Improving access to Bath from the east
East of Bath Express feasibility study

Bath & North East Somerset Council / West of England Combined Authority

08 March 2022

R02

Notice

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Executive Summary

Introduction

There is a long standing and increasing need to reduce private car trips into Bath from the east of the city. With the introduction of the Clean Air Zone (CAZ) in central Bath, and Bath & North East Somerset Council's (B&NES) commitment to carbon neutrality by 2030, high quality sustainable travel options that provide good connectivity and a realistic alternative to the private car are required.

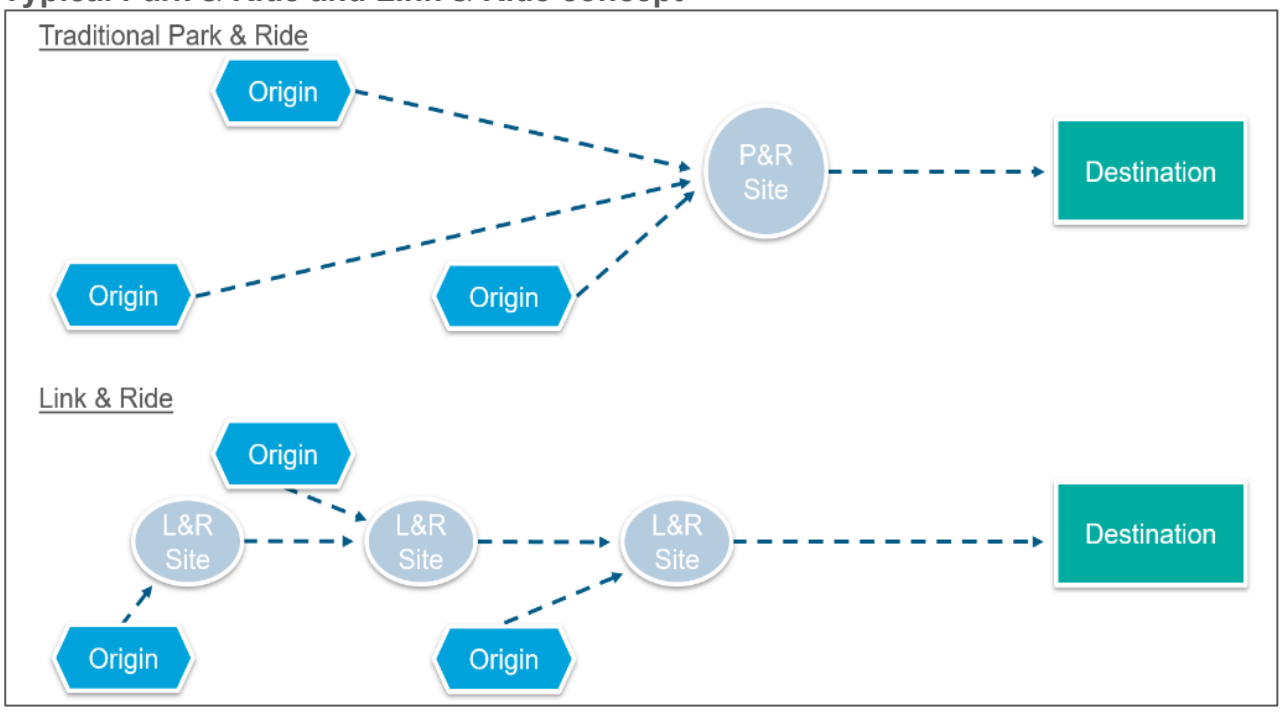
Transport improvements to the east of Bath, including introducing a traditional Park & Ride (P&R) site, have been a long term aspiration for B&NES, as set out in its Local Plan and Joint Local Transport Plan 4. However, this aspiration has not been realised due to there not being a suitable site available. During consultation and discussions on the subject of a traditional P&R to the east of Bath, the concept of a Link & Ride bus service (referred to as L&R from this point forward) was suggested.

Link & Ride bus service concept

The L&R bus service concept is different to a traditional P&R as it has multiple smaller interchange points along a route instead of a larger, singular interchange site (see diagram below).

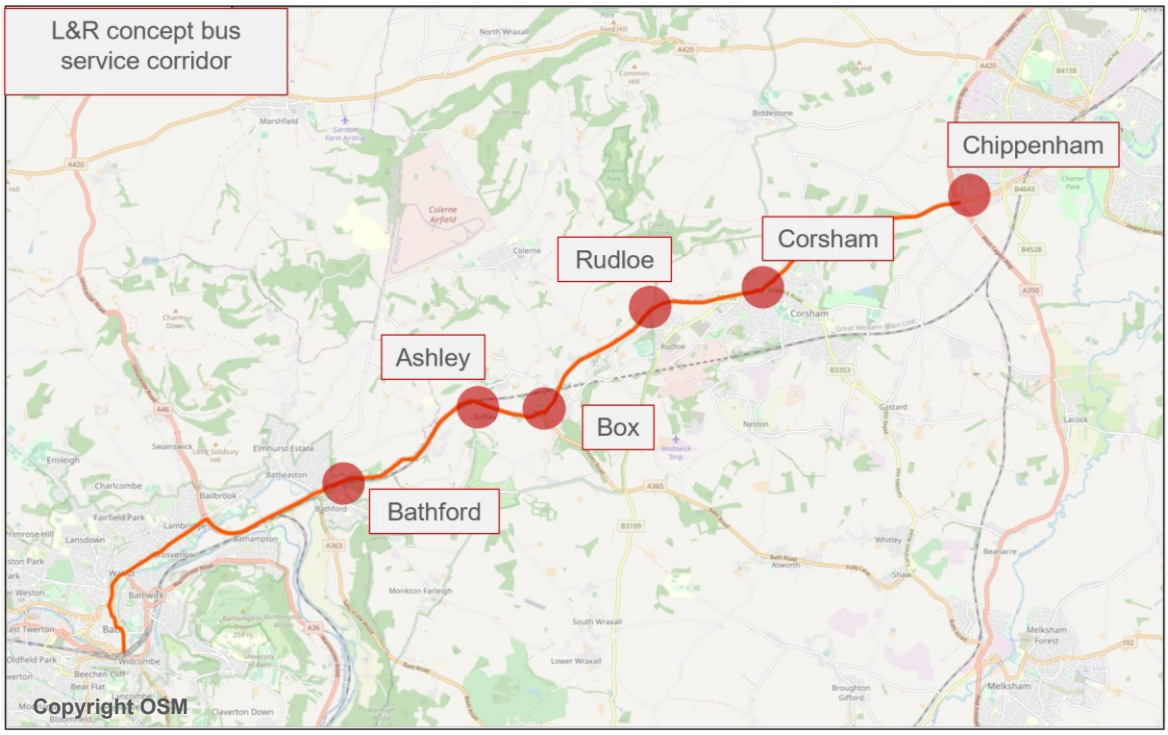
This study considers the feasibility of delivering a Chippenham to Bath L&R bus service offer with local interchange sites, linked bus services and cycle routes.

Typical Park & Ride and Link & Ride concept



The L&R bus service concept is intended to serve local towns and villages along the A4 corridor, providing a link to central Bath, as shown in the map below. The A4 corridor is currently served by the X31 Chippenham to Bath bus service.

L&R bus service concept corridor – Chippenham to Bath



L&R bus service concept objectives

The objectives for the L&R bus service concept are:

1. Increase the numbers travelling by public transport and reduce the number of car trips travelling into central Bath, thereby reducing carbon emissions and helping to address the climate emergency;
2. Provide a commercially viable, direct bus service on the A4 between Chippenham and central Bath;
3. Achieve an optimal journey time by providing a direct bus service with minimal number of stops on the route and bus priority measures;
4. Provide interchange points at Chippenham, Corsham, Rudloe, Box, Ashley and Batheaston/Bathford to capture car trips into central Bath both from these settlements and the wider catchment;
5. Interchange locations will act as transport hubs that allows seamless journeys for those walking, cycling and using public transport. The hubs will not just include car parking provision but will also be accessible and attractive for pedestrians and cyclists and will be safe and well lit; and
6. Provide a simple, easy to use bus service with distinctive branding to raise awareness and maximise ridership.

Summary of feasibility approach

In order to assess the feasibility of a L&R bus service concept along the A4 corridor, the following assessments were conducted:

- Bus service options specification.
- Bespoke demand modelling.
- Carbon assessment.
- Operating costs and revenue assessment.
- Interchange identification.
- Identification of bus priority measures.

A summary of the demand model and carbon assessment tests is provided below.

Summary of L&R bus service tests

To understand how the different L&R bus service options impact on potential patronage levels (and therefore the potential removal of cars from the roads), several scenarios were tested in the demand model.

The baseline test (scenario A) was undertaken to understand the baseline potential levels of mode shift from car to L&R. Several 'do something' tests were then developed to test the impact on demand of different service types and external policy measures.

L&R concept service test scenarios

Test	Test name	Description
A	Baseline	Existing X31 route.
B	Direct route	Direct bus service route along the A4 with no diversions (all of the other tests use this same direct route unless specified).
D	Frequency	Increased bus frequency
E	Fares	Fares capped at existing Bath P&R fare structure.
F	Bus priority measures	Bus priority measures at the A4 / London Road roundabout.
G	Interchange parking charge	Implementation of an interchange parking charge.
J	Combined option	Direct service with increased frequency, fares capped and bus priority measures at the A4 / London Road roundabout).
K	Alternating direct & X31 service offer	Alternating direct service route & X31 service route offer.

Scenarios C, H and I considered the impact of introducing demand management measures and were conducted for reference only.

The tests were conducted to understand the extent to which the L&R bus service concept could abstract car trips travelling along the corridor into central Bath. As such, the in-scope demand of these tests is car trips into central Bath rather than trips by other modes, notably bus and rail.

Summary of findings

The table below summarises the results for the key scenarios. In addition to demand, the L&R concept has been assessed against several additional metrics: daily patronage levels; identified potential brownfield parking; carbon emission reductions; and bus operating cost model outputs. It should be noted that an electric bus option was also assessed as a sensitivity test for the purposes of the carbon assessment.

The headline findings from the study are:

- All of the options tested for a L&R bus service have been shown to abstract some car trips for journeys on the A4 into central Bath. Lower fares, and a combined package of measures (including lower fares, a high frequency service and bus priority), have the greatest impact.
- Abstraction of car trips to the L&R bus service reduces the car vehicle kilometres travelled for the in-scope trips.
- To drive demand to commercially viable levels, the L&R between Chippenham and Bath would need to be delivered as part of a wider package of measures, including demand management measures. This wider package of measures is currently being developed through the Journey to Net Zero project that will identify the transport improvements required to address the Climate Emergency declared by B&NES in 2019. If a zero emission bus fleet were to be used then the abstraction of car trips could result in significant operational carbon reductions.
- Potential interchange sites have been identified to accommodate a proportion of the abstracted car trips. Options to further maximise access to these locations for pedestrians, cyclists and buses could be explored to minimise the need to identify additional locations.

Key study assessment outputs

Assessment	Measure	Scenario B - Direct route	Scenario D - Direct route & increased frequency	Scenario E - Direct route & capped fares	Scenario F - Direct route & bus priority measures	Scenario J – Combined package of measures	Scenario K – Alternating Direct & X31 service offer
Demand assessment	In-scope inbound vehicle trips in defined corridor (daily estimate)	7,369	7,369	7,369	7,369	7,369	7,369
Demand assessment	Estimated daily L&R bus service concept inbound patronage (persons)	215	257	574	233	793	220
Demand assessment	Estimated daily inbound vehicle trips removed by L&R	182	218	470	200	640	207
Demand assessment	Proportion of in-scope daily inbound vehicle trips removed by L&R	3%	3%	6%	3%	9%	3%
Demand assessment	Estimated change in daily private car veh-kms	-1,701 (-0.4%)	-1,758 (-0.4%)	-5,371 (-1.2%)	-1,731 (-0.4%)	-7,006 (-1.5%)	-1,455 (-0.3%)
Carbon assessment	Carbon emissions - net change (tonnes CO2e p.a) – diesel bus fleet	588	971	0	581	148	+333*
Carbon assessment	Carbon emissions - net change (tonnes CO2e p.a) – electric bus fleet	-109	-37	-705	-117	-859	-170

Cost assessment of a standalone bus service	Annual margin (estimated revenue - diesel bus operating costs, £'000s)	-£1,000	-£1,400	-£800	-£1,000	-£1,100	-£900**
Cost assessment of a standalone bus service	Estimated daily inbound patronage to break even	750	1,050	1,400	800	2,000	750
Interchange assessment	Identified brownfield parking spaces	~276	~276	~276	~276	~276	~276

*Additional carbon emissions from direct service only

**Cost for direct service only (for commercial reasons this study was not able to consider the current X31 costs or revenue)

The assessments presented above were based upon pre-Covid-19 pandemic levels of demand. Due to the uncertainty regarding the recovery of bus patronage levels from the Covid-19 pandemic, a number of sensitivity tests have been undertaken to understand how potential changes in travel demand might impact on the L&R patronage.

Sensitivity tests in relation to potential Link and Ride travel demand

Sensitivity test – reduction in daily patronage	Scenario B – Direct route	Scenario D – Increase frequency	Scenario E – Cap fares	Scenario F – Bus priority measures	Scenario J – Combined option	Scenario K - Alternating direct & X31 service offer
100%	215	257	574	233	793	220
50%	108	129	287	117	397	102
70%	65	77	172	70	238	61
80%	43	51	115	47	159	41

The sensitivity test demonstrates that the greater the reduction in daily bus patronage, the lower the resultant travel demand for the L&R. For example, under a 50% reduction sensitivity test the highest estimated daily patronage for L&R (scenario J – combined package of measures), reduces from 793 to 397 passenger trips. This reduces further to 159 passenger trips under an 80% reduction sensitivity test.

Assessment against concept objectives

The table below shows the assessment of the L&R bus service concept against the defined scheme objectives. This highlights that the L&R concept, as developed for this feasibility study, has been shown to align well with some of the concept objectives. However, further work would be required to optimise the scheme in relation to other objectives.

L&R bus service concept assessed against concept objectives

Concept objective	Assessment
Provide commercially viable, direct bus service on the A4	The bus operating costs model has shown that a standalone, direct L&R bus service (in addition to the current X31) is unlikely to be commercially viable without higher patronage. The operating cost assessment is an initial high level assessment; further work and discussions with bus operators may identify different options for providing a commercially viable service. The study has identified the most effective drivers of demand that could increase abstraction from the car to the L&R bus service. Further consideration of these as part of a package of measures, including wider policy and demand management measures, could help further maximise patronage and revenue to offset operating costs.

Concept objective	Assessment
Optimise bus journey time	The study has shown that a direct service, with minimal stops, has the potential to enhance journey times along the corridor, including by removing the time taken to travel through Corsham and Rudloe as per the existing X31 service. The feasibility study has identified potential locations for bus priority measures to improve bus journey times and reliability.
Provide interchange points at settlements	The study has identified potential interchange sites at existing brownfield locations at each settlement, but available capacity may not meet the likely demand. Further work would be required to consider these locations in more detail; in particular, through engagement with landowners.
Interchanges to include car parking provision and provide for pedestrians and cyclists	The study identified potential interchange locations which could be accessed by all modes, although enabling works would be required at some locations. Further work would be required to consider additional parking capacity at locations beyond the scope of this study. This should also seek to further maximise the potential for pedestrian, cycle and bus to provide access to these interchange locations in order to promote reduced car use and hence minimise the need to identify additional locations. Further work would be needed to confirm the feasibility of the interchange locations, including land and planning risks. This should include engagement with landowners.
Reduce car trips travelling into central Bath, contribute to B&NES carbon reduction targets	The study has shown that a L&R scheme could reduce the number of inbound daily car trips travelling into central Bath via the A4 corridor (up to 640 in scenario test J). If a zero emission bus fleet were introduced, the tests have identified a significant reduction in carbon, however further work would be required to: a) establish the most appropriate zero emissions technology for buses operating on this route; b) identify funding; and c) establish its contribution to the B&NES carbon reduction targets.

Possible options going forward

There are several possible options going forward to adapt the L&R bus service concept so that it can best meet the scheme objectives, including:

- Undertaking the further detailed work as outlined in the table above.
- Considering a short-term trial using one of the identified interchange sites that lies on the existing X31 service route. This could involve a low set-up cost and would not require any change to existing bus services but could help identify the potential demand for such a scheme. This would require careful management to avoid such a scheme becoming too popular, with demand for car parking becoming unmanageable and resulting in unintended consequences for local neighbourhoods.
- Considering options for feeder services to provide access to the X31 service or the L&R concept, including potentially connecting to a direct Royal United Hospitals (RUH) Bath feeder service. This could drive up demand and could take the form of

demand responsive transport. Such an exercise would need to consider the cost implications of providing the service.

- Identifying further car parking capacity or additional measures to increase pedestrian, cycle and bus access to the interchange locations in order to minimise the need for additional car parking. The study has shown that the existing brownfield site capacity identified along the A4 corridor, in its current form, is not sufficient to meet the demands associated with a commercially viable standalone service.

Next steps for the L&R concept

Suggested next steps for the currently developed L&R concept are as follows:

- B&NES, West of England Combined Authority (WECA) and Wiltshire Council to discuss the possible options going forward, as set out above, to further understand how a L&R could be progressed as part of the wider Bus Service Improvement Plans and associated Enhanced Partnerships.
- B&NES, WECA and Wiltshire Council to discuss the possible options going forward with the current commercial operator.

It should also be noted that this is the first time a detailed examination of a potential L&R scheme has been undertaken, and there is the possibility of conducting further work to consider the feasibility of introducing L&R in other corridors to the east of Bath (and across the Western Gateway Sub-national Transport Body area).

Next steps for the A4 corridor

Ultimately there is a need to provide a viable and affordable alternative to car travel for trips in the A4 corridor. The suggested next steps for the A4 corridor are as follows:

- Consider how a phased delivery of options could provide a sustainable improvement along the corridor. Strategies to support phased delivery could include incremental improvements, with initial focus on higher demand areas.
- Discussions with the existing service operators, WECA, Western Gateway Sub-national Transport Body and Wiltshire Council to develop a joint solution for the corridor.
- Discuss any interchange aspects with landowners, if the L&R is considered to be the best option for the corridor following an option assessment study for the corridor.
- Undertake stakeholder engagement, including a public consultation, to understand how the public feel their needs and concerns for the corridor can best be addressed.
- Identify quick wins that could be implemented, subject to funding, along the corridor to improve the immediate situation, for example upgrades to existing bus stop infrastructure.

Document history

Document title: East of Bath Express feasibility study

Document reference: R02

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 0.1	First draft	PB/RM/LC/JD/LA/PS	PB	MA/NW/MG/TM/ND	JFC	26/03/21
Rev 0.2	Final	LA/PB/SC	LA/PB	MA/NW/MG/TM/ND	PB	17/12/21
Rev 0.21	Final following final comments	LA/PB/SC	LA/PB	MA/NW/MG/TM/ND	PB	18/02/22
Rev 1.0	Final following final comments	LA/PB/SC	LA/PB	MA/NW/MG/TM/ND	PB	08/03/22

Client signoff

Client	Bath & North East Somerset Council / West of England Combined Authority
Project	East of Bath Express
Job number	5195971
Client signature/date	

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1. Introduction

1.1. Background to the study

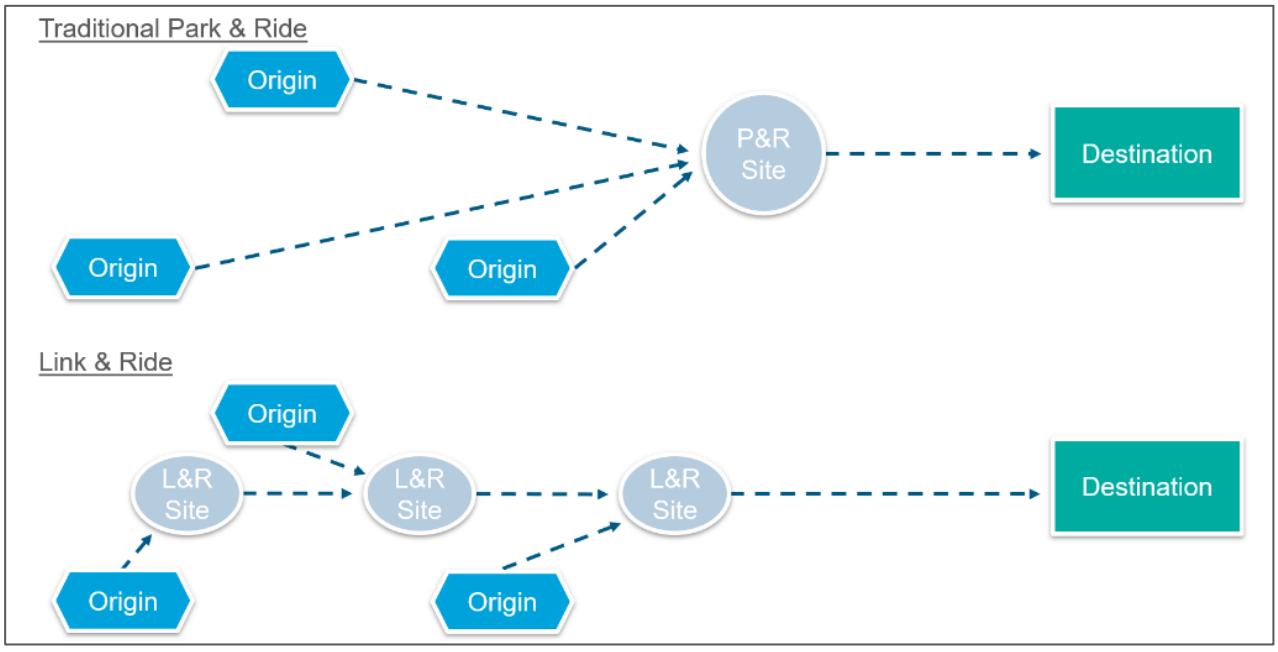
There is a long standing and increasing need to reduce private car trips into Bath including from the east. Bath & North East Somerset Council (B&NES) declared a Climate Emergency in March 2019, committing the Council to achieving carbon neutrality by 2030. Transport accounts for one third of emissions and will require a major shift to public transport, walking and cycling to reduce emissions. The Council introduced a Clean Air Zone (CAZ) on 15th March 2021 that charges pre euro 6 diesel, taxis, buses, coaches, lorries and vans in a bid to reduce nitrogen dioxide levels as part of a government directive. To support the further reduction in transport emissions, high quality sustainable travel options that offer good connectivity and a realistic alternative to the private car are required.

The need to reduce the number of car trips entering Bath from the east has been a long-standing aim of the Council and is set out in the Local Plan and Joint Local Transport Plan 4. Previous schemes, such as a traditional Park & Ride to the east, are well documented but the Council has been unable to implement such a scheme as no suitable site could be identified.

1.2. Scope of study

This study aims to assess travel demand and how it is currently met from the east of Bath. The study will assess the feasibility of a direct Chippenham to Bath bus offer with local Link & Ride sites (which will be referred to as L&R, from this point forward), linked bus services and cycle routes. As shown in Figure 1-1 the Link & Ride concept is different to a traditional Park & Ride with multiple interchange points along a route instead of a larger, singular interchange site. The L&R bus service would serve local towns and villages along the A4 corridor with linkages to other key destinations within the centre of Bath.

Figure 1-1 - Typical Park & Ride and Link & Ride concept



The scope of the east of Bath corridor, is shown in Figure 1-2, and comprises of residential and employment areas within Bath & North East Somerset and Wiltshire. The key settlements on the corridor are listed in Table 1-1.

Figure 1-2 - East of Bath corridor

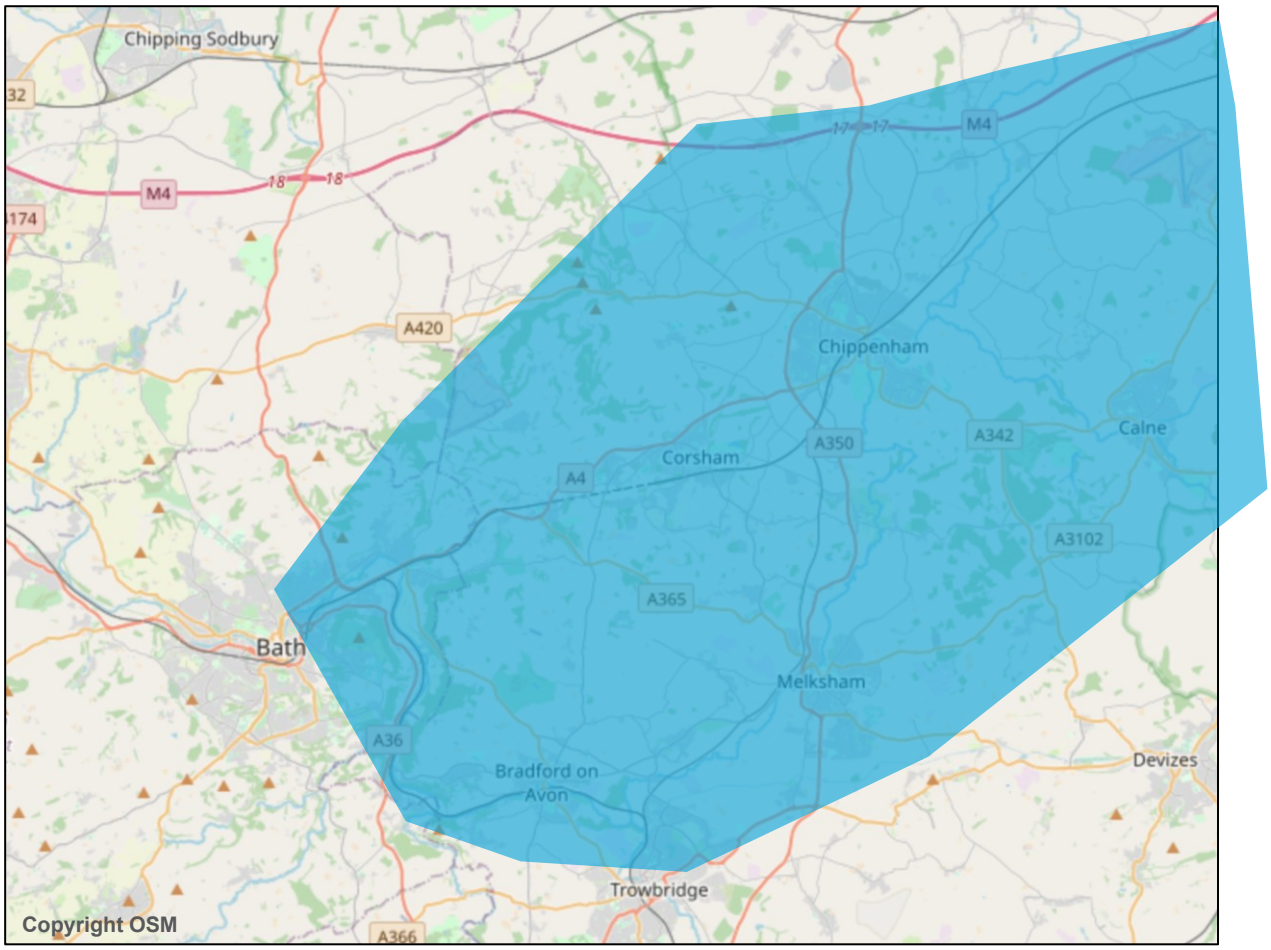


Table 1-1 - Key settlements along east of Bath corridor

Local Authority	Settlement
Bath & North East Somerset	Bathampton
Bath & North East Somerset	Batheaston
Bath & North East Somerset	Bathford
Wiltshire	Box
Wiltshire	Corsham
Wiltshire	Chippenham
Wiltshire	Calne
Wiltshire	Melksham
Wiltshire	Bradford-on-Avon
Wiltshire	Trowbridge

1.3. Stakeholder engagement

Key stakeholders were identified at the beginning of the feasibility study. For each stakeholder, an engagement plan was developed and followed through the feasibility study. Table 1-2 below shows the identified stakeholders, with a brief description of engagement.

Table 1-2 - Key stakeholders and summary of engagement

Stakeholder	Engagement summary
B&NES Council Cabinet Members	Monthly meetings were held. These meetings aimed to: • Summarise progress • Raise any concerns and hold open discussions on the vision for the L&R scheme • Communicate next steps
Wiltshire Council	Monthly meetings were held. These meetings aimed to: • Summarise progress • Agree joint corridor objectives between Wiltshire Council and B&NES • Identify any concerns and opportunities from Wiltshire Council regarding the L&R study • Communicate next steps
West of England Combined Authority (WECA)	B&NES officers met with WECA at the beginning of the study to outline the scope of the work. Findings from the study were presented to WECA on its conclusion.
Nottinghamshire County Council	To discuss Nottinghamshire County Council's pocket Park & Ride scheme, please see section 5.4 for further information.
Professor Graham Parkhurst, Director, Centre for Transport and Society, University of the West of England, Bristol	A meeting to discuss the demand modelling methodology was held with Professor Parkhurst.
Faresaver	Faresaver, the operator of the existing X31 Chippenham-Bath bus service, was engaged for information and data to inform the demand assessment and also understand challenges for bus operators on the corridor.

Engagement with National Highways (formerly Highways England) and landowners has not been conducted at this stage of feasibility work.

1.5. Report structure

This feasibility report is structured as follows:

- Chapter 2: Context for L&R in Bath.
- Chapter 3: Travel demands and impacts.
- Chapter 4: Existing bus service provision.
- Chapter 5: L&R concept – rational and objectives.
- Chapter 6: Demand assessment for L&R scheme.
- Chapter 7: Carbon assessment for L&R scheme.
- Chapter 8: Bus service operating cost model for L&R scheme.
- Chapter 9: L&R interchange sites and bus priority.
- Chapter 10: Conclusions and next steps.

- L&R concept – rationale and objectives.
- Chapter 6: Demand assessment for L&R scheme.
- Chapter 7: Carbon assessment for L&R scheme
- Chapter 8: Bus service operating cost model for L&R scheme.
- Chapter 9: L&R interchange sites and bus priority.
- Chapter 10: Conclusions and next steps.

1.6. Covid-19

The Covid-19 pandemic occurred during the agreement of scope for the feasibility study and commencement of work. It is acknowledged that the pandemic has had a significant impact on bus patronage levels which could potentially lead to future changes in the bus industry. Bus service funding and potential reform is covered in section 2.4.

For the purposes of this feasibility study, bus industry conditions for 2019 are considered as the baseline for assessments and analysis. Due to the uncertainty regarding the future of the bus industry any analysis concerning carbon reduction or bus operating costs has been completed for the base year only (i.e. 2019) instead of for a forecast year.

Sensitivity tests have been undertaken to understand the impact on demand for the proposed L&R scheme if patronage levels do not return to pre-pandemic levels.

2. Context for L&R in Bath

2.1. Introduction

This section provides an understanding of the context for a potential L&R scheme in Bath, including a review of existing transport provision, policies and environmental considerations that affect the L&R scheme. The key points are noted below.

Overview of existing transport provision:

- There is no provision currently for cyclists both off road and along the A4 corridor between Chippenham and Bath with no dedicated cycle routes available.
- The X31 bus service currently provides for bus journeys between Chippenham and Bath, routing via Rudloe, Corsham and Batheaston.
- There are Park & Ride sites serving the north, south and west of Bath.
- Rail services from Chippenham, Trowbridge and Bradford-on-Avon provide direct rail access to central Bath.
- Journeys by car into central Bath from the A46, A4, A363 and A365 corridors converge on the A4 London Road in the Bath urban area. In the AM peak (2019) around 1,400 vehicles an hour (two directional) on average were recorded at A4 London Road west of Beaufort West. For the inter peak period this figure was around 1,600 an hour.

Local policy context:

- B&NES and Wiltshire Council have declared climate emergencies and have policy aims to achieve modal shift.
- The West of England Joint Local Transport Plan 4 (JLTP4), Bath Delivery Action Plan 2020 and West of England Bus Strategy all aim to improve the bus service offer and increase bus patronage.

National regulatory and policy context for bus services:

- The National Bus Strategy (Bus back better) published in March 2021 outlines potential new funding opportunities for the provision of bus services and infrastructure.

Environmental designations:

- There are a number of environmental designations along the corridor, most notably the statutory designations along the corridor include an Area of Outstanding Natural Beauty (AONB) and Air Quality Management Area (AQMA) and non-statutory designations including Conservation Areas and Greenbelt. The city of Bath is also a UNESCO World Heritage Site, with the setting impacting the corridor.

Further detail for each of these is provided in the following sections.

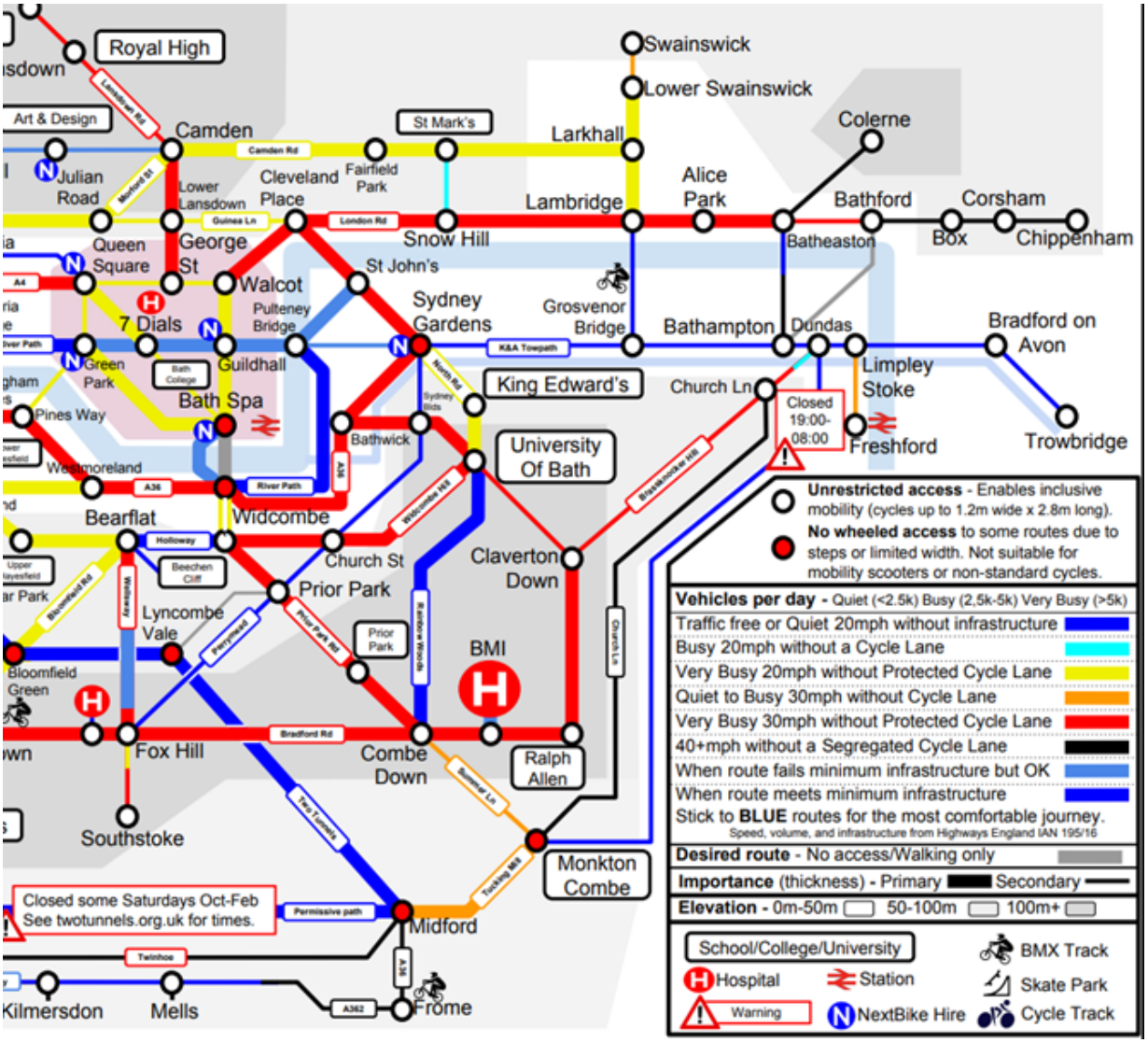
2.2. Overview of existing transport provision

2.2.1. Pedestrian and cycle network

The cycle network in Bath city centre and to the east is shown in Figure 2-1. There are two routes leaving the city on the east side:

- The Kennet & Avon Towpath (National Cycle Network route 4) that follows the River Avon south east to Bradford-on-Avon and Trowbridge that is graded as meeting minimum cycle infrastructure requirements.
- The A4 corridor to Corsham and Chippenham is represented as a '40+ mph road without a segregated cycle lane.

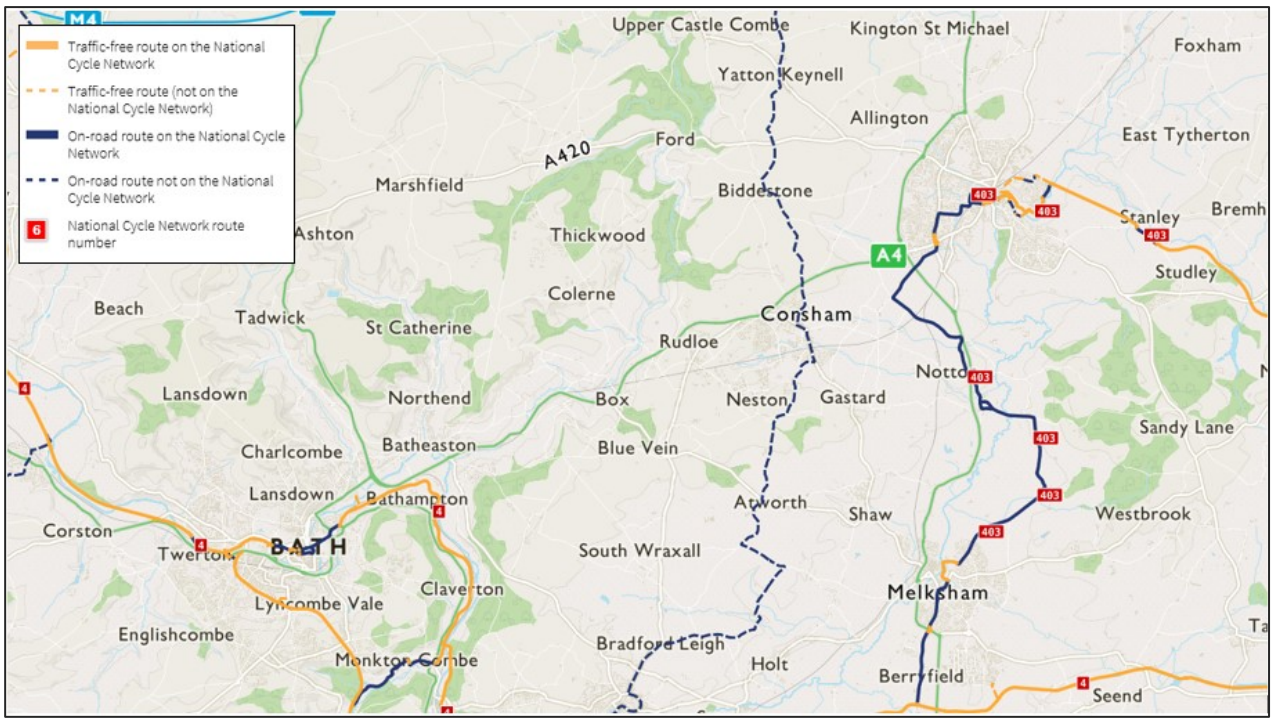
Figure 2-1 - Bath cycle network (city centre and east of Bath)



Source: Cycle Bath, bath-cycle-network-quality-map-august-2017.pdf (wordpress.com)

Figure 2-2 shows the National Cycle Network (NCN) routes in and around the east of Bath area. NCN route 4 links Bath to Bradford-on-Avon and Trowbridge, and NCN route 403 links Chippenham and Melksham. There is no NCN route within the A4 transport corridor connecting Bath to Chippenham and the intermediate towns in between.

Figure 2-2 - National Cycle Network in the east of Bath area



Source: Sustrans Map of the National Cycle Network & Ordnance Survey. Detailed maps & routes to explore the great outdoors | OS Maps

2.2.2. Bus network and services

The X31 bus service is operated by Faresaver on the A4 corridor between Bath and Chippenham (see Table 2-1).

More widely, services run between Bath and Melksham along the A365, and the Bath to Bradford-on-Avon bus service runs along the B3108. These services are detailed in Table 2-2 and the bus network to the east of Bath is shown by hourly frequency in Figure 2-3.

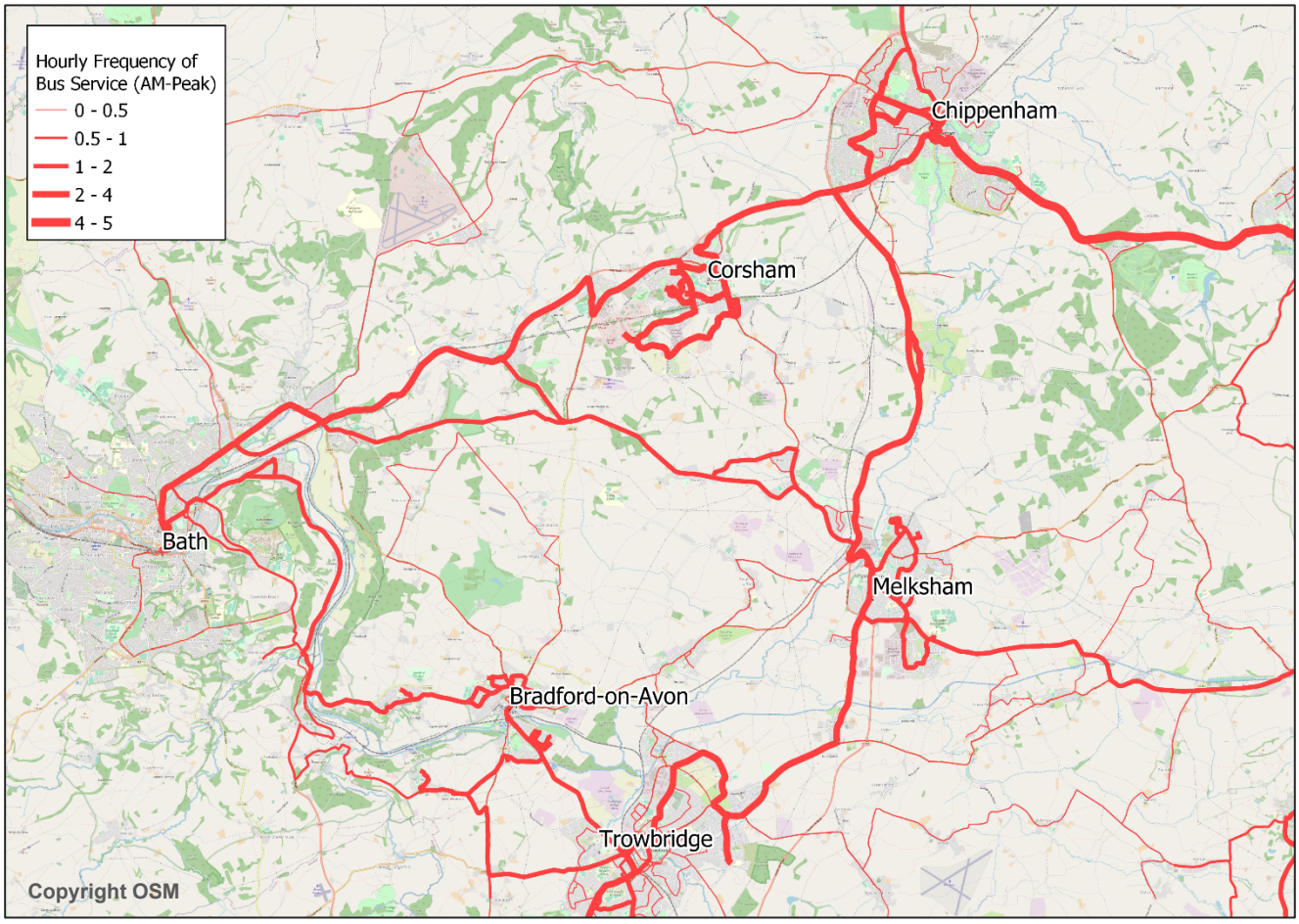
Table 2-1 – X31 bus service

Service	Principal corridor	Main settlements along route	Maximum frequency	Journey time (Bath to Chippenham)	Fare (Adult Day)
X31	A4 Bath Road	Bath - Corsham - Chippenham	20 minutes	Approx. 1h-1h 20 mins	£7

Table 2-2 – High frequency bus corridors to the east of Bath

Services	Principal corridor	Main settlements along route	Maximum frequency
D3. X72. X76. 271. 272	A365 Bath Road	Bath - Melksham	30 minutes
D1	B3108	Bath - Bradford-on-Avon - Trowbridge	40 minutes

Figure 2-3 - Hourly frequency of bus services in area east of Bath – Monday AM peak (0700-0859)



2.2.3. Park & Ride provision

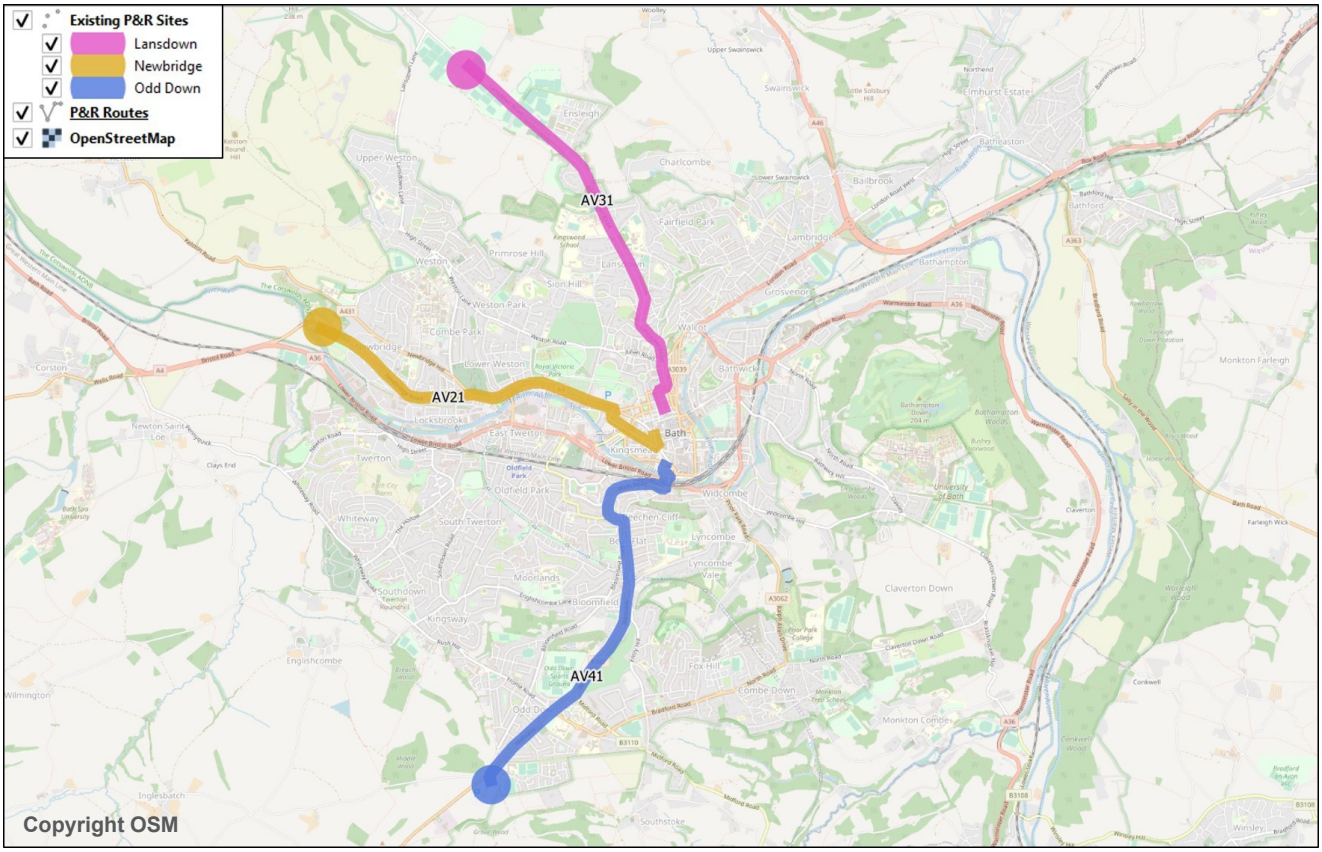
There are three existing Park & Ride (P&R) sites for Bath as follows:

- Odd Down – to the south with 1,252 parking spaces;
- Newbridge – to the west with 698 parking spaces; and
- Lansdown – to the north with 827 parking spaces.

Overall, there are 2,777 Park & Ride spaces in total.

Depending on the site the Park & Ride bus services operate at a frequency of a bus being available every 12-15 minutes, with no parking charges applied at the P&R site, users pay for a return ticket on the bus which is currently £3.60. A map of the sites is shown below in Figure 2-4. The Bath Park & Ride offer is successful in intercepting around 2 million vehicles a year and operates commercially under an agreement between the transport authority and the operator First bus.

Figure 2-4 - Existing P&R sites in Bath



2.2.4. Rail services

There is also the option to access rail services within the corridor at Chippenham, Trowbridge, Melksham, Bradford-on-Avon, and Bath Spa railway stations:

- The Great Western Mainline provides Bath with fast and direct rail links to Bristol, South Wales in the west; and Chippenham, Swindon, Reading and London to the east (see Table 2-3).
- The Wessex Mainline provides rail access from Bath to Bradford-on-Avon and Trowbridge.
- The Trans Wilts Mainline connects Trowbridge, Melksham, and Chippenham.

Chippenham, Bradford-on-Avon and Trowbridge railway stations provide access to direct rail services to Bath whilst access to Bath by rail from Melksham requires interchange at either Trowbridge or Chippenham. Aspirations for delivery of a railway station at Corsham are included in the Swindon & Wiltshire Local Enterprise Partnership Rail Strategy[1] with Wiltshire Council recently submitting a successful bid to fund the development of the scheme[2].

[1] Swindon And Wiltshire Rail Study - Rail Strategy Report, 2019. Swindon & Wiltshire Local Enterprise Partnership swlep-rail-strategy-final-09-05-2019.pdf
[2] Presentation title (swlep.co.uk)

Table 2-3 - Rail services at Bath Spa rail station – 2019 frequency

Destinations	Line	AM / PM peak period frequency	Off peak frequency	Journey time to/from Bath Spa rail station	Approx. fare (one direction, AM / PM peak)[3]
London Paddington	Great Western Main Line	Every 30 minutes	Every 60 minutes	~1h 18 mins – 1h 25 mins	~£50
Didcot Parkway	Great Western Main Line	Every 30 minutes	Every 60 minutes	~43-44 mins	~£35
Reading	Great Western Main Line	Every 30 minutes	Every 60 minutes	~56-57 mins	~£40
Bristol Temple Meads	Great Western Main Line	Every 30 minutes	Every 30 minutes	~12-13 mins	~£9
Swindon	Great Western Main Line	Every 30 minutes	Every 30 minutes	~25 mins	~£19
Chippenham	Great Western Main Line	Every 30 minutes	Every 30 minutes	~11 mins	~£7
Trowbridge	Wessex Main Line	Every 30 minutes	Every 30 minutes	~18-22 mins	~£7
Bradford-on-Avon	Wessex Main Line	Every 30 minutes	Every 30 minutes	~12-15 mins	~£5

2.2.5. Highway network

The A4 is the key highway route at the heart of the east of Bath corridor. It is part of the Primary Route Network (PRN), providing connectivity between the key settlements of Chippenham and Bath. There are intermediate towns and villages on its route and it serves a wider catchment of smaller settlements which use the A4 to access services and social and employment opportunities. The A4 is a single carriageway route and runs parallel to the Great Western Mainline (Figure 2-5).

The other key highway routes in the corridor are:

- The A363 - splits south from the A4 at Bathford and continues south to Bradford-on-Avon; and then further south to Trowbridge.
- The A365 - splits south from the A4 at Box and continues south to Melksham.

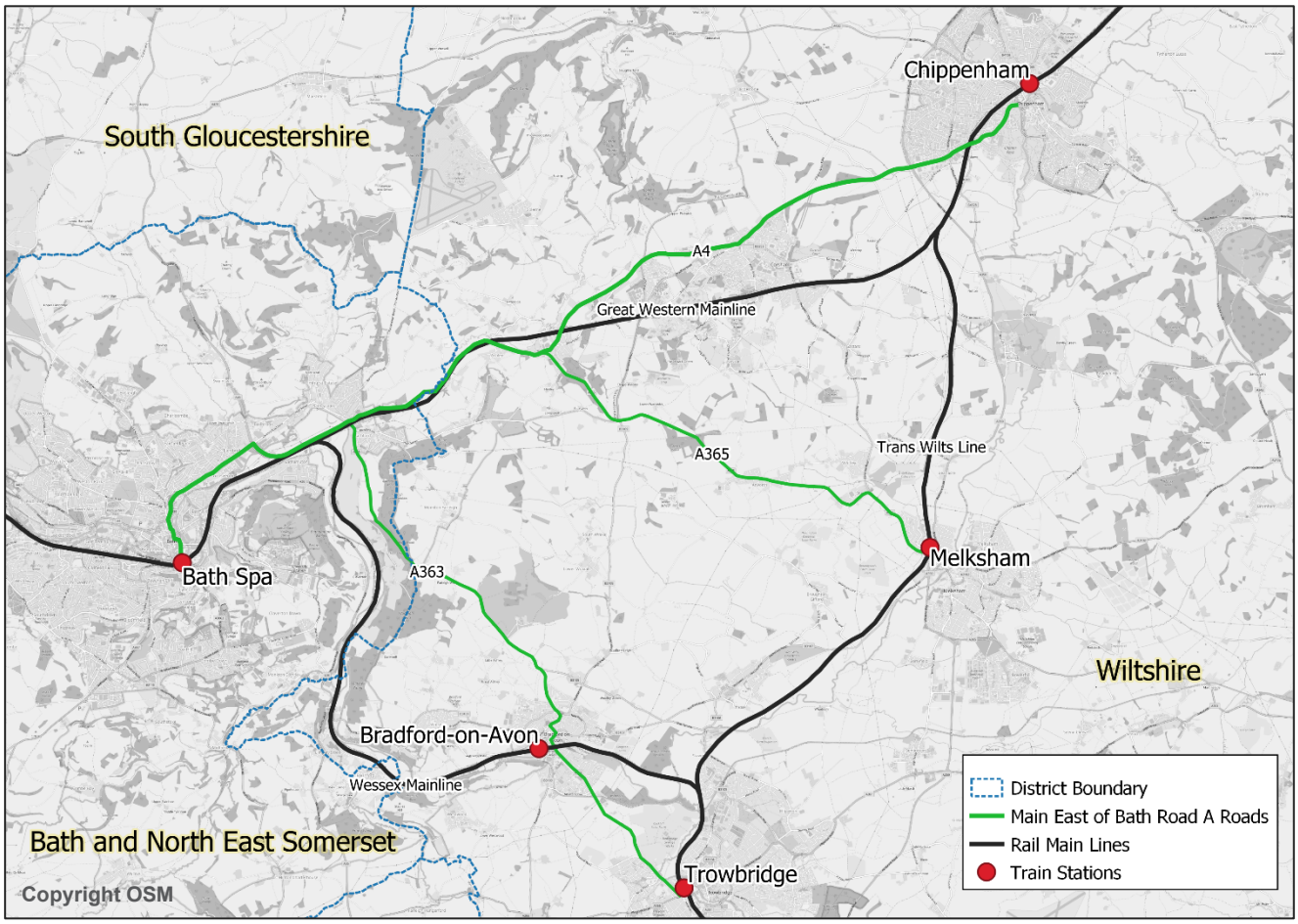
The A4, A365 and A363 highway routes provide connectivity to Bath from large and smaller settlements to the east of Bath for journeys by car, goods deliveries, and bus services.

[3] Advanced single ticket without any discount applied e.g. railcards.

Journeys into central Bath on these corridors converge on the A4 London Road in the Bath urban area.

The east of Bath corridor also connects to the Strategic Road Network (SRN, managed by Highways England). The A36, accessed via the A4 in central Bath, provides connectivity to the south coast and to the A303 and A350. The A46 provides connectivity to the M4, which is eight miles north of Bath.

Figure 2-5 - East of Bath corridor



2.3. Local policy context

2.3.1. Introduction

The relevant local policy documents are shown in Table 2-4, the key documents in relation to this feasibility study are summarised in the subsequent sections.

Table 2-4 - Policy context

Authority	Relevant policy document
Bath & North East Somerset Council	• Corporate Strategy • Local Plan 2016-2029 • Local Plan 2016-2036 (options consultation) • Getting Around Bath, 2014 • Parking Strategy • Climate Emergency Outline Plan (CEOP) • Transport Delivery Action Plan for Bath 2020
West of England Combined Authority	• Joint Local Transport Plan 4 2020-2036 • West of England Bus Strategy (adopted June 2020), WECA Bus Infrastructure Investment paper and Covid-19 bus recovery • Local Cycling and Walking Infrastructure Plan
Wiltshire Council	• Wiltshire Core Strategy 2006-2026 and supporting site allocation plans: Chippenham Site Allocations Plan and Wiltshire Housing Site Allocations Plan 2006-2026 • Local Plan Review 2016-2036 • Local Transport Plan 3 • Business Plan
Swindon & Wiltshire Local Enterprise Partnership	• Local Industrial Strategy • Rail Strategy • Strategic Economic Plan
Western Gateway Sub-National Transport Body	• Regional Evidence Base (REB) • Strategic Transport Plan

2.3.2. Corporate policies

2.3.2.1. Bath and North East Somerset Council Corporate Strategy 2020-2024

For context the B&NES corporate policies are provided in Table 2-5.

Table 2-5 - B&NES Corporate Strategy – core policies and priorities

One overriding purpose	To improve people's lives.
Two core policies	• Core Policy 1: Addressing the climate and nature emergency - Three priority areas for action: ▪ Energy efficiency improvements to existing buildings and zero carbon for new build ▪ A major shift to mass transport, walking and cycling to reduce transport emissions ▪ A rapid and large-scale increase in local renewable energy generation • Core Policy 2: Giving people a bigger say - Have developed & adopted a Community Engagement Charter
Three principles & relevant transport actions	• Principle 1: Preparing for the future - Enable a major shift to walking, micro mobility (cycling), car-sharing, buses, and rail • Principle 2: Delivering for local residents - Facilitate significant improvement to the transport infrastructure and encourage behaviour change to forms of transport other than the private vehicle - Introduce 'low traffic neighbourhoods' working with schools and local communities • Principle 3: Focusing on prevention - Prioritise preventative approaches so that people can stay healthy, we can tackle issues at the earliest stage and ensure a better quality of life for our local residents.

2.3.2.2. Wiltshire Council – Business Plan 2017-2027

For context the Wiltshire Council Business Plan priorities and goals are provided in Table 2-6. The Business Plan was updated by Full Council on 21 July 2020 to include an addendum on climate change.

Table 2-6 - Wiltshire Council Business Plan - priorities and goals

Our vision is to create strong communities. Our priorities are:

Growing the Economy	Strong Communities	Protecting the Vulnerable
Highly skilled Jobs (Employment) I can develop my skills and get a good job Good school results More apprenticeships and improved access to Further Mid Higher Education More businesses start-up, grow and invest in Wiltshire More sustainable tourism and rural jobs	Community wellbeing (Localisation) I can get involved and influence locally Strong community leadership More services and assets devolved to parish councils and community groups More Neighbourhood Plans More volunteers and work with VCS High recycling rates and reduced litter Military and civilian communities are well integrated	Early Intervention (Prevention) I get the help I need as early as possible Proactive Early Help and Children's Centres' services Schools that help all pupils achieve Reduced social isolation and loneliness Improved mental health Increased support for carers
Housing and Environment (Sustainable Development) I live in a good home I can afford More affordable homes to rent and buy Development where it is needed (implement and review core strategy to protect and enhance environment) Successful return of the British Army from Germany to Wiltshire Public land released for homes and jobs	Safe Communities (Protection) I feel safe Good regulation and consumer protection Reduction in Anti-social behaviour Reduction in substance misuse Reduced road casualties Reduced risk of floods	Joined up Health and Care (Integration) One service for health and social care Improved outcomes for children with a disability and care leavers Improved support for those with Mental Health or Learning Disabilities More social workers embedded with NHS teams Targeted support for complex cases
Transport and Infrastructure (Access) I can get around and access good services Road infrastructure is improved	Personal wellbeing (Prevention) I can take responsibility for my wellbeing Heathier population	Empowering and Safeguarding Families and Individuals (Personalisation) I get the right care, right place, right time Services put you in control

New infrastructure to support housing and employment growth Improved strategic roads and rail Accessible public transport services Regeneration of town centres More areas with fast broadband	Good countryside access and cycling and walking opportunities Improved leisure provision through new campuses, sports and leisure centres and community hubs (including libraries and community engagement).	Agencies work together to safeguard Looked after children are safe and well Suitable accommodation in place for vulnerable younger and older people Care is at or as close to home as possible

2.3.3. Climate emergency

B&NES council declared a climate emergency in March 2019. This has committed the council to provide leadership to enable Bath and North East Somerset to achieve carbon neutrality by 2030. In October 2019, the Council approved a Climate Emergency Outline Plan (CEOP), with engagement across different sectors and across the community. The report highlighted that 29% of B&NES emissions excluding aviation come from transport (Figure 1.6) and highlight that the majority of emissions are generated by the most affluent residents in the area Consequently, one of the 'Three Clear Priorities' requiring action from the council was highlighted as transportation, with a need for 'a major shift to mass transport, walking and cycling' to reduce emissions. The report sets out the scale of reduction required under different carbon reduction pathways. One pathway identified in the outline plan is a 25% reduction in car and van mileage per person per year by 2030, coupled with a 76% switch to electric cars and 14% to petrol/EV hybrid (leaving 10% petrol/diesel on the road by 2030), in conjunction with full electrification of passenger rail by 2030.

2.3.4. JLTP4

The Joint Local Transport Plan 4 (JLTP4) is led by the West of England Combined Authority (WECA), working with Bath & North East Somerset, Bristol, North Somerset and South Gloucestershire councils and looks at transport from 2020 to 2036. The JLTP is a high level document which sets out the vision for transport investment in the West of England and the policy framework within which the West of England authorities will work. The main emphasis of the JLTP4 is decarbonisation of the local transportation network by encouraging and helping people switch from cars to cycling, walking and public transport by providing transformational alternatives such as a new mass transit network backed up by demand management policies, 'possibly through congestion charging, emissions charging and workplace parking levy-type schemes'.

Key policy aims contained within the JLTP4 include:

- Reinventing public transport through mass transit, smart ticketing and making it more user friendly, convenient, safe, direct and attractive linking key destinations to enable everyone to use it.
- Rethinking how we use our existing transport corridors including reallocating more road space to buses, pedestrians and cyclists.
- Demand management measures to influence travel choice and raise revenue to reinvest in alternatives.

- First and last mile type solutions to provide a linked-up transport network.
- Exploring new ways to run and fund our transport networks to provide unprecedented investment in cycling, walking and public transport.
- Promoting zero carbon development that does not need to be retrofitted.

The vision for transportation included in the JLTP4 for the West of England is 'Connecting people and places for a vibrant, inclusive and carbon neutral West of England'. By 2036, at the completion of the JLTP4, the West of England will be a carbon neutral community where walking and cycling are the preferred choice for shorter journeys, and the vast majority of vehicles on the road are decarbonised and no longer powered by fossil fuels. The A4 corridor from the east of Bath is highlighted as a major scheme within the JLTP4 that could aid in reducing the number of car trips into Bath from the east.

2.3.5. Bath Delivery Action Plan 2020 (B&NES)

To progress the delivery of B&NES's Getting Around Bath Transport Strategy (2015) from 2020 onwards, an updated plan is currently being developed. The Plan will identify the transport measures that we are proposing to deliver in the short, medium and long term up to 2030. It will provide an opportunity to create better connected, healthier and more sustainable communities for people to live and work in. It will help tackle some of the biggest challenges we face today as a society by addressing climate emergency, road congestion and inequality whilst improving health, wellbeing and air quality. The Plan aims to provide a step change in public transport and considers recent developments such as:

- The Climate Emergency Declaration.
- The JLTP4.
- Liveable Neighbourhoods
- The Bus Service Improvement Plan
- The Walking and Cycling Infrastructure Plan
- Bath's Clean Air Zone plus supporting measures.
- Other emerging schemes and policies.

A consultation was held last year on the outline transport themes which informed the initial thinking for the development of the plan and the future schemes being explored. At this stage the project was called the Transport Delivery Action Plan for Bath. Since the first consultation, the project has been renamed to better reflect the importance and urgency we place on the climate emergency declaration. The Transport Delivery Action Plan for Bath has been renamed to the Journey to Net Zero: Reducing the environmental impact of Transport in Bath. A public consultation on the draft *Journey to Net Zero Plan* is due to take place during January 2022, with approval of the final Plan currently set for Summer 2022.

2.3.6. Bus strategy in the West of England

On 19th June 2020 the Joint meeting - West of England Combined Authority Committee and West of England Joint Committee approved the following documents:

- West of England Bus Strategy[4]

[4] Decision - West of England bus strategy - West of England Combined Authority (moderngov.co.uk)

- Bus Infrastructure Investment paper[5]
- Covid-19 bus network recovery paper[6]

The key components of these with relevance to the East of Bath Express concept are presented below. The impact of Covid-19 is reported in more detail in the Covid-19 bus network recovery paper and recognised in both the West of England Bus Strategy and the Bus Infrastructure Investment paper and is expected to influence future demand for bus services.

The new National Bus Strategy for England 'Bus Back Better' was published on 15th March 2021. Its requirements, for local transport authorities and operators, are outlined in more detail in section 2.4.1, below. It should be noted that the new National Bus Strategy will have an impact on the content and delivery of the following three documents.

2.3.6.1. West of England Bus Strategy

The West of England Bus Strategy is a supporting document to the Joint Local Transport Plan 4 (JLTP4) outlining how bus services could help to tackle traffic congestion and reduce carbon emissions at a regional level and support the aims of the JLTP4.

The bus strategy was developed and consulted upon prior to the Covid-19 pandemic, however it recognises the recovery and legacy issues outlined in the Covid-19 bus network recovery paper and states that:

"the key, longer term principles of the Bus Strategy remain irrespective of the current extent of the network and current level of journeys. Up to 2036, the authorities will be aiming to deliver a significant reduction in car dependency as part of their key, complementary commitments to achieve carbon neutrality in the transport sector, and growing bus passenger numbers will have a major role to play in realizing this vision."

It is expected that the bus strategy will be reviewed within 18 months of adoption given the changing economic, social and travel demand landscapes.

The vision and outcomes of the West of England Bus Strategy are shown in Table 2-7.

[5] Decision - Bus infrastructure investment - West of England Combined Authority (moderngov.co.uk)

[6] Decision - Covid-19 bus network recovery - West of England Combined Authority (moderngov.co.uk)

Table 2-7 - West of England Bus Strategy - Vision and outcomes

Vision
Our vision is for bus services people can depend on, are quick and reliable, combine to form a simple to understand and easy to use network, are accessible for everyone, are safe and comfortable, and offer value for money to passengers and to the public purse.
Outcomes
• A comprehensive and joined up bus network which maximises the range of journeys able to be made by bus, thereby improving access to key employment, health and leisure destinations for everyone. • A doubling in bus passenger numbers by 2036. • For rural areas, whilst the bus mode share will remain relatively low, an improved and easy-to-understand network will provide a practical alternative to the car for many journeys and a reliable means to accessing services for those without access to a car. • To maximise bus service reliability and reduce journey times. • To provide simplified ticketing which allows all bus users to travel on a single ticket (on one or more buses), with fares capped to a daily maximum. • Accessible passenger waiting facilities and vehicles, and better integration with other modes. • Address congestion and delays due to car travel by attracting car users to use buses for some or all of their journeys. • Continue to improve passengers' satisfaction with bus services and their value for money. • Reduce overall emissions due to general road traffic by persuading car drivers to travel by bus, and by improving the bus fleet to low or zero emission buses. • Maximise service quality, in terms of vehicle comfort and ease of boarding and alighting, reliable and real time information, and an attractive, safe and accessible bus stop environment. • Improve the public domain through the reduction in car traffic and transfer of highway space to buses, bicycles and pedestrians. • Better access to places for public transport, and better design for bus services in new developments. • To increase the proportion of bus passengers satisfied or very satisfied with bus services overall.

West of England Bus Strategy (adopted June 2020)

The strategy focuses on the following key themes to achieve the vision and outcomes:

- A well-designed network that is simple, coherent and efficient across the region
- Better services for people in rural areas
- Giving passengers more reliable and faster buses through priority infrastructure and wider policy
- Simple, smart and convenient ticketing
- A safe, pleasant and comfortable customer experience

- Modern, clean and accessible buses that contribute to reducing transport's harmful emissions
- A network complemented by Community and Demand Responsive Transport

The prioritisation and programme for delivery of bus infrastructure to help deliver the bus strategy are outlined in the WECA Bus Infrastructure Investment paper which is summarised below.

2.3.6.2. WECA Bus Infrastructure Investment paper

This paper outlines the plans for bus infrastructure investment by WECA, considers Covid-19 recovery and legacy issues and focuses on the plans for infrastructure delivery in order to:

> *"progress the infrastructure to unlock the network principles set out in the [West of England] Bus Strategy and consistent with any Covid-19 recovery and legacy issues; support our complementary plans for Strategic Park & Ride; and review the approach to Operator Agreements once recovery and legacy issues are better understood."*

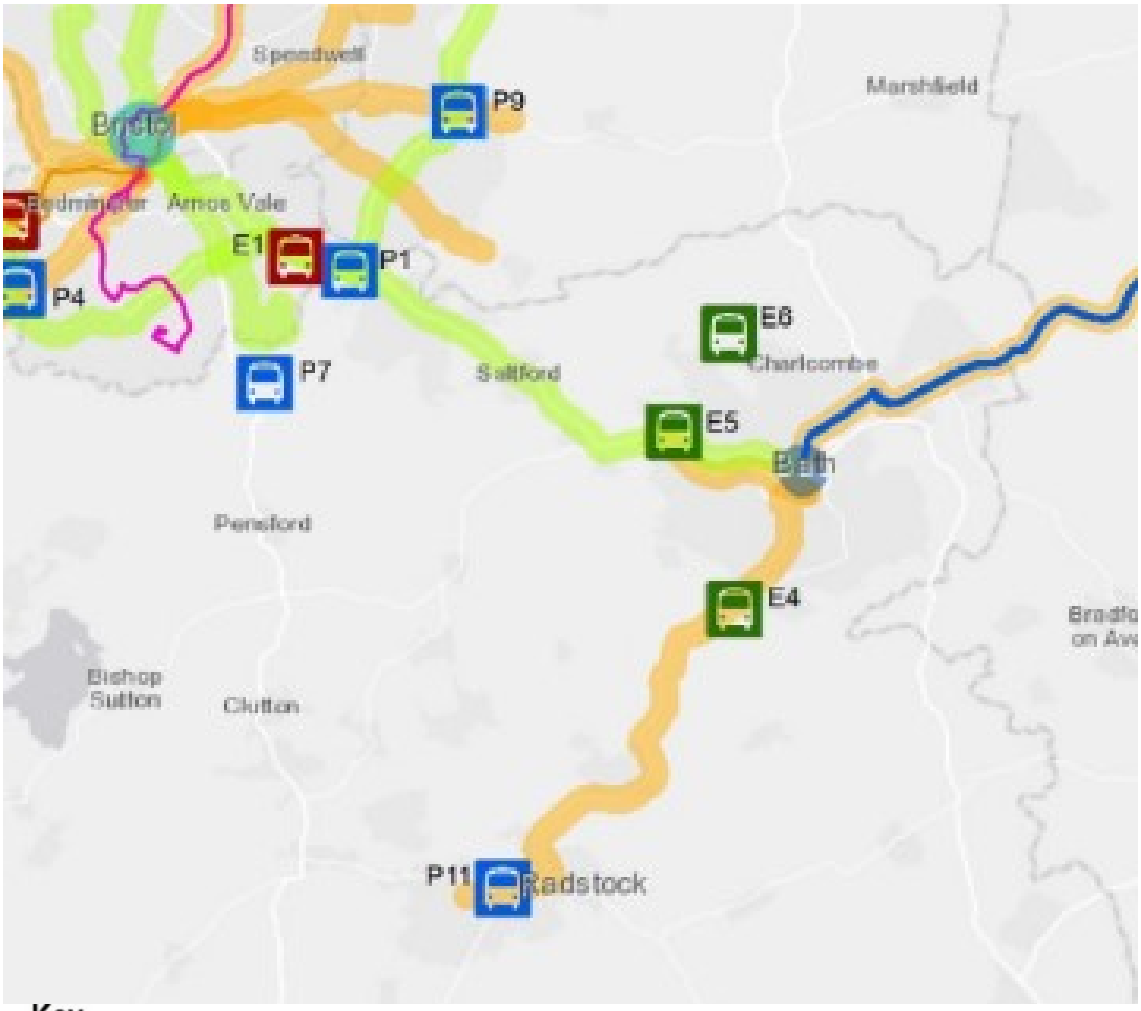
The paper provides a bus infrastructure investment programme for the longer term, beyond the Covid-19 pandemic, in order to provide a longer term programme for developing the public transport system in the region and achieving the aims of the West of England Bus Strategy and the JLTP4. The paper provides a bus infrastructure investment programme for the longer term, beyond the Covid-19 pandemic, in order to provide a longer term approach for developing the public transport system in the region and achieving the aims of the West of England Bus Strategy and the JLTP4.

The paper identifies key corridors and proposals, as shown in Figure 2-6, for investment and presents a phased approach to investment with proposals being prioritised into phase 1 and phase 2. The A4 London Road in Bath is included in phase 2. There are no specific timescales for phase 1 and 2 schemes included in the paper.

In addition to bus infrastructure the investment paper and bus strategy also consider the options available to WECA in relation to the provision of bus services in the region in the context of the Bus Services Act 2017. The paper outlines that:

"It is proposed that as part of the governance arrangements for the development of the Phase 1 and Phase 2 schemes that a non-statutory overarching agreement will be signed by the West of England Mayor in consultation with UA Leaders and Local Bus Operators, which will set out the broad principles under which individual agreements (consistent with 2017 Bus Services Act legislation) could be progressed."

Figure 2-6 - WECA Bus Infrastructure Investment proposals (2020-36)



2.4. National regulatory and policy context for bus services

Bus services are operated within the government's regulatory framework and the following Acts are relevant to the operation of bus services, local authorities' roles and subsidies:

- Transport Act 1985.
- Transport Act 2000.
- Local Transport Act 2008.
- Bus Services Act 2017.

The Transport Act 2000 introduced amendments to the 1985 Act in relation to local authorities and subsidies for bus services

"The 'Buses: grants and subsidies' research paper [7] explained that originally, as part of the 1985 Act, an authority could only subsidise a local service if it has invited open and competitive tenders to operate the service. The decision to run a service was then based on what in the authorities' view was the most effective and economic application of the funds available for paying subsidies.

The 2000 act introduced the 'best value' test which requires local authorities to assess a service based on the economy, efficiency and effectiveness of the service, the relevant bus strategy and environmental issues such as noise and air pollution.

The 2000 act also removed the constraint that local authorities must not act so as "to inhibit competition". An example of this may be if the subsidy mechanism was used to support services that combined lower fares and higher frequencies to the extent that commercial services could not successfully compete. This has instead been replaced with a new duty that requires local authorities to regard the interest of the public and of operates. It is considered this new duty will make it easier for authorities to subsidise additional service frequency.

Provision of a bus service that requires financial support will need to consider these regulations.

The most recent legislation, the Bus Services Act 2017, introduced changes to previous legislation, as summarised by the Department for Transport for the 2017 Act:

- *strengthened arrangements for partnership working between bus operators and local authorities in England, introducing new Advanced Quality and Enhanced Partnership schemes (AQPS). The AQPS are in broad terms when a local transport authority agrees to invest in improved facilities at specific locations along a bus route and operators who wish to use those facilities undertake to provide services of a particular standard;*
- *introduced, in England, bus franchising powers to replace previous Quality Contract Schemes. Quality Contract Schemes are when a contract is made by the local authority under which a particular operator is granted exclusive rights to operate specific services; and*
- *modernised previous ticketing legislation and provided the powers necessary for a step change in the information available to passengers through audio and visual on-*

board information (across Great Britain) and through the provisions of open data on timetable, fares and bus service arrival times (in England). [7]

There is also a wider framework of regulations in relation to vehicle standards, these include:

- Public Service Vehicles (Registration of Local Services) Regulations 1986;
- Public Passenger Vehicles Act 1981; and
- Public Service Vehicles Accessibility Regulations 2000.

2.4.1. National Bus Strategy for England, 2021

As part of the government's focus on sustainable transport and response to the target of the UK being Net Zero for carbon emissions by 2050, the Bus Back Better National Bus Strategy for England[8] (NBS), published on 15th March 2021, aims to deliver cheaper, more frequent and more reliable bus services for passengers outside London.

The strategy builds on existing powers for Local Transport Authorities and Mayoral Combined Authorities (hereafter referred to jointly as LTAs) under the Bus Services Act 2017, in particular relating to Enhanced Quality Partnerships.

Under the laws and regulations listed above in section 2.4, behaviours of commercial operators and LTAs mean that service delivery, network coordination, simple ticketing and publicity have often been fragmented. The NBS changes these relationships, setting out new ways of using on-going funding to provide a more passenger-focussed bus network.

As of 1st July 2021, funding streams, encompassing Covid-19 Bus Services Support Grant and Bus Service Operators Grant, will only be provided to LTAs and operators who have committed to entering into Enhanced Partnerships, or have started the statutory process for franchising services. The Enhanced Partnership needs to be in place by April 2022. In effect, this means that, without patronage recovery to pre-Covid levels and without a relaxation of social distancing, local authorities have had to commit to an Enhanced Partnership or face substantial contraction or collapse of their bus services.

Each LTA was required to publish a local Bus Service Improvement Plan (BSIP) by the end of October 2021, setting out how the Enhanced Partnership or franchising scheme will deliver the Strategy's goals and ambitions. LTAs may have also produced joint plans where networks or travel areas significantly overlap.

The BSIP will need to be updated annually, to reflect delivery achievements or changes to local priorities, and will clearly set out ambitions for the local bus network as agreed by the LTA, operators and other relevant stakeholders. The BSIP must reflect, and be reflected in, the authority's Local Transport Plan and other relevant policies such as Local Cycling and Walking Infrastructure Plans (LCWIPs). Six-monthly progress reports must be published, demonstrating achievement against targets.

The BSIP encompasses:

- Priority interventions;
- Fares policy;
- Network integration and simplification;

[7] The Bus Services Act 2017 New powers and opportunities, Department for Transport, 2017. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/918498/bus-services-act-2017-new-powers-and-opportunities.pdf

[8] https://www.gov.uk/government/publications/bus-back-better

- Network identity and information, including promotion of services to visitors in popular tourist areas;
- Passengers' rights;
- Consider opportunities for bus rapid transit;
- Superbus networks (for 'intermediate' areas which are neither deeply rural or fully urban);
- Decarbonisation plans; and
- Funding.

Changes to fares are principally aimed at reducing the difference in price between tickets which are valid on bus services ran by several different operators and tickets which are only valid on services ran by a single operator. In the longer term, the aim is to work towards daily and period fare capping with payment via contactless debit and credit cards. The opportunity exists for LTAs and operators to agree to lower fares than at present, particularly if extensive priority measures are introduced which will lower service operating costs.

Delivery of the strategy rests firmly with LTAs working in partnership with bus operators, and forces LTAs and operators to engage quickly in order to retain access to the emergency Covid-19 funding that will continue to be necessary to maintain bus services in anything like their current shape for the foreseeable future.

Within this new regulatory and delivery framework it is possible that the service and infrastructure enhancements set out in the subsequent chapters of this report could be delivered given the potential of additional funding streams for improved bus services.

2.4.1.1. Published Bus Service Improvement Plans

Since the publication of the National Bus Strategy, WECA and Wiltshire Council published their BSIPs in October 2021. The A4 corridor between Chippenham and Bath is recognised in both the WECA and Wiltshire BSIP as an important inter-urban corridor for bus services and infrastructure.

As outlined in the NBS, LTAs are working with bus operators to develop their Enhanced Partnership Plans and Schemes to be introduced in April 2022. An Enhanced Partnership is a statutory partnership between a local transport authority and their local bus operators that sets out how they will work together to deliver the outcomes in their published BSIPs.

2.5. Environmental context

Maps to understand the underlying environmental context for the east of Bath corridor have been developed. These maps show all the environmental designations on or near the corridor.

The list of statutory designations considered includes:

- Air Quality Management Areas (AQMAs);
- Areas of Outstanding Natural Beauty (AONBs);
- Local Nature Reserves;
- National Nature Reserves;
- Ramsar sites;
- Sites of Special Scientific Interest (SSSIs); and

- World Heritage Site (and setting).

The list of non-statutory designations considered includes:

- Environmentally Sensitive Areas;
- Proposed Ramsar sites;
- Special Area of Conservation;
- Special Protection Areas;
- Ancient Woodland;
- Registered Parks & Gardens; and
- Greenbelt.

Figure 2-7 - Statutory environmental designations on or near the east of Bath corridor

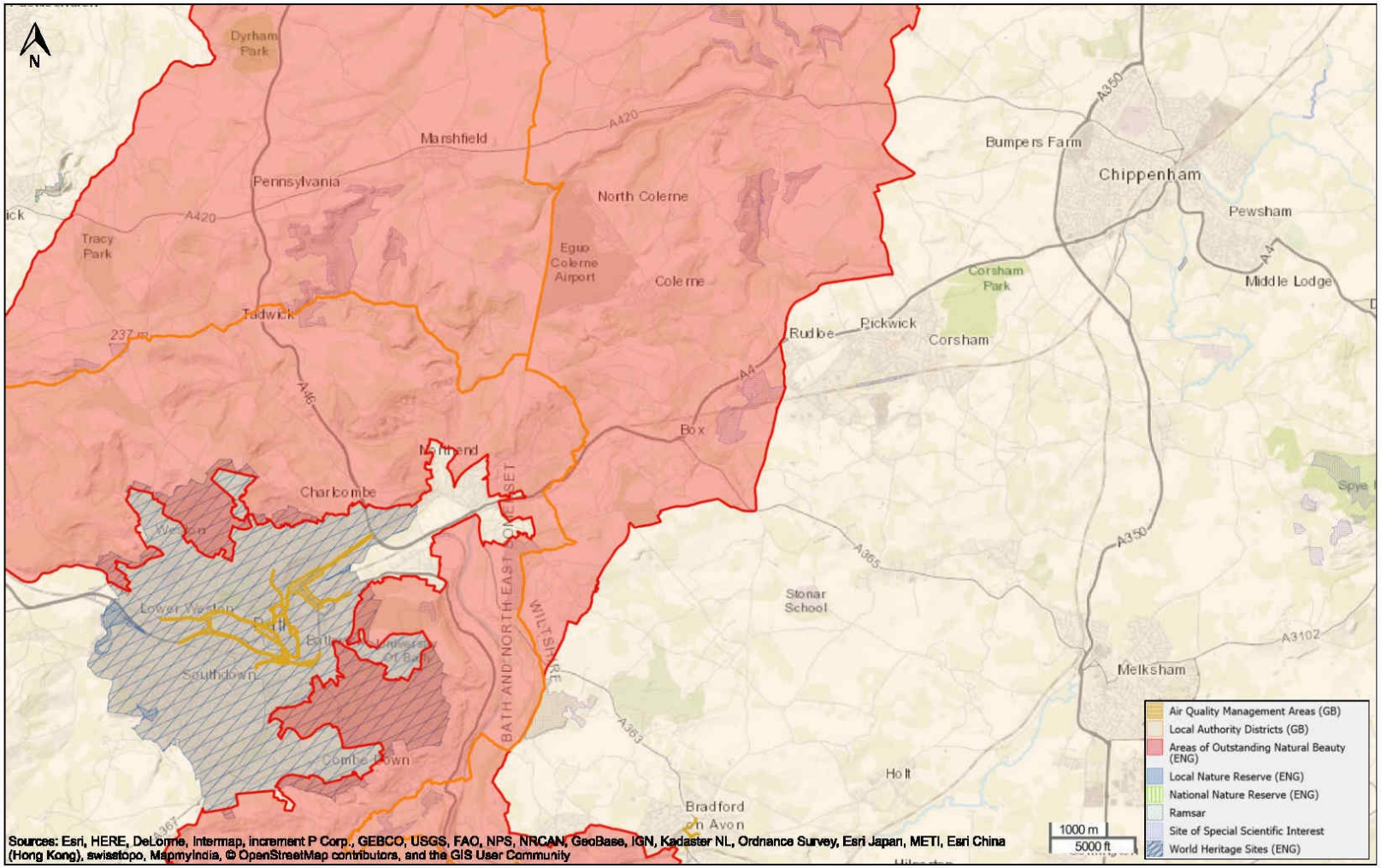
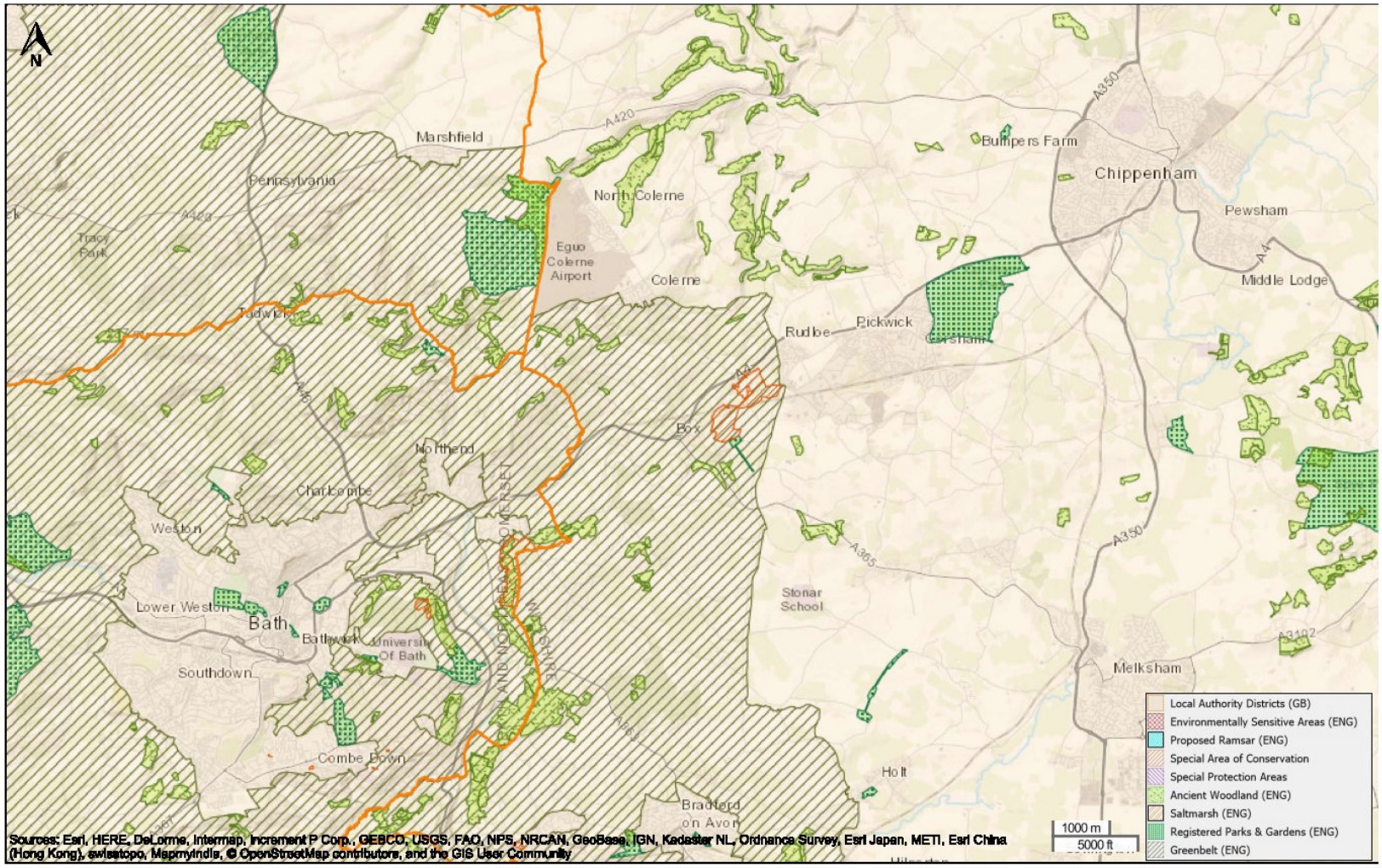


Figure 2-8 - Non-statutory environmental designations on or near the east of Bath corridor



3. Travel demands and impacts

3.1. Introduction

This section presents the existing travel patterns and demand for the east of Bath corridor and considers the impact of this demand on levels of congestion and on the local environment and air quality. This section identifies that:

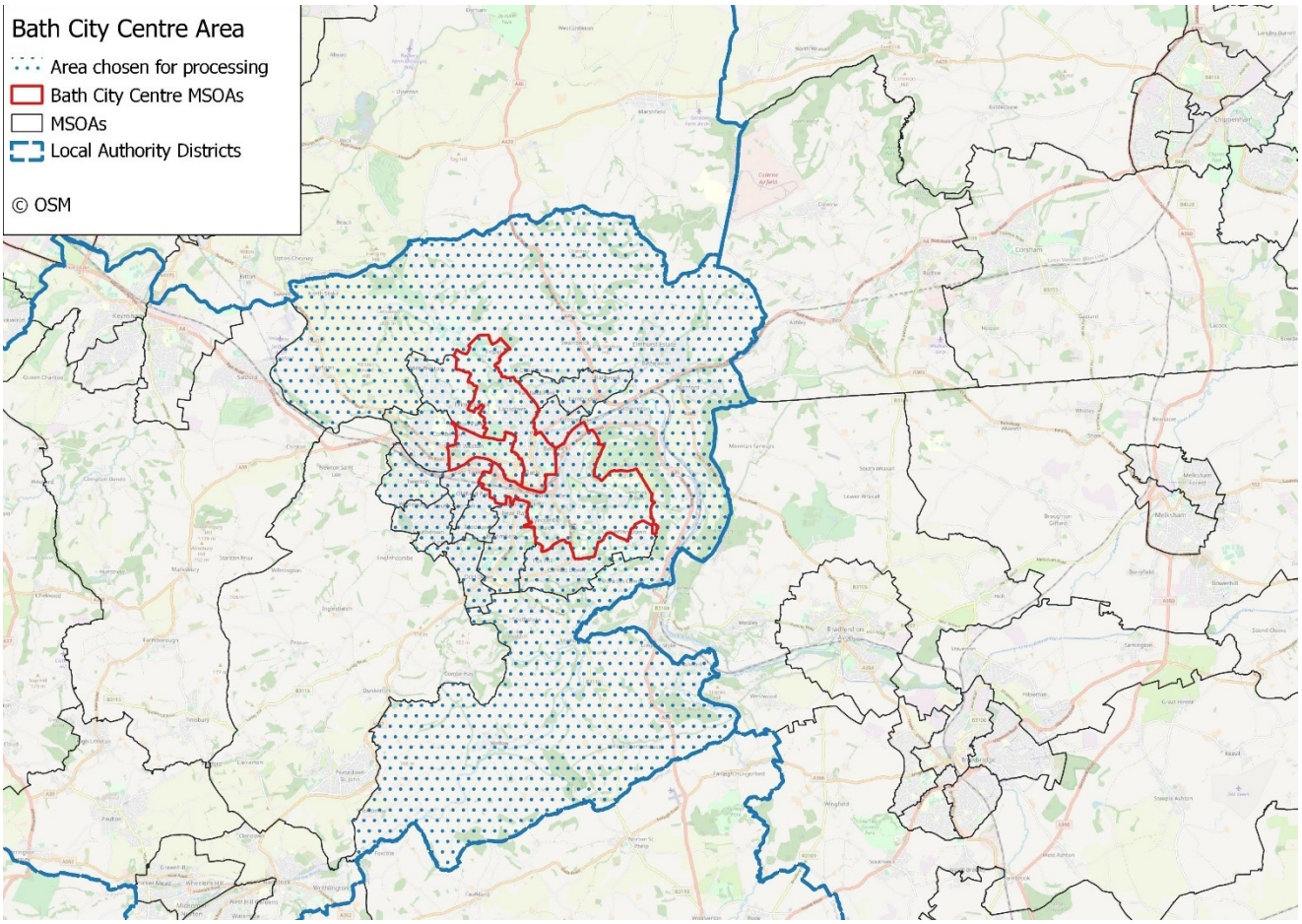
- Census journey to work (JTW) analysis shows that the car is the preferred mode of travel for commuting to Bath from the east of Bath corridor, with all areas other than Chippenham showing car usage levels that are higher than the England and Wales average;
- When considering permanent highway count sites (ATCs) along the London Road corridor, it is evident that traffic levels are very high throughout the day (around 1,400 vehicles an hour (two directional) on average in the AM peak and around 1,600 an hour on average in the inter peak period (2019 ATC data from A4 London Road west of Beaufort West)). This shows that while the corridor is used for commuting, it is also heavily used by discretionary traffic e.g. retail and leisure trips;
- Rail patronage levels have increased on average by 3% per annum between 2008-18, which may not be sustainable in the future without significant improvements to the rail service;
- The three existing P&R sites around Bath service between 150,000 and 200,000 customers per month in neutral months, but still account for a relatively small proportion of the total demand entering Bath daily; and
- The high dependency on the car to complete trips to Bath results in air quality issues within the city; noise issues; safety concerns; health worries for local residents; and high carbon emissions, with transport accounting for approximately 30% of B&NES's carbon emissions.

3.2. Travel demands

3.2.1. Commuting patterns

For the purposes of analysing the Census JTW data, MSOAs (Middle Super Output Areas) covering the Bath city centre area have been chosen and defined as shown in Figure 3-1. This is considered the "destination" area of interest, i.e. a scheme to the east of Bath could impact how people travel to this area. The three central Bath MSOAs (highlighted in red in Figure 3-1) are the destinations for at least 50% of the traffic travelling to this area from the east of Bath corridor.

Figure 3-1 - Bath city centre area: MSOAs considered "destinations of interest" for east of Bath study



Analysing the Census JTW data for settlements in the A4 corridor and the wider east of Bath access catchment area establishes where people commute from to get to Bath city centre for work.

3.2.1.1. A4 corridor JTW analysis

Figure 3-2 shows that longer distance trips from areas such as Chippenham and Trowbridge occur, as do shorter distance trips from areas such as Corsham, Box and Bradford-on-Avon.

Journey to work data indicates that approximately 85% of commuting trips to Bath city centre from MSOAs on the A4 corridor are made by car. Figure 3-3 shows the percentage of trips completed by car for each MSOA, with labels showing the absolute number of car trips.

Figure 3-2 - Census JTW: Total trips to Bath city centre area

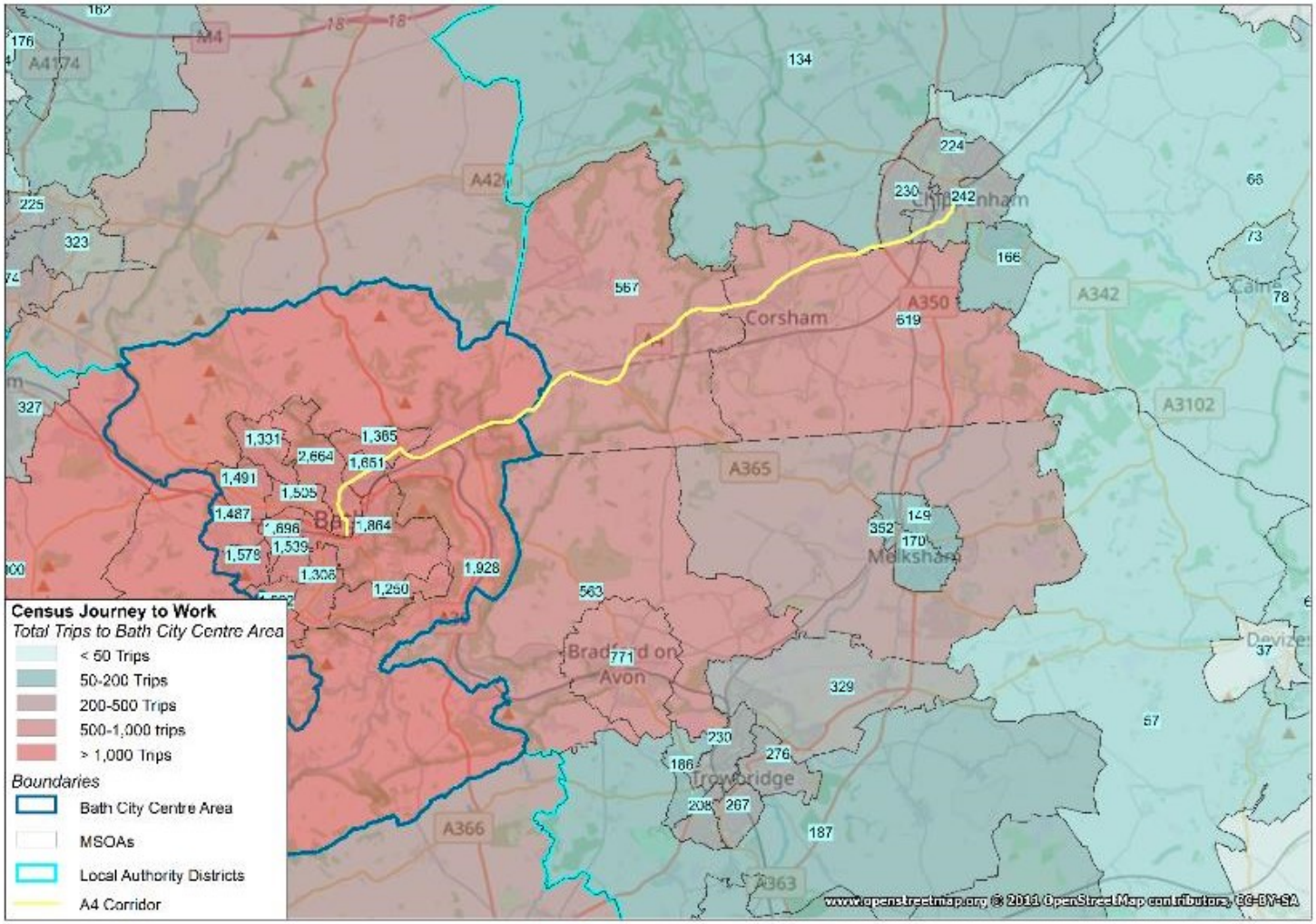
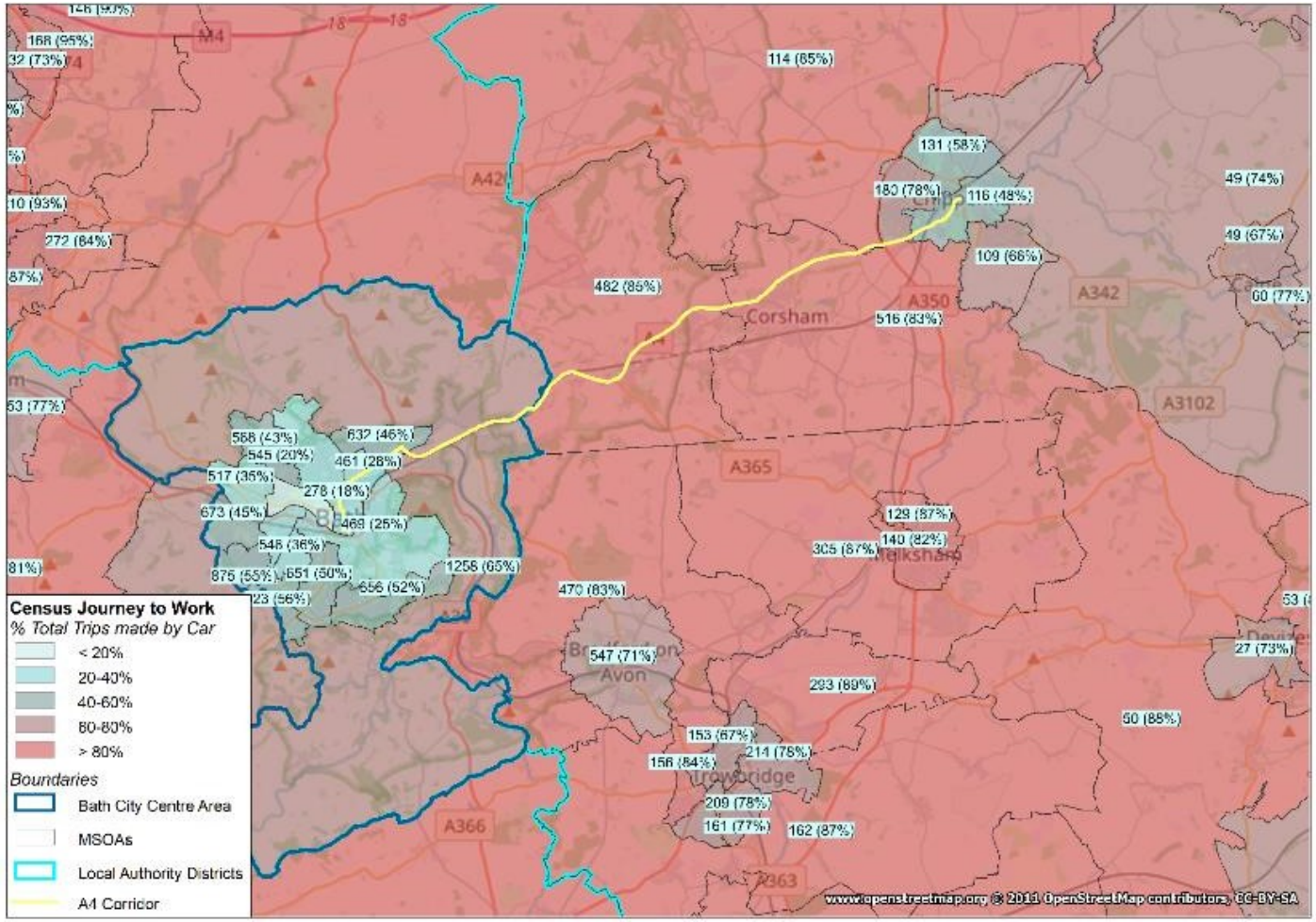


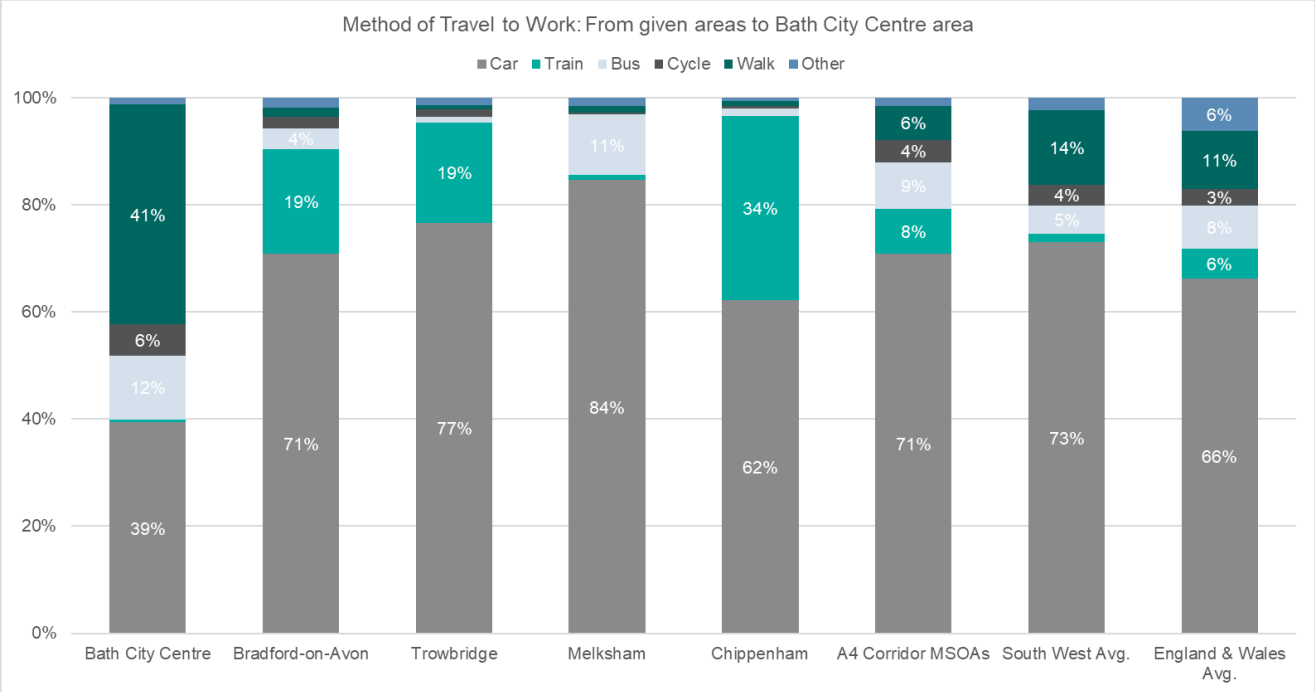
Figure 3-3 - Census JTW: % of trips to Bath city centre area made by car (with absolute numbers labelled)



Analysing this further, the data reveals how people from neighbouring towns commute to Bath city centre. Figure 3-4 below shows the mode split for commuters from each of the given areas to the city centre. This shows:

- People who both live and work within the city centre mostly travel sustainably, with only 39% choosing to travel by car;
- People who commute to Bath city centre from Chippenham make good use of existing rail services, with 34% commuting via train (compared to an average of 6% train commuters in England and Wales), although no further breakdown on the catchment for Chippenham station is available. The number of people who commute from Chippenham using the bus is very low at 2%, and 0% cycle;
- Overall, in the A4 corridor, only 9% of people commute to Bath city centre by bus and 4% by cycling; and
- For all other areas outside of Chippenham and Bath city centre, the car mode share is higher than the England and Wales average of 66%, indicating that, overall, there is high car usage among commuters who live to the east of Bath and work in Bath city centre.

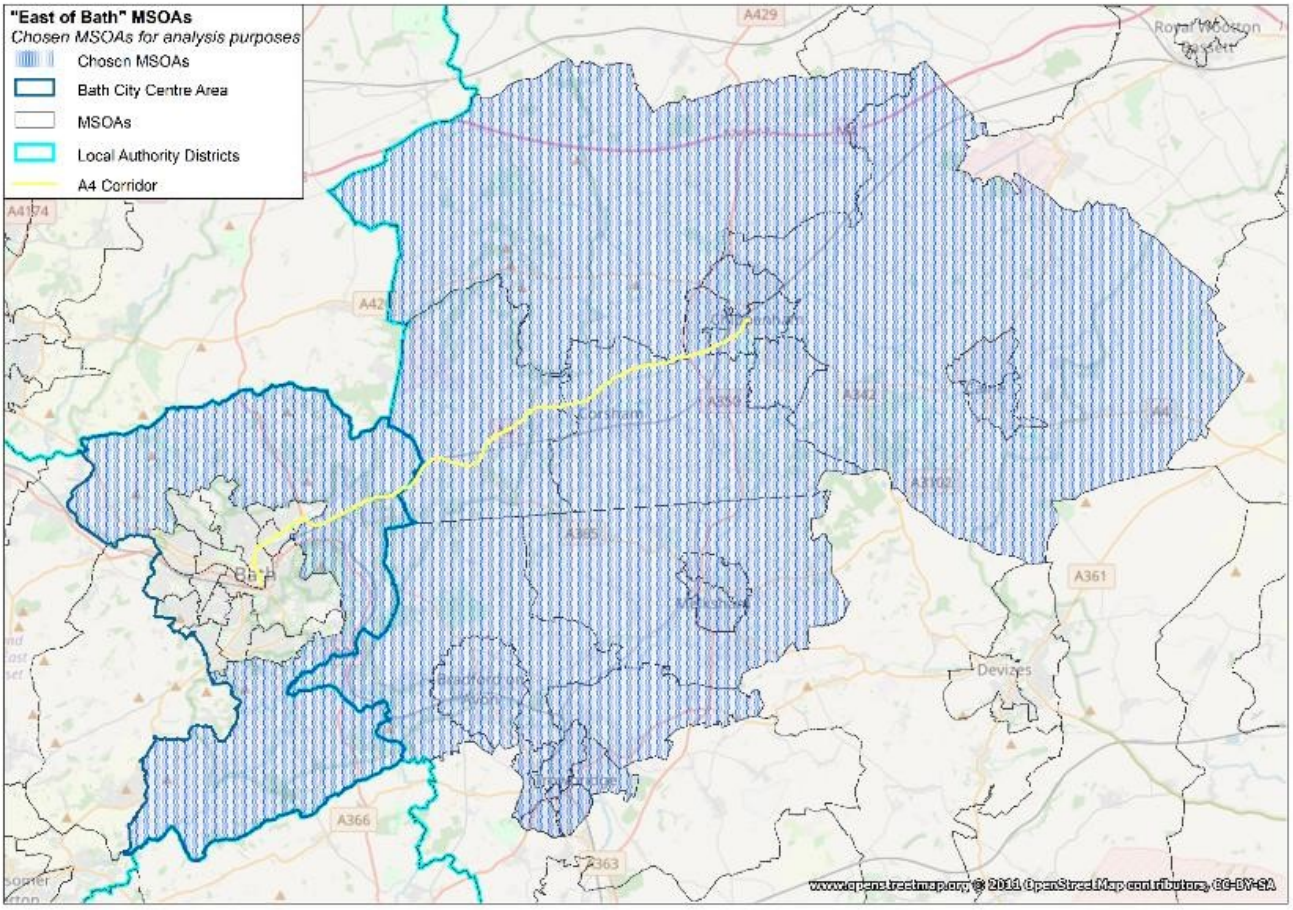
Figure 3-4 - Census JTW: Method of travel from chosen areas to Bath city centre area



3.2.1.2. East of Bath access catchment area JTW analysis

By considering the interactions between people commuting from a given area to the east of Bath (shown below in Figure 3-5) to Bath city centre, a more detailed understanding of commuting patterns along this corridor can be gained.

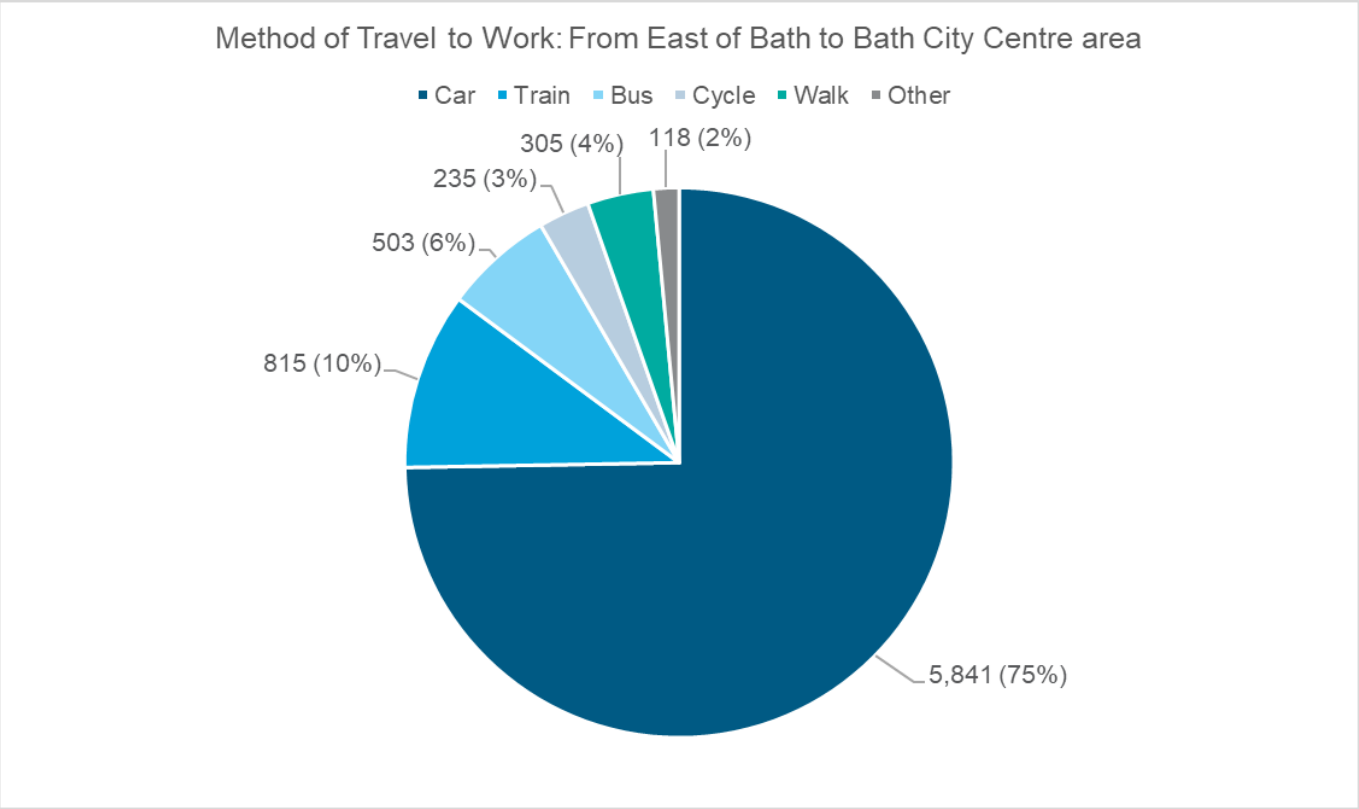
Figure 3-5 - East of Bath trip origin area chosen for Census JTW analysis



Processing the Census JTW data to consider people commuting from the defined east of Bath MSOAs to the defined Bath city centre area MSOAs reveals the following (summarised in Figure 3-6) about the general commuting patterns between these areas:

- There is high car dependency, with 75% of commutes completed by car (higher than both the South West average of 73% and the England and Wales average of 66%);
- Train accounts for 10% of all modes which is more popular than average across the South West and England and Wales, most likely due to the rail line between Chippenham and Bath;
- Bus mode share is in line with averages, but is low considering there is an existing bus route along the A4 corridor (the X31 service);
- Active modes, particularly walking, are lower than average between these two areas, most likely due to the large distances between population centres along the A4 corridor and due to the lack of safe segregated infrastructure for active travel

Figure 3-6 - Census JTW: East of Bath to Bath city centre commuters - absolute numbers and % mode share



3.2.2. Highway demand

The A4 is the primary route into Bath from the east, funnelling commuters from the Chippenham and Corsham areas situated along the length of the A4, while also absorbing traffic from Melksham via the A365 and Trowbridge and Bradford-on-Avon via the A363. Traffic data for the A4, A365 and A363 corridors (see Table 3-1) displays the increase in volume of traffic at counter 99383 (see Figure 2-5) on the A4 heading immediately into Bath and demonstrates how the A4 acts as a funnel into the city centre for road traffic.

The similarity in vehicle numbers from counter 73021 on the A4 and counter 38606 on the A363 would indicate that roughly the same amount of people travel into the east side of Bath from the south-east (Bradford-on-Avon and Trowbridge areas) as from the east (Chippenham, Melksham and Corsham areas).

Table 3-1 - Annual average daily traffic flows on the A4 corridor

Location	DfT Counter number	Traffic direction	2018 - annual average daily flow (all vehicles)
A4 Chippenham to Bath Corridor	99383	East	11,496
A4 Chippenham to Bath Corridor	99383	West	11,240
A4 Chippenham to Bath Corridor	73021	East	5,363
A4 Chippenham to Bath Corridor	73021	West	5,300
A4 Chippenham to Bath Corridor	99861	East	9,596
A4 Chippenham to Bath Corridor	99861	West	9,230
A365 Melksham to Bath Corridor	57023	East	2,174
A365 Melksham to Bath Corridor	57023	West	2,215
A363 Bradford-on-Avon to Bath	38606	North	5,505
A363 Bradford-on-Avon to Bath	38606	South	5,496

Figure 3-7 - Department for Transport traffic counter locations

ATC data collated by B&NES along London Road is also available for the period of 2014 – 2019 and shown in Figure 3-8. Some of the count data was corrupted, but for 2014, 2016 and 2018 full data was available. The variations across the years of hourly flows at this count site show that the flows remain relatively stable from 2014 to 2018, implying that the road was already at capacity in 2014 and therefore no further growth can be accommodated along this corridor. The ATC counts also show that the flows along the corridor are high throughout the day with only a small dip in demand during the inter-peak hours; this implies that high levels of shopping and leisure trips cause demand to remain high outside of commuting hours.

Figure 3-8 - London Road ATC flow variations by hour between given years

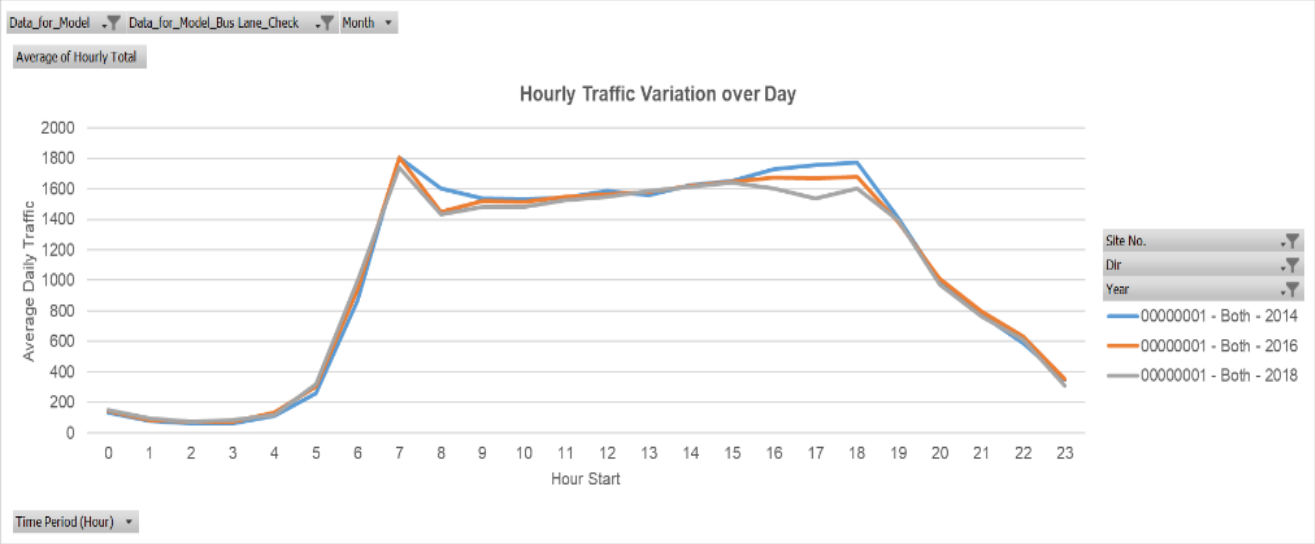


Figure 3-9 - ATC count site location

3.2.3. Walking and cycling

As shown in section 3.2.1 walking accounts for 4% of journeys to work in central Bath from the east of Bath whilst cycling accounts for 3%. Data presented in the Bath Delivery Action Plan (2020) and presented in Figure 3-10 and Figure 3-11 shows that the proportions of people walking and cycling to work reduces towards the periphery of Bath, which is as expected as the distance between home and work increases.

Figure 3-10 - Journeys to work on foot (Census 2011)

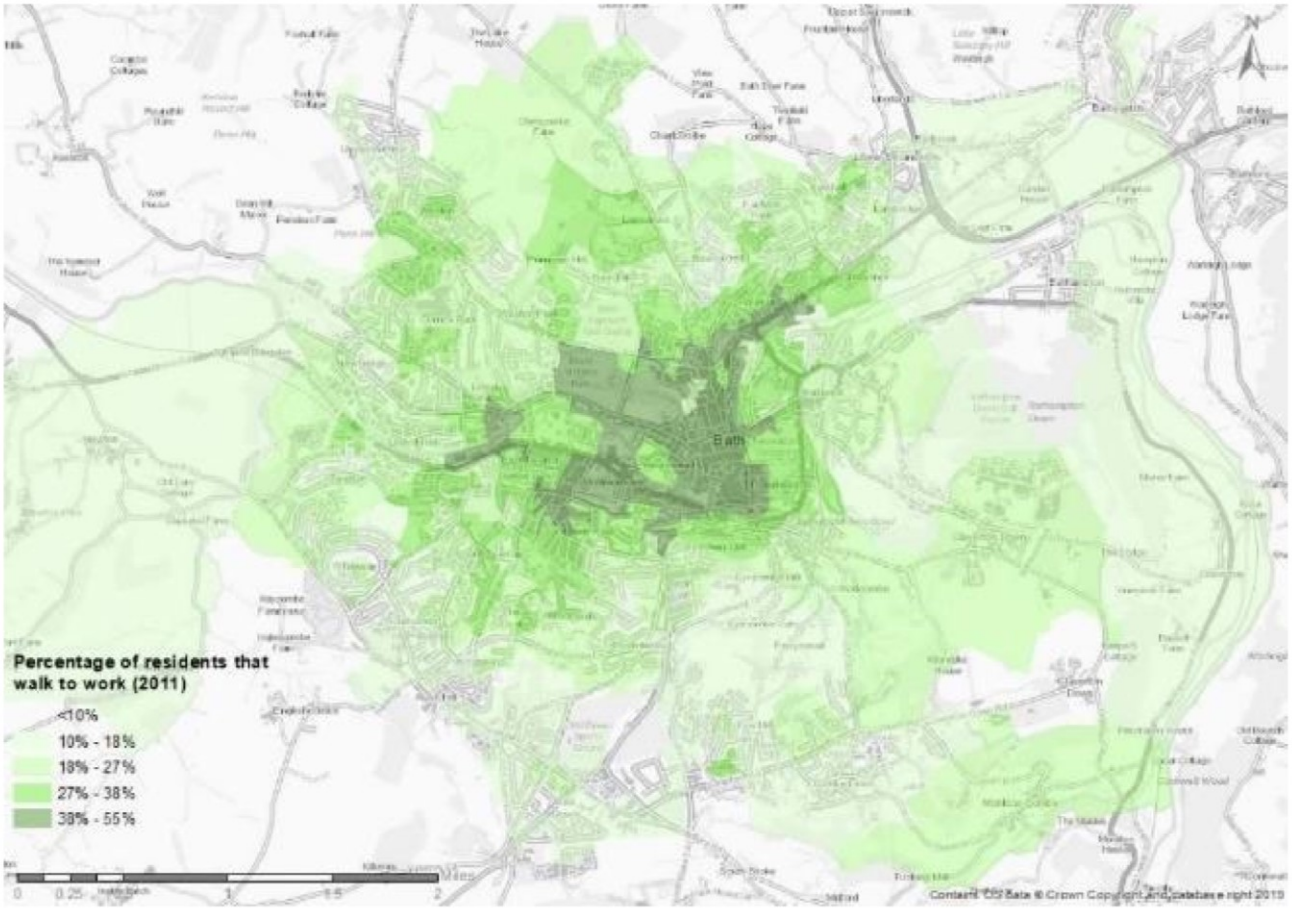
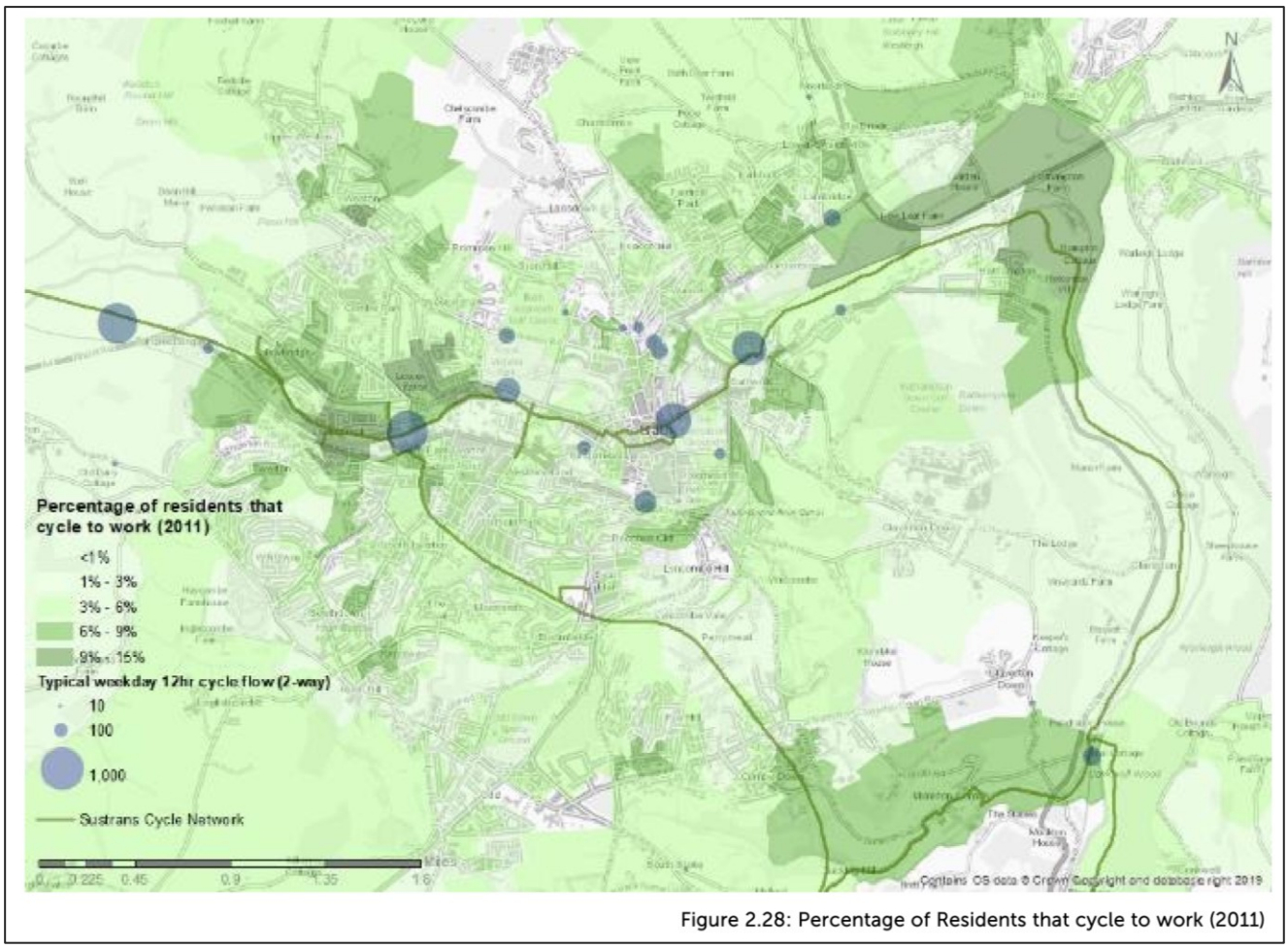


Figure 2.27: Percentage of Residents that walk to work (2011)

Source: Bath Delivery Action Plan (2020)

Figure 3-11 - Journey work by bike (Census 2011)



Source: Bath Delivery Action Plan (2020)

Evidence presented in the Bath Delivery Action Plan shows that since 2011 there has been an increase in the number of people cycling and using the bus. Although data for walking is not available, this indicates that there is the potential to change travel behaviours in the corridor.

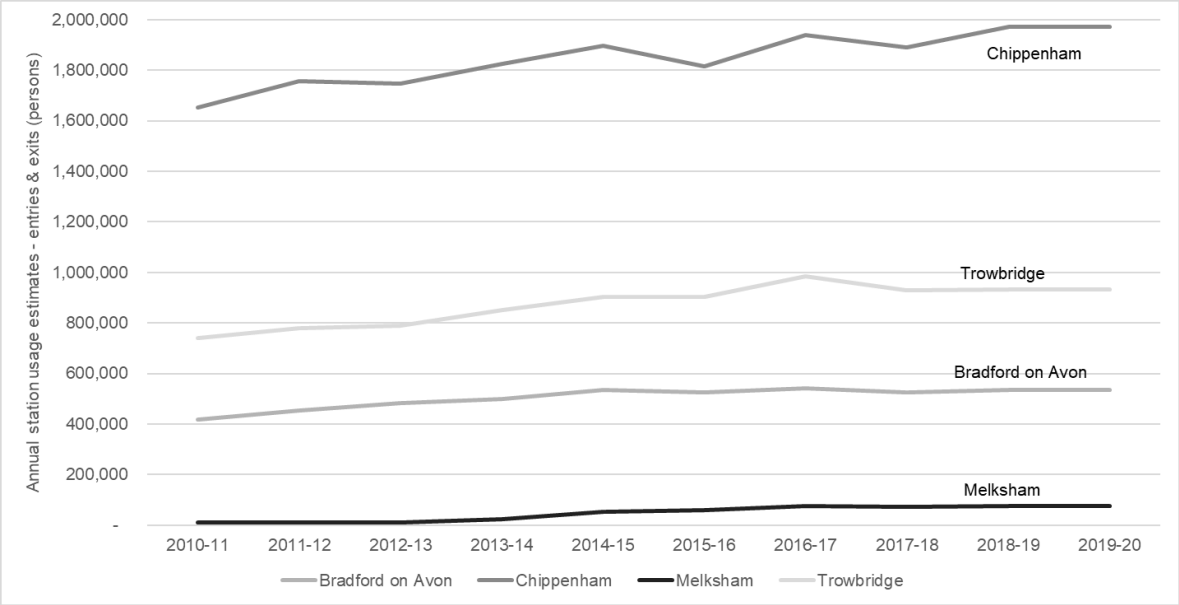
3.2.4. Rail patronage

Estimates of station usage from the Office of Rail and Road for the four railway stations in the corridor are presented in Figure 3-12. This is the latest available data and does not include 2020-21 to reflect changes in travel demands during the Covid-19 pandemic, although it could be expected that demand for rail travel will be lower due to lockdown restrictions and changes in travel patterns.

The data also does not provide an indication of the destinations accessed from each station, however data presented in section 3.2.1 shows that the percentage of people travelling into Bath by rail for work is 34% from Chippenham and 19% from Bradford-on-Avon and 19% from Trowbridge. These are all above the south west and national averages.

The estimates show that Chippenham has higher demand overall, this is due to its catchment area, associated population size and rail offer, whilst Melksham has the lowest which is expected due to the limited number of services available from the station.

Figure 3-12 - Estimates of station usage at railway stations in the wider east of Bath corridor



Source: Office of Rail and Road

3.2.5. Park & Ride

Data presented in the Bath Delivery Action Plan shows that Park & Ride demand has been consistently above 150,000 passengers a month over the three year period, which is shown in Figure 3-13. The data shows that that Park and Ride performs a role in helping reduce the number of car trips travelling in central Bath.

Figure 3-13 - Monthly Park & Ride patronage (all sites)

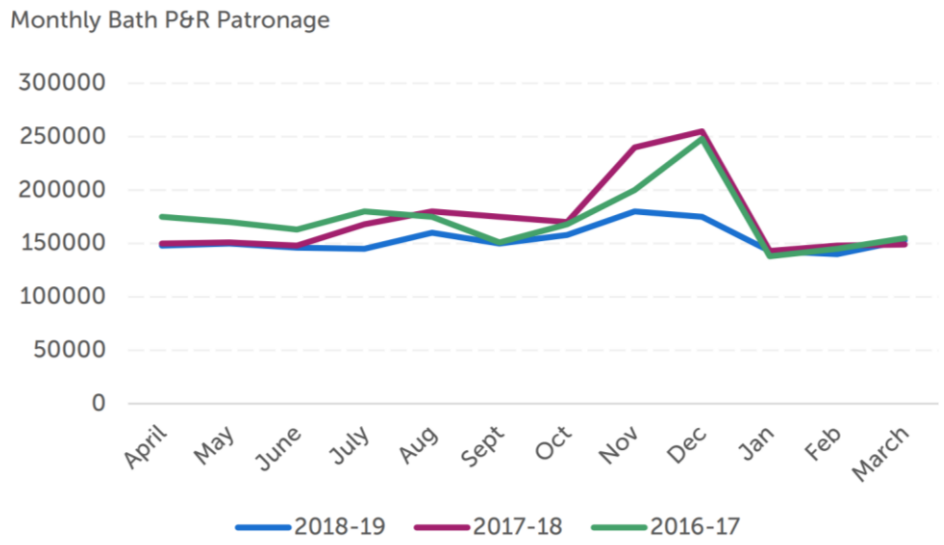


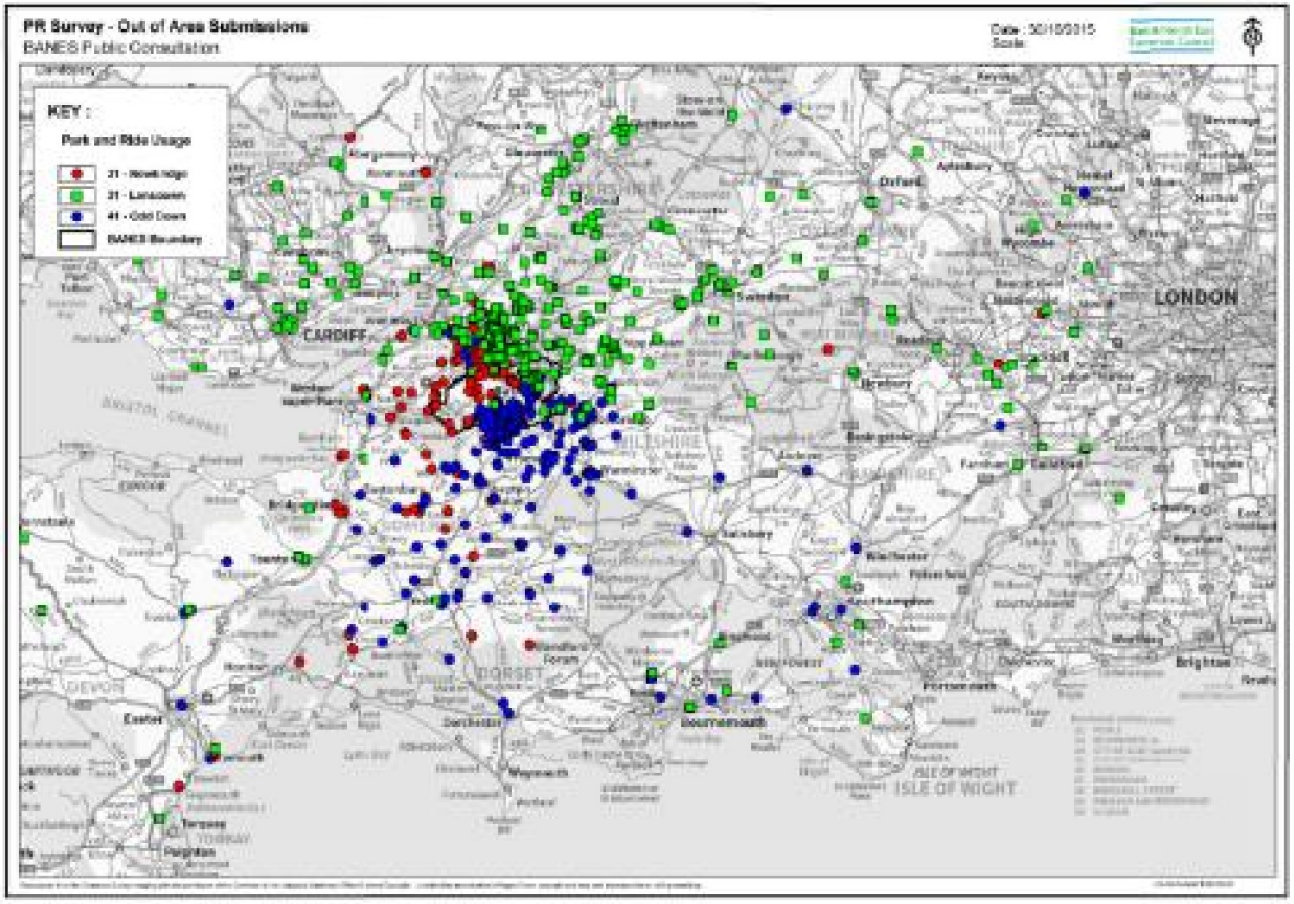
Figure 2.40: Bath Park & Ride patronage

Source: Bath Delivery Action Plan (2020)

Surveys were conducted to understand the origin of Park and Ride users, the findings of the analysis are presented in Figure 3-14. The data indicates that those travelling from the east of Bath, where there currently isn't a Park & Ride option, may travel through the Bath urban area to access one of the other sites to the north, south and west of the city.

Anecdotal accounts from stakeholders suggest that there is informal Park & Ride/Link & Ride activity on the A4 Bristol-Bath corridor and the A37 Wells-Bristol corridor. This is where users park their car on residential streets near existing bus routes and use the bus for the final leg of their journey into the urban areas. From discussions with stakeholders, there is no awareness of such activity occurring along the A4 between Chippenham and Ashley, however it is understood there are reports of such activity occurring in Batheaston, Bathford and Bathampton.

Figure 3-14 - Park & Ride user origins



Source: Bath Delivery action Plan (2020)

3.2.6. Parking

The *Transport Delivery Action Plan for Bath (2020)* acknowledges that parking plays a role in managing car demand, with availability and pricing key influences on individual travel choices. There are several large publicly available off-street car parks within Bath that experience high levels of occupancy nearing capacity. The car parks owned by B&NES are shown below in Table 3-2 and reflect prices at the time of modelling.

Table 3-2 - Off-street publicly owned parking within Bath

Car Park	Spaces	1hr	2hr	3hr	4hr	6hr	8hr	12hr
Claverton Street	11	£1.60	£3.20					
Bath Sports & Leisure Centre	128	£1.60	£3.20	£4.80	£6.40			
Broad Street	48	£1.60	£3.20	£4.80	£6.40			
Cattle Market	40	£1.60	£3.20	£4.80	£6.40			
Kingsmead Square	91	£1.60	£3.20	£4.80	£6.40			
Avon Street	628		£3.20	£4.80	£6.40	£9.60	£12.80	£15.00
Manvers Street	159		£3.20	£4.80	£6.40	£9.60	£12.80	£15.00
Charlotte Street	1,056				£6.40	£9.60		£15.00

The Parking Strategy (detailed in the Transport Delivery Action Plan for Bath) investigated parking charges in Bath and highlighted that while off-street short-stay parking charges in Bath are comparable to those in similar cities, the off-street long-stay parking charges are lower than those in similar cities.

The Transport Delivery Action Plan for Bath also acknowledges that there are residential streets where on-street parking is used by non-residential users such as shoppers and commuters. To manage the situation the Council introduced residential parking zones covering the centre of the city, although non-residents can still park in some of these on-street bays via pay and display. It is observed there is a shortage of available on-street parking for residents within the centre of Bath, with issued permits exceeding the number of spaces.

3.2.7. Bus travel

Information on existing bus service provision along the A4 east corridor is provided in chapter 4.

3.3. Impacts of travel demands for Bath

The *Transport Delivery Action Plan for Bath* (2020) recognises the impacts of high demand for travel by car into and through the city. The key impacts recognised in the Transport Delivery Action Plan for Bath and the JLTP4 are summarised in Table 3-3.

Table 3-3 - Key impacts in Bath of high volumes of car traffic

Impact	Summary from Transport Delivery Action Plan for Bath (2020)
Air quality	The A4 London Road is within the Bath Air Quality Management Area (AQMA). The introduction of the Clean Air Zone (CAZ) for Bath aims to bring the AQMA into compliance with EU and UK regulations.
Noise	*"Road traffic is the biggest cause of community noise in most cities, with noise linked to sleep disturbance, cardiovascular disease, psychological problems, and even premature death."* The data presented in the report shows that "*road and rail noise is concentrated on the key corridors within Bath, with large areas of the city negatively impacted."*
Safety	The analysis presented highlights a *"high number of collisions on key corridors including London Road, the A36 Lower Bristol Road, and within the city centre itself."* *The analysis also identified collision clusters at key locations including the Cleveland Place junction.*
Competing demands on road space	The report recognised that "*The private car has the highest impacts in terms of climate impacts and space requirements on our streets and spaces."* The A4 London Road currently caters for high volumes of traffic for both local and longer distance journeys but also for local journeys on foot, by bike and bus journeys. High volumes of traffic on the corridor impact on the local environment in terms of noise, air quality and safety as well as perceptions of the environment. Physical constraints and competing demands on the available road space present challenges for improving provision for pedestrians, cyclists and bus users.
Health	*Physical inactivity directly contributes to 1 in 6 deaths in the UK. Walking and cycling can play a key role in incorporating physical activity in everyday life;* *Air pollution within Bath is contributing to a significant number of deaths and poor health of residents;* *Road traffic is the biggest cause of community noise and is linked to a range of health issues.*
Carbon emissions	*The associated reports highlight that 29% of B&NES emissions excluding aviation come from transport (Figure 1.6)*

Impact

Summary from Transport Delivery Action Plan for Bath (2020)

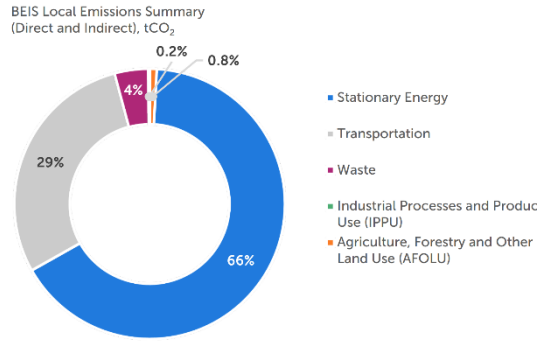


Figure 1.6: SCATTER Inventory: Direct and Indirect Emissions Summary, tCO_2e (BANES)[6]

Source: As reported in the Transport Delivery Action Plan for Bath (2020)

4. Existing bus service provision

4.1. Introduction

This section considers the underlying bus context surrounding the East of Bath Express concept in more detail, with particular consideration of the existing X31 service that currently services the east of Bath corridor.

4.2. Overview of existing X31 service

The X31 bus service is operated by Faresaver (with Wiltshire Council supporting some night-time services) and runs between Bath and Chippenham bus stations, following the A4 for most of the route. The service also serves Corsham and Rudloe. Figure 4-1 shows the X31 bus route and bus stops along the route.

At the time of modelling, during the week the X31 service would run approximately once every 20 minutes (three times an hour) between 06.13/15 and 17.15, reducing to a half hourly service (twice an hour) in the evening between 17.15 and 18.45, and then approximately once an hour, with the last service departing Bath at 2300 and Chippenham at 2200.

On Saturdays, the service ran approximately once every 30 minutes (twice an hour) between 06.18/20 and 17.15pm and then approximately once an hour after this. The last service departs Bath at 2300 and Chippenham at 2200.

On Sundays (and bank holidays), the route runs approximately once every 90 minutes with the first service departing Chippenham at 08.30 and Bath at 09.55. The final service departs Bath at 19.40 and Chippenham at 18.40.

The current (January 2021) X31 timetable provides services operating at a similar frequency; however, services only run three times an hour between 08:50 and 15:50 on weekdays.

Figure 4-1 - Existing X31 bus route

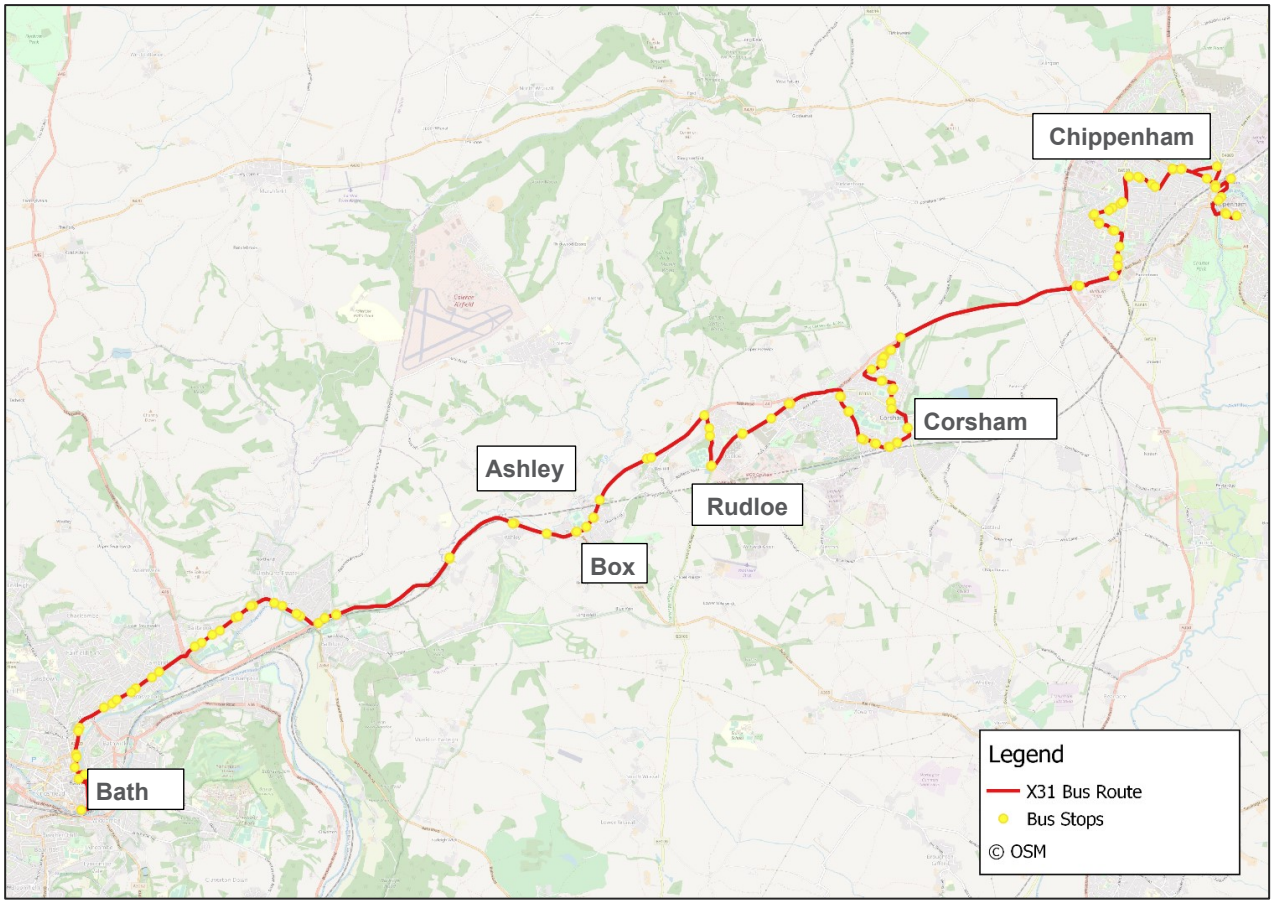
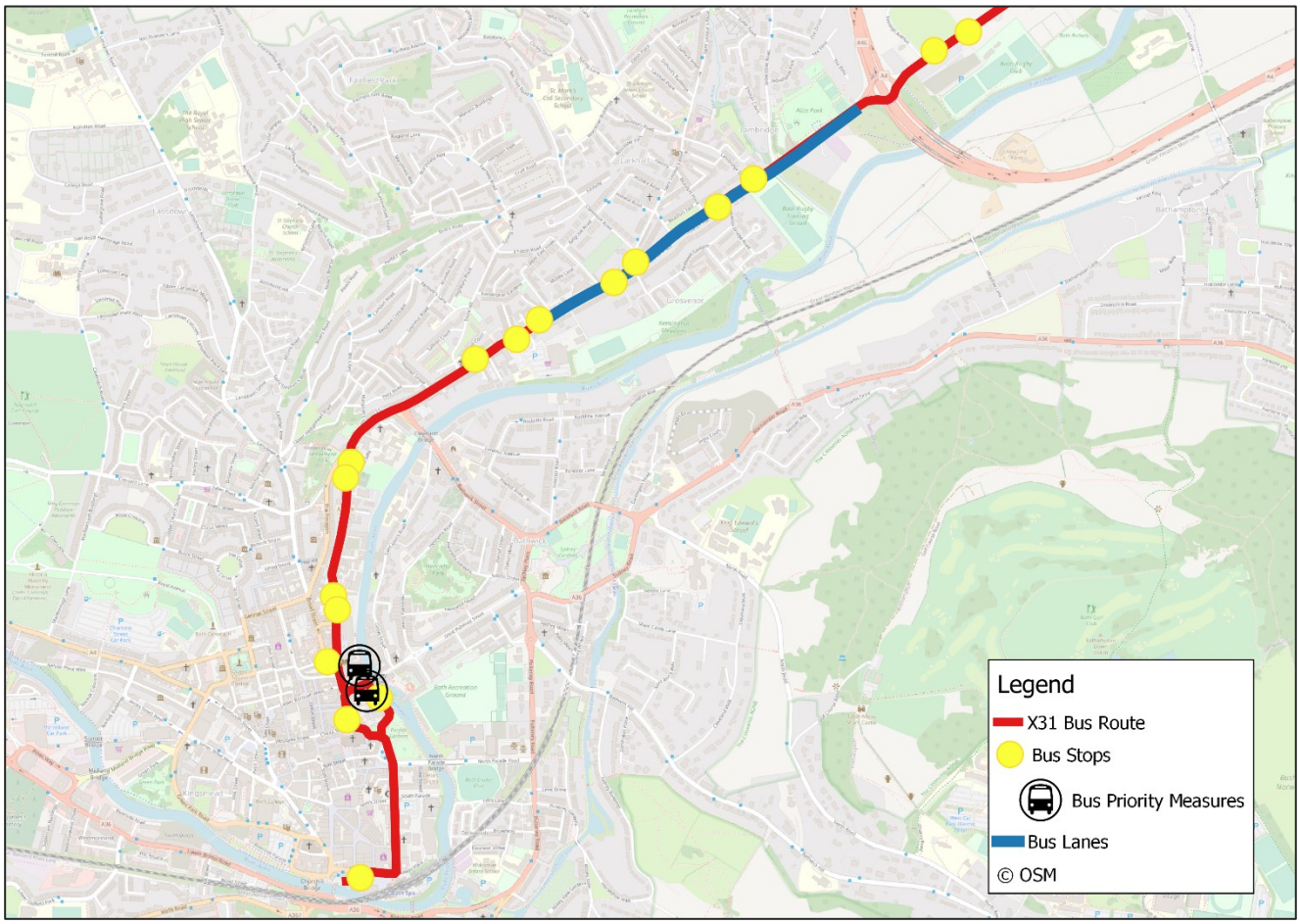


Figure 4-2 shows the existing bus lanes and bus priority measures along the route in Bath. Currently there is a bus lane along the westbound side of the A4 between London Road West roundabout and Kensington Place, as well as two bus (and taxi) only access routes within the city centre.

Figure 4-2 - Bus lanes and bus priority measures in Bath



4.3. Real time analysis & reliability

In B&NES, 78.5% of non-frequent buses ran on time[9] in 2018/19, compared to the national average of 83.1% for England[10]. Average excess waiting time for users of frequent services in B&NES was 2.5 minutes in 2018/19.

Table 4-1 shows RTI (Real Time Information) for the X31 bus service from October 2019. The data indicates that overall the X31 service offers a reliable service for users with limited delays. It is clear that the operator Faresaver has developed a timetable for the service which factors in congestion issues, by increasing scheduled run times during busier periods on the route, minimising delays to the expected service.

[9] On time' is defined as between 1.00 minute early and 5.59 minutes late.
[10] DfT Annual Bus Statistics (Bus reliability and punctuality (BUS09) - GOV.UK (www.gov.uk))

Table 4-1 - RTI data for X31 bus service - October 2019

Direction	Time period	Service departure time	Scheduled run time	Actual run time	Difference (minutes: seconds)
Inbound	AM	06:35	00:50:17	00:48:55	-00:01:22
Inbound	AM	07:00	01:09:31	01:07:54	-00:01.37
Inbound	AM	07:20	01:19:00	01:19:17	00:00:17
Inbound	AM	07:43	01:14:46	01:16:22	00:01:36
Inbound	PM	15:30	00:44:03	00:47:45	00:03:42
Inbound	PM	16:10	01:14:14	01:14:11	-00:00:03
Inbound	PM	16:40	01:14:14	01:19:12	00:04:58
Outbound	AM	06:55	01:12:08	01:05:12	-00:06:56
Outbound	AM	07:20	01:05:42	01:07:55	00:02:13
Outbound	AM	08:00	00:59:39	01:07:06	00:07:27
Outbound	PM	15:52	01:01:22	01:00:20	-00:01:02
Outbound	PM	16:12	01:05:50	01:12:28	00:06:38
Outbound	PM	16:32	01:13:16	01:01:15	-00:12:01
Outbound	PM	16:52	01:07:06	01:06:51	-00:00:15

Source: West of England Combined Authority, Transport Operations

4.4. High level audit of bus stops on the route

A high level audit of bus stops on the route for the L&R concept (A4 corridor) was conducted, a summary of the findings is presented in Table 4-2 for both directions. The findings of the audit for each stop are provided in Appendix A.

The audit shows that a large percentage of existing stops on the route do not have RTPI or a bus shelter and seating. As highlighted in the best practice guidance presented in section 4.8 these are key pieces of bus stop infrastructure for passenger comfort and safety, and to encourage use of public transport. The majority of existing stops have a flag pole and lighting.

Table 4-2 - High level bus stop audit – summary of findings

Route direction	No. of stops	% without a shelter	% without a flag pole	% without a layby/bus box	% without a raised kerb	% without seating	% without lighting	% without RTPI signs
Bath - Chippenham	20	65%	10%	40%	30%	65%	15%	70%
Chippenham - Bath	18	44%	0%	50%	50%	56%	28%	78%

4.5. Bus service demand

In B&NES, the annual number of passenger journeys on local bus services has increased from 11.4 million in 2009/10 to 14.7 million in 2018/19 (a 29% increase)[11]. This compares to a 7% decrease in bus journeys at a national level in England.

In 2018/19 B&NES had 76.7 passenger journeys per head of population and according to DfT's Annual Bus Statistics for 2018/19 Bath and North East Somerset Council is in the top 10 list of local authorities outside London for bus passenger journeys per head of population.

The local growth in bus journeys partly reflects relative economic success and a vibrant youth market associated with the universities, but it is also reflective of the many years of shared investment in improvements to bus service provision including the Greater Bristol Bus Network bus service corridors between 2008 and 2012. In Bristol, the benefits of the MetroBus services are now coming through, with complementary investment in mobile ticketing and contactless payment facilities combined with upgrades to the bus fleet by operators.

Patronage data for the X31 service was made available by Faresaver and for the existing Bath Park & Ride services by First Bus for use in the technical work presented later in the study, however due to reasons of commercial confidentially cannot be presented in this document.

4.6. Operator experience

The operator of the X31 service, Faresaver, has advised that the most common sections for delays along the route are within Bath. Occasionally delays can be experienced at the Chippenham end of the route during peak hours but this is not comparable to the delays experienced by buses within Bath city centre.

The X31 service operates through Batheaston rather than along the A4 bypass during the day due to high passenger usage from Batheaston towards Corsham. In addition, during the

[11] DfT Annual Bus Statistics (Local bus passenger journeys (BUS01) - GOV.UK (www.gov.uk))

morning peak period it can take a similar amount of time to exit the bypass onto London Road as going through Batheaston.

The evening services which operate via the Batheaston Bypass are given 18 minutes between Box and Bath city centre, whereas the daytime services which operate through Batheaston are given 26 minutes during the off peak and up to 33 minutes during the morning peak for the same section. Whilst there are more passengers boarding during the day, it is the operator's view that journey times would be reduced significantly if additional bus priority measures were put in place on this section of the route.

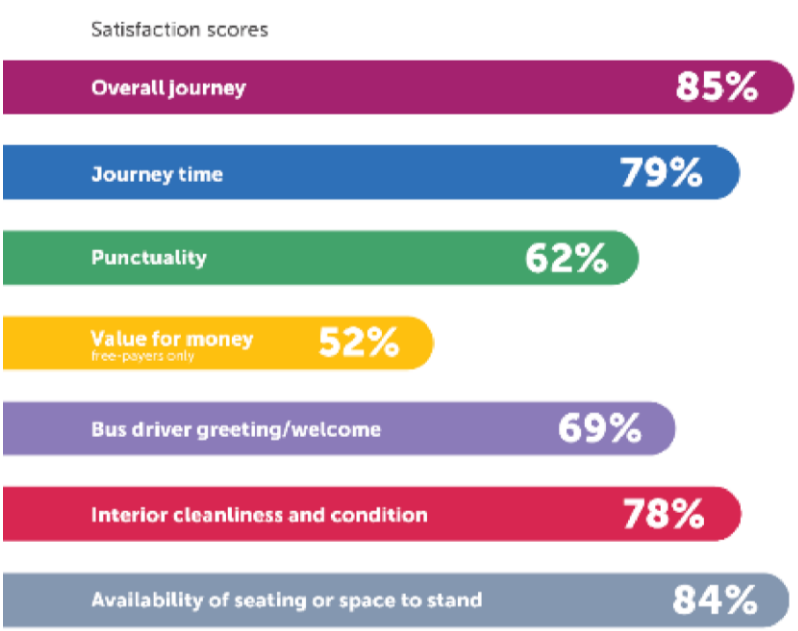
The other key area in Bath where the service currently experiences delays is between Grand Parade and the Bus Station. Congestion is common due to traffic having to pass through four consecutive sets of traffic light controlled junctions at North Parade, the Railway Station, the Bus Station exit and James Street West, combined with pedestrian crossings. Driving staff have commented that the traffic lights do not seem to be well synchronised, causing buses to have to stop at every set of lights.

4.7. Customer experience

Specific survey data for customer experience of the existing X31 service was not available, however information from the Bath Delivery Action Plan and West of England Bus Strategy provides a useful indication of customer satisfaction with bus services in the region.

Surveys of bus users have been conducted by Transport Focus for the West of England area to understand levels of satisfaction with bus services, the findings as presented in the Bath Delivery Action Plan are presented in Figure 4-3. The survey also sought bus users' suggestions for improvements; Figure 4-4 shows that punctuality and reliability of bus services was considered the most important improvement.

Figure 4-3 - Transport Focus survey of bus user satisfaction in the West of England



Source: Bath Delivery Action Plan

Figure 4-4 - Transport Focus survey - bus user suggestions for improvements to bus services

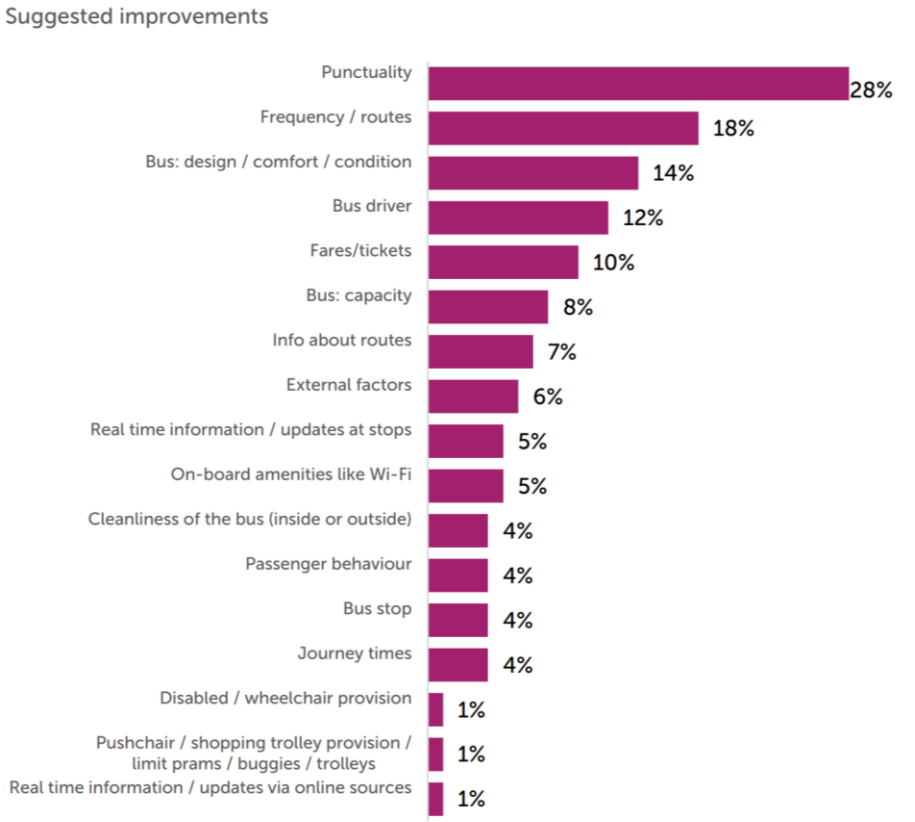


Figure 2.38: Suggested Bus Improvements (Source: Transport Focus)

Source: Bath Delivery Action Plan

Findings from the National Highways and Transport (NHT) survey for Bath and North East Somerset, as presented in the Bath Delivery Action Plan (2020), are shown in Figure 4-5. The findings show below NHT average satisfaction with local bus services, bus fares and congestion. However, satisfaction is above the NHT average for Park & Ride schemes and the condition of bus stops.

Figure 4-5 - NHT survey for Bath and North East Somerset (B&NES)

Satisfaction with...	BANES	NHT Avg
Good park & ride schemes	70%	49%
Cold weather gritting	64%	58%
The state of bus stops	69%	63%
Cycle parking	54%	49%
Pavements and footpaths	59%	54%
Condition of pavements	59%	54%
Cleanliness of pavements	57%	52%
Advanced warning of roadworks	64%	60%
Tackling illegal on-street parking	46%	42%
Pavements kept clear of obstruction	47%	43%
Cleanliness of roads	58%	54%
Local bus services	56%	60%
Cost of taxis or minicabs	48%	52%
Road safety environment	52%	56%
Routes taken by HGVs	40%	45%
Bus Fares	43%	49%
Traffic levels and congestion	36%	43%
Speed Limits	54%	64%

Public consultation conducted for the development of the West of England Bus Strategy provides useful information regarding public satisfaction with bus services in the West of England. Key findings presented in the bus strategy include:

- 48% [of respondents] would be prepared to walk further to a better, more reliable bus service
- 81% [of respondents] agreed that buses should have extra 'green time' at traffic signals to help services run punctually
- 76% of [respondents] agreed with the concept of an interchange-based network
- 76% of [respondents] agree with diverting traffic away from certain public transport corridors

- 84% of [respondents] agree with the reallocation of road space in favour of buses to ensure services run punctually
- 61% [of respondents] feel that modern vehicles are important to the passenger experience
- 66% [of respondents] are open to using a shared taxi/mini bus to connect to the wider network

The bus strategy also includes data from work conducted by WECA and Transport Focus to understand, what is assumed to be West of England specific, bus user satisfaction with bus services. This is shown in Figure 4-6.

Figure 4-6 - Bus user satisfaction (% satisfied with) - WECA and Transport Focus

Ithin an infographic of buses

The findings from the surveys highlight that the challenge for bus operators and local authorities is to maintain local growth in bus journeys, which can be achieved through making bus services more reliable, quicker, accessible and attractive to existing and new passengers. The aim is to make the overall bus route network sustainable and provide a high level of customer experience.

4.8. Best practice guidance for provision of bus stop infrastructure

There is a range of best practice guidance available for the design and implementation of bus stop and bus priority infrastructure.

Key requirements highlighted by this current guidance is that bus stops should be well lit, appropriately overlooked and suitably prominent within the street scene without being intrusive[12]. This helps to increase personal safety and to ensure users feel comfortable, promoting greater use of public transport.

Source	Best practice guidance
Chartered Institution of Highways and Transportation (CIHT) [13]	• Bus stops should be equipped with: - a shelter, including seating provision; - a high-visibility bus stop flag and pole, suitably illuminated, displaying route numbers of all services;

[12] 'Bus Services & New Residential Developments: General Highways and Urban Design advice to applicants and Highways Authorities (Stagecoach, 2017)
[13] 'Buses in Urban Developments' (Chartered Institute of Highways and Transportation, 2017)

	- comprehensive and consistent information display, including real-time information or details of how to access real-time information on mobile devices. This helps to provide a high level of certainty for users; - high-quality footway paving materials; - sufficient footway width to accommodate waiting passengers and passing pedestrians; and - attractive and recognisable design.
Transport for London (TfL)[14]	Good lighting should be provided to provide a sense of security for users as well as assist in station location and identification.
Institute for Transportation & Development Policy (ITDP)[15]	• Bus stops should be designed to: - promote access to public transport; - facilitate bus movement; and - minimise delays. A safe and comfortable bus stop environment is an important feature of a high-quality service. This includes providing shelter to protect from the weather.

[14] 'Accessible Bus Stop Design Guidance' (Transport for London, 2017)
[15] 'BRT Planning Guide' (Institute for Transportation & Development Policy, 2017)

5. L&R concept – rationale and objectives

5.1. Introduction

This section introduces the L&R concept, summarising the rationale for a L&R along the east of Bath corridor and the objectives that the concept will be measured against. It also provides a brief synopsis of the L&R scheme currently operating in Nottinghamshire and the success and lessons they have experienced.

5.2. Rationale - the transport challenge for the east of Bath corridor

A summary of the transport challenges for the east of Bath corridor is provided in Table 5-1. These challenges are set within the wider context of the climate emergency declared by B&NES and Wiltshire Council and the challenges associated with delivering a traditional Park & Ride to the east of Bath.

Table 5-1 - Transport challenges for the east of Bath corridor

Transport demands & options	1. Medium/longer distance (greater than 5 miles/8 km) car trips: - Travelling into the city on the A4, from the east and using the A4 London Road. - Crossing central area to access car parks and existing P&R site sites to the west, north and south of Bath. 2. Limited alternative options for these medium/longer distance car trips.
Impact	The transport issues outlined above contribute to the following, specifically on the A4 London Road into central Bath, but also across the city: • Congestion; • Poor bus reliability; • Poor local air quality; • Poor local environment; and • Constraints on delivery of appropriate provision for walking and cycling. This presents a challenge to meeting B&NES carbon targets.
Challenge for the corridor	Reduce the number of medium/longer distance car trips travelling into Bath from the east.

Intended outcomes	Address the challenge in order to: • Contribute to reducing congestion on the A4 London Road and within the city, improve air quality and environment; • Improve reliability of bus services; • Create the right conditions to improve walking and cycling provision; • Contribute to meeting the carbon reduction targets; • Improve levels of health and wellbeing; and • Improve levels of social inequality that exist in transport provision.

5.3. L&R concept objectives

The East of Bath Express bus service concept to be assessed would aim to meet the following objectives as agreed with B&NES officers and cabinet members:

3. Increase the numbers travelling by public transport and reduce the number of car trips travelling into central Bath, thereby reducing carbon emissions and helping to address the climate emergency;
4. Provide a commercially viable, direct bus service on the A4 between Chippenham and central Bath;
5. Achieve an optimal journey time by providing a direct bus service with minimal number of stops on the route and bus priority measures;
6. Provide interchange points at Chippenham, Corsham, Rudloe, Box, Ashley and Batheaston/Bathford to capture car trips into central Bath both from these settlements and the wider catchment;
7. Interchange locations will act as transport hubs that allows seamless journeys for those walking, cycling and using public transport. The hubs will not just include car parking provision but will also be accessible and attractive for pedestrians and cyclists and will be safe and well lit; and
8. Provide a simple, easy to use bus service with distinctive branding to raise awareness and maximise ridership.

5.4. Proof of concept – Nottinghamshire

Nottingham is currently served by 2 bus-based P&R sites, Racecourse and Queen's Drive, as well as 7 tram-based P&R sites that run along the northern line 1 and lines 2 and 3. Nottinghamshire County Council (NCC) is currently developing proposals for a new P&R site to service Nottingham. However, there was an immediate need to provide a viable public transport option for at least some of their car users due to increased levels of congestion and poor levels of air quality within the city. As an interim measure, NCC established a scheme very similar to the L&R concept.

NCC negotiated with two local landowners to enable the use of part of the existing parking provision for the L&R. The L&R includes 2 car parks, one at Cotgrave (Miners Welfare) which provides 33 parking spaces and a further car park at Stragglethorp (Shepherds restaurant) which provides 56 spaces. Both sites allow users to walk a short distance from the car park to get onto the bus and bus services are provided at a 10-20-minute frequency. The setting up costs and any ongoing maintenance costs for these parking sites to NCC are minimal. The two parking sites lie on existing bus routes, therefore eliminating the need for the bus operator to reroute the service to pick up the L&R demand. Roadside signage for the parking sites to direct drivers and raise awareness of the L&R scheme were put in place, and the bus operator helped to raise awareness of the scheme when it was introduced. Users do not pay to park at the sites, rather they pay for a ticket on the bus under the existing bus fare structure, meaning users can also take advantage of weekly or monthly ticket offers.

Overall, NCC report the L&R as a success. The scheme is popular, with the available parking frequently being near-full to full of L&R users, and has been implemented at minimal cost to NCC. NCC see the introduction of a L&R scheme as an interim solution only, with their long-term goal being a new large P&R site serving the north eastern corridor into the city., The L&R at Nottingham is seen as a success by NCC as it has utilised capacity that

wasn’t being used and it is a light touch measure with little maintenance costs attached but they do believe the L&R scheme has fully met their interim requirements.

6. Demand assessment for L&R scheme

6.1. Introduction

This section summarises the methodology followed to develop the bespoke demand model used for this project along with the outputs from the demand model. The demand model was developed to assess the potential modal shift away from cars that could be achieved by introducing a direct, standalone L&R scheme along the A4 corridor, with testing completed to understand how the level of modal shift could be affected by a number of different L&R bus service options.

Whilst there is an existing 2014 strategic transport model (GBATH SATURN), it was not deemed suitable for the use on this project as the model is deemed too complex for quickly scoping and assessing options. Additionally, the model zones (areas defined within the model to break it down into smaller sections for analysis, based on population size) within the study area are large and therefore would not provide the detail required for option assessment. Therefore, to inform the assessment of the feasibility of the local Link & Ride concept, a bespoke demand model was developed following guidance set out in *TAG: Supplementary Guidance: Bespoke Mode Choice Models*.

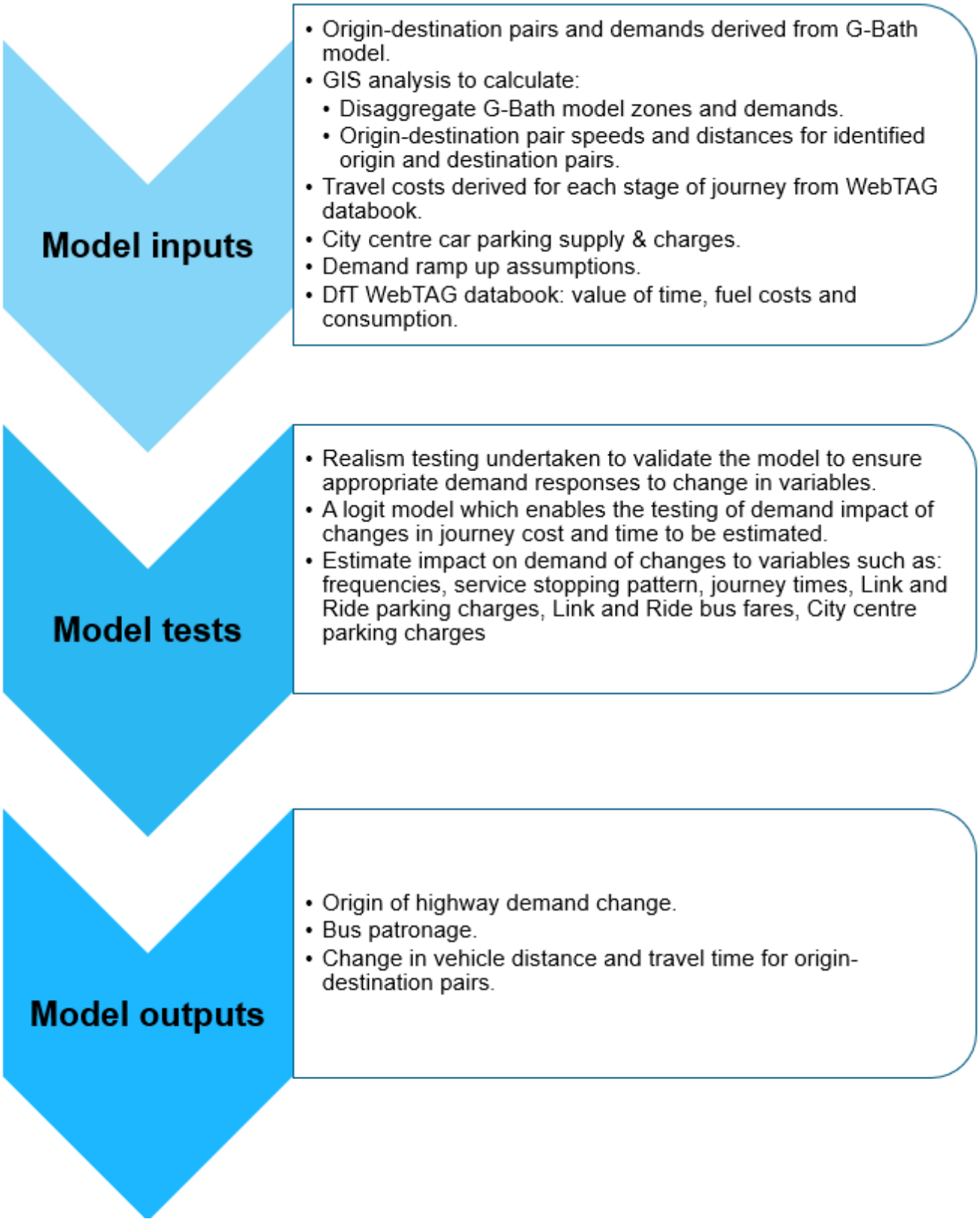
The demand model uses the GBATH model as its primary donor for the demand and travel time / distance data (skims). The demand model comprises two time periods: AM peak hour (0800 – 0900) and an average inter-peak hour (1000 – 1600).

Any further detail required regarding the demand model methodology that is not found in the following sections of this report can be found in the Demand Model Methodology note (Appendix B).

6.2. Approach

The demand modelling approach is summarised in Figure 6-1 and explained in more detail in this section.

Figure 6-1 - Demand modelling approach



6.2.1. Model flow validation

The GBATH model has a base year of 2014 whilst the demand model has a base year of 2019. Consequently, there was a need to assess the validity/accuracy of the GBATH model along the study corridor. To enable this check to be carried out, traffic count data was collected for four sites along the A4 corridor. The count sites are shown in Figure 6-2. These sites include permanent automatic traffic counter (ATC) sites maintained by B&NES, a temporary ATC site used by B&NES in 2018 and a WebTRIS site (Highways England managed traffic flow data).

Figure 6-2 - Count sites

For the two permanent ATC sites no 2019 data was available. It was therefore necessary to extrapolate to 2019 using historic data via the Compound Annual Growth Rate (CAGR) method for these sites. This is explained further in Appendix B.

Table 6-1 shows the comparison of modelled flows in 2014 against observed/extrapolated flows in 2018/19 for the four sites.

The GBATH model validates well against the WebTRIS dataset but is higher than the observed counts for the permanent ATC sites and lower than the temporary observed count for the temporary ATC site in the AM peak. Due to the lower confidence interval associated with validating against the extrapolated 2019 counts at these sites, it was identified that the GBATH

model data validates for 2019 against the count data and therefore no demand scaling was required to convert from the GBATH 2014 demand to 2019 demand.

Table 6-1 - Comparison of 2018/19 Observed/Extrapolated Flows and 2014 Modelled Flows (GBATH Model) – AM Peak Hour (0800-0900)

Site Name	Data type	Direction	Observed Flows (2018/19)	Modelled Flows (2014)	Difference (%)	Model - Pass/ Fail
A4 London Road - West of Beaufort West	Permanent ATC	WB / Inbound	694	1,076	55%	Fail
A4 Box Road - West of County Boundary	Permanent ATC site	WB / Inbound	515	520	1%	Pass
A4	WebTRIS dataset	WB / Inbound	1,154	1,050	-9%	Pass
A4 London Road	Temporary ATC site	WB / Inbound	912	868	-5%	Pass
A4 London Road - West of Beaufort West	Permanent ATC site	EB / Outbound	727	740	2%	Pass
A4 Box Road - West of County Boundary	Permanent ATC site	EB / Outbound	419	573	37%	Fail
A4	WebTRIS dataset	EB / Outbound	1,086	994	-9%	Pass
A4 London Road	Temporary ATC site	EB / Outbound	931	759	-18%	Fail

Table 6-2 - Comparison of 2018/19 Observed/Extrapolated Flows and 2014 Modelled Flows (GBATH Model) – IP Average (1000-1600)

Site Name	Data type	Direction	Observed Flows (2018/19)	Modelled Flows (2014)	Difference (%)	Model - Pass/ Fail
A4 London Road - West of Beaufort West	Permanent ATC site	WB / Inbound	785	890	13%	Pass
A4 Box Road - West of County Boundary	Permanent ATC site	WB / Inbound	335	371	11%	Pass
A4	WebTRIS dataset	WB / Inbound	733	697	-3%	Pass
A4 London Road	Temporary ATC site	WB / Inbound	888	787	-11%	Pass

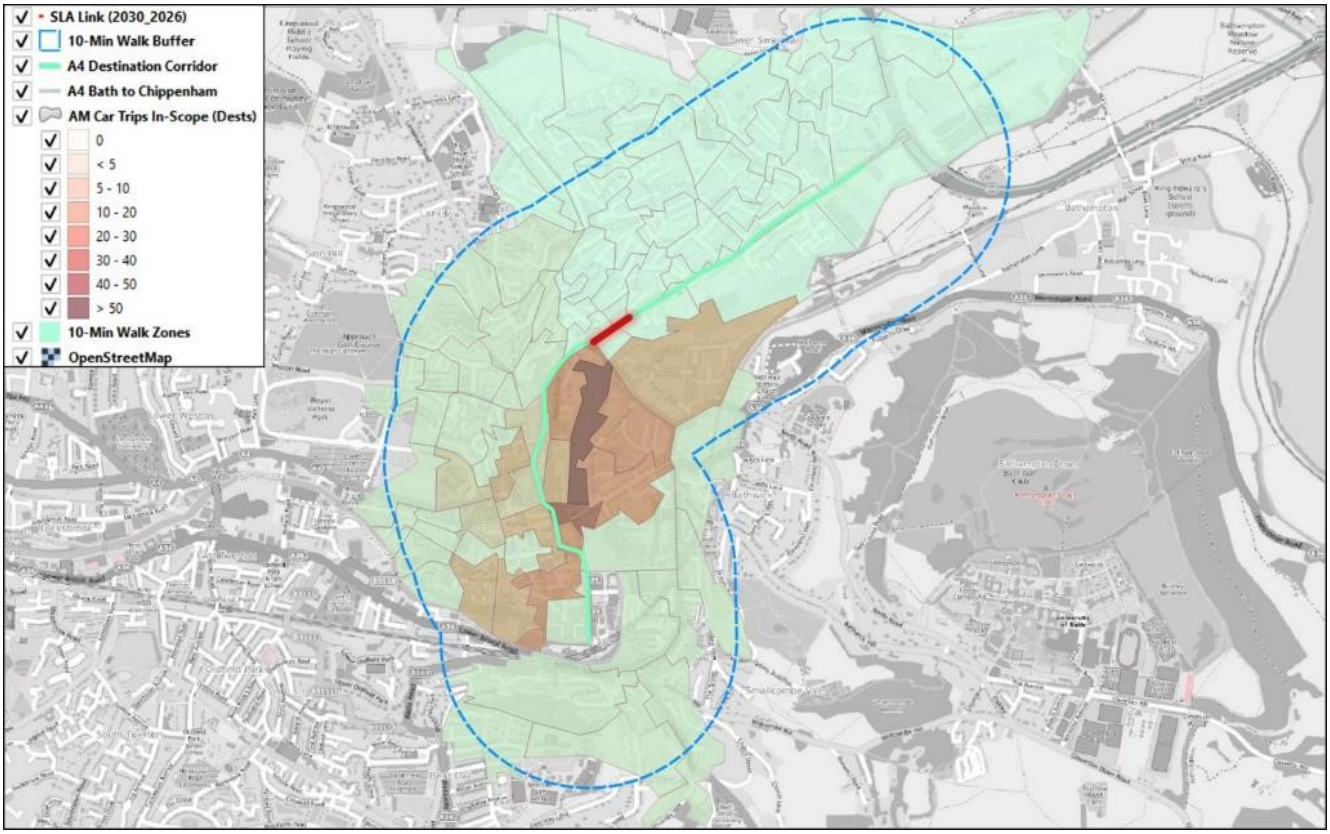
Site Name	Data type	Direction	Observed Flows (2018/19)	Modelled Flows (2014)	Difference (%)	Model - Pass/ Fail
A4 London Road - West of Beaufort West	Permanent ATC site	EB / Outbound	775	755	-3%	Pass
A4 Box Road - West of County Boundary	Permanent ATC site	EB / Outbound	344	379	10%	Pass
A4	WebTRIS dataset	EB / Outbound	697	674	-3%	Pass
A4 London Road	Temporary ATC site	EB / Outbound	947	870	-8%	Pass

6.2.2. In-scope demand

To identify what demand from the GBATH model was relevant for input to the demand model, it was required to develop the in-scope demand.

A destination corridor for the L&R system in Bath city centre was developed based on the existing X31 bus route through the city centre (extending to the north-east along London Road). A 10-minute walk buffer around the destination corridor using a walk speed of 4km/hr was created and all model zones within that buffer were designated as in-scope destination zones, i.e. destinations where it is expected potential L&R users would travel to using the service. Figure 6-3 below shows the destination corridor and the associated in-scope destination zones.

Figure 6-3 - A4 In-scope destinations (with AM car demand from GBATH)



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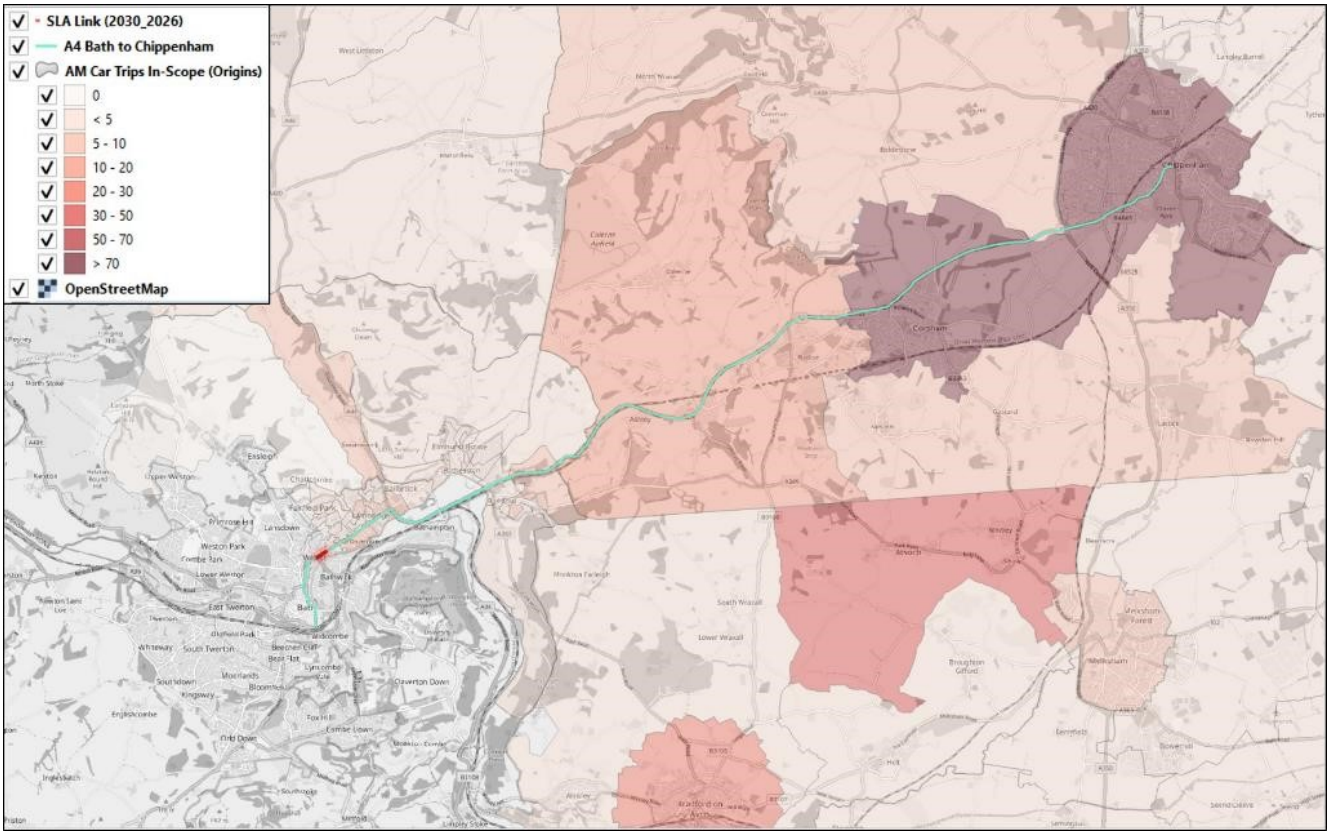
Using SATURN transport modelling software, it is possible to identify origins and destinations for all trips which travel along a selected route (link); this is called a select link analysis (SLA). To determine in-scope origins, i.e. locations where it is expected potential L&R users would travel from, an SLA was undertaken for the proposed L&R route. All origin-destination pairs where the destination was an in-scope destination (as outlined above) were selected and this was used to identify the in-scope origin zones, as shown in Figure 6-4.

Figure 6-4 - A4 In-scope origins (with AM car demand from GBATH)



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The identified in-scope vehicle demand for each journey purpose (as defined in TAG and the GBATH model) and time period are shown in Table 6-3 below.

Table 6-3 - Base year in-scope vehicle demand totals by purpose and time period

Journey purpose (as defined in TAG and GBATH)	Base AM Demand	Base IP Demand
Home-based* work (HBW) (commuter)	545	100
Home-based employers' business (HBEB)	28	23
Home-based other (HBO)	495	550
Non home-based** employers' business (NHBEB)	15	30
Non home-based other (NHBO)	134	72
Total	*1,216*	*776*

* Home-based refers to journeys originating from home, i.e. commuting from home to a workplace

** Non-home based refers to journeys originating from another location i.e. journey from a workplace

6.2.3. Catchment areas

To enable the modelling of the L&R option, it is required to understand which L&R interchange site individuals are likely to use based on the origin of their trip.

Catchment areas have been identified for the L&R interchange sites along the A4 corridor where users would park their vehicles to access the L&R bus service (access catchment areas), as well as for the bus stops in the city centre where users would alight to walk to their final destination (egress catchment areas).

Access catchment areas were determined by identifying which L&R interchange site individuals would choose based on the existing road structure. An assumption was made that people would drive to their nearest L&R interchange site rather than drive to the closest site to Bath city centre. All in-scope origin zones were allocated an access catchment area.

Egress catchment areas were defined based on minimum walk time from an existing X31 bus stop, as it is assumed these bus stops would also be used by the L&R bus service. All in-scope destination zones were allocated an egress catchment area.

Based on the access and egress catchment areas, an interchange site and a city centre bus stop is allocated for each in-scope origin-destination pair. Figure 6-5 shows the access catchment areas for all in-scope origin zones, and Figure 6-6 shows the egress catchment areas for all in-scope destination zones.

Figure 6-5 - Access catchment areas for each potential L&R interchange location

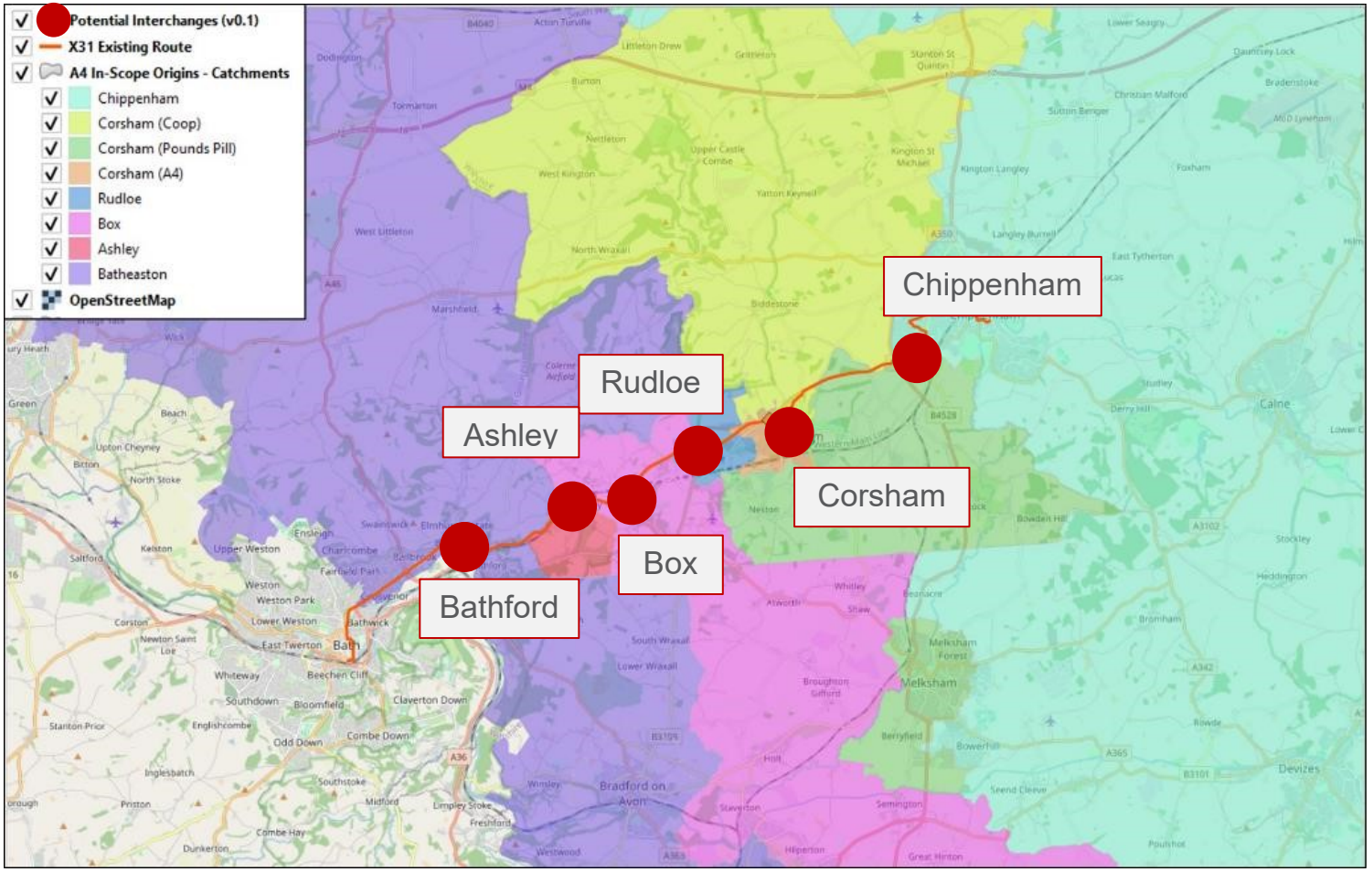

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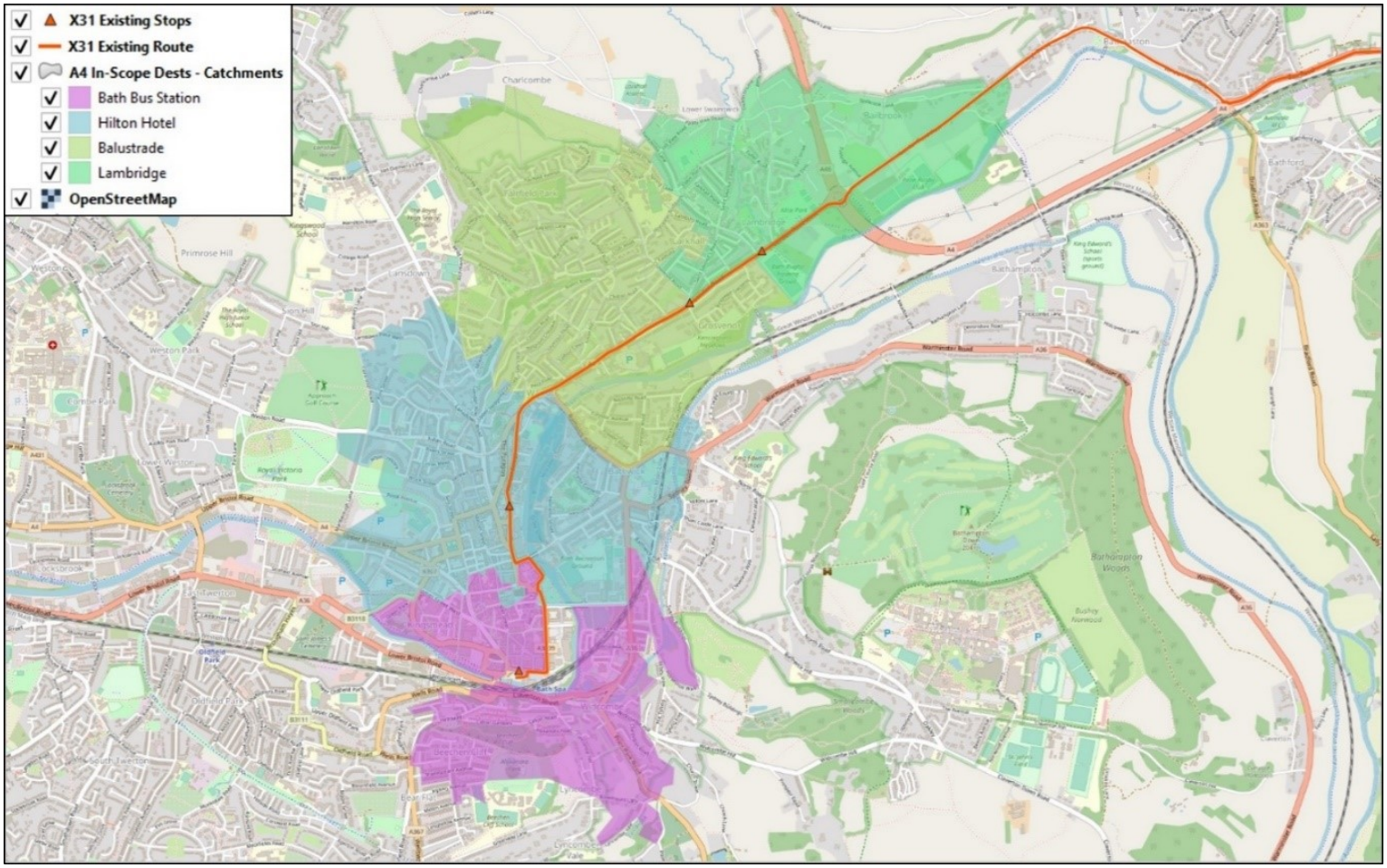
Figure 6-6 - Egress catchment areas for each existing X31 city centre bus stop



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6.2.4. Generalised trip times

To enable a comparison between the costs associated with completing an origin-destination trip by car versus the costs associated with completing the same origin-destination trip by L&R, generalised times for each mode are calculated.

These generalised times, which include everything from the fuel costs associated with a car trip to waiting times associated with catching a bus, contain different elements for both car and L&R and are built up in different ways.

Figure 6-7 and Figure 6-8 show the two different modes and the associated costs that are included in the generalised time along the route for a journey completed by each mode.

Figure 6-7 - Car mode: generalised time elements along route

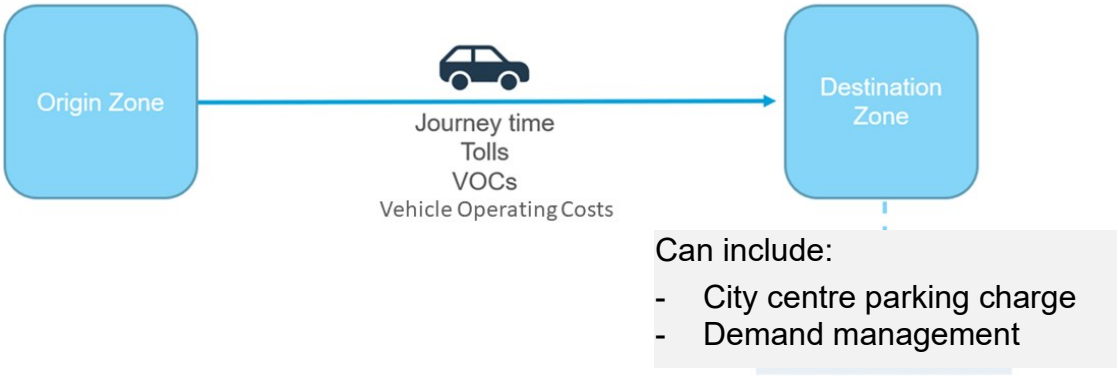
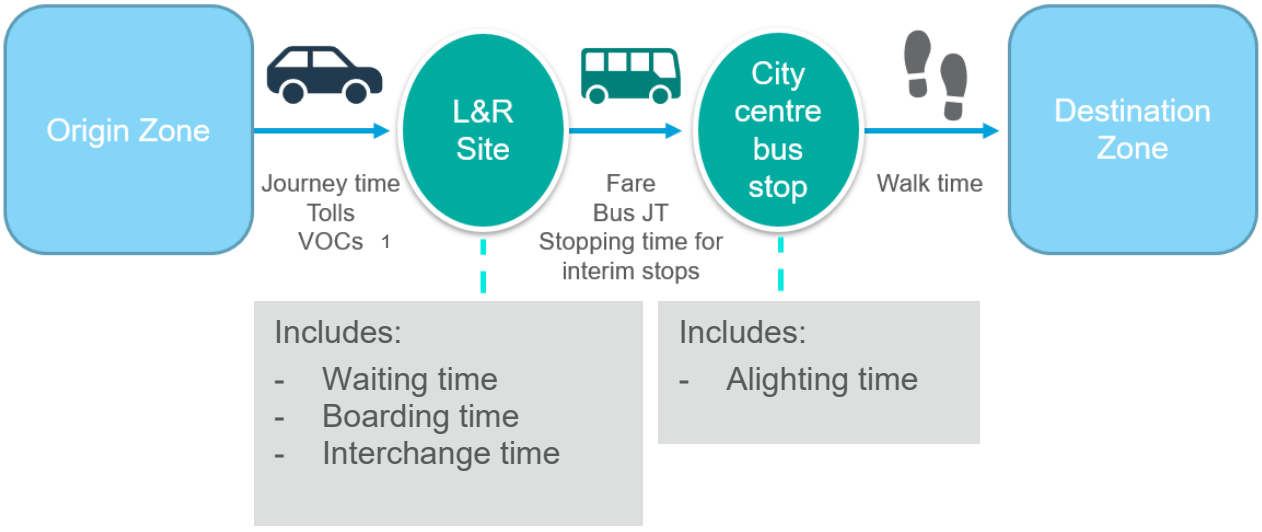


Figure 6-8 - L&R mode: generalised time elements along route



The equations used to calculate the generalised time for Car mode and L&R mode are presented in the Demand Model Specification.

[16] VOC – Vehicle Operating Costs

As per the approach set out in *TAG: Supplementary Guidance: Bespoke Mode Choice Models*, walk time was added as a cost time for the L&R mode but not the car mode. It is recognised that the nature of Bath city centre's layout means that some car users may have to walk to their final destination from their parking location, however the decision was made to follow the TAG approach for the purpose of this assessment.

For the car mode, city centre parking and demand management measures are included for the relevant destination zones where these charges would be applied for the purposes of testing.

6.2.5. Logit form

To calculate how many individuals completing an origin-destination trip will complete it using each available mode, a logit form is developed to distribute the probabilities of mode choice.

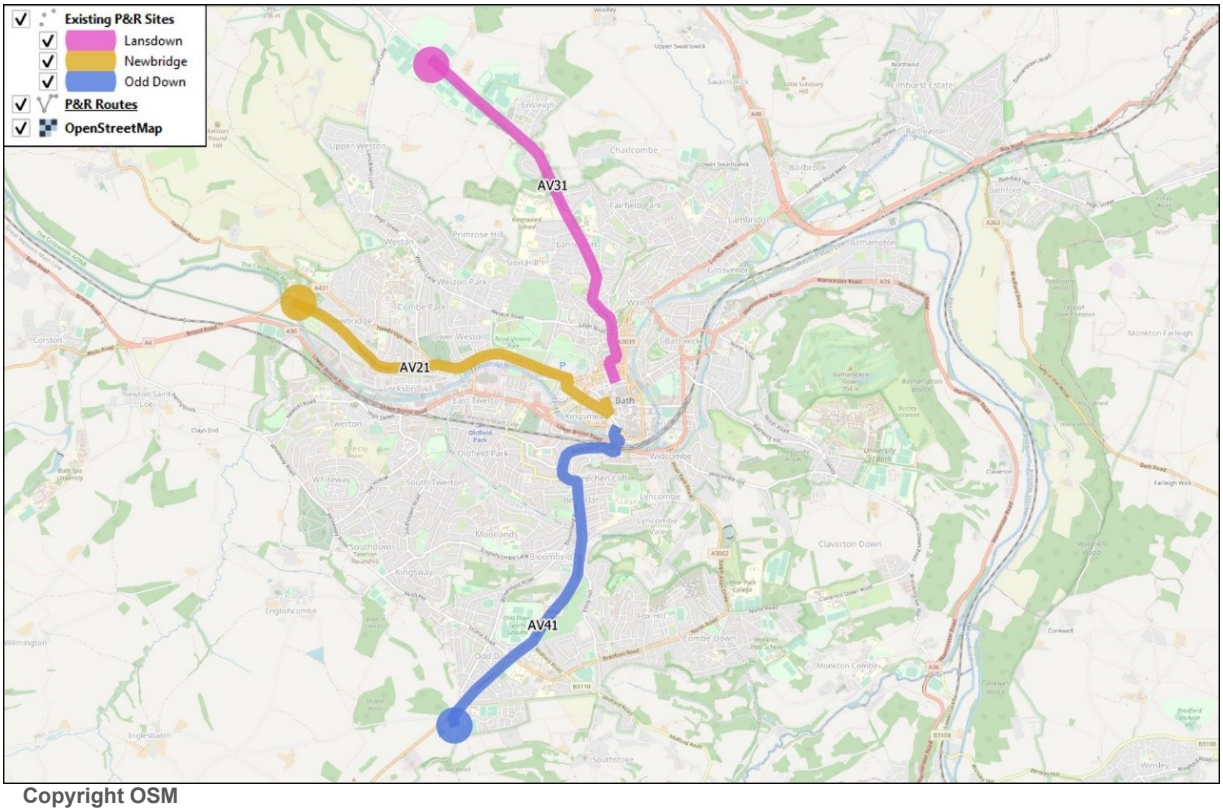
Demand for the different modes of transport was calculated using the standard logit function as required by DfT's Transport Analysis Guidance (TAG): Supplementary Guidance: Bespoke Mode Choice Models section 3.1.4. The exact equation implemented is specified in the Demand Model Specification.

6.2.6. Calibration

Calibrating a demand model is the process of updating the sensitivity parameters associated with the logit form to ensure that the mode choice resulting from that logit form matches observed data from the study area.

Given the lack of comparable L&R schemes locally and regionally the most suitable data to use to calibrate the model was deemed to be the existing P&R sites that serve Bath. There are three existing P&R sites in Bath, situated to the north, west and south of the city, as shown in Figure 6-9, that have been used during calibration as a source of observed data for calibrating the demand model.

Figure 6-9 - Existing P&R sites and routes



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To calibrate the demand modelling tool and ensure it is as representative as possible of real-life demand, patronage level data for these sites has been used for comparison. Ticketing information was provided by First Bus who run the existing P&R services. This data consists of the number of individuals who bought a ticket at each bus stop along the P&R routes, with a timestamp for each ticket purchase.

Demand model calibration has been undertaken by comparing observed and modelled patronage for the three existing traditional P&R sites currently operating in Bath, as presented in Table 6-4. As can be seen, the demand model is well calibrated for all sites apart from Odd Down in the AM peak hour.

Table 6-4 - Observed and modelled P&R patronage, 2019 – AM Peak Hour (0800-0900)

	Observed Passenger Numbers	Modelled Passenger Numbers	Difference (%)	Model - Pass/ Fail
Lansdown (Service: AV31)	133	146	10%	Pass
Newbridge (Service: AV21)	188	178	-5%	Pass
Odd Down (Service: AV41)	195	72	-63%	Fail

Table 6-5 - Observed and modelled P&R patronage, 2019 – IP Average (1000-1600)

	Observed Passenger Numbers	Modelled Passenger Numbers	Difference (%)	Model - Pass/ Fail
Lansdown (Service: AV31)	55	55	0%	Pass
Newbridge (Service: AV21)	61	83	37%	Pass
Odd Down (Service: AV41)	92	70	-24%	Pass

6.2.7. Realism testing

Realism testing is required to understand how well the demand model reacts to changes in the costs that feed into the generalised time for each mode. For example, if a model is too elastic it will overreact to changes in costs and therefore could overestimate the potential impacts of the scheme or new scenario being tested. On the contrary, if a model is too stiff then it will not respond to changes in costs which could lead to underestimating the potential impacts of the scheme or new scenario being tested.

Realism tests and the anticipated elasticity ranges are specified within the DfT's TAG unit M2-1: Variable Demand Modelling section 6.4. While it is not possible to run full realism tests on a non-iterating demand model such as the L&R demand model (there is no feedback loop between the demand modelling tool and the highway assignment model). This means that, for example the L&R demand model can't model the effect that reduced highway demand may have on congestion which, if reduced, may result in released suppressed demand and additional highway demand. This would be an expected response as the car becomes an attractive option if congestion is reduced.

It is, however, still possible to understand how stiff or elastic the model responses are. The three realism tests specified and undertaken for the L&R demand model are as follows:

1. Car fuel cost test – increase car fuel costs by 10% and check car vehicle-km elasticity.
2. Public Transport (PT) fare test – increase PT fares by 10% and check PT trip elasticity.
3. Car journey time test – increase car journey times by 10% and check car trip elasticity.

The results of the realism tests for the L&R demand model, along with TAG anticipated ranges, are shown below in Table 6-6.

As shown, the demand model is too stiff to change in terms of car costs, but too elastic to change in PT fares. The model cannot be adapted to change the underlying elasticity without sacrificing the calibration; therefore, it is instead noted that the model is likely to overestimate mode shift when testing measures such as changes in the fare structure for buses and is likely to underestimate mode shift for tests such as journey time changes.

Table 6-6 - Realism test results (undertaken for Lansdown P&R model)

Test	Measure	TAG Elasticity	Model Elasticity - AM Peak	Model Elasticity - Average IP

Car fuel cost	Car vehicle-kms	-0.25 to -0.35	-0.01	-0.01
PT fare	PT trips	-0.2 to -0.9	-3.5	-3.9
Car journey time	Car trips	0 to -2	-0.1	-0.0

6.2.8. Forecasting

A forecast year of 2029 has been developed to understand how increases in demand and costs could impact upon people's mode choices, and whether a L&R bus service would still be an attractive option in a future scenario.

As no appropriate GBATH forecast model was available, the methodology used to develop the forecast demand model is as follows:

- TEMPro 7.2 was used to factor the demand from base year 2019 to forecast year 2029
- Update fuel costs and values of time based on the TAG Databook
- Increase PT fares by 2% per annum (based on previous studies completed by Atkins)
- Increase short-term parking charges (informed by B&NES)
- Base year values are used for skims (matrices containing distance and journey time values for each zone to zone movement), as there is no forecast model to extract these from.

The forecast in-scope vehicle demand compared with base year totals is shown below in Table 6-7.

Table 6-7 - Forecast in-scope vehicle demand by purpose (with base year totals)

Journey purpose	Base Year (2019) - AM	Base Year (2019) - IP	Forecast Year (2029) - AM	Forecast Year (2029) - IP	Abs. Growth - AM	Abs. Growth - IP	% Growth - AM	% Growth - IP
Home-based work (HBW)	545	100	571	103	26	3	5%	3%
Home-based employers' business (HBEB)	28	23	29	24	1	1	4%	4%
Home-based other (HBO)	495	550	539	599	44	49	9%	9%

Non home-based employers' business (NHBEB)	15	30	16	32	1	2	7%	7%
Non home-based other (NHBO)	134	72	144	78	10	6	7%	8%
Total	*1,216*	*776*	*1,299*	*835*	*83*	*59*	*7%*	*8%*

6.2.9. Methodology caveats

There are several caveats to be noted regarding the modelling methodology. These are summarised as follows:

1. Bespoke model – as noted at the start of this section, given that the GBATH model was no longer suitable to use, a bespoke demand model was developed for this project. The model that has been built is WebTag compliant.
2. Mode shift – as the demand model considers only mode shift from private car to the L&R bus service it will not consider any potential mode shift from existing bus services. It is anticipated the number of individuals likely to shift from an existing bus service to the L&R bus service are negligible as has been the case for the L&R in Nottingham. Therefore it is proportionate not to include them in the choice model.
3. L&R catchment areas – to avoid over-complicating the model it was agreed to implement L&R catchment areas for each of the L&R interchange sites. These catchment areas are a limitation to the function of the model, as in reality there is the potential for individuals to drive further to park at an L&R interchange site nearer to Bath city centre which will not be reflected in the model.
4. Standalone service - The model assumes this is a standalone service that runs alongside the X31 (not instead of). There is a risk that a direct service could abstract demand from this existing commercial service, but this has not been tested and is a recognised constraint to the study.
5. Concessionary fares – as the demand was not provided from the GBATH model with any age segmentation, concessionary fares and passes are not included in the modelling. This is a proportionate approach but could lead to potentially underestimating patronage or overestimating the impact of changes in fares for the L&R bus service. To try and mitigate against this, an average fare per single trip was calculated based on the different ticket types and assumptions around the percentage breakdown of patrons who would use each ticket type.
6. Patronage build-up – TAG: Supplementary Guidance: Bespoke Mode Choice Models section 5.5 notes that whilst the mode choice model will show mode switching as occurring instantaneously, this is not likely due to inertia within the market. It is therefore understood that initial patronage forecasts need to be considered as absolute maxima by any interpreter or results, with the expectation that full mode shift will take place within 2 years of the scheme opening.
7. One directional demand – The model only models demand in one direction (Chippenham-Bath). The other direction would not have been a robust test of demand as

the L&R bus service would drop passengers at interchange sites and people would be required to walk to their final destination, thereby limiting demand.

8. 'Kiss and ride' – the model does not account for 'kiss and ride' users (where passengers are given a lift to an interchange site by another person/people who does/do not park at the interchange or use the L&R bus service).
9. Forecasting – as the journey time skims remained at base year levels, increased congestion along the corridor due to increased forecast demand is not reflected. However, the risk associated with this is minimal as car and L&R journey times are taken from the same highway model, thereby meaning any increased congestion experienced by car would also be experienced by L&R and so the relative differences between generalised times would not change.
10. Covid-19 – for the base 2019 model, demand levels have been assumed as pre-Covid-19 levels. For the forecast year 2029, the TAG recommended approach of applying core TEMPro growth factors has been followed which assumes demand forecasts will remain the same by 2029 despite Covid19. A number of sensitivity tests have been undertaken to understand how changes in travel demand due to Covid-19 would impact on the L&R patronage.

6.3. Scenario tests

6.3.1. Scenarios

To understand how the different L&R bus service options impact on potential patronage levels (and therefore the potential removal of cars from the roads), several scenarios were specified to be tested in the demand model.

A baseline test for the do minimum service option has been undertaken to understand the baseline potential levels of mode shift from car to L&R (and is labelled test A). The baseline service test models the existing X31 service from Chippenham to Bath, with L&R passengers able to board the bus at the identified L&R interchanges.

To understand how changes to the do minimum option could impact patronage levels, several do something tests were developed to test different service and external policy measures:

- Direct bus service route along the A4 with no diversions (all of the other tests use this same direct route unless specified).
- Increased bus frequency.
- Fares capped at existing Bath P&R fare structure.
- Bus priority measures at the A4 / London Road roundabout.
- Implementation of an interchange parking charge.
- Implementation of demand management measures (external policy measure for reference only).
- Increased city centre parking charges (external policy measure for reference only).
- Complete suite of changes (all service/policy measures applied, apart from interchange parking charge).
- Combined option (direct service with increased frequency, fares capped and bus priority measures at the A4 / London Road roundabout).

- Alternating direct service route and X31 service route offer.

A more detailed summary of the tests undertaken and parameters applied for each of the tests is shown below in Table 6-8.

Table 6-8 - Inputs to demand model tests

Test	Name	Route	AM bus frequency	IP bus frequency	Fare	Bus priority (JT change)	Interchange parking charge	Demand management measures	City centre parking charge
A	Baseline	X31	4 bph	3 bph	X31	-	-	-	-
B	Direct route	Direct	4 bph	3 bph	X31	-	-	-	-
C*	Complete suite of changes	Direct	6 bph	4 bph	Capped at £3.60 return	✓	-	Applied	Charges increased
D	Frequency	Direct	6 bph	4 bph	X31	-	-	-	-
E	Fares	Direct	4 bph	3 bph	Capped at £3.60 return	-	-	-	-
F	Bus priority measures	Direct	4 bph	3 bph	X31	✓	-	-	-
G	Interchange parking charge	Direct	4 bph	3 bph	X31	-	£1 per car	-	-
H*	Demand management measures	Direct	4 bph	3 bph	X31	-	-	Applied	-
I*	City centre parking charges	Direct	4 bph	3 bph	X31	-	-	-	Charges increased

J	Combined option	Direct	6 bph	4 bph	Capped at £3.60 return	✓	-	-	-
K	Alternating direct & X31 service offer	Alternating direct/X31	6 bph (3 direct, 3 X31 route)	5 bph (2 direct, 3 X31 route)	X31	-	-	-	-

* Scenarios C, H and I considered the impact of introducing demand management measures and were conducted for reference only.

6.3.2. Service scenario test results

The service scenario test results for the base year and forecast year demand model are presented below in Table 6-9 and Table 6-10 respectively. Scenarios C, H and I considered the impact of introducing demand management measures and were conducted for reference only.

The service tests results show that scenario A (baseline test) has the lowest potential for abstracting car users to the L&R scheme, whilst scenario J (combined option test) has the greatest potential for car mode abstraction of the service option only tests.

In scenario J (combined option test), the L&R mode share is 10% in the AM peak in 2019 compared to 2% in scenario A (baseline test). In the IP, L&R mode share is 3% for option J compared to 1% in scenario A. For scenario J, the primary L&R demand is from home-based work trips in the AM peak and from non-home-based employers' business trips in the IP.

Comparing single service option measures (as opposed to scenarios with combinations of measures) highlights scenario D (frequency test) and scenario E (fares test) as the two scenarios that have the largest potential impact on L&R patronage levels. It is noted the response seen in scenario E could be an overestimation as realism testing showed the model is elastic to changes in public transport fare.

As anticipated, scenario G shows that an additional charge to L&R users via an interchange parking charge of £1 per car has a negative impact on L&R patronage. Scenario F (bus priority measures test) shows that the introduction of bus priority measures at the A4 / London Road roundabout would have a minimal impact on patronage. This is because the journey time savings created by bus priority measures are a very small proportion of the overall bus journey time and therefore do little to increase the attractiveness of the service. However, it is noted the response seen for scenario F could be an underestimation as realism testing showed the model is stiff to changes in journey time.

Scenarios C, H and I considered how external policy measures could impact on L&R patronage levels. These showed that the introduction of demand management would considerably increase the abstraction rate from car mode to the L&R bus service, while increasing city centre parking charges has a limited impact on mode shift as the potential increase is capped by the nationally set penalty charge notice (PCN) figure. If this figure were exceeded the cost of a PCN would be cheaper than the cost to park a car, therefore it could be expected that drivers would choose to accept a PCN by parking illegally, as opposed to paying for parking or shifting mode to L&R.

Scenario K (alternating direct and X31 service offer) performs similarly to Scenario B (direct route) with both tests predicting an L&R mode share of 2% in the AM peak (220 daily passengers for Scenario K and 215 for Scenario B). This suggests that alternating services across the two routes is not expected to improve patronage levels for the L&R bus service compared to using only the direct route. This is likely due to the slower journey time on the X31 route.

For every scenario, the potential intercept rate for the L&R scheme reduces in the forecast year i.e. there is lower abstraction from car in the 2029 model. This is due to the relative changes in costs of travel by bus versus car. Following TAG parameters, the perceived costs associated with using the car decrease in forecast years whilst the perceived costs associated with using the L&R increase. Therefore, the L&R mode share decreases in the forecast year.

Table 6-9 - Scenario testing base year (2019) results (service option tests only)

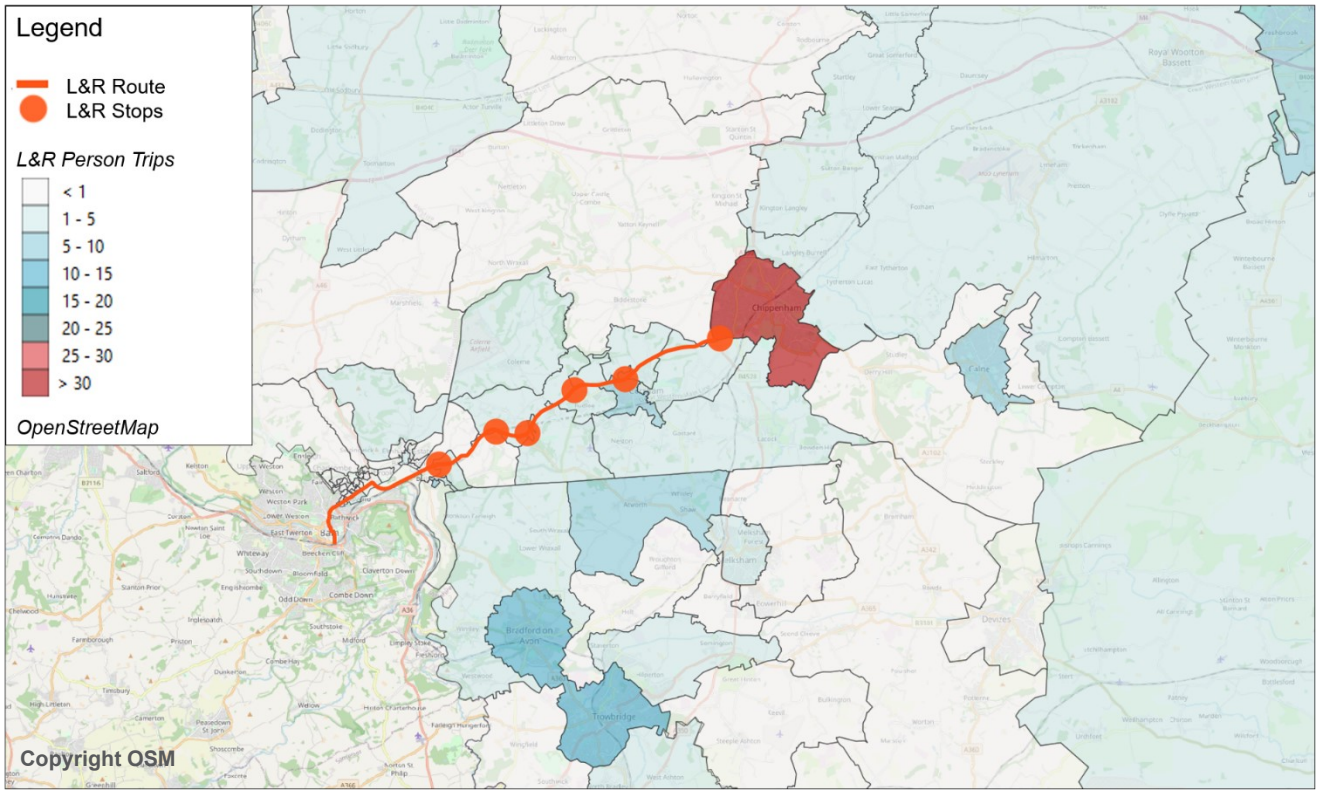
Test	Name	Vehicle trips - AM Peak Car	Vehicle trips - AM Peak L&R	Vehicle trips - IP Avg. Car	Vehicle trips - IP Avg. L&R	Person trips - AM Peak Car	Person trips - AM Peak L&R	Person trips - IP Avg. Car	Person trips - IP Avg. L&R	Mode share (person trips) - AM Peak Car	Mode share (person trips) - AM Peak L&R	Mode share (person trips) - IP Avg. Car	Mode share (person trips) - IP Avg. L&R	Daily L&R patronage	% patronage increase vs test A
A	Baseline	1,186	30	767	8	1,707	35	1,195	10	98%	2%	99%	1%	166	-
B	Direct route	1,180	37	763	13	1,699	43	1,190	15	98%	2%	99%	1%	215	29%
D	Frequency	1,170	46	763	13	1,688	55	1,190	15	97%	3%	99%	1%	257	54%
E	Fares	1,115	101	749	26	1,619	123	1,173	32	93%	7%	97%	3%	574	245%
F	Bus priority	1,176	41	763	13	1,694	48	1,190	15	97%	3%	99%	1%	233	40%
G	Interchange parking charge	1,185	31	765	11	1,705	37	1,192	13	98%	2%	99%	1%	183	10%
J	Combined option	1,069	147	769	26	1,560	182	1,173	32	90%	10%	97%	3%	793	376%
K	Alternating direct & X31 service offer	1,696	46	764	12	1,695	46	1,192	13	97%	3%	99%	1%	220	32%

Table 6-10 - Scenario testing forecast year (2029) results (service option tests only)

Test	Name	Vehicle trips - AM Peak Car	Vehicle trips - AM Peak L&R	Vehicle trips - IP Avg. Car	Vehicle trips - IP Avg. L&R	Person trips - AM Peak Car	Person trips - AM Peak L&R	Person trips - IP Avg. Car	Person trips - IP Avg. L&R	Mode share (person trips) - AM Peak Car	Mode share (person trips) - AM Peak L&R	Mode share (person trips) - IP Avg. Car	Mode share (person trips) - IP Avg. L&R	Daily L&R patronage	% patronage increase vs test A
A	Baseline	1,269	30	826	9	1,831	35	1,290	10	98%	2%	99%	1%	166	-
B	Direct route	1,264	35	822	13	1,825	42	1,285	15	98%	2%	99%	1%	210	26%
D	Frequency	1,259	40	822	13	1,819	48	1,285	15	97%	3%	99%	1%	235	41%
E	Fares	1,216	83	810	25	1,763	104	1,269	31	94%	6%	98%	2%	498	199%
F	Bus priority	1,262	37	822	13	1,823	44	1,285	15	98%	2%	99%	1%	221	33%
G	Interchange parking charge	1,267	32	824	11	1,829	38	1,287	13	98%	2%	99%	1%	189	13%
J	Combined option	1,175	124	810	25	1,708	159	1,269	31	92%	8%	98%	2%	702	322%
K	Alternating direct & X31 service offer	1,264	35	824	11	1,264	35	1,288	13	98%	2%	99%	1%	203	22%

For test J (combined option test), maps showing where the users of the L&R bus service have travelled from and where they are travelling to within Bath city centre are given below in Figure 6-10 and Figure 6-11. These maps represent the base year (2019) AM demand. These clearly show that the highest contributor of demand to the L&R bus service is Chippenham, with Bradford-on-Avon and Trowbridge the second highest. Within Bath city centre, the most popular destinations for the L&R bus service are those nearest to the anticipated city centre bus stops such as Bath Abbey and near to the Bath bus station.

Figure 6-10 - Option J - 2019 AM origin L&R person trips



Note: Catchment areas associated with each of the L&R interchange are shown in section 6.2.3 of this report.

Figure 6-11 - Option J - 2019 AM destination L&R person trips

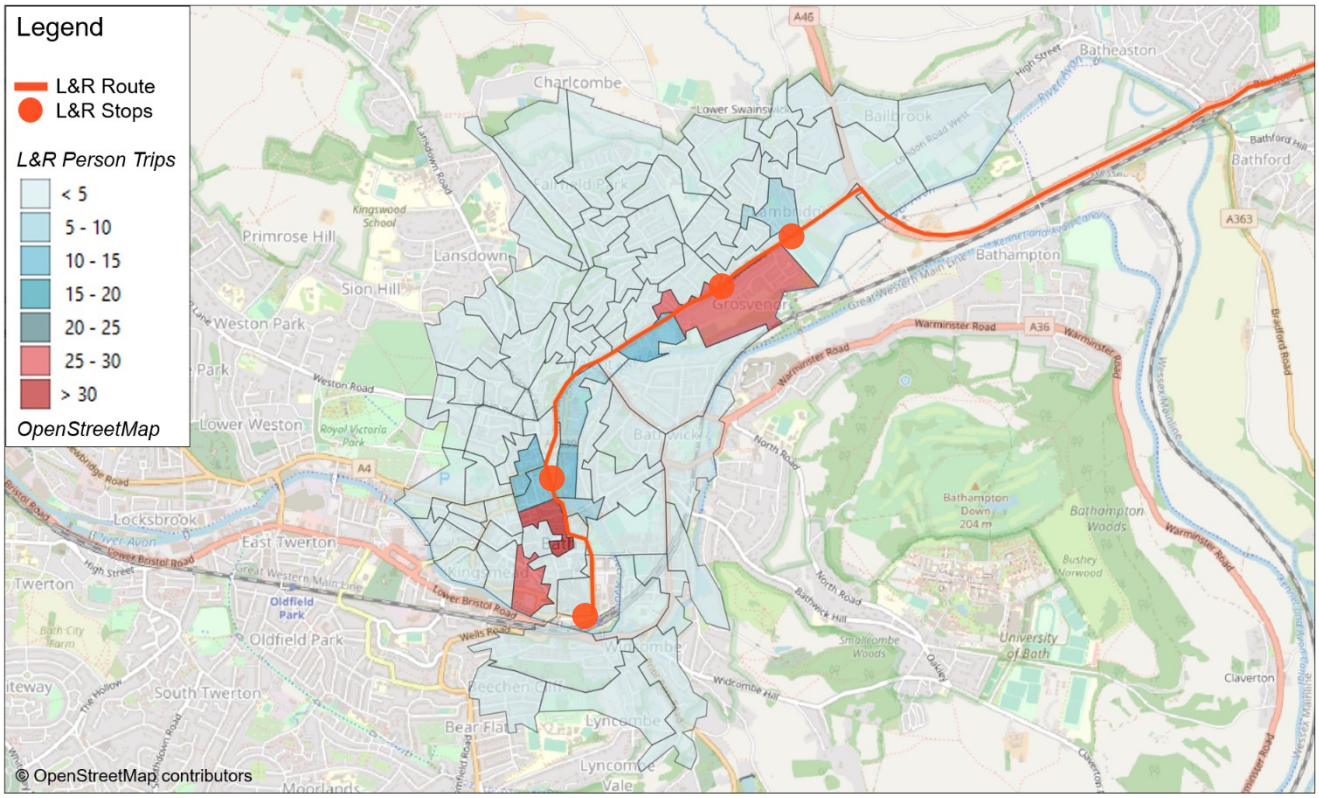


Table 6-11 shows the daily demand at six proposed interchange locations on the corridor for the seven tests (more detail on proposed interchange sites is given in section 9). This shows that an interchange in Bathford would experience the highest level of demand for most of the tests, followed by Chippenham, other than test E and J where Chippenham has the highest level of demand.

Table 6-11 - Daily demand by interchange location (2019 model year)

Interchange location	A – X31 route	B – Direct route	D – Increase frequency	E – Cap fares	F – Bus priority measures	J – Combined option	K - Alternating direct & X31 service offer
Chippenham	44	65	66	249	65	339	52
Corsham	4	6	6	65	6	90	6
Rudloe	0	1	1	10	1	14	1
Box	0	11	12	39	11	50	11
Ashley	7	0	0	2	0	3	0
Bathford	104	132	172	209	149	297	147

Total	159	215	257	574	233	793	217

6.3.3. Covid-19 sensitivity test results

As noted previously, it is acknowledged that the Covid-19 pandemic has had a significant impact on bus patronage levels which could potentially lead to future changes in the bus industry.

Due to the uncertainty regarding if and when patronage levels will return to pre-pandemic levels, a number of sensitivity tests have been undertaken to calculate total daily demand on the proposed L&R bus service if demand was reduced by 50%, 70% or 80%. The results are presented in Table 6-12.

Table 6-12 - Covid-19 sensitivity test – total daily demand (2019 model year)

Sensitivity test – reduction in daily patronage	Scenario B – Direct route	Scenario D – Increase frequency	Scenario E – Cap fares	Scenario F – Bus priority measures	Scenario J – Combined option	Scenario K - Alternating direct & X31 service offer
100%	215	257	574	233	793	220
50%	108	129	287	117	397	102
70%	65	77	172	70	238	61
80%	43	51	115	47	159	41

7. Carbon assessment for L&R scheme

7.1. Introduction

This section details the carbon assessment for the L&R concept. The aim of the carbon assessment is to understand the primary emissions impacts of the L&R scheme capturing:

- Net additional emissions generated by the new and any re-specified bus services; and
- Emissions savings associated with reduced numbers and lengths of car trips due to mode switch to the Link and Ride.

Carbon impacts have been assessed for the L&R scenarios presented in Table 7-1. The assessment for scenarios B-J are based on the L&R concept being a direct, standalone service operating along the corridor and considers the potential change in car vehicle kilometres from car users intercepted by variations of a direct service. Scenario A considers the current X31 service and potential change in car vehicle kilometres from car users intercepted by the current X31 service. Scenario K considers the potential change in car vehicle kilometres from car users intercepted by a service alternating between the direct and current X31 routes. Note that for scenario K the assessment has only been undertaken for the direct service (not the existing X31 service) in order to understand the level of additional carbon emissions generated.

Table 7-1 - Service tests modelled as part of the carbon assessment

Demand assessment reference	Scenario name	Description
A	Baseline	Current X31 route
B	Direct route	4km shorter than X31
D	Direct & increase frequency	Increase frequency
E	Direct & cap fares	Cap fares at existing P&R fare level
F	Direct & bus priority measures	Reduced bus JT to reflect bus priority
J	Direct - combined option	Higher frequency, lower fares and bus priority measures
K	Alternating direct & X31 service offer	Alternating direct & X31 service offer

A summary of both the methodology and results is provided below, the detailed methodology and results are provided in Appendix C.

7.2. Approach

The carbon emissions assessment focussed on the impacts of the forecast change in car and bus vehicle kilometres as a result of the L&R options.

Annual car vehicle kilometres for each scenario and origin-destination (OD) pair, and total annual vehicle kilometres for the proposed bus service, were extracted from the transport model to inform the assessment.

Travel speed has an important influence on vehicle emissions. As such, the forecast changes in car vehicle kilometres as a result of each scenario were disaggregated by speed band on the basis of the traffic conditions on the road that the vehicle kilometres were assumed to be removed from.

Emissions estimates for the change in car vehicle kilometres were calculated in three steps:

- Allocate the change in car vehicle kilometres for each L&R option to an assumed car fleet mix (accounting for mix of vehicle types) for car journeys affected by the L&R.
- Calculate the fuel consumption/electricity use associated with the annual change in vehicle kilometres for each fuel/energy type in each speed band in each year.
- Convert the change in fuel and electricity consumption estimates to estimated change in emissions by year using the DfT and BEIS carbon intensity factors (well to wheel17 kg CO2e/ litre of fuel or kWh of electricity) by year.

Bus emission factors (well to wheel in kgCO_2e/vehicle km) were extracted from the DfT's Transport Energy Model[18]. Factors for years after 2017 were derived by applying the efficiency improvement assumptions by year and the reduction in carbon intensity of electricity generation (for electric buses) set out in DfT's TAG databook[19].

7.3. Scenario results

Table 7-2 and Figure 7-1 show the change in daily private car veh-kms and carbon emissions generated as a result of the L&R scheme for each of the scenarios (2019 and 2029 model years) if an all-diesel or all-electric bus fleet was operating on the service.

These results are based on the vehicle fleet mix projections in the current DfT TAG databook. However, it is noted that these projections do not account for the ban on the sales of petrol and diesel cars and vans from 2030 that the UK Government announced in November 2020. This ban will accelerate the uptake of electric vehicles and the reduction in average car emissions levels, reducing the emissions savings from car vehicle kilometre reductions in 2029.

[17] Well to wheel emissions factors account for emissions associated with producing and transporting the fuel/energy, upstream of the fuelling point as well as Tank to Wheel emissions (i.e. emissions associated with vehicle use).
[18] pg 33 - https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/739462/transport-energy-model.pdf
[19] This approach averaged out fleet upgrades over the course of the appraisal period, assuming bus emissions were consistent with the fleet average in each year rather than identifying an assumed bus type and associated emissions for its full lifetime

Table 7-2 - Change in daily private car veh-kms and carbon emissions generated by scenario (2019 and 2029)

Year	Measure	A - Baseline	B – Direct route	D – Increase frequency	E – Cap fares	F – Bus priority measures	J – Combined option	K - Alternating direct & X31 service offer
2019	Change in daily private car veh-kms	-1,250 (-0.3%)	-1,701 (-0.4%)	-1,758 (-0.4%)	-5,371 (-1.2%)	-1,731 (-0.4%)	-7,006 (-1.5%)	-1,455 (-0.3%)
2019	Carbon emissions (tonnes CO2e p.a) – diesel fleet	796	588	971	0	581	148	333*
2019	Carbon emissions (tonnes CO2e p.a) – electric fleet	-52	-109	-37	-705	-117	-859	-170
2029	Change in daily private car veh-kms	-1,322 (-0.3%)	-1,740 (-0.4%)	-1,785 (-0.4%)	-4,660 (-0.9%)	-1,763 (-0.4%)	-6,724 (-1.3%)	-1,443 (-0.3%)
2029	Carbon emissions (tonnes CO2e p.a) – diesel fleet	831	645	1,030	380	643	621	398*
2029	Carbon emissions (tonnes CO2e p.a) – electric fleet	-80	-115	-65	-386	-117	-484	-153

*Additional carbon emissions from direct service only

These results reveal the balance between the additional emissions generated by the additional bus kilometres and the emissions savings caused by the reduction in car vehicle kilometres due to mode switch to L&R.

An all-diesel L&R bus fleet would lead to a net disbenefit for scenarios A, B, D, F, J and K in both 2019 and 2029. This is due to there being insufficient car vehicle km savings to offset the additional carbon impacts of running a new diesel bus service.

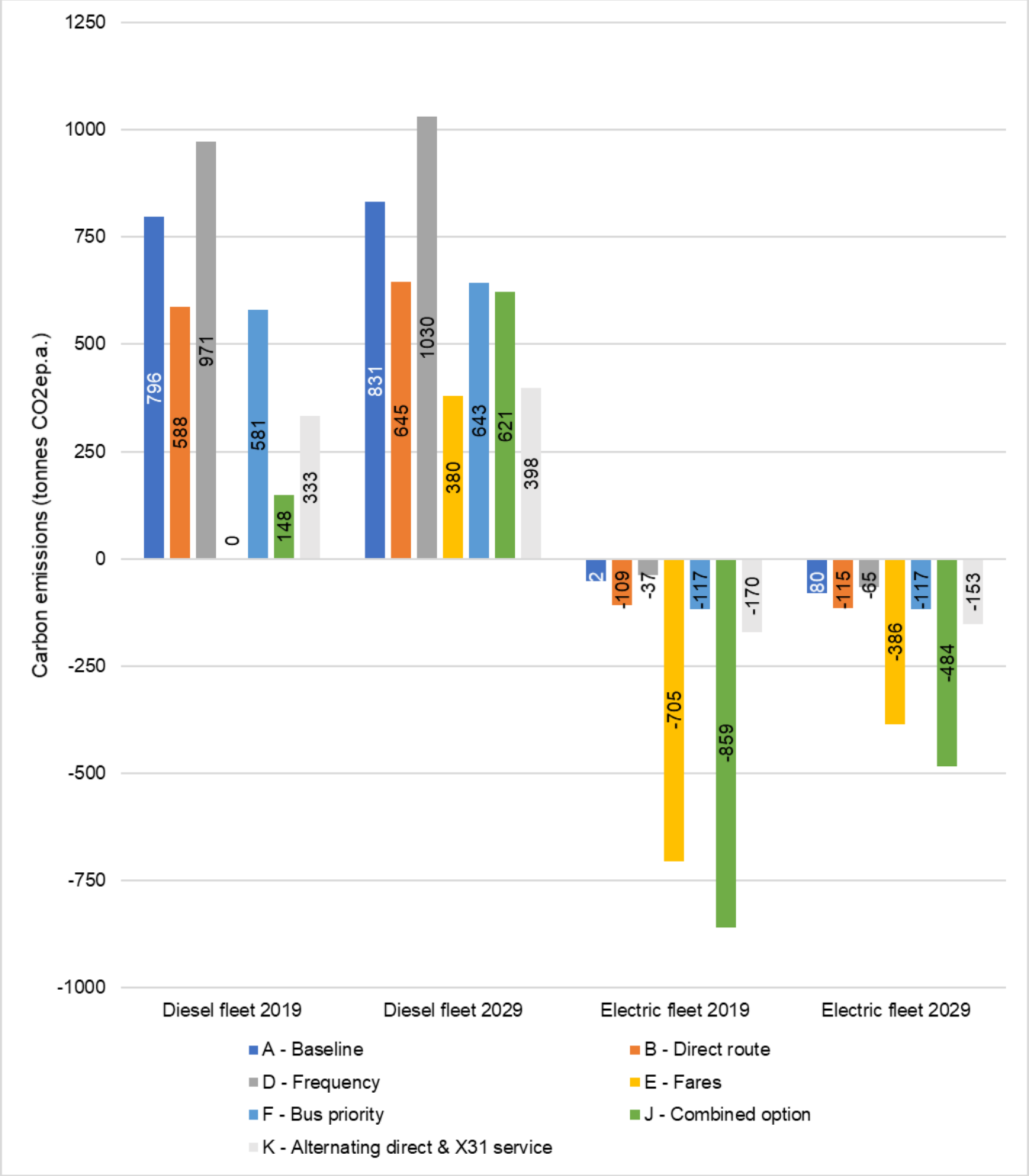
In the case of scenario E, where increased patronage is encouraged through capping fares but there are no increases in bus frequency and fewer additional buses required, the reduction in car vehicle km forecast for 2019 is sufficient to offset the impact of introducing the new bus service. This is not the case for the 2029 modelled year where the forecast reduction in car vehicle kms, and associated emissions savings, is expected to be lower.

These findings suggest that reducing fare costs (scenario E) is a more favourable approach to increasing patronage in terms of carbon impacts than increasing the frequency of the service, as it does not lead to an increase in bus vehicle kms. However, this would not be feasible in reality as regulations prevent the council from introducing a competing service to existing services and undercutting their prices.

If an all-electric bus fleet is assumed then it is forecast that there would be a net carbon saving for all options, with scenario J performing the best.

A more detailed breakdown of the findings is presented in Appendix C.

Figure 7-1 - Net CO2e emissions generated by the L&R bus service concept tests (tonnes CO2e p.a.), standard TAG vehicle projections



8. Bus service operating cost model for L&R scheme

8.1. Introduction

This section details the bus operating cost model work completed for the L&R scheme. The aim of undertaking a bus operating cost model test is to provide a high-level indicator as to whether the potential daily patronage levels will generate enough revenue to cover the costs of operating the service.

8.2. Approach

8.2.1. Bus service operating costs

Atkins has a standard tool that estimates the operating costs associated with a service based on route length, frequency of buses and a given year. The costs estimated via this tool include, but are not limited to:

- Hourly-based costs – driver salary
- Distance-based costs – fuel and engineering materials e.g. tyres
- Vehicle-related costs – licensing, insurance, and depot overheads
- Capital costs per bus – upfront capital cost, refurbishment costs

The overall CPT (Confederation of Passenger Transport UK) index has been used to inflate the costs to 2019 levels. A minimum layover (i.e. break between the two sections of a round-trip) of 10% of round-trip time has been assumed, and the vehicle costs have been based on a standard single-decker bus.

8.2.2. Farebox revenue

The standard tool developed by Atkins allows for a 'fare basket' approach to calculate the average expected single trip fare. This incorporates the different fares that are available including:

- Single trip ticket
- Return trip ticket
- Weekly season ticket
- 4-weekly season ticket
- Child ticket
- Concessionary ticket

By considering the different ticket types and assuming the percentage breakdown of patrons who would be using each ticket type, an average fare per single trip is calculated and used to estimate the potential fare revenue.

8.3. Scenario results – costs vs revenue

The operating costs associated with each of the service tests carried out for the demand modelling and the carbon assessments (as detailed in section 6 and section 7 respectively) have been derived using the approach outlined in section 8.2.1. The potential farebox revenue, based on base year 2019 daily patronage outputs from the demand model, has

been derived based on the methodology outlined in section 8.2.2. By comparing the two, the anticipated annual margin associated with running the L&R bus service can be estimated for each service option.

Table 8-1 below shows the estimated annual margin based on costs versus farebox revenue for scenarios B, D, E, F, and J. There are some caveats regarding the annual margin calculations, including:

- The only revenue considered is the farebox revenue, whereas bus operators often seek revenue from other sources such as advertising.
- The daily patronage figures output from the demand model are for an average weekday yet have been considered as the expected patronage levels for all seven days of the week in the calculations below.
- The revenue is calculated based upon patronage identified in the demand assessment, this considers potential patronage which could be derived by abstracting car trips travelling into central Bath.
- As no data was available on the different ticket types purchased on the existing X31 service, it is assumed 100% of the patrons are paying the average one-way fare due to the market being considered in the demand assessment, while there could be children and concessionary tickets that provide lower revenue. This is likely to result in an overestimation of revenue.
- None of the costs that would be required to set up or maintain the L&R infrastructure (i.e. interchange sites, bus priority measures) have been included in the operating costs below.

The results set out in Table 8-1 below show that none of the service options tested are commercially viable, with the operating costs consistently outweighing the potential farebox revenue. Scenario D (increased bus frequency) has the highest absolute and percentage loss in annual margin due to the increased fleet costs required to run a high frequency service, while scenario E (capped fares) has the lowest absolute and percentage loss in annual margin due to lower operating costs and higher daily patronage levels.

Scenario K presents the costs and revenue for a service offer alternating between the direct and X31 routes. This option still does not generate sufficient demand to fill the gap in revenue, with only a slighter lower loss in annual margin than a direct route option.

Table 8-1 - Bus service operating costs (£'000s) (2019)

	B – Direct route	D – Increase frequency	E – Cap fares	F – Bus priority measures	J – Combined option	K - Alternating direct & X31 service offer
Direct costs	£1,200	£1,600	£1,200	£1,200	£1,600	£1,100
Shared costs	£200	£300	£200	£200	£300	£200
Total costs	**£1,400**	**£1,900**	**£1,400**	**£1,400**	**£1,900**	**£1,400**

Table 8-2 - Bus service demand and fare (2019)

	B – Direct route	D – Increase frequency	E – Cap fares	F – Bus priority measures	J – Combined option	K - Alternating direct & X31 service offer
Average fare/trip	£2.69	£2.69	£1.50	£2.69	£1.50	£2.69
Daily inbound patronage	215	257	574	233	793	220

Table 8-3 – Annualise (£'000s) (2019)

	B – Direct route	D – Increase frequency	E – Cap fares	F – Bus priority measures	J – Combined option	K - Alternating direct & X31 service offer*
Annual farebox revenue	£400	£500	£600	£400	£800	£500
Annual costs	£1,400	£1,900	£1,400	£1,400	£1,900	£1,400
Annual margin	**-£1,000**	**-£1,400**	**-£800**	**-£1,000**	**-£1,100**	**-£900***
% annual margin	**-70%**	**-75%**	**-55%**	**-70%**	**-55%**	**-65%**
Estimated daily inbound patronage to break even	***750***	***1,050***	***1,400***	***800***	***2,000***	***750***

*Cost for direct service only (for commercial reasons this study was not able to consider the current X31 costs or revenue)

Scenario A (the X31 route) is not included in the bus operating costs assessment. This is because the demand model outputs only consider patronage generated by a shift from car mode to L&R, however the patronage levels for a service following the current X31 route would also include existing pedestrian patronage for which no data is available.

Scenario G (direct route with interchange parking charge) is not included in the bus operating costs assessment as it is not considered an appropriate option due to deliverability risks associated with arrangements for setting up an additional parking charge for the L&R option and the impact it has on demand. It is worth noting that the Nottinghamshire scheme does not include a parking charge.

9. L&R interchange sites and bus priority

9.1. Introduction

The first part of this section outlines the methodology for identifying potential L&R interchange sites. The purpose of the interchange site identification exercise is to:

- Identify potential existing locations for interchanges along the L&R route;
- Identify potential car parking capacity at each site;
- Identify existing or required pedestrian and cycle access;
- Understand highway access for each site; and
- Understand potential constraints for each site.

As this is a feasibility study no formal discussions have taken place with land owners regarding potential L&R interchange sites. Therefore, the specific sites which have been identified (or the assessment results for each site) are not shared in this report.

Bus priority measures are considered in the second part of this section.

9.2. Interchange sites

9.2.1. Relevant scheme objectives

The East of Bath Express concept objectives are specified in section 5.3 of this report. The concept objectives which are relevant to the L&R interchange sites are highlighted in bold below:

1. Increase the numbers travelling by public transport and reduce the number of car trips travelling into central Bath, thereby reducing carbon emissions and helping to address the climate emergency.
2. Provide a commercially viable, direct bus service on the A4 between Chippenham and central Bath.
3. Achieve an optimal journey time by providing a direct bus service with minimal number of stops on the route and bus priority measures.
4. Provide interchange points at Chippenham, Corsham, Rudloe, Box, Ashley and Batheaston/Bathford to capture car trips into central Bath both from these settlements and the wider catchment.
5. Interchange locations will act as transport hubs that allows seamless journeys for those walking, cycling and using public transport. The hubs will not just include car parking provision but will also be accessible and attractive for pedestrians and cyclists and will be safe and well lit.
6. Provide a simple, easy to use bus service with distinctive branding to raise awareness and maximise ridership.

9.2.2. Approach to identifying interchange sites

As outlined in objective 4, potential interchange sites were identified in the following settlements along the A4 corridor: Chippenham, Corsham, Rudloe, Box, Ashley and Batheaston/Bathford.

When identifying potential L&R interchange sites, a holistic approach was taken to identify all existing areas of tarmac or brownfield space located on or near to the suggested direct L&R route along the A4 corridor. Identifying sites near to the direct L&R route supports scheme objective (3) regarding providing a direct bus service. To support objective (4) at least one L&R interchange site was identified for each of the listed settlements. To support objective (5), each site was assessed to understand the existing and potential scope for pedestrian and cycling access.

For the purposes of this feasibility study, no greenfield sites or green spaces were identified as they were considered outside the scope of this study. This approach is also in line with the concept and agreed with stakeholders. As noted in section 3.2.5 there is no evidence suggesting informal P&R/L&R activity on the A4 Chippenham-Bath corridor between Chippenham and Ashley which if in existence would have been considered in this exercise. However, it is understood from stakeholders that there are reports of such activity occurring in Batheaston, Bathford and Bathampton.

9.2.3. Planning considerations

A summary of the planning considerations for developing the interchange sites is provided below. Further discussion is provided in Appendix D.

The identified sites vary in the nature of their existing use. Sites include private car parks, laybys and disused parcels of land adjacent to the highway. None of the sites are currently used as an L&R interchange. The use of these sites as a L&R facility would constitute a material change in the use of the land. The provision of a L&R would not appear to constitute a highways maintenance or improvement scheme. As such the change of use would be considered ‘development’ as defined in section 55 of the Town and Country Planning Act 1990 as amended.

B&NES is the local highway authority responsible for the maintenance and improvement of the A4 corridor through Bathford as far as the border with Wiltshire Council. Wiltshire Council is the local highway authority responsible for the A4 corridor through Ashley, Box, Rudloe, Corsham and Chippenham. Local highway authorities benefit from powers of permitted development under Part 9 of Schedule 2 of the Town and Country Planning (General Permitted Development) (England) Order 2015 as amended.

While these rights extend to works undertaken by the relevant highway authority on land immediately adjacent to the highway within their area, they only apply to works which are for or incidental to the maintenance or improvement of the highway. For that reason, the provision of a Link & Ride interchange is not considered to be permitted development under Part 9.

In addition, local authorities benefit from powers of permitted development under Part 12 of the General Permitted Development Order (GPDO). These powers extend to the erection of and alteration to small ancillary buildings on land belonging to or maintained by them provided that it relates to the function that the authority provides on the land. Part 12 extends to include information kiosks, passenger shelters and similar structures that relate to a public service operated by authorities.

The change of use of the land to an L&R interchange is not considered to come under Part 12. Depending on the nature of the physical interventions required to support a Link & Ride facility, the works may be wholly or in part permitted development under Part 12. Nonetheless, planning permission would be required for the material change of use of the sites to sui generis use class from their existing uses.

At this stage, any physical interventions needed to support the use of these sites as L&R facilities have not been confirmed. Types of development that might be required could include resurfacing, alterations to highways accesses and provision of additional parking spaces, bus stops and associated street furniture. A review of the applicability of the powers of permitted development under Part 12 should be undertaken once sites have been selected and the design has been developed further. A clearer picture of the works requiring planning permission would help inform the consenting strategy; although it is likely that all works should be captured in the same planning application(s) for the material change of the use of the sites.

9.2.4. Assessing sites

An assessment of the identified sites has been conducted to consider whether any of the potential sites were suitable for more detailed consideration.

The assessment was conducted in two stages:

- Firstly, access to the locations by walking, cycling and car was considered alongside facilities for bus provision.
- Secondly, headline deliverability matters were considered.

It should be noted that a number of environmental designations and constraints exist along the corridor as recognised in section 2.4.

9.2.4.1. Access by modes

An assessment of the potential interchange locations has been conducted using available mapping data and a desktop assessment against the criteria shown in Table 9-1.

Table 9-1 - Assessment criteria for assessing access to potential interchange locations by mode

Score	Facilities for bus	Access by car	Access by cycle / walking
0	**Space constraints and safety concern**	**No parking available at location/nearby, unsuitable, or unsafe access.**	**No existing provision or unsuitable. Limited scope for improvement.**
1	**Existing provision is poor, further provision required**	**Parking accessed by existing access but unsuitable access to bus stops. Constrained capacity.**	**Limited existing provision and busy roads. Limited scope to enable improvements.**
2	**Constrained location, limited space for shelters**	**Constrained capacity, unsuitable access.**	**Narrow links and on-road routes, located away from settlement.**
3	**Existing stops with no shelters**	**Accessed by existing junctions.**	**Existing links in settlement and scope to enable improvements.**

4	Existing stops with shelters	Suitable access, scope for providing access enhancements.	High quality segregated provision.

9.2.4.2. Deliverability

A high-level assessment of deliverability has been conducted which considered:

- Land ownership;
- Capacity constraints and suitability to provide interchange facilities for all modes;
- Intercepting car trips from the corridor and routing (users would be less inclined to travel back on themselves); and
- Potential requirements for additional infrastructure, such as pedestrian crossings.

9.2.5. Parking capacity

This assessment allowed for the identification of a potential site in each settlement along the corridor. The potential number of parking spaces was then identified for each of these sites. The potential parking capacity was calculated on the following basis:

- An existing site – the number of spaces were counted using a desktop search, these are then factored by 45% to reflect that some existing locations, for example a pub, would want to maintain some parking capacity for their business use. 45% was derived from the example provided by Nottinghamshire County Council which allocated 45% of existing spaces to its L&R users.
- Sites without existing parking provision – an estimate of the site area was taken and multiplied by the factor applied in previous Park & Ride assessments for B&NES. This figure was based upon the number of parking spaces/hectare from the existing sites. The factor applied was 210 parking spaces/hectare.

The identified number of parking spaces for each location is provided in Table 9-2. It is estimated that around 276 parking spaces could be provided at the identified interchange sites.

Table 9-2 - Estimates of potential parking capacity at identified interchange sites

Interchange location	Estimated - existing/potential parking spaces	Estimated car parking spaces for L&R (*45% for existing, 100% for new)
Chippenham	100	100
Corsham	25	11
Rudloe	-	<10
Box	60	27
Ashley	40	18
Batheaston/Bathford	-	110
Total	**225**	**276**

9.2.6. Assessing demand against potential interchange capacity

The anticipated daily L&R demand and hence the number of vehicles that parking would need to be provided for is also output from the demand model. This enables a comparison against the identified potential capacity at existing brownfield sites along the direct route, as listed in Table 9-2.

Table 9-3 below compares the daily number of vehicles for the base year (2019) anticipated by the demand model at each interchange site against the identified potential capacity for each site. Scenarios E and J lead to the highest patronage levels, yet these outstrip the potential brownfield parking spaces (as identified during the interchange site identification stage of the feasibility study) at every interchange area except Ashley. It is noted that the demand model assumes 100% of the demand shifting to L&R will require a parking space at the interchange site. In reality, this is unlikely as some users may choose instead to cycle or walk to the interchange site or be dropped off at this site and is therefore identified as a constraint to this assessment. It is also assumed that the turnover of parking spaces would be low, with most vehicles staying for a minimum of half a day.

Table 9-3 - Modelled daily base year (2019) vehicles versus potential brownfield parking spaces

Interchange Area	A – X31 route	B – Direct route	D – Increase frequency	E – Cap fares	F – Bus priority measures	J – Combined option	K - Alternating direct & X31 service offer	Brownfield parking spaces
Chippenham	44	65	66	249	65	339	52	Approx. 100
Corsham	4	6	6	65	6	90	6	Approx. 10
Rudloe	0	1	1	10	1	14	1	Approx. 10
Box	0	11	12	39	11	50	11	Approx. 30
Ashley	7	0	0	2	0	3	0	Approx. 20
Bathford	104	132	172	209	149	297	147	Approx. 110
Total	*159*	*215*	*257*	*574*	*233*	*793*	217	*Approx. 280*

9.2.7. Interchange concept – mobility hubs and points

The identified sites vary in nature, with some locations being existing car parks with limited provision for interchanges whilst others are currently being used for activities but have no parking or interchange facilities present. The delivery of interchange sites to enable the Link & Ride concept to function will depend upon the availability of funding, land purchase or landowner agreements and planning permission.

Interchange sites will need to be developed in accordance with best practice guidance and local policies. In the case of the East of Bath Express concept, six of the interchange sites are located within Wiltshire - the Bathford site is the only one located within B&NES. There is

no specific guidance available for the specification of bus stops or interchanges in Wiltshire or B&NES, however recent work on the Future Transport Zones (FTZ) in B&NES and the WECA region focusses on mobility hubs.

The principle of mobility hubs is consistent with the aims of the East of Bath Express concept. Mobility hubs provide more than a simple car park for users to park and access a bus service, they provide interchange facilities for a range of modes.

The concept of mobility hubs and points in the B&NES and WECA FTZ is outlined in

Figure 9-1. Due to the varying nature of the identified interchange sites for the East of Bath Express in some cases a mobility point rather than a mobility hub may be more appropriate. An illustrative layout for the mobility hub concept is provided in

Figure 9-2.

Figure 9-1 - Mobility hub and points concept - B&NES and WECA Future Transport Zone

Table 4 – Mobility hubs and points

	Mobility Hub	Mobility Points
Detail	Larger Mobility Stations, with a range of services offered. This could be in a neighbourhood centre, linked to a train station, park and ride site or a major trip attractor (e.g. Southmead Hospital).	Smaller Mobility Stations, that serve local communities. These may just be a bus stop with appropriate branding and route information but could have additional services integrated.
Proposed features	• Integrated public transport services. • Cycle parking infrastructure. • Digital map and wayfinding. • Micromobility options. • EV charging for shared and/or private vehicles. • Car share bays and vehicles. • Drop-off/pick-up points, for passenger/logistics. • A covered waiting area. • Commercial facilities e.g. a cafe. • Parcel locker/freight consolidation.	• Consistent branding. • If located on a public transport route, public transport will be integrated. • Services to connect users to public transport, including micromobility and DDRT. • Cycle parking infrastructure – whether a Sheffield stand, secure covered storage or lockers. • Static map and wayfinding information. • Potential for parcel lockers/freight consolidation based on size.

Figure 9-2 - Illustration of the mobility hub concept - B&NES and WECA Future Transport Zone

9.3. Bus priority measures

Engagement with Faresaver, Wiltshire Council, B&NES officers and analysis of congestion and real time data has identified delays for inbound services being the primary challenge. The following locations are where delays have been identified for bus services on the A4 corridor between Chippenham and Bath:

- Westbound approach to A350 Chequers roundabout (A4 Bath Road/A350 junction)
- Westbound approach Corsham – A4 Bath Road/B3353 roundabout (next to Hares & Hounds pub)
- Westbound Box – A4 Bath Road/Devizes road signalised junction
- Westbound A4 Batheaston Bypass/London Road East/A363 Bradford Road roundabout.
- Westbound A4 Batheaston Bypass/A46/London Road West/London Road East grade separated junction.
- Central Bath – Grand Parade to bus station.

A high-level assessment of the potential for bus priority measures at these locations has been conducted, this is provided in Table 9-4.

Table 9-4 - High level assessment of bus priority measures

	Location	Potential bus priority measure
a	Inbound - westbound approach to A350 Chequers roundabout (A4 Bath Road/A350 junction)	A recent scheme implemented by Wiltshire Council has widened the westbound approaches to the roundabout. Existing constraints, to the southern side of the A4 western approach to the roundabout mean that providing a further lane for bus priority would require extensive works. These constraints are primarily a steep embankment close to the highway boundary and Tree Preservation Orders (TPOs). Further information is available in the general arrangement drawings available here: Outline-business-case-a350-improvements.pdf (wiltshire.gov.uk) There could be potential to consider reallocating the additional highway capacity to prioritising bus services but would need to be discussed with Wiltshire Council.
b	Inbound - westbound approach Corsham – A4 Bath Road/B3353 roundabout (next to Hares & Hounds pub)	Constraints at this junction: • Proximity of the listed building (Hare & Hounds) to the highway and narrow footway on the southern side. • Footway & wall constraints on the north side. • Conservation area. Providing a priority lane for buses is considered to not be feasible at this location. Would need to be discussed with Wiltshire Council.

c	Inbound - westbound approach to Box – A4 Bath Road/Devizes Road signalised junction	Constraints at this junction: • Limited highway and footway width. • Historic walls and memorial. • Listed buildings (within 60m of the junction) • Conservation area. • Greenbelt. • AONB. Providing a priority lane for buses is considered to not be feasible at this location. Vehicle activated priority at the signalised junction could be considered, subject to existing signalling equipment or replacement of existing. Would need to be discussed with Wiltshire Council.
d	Inbound - westbound approach A4 Batheaston Bypass/London Road East/A363 Bradford Road roundabout.	Potential to provide priority lane for buses on the westbound approach to the junction. Appears to be sufficient space within the highway boundary to widen the highway to enable this. There may be a need for additional land beyond the highway boundary.
e	Inbound - westbound exit slip at the A4 Batheaston Bypass/A46/London Road West/London Road East grade separated junction.	Bus lane on the exit slip for the A4 London Road westbound lane, extend the existing A4 London Road bus lane to connect with this. To provide continuous bus lane from the exit slip onto London Road. This is being considered as part of a separate exercise to consider further opportunities for bus priority along the A4 London Road corridor.
f	Inbound and outbound journeys Central Bath – Grand Parade to bus station.	Currently buses are delayed at pedestrian crossings and traffic signals on this section of the route. Pedestrian access at these locations will need to be maintained, therefore detailed consideration of revalidation of traffic signal coordination and timings or re-routing general traffic in the central area would need to be considered to enable and improve bus priority in central Bath.

Further development of these will need to consider the benefits for the whole and against the costs. As noted in the demand assessment, journey time savings are a small proportion of the total journey time due to the length of the route and, as such, has a small impact on abstracting car trips travelling into central Bath.

10. Conclusions and next steps

10.1. East of Bath Express feasibility study conclusions

10.1.1. Headline findings

The East of Bath Express feasibility study has assessed the potential for a L&R bus service along the A4 corridor to improve access to Bath from the east. This study has undertaken several steps including identifying potential L&R interchange sites, demand modelling to understand abstraction rates from car, a carbon assessment to assess how the abstraction from car can help reduce carbon emissions along the corridor and a bus operating costs model to assess the potential commercial viability for a L&R bus service.

The headline findings from the study are:

- All of the options tested in terms of an L&R bus service have shown to abstract some car trips for journeys on the A4 into central Bath. Lower fares and a combined package of measures including lower fares, a high frequency service and bus priority have the greatest impact on levels of abstraction.
- Abstraction of car trips to the L&R bus service reduces the car vehicle kilometres travelled for the in-scope trips.
- To drive demand to commercially viable levels, the L&R between Chippenham and Bath would need to be delivered as part of a wider package of measures, including demand management measures. This wider package of measures is currently being developed through the Journey to Net Zero project that will identify the short medium and long term transport improvements that are required to address the climate emergency declared by B&NES in 2019. If a zero emission bus fleet were to be used then the abstraction of car trips could result in significant operational carbon reductions.
- Interchange sites have been identified to accommodate a proportion of the abstracted car trips. Options to further maximise access to these locations for pedestrians, cyclists and buses could be explored to minimise the need to identify additional locations.

Further discussion of the findings is provided below.

10.1.2. Discussion of headline findings

The study identified potential interchange locations along the A4 corridor to meet the scheme objectives. Access to these locations and potential parking capacity has been assessed in section 9, and planning permission would be needed for any interchange set up as described in section 9.2.3.

Through the demand modelling task, the study identified there is potential to abstract car trips to a bus service by providing parking interchanges along the bus route. This potential is increased by adjusting service options such as providing a direct bus route, capping the fare, and increasing bus frequency. However, the patronage outputs show that the demand for parking could exceed the potential brownfield capacity identified in section 9.

Bus priority locations have been identified as part of the study, but the demand model testing shows that the measures would not have a strong influence on demand, compared to other measures. This is because they are located in areas where there is little congestion and

therefore offer small changes in journey times that, due to the length of the route, have a limited impact on overall journey time. However, it is noted that there may be some potential wider behaviour benefits from bus priority measures due to car drivers noticing buses being able to bypass traffic, increasing the attractiveness of travel by bus for some people.

The operational carbon assessment identified that there is sufficient demand to achieve a carbon reduction in all scenarios (through abstraction of car vehicle trips) if an electric bus fleet were to be used.

The operational carbon assessment of a diesel fleet identified that reducing the fares is a more favourable approach to increasing patronage in terms of carbon impacts compared to increasing the frequency of the service, as it does not lead to an increase in the number of buses and therefore total bus vehicle kilometres. It should be noted however that current regulations prevent the council from introducing a competing service to existing services and undercutting their prices. However, there may be scope to consider pricing for services along the corridor, subject to BSIP funding and agreements in Enhanced Partnerships.

The study identified that operating costs exceed potential revenue for a standalone direct service for any tested service option, although it is noted there is potential for a service to break even financially if an external policy measure were implemented that significantly increased demand. Potential demand management measures which could increase demand for the L&R bus service are being investigated as part of a wider package of measures for the Journey to Net Zero project.

There is also a risk that a direct service could abstract demand from any existing commercial service, but this has not been tested and is a recognised constraint to the study. There is the option to conduct further work to consider additional corridors, such as a Melksham route.

Table 10-1 summarises the study's findings for scenarios B, D, E, F, J and K.

Table 10-1 - Summary of study outputs

		Scenario B - Direct route	Scenario D - Direct route & increased frequency	Scenario E - Direct route & capped fares	Scenario F - Direct route & bus priority measures	Scenario J – Combined package of measures	Scenario K – Alternating Direct & X31 service offer
Demand assessment	In-scope inbound vehicle trips in defined corridor (daily estimate)	7,369	7,369	7,369	7,369	7,369	7,369
Demand assessment	Estimated daily L&R bus service concept inbound patronage (persons)	215	257	574	233	793	220
Demand assessment	Estimated daily inbound vehicle trips removed by L&R	182	218	470	200	640	207
Demand assessment	Proportion of in-scope daily inbound vehicle trips removed by L&R	3%	3%	6%	3%	9%	3%
Demand assessment	Estimated change in daily private car veh-kms	-1,701 (-0.4%)	-1,758 (-0.4%)	-5,371 (-1.2%)	-1,731 (-0.4%)	-7,006 (-1.5%)	-1,455 (-0.3%)
Carbon assessment	Carbon emissions - net change (tonnes CO2e p.a) – diesel bus fleet	588	971	0	581	148	+333*
Carbon assessment	Carbon emissions - net change (tonnes CO2e p.a) – electric bus fleet	-109	-37	-705	-117	-859	-170

Cost assessment of a standalone bus service	Annual margin (estimated revenue - diesel bus operating costs, £'000s)	-£1,000	-£1,400	-£800	-£1,000	-£1,100	-£900**
Cost assessment of a standalone bus service	Estimated daily inbound patronage to break even	750	1,050	1,400	800	2,000	750
Interchange assessment	Identified brownfield parking spaces	~276	~276	~276	~276	~276	~276

*Additional carbon emissions from direct service only

***Cost for direct service only (for commercial reasons this study was not able to consider the current X31 costs or revenue)

10.1.3. Assessment against concept objectives

Table 10-2 shows the assessment of the L&R concept against the scheme objectives. This highlights that while the L&R concept as developed for this feasibility study has been shown to achieve some of the concept objectives, the findings identify that further work would be required to meet the requirements for several other objectives.

Table 10-2 - L&R concept assessed against concept objectives

Concept objective	Assessment
Provide commercially viable, direct bus service on the A4	The bus operating costs model has shown that a standalone, direct L&R bus service (in addition to the current X31) is unlikely to be commercially viable without higher patronage . The operating cost assessment is an initial high level assessment; further work and discussions with bus operators may identify different options for providing a commercially viable service. The study has identified the most effective drivers of demand that could increase abstraction from the car to the L&R bus service. Further consideration of these as part of a package of measures, including wider policy and demand management measures, could help further maximise patronage and revenue to offset operating costs.
Optimise bus journey time	The study has shown that a direct service, with minimal stops, has the potential to enhance journey times along the corridor, including by removing the time taken to travel through Corsham and Rudloe as per the existing X31 service. The feasibility study has identified potential locations for bus priority measures to improve bus journey times and reliability.
Provide interchange points at settlements	The study has identified potential interchange sites at existing brownfield locations at each settlement, but available capacity may not meet the likely demand. Further work would be required to consider these locations in more detail; in particular, through engagement with landowners.
Interchanges to include car parking provision and provide for pedestrians and cyclists	The study identified potential interchange locations which could be accessed by all modes, although enabling works would be required at some locations. Further work would be required to consider additional parking capacity at locations beyond the scope of this study. This should also seek to further maximise the potential for pedestrian, cycle and bus to provide access to these interchange locations in order to promote reduced car use and hence minimise the need to identify additional locations. Further work would be needed to confirm the feasibility of the interchange locations, including land and planning risks. This should include engagement with landowners.

Reduce car trips travelling into central Bath, contribute to B&NES carbon reduction targets	The study has shown that a L&R scheme could reduce the number of inbound daily car trips travelling into central Bath via the A4 corridor (up to 640 in scenario test J). If a zero emission bus fleet were introduced, the tests have identified a significant reduction in carbon, however further work would be required to: a) establish the most appropriate zero emissions technology for buses operating on this route; b) identify funding; and c) establish its contribution to the B&NES carbon reduction targets.

10.1.4. Possible options going forward

There are several possible options going forward to adapt the current initial L&R bus service concept so it can best meet the scheme objectives, including:

- Undertaking the further detailed work as outlined in the table above.
- Considering a short-term trial using one of the identified interchange sites that lies on the existing X31 service route. This could involve a low set-up cost and would not require any change to existing bus services but could help identify the potential demand for such a scheme. This would require careful management to avoid such a scheme becoming too popular, with demand for car parking becoming unmanageable and resulting in unintended consequences for local neighbourhoods.
- Considering options for feeder services to provide access to the X31 service or the L&R concept, including potentially connecting to a direct Royal United Hospitals (RUH) Bath feeder service. This could drive up demand and could take the form of demand responsive transport. Such an exercise would need to consider the cost implications of providing the service.
- Identifying further car parking capacity or additional measures to increase pedestrian, cycle and bus access to the interchange locations in order to minimise the need for additional car parking. The study has shown that the existing brownfield site capacity identified along the A4 corridor, in its current form, is not sufficient to meet the demands associated with a commercially viable standalone service.

10.1.5. Next steps for the L&R concept

Suggested next steps for the currently developed L&R concept are as follows:

- B&NES, WECA and Wiltshire Council to discuss the possible options going forward, as set out in section 10.1.4, and to better understand how a L&R could be progressed as part of the wider BSIP and associated Enhanced Partnerships.
- B&NES, WECA and Wiltshire Council to discuss the possible options going forward with the current commercial operator, as set out in section 10.1.4.

Note there is a need to conduct discussions within the context of the regulatory environment for bus services.

It is also noted that this is the first time a detailed examination of a potential L&R scheme has been undertaken, and there is the possibility of conducting further work to consider the

feasibility of introducing L&R in other corridors to the east of Bath (and across the Western Gateway Sub-national Transport Body area).

10.2. Next steps for the A4 corridor

Ultimately there is a need to provide a viable and affordable alternative to car travel for trips in the A4 corridor. The suggested next steps for the A4 corridor are as follows:

- Consider how a phased delivery of options could provide a sustainable improvement along the corridor. Strategies to support phased delivery could include incremental improvements, with initial focus on higher demand areas.
- Discussions with the existing service operators, WECA, Western Gateway Sub-national Transport Body and Wiltshire Council to develop a joint solution for the corridor.
- Discuss any interchange aspects with landowners, if the L&R is considered to be the best option for the corridor following an option assessment study for the corridor.
- Undertake stakeholder engagement, including a public consultation, to understand how the public feel their needs and concerns for the corridor can best be addressed.
- Identify quick wins that could be implemented, subject to funding, along the corridor to improve the immediate situation, for example upgrades to existing bus stop infrastructure.

Appendix A. A4 corridor bus stop audit

A high level audit of bus stops on the route for the L&R concept is presented in Table A-1 (Bath-Chippenham direction) and Table A-2 (Chippenham-Bath direction).

As would be expected, there is a greater level of infrastructure provided within Bath. Outside of the more populated areas along the A4 the existing bus stops are normally only marked by a flag and do not have a layby or bus box. They also do not all have a proper shelter with seating and RTPI (Real Time Passenger Information). Pedestrian access is normally adequate along the route with the bus stops accessible by footpath and street lighting provided at most of the stops.

Table A-1 - Outbound bus stops - Bath-Chippenham

	Shelter/flag pole only	Layby or Bus box (on street)	Raised kerb	Seating	Pedestrian access	Lighting	RTPI sign
Manvers Street, Bath	Flag (shelter at colonnade)	Layby	Yes	No	Yes - footpath	Street lighting	Yes
Bath Abbey	Shelter	Bus box (on street)	Yes	Yes	Yes - footpath	Street lighting	Yes
Guildhall, Bath	Shelter	Layby	Yes	Yes	Yes - footpath	Street lighting	Yes
Broad Street, Bath	Flag pole	No	No	No	Yes - footpath	Street lighting	Yes
Snow Hill, Bath	Shelter	Bus box (on street)	Yes	Yes	Yes - footpath	Street lighting	Yes
Morrisons, Bath	Flag pole	Bus box (on street)	Yes	No	Yes - footpath	Street lighting	Yes
Balustrade, Bath	Flag pole	Bus box (on street)	Yes	No	Yes - footpath	Street lighting	No
Lambridge, Bath	Flag pole	Bus box (on street)	Yes	No	Yes - footpath	Street lighting	No
Westwoods, Bathford	Flag pole	No	No	No	Yes - footpath	Street lighting	No

Shockerwick Lane, Lower Shockerwick	Flag pole	No	Yes	No	Step access from footbridge over railway, footpath on other side of road	No	No
Northey Arms, Ashley	Shelter	No	Yes	Yes	Yes - footpath	No	No
Cemetery, Box	Flag pole	No	No	No	Yes - footpath	Street lighting	No
Pharmacy, Box	Flag pole	No	Yes	No	Yes - footpath	Street lighting	No
Primary School, Box	No	No	No	No	Yes - footpath	Street lighting	No
Post Office, Box	No	No	No	No	Yes - footpath	Street lighting	No
The Bassetts, Box	Shelter	Layby	Yes	Yes	Yes - footpath	Street lighting	No
Hedgesparrow Lane, Box Hill	Shelter	Layby	Yes	Yes	Yes - footpath	No	No
Rudloe Arms, Rudloe	Shelter	Layby	Yes	Yes	Yes - footpath	Street lighting	No
Two Pigs, Pickwick	Flag pole	Layby	No	No	Yes - footpath	Street lighting	No
Cross Keys, Corsham	Flag pole	Layby	Yes	No	Yes - footpath	Street lighting	No

Table A-2 – Inbound bus stops - Chippenham-Bath

	Shelter/flag pole	Layby or Bus box (on street)	Raised kerb	Seating	Pedestrian access	Lighting	RTPI
Two Pigs, Pickwick	Flag pole	No	No	No	Yes - footpath	Street lighting	No
Rudloe Arms, Rudloe	Shelter	Layby	Yes	Yes	Yes - footpath	No	No
Hedgesparrow Lane, Box Hill	Shelter	No	N/A	Yes	Footpath on other side of road	No	No
Post Office, Box	Shelter	Layby	Yes	No	Yes - footpath	Street lighting	No
Primary School, Box	Flag pole	No	No	No	Yes - footpath	Street lighting	No
Pharmacy, Box	Flag pole	No	No	No	Yes - footpath	Street lighting	No
Cemetery, Box	Flag pole	Layby	Yes	No	Yes - footpath	Street lighting	No
Northey Arms, Ashley	Shelter	No	Yes	Yes	Footpath on other side of road	No	No
Shockerwick Lane, Lower Shockerwick	Flag	No	No	No	Yes - footpath	No	No
Westwoods, Bathford	Shelter	No	Yes	No	Yes - footpath	Street lighting	No

	Shelter/flag pole	Layby or Bus box (on street)	Raised kerb	Seating	Pedestrian access	Lighting	RTPI
Lambridge, Bath	Shelter	Bus lane	Yes	Yes	Yes - footpath	Street lighting	Yes
Balustrade, Bath	Shelter	Bus lane	Yes	Yes	Yes - footpath	Street lighting	Yes
Morrisons, Bath	Flag	No	No	No	Yes - footpath	Street lighting	No
Snow Hill, Bath	Shelter	Bus box (on street)	Yes	Yes	Yes - footpath	Street lighting	Yes
Walcot Gate, Bath	Flag	No	No	No	Yes - footpath	No	No
Hilton Hotel, Bath	Shelter	Bus box (on street)	Yes	Yes	Yes - footpath	Street lighting	Yes
Grand Parade, Bath	Shelter	Bus box (on street)	No	Yes	Yes - footpath	Street lighting	No
Manvers Street, Bath	Flag	Bus box (on street)	No	No	Yes - footpath	Street lighting	No

Appendix B. Demand modelling technical note

Appendix C. Carbon assessment technical note

Appendix D. Planning advice

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