilities from Hinksey Hill via Southern-By-Pass to Old Abingdon Road
C19	Provide dedicated signage on local routes across the corridor
<b>Package D2</b>	<b>Faringdon Road / Honey Bottom Lane Corridor Enhancement</b>
H9	Improve capacity of highway to accommodate bus services
B2	Work with operators to integrate development into existing bus routes (diversion of Route 3)
<b>Package E</b>	<b>Dry Sanford to North Hinksey</b>
C14	Enhance rights of way to provide high quality cycle route
C19	Provide dedicated signage on local routes across the corridor
<b>Package F</b>	<b>B4017 Corridor Enhancements</b>
B7	Improve frequency of premium routes 'turn up and go'
B11	Work with operators to integrate tracking technology with smartphone apps and bus stops
C10	Improve B4017 for cyclists from Dalton Baracks to A4280
<b>Package G</b>	<b>A420 Corridor Enhancements</b>
B7	Improve frequency of premium routes 'turn up and go'
B8	Improve the quality and comfort of bus stop waiting facilities
B9	Introduce real time passenger information (RTPI) at key bus stops
B11	Work with operators to integrate tracking technology with smartphone apps and bus stops
<b>Package H</b>	<b>Access to Abingdon</b>
H1	Capacity Improvements to the A338/A415 junction at Frilford
H3	Introduction of demand/queue responsive traffic lights at Frilford lights
H4	Introduction of bus priority signals at Frilford lights
W6	Improved pedestrian footway between Abingdon and Dalton Barracks via Faringdon Road
C27	Increased signage and widening of advisory cycle lanes on Faringdon Road between Abingdon and Dalton Barracks
<b>Package I</b>	<b>Demand Management</b>
STP1	Workplace travel plans
STP2	Innovation Travel Plans for Harwell Campus, Culham Science Park etc
STP3	Higher education travel plans
STP4	Residential travel plans
STP12	Promote car sharing/car pooling schemes at key employment hubs
STP13	Promote the uptake of electronic communications/video-conferencing
B13	Work with operators to promote awareness of bus services
B14	Work with operators and key businesses to promote bus season tickets

- B15 Work with operators to revise 'young person' tickets
- B17 Engage with key employers and operators to encourage off-peak travel
- B18 Engage with operators to help market the currently under-utilised mobile ticketing
- C&P3 Create rewards schemes for bike hire at key public transport interchanges

**Package J**

**Improve ease of travel by Sustainable Travel**

- C&P1 Promote cashless payment system across all viable modes
- C&P2 Support bus operators in the provision of e-ticketing
- STP7 Road safety education and cycle training
- STP8 Improved information on active travel routes through online widgets/app
- STP9 Improved information on public transport routes, frequencies at workplaces and developments
- IM1 Work with bus operators to integrate demand responsive transport with high freq routes
- P&R14 Work with operators to extend the SmartZone ticket to Park and Ride routes
- P&R16 Provide facilities for electric vehicle charging at Park & Ride sites

## APPENDIX C – SMART MOBILITY CASE STUDY



## **1. Case Study and Policy Review**

### **1.1 A Smart Move for Northamptonshire - Northamptonshire County Council**

- 1.1.** The aim of the Smart Corridor / Smart Commuting project is to bring live and user-focused travel information to Northamptonshire, reflecting the increasing value of technology in people's lives. The idea is to complement ongoing infrastructure improvement projects with the Smarter Living project, which aims to increase 'digital fluency' and to help a larger number of people utilise the Smarter Commuter tools. The document describes a Smart Commuter as a traveller with expectations that information can be accessed and delivered live, often via a smart phone.
- 1.2.** Northamptonshire County Council (NCC) wants to better use existing infrastructure in the area, as a way to increase the capacity of the transport network and also to allow people to make informed travel choices. To create Smart Commuters, NCC states that they will create the following tools:
- Travel information portal and business engagement hub;
  - Real time multi-modal journey planner with live updates;
  - Location sensitive Smarter Commuter App with incentive scheme;
  - County-wide Commuter Challenge with Super Commuters leaderboard; and
  - Information 'totems' with 'live feeds' providing real time information on travel, attractions and local events.
- 1.3.** The above tools are set out in detail in the document, with information provided on how they will be created, what they include and the benefits of each. In parallel to these tools, NCC will:
- Market the concept using social media and business engagement;
  - Roll out wider and more accurate bus real time information;
  - Establish a business engagement team to promote the concept and its tools;
  - Investigate contactless payment technologies; and
  - Make data available to app developers.
- 1.4.** NCC intends to set up a dedicated business engagement team to investigate current commuting habits. The team will also put across the benefits of travelling smarter to commuters. Personalised journey planning, bicycle loans and free bus tickets are recommended as potential methods of achieving a switch towards smarter travel choices.
- 1.5.** The benefits of the concept include:
- Helping commuters understand the financial, health, environmental and time impacts of travel;
  - Reducing congestion and delays;
  - Making better use of existing network, data and systems and reducing operational costs;
  - Encouraging investment and regeneration in the area;
  - Encouraging modal shift; and
  - Raising the profile of Northampton and Northamptonshire Arc as a Smart City.

See:

<http://www.steerdaviesgleave.com/sites/default/files/elfinder/Newsinsights/NorthantsSmartCommuter.pdf>

## **1.2 CAMBRIDGE – MILTON KEYNES – OXFORD CORRIDOR: INTERIM REPORT – The National Infrastructure Commission 2016**

- 1.6.** The report notes that, in general, east-west trips in the area are slow and unreliable in comparison to the north-south links to and from London.
- 1.7.** It is stated that new transport investment in the corridor could provide better links to homes and employment, opening up new sites for development. It is also mentioned that such investment could help to mitigate congestion within the city centres in the area. The report states that it will the development of transport schemes that enable smart, sustainable communities will be prioritised, alongside those which improve connectivity, create and jobs.

## **1.3 England's Economic Heartland: Planning for Growth. A position statement from England's Economic Heartland's Transport Forum. 2016.**

- 1.8.** The aim and vision of England's Economic Heartland's Transport Forum is to deliver an integrated transport system that improves links between urban centres, especially along the east-west corridor. The position statement notes that within this area better transport interchanges and strategic 'first mile / last mile' connectivity will improve the overall connectivity of the area, unlocking urban congestion hot spots. Increased first and last mile connectivity would expand both potential labour markets and linkages between firms and suppliers.
- 1.9.** With regards to innovation in transport, Buckinghamshire, Oxfordshire and Northamptonshire are involved in an Innovate UK funded project which is expected to result in the emergence of intelligent, data driven transport systems which integrate with the mobility needs of both business and personal users in the area. Milton Keynes in particular is an established centre for technology-led transport innovation. It has promoted itself as a hub for autonomous vehicles and battery powered buses as an 'urban laboratory'.
- 1.10.** Intelligent mobility is becoming increasingly important, it relies on more responsive and predictive 'data-driven' transport systems. Intelligent mobility has the potential to connect people in a more efficient and sustainable manner than in the past while optimising network capacity.  
See:  
[http://www.englandseconomicheartland.com/Documents/05%20EEH-Transport-statement%20v5\\_211016.pdf](http://www.englandseconomicheartland.com/Documents/05%20EEH-Transport-statement%20v5_211016.pdf)

## **1.4 Cranfield University**

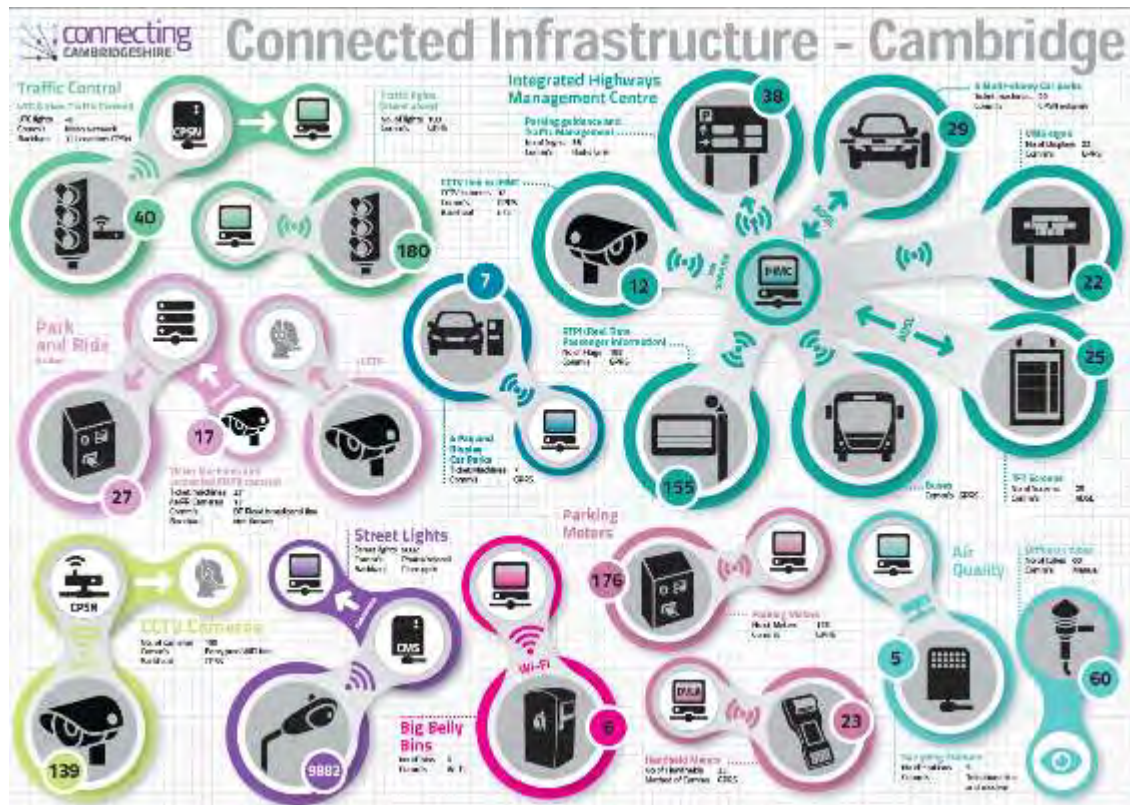
- 1.11.** The IMEC (Intelligent Mobility Engineering Centre) is one of Cranfield University's new facilities and Cranfield University has a position as one of the UK's leading centres for education, training and research for the rapidly growing intelligent mobility and transport systems sector.
- 1.12.** The £10 million Centre provides a shared teaching space for Cranfield students, key business partners, and other local educational institutions that are focused on transport engineering systems and autonomous vehicle technologies. The Centre will house simulation laboratories, student breakout spaces, and deliver practical workshops and on the ground floor, a large foyer will be used for exhibitions and teaching.

- 1.13.** In addition Cranfield also host the MUEAVI (Multi-User Environment for Autonomous Vehicle Innovation) a £9 million research facility. Also opening in 2017, it is a mile of ‘smart’ roadway that will be used in the development of connected and autonomous vehicles, including the associated systems needed to integrate technologies into our day-to-day lives. MUEAVI will be unique, as it will be integrated into the heart of the campus, providing a new arterial road and a pedestrian friendly boulevard, while also serving as a ‘living lab’ research environment.

## **1.5 Smart Cambridge 2017-2018**

- 1.14.** Smart Cambridge involves ‘exploring how data, innovative technology and better connectivity can be used to transform the way people live, work and travel in the Greater Cambridge area and beyond’. It involves the local councils, technology businesses, universities and other organisations working together to tackle challenges in four key areas: transport, environment, healthcare and smart living. The aims for transport are to make travelling easier, to reduce congestion and to explore the possibilities around intelligent mobilities.
- 1.15.** To enable Greater Cambridge to become a ‘smart city region’ infrastructure to collect and analyse data will need to be provided. For transport there is an aim to maximise its impact by using better quality and a better quantity of data while embedding digital solutions and emerging technology. It is stated that over a three year period the programme will cover the following elements:
- Better travel and transport information for journeys
  - Easier payment options including integrated ticketing and online payments
  - Smarter signalling
  - Monitoring of air quality
  - Future transport initiatives including driverless vehicles
- 1.16.** Greater Cambridge already has a significant infrastructure that is connected and produces valuable data, this is demonstrated in the infographic overleaf.

## **1.6**



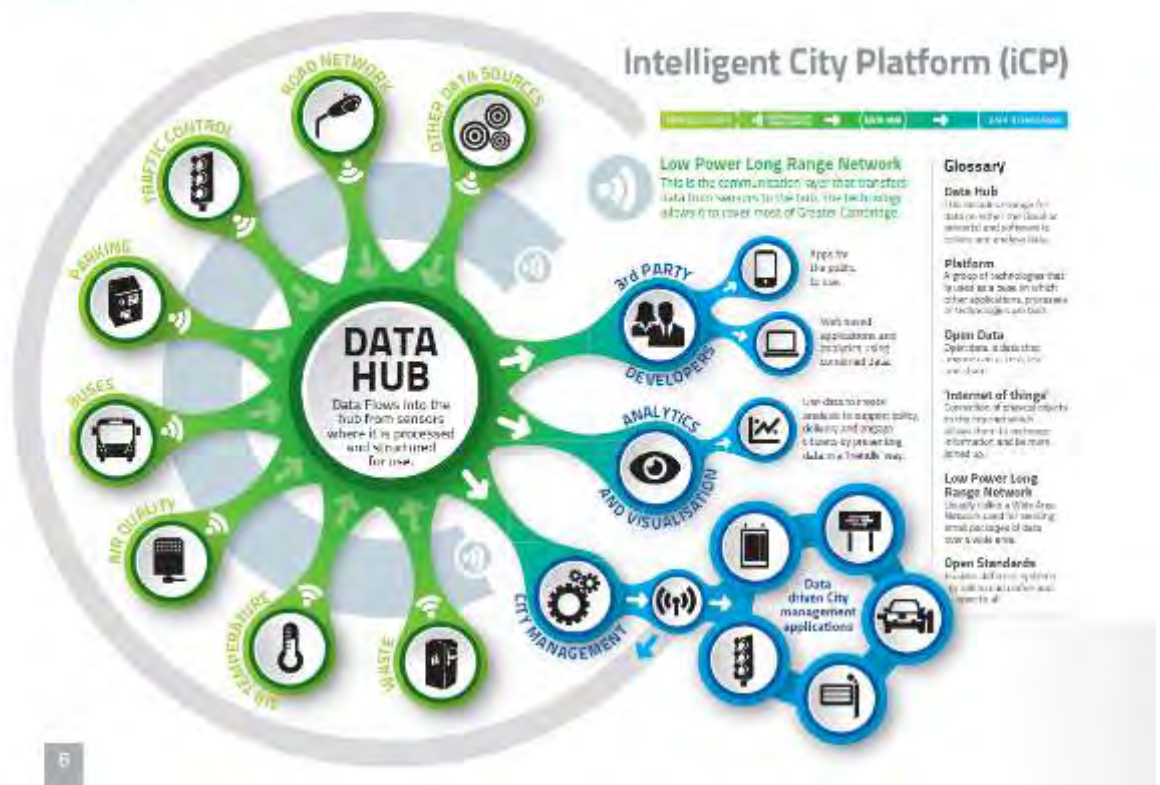
1.7

1.8 Connecting Cambridgeshire, 2017, <http://www.connectingcambridgeshire.co.uk/smartcamb/resources/>

1.17. The data hub collates and processes data and is set up in partnership with the University of Cambridge. Outputs from this approach to the area include a new free mobile travel app to help travellers plan journeys using more sustainable modes of transport, this will include real-time information. One of the other aims of Smart Cambridge relates to research into 'Intelligent Mobility', research will be conducted into:

- Gathering better transport data to help model future schemes;
- Integrated ticketing to make public transport quicker and more attractive to use;
- Digital 'wayfinding' to help people move around the city more easily; and
- Exploring the potential for autonomous vehicles (driverless cars).

1.18. The image below shows the Intelligent City Platform for Smart Cambridge:



1.8.1

**1.9** Connecting Cambridgeshire, 2017, <http://www.connectingcambridgeshire.co.uk/smartcamb/resources/>

### 1.10 Milton Keynes – A Transport Vision and Strategy for Milton Keynes

**1.19.** Milton Keynes recognises that Technology and Intelligent Mobility will play a major role in traffic and highway management, including through the implementation of an integrated Intelligent Transport System (ITS). For Milton Keynes, the integrated ITS includes the improvement of the existing signalling system, using the fibre optic network to 'connect' signals together and allow them to communicate. This will provide better adaptive signal control as signals react to real-world conditions instead of being 'static' in their timings. For this to be effective a traffic management control centre will be necessary as a hub to allow borough wide coordination in collaboration with Highways England, a traffic management control centre forms the hub of this package of interventions. In addition Variable Message Signs will be implemented to alert drivers in the borough to issues or to provide advice in situations such as accidents or parking.

**1.20.** Interventions in Milton Keynes include:

- Urban Traffic Management Control (UTMC) Common Database;
- New Traffic Control Centre including reciprocal data links with the Highway Agency for strategic interventions and traffic management;
- Improved coordination of traffic signals;
- ITS for roadside traffic alerts;
- ITS for parking management e.g. Variable Message Signs (VMS);
- CCTV for traffic monitoring;
- Coordinated ITS with Highways England for management of traffic using the M1.



**1.21.** Milton Keynes is also looking to progress the following in its strategy:

- Protecting the current reliability and predictability of journey times, and stabilising the number of vehicle movements on Milton Keynes' grid roads and build new homes close to priority routes and transport interchanges;
- Establishing new technologies to provide through ticketing, booking and journey choices enabling an on-demand integrated mobility offer and the use of pre-booked electric cars and readily available shared bicycles as popular choices;
- Providing shared electric taxi/pod service as the first thought for journeys within the city, and to provide door-to-door transport, and dispensing with the hassle of car parking; and
- Providing bullet and other rapid electric shuttle buses which operate on priority express routes; offering lower cost journeys to and from main destinations.

### **1.11 Transport Systems Catapult**

#### **1.12 THE CASE FOR GOVERNMENT INVOLVEMENT TO INCENTIVISE DATA SHARING IN THE UK INTELLIGENT MOBILITY SECTOR – Briefing Paper March 2017.**

<https://s3-eu-west-1.amazonaws.com/media.ts.catapult/wp-content/uploads/2017/04/12092544/15460-TSC-Q1-Report-Documents-suite-single-pages.pdf>

#### **1.13 Shared Data in the Intelligent Mobility Sector**

**1.22.** Due to issues associated with security and cost, data in the transport sector is not currently being shared. Transport Systems Catapult has put forward a new vision for data sharing that will put the UK at the forefront of a new mobility solution, enabling a number of benefits. If such a vision is taken forward, the UK can secure its share in a global market worth approximately £9,000 billion annually. Transport data can be used to support different sectors and increase productivity, which in turn can increase economic growth. Intelligent mobility plays a crucial role in this process through data sharing. Sharing data allows for a more sustainable and efficient movement of people and services, for example by reducing congestion through control systems connecting to vehicles to share location-based data.

**1.23.** Furthermore, the benefits of sharing data to build mobility solutions spread to various sectors. For instance:

- The number of fatalities on the road could be reduced as a result of greater automation of vehicles;
- More transportation solutions for the disadvantaged allowing greater access to public spaces; and
- A case for sustainable development due to reduction in carbon dioxide emissions.

**1.24.** However, it is noted that there are barriers to data sharing enabling greater mobility, mainly due to issues of data security and safety and the belief that the intense cost of such sharing will not outweigh the amount of money saved. However, to move forward with this idea, the

government needs to support safe access to data, help reduce the costs of sharing data through licensing and be more open to data sharing to help the UK to become a world leader in the IM sector.



#### 1.14 OLDER TRAVELLERS AND TECHNOLOGY ENGAGEMENT - 2017

<https://s3-eu-west-1.amazonaws.com/media.ts.catapult/wp-content/uploads/2017/04/03094002/TSC-Older-Travellers-Technology-Engagement-Report-March-17.pdf>

- 1.25. As the UK faces an ever ageing population, it is becoming increasingly important that the elderly engage in changing technologies that enable efficient access of transport. There are a number of barriers for the elderly to engage with such technology, include the complexity of design features, a lack of prior experience, psychological issues such as resistance to change in technology, and a fear of using technology due to a lack of trust. Via a previous Transport Systems Catapult study, it was seen that the technology that the elderly most engage in are ones relevant to daily activity, such as for route planning in group activities- it was recognised that the technology that the elderly engaged in most has an embedded sense of simplicity. Greater engagement of the elderly in emerging technology that facilitates intelligent mobility can be done through involving such people in the design process, making technologies easier to negotiate through more efficient route mapping systems and greater physical access information.

#### 1.15 TECHNOLOGY STRATEGY 2016: FOR INTELLIGENT MOBILITY. Think big, take small steps, learn fast.

[http://tsctechstrategy.co.uk/wp-content/uploads/2016/04/Tech\\_Strategy\\_Brochure.pdf](http://tsctechstrategy.co.uk/wp-content/uploads/2016/04/Tech_Strategy_Brochure.pdf)

- 1.26. Intelligent Mobility (IM) will have a great impact on the future of transport as it changes how people and goods move across the globe - IM will create a more efficient and sustainable transport system. There are eight IM goals set by Transport Systems Catapult:
- Make travelling and end-end user-centric experience- personalised and catered transport services, mobility as a service, better connectivity and more autonomous transport;
  - Encourage transport sharing to reduce journey numbers and lower emissions, more awareness of eco-footprint;

- Reduce human error through automated vehicles, provide more location-specific information and controlling emissions to reduce health impacts linked to air pollution;
- Advocate new businesses created on mobility platforms to increase revenue opportunities and enhance cost reduction through improving data driven networks;
- Enhance dynamic responses to reduce impact, co-operative systems to self-manage response to disruptions;
- Realise opportunities associated with data sharing, greater modelling for better predictions and shared-use mobility to ease pressure on assets;
- Provide new transport systems that respond to changes in population demographics, more collaborative systems to improve transport access and number of services and greater transport efficiency.
- Make Transport of People and Goods Quicker- Data analysis of travel needs and patterns enabling faster transport systems, decrease travel times by seamless transport mode transition and more connected systems.



## APPENDIX D – PACKAGE COST BENEFIT APPRAISAL

Packages	Cost Band	Dalton Barracks	Marcham	Kingston Bagpuize	Support LP2	Promoting Organisation	Delivery Organisation	Deliverability (Sponsor)	Deliverability (Physical)	Deliverability (Funding)	Deliverability	Economic (Direct Benefits)	Economic (Wider)	Economic	Social (Safety)	Social (Accessibility)	Social	Environment (Pollution)	Environment (Town/Landscape)	Environment	Overall Score		Value for Money
<b>Traffic Management Packages</b>																							
TM1 Capacity Improvements to Frilford Junction	4		1	1	2	VoWHDC	VoWHDC	5	2	4	4	4	2	4	4	2	3	-1	-1	-1	5.5	1	Average
TM 2 Demand responsive traffic lights at Frilford light	2		1	1	2	VoWHDC	VoWHDC	5	3	3	4	3	2	3	1	3	2	-1	0	-1	5	3	Good
TM3 Bus priority signals at Frilford lights	2		1	1	2	VoWHDC	VoWHDC	5	3	3	4	2	2	2	1	3	2	2	0	1	5.25	3	Good
<b>Bus Improvement Packages</b>																							
B1 Improve frequency of premium routes	4	1		1	4	VoWHDC	Bus Operator	3	5	1	3	3	3	3	0	5	3	3	0	2	8.75	2	Good
B2 Promote cashless payment systems	2	1	1		5	VoWHDC	Bus Operator	3	5	2	4	1	1	1	0	2	1	1	0	1	9.25	5	High
B3 Support provision of e-tickets	1	1	1	1	5	VoWHDC	Bus Operator	3	5	2	4	1	1	1	0	2	1	1	0	1	9.25	9	Very High
B4 Improved Public Transport Information	1	1	1	1	5	VoWHDC	OCC	3	5	5	4	1	1	1	0	3	2	1	0	1	9.5	10	Very High
B5 Extend SmartZone ticket	2	1			3	VoWHDC	OCC/Bus Opertor	2	5	4	4	1	1	1	0	3	2	1	0	1	6.5	3	Good
B6 RTI at key bus stops	3	1		1	4	VoWHDC	VoWHDC	5	3	2	4	2	2	2	1	3	2	2	-1	1	8.25	3	Good
B7 Real-time tracking (Apps/Bus Stops)	2	1	1	1	5	OCC	OCC/Bus Opertor	1	5	2	3	2	1	2	1	3	2	2	0	1	9.5	5	High
B8 Bus stop waiting facilities	3	1	1	1	5	VoWHDC	VoWHDC	5	3	4	4	1	1	1	3	2	3	1	-1	0	9.5	3	Good
B9 Dalton Barracks to Lodge Hill (Busway)	5	1			3	VoWHDC	VoWHDC	5	2	2	3	5	5	5	2	5	4	3	-3	1	7.75	2	Good
<b>Active Travel Package</b>																							
AT1 Pedestrian footway on Faringdon Road	1	1			3	VoWHDC	VoWHDC	5	4	5	5	1	1	1	3	2	3	2	0	1	7	7	Very High
AT2 Cycle lanes on Faringdon Road	2	1			3	VoWHDC	VoWHDC	5	4	5	5	1	2	1	3	2	3	2	0	1	7	4	High
AT3 Long Tow Footpath + Cycle Lanes	2	1			3	VoWHDC	VoWHDC	5	3	5	4	1	2	1	4	2	3	2	0	1	6.75	3	Good
AT4 Oxford Road cycle route	2	1	1		4	VoWHDC	VoWHDC	5	3	5	4	2	2	2	4	2	3	2	0	1	8.5	4	High
AT5 Improvements to the NCN5	2	1			3	VoWHDC	VoWHDC	5	2	4	4	2	1	2	3	4	4	2	-1	1	7.25	4	High
AT6 Twelve Acre Drive and White's Lane (Cycling)	4	1	1		4	VoWHDC	VoWHDC/Other	3	1	3	2	2	0	2	3	3	3	1	-2	0	7.75	2	Good
AT7 Abingdon to Oxford (via Radley Station) (Cycling)	2	1	1		4	VoWHDC	VoWHDC	5	2	5	4	1	1	1	4	3	4	2	0	1	8.5	4	High
AT8 Cumnor Hill (Cycling)	3	1			3	VoWHDC	VoWHDC	5	4	5	5	1	0	1	3	2	3	1	0	1	7	2	Good
AT9 Dalton Barracks to Cumnor Hill (Cycling)	3	1			3	VoWHDC	VoWHDC	5	2	5	4	1	0	1	3	2	3	1	0	1	6.75	2	Good
AT10 Enhance Public Rights of Way (Cycling)	3	1	1	1	5	VoWHDC	VoWHDC	5	2	3	3	2	0	2	3	3	3	1	-1	0	9.5	3	Good
AT11 Marcham to Abingdon - Improved Signage	2		1		1	VoWHDC	VoWHDC	5	4	5	5	1	0	1	3	2	3	1	0	1	4	2	Good
AT12 Dalton Barracks to Lodge Hill (Cycling)	4	1			3	VoWHDC	VoWHDC	5	2	2	3	4	2	4	4	5	5	3	-2	2	8	2	Good
<b>Smart Mobility Package</b>																							
SM1 VMS signs at key locations	2		1	1	2	VoWHDC	VoWHDC	5	3	3	4	2	2	2	1	2	2	1	-1	0	5	3	Good
SM2 Intelligent Traffic Signalisation	2	1	1	1	5	VoWHDC	VoWHDC/OCC/HE	2	3	3	3	3	2	3	1	2	2	1	0	1	9.75	5	High
SM3 Travel Options	3	1			3	VoWHDC	VoWHDC/OCC/Other	2	4	3	3	3	2	3	2	5	4	2	0	1	7.25	2	Good
SM4 Travel Planning	1	1	1	1	5	VoWHDC	VoWHDC/OCC	4	5	5	5	2	1	2	3	4	4	2	0	1	10.5	11	Very High
SM5 Social Media Feed & Feedback	1	1	1	1	5	VoWHDC	VoWHDC	5	5	5	5	1	0	1	1	2	2	1	0	1	9.75	10	Very High
SM6 Journey Planner App	3	1	1	1	5	OCC	OCC	1	5	4	3	1	0	1	2	2	2	1	0	1	9.25	3	Good
SM7 Gamification and Incentivisation	1	1	1	1	5	VoWHDC	VoWHDC	5	5	5	5	1	0	1	1	2	2	1	0	1	9.75	10	Very High
SM8 Smart Mobility Forum & MaaS	1	1	1	1	5	VoWHDC	VoWHDC	5	5	5	5	1	0	1	2	3	3	2	0	1	10	10	Very High



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