Bath & North East Somerset Council

South East Bristol and Whitchurch Transport Package

Options Assessment Report

October 2018

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Executive summary

This Options Assessment Report (OAR) sets out the evidence supporting the South East Bristol and Whitchurch Strategic Transport Schemes. It describes the process of analysing the transport challenges, defining corridor-specific objectives and identifying and assessing potential interventions. It demonstrates whether proposed schemes are anticipated to represent value for money and demonstrates and differentiation between alternative options for each of the schemes.

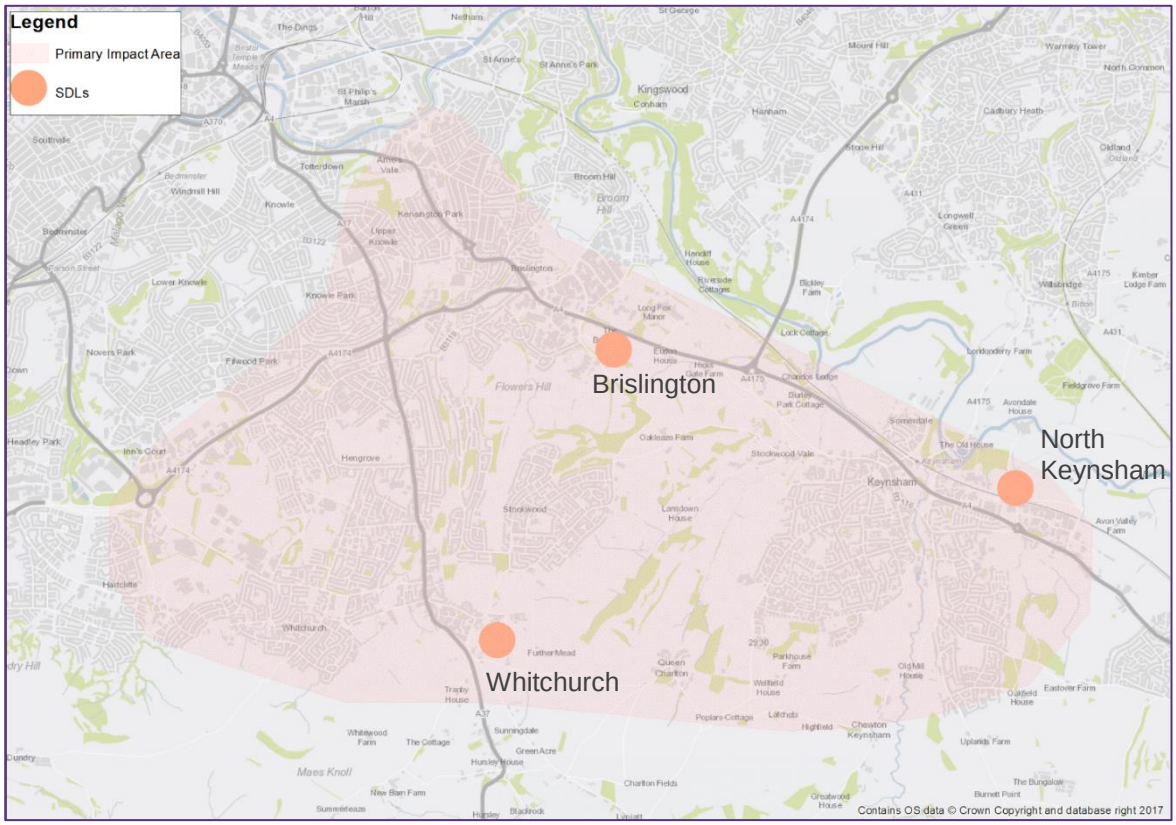
This report builds upon the findings of the previous Joint Transport Study[1], a high-level strategic study that responded to the current and future connectivity challenges in the West of England and identified strategic mitigation in support of the Strategic Development Locations (SDLs) proposed in the Joint Spatial Plan (JSP).

This OAR demonstrates how the proposed transport interventions in the South East Bristol and Whitchurch Corridor will support the proposed Local Plan allocations and meet the principles of sustainable travel described in the JSP.

Context

Figure 1 highlights the location of the SDLs of relevance to this package at Brislington, North Keynsham and Whitchurch. Table 1 summarises the JSP plan for growth in each of these SDLs and the following sections provide an overview of the planned development.

Figure 1 Strategic Development Locations (SDL) relevant to corridor



[1] https://www.jointplanningwofe.org.uk/consult.ti/JTSTransportVision

Table 1 Summary of plans for SDLs in corridor

SDL	Number of Dwellings by 2036	Total Potential Dwellings	Employment Land
Whitchurch	1,600	2,500	Primarily residential
Brislington	750	750	Primarily residential
North Keynsham	1,400	1,500	14 ha

The ambitions for growth set out in the JSP and in neighbouring regions will have implications for the future transport system and, while major improvements to the transport network have already been delivered in recent years, challenges associated with additional growth remain, as identified in the JTS. In line with the requirements of the National Planning Policy Framework (NPPF), the JSP seeks to maximise the sustainability of the SDLs, including maximising the use of active travel and public transport, it is therefore consideration of SDL growth is a critical as part of the option generating and sifting.

Issues identification, objective setting and sifting

Issues identification

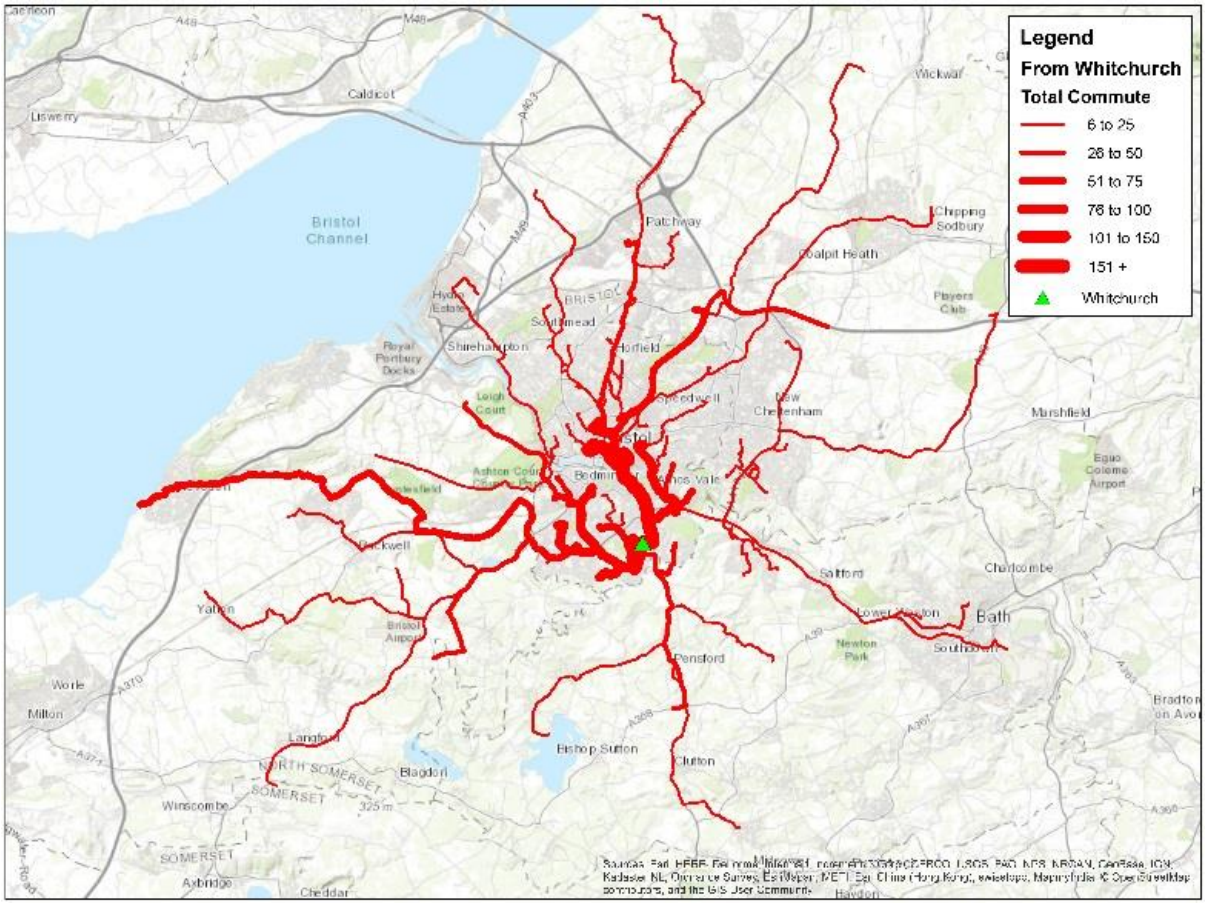
A wide range of data sources have been analysed and distilled to the following issues:

- Impact of JSP Growth. **Figure 2** shows forecast traffic flows generated by SDL sites in the AM Peak, compared to a 'Without JSP' scenario.

Figure 2 AM peak flow difference (with JSP vs. without JSP, without mitigation)

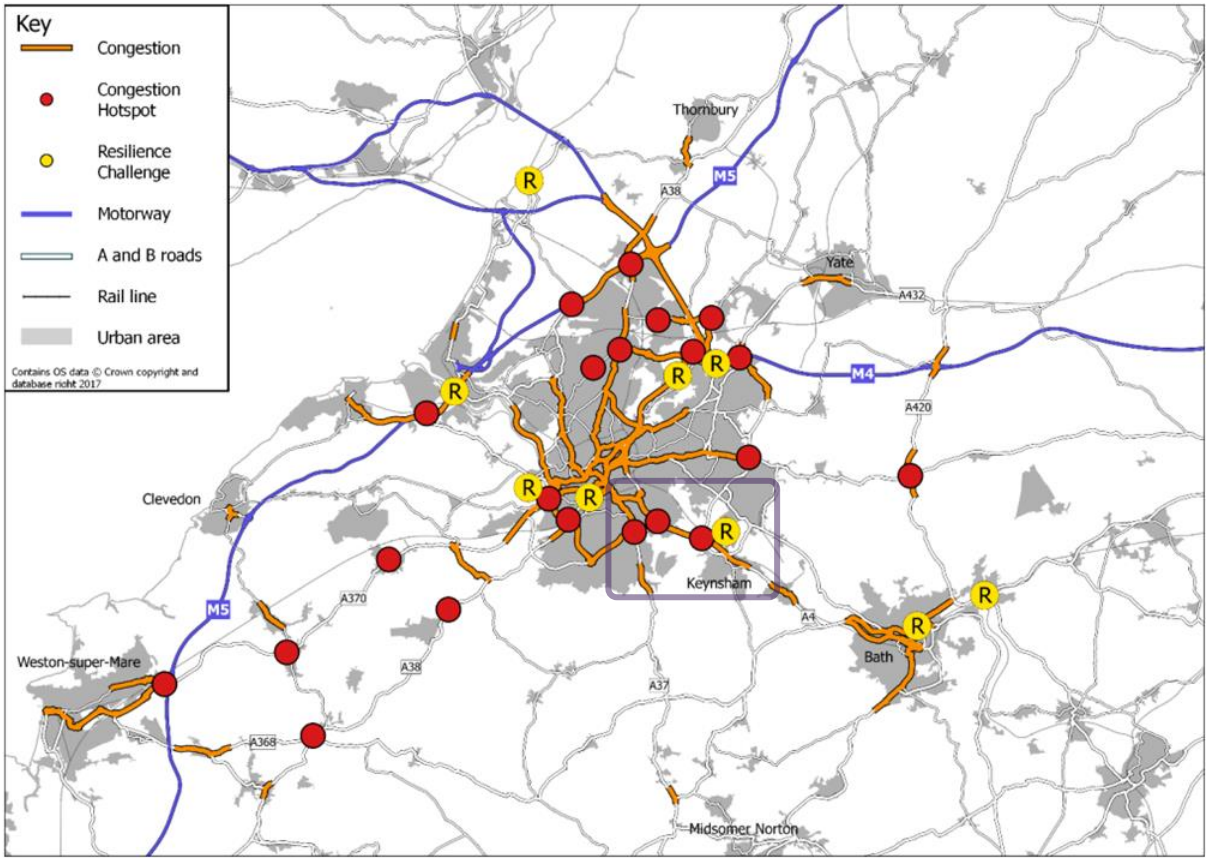
- Study area predominately residential, but with high levels of economically active residents but limited commercial offer. There is therefore a high demand for commuter travel to employment in other areas.
- Poor infrastructure and public transport service facilitating orbital movements around south Bristol. The A4174 and A4 provide the recommended route for orbital movements, and therefore carry both orbital and radial movements. There is no orbital bus service between the East Fringe and areas south of Bristol such as Whitchurch.
- Public transport serves the city centre only, particularly from Whitchurch. Commuter travel demand patterns, shown in Figure 3 (2011 Census data) shows significant demand to other destinations, with no public transport option available.

Figure 3 Commuter destinations from Whitchurch



- High traffic and congestion levels on A37, A4, A417. A summary of findings based on traffic modelling and observed existing conditions for the JTS is provided in Figure 4.

Figure 4 Key congestion hot spots in West of England



- Trips divert to the local network – particularly around Whitchurch. Local pressures are placed on minor local routes including Ridgeway Lane, Maggs Lane, minor orbital routes north east of Whitchurch, Stockwood Lane and minor routes via Queen Charlton.
- Severe delay at key locations forced to accommodate radial and orbital traffic due to a lack of alternatives. The key locations in question are Hicks Gate Roundabout and West Town Lane Junctions.

Objective setting

The issues have directly informed the corridor objectives, which were used to guide option generation and sifting of options to a short list:

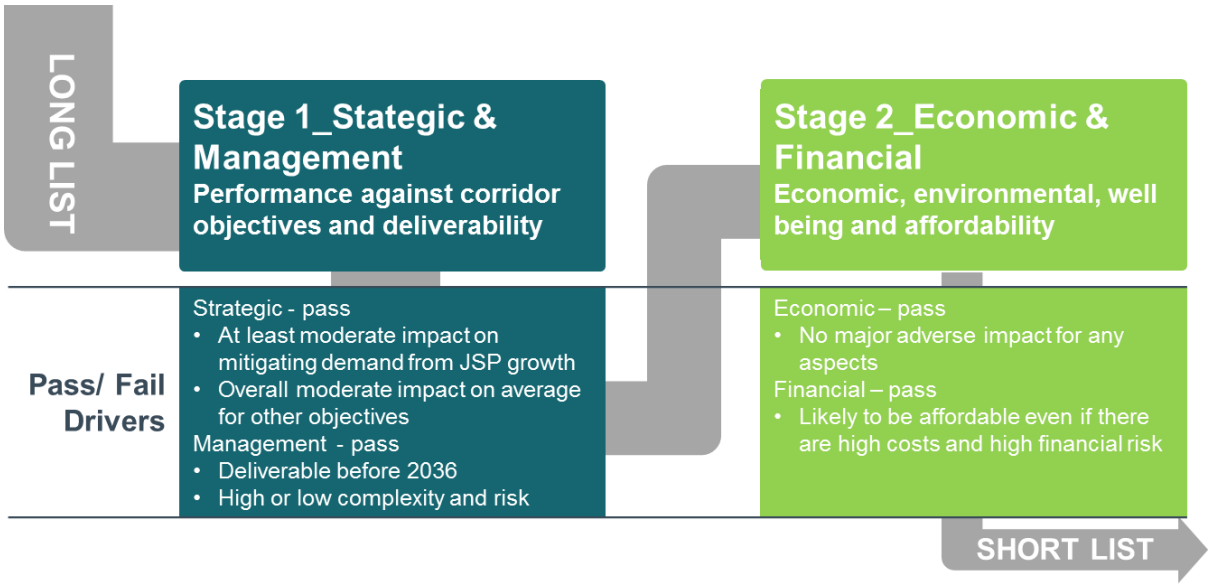
1. Mitigate increased travel demand enabling planned growth (JSP and non-JSP).
2. Provide a range of convenient and attractive journey options for south east Bristol to key destinations such as Bristol city centre and Keynsham, and for orbital movements, to enable mode shift.
3. Increase orbital connectivity to improve access around south east Bristol, reduce delays on the existing network and minimise inappropriate movements on local roads.
4. Improve journey time reliability for public transport along the corridor and for orbital movements.

Sifting

A long list of potential interventions was generated taking into account the breadth of previous work and identifying new schemes. The schemes were sifted through a two-stage process, using qualitative scoring:

- Stage 1 – Assessment against strategic and management cases;
- Stage 2 – Assessment against economic and financial cases (only schemes that passed Stage 1).

1.



The potential interventions that were taken forward as a short list for scheme development and assessment were grouped into the following packages:

- Orbital Highway link
- A37 Corridor Public Transport
- Orbital Multi-modal Corridor
- Active Travel options

Assessment of the short list

The key stages of option development and assessment comprise:

Option Development	Option Assessment
• Engineering Design Development • Public Transport only - Service Development	• *Strategic* Case (objectives fit) • *Economic* Case (economic benefits and costs, social, environmental) • *Financial* Case (capital and operating costs) • *Commercial and Management* Cases (risks, deliverability, acceptability)

A set of modelling tools has been used to model the schemes and generate the cost-benefit analysis that supports the economic case:

- The GBATS4 highway assignment model has been used for highway assessment (decongestion benefits from mode shift to MetroBus and Cycling) together with TUBA for cost-benefit analysis;
- A bespoke Public Transport Mode Choice Model has been established to forecast Public Transport demand (which is used to calculate forecast revenue) and benefits;
- Atkins' bespoke bus operating costing tool was used to guide the assessment of operating costs.
- The estimated capital, maintenance and renewal costs together with the benefits, revenue and operating cost model outputs are converted into the correct annualised price base in accordance with WebTAG and are collated in a spreadsheet cost-benefit analysis model.

The models used are appropriate for this strategic stage of scheme and model development; further forecasting granularity, detail and coverage (i.e. including accidents, reliability and wider economic impacts) can be added at subsequent stages.

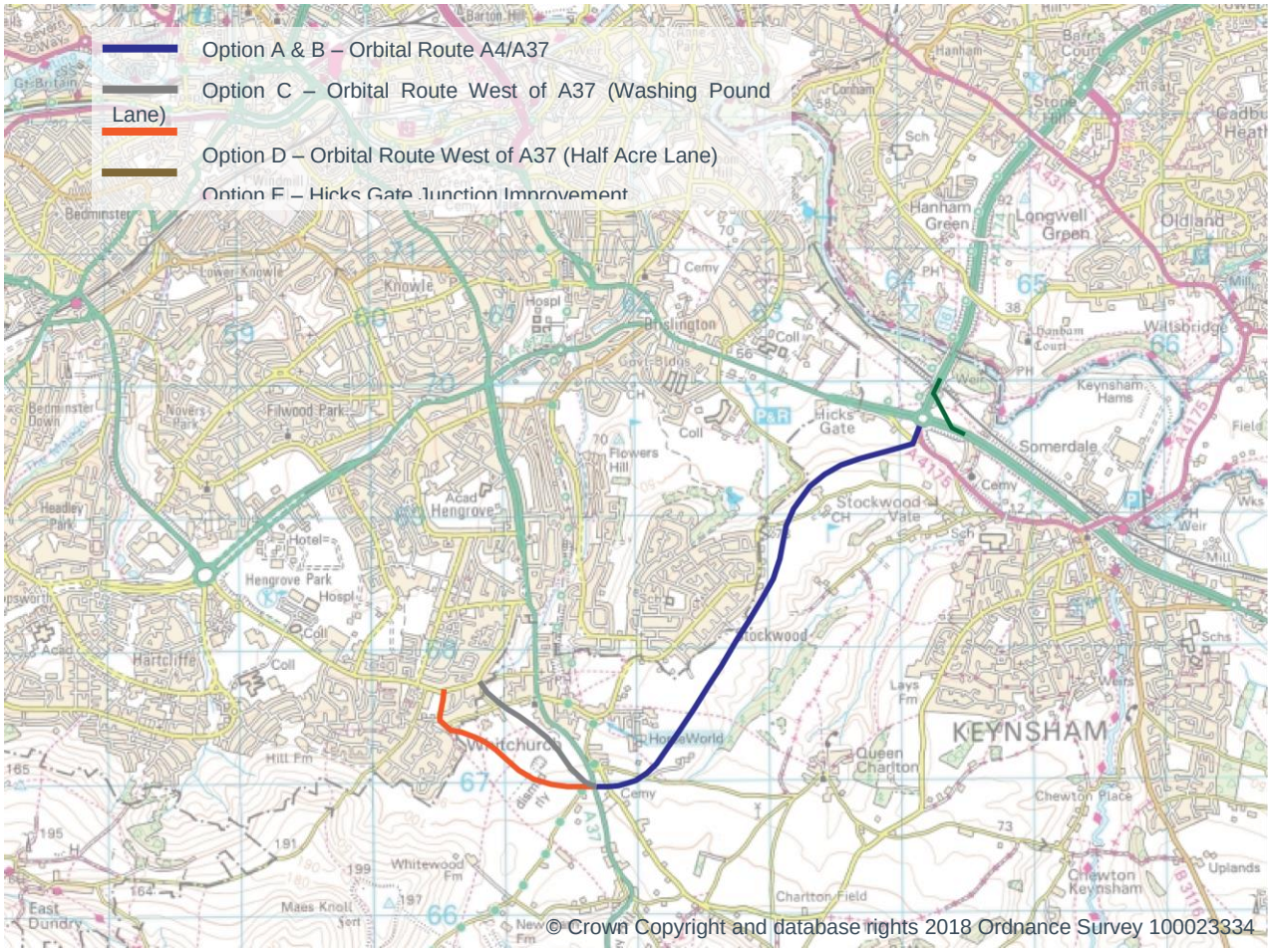
Orbital Highway Link

Option overview

The orbital highway group comprises a series of highway schemes between A4/A4174 at Hicks Gate and Whitchurch Lane, linking to Hengrove, west of Whitchurch. At this stage of scheme development, each component has been assessed in isolation, and also as a combined scheme providing the full orbital route. The options assessed are listed below and shown in Figure 5:

- Orbital Route - A4-A37 Link – Blue route:
  Option A - Orbital Route A4-A37 (40mph road providing intermediate junction access to SDL).
  Option B - Orbital Route A4-A37 (50mph road with no intermediate junction access to SDL provided).
- Orbital Route - West of A37 link:
  Option C - Orbital Route West of A37 (Washing Pound Lane) – Grey route.
  Option D - Orbital Route West of A37 (Half Acre Lane) – Orange route.
- Hicks Gate Junction Improvement:
  Option E - Hicks Gate Junction Improvement (A4 Keynsham to A4174) - Brown route

Figure 5 Orbital Highway link options



Option assessment

Strategic case

The option elements considered all strongly align with the corridor objectives, providing additional network capacity to complete an evidenced gap in the network, alleviate existing congestion issues and accommodate future growth. As a combined scheme, these benefits are further enhanced.

Economic case

As a stand-alone scheme, the A4/A37 element does not perform strongly, although at this stage transport monetised benefits have been the focus and there are further non-monetised (social impacts) and non-transport benefits (land-value uplift and wider economic impacts) that can be added at future stages. Although the other elements do perform well as stand-alone schemes, the full combined orbital scheme has the strongest case, representing high value for money, with positive social impacts. Environmental impacts have been identified, particularly with respect to water and landscape, although mitigation is viable.

Financial Case

• Orbital Route - A4-A37 Link:	c.£47-48m 2017	(c.£65-67m outturn)
• Orbital Route - West of A37 link:	c.£21-29m 2017	(c.£29-40m outturn)
• Hicks Gate Junction Improvement:	c.£2m 2017	(c.£2m outturn)
• **Combined Orbital Scheme:** [2]	**c.£75m 2017**	**(c.£105m outturn)**

[2] Based on highest cost options (B+D+E)

Management and Commercial case

- **Commercial delivery** - Likely local authority scheme promoter.
- **Risks** - Key risks identified at this stage include:
  - The relationship between the link road and Whitchurch SDL unknown (level of access, frontage etc.)
  - Land assembly
  - Development in Green Belt
  - Crosses gas and water pipeline at Hicks Gate
  - Hicks Gate junction scheme tested without A4-A37 Link – compatibility to be verified with more detailed assessment
- **Deliverability** - Moderate delivery challenges relating to water and landscape mitigation, the alignment crossing a strategic gas pipeline, and departures from standard at Hicks Gate junction.
- **Acceptability -** Likely to encounter strong issues; new highway infrastructure in green belt, impacting on local landscape and landmarks. Increased traffic through Whitchurch Lane.

A37 Corridor Public Transport

Option overview

The A37 corridor options aim to provide a high-quality public transport service from the Whitchurch area (and SDL) into Bristol and develop a new Park & Ride site at Whitchurch. The shortlisted scheme options are outlined below and shown in Figure 6.

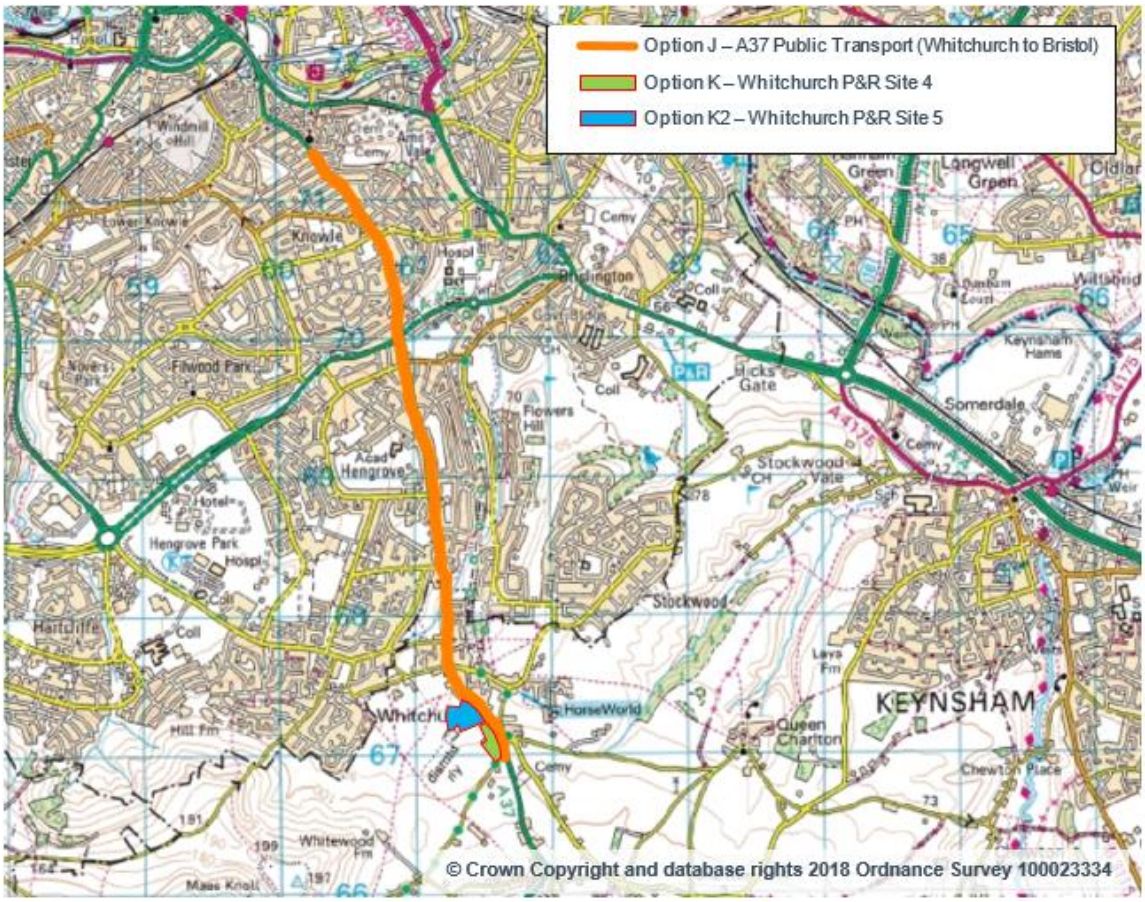
- Option J – Enhanced bus service on A37 (Whitchurch - Bristol); and
- Whitchurch P&R:
  - Option K1 – Site 4 west of A37, north of Norton Lane
  - Option K2 – Site 5 west of A37, south of Church Road.

Alternative routing options for public transport services have been considered, including an extension of the MetroBus M1 service from Hengrove to Whitchurch, and routing via the new link road to Hicks Gate and then the A4. Journey time analysis showed the A37 to provide the fastest journey times to the city centre and was therefore selected as the core option.

A high-level assessment for the potential to provide new lengths of bus lane on the A37 was undertaken. Limited opportunities to introduce new bus lanes were identified with the potential to generate a small journey time saving (c.1min). Given the very limited potential benefit, no new bus lanes have been included in the scheme design, and hence no improvement to journey time assumed.

The core assessments for this scheme assumed a new 6 bus-per-hour service is provided serving the Whitchurch SDL and P&R (in addition to the existing inter-urban 2 bus-per-hour service on the corridor. Options for service optimisation have been considered and assessed – namely a 4 bus-per-hour service comprising 2 new services and the existing 2 inter-urban services.

Figure 6 Overview of A37 public transport schemes for further assessment



Option assessment

Strategic case

Both options of an enhanced bus service frequency and new P&R align moderately with corridor and JLTP objectives, providing a range of mode options on the corridor. They mitigate against demand growth from the Whitchurch SDL by delivering a frequent public transport service directly serving the SDL and supporting the sustainable growth of the city.

Economic case

The high operating costs of enhancing the present A37 bus service frequency greatly outweighs the forecast revenue and scheme benefits particularly for the higher frequency options - a new 6BPH service. Opportunities to optimise the commercial viability of the service could result in the VfM assessment being raised to Medium (considering only monetised benefits), subject to more detailed appraisal of service operation on the corridor. A significant subsidy is likely to be required in initial stage of the service operation, as has typically been the case with other P&R services until they are fully established.

The enhanced bus service will result in beneficial social impacts with a small increase in journey quality and option values. Introducing the new Whitchurch P&R improves non-business travel options, journey quality and access to services. All options for this scheme are forecast to have either neutral, or at most slight environmental impacts.

Financial case

Capital costs:

- A37 Infrastructure: c. **£0m**
- P&R element c. **£5m** 2017 **(**c.£6m outturn)

Operating Costs:

- New 6BPH service (in addition to existing services):

£1.3m over current services. c.£1m revenue deficit - service is not commercially viable

- 4BPH service (Existing 2BPH 376 service supplemented with additional 2BPH, not serving city centre loop): c.£0.2m revenue deficit - service is not commercially viable although subsidy required is typical for P&R services until they are fully established

Management and Commercial case

- **Commercial delivery** - Likely local authority scheme promoter. Further consideration of service optimisation on the corridor is required to identify a commercially viable operation.
- **Risks** - Key risks identified at this stage include:
  - Service optimisation may not identify a commercially viable service.
  - Land assembly
  - Development in Green Belt
  - Water mitigation requirements
- **Deliverability** – Very challenging in terms of demonstrating a commercially viable service. Minor to moderate challenges to deliver the P&R site due to water mitigation, and relationship with link toad schemes.
- **Acceptability –** A37 bus service is likely to be generally acceptable with little or no issues. Some issues could be encountered with the P&R sites, being close to the residential edge of Whitchurch, and a local cemetery.

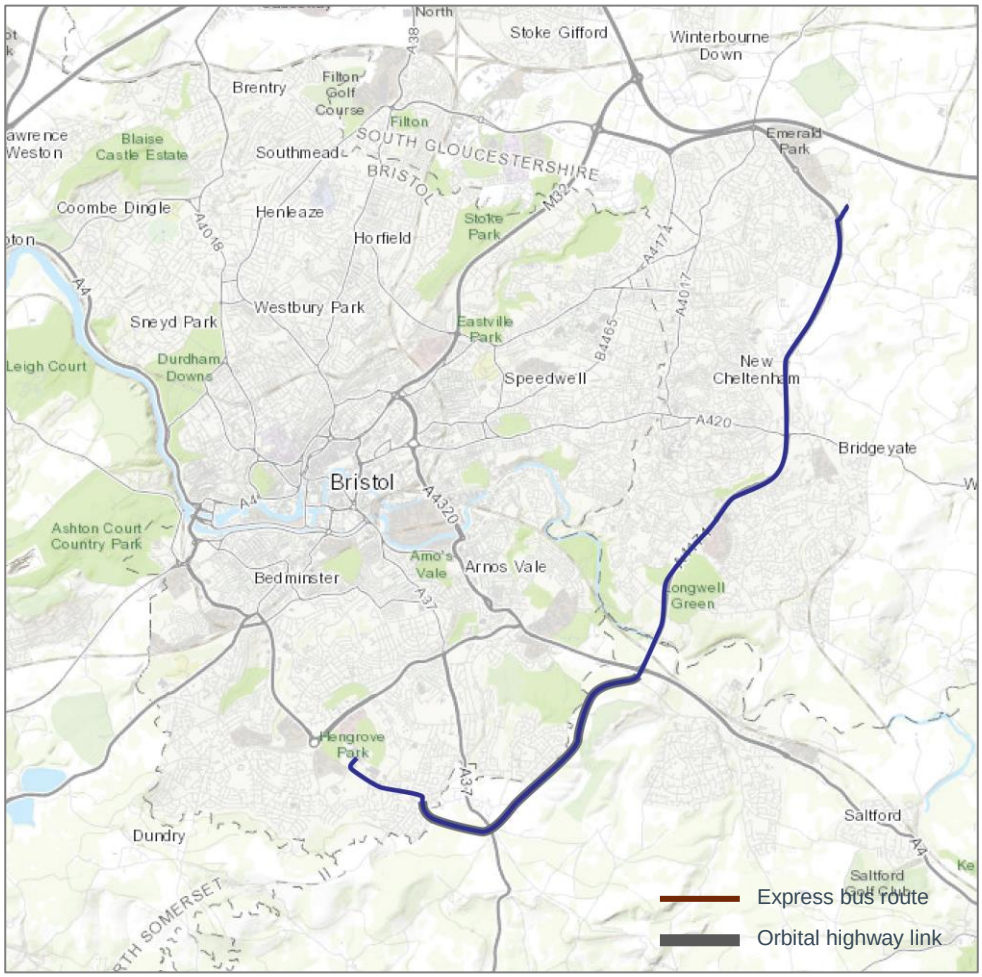
Orbital Multi-modal Corridor

Option overview

This scheme is dependent on the construction of the orbital highway link which would connect the Hicks Gate Junction to Whitchurch (see above/Chapter 6). As well as the highway link, this scheme option includes an orbital high quality express bus service between Hengrove and Emersons Green (linking to MetroBus M1 route at either end) with bus priority measures on the new link and existing ring road. See Figure 7for details.

Option L – Orbital multi-modal corridor, Hengrove to Emersons Green via Whitchurch.

Figure 7 Overview of orbital multi-modal corridor



Option assessment

Strategic case

The scheme aligns well with corridor objectives, providing a new convenient, orbital travel option, directly serving the Whitchurch SDL, and enabling orbital movements that support sustainable economic growth. The orbital multimodal corridor aligns moderately with JLTP objectives in supporting economic growth and accessibility through providing a new public transport route option.

Economic case

This scheme is expected to deliver high VfM, with the additional costs beyond constructing the highway link being broadly off-set by additional public transport benefits, and large social benefits through improving journey choice and quality for orbital movements, and access to services. Environmental impacts have been identified, particularly with respect to water and landscape, although mitigation is viable.

Financial case

Capital costs:

- Orbital Multi-modal corridor: c. **£96m** 2017 **(**c.£133m outturn)

(Additional costs over highway scheme) c. £20m 2017 **(**c.£28m outturn)

Operating Costs:

- New 2BPH service (in addition to existing services):
  £0.4m over current services. c.£0.3m revenue deficit - service is not commercially viable although subsidy required is typical for some services until they are fully established

Management and Commercial case

- **Commercial delivery** - Likely local authority scheme promoter. Further consideration of service optimisation on the corridor is required to identify a commercially viable operation.
- **Risks** - Key risks identified at this stage include:
  - Public transport service if not forecast to be commercially viable and hence further service optimisation is required
  - Public transport service dependent on construction of the potential orbital highway link between Whitchurch Lane and Hicks Gate.
  - No design feasibility assessment has been undertaken on bus priority measures on the existing A4174 ring road.
  - Relationship with Whitchurch SDL unknown
  - Land assembly
  - Development in Green Belt
  - Crosses gas and water pipeline at Hicks Gate
  - Hicks Gate junction scheme tested without A4-A37 Link – compatibility to be verified with more detailed assessment
- **Deliverability** – Moderate delivery challenges for the new highway link relating to water and landscape mitigation, the alignment crossing a strategic gas pipeline, and departures from standard at Hicks Gate junction. Feasibility of works on existing network have not been considered at this stage.
- **Acceptability** – Likely to encounter strong issues; new highway infrastructure in green belt, impacting on local landscape and landmarks. Increased traffic through Whitchurch Lane.

Active Travel

Whitchurch is well served by cycling infrastructure, lying on the existing National Cycle Network (NCN) Route 3 which follows the abandoned Whitchurch railway alignment to Bristol City Centre.

The orbital and A4 schemes discussed above include significant improvements to walking and cycling provision, and whist they are not stand-alone active travel schemes, they will provide a significant benefit to active travel trips on the corridor. These benefits have not yet been quantified in the assessments, but represent meaningful improvements.

As a result, no stand-alone strategic active travel schemes are identified at this stage, although promotion of active travel remains a key priority to deliver sustainable development and growth in this area.

Phasing

Potential scheme opening years have been calculated assuming the option is selected and progressed this year. The assumed scheme programme is shown in Table 2.

Table 2 – Phasing of Schemes

	Orbital Highway Link	A37 Corridor Public Transport		Orbital Multi-modal Corridor
		Option J: A37 Enhanced Bus Service	Option K1/K2: Whitchurch P&R	
2018				
2019				
2020		2020		
2021			2021	
2022				
2023				
2024				
2025				
2026				
2027				
2028	2028			2028
2029				

Preparatory (Business Case & Funding)

Preparatory (Design)

Construction

Opening Year — Date

Next steps

The OARs represent a significant step forward in the development of the strategic transport proposals, demonstrate the likely case and differentiation between options. However, the proposals still represent an early stage of option development, modelling and assessment. Further service optimisation and benefits capture is required in some instances to improve the VfM. Further scheme development and public consultation will be undertaken during 2018/9 as part of the Local Plan consultation process.

The Options Assessment Report (OAR) demonstrates that sufficient consideration has been given to the case for intervention, assessment of options, technical feasibility, costs, benefits, impacts, potential strength of business case and affordability of the proposed transport schemes. The OARs have been structured and prepared in accordance with best practice set out in WebTAG. These documents are not formal business cases: these will be prepared at a later date following consultation on the scheme options.

1. Introduction

1.1. Purpose of this report

This is the Options Assessment Report for the South East Bristol and Whitchurch Work Package. It describes the process of analysing the transport challenges, defining corridor-specific objectives and identifying and assessing potential interventions to tackle these challenges.

This report builds upon the findings of the previous Joint Transport Study[3], a high-level strategic study that responded to the current and future connectivity challenges in the West of England and identified strategic mitigation in support of the Strategic Development Locations proposed in the Joint Spatial Plan.

Additional work is required to support the progression of the schemes through the Local Plan making process and Department for Transport funding pipeline. The West of England authorities have therefore commissioned further technical studies to examine in more detail the transport impacts of the Strategic Development Locations, and to develop the strategic transport schemes to allow consultation to take place through the Local Plan process on potential site selection, route alignment, costs and deliverability. This technical work is documented in a series of Options Assessment Reports (OARs).

These OARs have been structured in line with best practice for transport studies, as documented in the Department for Transport's Transport Analysis Guidance (WebTAG)[4]. Specific guidance for transport studies is documented in the unit titled 'The Transport Appraisal Process'[5], which sets out a stepped process for analysis of the issues, and identification and assessment of potential options.

Whilst the OARs represent a significant step forward in the development of the strategic transport proposals, they still represent an early stage of option development, modelling and assessment. Further scheme development and public consultation will be undertaken during 2018 following the publication of the OARs, as part of the Local Plan process.

1.2. Strategic Context

There are several important strategic policies that have informed the development of the proposals described in this report. These are identified below.

National Planning Policy Framework

The National Planning Policy Framework (NPPF)[6] sets out the Government's planning policies and how these are expected to be applied. The Framework must be taken into account in local plans and is a material consideration in planning decisions. It must therefore be reflected in developing the transport proposals in this study. In particular:

- **Paragraph 162** states that local planning authorities should work with other authorities and providers to assess the quality and capacity of infrastructure for transport and its ability to meet future needs.
- **Paragraph 165** highlights the importance of the economic, social and environmental dimensions of sustainable development and that significant adverse impacts on any of these dimensions should be avoided.
- **Paragraph 182** refers to the examination of Local Plans and states that the local authority should submit a plan for examination which it considers is sound, namely that it is positively prepared, justified, effective and consistent with national policy.

[3] https://www.jointplanningwofe.org.uk/consult.ti/JTSTransportVision
[4] https://www.gov.uk/guidance/transport-analysis-guidance-webtag
[5] https://www.gov.uk/government/publications/webtag-transport-appraisal-process
[6] https://www.gov.uk/government/publications/national-planning-policy-framework--2

This OAR demonstrates how the proposed transport interventions in the South East Bristol and Whitchurch Work Package will meet the requirements of the NPPF. Section 1.5 below explains how the tests of soundness (from NPPF Paragraph 182) are demonstrated through this report.

Joint Spatial Plan and Local Plans

The West of England Joint Spatial Plan (JSP)[7] is a prospectus for sustainable growth to help the region meet its housing and transport needs for the period to 2036. The JSP is the first such joint planning approach in the UK, which takes into account cross-boundary effects within the West of England. The JSP sets out the policies and principles that have been applied in identifying future housing and employment needs and the most sustainable locations for future development.

The JSP is a strategic statutory Development Plan Document (DPD) for the West of England. It is being prepared jointly by, and will cover, the four Unitary Authorities of Bristol, Bath and North East Somerset, North Somerset and South Gloucestershire. On adoption as a DPD it will carry full weight in the planning system and provide the higher level strategic planning policy framework for each authority's new Local Plan for the period 2016 to 2036.

The JSP supports the delivery of 82,500 new jobs and 105,600 new homes by 2036, of which 61,400 homes are existing commitments and the JSP makes provision for 44,200 new homes. Of this, 17,300 homes will be in Strategic Development Locations (SDLs), 16,600 through Urban Living, 6,900 through small windfall sites and 3,400 in non-strategic growth.

The SDLs will be brought forward as allocations through each authority's new Local Plan. New site-specific allocations and policy designations in Local Plans will need to be in conformity with the JSP. Work has commenced on preparing the four Local Plans based on the current JSP proposals, although these will not be finalised until after examination and adoption of the JSP. Local Plan consultations will be undertaken throughout 2018 and will include the proposed transport schemes required to support delivery of the Local Plan allocations, including the SDLs.

This OAR demonstrates how the proposed transport interventions in the South East Bristol and Whitchurch Work Package will support the proposed Local Plan allocations and meet the principles of sustainable travel described in the JSP.

Joint Local Transport Plan

The current Joint Local Transport Plan (JLTP3) covering the period 2011 to 2026 sets out the following five key transport goals for the region (see Table 1.1 below for more detail):

- Reduce carbon emissions;
- Support economic growth;
- Promote accessibility;
- Contribute to better safety, security and health; and
- Improve quality of life and a healthy natural environment.

The West of England local authorities are currently in the process of developing a new Joint Local Transport Plan (JLTP4) for the area. This will cover the period to 2036 and will therefore align with the Joint Spatial Plan. The JLTP4 is currently being prepared, with consultation scheduled to take place during summer 2018.

The JLTP4 will consider the recommendations of the Joint Transport Study and develop a long-term transport policy framework that is consistent with the Joint Spatial Plan. It will develop a long-term investment programme shaped by a set of objectives that build on the JLTP3 goals

[7] https://www.jointplanningwofe.org.uk/consult.ti/JSPPublication/consultationHome

Table 1-1 JLTP3 Objectives

Goals	Sub-goals
Reduce carbon emissions	Reduce greenhouse gas emissions
	Provide a resilient and adaptable transport network
	Promote walking, cycling, and public transport
Support economic growth	Implement the programme of major transport schemes
	Tackle congestion
	Promote use of alternatives to the car – walking, cycling, public transport and smarter choices
	Support delivery of and access to houses and jobs
	Increase capacity and reliability of transport networks
	Maintain, manage and make best use of transport assets
Contribute to better safety, security and health	Reduce the number of road casualties
	Encourage more physically active travel – walking, cycling and public transport
	Implement Air Quality Management Areas
	Improve personal security on the transport network
Promote accessibility	Improve access to health and employment
	Assist regeneration of deprived areas in Bristol and Weston-super-Mare
	Implement the Rights of Way Improvement Plans
	Improve access for rural residents and people with mobility difficulties
Improve quality of life and a healthy natural environment	Enhance the public realm
	Minimise the impact on the natural and historic environment
	Enhance the journey experience
	Promote better access to leisure activities and the countryside
	Support Bath World Heritage site and Areas of Outstanding Natural Beauty

This OAR will provide an overall assessment of how the schemes proposed for the South East Bristol and Whitchurch Work Package will address the draft JLTP3 objectives set out in Table 1-1.

1.3. Relationship with Transport Topic Paper

A Transport Topic Paper has also been produced, which provides supporting transport evidence for the JSP and will be submitted as evidence for consideration at the Examination of the Plan. The Transport Topic Paper addresses the overall strategic transport issues in the West of England, considers the impacts of proposed development in the JSP, and presents the overarching transport infrastructure programme to meet future needs.

The Transport Topic Paper integrates the proposed infrastructure identified from this OAR for the South East Bristol and Whitchurch Work Package into the overall JSP infrastructure programme and demonstrates that this programme will mitigate the impacts of the Strategic Development Locations, Urban Living and wider growth in the JSP.

1.4. Approach to Options Assessment Reports

The Options Assessment Report (OAR) demonstrates that sufficient consideration has been given to the case for intervention, assessment of options, technical feasibility, costs, benefits, impacts, potential strength of business case and affordability of the proposed transport schemes. The OARs have been structured and

prepared in accordance with the best practice set out in WebTAG[8]. These documents are *not* formal business cases; these will be prepared at a later date following consultation on the scheme options.

In following the WebTAG approach, the OARs do not specifically consider the mitigation impacts of the transport interventions in respect of the JSP and Local Plan proposals, although the case for intervention is partially built around this. The mitigation impacts are assessed separately in the Transport Topic Paper, whilst the focus in the OARs is on development of business cases based as much as possible on committed levels of development, as required by WebTAG. This is in order to demonstrate that the transport interventions are fundable and could be progressed in advance of the developments proposed in the JSP and Local Plans. Sensitivity testing including the JSP development has been carried out in this OAR.

1.5. Structure of this report

Table 1.2 sets out the structure of this report. The table also shows which of the four NPPF tests of soundness are addressed in the evidence in each chapter.

Table 1-2 Structure of this report

Chapter		Contents of chapter	NPPF Tests of Soundness			
			Positively prepared	Justified	Effective	Consistent with nat. policy
2	Understanding the current situation	Description of study area Current travel demand Existing transport problems	Yes (evidence on needs)	-	-	-
3	Understanding the future situation	Future land uses and policies Changes to the transport system Future travel demand Future transport problems	Yes (evidence on needs)	-	-	-
4	Transport Package Objectives	Summary of problems and issues Scheme objectives and outcomes Measures for success Geographical scope	Yes (objectives for future network)	-	-	Yes (objectives consistent with policies)
5	Generating and sifting options	Approach to option generation Approach to option sifting Results of option sifting Approach to next steps	Yes (options to address objectives)	Yes (assess and sift options)	-	Yes (sifting to take account of policies)
6	Highway Schemes	Options development Options assessment Conclusions	Yes (analysis of each mode)	Yes (appraisal of costs, benefits, impacts)	Yes (assess technical feasibility)	Yes (appraisal to take account of policies)
7	A4 Public Transport Schemes					
8	A37 Public Transport Schemes					
9	Orbital Public Transport Schemes					
9	Active Travel schemes					

[8] https://www.gov.uk/government/publications/webtag-transport-appraisal-process

Chapter		Contents of chapter	NPPF Tests of Soundness			
10	Conclusions	Overall conclusions of this report	Yes	Yes	Yes	Yes

2. Understanding the current situation

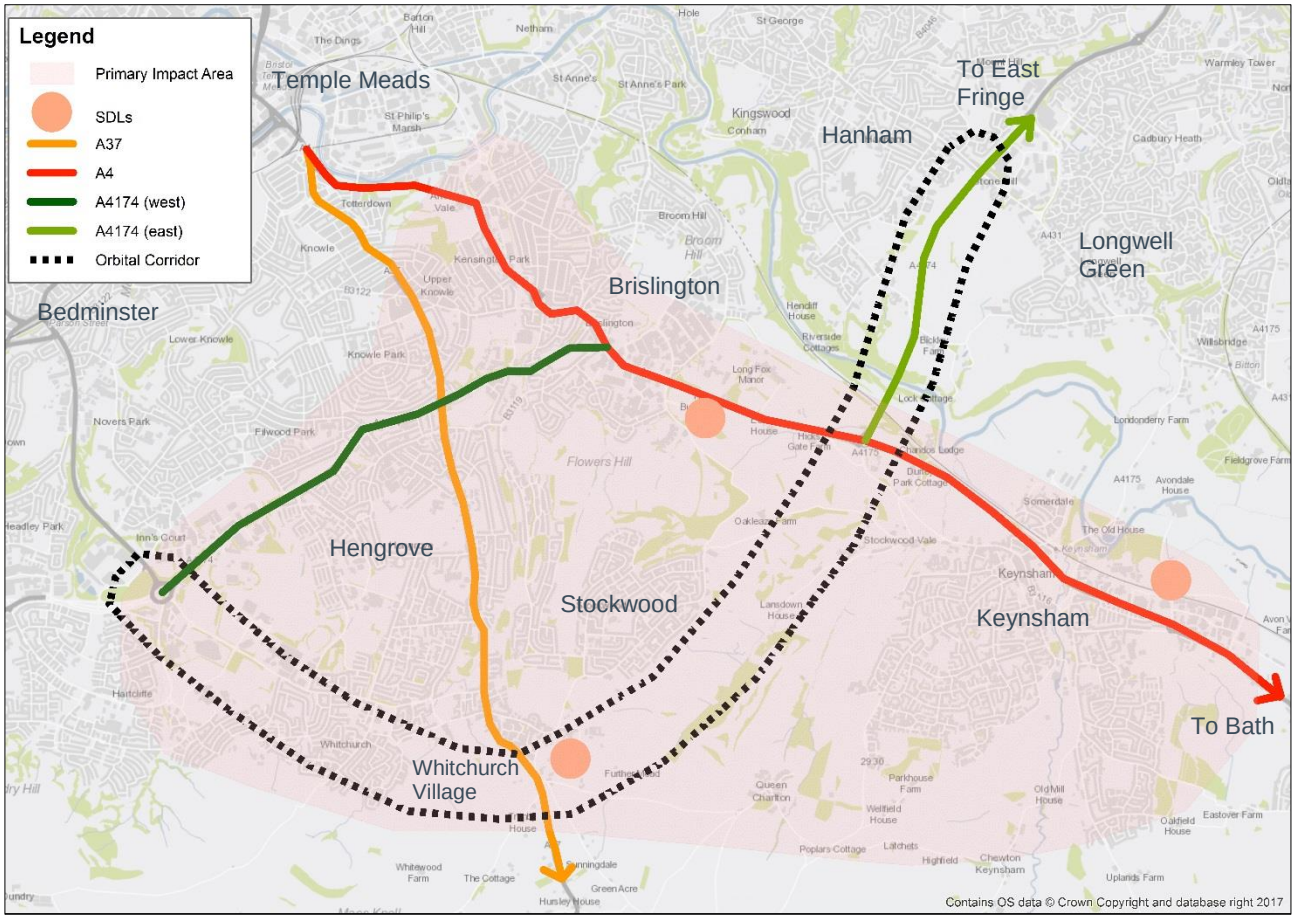
2.1. Description of the study area

The south east Bristol and Whitchurch transport package serves proposed SDL locations at Brislington, Keynsham, and Whitchurch. The package extents considered in this study have been defined to reflect the area and parts of the transport network anticipated to be most impacted by the proposed SDLs, and for which transport interventions will be required to support the SDL delivery.

The key settlements in this area are Whitchurch, Keynsham, and south east Bristol neighbourhoods including Brislington and Stockwood.

The package study area spans Bristol and Bath and North East Somerset (B&NES), and is shown in Figure 2-1.

Figure 2-1 Geographical area of the package



The A4 is the key strategic road link between Bristol and Bath and is an extremely important physical connection between these two important cities. The Great Western Mainline is broadly parallel to the A4 route, offering fast rail services between Bristol and Bath. The A37 provides direct access to Bristol from more rural areas to the south of the city, Somerset and the south. The dual-carriageway A4174 Bristol ring-road, around the north and east of the city ends at the A4 at Hicks Gate Roundabout to the east of Brislington. Orbital movements to the south and west are directed along the A4 and A4174 requiring users to travel into and back out of the city. Note the orbital corridor outlined in Figure 2-1 is indicative of the fact there is a lack of a direct orbital route.

Issue: There is no strategic link to accommodate orbital movements south of Bristol.

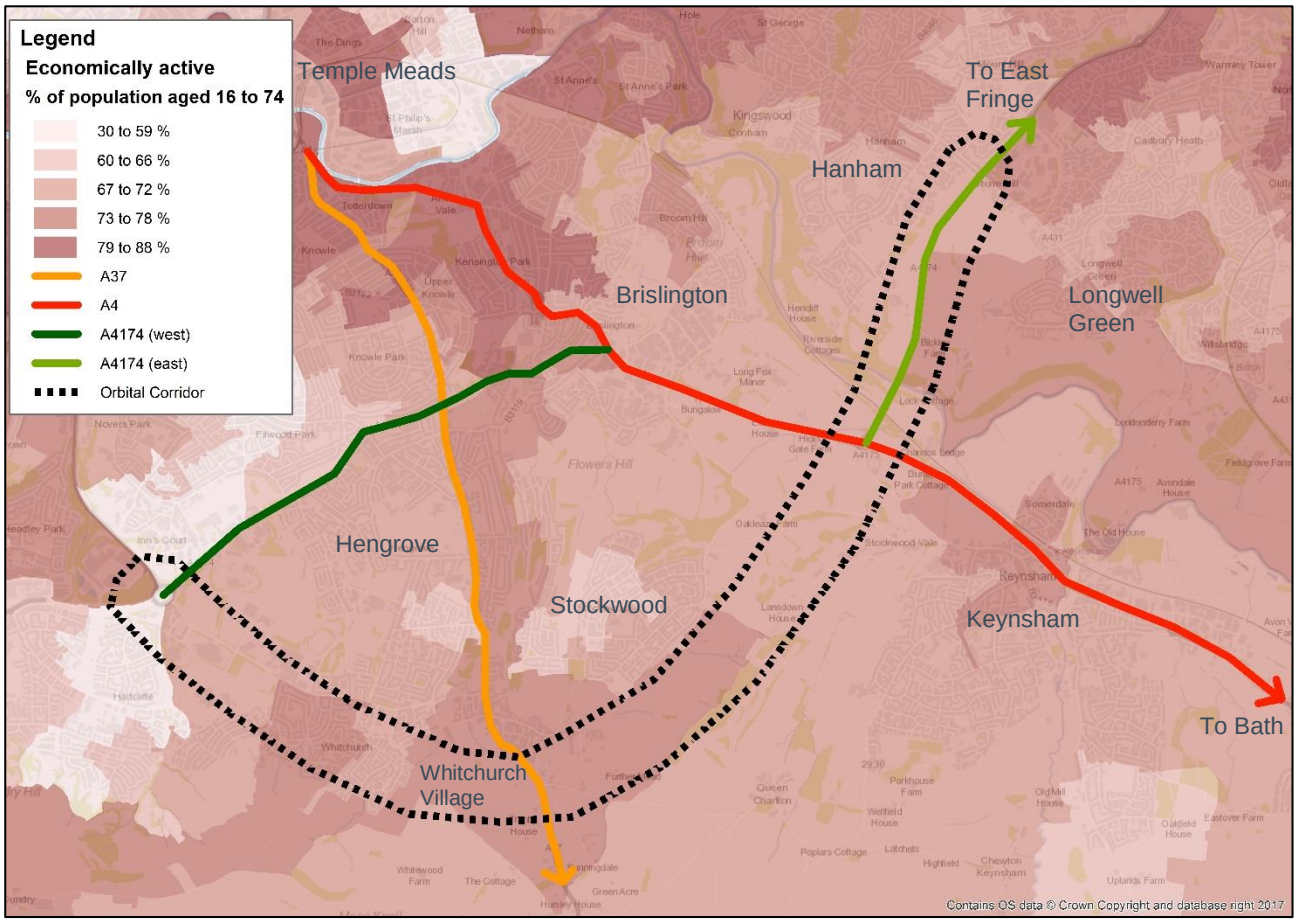
2.1.1. Land use, socio-economic and demographic context

The study area is predominately residential, including some local services and schools, but limited commercial offer. The distinct neighbourhood of Stockwood, and Whitchurch Village are separated from the Bristol urban mass by green space. To the eastern urban extent on the A4 corridor, there is a large light-industrial area providing a key employment destination.

To the south and east of the urban area, the land is mainly agricultural and open grassland, with mostly non-developed land forming part of the green belt between Bristol and Bath/Keynsham. To the east is Bath, a World Heritage Site.

Much of the area has levels of economically active work age residents broadly in line with the national average of 69.5%, as displayed in Figure 2-2. There are areas of very high levels of economic activity towards the centre of Bristol and adjacent to major roads, such as around the A4 in Brislington and Totterdown, and along the A37 in Hengrove and Whitchurch.

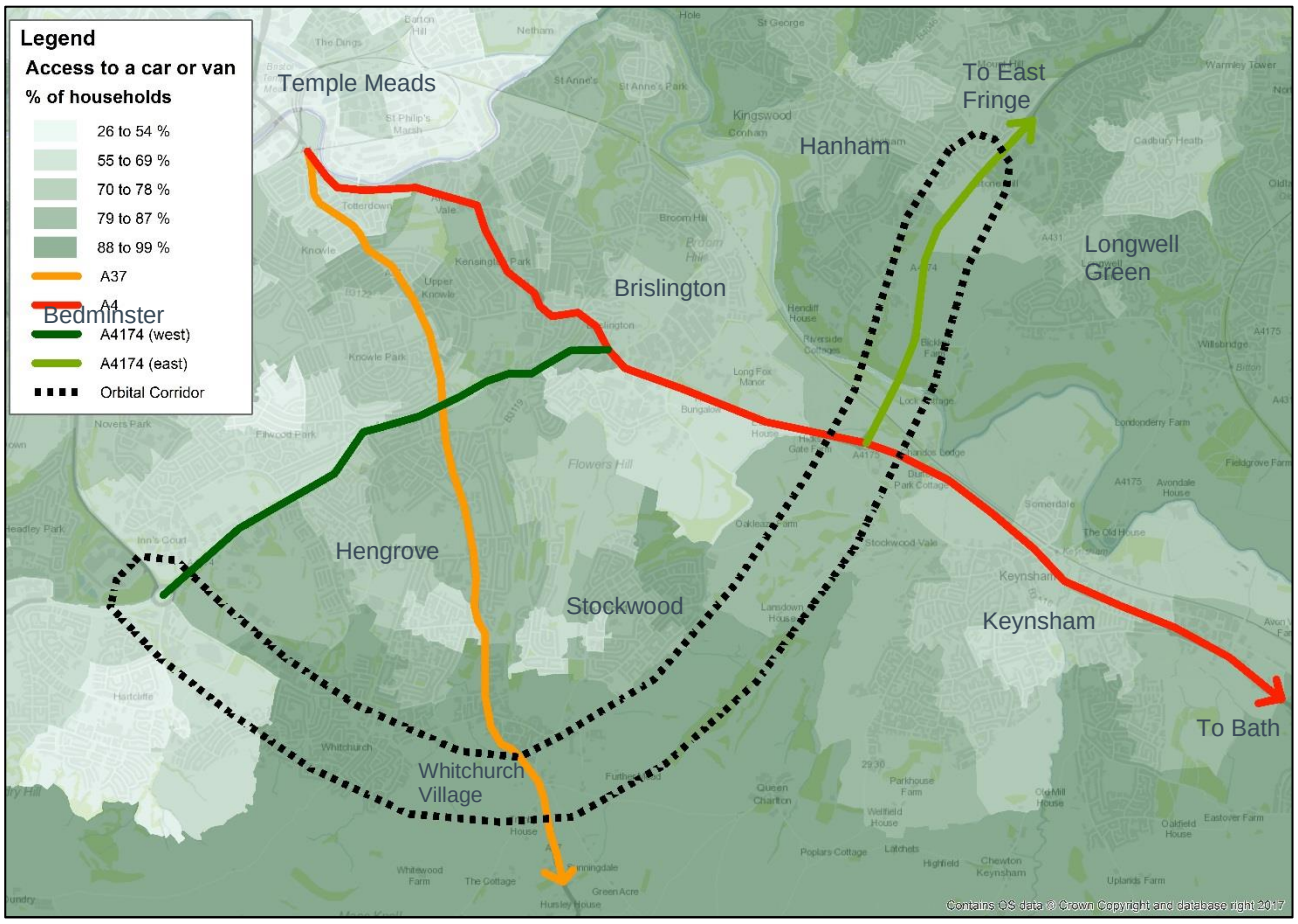
Figure 2-2 Percentage of economically active residents



Issue: Predominately residential area with above average levels of economic activity - demand to access to employment sites elsewhere.

There is a clear distinction between the rural and urban areas in relation to the percentage of households that have access to a vehicle. As shown in Figure 2-3, over 87% of households to the south of Whitchurch and to the north and south of Keynsham (which are predominantly rural) have access to a car or van. This is significantly higher than the national average of 76% (2015)[9]. Whereas urban areas in the south east of Bristol have much lower levels of car access. This reflects the quality of alternative transport options to the private car, with the rural communities more dependent on car travel.

Figure 2-3 Percentage of households with access to a car or van



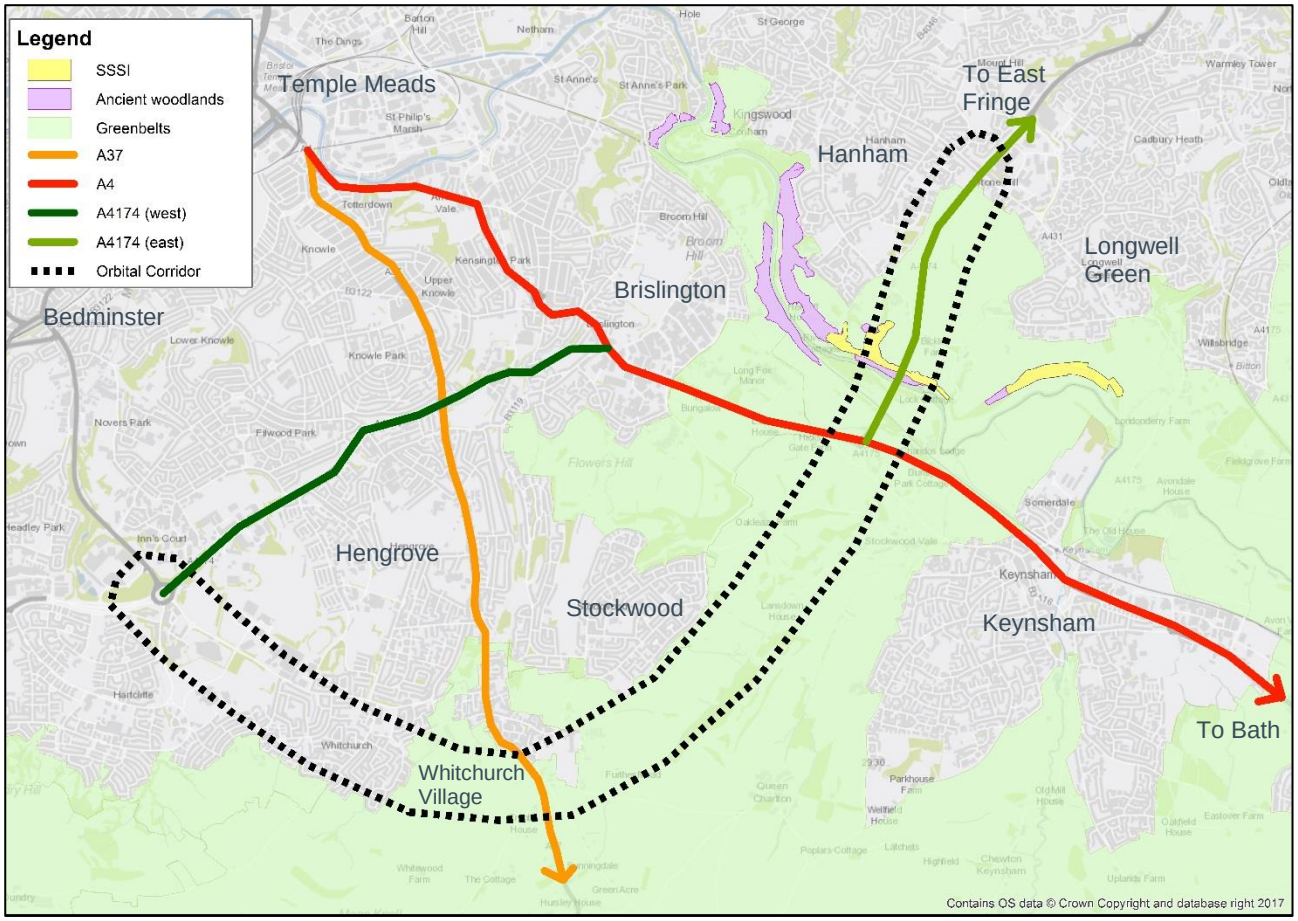
Issue: High levels of car ownership and car dependency in urban fringe and rural areas to south and east of Bristol

[9] https://www.statista.com/statistics/300036/break-down-of-people-buying-cars-in-the-united-kingdom/

2.1.2. Physical and environmental constraints

Figure 2-4, Figure 2-5 and Figure 2-6 illustrate some of the key environmental and heritage constraints in the area in terms of designations, flood risk and heritage assets respectively.

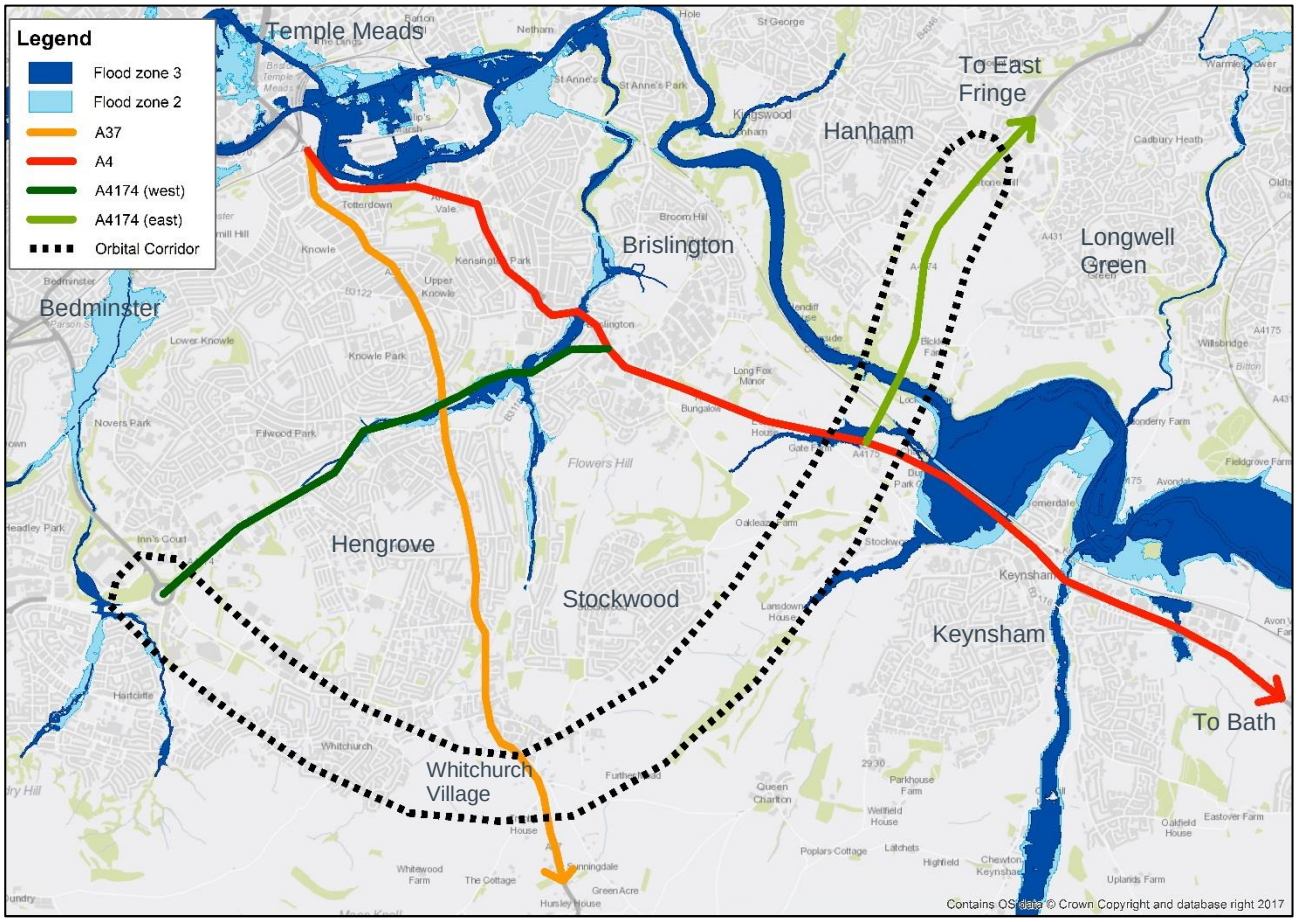
Figure 2-4 Environmental designations



The Bath and North East Somerset Green Belt covers undeveloped land between Bath and Bristol and protects the land between Whitchurch, Stockwood, Keynsham and Bristol. There are Sites of Special Scientific Interest (SSSIs) and ancient woodland north of the A4 at Hicks Gate, but not in the remainder of the study area.

Other specially protected areas such as National Parks, Areas of Outstanding Natural Beauty (AONB), nature reserves and world heritage sites, were considered however, none are located in this area.

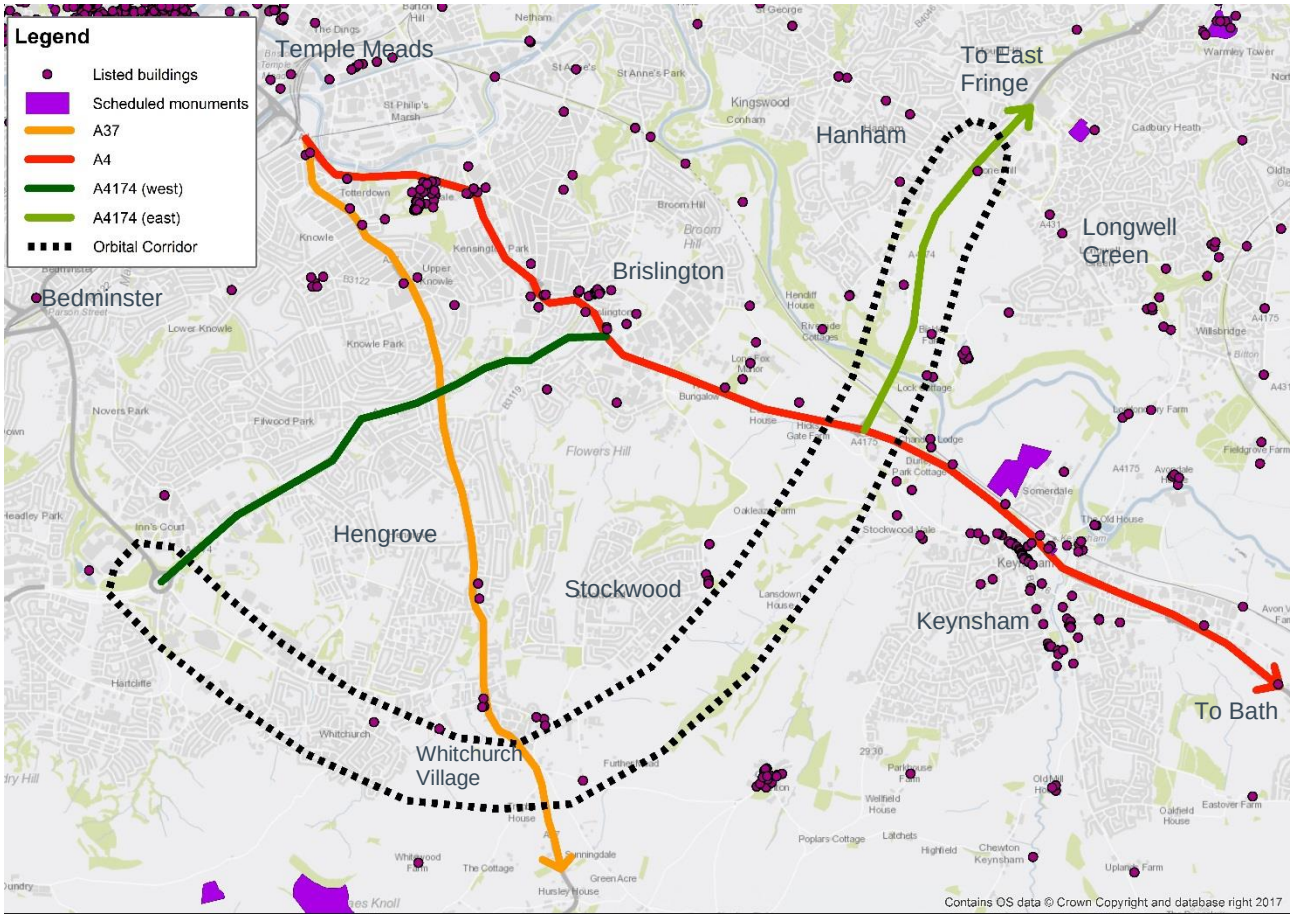
Figure 2-5 Flood zones



The designation Flood Zone 3 identifies the land greatest at risk from flooding.

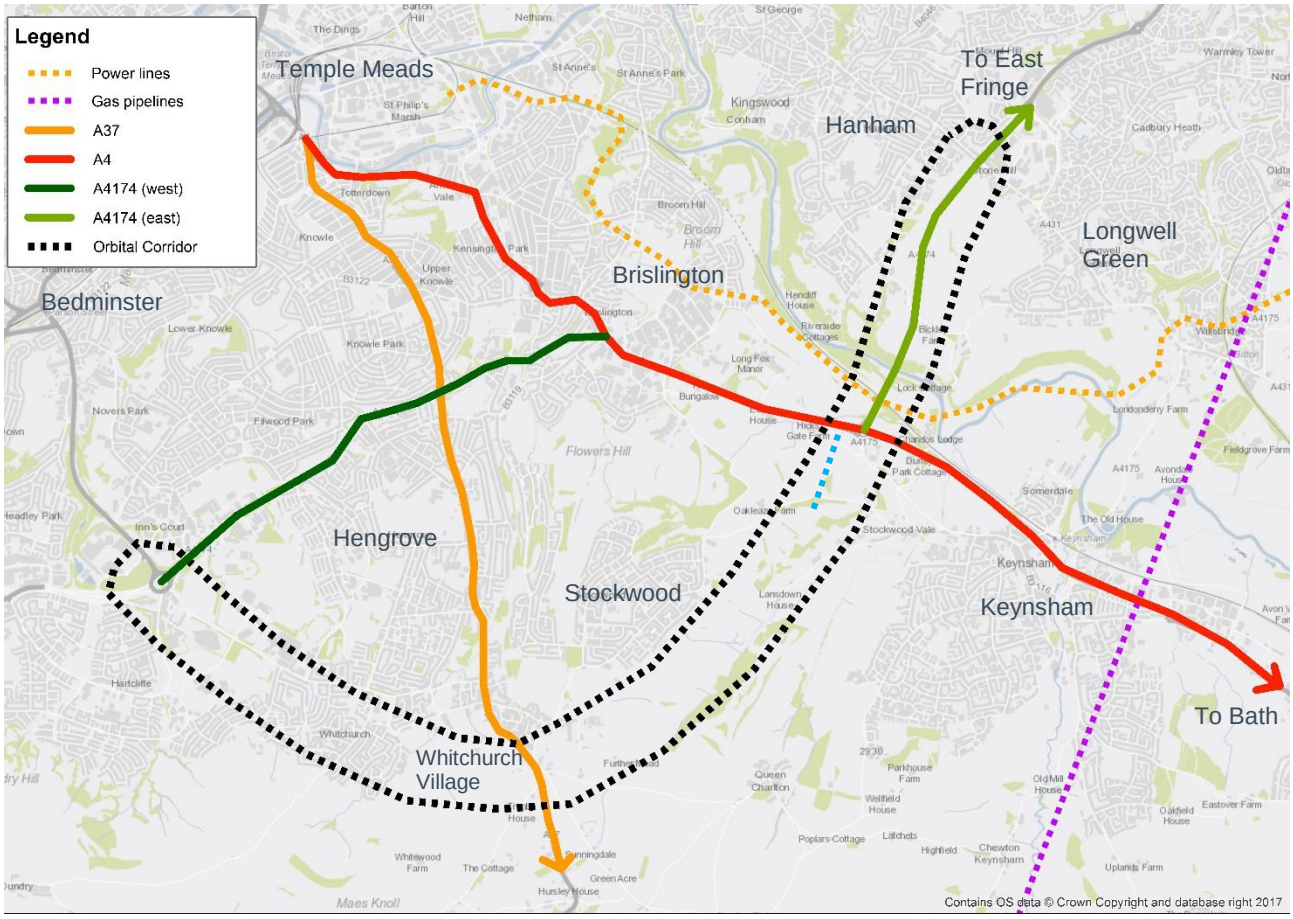
The River Avon runs to the north of the A4, and traverses relatively close to the road alignment in Totterdown and Keynsham. Between these locations the river itself is unlikely to have an impact on potential transport interventions. The Stockwood Vale Valley runs between the A4 at Hicks Gate and the A37 at Whitchurch, with steep gradients extending close to the existing urban edge at Stockwood. The deep Dundry Hill Ridge runs east-west from Dundry to south of Whitchurch into the Avon Valley.

Figure 2-6 Heritage sites



There are a number of listed buildings located throughout the study area, with a particular concentration close to the A4 in Brislington. There are scheduled monuments within the area including Maes Knoll, an Iron Age hillfort, and two sections of Wansdyke, south-west of Whitchurch.

Figure 2-7 Utilities



There are a number of listed buildings located throughout the study area, with a particular concentration close to the A4 in Brislington. There are scheduled monuments within the area including Maes Knoll, an Iron Age hillfort, and two sections of Wansdyke, south-west of Whitchurch.

Figure 2-7 shows available information relating to the location of key utilities (existing powerlines and gas pipelines) (provided by the National Grid) which may constrain any nearby development. Less strategic infrastructure will be present throughout the area, and more detailed searches of utilities equipment will be needed in future stages of work. In addition to the national grid data, there is a significant gas pipeline to the west of Hicks Gate junction – an indicative alignment shown on the plan.

Issue: Key physical and environmental constraints have been identified including:

- Green belt designation covering mostly undeveloped land between Bristol, Whitchurch, Stockwood, Keynsham and Bath;
- Flood zone areas crossing the corridor at Hicks;
- Stockwood Vale Valley and Dundry Hill Ridge with steep gradients and important landscapes;
- Scheduled monument of Maes Knoll and its setting; and
- Significant utility infrastructure west of Hicks Gate Roundabout.

2.2. Current travel demand and levels of service

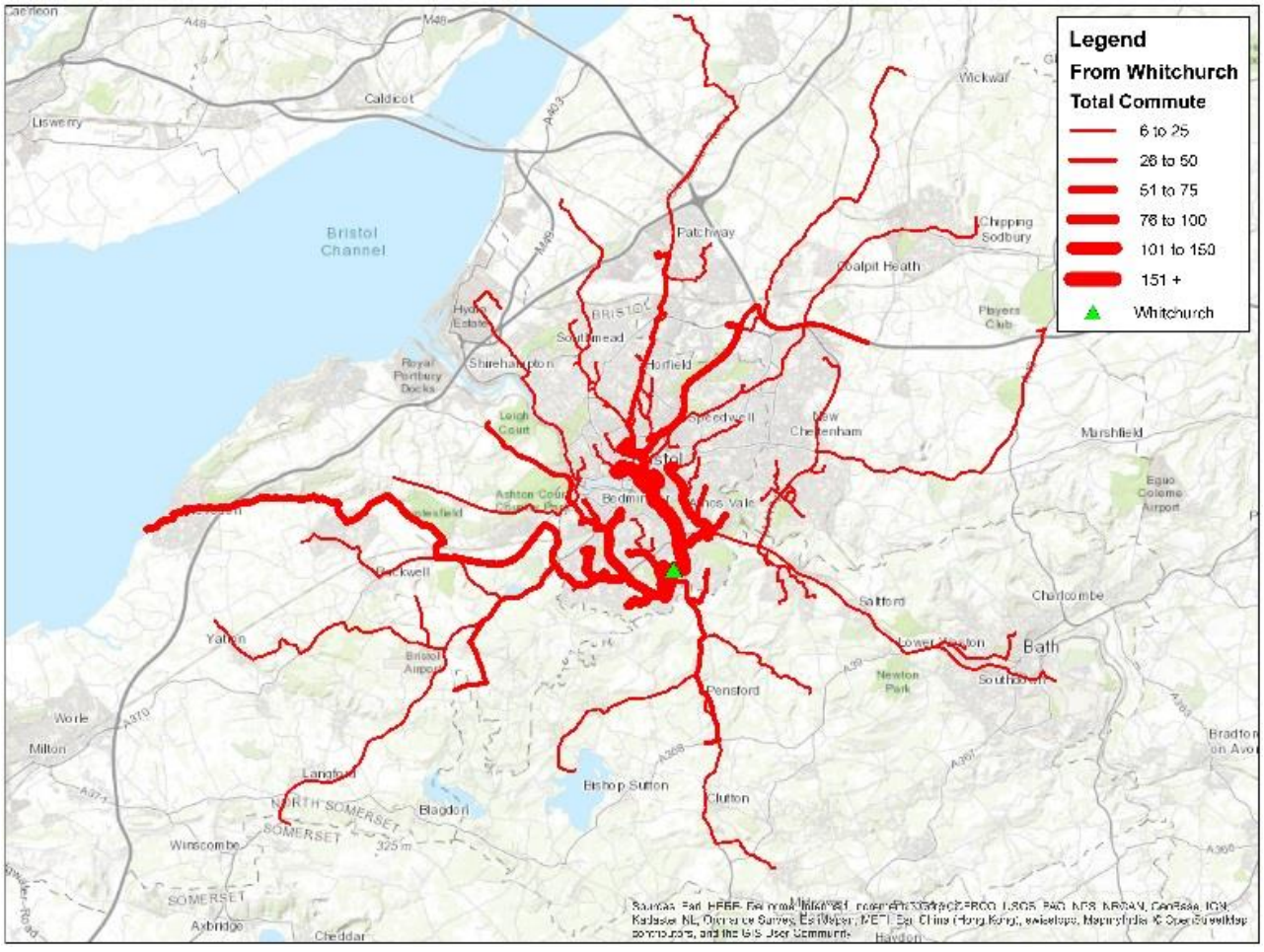
South east Bristol and the surrounding area is predominately a mixture of residential and rural land. The A4 and A37 are the key corridors into the city, and facilitate radial movements. The A4174 and A4 provide the recommended route for orbital movements, however this is not a direct route and the A4 therefore carries movements both in and out of Bristol and orbitally. This results in this part of the corridor having congested traffic flows due to the conflicting movements and uses of this corridor. As this orbital route is both congested and indirect it also encourages users to find alternative routes via residential roads.

2.2.1. Commuting patterns and identification of key trip destinations

The 2011 Census Travel to Work data has been investigated to understand the origins and destinations of commuters who travelled into and out of the area, to identify commuting patterns and key trip generators in the area.

Figure 2-8, Figure 2-9, Figure 2-10 and Figure 2-11 show commuter patterns to and from Whitchurch and Keynsham, based on origins and destinations. The figures show the combined total trips for all modes. The routing is estimated using a Network Analysis tool and is unlikely to capture all movements on local roads. The trip volumes shown do not include commuters who used the route but began and/or ended at places other than Whitchurch or Keynsham[10], and so actual trip volumes will be significantly higher.

Figure 2-8 Commuter destinations from Whitchurch



The volumes in Figure 2-8 and Figure 2-9 indicate that more people live in Whitchurch and work elsewhere than vice versa. Figure 2-8 shows that the key employment destination for those who live in Whitchurch is Bristol city centre. There are also significant movements to the North and East Fringe, and the network analysis indicates that these trips require travel into the centre via the A37 before then continuing north.

[10] Only trips with more than 6 people are shown.

There is also a strong orbital flow to the west to south Bristol and Clevedon, likely requiring routing via Ridgeway Lane and Whitchurch Lane which are not designed for large commuter movements. Interestingly there are few movements to Bath from Whitchurch, which suggests Bath is not a current employment destination for Whitchurch residents – this suggests the route between these two places is constrained, and presents an opportunity for improving connections to enable growth.

Figure 2-9 Commuter origins to Whitchurch

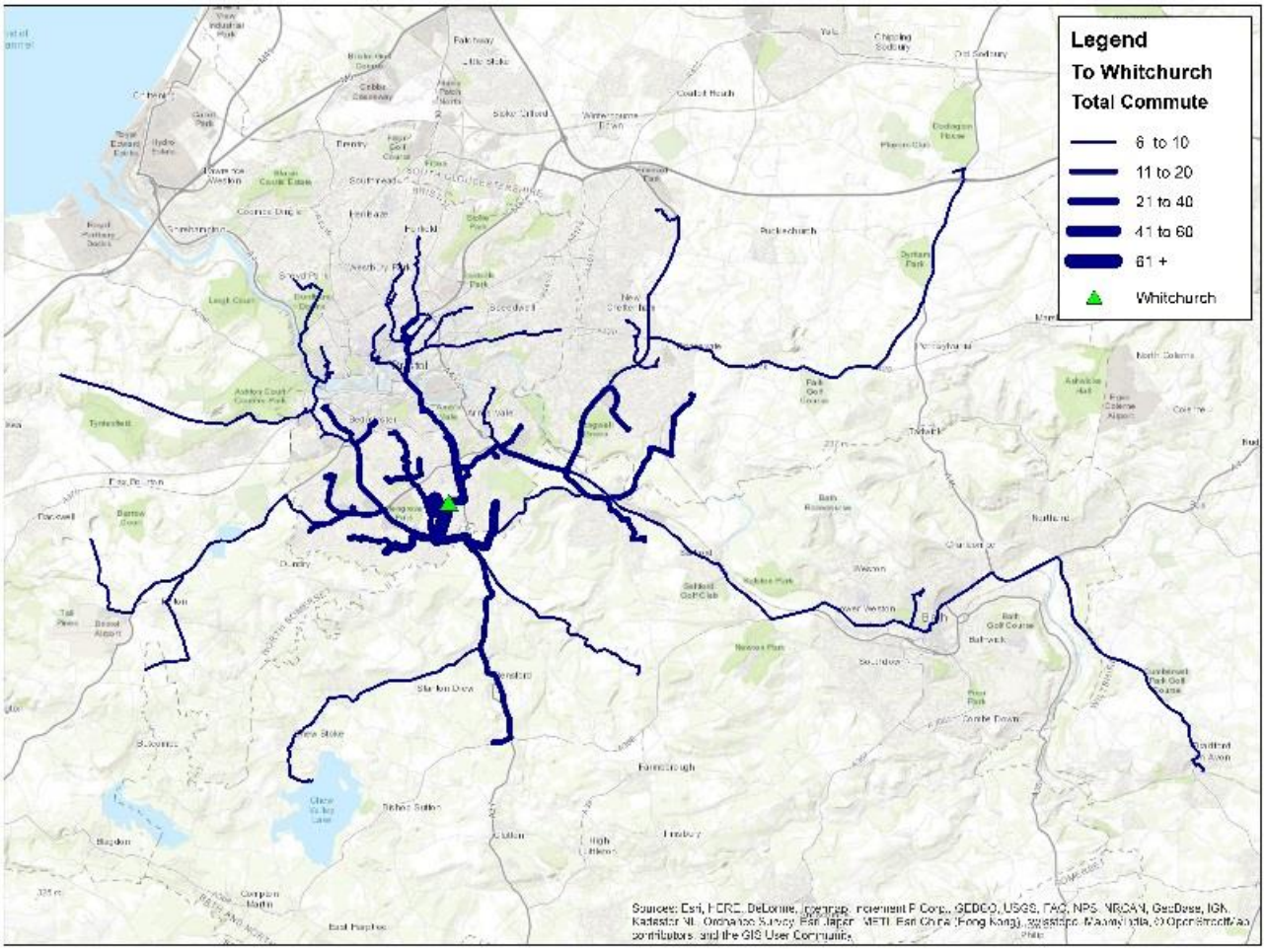
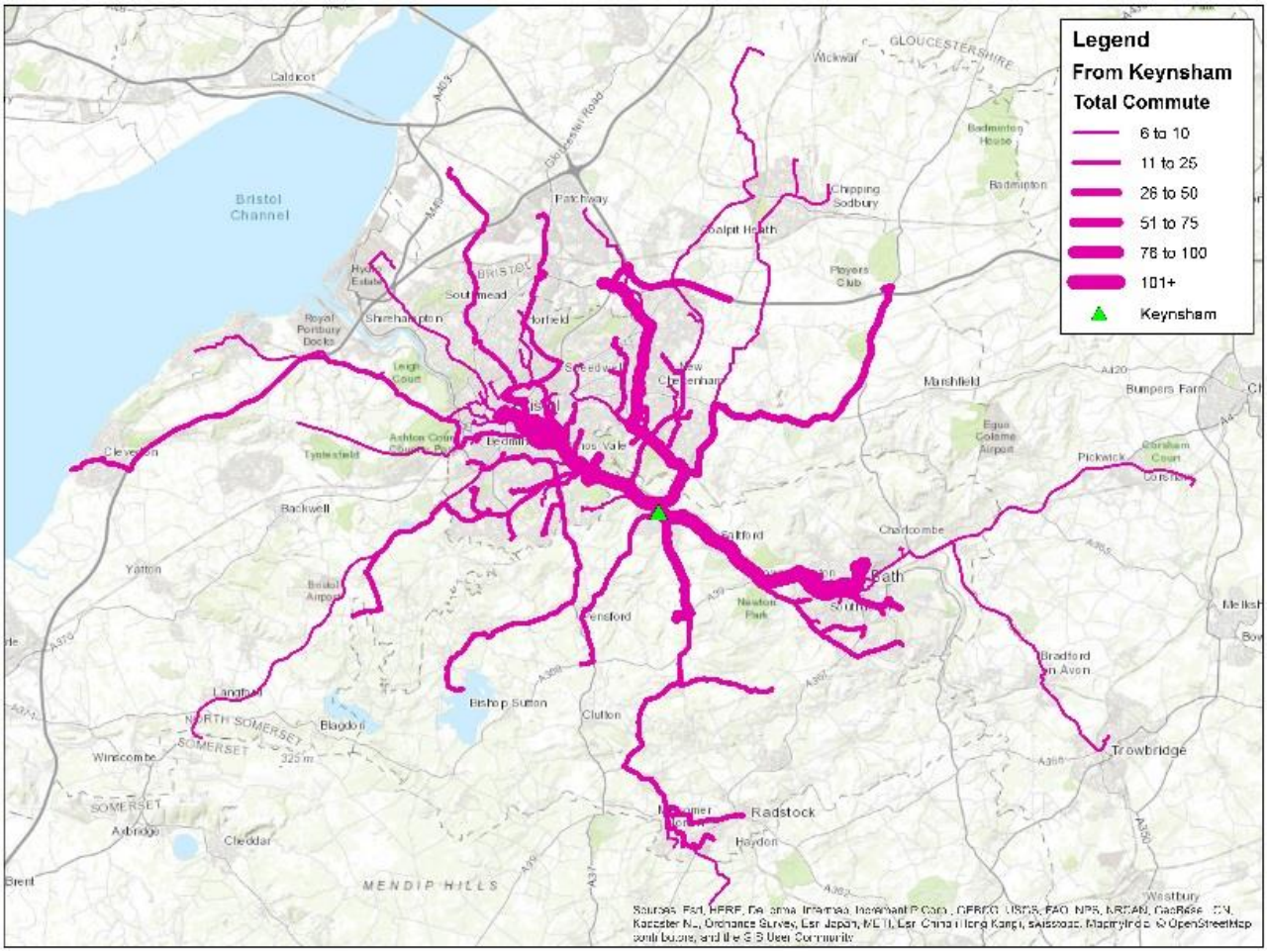


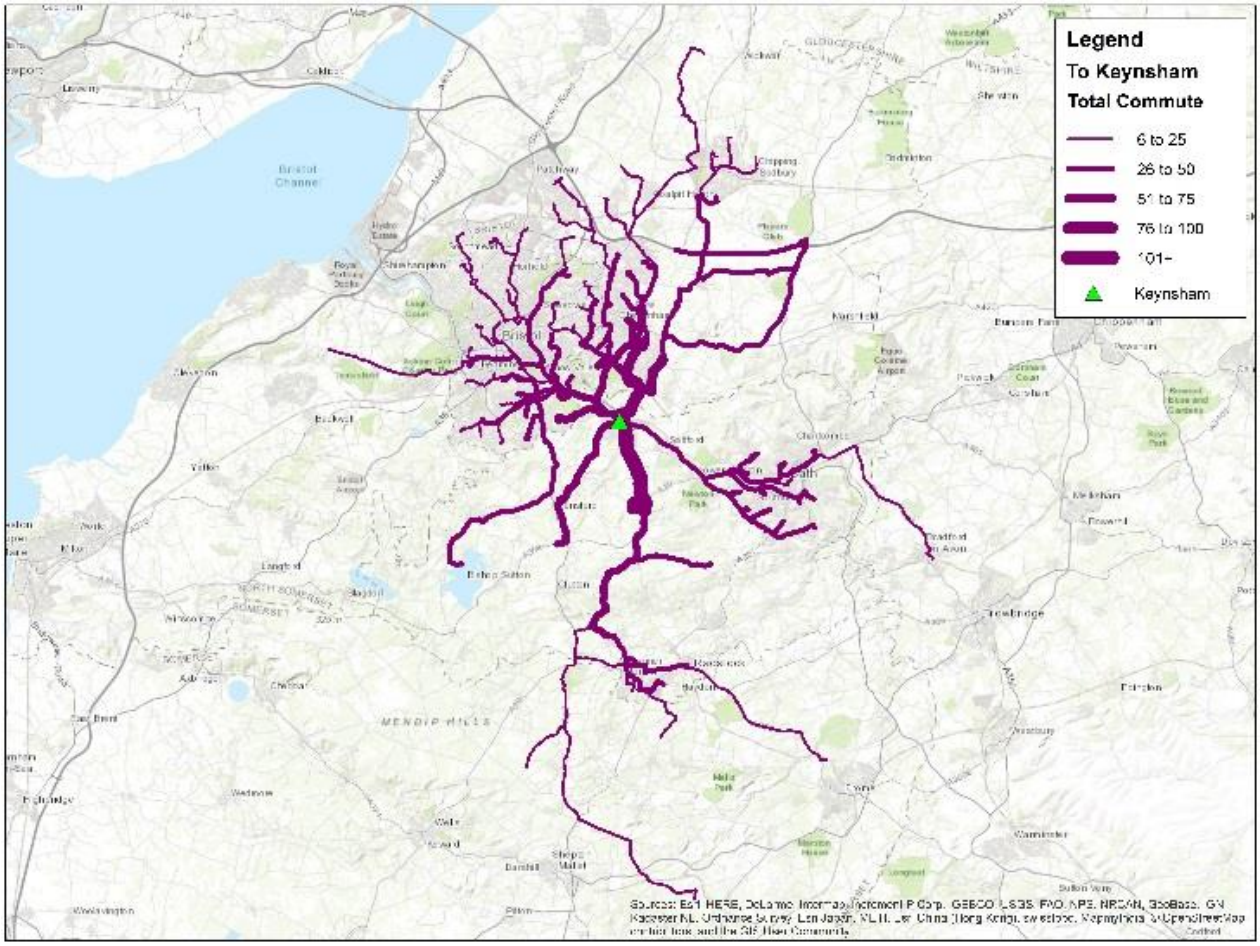
Figure 2-9 shows that the origins of commuters into Whitchurch tended to be from areas closer to the village, with many people traveling from Keynsham, south Bristol and rural locations just south of Whitchurch, and also a strong movement down the A37 from Bristol.

Figure 2-10 Commuter destinations from Keynsham



From Keynsham, there is a relatively even split of commuters heading into Bristol city centre, Bath city centre and to the East Fringe. Keynsham is well linked to these destinations, as the A4 offers direct service into the cities and the A4174 Ring Road is a fast orbital route to the north.

Figure 2-11 Commuter origins to Keynsham



The biggest commuter movements to Keynsham are from rural villages to the south such as Farmborough, Marksbury and Stanton Prior, and from neighbourhoods on the eastern side of Bristol.

Issue: Even though Whitchurch is close to Keynsham in terms of geographical location, there is a substantial difference in the connectivity and route patterns from each, with far fewer people commuting to Bath and the East Fringe from Whitchurch. This potentially highlights the lack of orbital connectivity, with Whitchurch connected to the west, and Keynsham connected to the north and east, but poor links between the two.

2.2.2. Vehicle flow data for key routes

Figure 2-12 shows annual average daily flow (AADF) data collected in 2016 at various sites in the area by the Department for Transport (DfT)[11]. The largest AADFs recorded are on the A4174 Ring Road, with flows of between 35,000 and 45,000 vehicles at various points between the M4 and A4 junctions. This indicates there is a strong demand for high capacity, fast, convenient roads around the eastern edge of Bristol.

The count point just north of Hicks Gate Roundabout (A4174 Bristol ring road) captured 37,068 vehicles, the count point to the west (A4 Bristol) 37,065 vehicles, the count to the east 27,662 (A4 Keynsham ring-road) and the count to the south on Durley Hill (to Keynsham centre) 13,653 vehicles. This shows a strong movement of vehicles across the junction from all arms, with the strongest movements between the northern, eastern and western arms in particular.

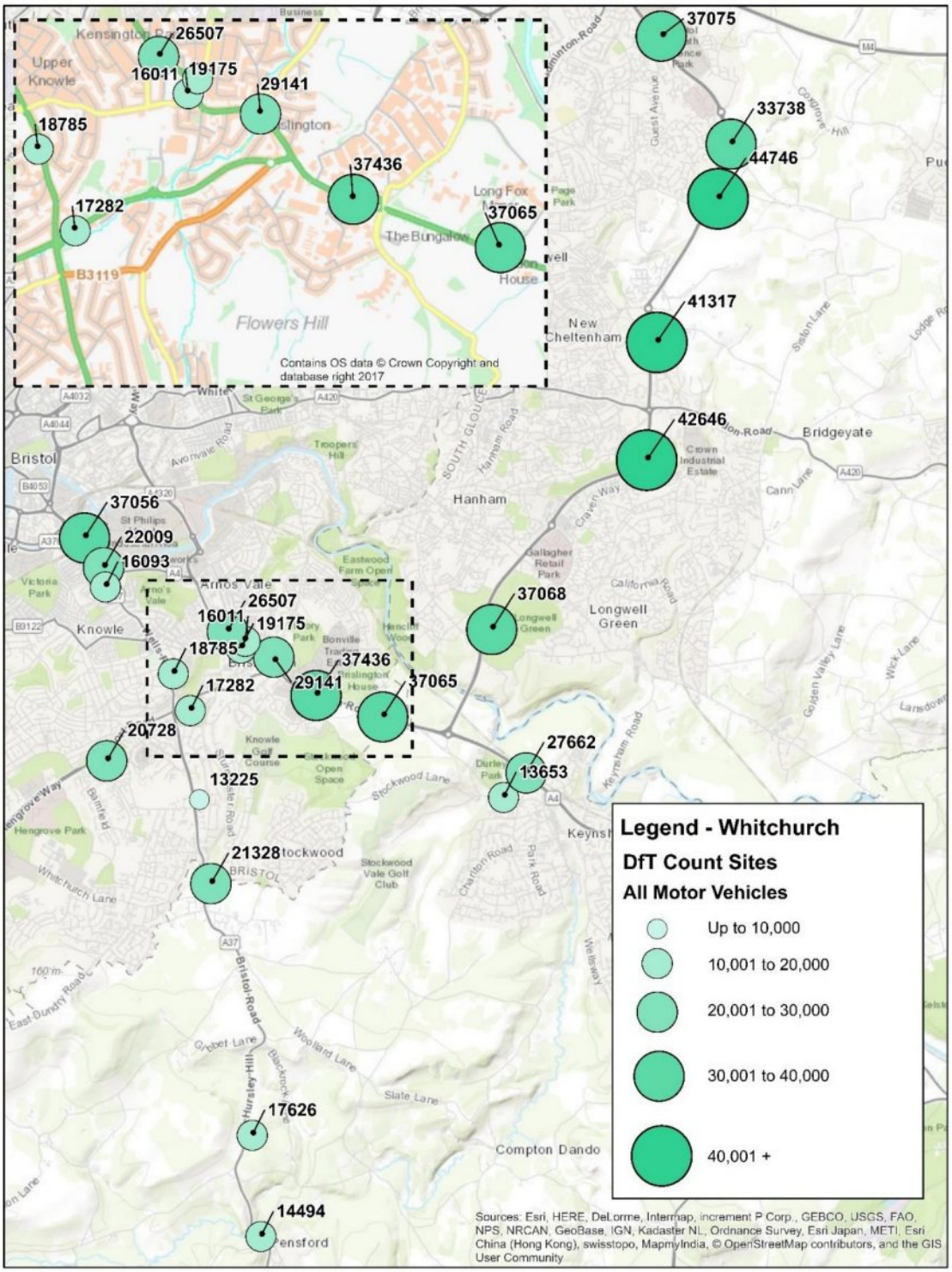
The highest counts on the A4 are between the Hicks Gate and West Town Lane junctions, which is to be expected as this section of the road is catering for both the A4 radial movements and the orbital movements from the A4174. At c.37,000 vehicles this section carries equivalent traffic to sections of the Bristol ring road despite being a very different highway environment. Most vehicles continue to move up the A4 to the north of

[11] This data is freely available on the DfT website: https://www.dft.gov.uk/traffic-counts/

West Town Lane junction (29,141), however there is a significant turning movement to the west along the A4174, with a flow on this section of 17,282 vehicles.

On the A37, the largest number of vehicles are captured north of Whitchurch before the junction with Ridgeway Lane (21,328 vehicles); while the subsequent count point only a short distance north of this captured 13,225 vehicles. This indicates there is a significant movement of vehicles away from the A37 between these two points, although there are no large employment centres or main roads, suggesting vehicles are traversing off the main route to make orbital movements via minor local routes such as Maggs Lane and Ridgeway Lane.

Figure 2-12 Annual average daily traffic flows (2016)



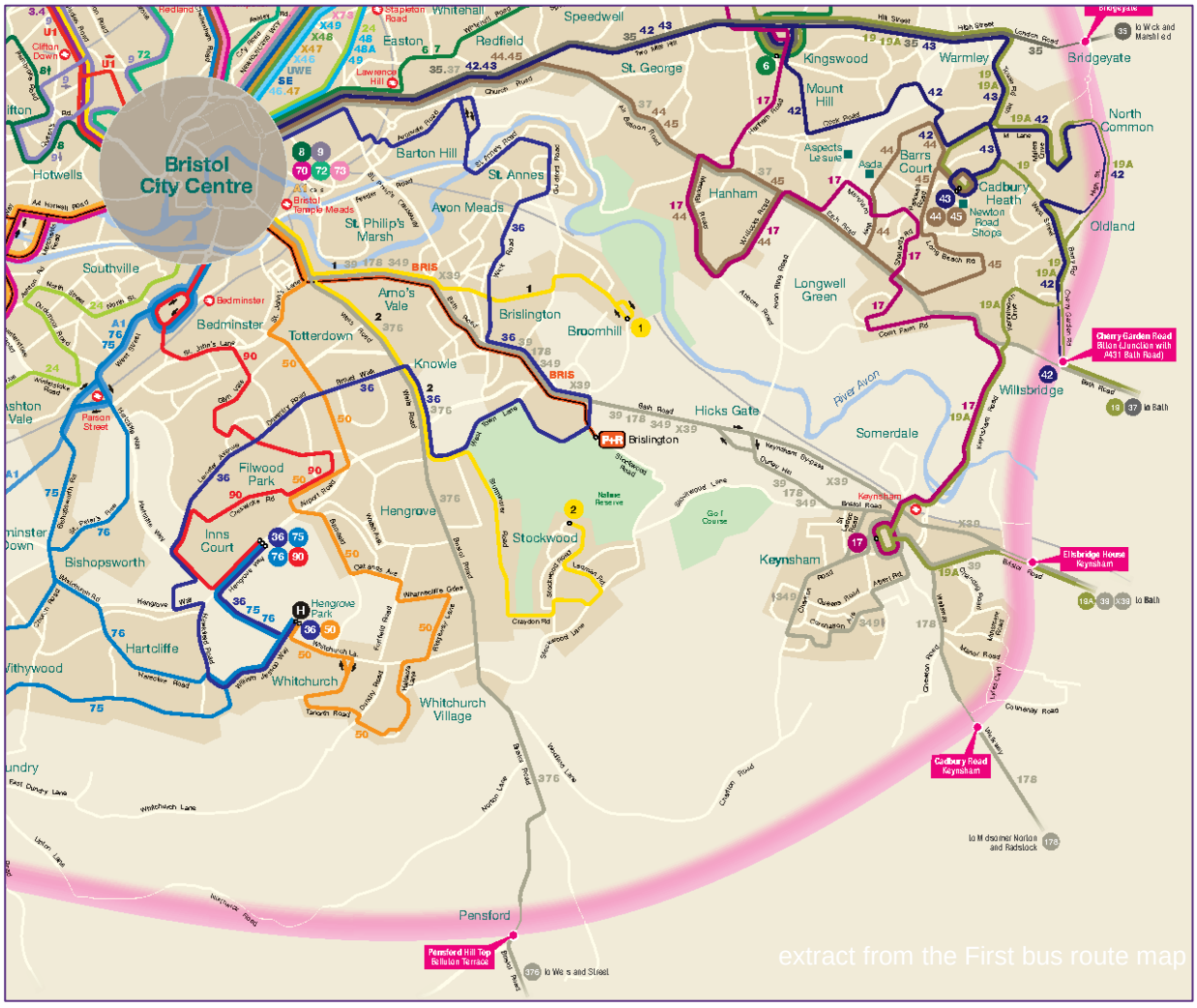
Issue: Traffic count data shows very high pressure on key parts of the corridor, particularly Hicks Gate junction, and on the A4 between Hicks Gate and West Town Lane. Relatively high volumes of orbital movements are also shown, adding pressure to the A4174 Callington Road/ West Town Lane junction, and on minor local routes around Whitchurch.

2.2.3. Public transport service provision and usage

2.2.3.1. Bus services

The study area is currently served by a number of bus services that take various routes to provide for the key residential locations, as shown in Figure 2-13, an extract from the First bus route map[12]. Areas to the south east of Bristol are relatively well served by services that take them into the centre of Bristol however, except for some services on the A4 corridor which serve Bath, there are few direct services to other destinations. In particular, there is no orbital service between the East Fringe and areas south of Bristol such as Whitchurch – despite the Census data showing that there are commuters who travel between these two areas and therefore there is an opportunity to grow public transport market share and achieve more sustainable transport movements.

Figure 2-13 Bus routes in south east Bristol



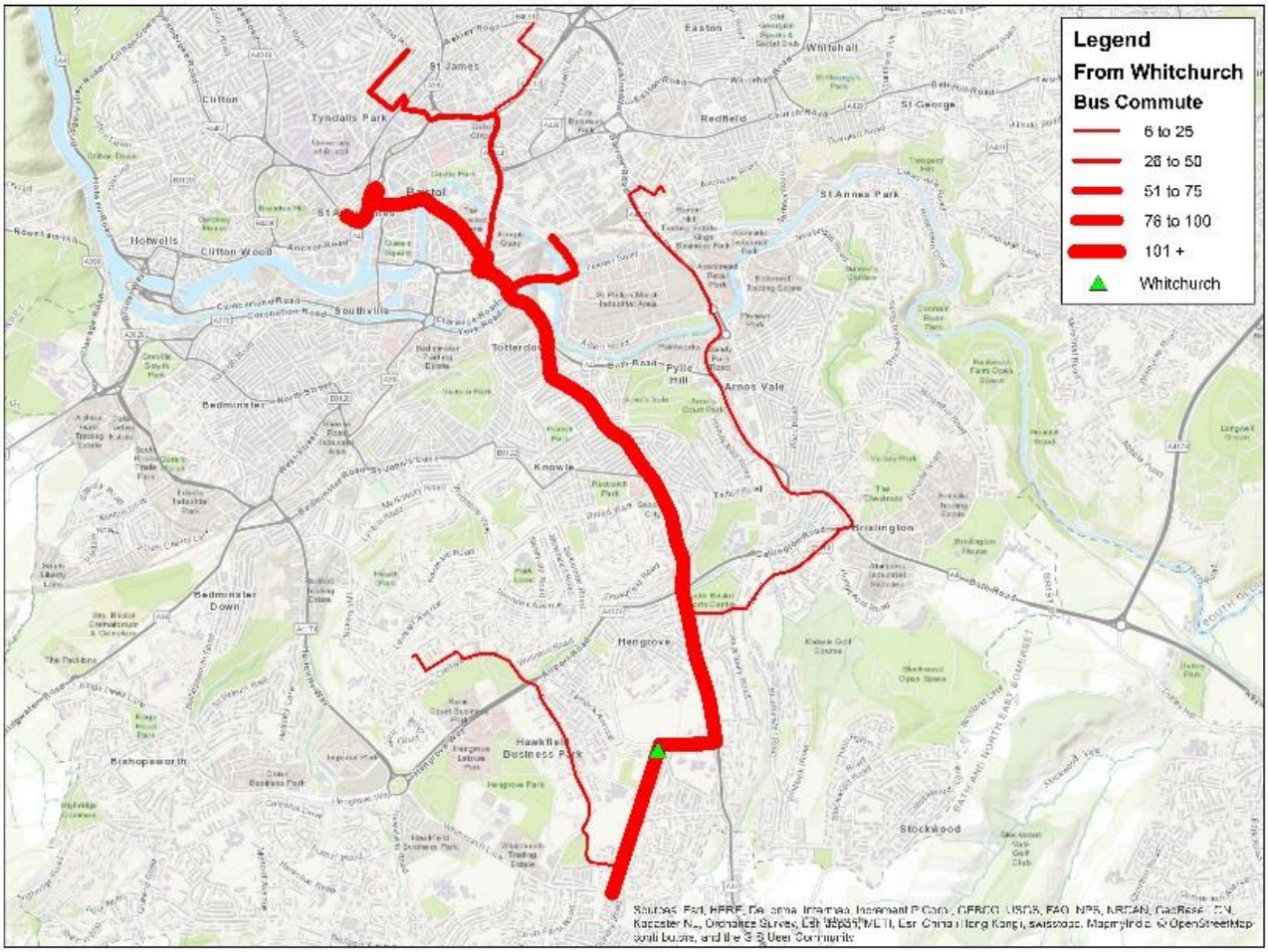
2011 Census data relating to travel to work trip by bus, displayed in Figure 2-14, clearly shows that there are significant movements from Whitchurch into Bristol city centre for work, but there is very little movement of commuters to other destinations. This reinforces the fact that there are very few choices of destinations served by existing public transport options.

[12] Full map available here: https://www.firstgroup.com/uploads/maps/First%20Bristol%20Map_0.pdf

Whilst there is clearly a demand for bus services into Bristol from Whitchurch, the numbers of trips identified commuting into Whitchurch by bus were negligible in 2011. There are few employment destinations in Whitchurch, and this coupled with the fact that only the city centre is linked via a direct bus service (other origins requiring interchange) are the key reasons for such low demand.

Factors influencing mode choice include distance, journey time, car ownership, ease of parking and the ease and cost of travel by other modes. As such, public transport options, in this case buses, are only seen as viable options where there is an attractive service frequency, fares are reasonable and direct journeys can be made. Whilst there are some good services into Bristol from Whitchurch, there is poor bus service provision to other destinations despite the fact there is clear demand as shown by the maps in section 2.2.1, which show commuting patterns by all modes, and the undesirability of bus usage is reflected by the 2011 Census travel to work data.

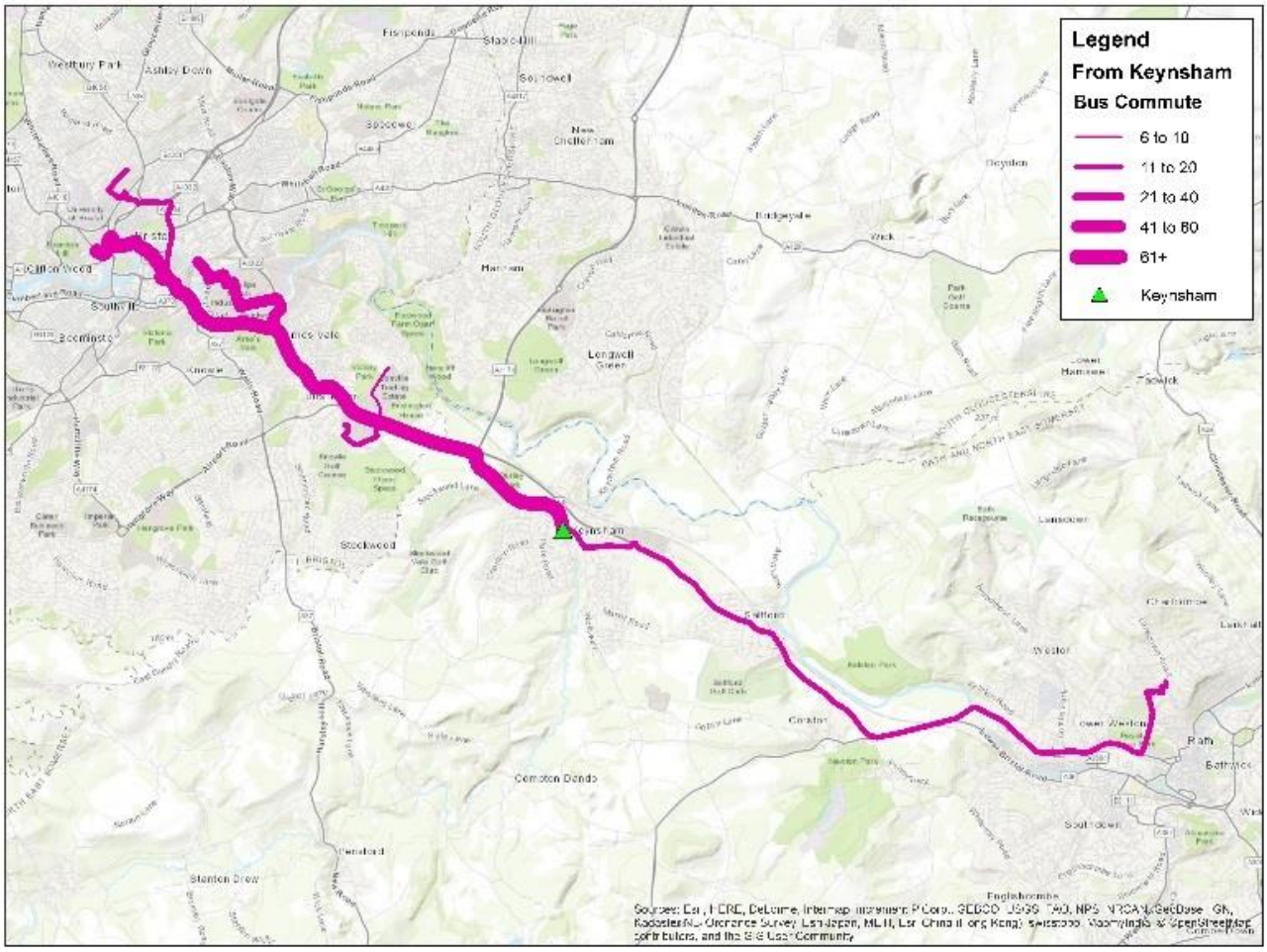
Figure 2-14 Bus commuter destinations from Whitchurch[13]



From Keynsham there are also some clear patterns of bus use as shown in Figure 2-15, and these are very dependent on the A4 corridor. There is a clear flow into Bristol and a smaller but still significant flow into Bath by bus from Keynsham. It is likely that most of these bus commuters use the 178 and 39 services, which during peak times runs every 10-15 minutes. Despite having access to a service to the East Fringe (17), and a significant number of commuter trips between Keynsham as the East Fringe (Figure 2-10), no bus use patterns were found in 2011.

[13] Note: The point provided on the map for Whitchurch is the central point for the Whitchurch Lower Super Output Area (LSOA) and thus is a simplification of the start point for most trips. It is likely that many trips take the 50 (Hengrove – Bristol every 15 minutes in peak) or 376 (Street – Bristol every 30 minutes) services – although note that the map cannot show this accurately due to the network analysis tool indicating the fastest route without taking into account actual bus routes.

Figure 2-15 Commuter destinations from Keynsham



For those commuting into Keynsham centre, the numbers are only marginally larger than those that commute into Whitchurch (note this analysis only considers trips to Keynsham centre). Figure 2-16 shows the only bus usage patterns are from areas on the outskirts of the town, which are focused on orbital movements rather than the A4, in contrast to movement from Keynsham.

Figure 2-16 Origins of bus commuters to Keynsham

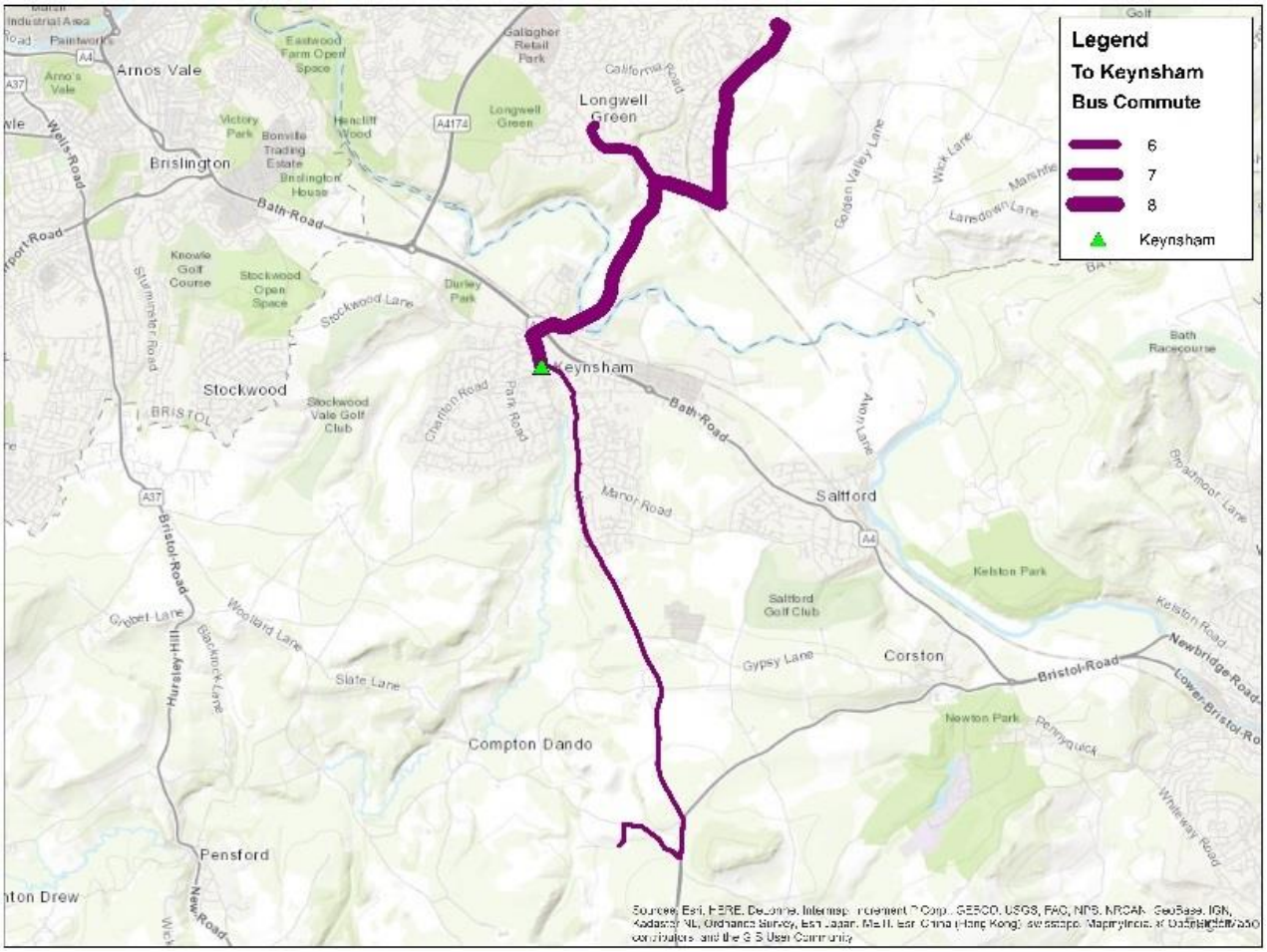


Table 2-1 and Table 2-2 provide summaries of the bus services that serve both the A37 and orbital corridors, with details of peak and off-peak frequencies, and the hours that each bus is in service.

Table 2-1 Bus Frequency on the A37 Corridor

Bus number and route	Hours in service	Peak frequency	Off-peak frequency
376 (Street – Bristol)	7am – 11pm	Every 30 minutes	Every 30-60 minutes
2 (Stockwood – Cribbs Causeway)	5am – midnight	Every 10 minutes	Every 15-30 minutes
50 (Bristol – Hengrove)	6am – 11pm	Every 15 minutes	Every 15-60 minutes
90 (city centre – Hengrove)	6am – midnight	Every 15 minutes	Every 15-30 minutes

Table 2-2 Bus Frequency on the Orbital Corridor

Bus number and route	Hours in service	Peak frequency	Off-peak frequency
36 (city centre – Hengrove via Brislington)	5am – 11pm	Every 25-30 minutes	Every 30-60 minutes
17 (Southmead – Keynsham via Kingswood)	6am – 11pm	Every 25-30 minutes	Every 30-60 minutes
19 / 19A (Bath – Cribbs Causeway via UWE)	6am – 10pm	Every 45 minutes	Every 45-60 minutes

2.2.3.2. Rail services

There are no train stations in Whitchurch or a train line along the A37 corridor, neither are there any stations in the orbital area to the east of Bristol near the ring road. There is a train station in Keynsham, which is located just to the north of the A4 although is accessible from Keynsham High Street. This station is located on the Great Western Mainline which is the key train line from London to the west and Wales.

From Keynsham to Bristol Temple Meads, the train takes an average of 9 minutes, with times varying between 6 and 10 minutes. There are approximately 36 trains each weekday, with the first train at 06:38 and the last train at 23:12. There are approximately 2 trains per hour, however in peak times these run up to every 10 minutes and hourly off-peak. Trains from Bristol Temple Meads to Keynsham take an average of 6 minutes, with approximately 24 trains per weekday, averaging one train every 45 minutes, although off-peak the longest interval is 75 minutes and at peak times the shortest interval is 10 minutes.

Table 2-3 shows the breakdown of the types of tickets bought in 2016/17, and Figure 2-17 shows the rail patronage for the station since 2010/11. Rail use has increased significantly in the last 5 years of available data (c.55%), which is likely as a result of improved services and also transferred trips due to increased road congestion. Some of these trips will not be local commuting journeys but long-distance journeys beyond Bristol and Bath.

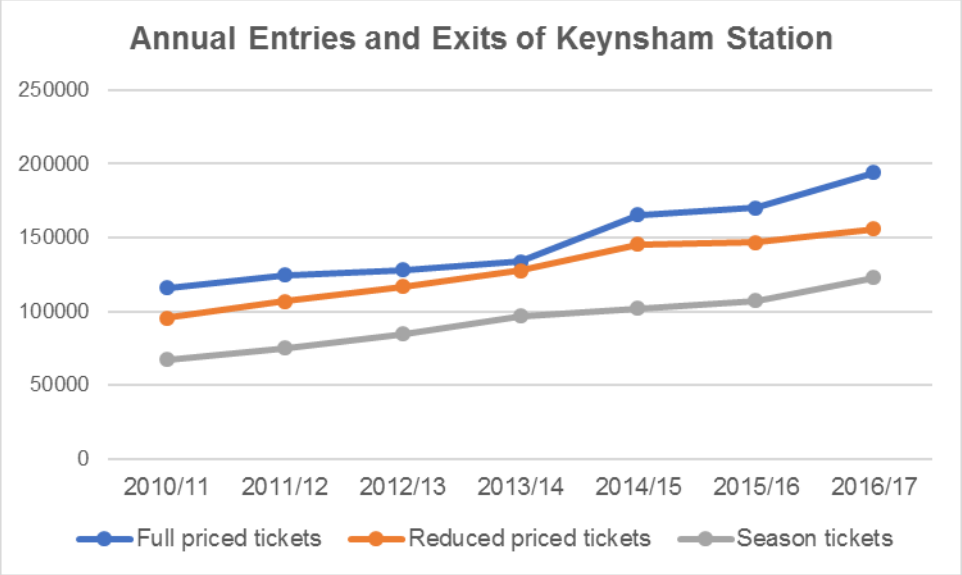
Investigation of Census Travel to Work data from 2011 shows that from Keynsham, there were 258 train journeys to work per day; the key destinations being Bristol Temple Meads, Bristol Parkway and Bath Spa. For journeys to Keynsham, there were 90 journeys that day by train – the residences of most of these people were most often spread across the cities of Bristol and Bath. This implies there are people commuting to Keynsham each day, however about three times as many people are commuting out of the town.

Figure 2-17 shows that the use of all types of tickets has increased since the 2011 Census was conducted, including season tickets which indicates many more commuters using Keynsham station now than in 2011.

Table 2-3 Breakdown of Rail Patronage at Keynsham Station for 2016/17

Ticket type	2016/2017
Full priced ticket	194,018
Reduced priced ticket	155,812
Season ticket	122,800
All tickets total	**472,630**

Figure 2-17 Rail Patronage at Keynsham Station since 2010



2.2.4. Comparative modal journey times and reliability

To understand bus journey times and delay to services in peak periods, timetabling information has been gathered and compared across peak and off-peak journey times. It should be noted that longer journey times at peak times will not solely be due to greater congestion on the route, as buses will also be required to stop more often and for longer due to a larger number of passengers embarking and disembarking in peak periods. Furthermore, timetabling difference is only an indication of journey time increase, and does not provide accurate information regarding journey time reliability as it does not capture the journey time differences day to day.

This shows there is a significant increase in the journey time along the A4 in the peak compared with the off-peak, particularly in the Keynsham to Bristol westerly direction in the AM peak, which increases by 17 minutes (100%) compared with the off-peak time indicating some delay due to general congestion on the corridor.

For the same route by car in a free-flowing network at off peak times, the journey time is 12 minutes in both directions, which is slightly faster than timetabled bus times, as would be expected in free-flowing conditions. However, car journeys in peak periods are significantly longer than the timetabled bus times – likely due to existing bus lanes provided at intervals between West Town Lane and Temple Meads, resulting in some priority for bus journeys. However, car journey data suggests congestion is present for the majority of the route, including east of West Town Lane, where a bus lane is not present and it is likely therefore that the timetabled bus times are an underestimation of the actual time the journey takes by bus during peak periods. More general journey time data is considered in more detail in section 2.3.4.

Whilst the train journey is much quicker between Keynsham and Bristol than via bus, it is not as frequent throughout the day, and clearly does not serve other locations along the route.

For the A37 corridor, the 376 bus timetable is examined in Table 2-4 as this follows a direct route on the A37 into Bristol from Whitchurch. The time taken for the bus to travel between Whitchurch, Staunton Lane bus stop and Bristol Temple Meads bus stop, and vice versa, is used.

Table 2-4 Bus Journey Time on the A37 Corridor

	Bus 376	**Bus timetable time**	**Percentage difference compared with off peak (in same direction)**	***Car journey time***
Whitchurch– Bristol	AM PEAK	23 minutes	+109%	*23 minutes*
	PM PEAK	18 minutes	+64%	*17 minutes*
	OFF PEAK	11 minutes	0%	*10 minutes (free flowing)*
Bristol – Whitchurch	AM PEAK	18 minutes	+64%	*19 minutes*
	PM PEAK	23 minutes	+109%	*21 minutes*
	OFF PEAK	11 minutes	0%	*10 minutes (free flowing)*

This shows a greater variation in terms of percentage for journey times in peak and off peak for the A37 corridor than the A4, reflecting the more limited existing bus priority measures on the corridor. It shows that the longest timetabled journey times are in the AM peak from Whitchurch to Bristol, and the opposite direction during the PM peak – 23 minutes, or 109% greater than the off-peak journey time.

The same route in free-flowing conditions by car would take approximately 10 minutes – this is slightly faster than timetabled bus times, which makes sense in free-flowing conditions, however the bus timetable is therefore making no allowance for congestion or long pickups at bus stops. However, car journeys are about the same as bus journey times in peak periods. Although there is a bus lane for some of the route north of Wells Road junction, for much of the route buses must share space will other vehicles, and stop frequently to pick up passengers. In this case it would be expected that bus journey times would be slower in congested periods than timetabled, which suggests at the timetabled bus times are an underestimation of the actual time the journey takes by bus during peak periods. More general journey time data is considered in more detail in section 2.3.4.

The journey time of orbital bus movements are not examined as there is not a bus route with appropriate routing to be able to examine the journey times of the routes meaningfully.

Issue: Analysis of existing public transport provision has highlighted:

- Poor choice of destination options with radial movements to Bristol city centre only being served;
- Poor orbital provision, and poor use of orbital services where they do exist (between Keynsham and East Fringe); and
- Doubling of public transport journey times during peak hours compared to off peak.

2.3. Existing transport problems

2.3.1. Transport gaps – active travel

The popularity of cycling has increased significantly in recent years within Bristol due to significant investment in cycling facilities, and because cycling provides reliable journey times. Cycling can be an

attractive option for journeys up to five miles, but for longer journeys, for example from south of Whitchurch and east of Keynsham to Bristol City Centre, cycling remains an unpopular option.

Between Whitchurch and Bristol, the A37 provides some cycle facilities in the form of on-road cycle lanes and shared bus lanes. The Whitchurch Railway Path also provides an alternative offline option for cyclists which runs relatively parallel to the road on traffic free and minor road routes. The Whitchurch Railway Path is a section of the longer Route 3 National Cycle Route from Cornwall to Bristol. Whitchurch to Bristol city centre is approximately 8km (5 miles) in length – a distance which would be viable for many users traveling between Whitchurch and Bristol. However, Census data indicates that there were not large numbers of people cycling from the Whitchurch area to Bristol as their main journey method for work in 2011. Being part of the National Cycle Network (NCN) the route is of relatively good quality, although there are sections that are hindered by junction crossings and sub-standard sections which also have safety concerns.

The A4174 Ring Road north of Hicks Gate offers an offline cycling and walking path for most of the route into North Bristol. This provides a traffic-free route for cyclists who wish to travel to and through the East and North Fringe, and employment sites in those areas. However south and west of Hicks Gate, towards Whitchurch and Bristol, this offline cycle route ends and cyclists are required to share the road with vehicles, often without a cycle lane. The continuation of the A4174 to the west after West Town Lane does not have significant cycle facilities.

Walking is the most sustainable form of travel, requiring no vehicle, with physical activity being the main feature of the journey. It is arguably the most viable form of travel for short journeys within communities and can be an attractive option for most journeys of less than one mile. For the strategic corridors, walking forms an important role in linking trips such as walking to the bus stop/station and shops.

Issue: There is poor quality and discontinuous cycle routes through much of the study area. Where a relatively good cycle link is available along the A37 corridor, there are sub-standard sections, and it is not well used.

2.3.2. Transport gaps – public transport

Given that the area is located relatively close to key centres of Bristol and Bath, it would be expected that larger numbers of people use public transport for travelling to work than the numbers presented in Section 2.2.3.

The A37 has significant physical constraints with buildings on either side for much of the route north of Whitchurch to the City of Bristol. To the south of Wells Lane junction, there is designated parking on the A37 for roadside houses; there would likely be opposition to removing this parking in place of a bus lane as many houses do not have driveways. In some sections bus priority is provided (mostly inbound), however most of the route has only one lane for all vehicles in each direction.

Similarly, for the A4, there are some sections with bus priority, however this is not at a consistent level or continuous across the route. In particular, key points of congestions and delay such as Wells Road Junction, currently have no bus priority.

Issue: Existing bus priority measures are not sufficient to provide reliable public transport journey times, with key sources of delay having no priority measures.

2.3.3. Bus accessibility

As discussed in Section 2.2.3, regular bus routes serve the A4 and A37 corridors, and there are more local services which stop in the residential areas around the area before heading into Bristol. However, there are few services which cater for orbital movements, and certainly none which would allow someone to travel from Whitchurch to the East Fringe without having to interchange in Bristol city centre.

In terms of bus stops, the area is well served with the majority of residential areas within a few hundred metres of a bus stop with at least one service. However most services would only allow them direct access to Bristol city centre, where they would have to change to a new route to access any other destinations.

Issue: Access to buses is generally adequate but there is a poor choice of destination options with direct services – particularly to south and east Bristol where some demand is evident.

2.3.4. Vehicle delay

Traffic congestion causes longer and less reliable journey times, reduced resilience in the event of incidents, worsened reliability of bus services, rat-running of traffic through residential areas and idling traffic causing air quality problems. Slow journeys also reduce accessibility to jobs and businesses and act as a barrier to the competitiveness of the region.

Corridor specific congestion problems have been analysed using the Strat-e-gis congestion software package. This package allows interrogation of DfT traffic and journey data collected from real journeys (anonymously). This data can be analysed to show where congestion regularly occurs on the road network. i.e. how much slower a trip will be compared to the advertised speed limit due to the volume of traffic.

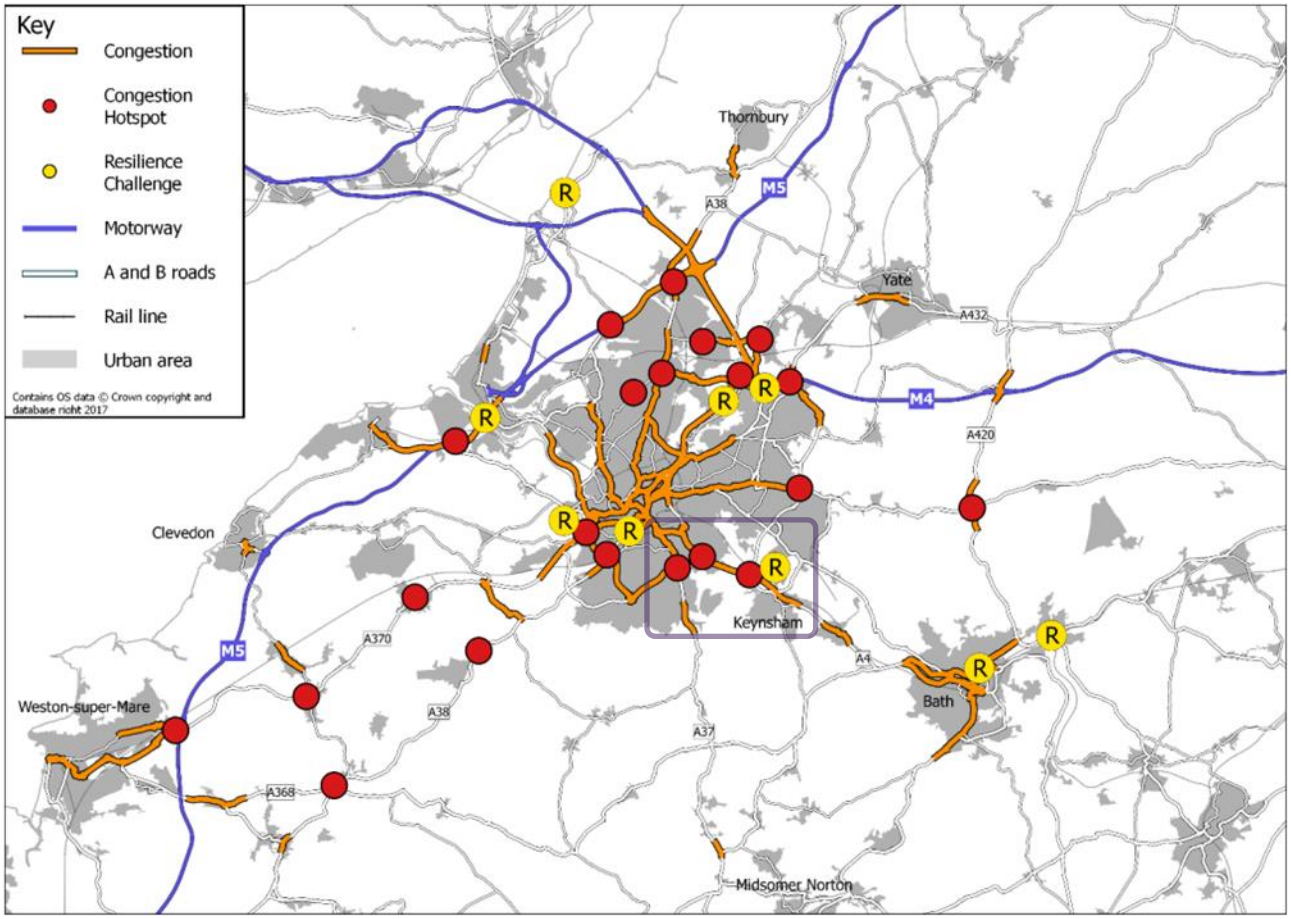
An analysis of Strat-e-gis data shows there is significant congestion along the A4 and A37 in both directions during peak periods. As there is limited public transport priority provision, buses are impacted by this congestion. In particular there is significant congestion on the A37 in Whitchurch south of Queen Charlton Lane – this is likely due to the conflicting right and left turn movements of Norton Lane and Queen Charlton Lane. North of the A4174, both the A37 and A4 have significant amounts of congestion along the route into Bristol, and there is also delay on the A4174 to the west of Wells Lane junction. West Town Lane junction causes significant delay on the northbound approach, and there is delay on all approach arms of Hicks Gate roundabout. It has been observed that West Town Lane junction results in delay all the way along the A4 and largely contributes to the delay at Hicks Gate. Anecdotally, access to the existing Brislington P&R is also a source of local congestion.

Figure 2-18, taken from the Joint Transport Study is based on transport model data and observed conditions on the road network and shows key locations within the West of England where the resilience of the network is an issue. Locations with poor resilience tend to be particularly vulnerable when traffic accidents or other incidents occur, causing widespread disruption across the wider network. This highlights the same issues as other sources for this package, summarised as follows:

Issue: Particular known issues of congestions and delay on the network include:

- congestion on the entire A4 from Bristol to Keynsham;
- congestion on the A37 around Whitchurch and north of A4174;
- congestion on the A4174 west of Brislington;
- congestion at A37/Wells Road junction;
- congestion at A4/West Town Lane junction, contributing to congestion at Hicks Gate;
- resilience issues at Hicks Gate junction.

Figure 2-18 Key congestion hot spots in West of England region



2.3.5. Congestion on local roads

Trip demand data has shown relatively high demand for movements between Whitchurch, south Bristol and further to the west. Vehicle flow data also showed a large volume of vehicles turning from the A37 corridor north of Whitchurch, likely making these orbital movements. As there are no routes of a suitable capacity to facilitate this movement, local pressures are placed on minor local routes including Ridgeway Lane and Maggs Lane.

There is also anecdotal evidence of inappropriate traffic levels on minor orbital routes north east of Whitchurch, on Stockwood Lane and minor routes via Queen Charlton.

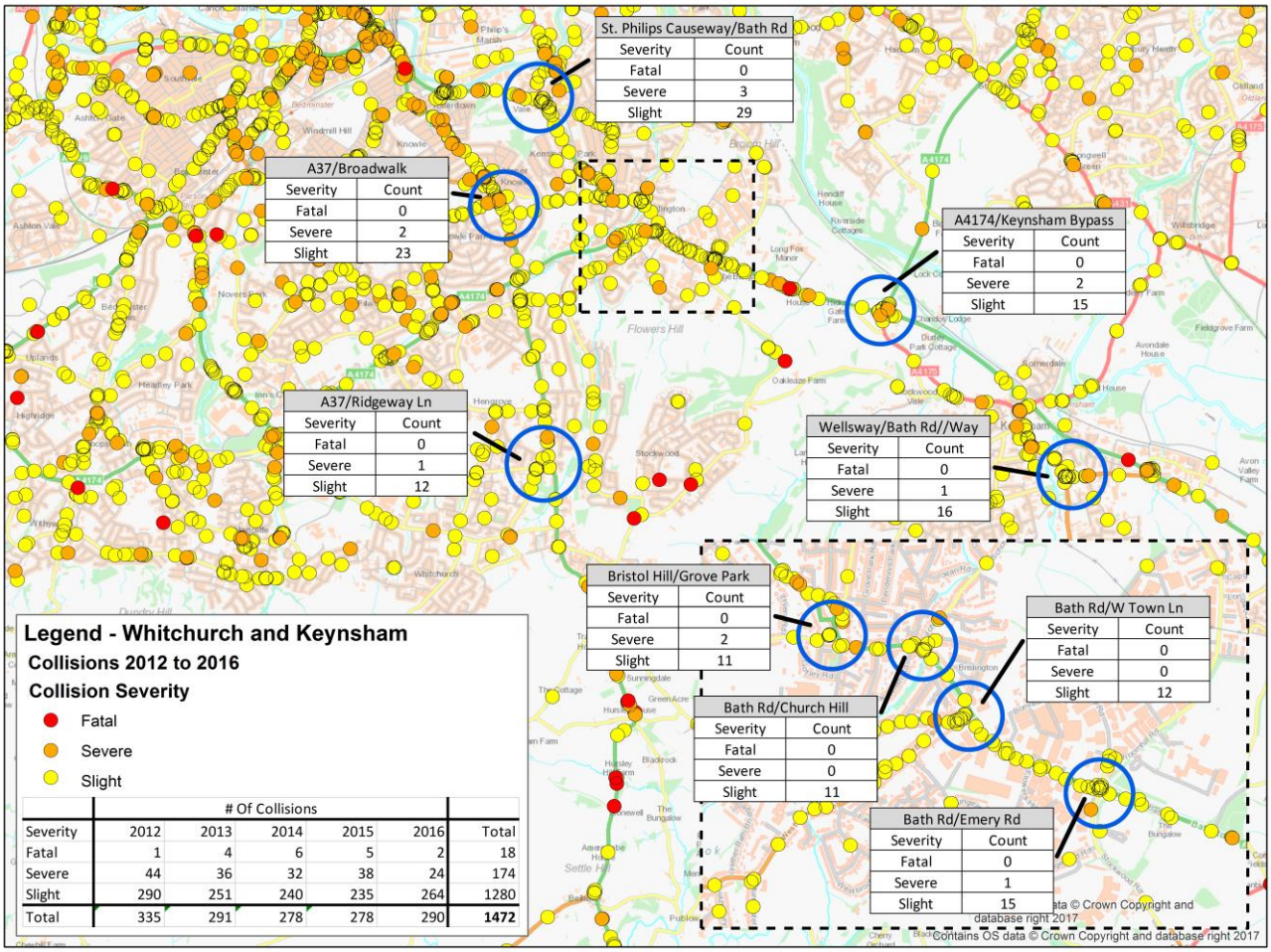
Issue: Reliance on minor local routes to facilitate orbital movements and demand from Whitchurch, resulting in congestion.

2.3.6. Accidents

Figure 2-19 displays collision data collected across five years between 2012-16. This shows there are a significant number of accidents in the study area, in particular on the A37 between Whitchurch and the Three Lamps junction, and on the A4 between Hicks Gate roundabout and the Three Lamps junction. On the A4174 Bristol ring-road there are very few accidents despite this section having the highest volume of vehicles – this reflects the fact it is a strategic road link environment, with less conflict between other modes and uses than the other parts of the network.

There are some clear collision cluster sites in the area. These include the West Town Lane junction, Hicks Gate roundabout, St Phillips Causeway / A4 junction, Hengrove Way roundabout and the A37 Ridgeway Lane junction. There are also a high number of road collisions on particular stretches of road, in particular from Ironmould Lane on the A4 and Wells Road junction on the A37 into Bristol there are very high numbers of road collisions.

Figure 2-19 Reported road collisions in the area



Issue: Collision clusters at key points of the network where there is little resilience or capacity to cope with disruption. Congested locations also the focus of safety concerns.

2.3.7. Impacts on communities

2.3.7.1. Severance

According to the Institute of Environmental Assessment (IEA) guidelines[15], severance is *"the perceived division that can occur within a community when it becomes separated by a major traffic artery. The term is used to describe a complex series of factors that separate people from places and other people. Severance may result from the difficulty of crossing a heavily trafficked road or a physical barrier created by the road itself. It can also relate to quite minor traffic flows if they impede pedestrian access to essential facilities. Severance effects could equally be applied to residents, motorists or pedestrians."*

The Department for Transport's Design Manual for Roads and Bridges (DMRB)[16] defines community severance as *"the separation of residents from facilities and services they use within their community by changes in traffic flows."*

This study area incorporates urban and rural land, and covers many households on the edge of the urban area. As these areas are already a distance from the community centres, the impact of severance due to transport schemes can be larger. Therefore, it is important that options taken forward do not unduly sever the direct links that communities have, or would like to be created in the future.

[15] Institute of Environmental Assessment,1993. Guidelines for the Assessment of Road Traffic. Institute of Environmental Assessment.
[16] DMRB Volume 11 Section3 Part 8, 1993. Pedestrians, Cyclists, Equestrians and Community Effects.

The A4 is the most significant source of severance at present as it functions as a large strategic transport link, but also passes through the urban environment and local services. The A4174 Ring Road provides very limited opportunities to cross its corridor, but also does not conflict large sources of trip origins and destinations. The lack of provision for orbital movements, requiring traffic to use unsuitable routes through the urban environment will increase the severance impact of these routes

The percentage of households with access to a car or van were mapped in Figure 2-3 in Section 2.1.1. This shows that the lowest level of car access was in areas closest to central Bristol, but also in in Bishopsworth south of Hengrove Way, the area adjacent to the A4 south of Brislington and a few locations in Stockwood and Hengrove. Severance is known to impact those without an access to a vehicle more heavily, so these locations will be most sensitive to potential effects. Planned developments in the area will change and increase where there are high traffic flows, which can impact where increased severance is experienced – e.g. if a local road sees greater traffic flows, this reduces the ability of other users to cross the street and thus increases severance. Any transport interventions must therefore consider this potential impact and look to minimise it.

Issue: High traffic flows and a reliance on urban routes for strategic traffic movements increases the impact of severance on these corridors – some of these local communities are particularly sensitive to severance effects.

2.3.7.2. Security

Much of the network in the study area is in an urban environment and generally levels of street lighting are adequate on key routes.

There is no lighting on rural sections such as the A4 from Keynsham to Hicks Gate roundabout, but these sections generally do not cater for cyclists or pedestrians. As discussed above, provision for cycling and walking are intermittent and of poor quality in places making it an unappealing environment for users.

The A37 does not provide particularly good cycling facilities, however it does offer walking facilities and is well lit. The Whitchurch Railway Path offers an alternative to cyclists, and has good street lighting. Much of the route follows an alignment overlooked by houses or other users, although there are some isolated sections with no surrounding land use to provide activity or overlooking, such as allotments.

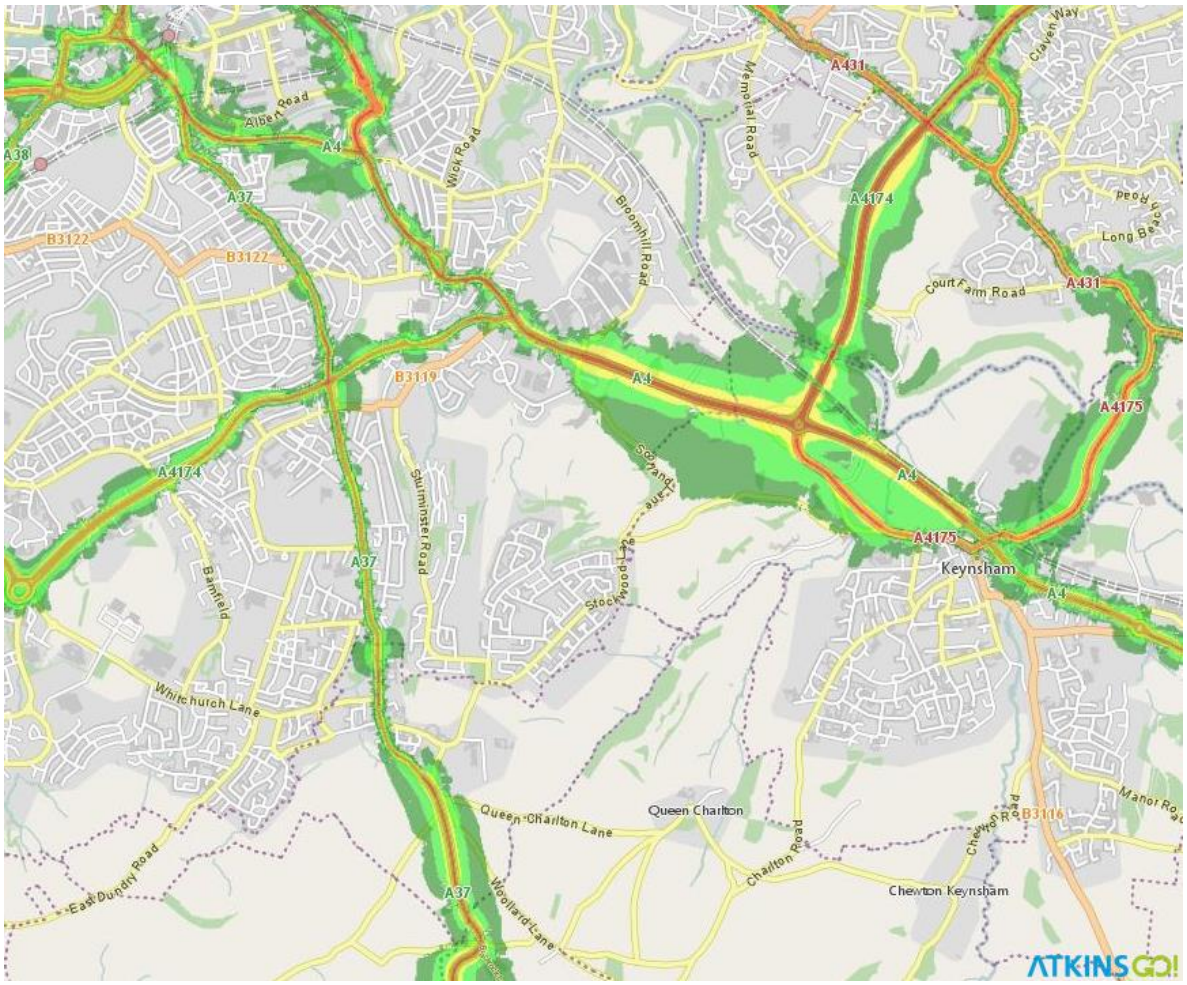
On the A4174 orbital route from Hicks Gate to the East Fringe there is an offline cycle path for most of this route, however its isolated nature makes it an uncomfortable environment at night for many users.

Issue: Intermittent levels of provision in terms of walking and cycling facilities and security of routes means there is a lack of continuous high-quality routes that users will feel comfortable using at all times.

2.3.7.3. Noise

Modelled noise level data provided by the Department for Environment, Food & Rural Affairs (DEFRA) is shown in Figure 2-20.

Figure 2-20 Road Noise Contours - 24-hour period



The data shows the A4 corridor to have a high noise impact throughout it length. Through the urban environment, the geographic extent of this impact is constrained due to the built-up frontage to the corridor, but there are significant local impacts.

The other key corridors of the A37 and A4174 generally have a smaller noise impact, due to lower traffic volumes, although again they have significant local effects.

The rural sections of the A4, A4174 Ring Road and A37 all have significant impacts that affect a wide area with no features to abate the noise from travelling over distance.

Issue: High traffic volumes in urban environment resulting in very significant noise impact locally – particularly on the A4.

2.3.7.4. Air quality

Figure 2-21 presents the Air Quality Management Area (AQMA) for Bristol. This shows the area where air quality is deemed to be sensitive, and in need of particular mitigation from negative air quality impacts – e.g. residential areas, areas of heritage interest, etc. The Bristol AQMA extends south along the A4 to Brislington and the A37 to just past Wells Road junction.

The Department for Environment Food and Rural Affairs (DEFRA) reports on air quality. Figure 2-22 displays data from their national Pollution Climate Mapping model in 1km squares. Urban areas in central Bristol have

the worst air quality, which is likely attributable to greater volumes of cars and less air dispersal. Air quality within the study area appears to be relatively good towards the city centre in comparison to other parts of the city, and consistent with other parts of Bristol away from the centre.

Other areas that are particularly sensitive to air quality changes are residential areas, particularly where they have large numbers of the elderly and children. Urban areas such as Keynsham, Whitchurch, Hengrove and Bristol where many people live are more at risk from negative air quality impacts due to a decrease in air quality.

Figure 2-21 Bristol AQMA map

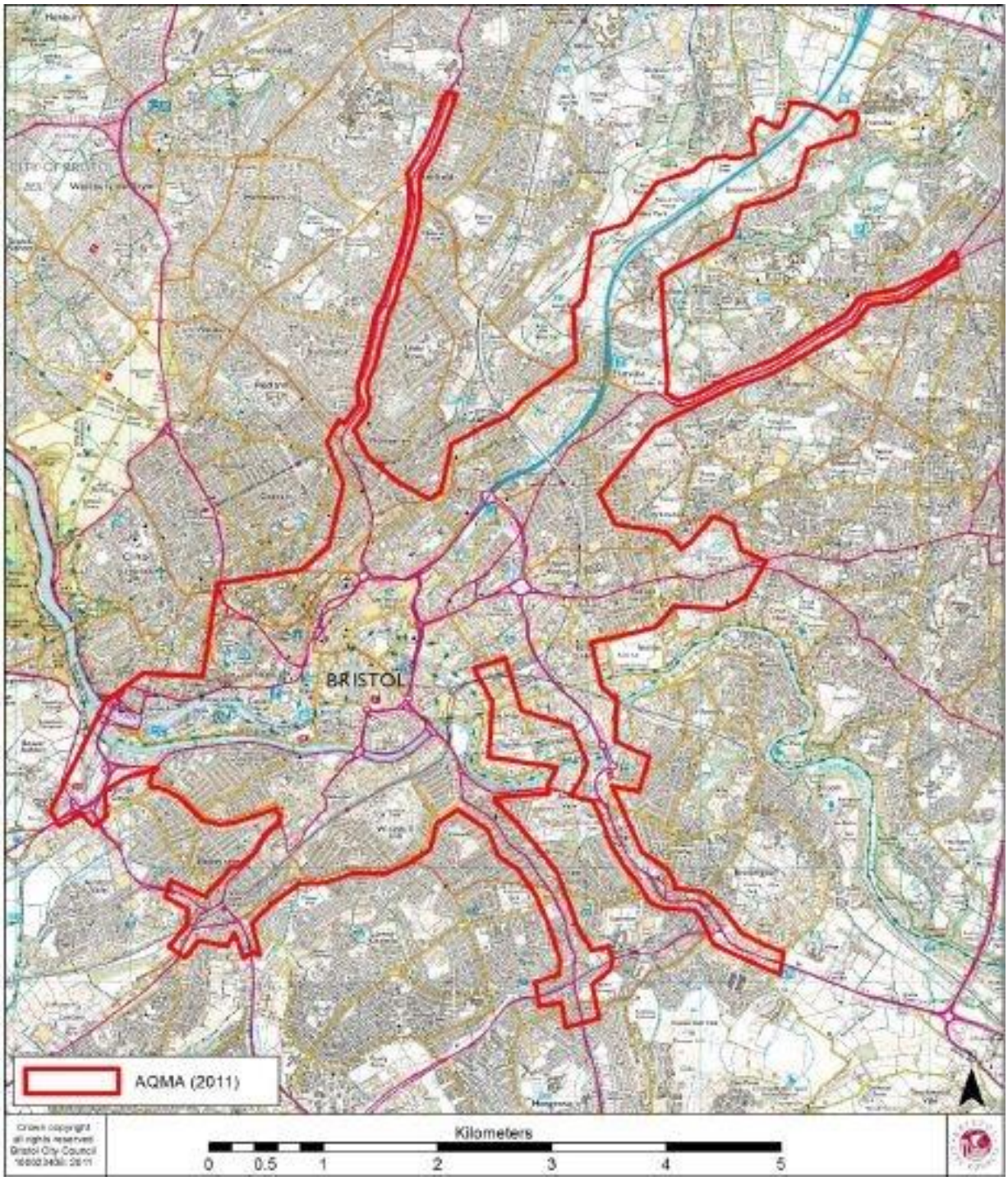
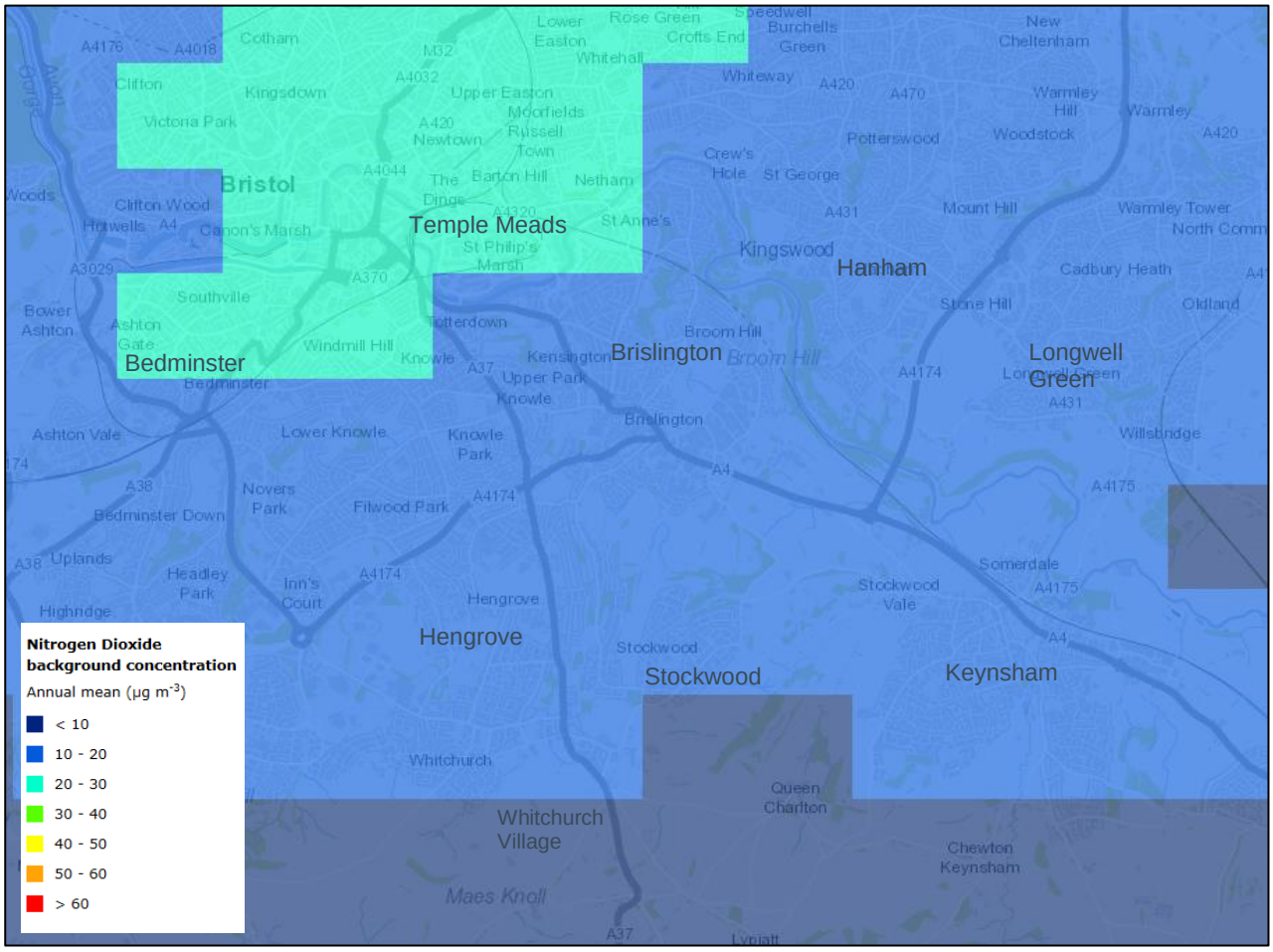


Figure 2-22 Background concentration of Nitrogen Oxides



2.4. Summary of current situation and issues

Issue	Impact
The study area is predominately residential, but with high levels of economically active residents.	A high demand for trips to other locations.
Existing transport links restrict travel choices with no strategic infrastructure or public transport service facilitating orbital movements around south Bristol.	Restricts access from Whitchurch to the north and east, and from Keynsham to the south and west.
Public transport serves the city centre only, particularly from Whitchurch.	A high level of car dependency.
Congestion on key radial and orbital routes.	Congestion leads to long and unreliable journey times for radial public transport at peak times, with journey times doubling compared to off-peak.
Severe delay at key locations forced to accommodate both radial and orbital movements due to a lack of alternatives – Hicks Gate and West Town Lane junctions.	Focus of very large delays and impact to all modes. No resilience to accommodate increased demand.
Trips divert to the local network – particularly around Whitchurch.	Localised congestion and impacts from rat-running on minor orbital routes.

3. Understanding the future situation

3.1. Future land uses and policies

3.1.1. Current known / committed developments / allocations from existing Local Plans

Current planned development in the West of England is directed towards land within and close to existing towns and cities, which will help to support the needs of the economy and respond to housing needs. Alongside areas including Bristol city centre, Bath, Weston-super-Mare and the North Fringe, the south east Bristol to Keynsham area is a significant location proposed for growth. The four authorities' existing Core Strategies already make provision for around 66,800 dwellings. Bristol and Bath & North East Somerset's plans are summarised in Table 3-1.

Table 3-1 The four authorities' plans for non-JSP planned growth[17]

Area	Homes	Employment
Bath & North East Somerset (2011-2029)[18]	**12,960**	**10,300 jobs**
Bath	7,020	6,950 jobs
Keynsham	2,150	1,600 jobs
Somer Valley	2,470	900 jobs
Rural areas and Whitchurch	1,120 rural areas, 200 Whitchurch	700 jobs
Bristol (2006-2026)[19]	**30,600 (min 26,400)**	**21,900 jobs**
City centre	7,400	150,000 m^2 office in city centre, 10 ha industry + 60,000 m^2 office in S. Bristol, 26,000 m^2 office in centres across the city
South Bristol	8,000	
Inner East	2,000	
Northern Arc	3,000	
Rest of city	6,000	
Smaller sites	4,200	

This study area is impacted directly by a number of these planned developments, in particular the growth planned for Whitchurch, South Bristol and Keynsham will add many additional users to the transport systems. The planned growth in the wider region is likely to still have an impact on this area and the associated schemes that are put forward. For example, the number of orbital movements are impacted by growth in the East Fringe in South Gloucestershire and from areas in North Somerset by the A38.

Additionally, relevant to this corridor, the South West is experiencing growth in the nuclear sector driven by development at Hinkley Point C (in Somerset) and future development at Oldbury (in South Gloucestershire).

Bristol Airport

Also relevant to this strategic package is airport growth. In 2016, 7.5 million passengers[20] passed through Bristol Airport, helping to deliver an estimated £31.4 billion boost to the region's economy and support 15,000 full time equivalent jobs[21]. The airport currently only has the capacity and transport infrastructure for 10 million passengers per annum, however demand is expected to increase to 15 million passengers a year by 2036. Consultation is currently ongoing for the plan to develop the airport and adjacent transport infrastructure to cater for this demand. Bristol Airport is located to the west of the A38, south-west of Bristol, approximately 11km (7 miles) to the west of Whitchurch. A lack of quality transport infrastructure to the airport has been an issue for a number of years, as the airport is not located near a major motorway or railway line. Currently the fastest route for those people in the east and north of Bristol is to travel down

17 West of England Joint Transport Study, Final Report (October 2017) (Housing numbers as published)
18 Bath & North East Somerset Core Strategy, Adopted July 2014
19 Bristol Core Strategy, Adopted June 2011
20 Civil Aviation Authority: UK Airport Data
21 Bristol Airport Future, available at: https://www.bristolairportfuture.com/pillar-2

through the city centre, across the newly opened (2017) South Bristol Link road and down the A38. Improved links around the east and south of Bristol orbitally, would help cater for the increase in demand by removing the traffic from central Bristol and thus reducing congestion.

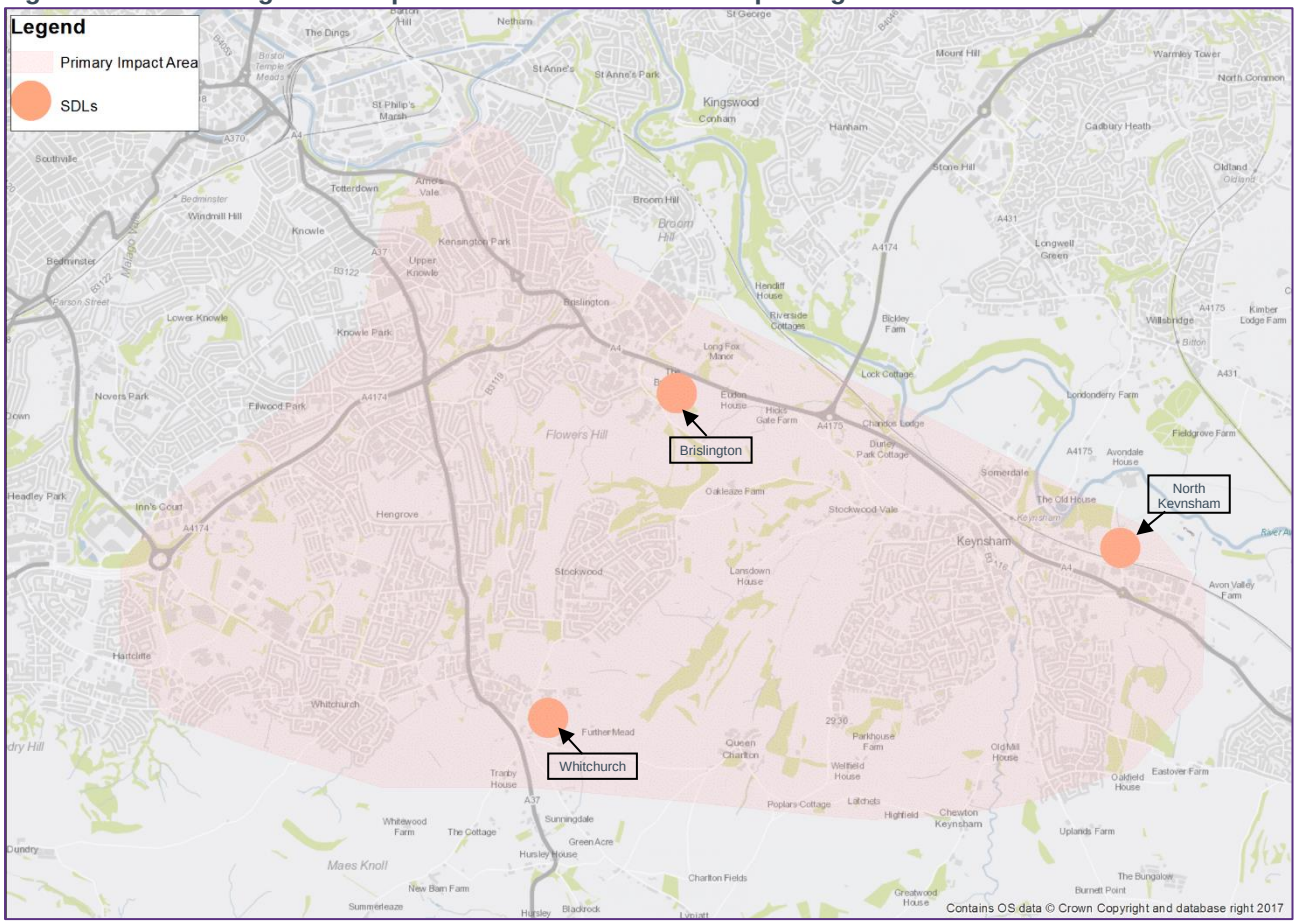
3.1.2. Joint Spatial Plan (JSP) proposals

The JSP is intended to meet the needs arising from both the Bristol and Bath Housing Market Areas to 2036. The Plan will provide a framework to deliver up to 105,000 net additional new homes between 2016 and 2036, including the committed growth within the four Core Strategies as set out in Table 3-1 above. This means that there is a requirement for up to 39,000 additional dwellings (to 2036) that need to be accommodated across the entire region through the JSP spatial strategy[22]. The JSP has identified a number of Strategic Development Locations (SDLs) which it is proposed will accommodate the majority of this requirement.

Figure 3-1 shows the location of three SDLs of particular relevance to this strategic package. These are Whitchurch (this is the key SDL which needs transport intervention), Brislington and North Keynsham. In line with the requirements of the National Planning Policy Framework (NPPF), the JSP seeks to maximise the sustainability of the SDLs, including maximising the use of active travel and public transport, it is therefore crucial that SDL growth is considered when identifying transport mitigation schemes as part of the option generating and sifting.

Table 3-2 summarises the JSP plan for growth in each of these three SDLs for the period up to 2036 and the following sections provide an overview of the planned development.

Figure 3-1 Strategic Development Locations relevant to package



[22] Per West of England Joint Transport Study, Final Report (October 2017)

Table 3-2 Summary of SDLs in the area

SDL	Number of Dwellings by 2036	Total Potential Dwellings	Employment Land
Whitchurch	1,600	2,500	Primarily residential
Brislington	750	750	Primarily residential
North Keynsham	1,400	1,500	14 ha

In addition to SDLs, the JSP Emerging Spatial Strategy identifies 16,000 new dwellings to be built across the urban area of Bristol. A further 3,400 non-strategic growth dwellings are expected to be built across the West of England to support local towns and villages, with up to 1,000 in each unitary authority. This includes up to 400 dwellings in the Ashton Vale area.

3.1.2.1. SDL at Whitchurch

The West of England JSP - Publication Document (Nov 2017)[23] identified an area to the south east of Whitchurch Village to develop 1,600 dwellings in the plan period to 2036, with the potential for 2,500 dwellings in total. The land is mainly untended grassland with pasture and grazing land and areas of recreational land. Land to the east of Whitchurch Village has already been allocated in the B&NES Local Plan as a strategic site; this is the only existing development scheme in the immediate area. The site sits within the Green Belt, and within the setting of Maes Knoll and the Queen Charlton Conservation Area.

The SDL at Whitchurch is one of the larger SDLs for the West of England region – in an area which is already on in the urban periphery. This development is a key driver in improving transport links in the area. The West of England concept diagram for the site[24] is shown in Figure 3-2.

Figure 3-2 Whitchurch SDL - Concept Diagram

[23]https://www.jointplanningwofe.org.uk/gf2.ti/f/845730/31505701.1/PDF//West_of_England_Joint_Spatial_Plan__Publication_Document_2017.pdf

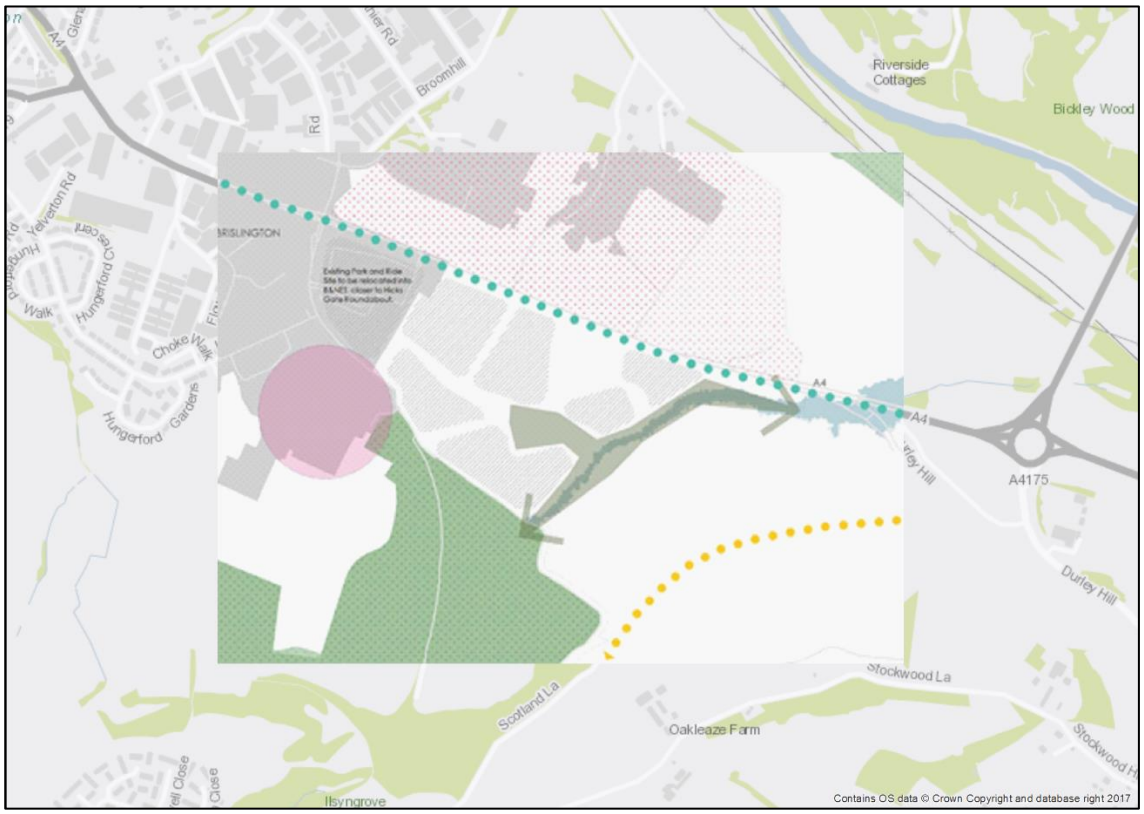
[24]JSP SDL Templates, available at: https://www.jointplanningwofe.org.uk/gf2.ti/-/845730/31385349.1/PDF/-/Strategic_Development_Location_Templates.pdf

Issue: It has been shown that residents of Whitchurch already experience significant transport challenges and constraints, particularly when making orbital movements, and public transport trips to any destinations other than Bristol city centre. Without significant improvement to transport provision, residents of any new development will experience the same challenges, the addition of more trips will exacerbate the issues and there will be associated local transport impacts.

3.1.2.2. SDL at Brislington

The JSP Emerging Spatial Strategy (Nov 2016) identified Brislington as accommodating 750 dwellings. Land at Brislington provides an opportunity for the creation of a new neighbourhood in Bristol with good links to the city centre and the countryside beyond Bristol's boundaries. This site is dependent on the relocation of Brislington Park & Ride to a location further east on the A4. The West of England concept diagram for the site[25] is shown in Figure 3-3.

Figure 3-3 Brislington SDL - Concept Diagram



Issue: This development location will increase demand on a very busy and congested section of the A4, close to Hicks Gate junction which is a key congestion and resilience concern. It also requires the relocation of key transport infrastructure – the Brislington P&R.

3.1.2.3. SDL at North Keynsham

The JSP Emerging Spatial Strategy (Nov 2016) also identified an area in North Keynsham, to the north of the A4 and High Street, as accommodating 1,100 dwellings in the plan period to 2036, with the potential for 1,500 dwellings in total, which includes land for 250 dwellings that have already been safeguarded. The West of England concept diagram for the site[26] has been mapped in context in Figure 3-4.

[25] JSP SDL Templates, available at: https://www.jointplanningwofe.org.uk/gf2.ti/-/845730/31385349.1/PDF/-/Strategic_Development_Location_Templates.pdf
[26] JSP SDL Templates, available at: https://www.jointplanningwofe.org.uk/gf2.ti/-/845730/31385349.1/PDF/-/Strategic_Development_Location_Templates.pdf

Figure 3-4 North Keynsham SDL - Concept Diagram

Issue: It has been shown that a significant number of trips are made between Keynsham and Bristol on the A4 corridor, which has little resilience to accommodate additional demand. It has also been shown that there are poor links between Keynsham and south Bristol, placing increased pressure on the A4/A4174 route.

3.2. Future changes to the transport system

The ambitions for growth set out in the JSP and in neighbouring regions will have implications for the future transport system and while major improvements to the transport network have already been delivered in recent years, challenges associated with additional growth remain, as identified in the JTS.

3.2.1. Planned / committed changes

There are planned and committed transport schemes in the pipeline. For the purpose of this study, it is assumed they are delivered as planned, and their potential impact on the study area is detailed below.

3.2.1.1. MetroBus: North Fringe to Hengrove Package (NFHP)

The North Fringe to Hengrove MetroBus bus rapid transport scheme (NFHP) links areas of housing and economic growth in the North and East Fringe of the Bristol urban area with a major regeneration area in South Bristol via Bristol city centre. When construction is completed in 2018 the NFHP will provide a fast, frequent and reliable public transport service using bus priority measures and new infrastructure including a new bus-only junction onto the M32. The NFHP has the potential to capture journeys between the city centre and the south -the service is currently planned to terminate at Hengrove Park, 2.2km (1.4miles) west of Whitchurch, and could therefore link with services from Whitchurch. A route map is provided in Figure 3-5.

Figure 3-5 MetroBus route map

3.2.2. Other relevant transport schemes under consideration

Further transport scheme options are under consideration but are not committed at this stage. Their potential impact on the study area will be considered as scheme options are assessed in subsequent stages of this study.

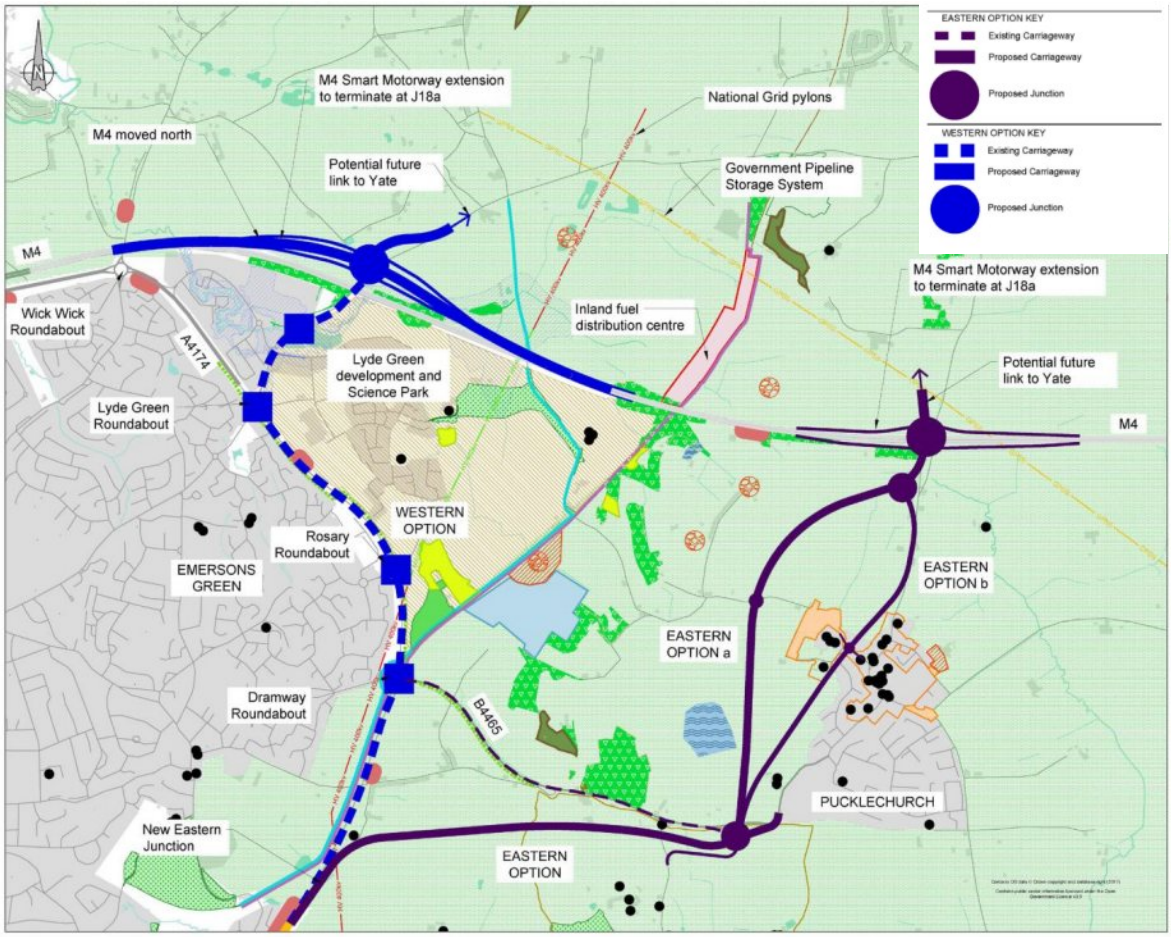
West of England Mass Transit

A mass transit system, potentially involving sections of underground running is at an early stage of consideration. So far four potential routes connecting to Bristol city centre have been identified – one to the North Fringe, one to the East Fringe, one to the south and Bristol Airport; and one to Keynsham/Bath.

New M4 Junction 18A

Options for a new M4 junction north-east of Bristol (Junction 18A) have been developed and presented for public consultation. This new junction would connect the A4174 Ring Road and A432. The intention is that this will help alleviate congestion at Junction 19 and unlock economic growth in the East Fringe and Yate. It is highly likely this junction would make the A4174 a much more attractive orbital route for movements to south Bristol and Bristol Airport from the M4. Options which are being consulted on are shown in Figure 3-6. In March 2018, following the public consultation, the South Gloucestershire Council Cabinet agreed the western option was the preferred option.

Figure 3-6 The two consultation options[27]



[27] M4 Junction 18A link Study; Consultation Document; August 2017

3.3. Future travel demand and problems

The G-BATS4 model represents the highway network covering the Bristol urban area and wider sub-region. The model was created in 2013 and validated against traffic count data, road side surveys and observed traffic flows at that time. The G-BATS4 model has enabled strategic analysis of current and future issues at the sub-regional level and has helped inform analysis of the potential for mode shift from the private car and in the analysis of the performance of the transport network.

3.3.1. Spatially Neutral

The 2036 Spatially Neutral scenario, upon which the core modelling in this OAR is based, has been developed to be consistent with WebTAG Unit M4 on Forecasting and Uncertainty. This scenario was created using Reference Case travel demand which reflects changes in population, employment, car ownership and other demographic and economic factors as defined using the Department for Transport's National Trip End Model (NTEM 7.2). Changes in generalised cost between the Base Year and the Reference Case are then taken into account through the Variable Demand Model (VDM). The VDM process modifies the Reference Case demand forecasts to reflect the impacts of increasing congestion on the road network by producing a without-scheme (Do-Minimum) scenario.

The creation of the Spatially Neutral scenario follows relevant guidance in WebTAG in Unit M4, which recommends the establishment of an uncertainty log. Uncertainty logs classify future land development and infrastructure changes by the likelihood that they will occur. Only changes which are considered 'near certain' or 'more than likely', are included in the Spatially Neutral scenario.

Note that, based on this definition, the planned quantum and location of the JSP developments and infrastructure is not considered to be sufficiently certain in WebTAG terms. Traffic growth arising from these planned housing developments is included within the West of England region, but in a spatially neutral location, i.e. spread throughout the area based on existing housing locations. This is consistent with WebTAG recommendations on applying growth to transport models.

The schemes included in the Spatially Neutral model are consistent with the uncertainty log which is included within the Traffic forecast report provided by CH2M/Jacobs.

3.3.2. With JSP Scenario

Further sensitivity testing has been completed on the shortlisted schemes in conjunction with a With JSP scenario, which reflects the quantum of development at each SDL. Whilst not WebTAG compliant in terms of the uncertainty log, as the SDLs are not yet committed development, it seeks to demonstrate the increased benefits as a result of JSP development. This is through increased patronage from the SDLs, and mitigating congestion issues as a result of additional traffic from the SDLs.

The JSP planning assumptions were used with the alternate assumptions function within TEMPro software, based on the DFTs National Trip End Model (NTEM7.2) database, to determine the forecast change in highway trips as a result of the JSP relative to the NTEM assumptions. This estimate of change was applied as a target constraint, by unitary authority, to the previously calculated matrices.

3.3.3. Traffic growth and congestion

Significant changes in the traffic conditions and congestion are anticipated across south east Bristol resulting from growth approved through the West of England authority's approved Core Strategies as a consequence of population and employment growth.

Based on the housing and development growth the G-BATS4 model in a Spatially Neutral scenario forecasts indicate that there will be an estimated 16% increase in highway trips on the road network between 2013 and 2026, with an increase in average delay of 17%[28]. The relatively modest increase in delay reflects the already planned improvements to the transport network including the MetroBus schemes, South Bristol Link and Stoke Gifford Transport Link, that will have been completed since 2013.

The growth in numbers of people living and working in the area in the longer term to 2036 will result in a forecast 26% increase in highway trip demand between 2013 and 2036 in a Spatially Neutral scenario, with

[28] Source: Analyses by Atkins using G-BATS4 model

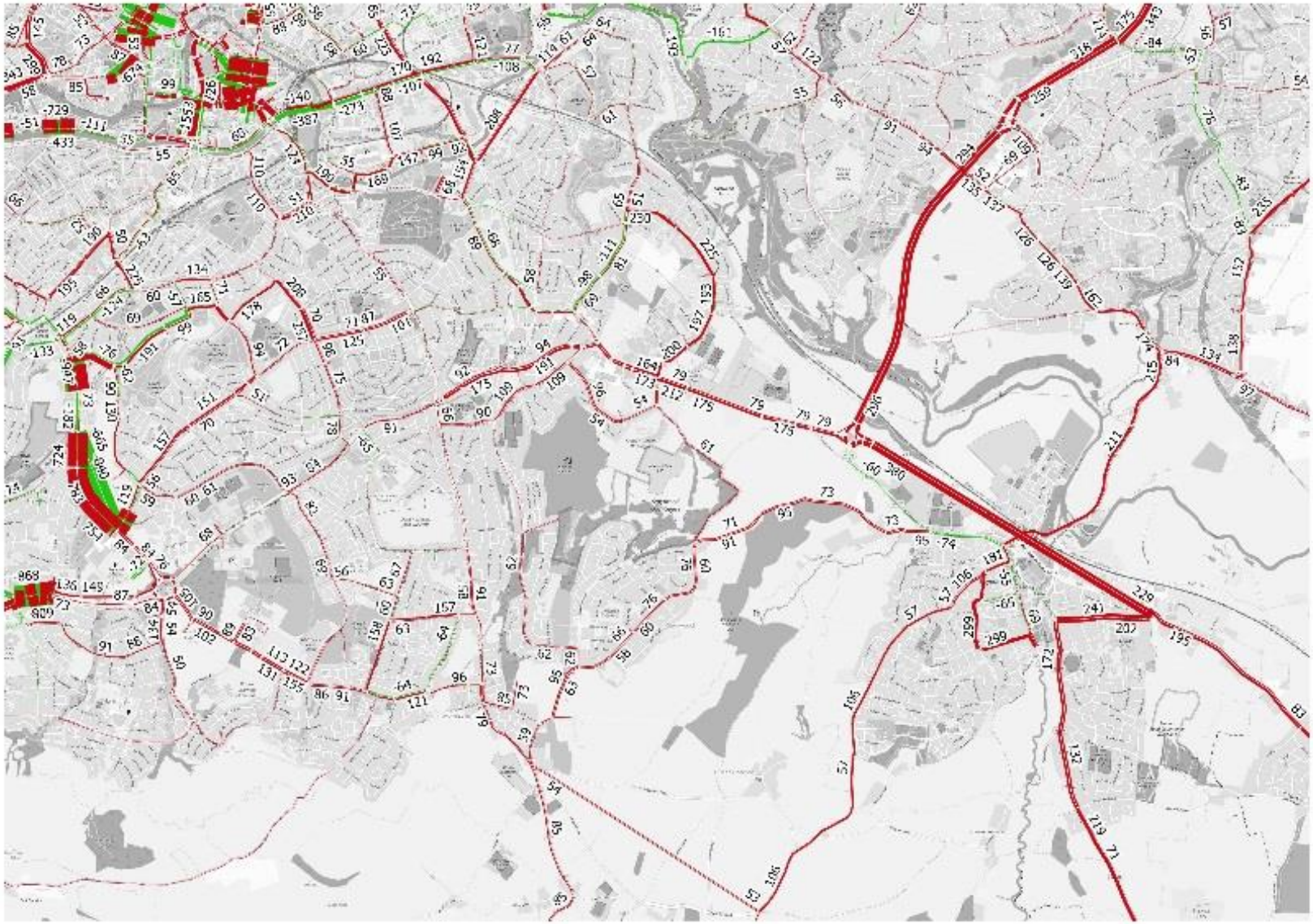
an increase in average delay of almost 40%[29]. This indicates that the network will be under increasing strain, with further parts of the network experiencing high levels of congestion resulting from longer-term growth.

Figure 3-7 shows the forecast difference in AM peak hour demand flow (spatial neutral scenario) between 2013 and 2036 with no further transport interventions beyond currently committed schemes.

Issue: Growth is forecast to increase flows on key parts of the network including:
A4174 ring-road to A4 Keynsham bypass route (and associated movements through Hicks Gate junction);
A4 between Hicks Gate and West Town Lane junction, and continuing A4174 orbital route to the west; and
Orbital movements on minor routes around Whitchurch, including Whitchurch Lane, Stockwood Lane and Charlton Road.
Planned/committed schemes will not address these issues or accommodate future growth in the area.

[29] Source: Analyses by Atkins using G-BATS4 model

Figure 3-7 AM Peak Demand Flow Difference (2013 Base to 2036 Do Minimum; Spatially Neutral)



Car journey times for key routes in south east Bristol have been used as the primary performance indicator to understand the likely future highway network performance, as predicted by the model. Ten journey time routes through the network were examined covering separate links. These routes are illustrated in Figure 3-8.

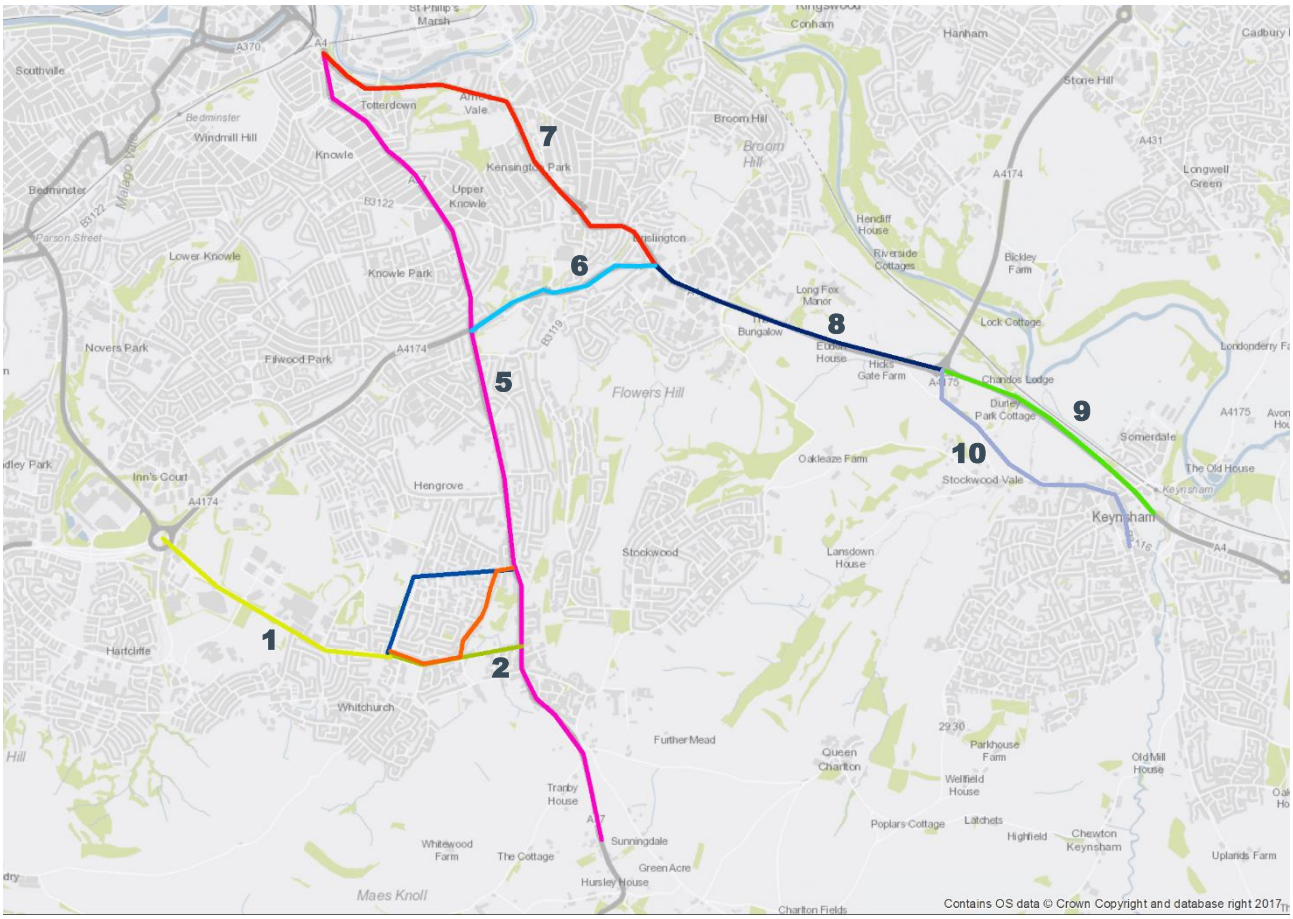


Figure 3-8 Forecast car journey time comparison routes

The forecast journey time for 2013 base and 2036 do minimum scenarios is compared in Table 3-3 for morning peak and Table 3-4 for evening peak.

Table 3-3 Car journey times for selected routes during the morning peak hour (08:00 - 09:00)

Route	Direction	Distance (m)	Base Year	Do Minimum	Increase (%)	2036 Do Minimum Speed (mph)
			2013 (sec)	2036 (sec)		
1 – Fortfield Road / Whitchurch Lane junction to Hengrove Way via Whitchurch Lane	Westbound	1750	160	175	9%	22.4
	Eastbound		183	206	**13%**	19.0
2 – A37 to Fortfield Road / Whitchurch Lane junction via Maggs Lane*	Westbound	947	110	122	**11%**	17.4
	n/a		n/a	n/a	n/a	n/a
3 – A37 to Fortfield Road / Whitchurch Lane junction via Ridgeway Lane	Westbound	1259	243	266	9%	0.0
	Eastbound		119	119	0%	0.0
4 – A37 to Fortfield Road / Whitchurch Lane junction via Fortfield Lane	Westbound	1242	244	266	9%	10.5
	Eastbound		139	140	1%	19.9
5 – A37 from Gibbet Road to Three Lamps A4-A37 junction	Southbound	6300	873	863	-1%	16.4
	Northbound		853	927	9%	15.2
6 – A4174 from Wells Road Junction (A37) to West Town Lane Junction (A4)	Westbound	1125	77	77	0%	32.7
	Eastbound		81	81	0%	31.1
7 – A4 from West Town Lane junction to Three Lamps A4-A37 junction	Southbound	2943	530	514	-3%	12.9
	Northbound		304	375	**23%**	17.5
8 – A4 from Hicks Gate to West Town Lane junction	Southbound	2035	179	184	3%	24.8
	Northbound		337	390	**16%**	11.7
9 – A4 from Keynsham Rail Station to Hicks Gate	Southbound	2616	113	135	**19%**	43.4
	Northbound		122	125	2%	46.9
10 – Keynsham High Street to Hicks Gate via Bristol Road and Durley Hill	Southbound	2829	315	316	0%	21.5
	Northbound		345	342	-1%	17.2

Table 3-4 Car journey times for selected routes during the evening peak hour (17:00 - 18:00)

Route	Direction	Distance (m)	Base Year 2013 (sec)	Do Minimum 2036 (sec)	Increase (%)	Do Minimum Speed (mph)
1 – Fortfield Road / Whitchurch Lane junction to Hengrove Way via Whitchurch Lane	Westbound	1750	167	216	**29%**	18.1
	Eastbound		186	196	5%	20.0
2 – A37 to Fortfield Road / Whitchurch Lane junction via Maggs Lane*	Westbound	947	113	114	1%	18.6
	n/a		n/a	n/a	n/a	n/a
3 – A37 to Fortfield Road / Whitchurch Lane junction via Ridgeway Lane	Westbound	1259	241	243	1%	2.2
	Eastbound		119	120	1%	2.2
4 – A37 to Fortfield Road / Whitchurch Lane junction via Fortfield Lane	Westbound	1242	241	243	1%	11.4
	Eastbound		140	140	0%	19.9
5 – A37 from Gibbet Road to Three Lamps A4-A37 junction	Southbound	6300	801	796	-1%	17.7
	Northbound		816	852	4%	16.6
6 – A4174 from Wells Road Junction (A37) to West Town Lane Junction (A4)	Westbound	1125	77	78	1%	32.3
	Eastbound		82	83	1%	30.4
7 – A4 from West Town Lane junction to Three Lamps A4-A37 junction	Southbound	2959 (2927)	482	512	6%	12.9
	Northbound		271	289	7%	22.7
8 – A4 from Hicks Gate to West Town Lane junction	Southbound	2035	233	253	9%	18.0
	Northbound		256	264	3%	17.3
9 – A4 from Keynsham Rail Station to Hicks Gate	Southbound	2616	136	140	3%	41.9
	Northbound		122	124	2%	47.3
10 – Keynsham High Street to Hicks Gate via Bristol Road and Durley Hill	Southbound	3035 (2623)	326	356	9%	19.1
	Northbound		339	337	-1%	17.4

The data presented in Table 3-3 and Table 3-4 indicated that the journey times for the examined routes are forecast to increase in the future Do Minimum (spatially neutral) scenario.

Significant increases are forecast on Whitchurch Lane (Route 1) carrying orbital movements from/to south Bristol, with each of the minor routes linking that to the A37 (Routes 2, 3, and 4) also experiencing increased delay, particularly in the AM peak.

Overall, when compared with the actual speed limits on roads, the forecast average speeds in 2036 Do Minimum scenario (spatially neutral) for these links are consistently lower. This observation implies that future journey times along the routes will increase due to the growth of existing demand and those from approved development identified in 2026, unless improvement and/or alterations to transport provisions are enabled.

Issue: Increasing demand on key sections of the network forecast to result in significant increases in journey time, particularly on Whitchurch Lane to the west.

3.3.4. Impact of JSP proposals

The routings of the traffic generated by the SDLs in the Emerging Spatial Strategy[30] in the morning peak hour – before mitigation – are shown in Figure 3-9. The widths of the coloured lines on the map are proportionate to the volumes of traffic generated by the strategic locations. Each colour represents a strategic location tested.

The Emerging Spatial Strategy was published in November 2016, however since then there have been some updates in terms of SDL location, allocation and size, which can be found in the Joint Spatial Plan[31] which was published for public consultation in 2017. This includes the reallocation of Brislington Park & Ride to be a housing development. An update to the modelling work is currently underway to understand the change in the impact of the developments on the existing road network and will be available for EIP in 2018. Figure 3-9 therefore provides a good overview of how the additional traffic from the SDLs will interact with the road network, however when the new modelling becomes available there will likely be small changes to this.

Figure 3-9 Routings of traffic generated by new development (without mitigation)[32]

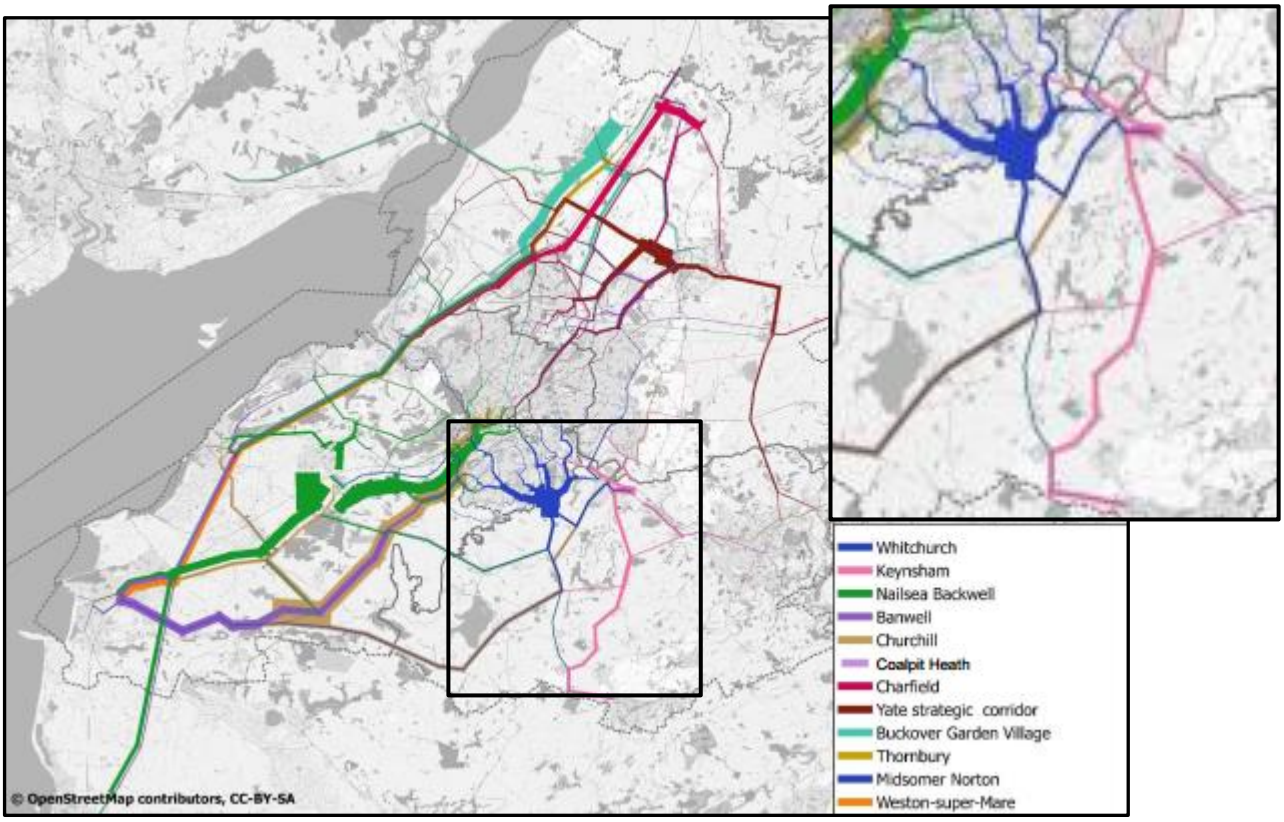


Figure 3-9 indicates the significant additional demand for orbital movement from the Whitchurch area – particularly to the west into south Bristiol, and north to the East Fringe. It has been shown that there is currently inadequate provision to support these movements, both in terms of infrastructure and public transport service options.

Figure 3-10 shows the forecast traffic flow differnence (AM peak) due to the JSP development proposals without mitigation, further highlighting the impact on radial and orbital corridors.

30 https://www.jointplanningwofe.org.uk/consult.ti/JSPEmergingSpatialStrategy/viewCompoundDoc?docid=8259188

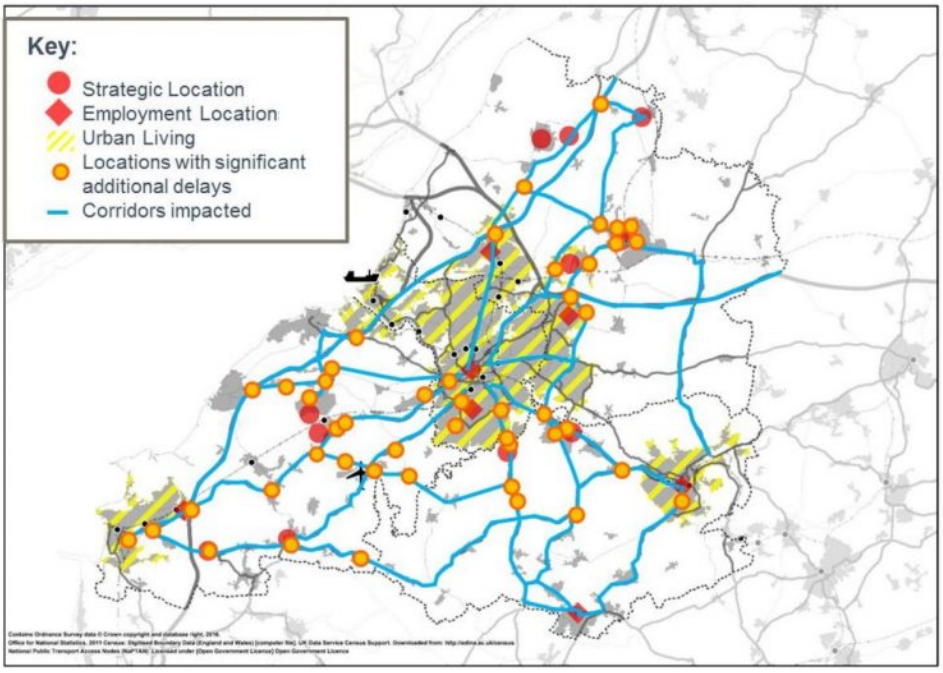
31 https://www.jointplanningwofe.org.uk/consult.ti/JSPPublication/consultationHome

32 Emerging Spatial Strategy: Transport Topic Paper, November 2016.

Figure 3-10 AM peak flow difference (with JSP vs. without JSP, without mitigation)

The cumulative impacts of the Emerging Spatial Strategy at this stage were summarised in the diagram presented in Figure 3-11. The corridors and key locations forecast to experience the most impact and delay are highlighted. Within the study area, both the A4 and A37 corridors are identified, with particular issues at Hicks Gate junction, A37/A4174 junction, and A37 junctions with Ridgeway Lane and Maggs Lane, immediately north of Whitchurch.

Figure 3-11 Emerging Spatial Srategy: Impacts on Road Network - Without Mitigation



Issue: Emerging JSP proposals for a SDL at Whitchurch further compound growing pressure on the local network particularly with regard to orbital movements to the west and north, for which it has been shown there is inadequate provision in terms of highway and public transport infrastructure, and public transport service options.

3.3.5. Summary of Future transport-related problems

The previous sections clearly highlight that without mitigation, future transport demand caused by background, JSP and non-JSP growth is forecast to result in detrimental impacts on journey times and journey speeds across the south-east Bristol and Whitchurch strategic package.

The key forecast issues include:

Issue	Impact
No strategic infrastructure or public transport services facilitating orbital movements around south Bristol	Dependence on car travel for all trip destinations other than Bristol city centre; Severe delay at key locations forced to accommodate both radial and orbital movements; Associated impacts as trips divert to the local network – particularly around Whitchurch
Committed development forecast to increase demand on key locations of the network which are already congested.	Compounded issues at Hick Gate junction, the A4, and various orbital routes including the A4174, Whitchurch Lane and local rat-runs.
Strategic Development Locations providing a significant number of new houses and employment in locations with proven existing issues in terms of connectivity and choice of travel options – particularly Keynsham and Whitchurch.	Requirement for new transport links and services if SDLs are to be accessible to/from a full range of local destinations.
Airport growth – demand is forecast to double between 2016 and 2036.	Increased demand for orbital trips around south Bristol from Keynsham, the East Fringe, Whitchurch, south Bristol and more distant locations.

3.3.6. JSP Mitigation Package

The previous Emerging Spatial Strategy: Transport Consultation Draft (Oct 2017) concluded the following schemes are required to mitigate the impact of development on this corridor:

A new A4 MetroBus service from Bristol to Keynsham and Bath;
New Park & Ride facilities at Whitchurch (A37) and Hicks Gate (A4 to replace Brislington);
An orbital multi-modal transport link between Hengrove and the A4;
A new orbital MetroBus service from south Bristol to Emersons Green.

It should be noted that policy interventions such as parking charges are not considered as part of the mitigation strategy in this OAR.

4. Transport Package Objectives

4.1. Summary of current and future problems, impacts and outcomes

The previous sections of this report have identified the existing and future problems relevant to this strategic package and the impacts that result. These are summarised in Table 4-1:

Table 4-1 Summary of key problems and impacts

Issue	Impact
The study area is predominately residential, but with high levels of economically active residents.	A high demand for trips to other locations.
Existing transport links restrict travel choices with no strategic infrastructure or public transport service facilitating orbital movements around south Bristol.	Restricts access from Whitchurch to the north and east, and from Keynsham to the south and west.
Public transport serves the city centre only, particularly from Whitchurch.	A high level of car dependency.
Congestion on key radial and orbital routes.	Congestion leads to long and unreliable journey times for radial public transport at peak times, with journey times doubling compared to off-peak.
Severe delay at key locations forced to accommodate both radial and orbital movements due to a lack of alternatives – Hicks Gate and West Town Lane junctions.	Focus of very large delays and impact to all modes. No resilience to accommodate increased demand.
Trips divert to the local network – particularly around Whitchurch.	Localised congestion and impacts from rat-running.
Committed development forecast to increase demand on key locations of the network which are already congested.	Compounded issues at Hick Gate junction, the A4, and various orbital routes including the A4174, Whitchurch Lane and local rat-runs.
Strategic Development Locations providing a significant number of new houses and employment in locations with proven existing issues in terms of connectivity and choice of travel options – particularly Keynsham and Whitchurch.	Requirement for new transport links and services if SDLs are to be accessible to/from a full range of local destinations.
Airport growth – demand is forecast to double between 2016 and 2036.	Increased demand for orbital trips around south Bristol from Keynsham, the East Fringe, Whitchurch, south Bristol and more distant locations.

Without major transport investment these corridors will be unable to cater for forecast growth, particularly in Whitchurch, Brislington and Keynsham.

4.2. Scheme objectives and outcomes

Table 4-2 lists the key issues identified for the study area which have informed development of the Transport Package objectives presented in Table 4-3.

Table 4-2 Package key issues

Key Issue	
A	High traffic levels and congestion on key routes and junctions, including A4, A37, A4174, Hicks Gate Roundabout
B	Limited travel choices with poor connectivity for both car and public transport modes for orbital movements and to destinations other than Bristol city centre
C	Poor bus journey times and reliability, particularly on the A4 during peak times into Bristol
D	Lack of direct orbital connectivity increases traffic on radial routes such as the A4 and adds to congestion at junctions which lack capacity, including Hicks Gate roundabout and West Town Lane junction
E	Local roads being used as alternatives to the congested strategic links

Table 4-3 Objectives mapped against key issues

	Objectives	Address Key issue?				
		A	B	C	D	E
1	Mitigate increased travel demand enabling planned growth (JSP and non-JSP)	✓	✓			
2	Provide a range of convenient and attractive journey options for south east Bristol to key destinations such as Bristol city centre and Keynsham, and for orbital movements, to enable mode shift	✓	✓	✓	✓	
3	Increase orbital connectivity to improve access around south east Bristol, reduce delays on the existing network and minimise inappropriate movements on local roads	✓	✓		✓	✓
4	Improve journey time reliability for public transport along the corridor and for orbital movements	✓	✓	✓	✓	

4.3. Measures for success

The measures for success of each objective is presented in Table 4-4.

Table 4-4 Objectives' Measure of Success

Objective	Measure for success
1. Mitigate increased travel demand enabling planned growth (JSP and non-JSP).	No increase in average peak hour journey time on the A4 and A37 following delivery of the SDLs. (journey time data, public transport timetable information)
2. Provide a range of convenient and attractive journey options for south east Bristol to key destinations such as Bristol city centre and Keynsham, and for orbital movements, to enable mode shift	Access to quality public transport services between the corridor, Bristol city centre, the East Fringe and south Bristol (service maps & frequencies, Census travel to work data) Increase to the cycling mode share for trips (%) (Census travel data) Access to modal interchange options for car-based users entering the Bristol urban area (Park & Ride, Walk, Cycle or Share options)
3. Increase orbital connectivity to improve access around south east Bristol, reduce delays on the existing network and minimise inappropriate movements on local roads	Access to quality public transport services between the corridor, the East Fringe and south Bristol (Service maps & frequencies, Census travel to work data) Journey to work patterns showing increased movement between Whitchurch and east Bristol, and Keynsham and south Bristol (Census travel to work data) No increase in average peak hour journey time on the A4 and A37 following delivery of the SDLs. (journey time data, public transport timetable information) No increase in vehicle flows on Stockwood Lane, Charlton Lane, Maggs Lane and Ridgeway Lane (Traffic counts)
4. Improve journey time reliability for public transport along the corridor and for orbital movements	Faster public transport journey times than existing between Keynsham, Whitchurch, Brislington and the city centre during the peak hours (public transport timetable information) Smaller % increase in public transport journey time between off-peak and on-peak services (public transport timetable information) Access to quality public transport services between the corridor, the East Fringe and south Bristol (Service maps & frequencies, Census travel to work data)

5. Generating and sifting options

5.1. Approach to option generation

The aim of the initial option generation stage is to generate as full a list as possible of the potential transport interventions in the corridor that will contribute to meeting the package objectives. As evidenced in the previous chapters, there are clear transport issues on the south east Bristol and Whitchurch strategic corridor which will intensify in the future without intervention and which are critical to accommodating JSP planned developments that support economic growth. To respond to these issues, potential schemes have been identified.

The aim of the initial option generation stage is to generate as full a list as possible of potential transport interventions in the corridor that will contribute to meeting the objectives set out.

Many potential schemes have previously been considered by BCC and B&NES through previous work, and developed or assessed to differing levels of detail. This options generation and sifting process has sought to draw upon and be informed by previous work where available, whilst considering any additional options and providing a consistent proportionate assessment which is not dependent on scheme options having previously been developed to a high level of detail.

The approach to longlist option generation, taking account of previous work, has therefore comprised:

1. Reviewing the scheme options considered for the JTS, included supporting technical proformas and notes;
2. Reviewing the Joint Spatial Plan and Core Strategy, and any scheme options identified;
3. Reviewing any further previously identified scheme options and any supporting technical material; and
4. Reviewing the evidence base presented in the report and identifying any new scheme options in response to issues highlighted.

This approach resulted in a full range of strategic options being considered for the corridor, relating to:

Highway – upgraded and new roads and junctions;

Public Transport – including both offline and online MetroBus and bus service improvements;

Active Travel – cycling and walking provision; and

Park & Ride – both upgraded and new sites.

5.2. Approach to option sifting

All scheme options have undergone a robust but proportionate sifting process to identify a short-list of the schemes that justify more detailed development and consideration. The sifting process follows a clear method and set of criteria for scheme progression, which allows for a transparent audit trail. The full sifting process and assessment guidance can be seen in Appendix 5:1.

To allow for a detailed and proportionate sift, schemes options were considered individually, and only the impact of the specific scheme being assessed was taken into account (rather than any packaging considerations), unless otherwise stated.

5.2.1. Sifting Methodology Framework

The Department for Transport (DfT) has defined five business cases to assess transport schemes and allow decisions to be made. These five cases show whether schemes:

are supported by a robust **case for change** that fits with wider public policy objectives – the ‘strategic case’;

demonstrate **value for money** – the ‘economic case’;

are **commercially viable** – the ‘commercial case’;

are **financially affordable** – the ‘financial case’; and

are **achievable** – the 'management case'.[33]

The sifting tool uses four out of these five cases to assess schemes – the strategic, management, economic, and financial cases. The commercial case (considering topics such as procurement strategies, contract timescales, etc.) is not used due to the early stage of sifting with such aspects being too uncertain, as well being unlikely to differentiate between options at this stage. Potential income generation has been considered as part of the financial case at this stage.

An overview of each case, in reference to their role and intended purpose for this task, is provided in Table 5-1.

Table 5-1 The role and purpose of the business cases

Case	Role	Purpose
Strategic Case	Determines whether there is a clear need for this intervention – that it is meeting the Objectives for the Corridor and addressing a known, evidenced issue. i.e. does this investment meet the needs of the project.	Each scheme option is assessed against the corridor objectives. Additional weight is given to Objective 1 which support the Joint Spatial Plan's objectives.
Management Case	Determines whether a project is deliverable in the context of the Joint Spatial Plan's period to 2036. Key risks to delivery such as physical or environmental constraints are also considered	Risks and issues considered include planning complexity, requirement for land purchase, interactions with other infrastructure and acceptability by the public and stakeholders. From this, schemes are assessed as 'Unlikely to be deliverable', 'Deliverable but high complexity/risk' or 'Deliverable with low complexity/risk'. Based on these factors (and not funding availability) an assessment is also made as to whether the scheme could be delivered before 2026, 2036 or afterwards.
Economic Case	Determines if a scheme delivers Value for Money. Impacts considered are those with a direct monetary impact on the economy and those which cannot be monetised.	Scheme options are assessed as to whether they would have beneficial or adverse impacts against the economy, socially and towards the environment. The economic portion considers connectivity, reliability, delivery of housing and wider impacts. With regard to the social impact the assessment anticipates the extent to which the scheme would influence physical activity, journey quality, accidents, security, access to services, affordability and severance; this is completed considering the existing situation which is presented in Section 2. Environmental impacts which are considered are air quality, noise, carbon emissions, landscape & townscape biodiversity, heritage and the water environment. Where one element would be adversely affected but another beneficially, the worst case holds the greatest weight for the scoring.
Financial Case	This concentrates on the affordability of the proposal, both in the capital costs of implementing the scheme and the ongoing operational cost of running and maintain the service.	Expected capital cost is assessed (in bandings), and the likely requirement for ongoing revenue support for operation of transport services or facilities. Based on these two assessments the affordability and financial risk is scored i.e. very high capital and/or revenue costs mean that a scheme is not likely to be affordable. Associated financial risks are also considered e.g. is there a risk the council will be faced with long term outgoing costs which cannot recouped by the scheme or it's associated benefits.

5.2.2. Sifting Process

The sifting methodology followed a two-stage process, summarised in Figure 5-1:

Stage 1 – Assessment against strategic and management cases; and
Stage 2 – Assessment against economic and financial cases.

[33] Transport business case, January 2013; https://www.gov.uk/government/publications/transport-business-case

Only scheme options that passed Stage 1 were assessed at Stage 2. The options that pass Stage 2 are assessed in more detail in Chapters 6 to 10. Where the sifting tool did not capture the scheme impacts effectively at either phase, a manual override to pass/fail a scheme option was applied, with the justification for doing so recorded.

Figure 5-1 Sifting process summary

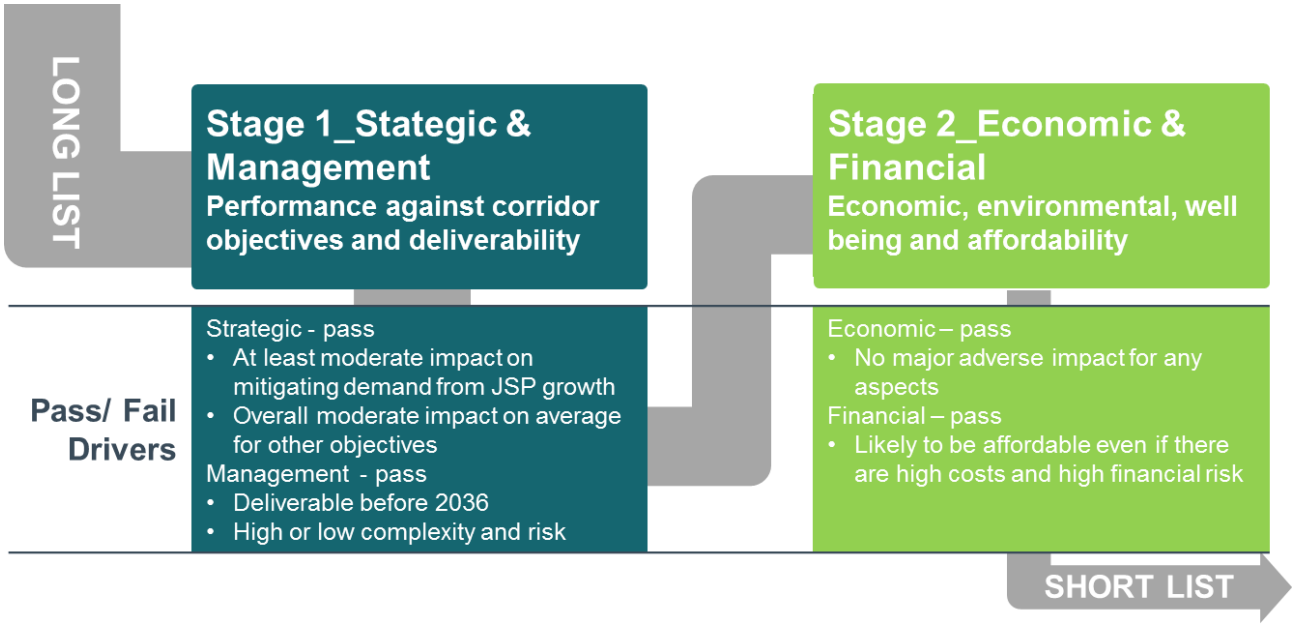


Table 5-2 provides an outline of the key pass / fail criteria and drivers at for each case.

Table 5-2 Pass / Fail Criteria and Drivers

Case	'Pass'	'Fail'
Strategic Case	**Criteria** · At least moderate impact on the first Strategy Objective, mitigating demand from JSP growth. Overall moderate impact on average for other objectives. In this instance 'Moderate' equates to a scheme which is expected to have a reasonably significant impact with respect to the identified objective or outcome.	**Criteria** Minor impact or smaller on mitigating demand from JSP growth. · Overall minor impact or smaller on average for other objectives. · In this instance 'Minor' would be selected when the scheme would have a modest overall impact.
	Drivers Large impact on SDL. Increases journey options, convenience and attractiveness to users. Reduces traffic. Improve public transport journey time reliability. Enables public transport mode shift.	**Drivers** Small impact on SDL. Lack of positive impact on public transport journey time and reliability. Not reducing congestion at known pinch points. Not enabling a mode shift to public transport.
Management Case	**Criteria** Deliverable before 2036. High or low complexity and risk.	**Criteria** Would be delivered after 2036. Very high complexity and risk.
	Drivers · Schemes that will be simpler to progress, design, and deliver. · Schemes where there are fewer unknowns and showstoppers.	**Drivers** Schemes that are very unlikely to be deliverable due to engineering and environmental constraints e.g. lack of highway space.

Case	'Pass'	'Fail'
Economic Case	**Criteria** Beneficial impacts, neutral or minor/moderate adverse impacts for any aspects. · In this instance a minor/moderate adverse is one which can probably be satisfactorily mitigated through the design process. Minor/Moderate beneficial impacts are only scored where there is reasonable evidence of minor / moderate beneficial impacts overall, and no risk of adverse impacts.	**Criteria** A major adverse impact on any aspect. In this instance a major adverse impact is one which could not be satisfactorily mitigated.
	Drivers Economic Growth Connectivity Reliability Wider economic impacts · Resilience Delivery of housing · Expected VFM Environment Air quality Noise Carbon emissions Landscape & Townscape Biodiversity Heritage Water environment Well being Physical activity Journey quality Accidents Security Access to services Affordability Severance	**Drivers** Driver as stated in Pass column. Minor adverse impacts are not enough to justify an option not progressing (as the impacts could be mitigated) Major adverse impacts on the Economy, Environment or Wellbeing would be very difficult to mitigate and could have particularly damaging impacts on a certain aspect.
Financial Case	**Criteria** Likely to be affordable even if there are high costs and high financial risk as there is a strategic need for the option.	**Criteria** Likely to be unaffordable due to very high capital costs and high ongoing revenue costs.
	Drivers Capital Costs Revenue Costs i.e. is it likely to require ongoing revenue support for operation of transport services or facilities (e.g. over 5 years). Note, infrastructure maintenance is accepted as an ongoing cost and not included in this assessment. · Affordability & Financial risk takes in to account the previous two points and considers financial risk.	**Drivers** Very high capital costs - Not affordable / very high financial risk (e.g. >£50m). Ongoing revenue support required (>5 years).

This process sets out the method and set of criteria for scheme progression, which provides a clear record of how shortlisted schemes were selected over other options. The assessment at this stage is at a high-level, but where there is insufficient information available to assess a scheme thoroughly, it was passed into the shortlist for further consideration until sufficient understanding is achieved.

To allow for a detailed and proportionate sift assessment, scheme options were considered individually, and only the impact of the specific scheme option being assessed were taken into account, unless otherwise stated. Where relevant, interdependencies between scheme options are noted, as well as potential combined benefits.

Assumptions

The following assumptions were made during the sifting stage:

- MetroBus options assume 10-minute frequency of services with high quality vehicles, stops, RTPI (real time passenger information system) and parallel cycle provision. This recognises service frequencies may need to be optimised for shortlisted schemes when patronage results become available from modelling;
- Park & Ride focuses on the location of the potential sites, and assumes a quality onward service from that point (either standalone service or served by MetroBus); and
- Affordability assessment: no assumed aggregate cost threshold. Only scheme specific costs are considered.

5.3. Results of option generation and sifting

A summary of the sifting assessments are presented below. The full sifting tool and assessments is provided in Appendix 5:1.

The identified scheme options have been grouped for analysis purposes under the following themes:

Highway schemes (new links and improvements to existing network) including scheme options for:

Orbital route - A4-A37 Link
Orbital route - West of A37 Link
Hicks Gate Junction improvements

Public Transport schemes, including scheme options for:

Orbital Service (MetroBus and Bus service)
Whitchurch Railway Path MetroBus
A37 Corridor Public Transport

Active Travel schemes, including scheme options for:

Whitchurch Railway Path Cycle Route

Park & Ride schemes, including scheme options for:

Hicks Gate P&R
Whitchurch P&R.

5.3.1. Highway Scheme Options

5.3.1.1. Orbital Route - A4-A37 Link

The JTS identified a potential new link to better accommodate orbital movements between the A4 at Hicks Gate and the A37. High level feasibility studies for the JTS identified three potential alignments which comprised variants at the northern end of the link between Stockwood and Hicks Gate[34]. Online improvements to the A4/A4174 route were also considered. At the time of this OAR, early scoping work for the Strategic Masterplan Framework is being undertaken in relating to the potential SDL at Whitchurch, and consideration of the potential relationship between a link road and the SDL have highlighted further alignment options to the south, routing around the south east of the SDL. The northern and southern alignment options are considered in isolation to avoid significant duplication within the assessment and sifting process, although in all cases the assumption is made that the link element is part of a complete link between the A4 and A37. The alignment options identified are shown in Figure 5-2.

A dual-carriageway option is included for completeness (covering all alignment options to avoid significant duplication within the assessment and sifting process). Previous traffic modelling undertaken for the JTS, and early study into a southern orbital route to A38/Airport indicates that the potential traffic flow on this A4-A37 Link is below the levels where a dual-carriageway would be required. However, the potential impact of a southern orbital route has not been thoroughly assessed alongside other potential schemes such as M4 Junction 18a and upgrades to the A4174 ring-road through east Bristol. Therefore, the potential for the single-carriageway options considered to be upgraded to dual carriageway in the future has been noted as part of our assessment.

In all cases parallel walking/cycling route is assumed as part of the scheme, however cycle network options will be considered at a later stage.

The assessment of the A4-A37 Link options is summarised in Table 5-3, and those options shortlisted for more detailed assessment highlighted.

[34] Appendix A, West of England Joint Transport Study Report, October 2017.

Figure 5-2 A4-A37 Link Option Alignments

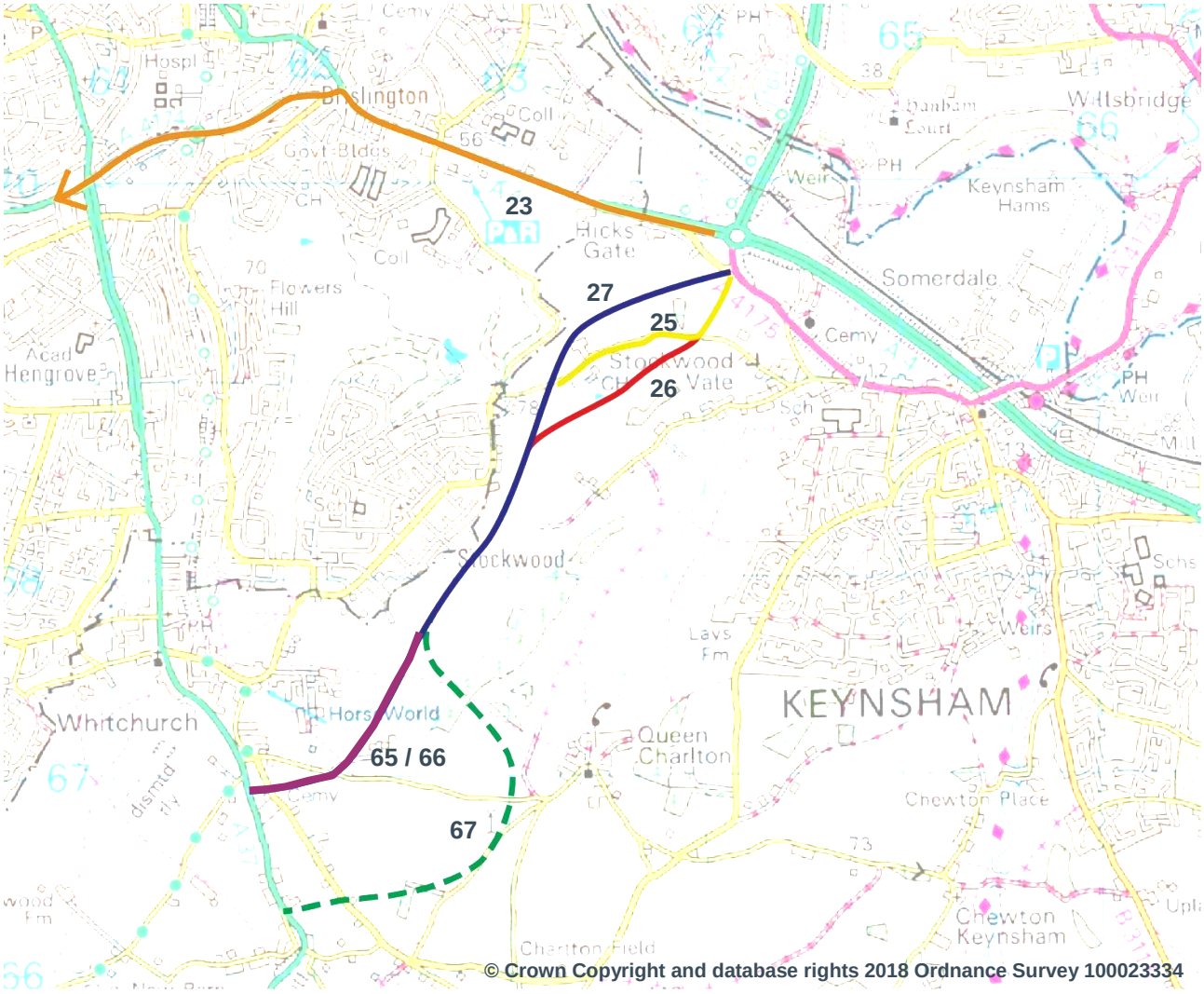


Table 5-3 Orbital route - A4-A37 Link Options Sifting Summary

No.	Orbital Route - A4-A37 Link	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support Objective 1?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
23	On-line widening of existing route via A4 Bath Rd, A4174 Callington Rd, Airport Rd.	Fail	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Unlikely to be sufficient to meet the demands on the corridor as congestion would remain poor, with conflicting movements in/out of Bristol and orbitally.
25	North Alignment 1 - Single carriageway orbital corridor between Hicks Gate Roundabout and A37 – southerly route from Hicks Gate to Stockwood Lane – improvement to Stockwood Lane – parallel route to Stockwood avoiding Stockwood Vale valley. (Yellow/Blue)	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Fail	Pass	Pass	Fail	No	E	Fails on the environment section of the economic case as this option alignment would require a climbing lane and significant cutting and earthworks.
26	North alignment 2 - Single carriageway orbital corridor between Hicks Gate Roundabout and A37 – southerly route from Hicks Gate to Stockwood Lane – parallel route to Stockwood avoiding Stockwood Vale valley. (Yellow/Red/Blue)	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Fail	Pass	Pass	Fail	No	E	Fails on the environment section of the economic case as this option alignment would require a climbing lane and significant cutting and earthworks.
27	North Alignment 3 - Single carriageway orbital corridor between Hicks Gate Roundabout and A37 – south westerly route from Hicks Gate following topography – parallel route to Stockwood avoiding Stockwood Vale valley. (Blue)	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Passes as this is the best option alignment in the economic case. The detailed alignment will require consideration of utilities when considering specific route. Modelling indicates that single carriageway would be sufficient for the level of demand.
65	South Alignment 1 - Single carriageway orbital corridor between Hicks Gate Roundabout and A37 - takes a direct alignment through the potential SDL. 40mph link providing access to the SDL and significant measures to provide connectivity across the link. Connecting to the A37 south of Staunton Lane. Not compatible with future dualling. (Purple)	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Commentary as per Option 27, plus: Note this approach would include features to avoid greater severance of the SDL and would not be compatible with a future dual carriageway option.
66	South Alignment 2 - Single carriageway orbital corridor between Hicks Gate Roundabout and A37 - takes a direct alignment through the potential SDL. 50mph link with no access to the SDL and limited measures to provide connectivity across the link. Connecting to the A37 south of Staunton Lane. Potentially compatible with future dualling. (Purple)	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Passes as this is the best option alignment across the cases. The detailed alignment will require consideration of utilities when considering specific route. This approach risks a degree of severance of the SDL, although appropriate design of crossing opportunities and adjacent land use could mitigate this. Strategically it offers good impact against objectives. Modelling indicates that single carriageway would be sufficient for the level of car use demand at this time – but this option allows for the future consideration of dual carriageway, although the risk of severance would increase.

No.	Orbital Route - A4-A37 Link	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support Objective 1?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
67	South Alignment 3 - Single carriageway orbital corridor between Hicks Gate Roundabout and A37 – takes an alignment around the southern eastern extent of the potential SDL. 50mph link with no access to the SDL and limited measures to provide connectivity across the link. Connecting to the A37 north of Gibbet Lane. Potentially compatible with future dualling. (Dotted green)	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Fail	Pass	Pass	Fail	No	E	Fails as would be a much more expensive alignment, requiring a long and indirect route around the SDL with high environmental constraints. To achieve this alignment around the potential SDL, either the link, or SDL are required to be located where they result in significant environmental harm.
68	Dual carriageway – all alignments	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Fail	Fail	No	F	At this stage previous modelling available indicates that demand would be well below the expected level for a dual carriageway route. However this demand is only modelled with Local Plan committed development and therefore does not include SDL growth in specific locations and does not include potential demand for this route if the full orbital corridor to the Airport is realised with M4 J18A – therefore there may be greater demand in the future. The low demand for dual carriageway at this stage and the uncertainty about the level of demand in the future with potential development, results in this option failing on the financial case due to high risk costs which are not required. However it may be desirable to future proof for a dual carriageway route. Furthermore, there is concern that a dual carriageway route is not in line with the subsequent route to the west, e.g. would result in more usage of Whitchurch Lane.

Orbital Route - A4-A37 Link Sifting Outcome

The shortlisted options for the A4-A37 scheme are:

North Alignment 3 (Blue) – south-west alignment from Hicks Gate following local topography; with

South Alignment 1 (Purple) – single carriageway with direct alignment through the potential SDL. 40mph link providing access to the SDL and significant measures to provide connectivity across the link; or

South Alignment 2 (Purple) – single carriageway with direct alignment through the potential SDL. 50mph link with no access to the SDL and limited measures to provide connectivity across the link. Potentially compatible with future dualling.

5.3.1.2. Orbital Route - West of A37 Link

The JTS identified a potential new link to better accommodate orbital movements west of Whitchurch and the A37. High level feasibility studies for the JTS identified three potential alignments between the A37 south of Whitchurch and Washing Pound Lane, Half Acre Lane and Ridgeway Lane via the eastern side of Whitchurch. These links would better facilitate movements from Whitchurch/A37 to Whitchurch Lane, which in turn links to key routes in south Bristol at Hengrove. Further initial study into a more strategic southern orbital route has identified links west to Bishport Avenue, and beyond to the A38/Airport, although the feasibility of these options has not been assessed in detail.

In all cases parallel walking/cycling route is assumed as part of the scheme, however cycle network options will be considered at a later stage.

The option alignments are shown in Figure 5-3, and a summary of the sifting is provided in Table 5-4.

Figure 5-3 West of A37 Link Option Alignments

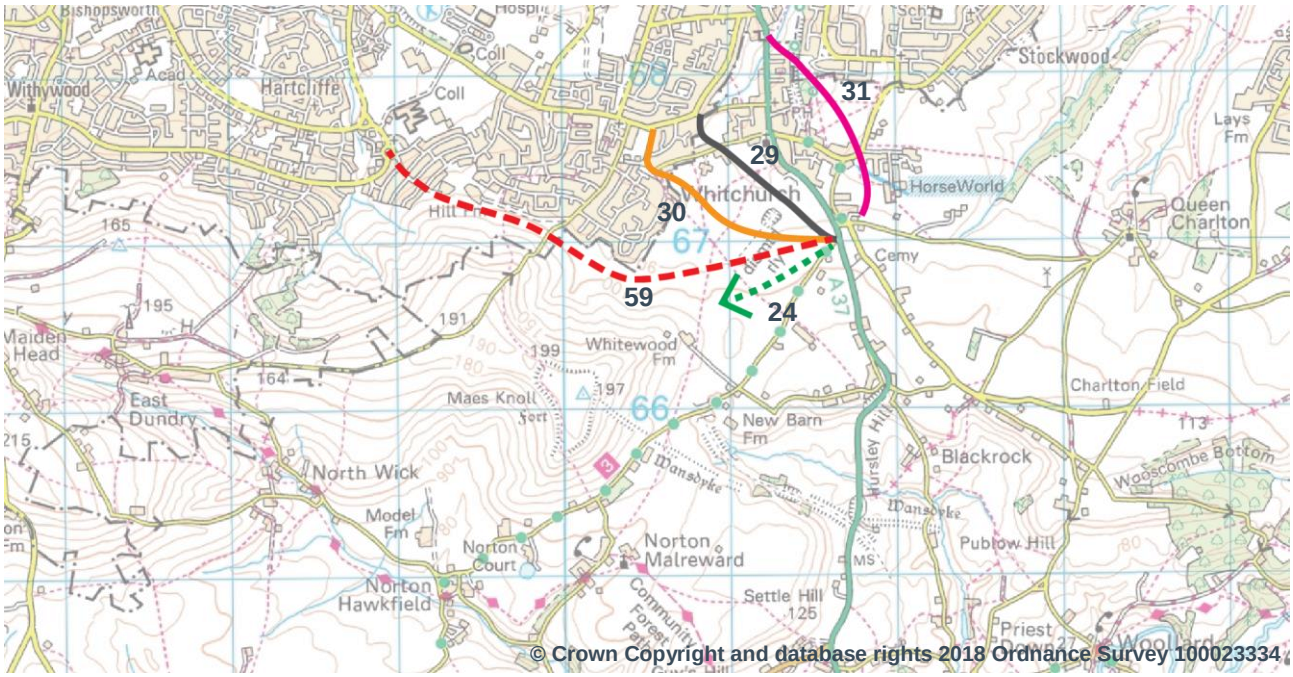


Table 5-4 Orbital Route - West of A37 Link Options Sifting Summary

No.	Orbital Route - West of A37 Link	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support Objective 1?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
24	New orbital corridor between Whitchurch and A38 at Barrow Common.	Pass	Pass	Fail	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	This scheme has very significant delivery challenges, possibly requiring a lengthy tunnel for both environmental and heritage/landscape reasons. Delivery within the plan period is unlikely. However, it is recognised that it remains a potential future aspiration, and would provide a suitable strategic link of higher quality than other options.
29	Connect from the A37 (at the roundabout with the routes to the east) to Washing Pound Lane, north of the junction with Church Road. Washing Pound Lane would be widened within existing highway boundary with an improved junction created at the junction with Ridgeway Lane and Whitchurch Lane. (Grey)	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Passes as there is the need for a route to the west of Whitchurch, as there is evidence of local roads being used instead of the main roads, and with the SDL and potential orbital route A4-A37 Link this issue could worsen. Careful consideration required of how Whitchurch Lane will be impacted by this option and the potential orbital route A4-A37 Link.
30	Connect from the A37 (at the roundabout with the routes to the east) to Stoneberry Road, which would connect via Half Acre Lane to Whitchurch Lane. It is assumed that Stoneberry Road and Half Acre Lane would be widened within existing highway boundary, with an improved junction at Whitchurch Lane. (Orange)	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Commentary as per Option 29.
31	Connect around the east of Whitchurch to connect back to the A37 near the boundary between Bristol and Bath & North East Somerset. Traffic towards Whitchurch Lane would then route along the A37 into Bristol and turn west (then south west) into Ridgeway Lane, which then continues as Whitchurch Lane to the west. (Pink)	Fail	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	This option fails as would it not stop traffic using residential roads in Whitchurch and thus scores poorly against objective 3. The issue that is aiming to be addressed here is not the north-south movement from the SDL but the orbital movement. This alignment also does not cater for SDL movements to the west.
59	Single carriageway road connecting the A37 to Bishport Avenue and Hawkfield Road in the west through an alignment south of Whitchurch Village.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Fail	Pass	Pass	Fail	No	E	This option fails as would have significant adverse environmental impacts, including negative noise and air quality impacts for the residential area it would pass through. This route has potential engineering constraints, and would run close to residential areas, particularly where it joins with Bishport Avenue. Would require careful consideration of the traffic from this alignment on the Bishport Avenue residential area. Likely to be significantly more expensive than the other options due to the length and cutting required, however could form part of a potential future A38 link.

Orbital Route – West of A37 Link Sifting Outcome

The more strategic options of links to Bishport Avenue or the A38 strongly align with the strategic objectives, but are discounted at this stage due to their high financial cost, engineering risks (widths and Durley Hill valley) and potential large adverse impact on the environment and landscape due to the sensitivity of the land in the area. It is recognised they remain potential options for the future, but are not aligned with the scope of this assessment.

Two shortlisted options are selected offering slightly alternative alignments from the A37 to Whitchurch Lane. It is recognised that Whitchurch Lane itself is not currently well equipped to be a strategic link road, however with improvements these routes could feed into routes through south Bristol, such as the South Bristol Link road.

The shortlisted options for the West of A37 scheme are:

A37 – Washing Pound Lane (Grey) – single carriageway with parallel pedestrian and cycle route.
A37 – Half Acre Lane (Orange) – single carriageway with parallel pedestrian and cycle route.

5.3.1.3. Hicks Gate Junction

A previous study[38] assessed options to make capacity improvements to Hicks Gate Roundabout, focussed on addressing existing issues and forecast demand up to 2024. The options previously considered are included in this sifting assessment independent of the A4-A37 Link road options. The sifting assessment takes account of the potential for these to be stand-alone scheme, or incorporated into works for the A4/A37 link to Whitchurch, and potentially beyond. Should the link road be progressed, the movement patterns at the junction would be significantly different to those assumed in the previous study, and if necessary, junction improvement options will be revisited as part of the link road scheme development.

A summary of the option sifting assessment is provided in Table 5-5.

[38] A4/A4174 Hicks Gate Roundabout Improvement Options, 2015. http://www.bathnes.gov.uk/sites/default/files/sitedocuments/Planning-and-Building-Control/Planning-Policy/Evidence-Base/Transport/hicks_gate_improvement_options_technical_report.pdf

Table 5-5 Hicks Gate Junction Options Sifting Summary

No.	Hicks Gate Junction	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support Objective 1?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
33	At-grade junction improvement – link between A4 Keynsham and A4174.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Need to consider potential interaction with new Hicks Gate P&R, Orbital MetroBus, A4 MetroBus and new A4-A37 Link. The best option will likely be determined by which other schemes are progressed, and may change depending on the package of schemes taken forward.
34	Grade separation with A4174-A4 flyover.	Pass	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Failed as modelling suggests that a lack of a left-turn filter lane from the A4174 to the bypass would result in queuing on the A4174 approach by 2024 in the evening peak when compared with a left turn filter lane, and would reduce speeds through the roundabout due to more vehicles having to use it to turn left. Also potential constraints due to additional land take required in the NW quadrant of the roundabout.
36	Grade separation with A4-A4 flyover.	Pass	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Failed as does not address the orbital movement issue sufficiently.
37	At-grade junction improvement – A4 throughabout.	Fail	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Failed as does not address the orbital movement issue sufficiently.

Hicks Gate Junction Sifting Outcome

The sifting assessment has selected one standalone junction improvement scheme which increases capacity for the dominant movement between A4 Keynsham and A4174 Bristol ring road. However it is recognised that the best option for Hicks Gate roundabout improvements may change depending on the package of schemes taken forward, as this will significantly impact the traffic levels on each arm. Nonetheless, without other schemes there are still options for Hicks Gate roundabout that should be considered to alleviate capacity issues.

The shortlisted option for the Hicks Gate junction standalone scheme is:

At-grade junction improvement – link between A4 Keynsham and A4174.

5.3.2. Public Transport Scheme Options

The key principles of the JTS Transport Vision[39] have a strong focus on active and sustainable travel, particularly within the urban areas. As such, the delivery of improved public transport options and services in conjunction with active travel facilities, is a key priority for the area.

5.3.2.1. MetroBus classification

To reflect similar schemes being delivered on other corridors in Bristol, MetroBus routes are included in the option sifting assessments where appropriate. At this stage, an assumption is included that any MetroBus scheme will also include improved cycle infrastructure on the route. MetroBus and cycle facilities can range from basic online priority at junctions and shared use lanes, to continuous fully segregated bus and cycle lanes. In order to assess the relative benefits and drawbacks of these variations in consistency across all the MetroBus options, three sub-variations were defined within MetroBus options: Gold standard, Silver standard and Bronze standard. These are defined in Table 5-6.

Table 5-6 MetroBus/Strategic cycle route standards

Standard	Definition
Gold	Fully segregated bus and cycle lanes, to fully compliant widths, along entire corridor. Likely to require land-take and traffic and parking management.
Silver	Targeted segregated improvements where required. Online bus lane priority through areas of congestion. May require land-take and local traffic and parking management at key locations.
Bronze	Segregated improvements where easily deliverable, with bus gates where highway width permits. Bus signal priority on existing junctions and bus gates

[39] https://www.jointplanningwofe.org.uk/inovem/sites/site120/custom/JPS_Launch_Event_presentation.pdf

5.3.2.2. Orbital Service (MetroBus & Bus Service)

The JTS identified a potential new MetroBus route between Whitchurch and the East Fringe, linking various interchange sites located on or near the Bristol ring road. There has been limited assessment of this scheme previously to inform the assessments made in this sifting process.

The options identified for this scheme are:

1. MetroBus route between Emersons Green and Whitchurch, connecting to existing MetroBus infrastructure (via new transport link around South East Bristol) - Gold standard.
2. MetroBus route between Emersons Green and Whitchurch, connecting to existing MetroBus infrastructure (via new transport link around South East Bristol) - Silver standard.
3. MetroBus route between Emersons Green and Whitchurch, connecting to existing MetroBus infrastructure (via new transport link around South East Bristol) - Bronze standard.
4. MetroBus route between Emersons Green and Whitchurch, connecting to existing MetroBus infrastructure (on existing roads, e.g. Whitchurch Lane/Stockwood Ln).
5. Improvements to city centre interchange between South Bristol and East Fringe bus services.
6. Enhanced bus service between Emersons Green and Whitchurch via new transport link.

Note that a number of these options are dependent on the building of the A4-A37 Link road scheme.

A summary of the option sifting assessment is provided in Table 5-7.

Table 5-7 Orbital Service Options Sifting Summary

No.	Orbital Service	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support growth objective?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
1	MetroBus route from Emersons Green to Whitchurch, connecting to existing MetroBus infrastructure (via new transport link around South East Bristol) - Gold standard.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Fail	Fail	No	F	Continuous segregated bus provision would provide limited benefit on much of the route, at significant cost. Journey time performance would not be significantly greater than silver standard and would have little effect on passenger demand. This has high financial risk, as would be extremely costly to widen the existing A4174 for limited extra benefit.
2	MetroBus route from Emersons Green to Whitchurch, connecting to existing MetroBus infrastructure (via new transport link around South East Bristol) - Silver standard.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Targeted segregated bus provision provides required priority to achieve better journey times, and maximise demand. Option likely to achieve best value for money as interventions are targeted to where they realise a benefit.
3	MetroBus route from Emersons Green to Whitchurch, connecting to existing MetroBus infrastructure (via new transport link around South East Bristol) - Bronze standard.	Pass	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Option fails as the “easily deliverable” improvements are not likely to have big improvement on orbital public transport movements, but would still be costly to implement, and thus it fails on the strategic objectives of the corridor.
4	MetroBus route from Emersons Green to Whitchurch, connecting to existing MetroBus infrastructure (on existing roads, e.g. Whitchurch Lane/Stockwood Ln).	Fail	Fail	Pass	Fail	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Fails as existing infrastructure only, with no new link roads, would not provide a sufficient or direct orbital route. Furthermore a MetroBus standard would not be achievable on the route due to many constraints including lack of highway width space for MetroBus expansion.
5	Improvements to city centre interchange between South Bristol and East Fringe bus services.	Fail	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Fails as this is an undesirable and indirect journey for orbital movement. This would not address the key issue of congestion on the route.
6	Enhanced bus service on new orbital transport link.	Pass	Fail	Pass	Pass	Fail	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Passed as although the benefits are limited, there has been little assessment to date to understand potential demand for an orbital service. Furthermore there is limited understanding of how congested the orbital route will be, and what level of bus priority may be required to ensure a good service. This represents a low cost, deliverable scheme and is manually passed so that further assessment can be undertaken.

Orbital Service Sifting Outcome

Two options have been selected for further consideration: Silver standard MetroBus (option 2) and an enhanced bus service (option 6). Both options are dependent on the A4-A37 orbital link being built to carry the services.

The silver standard MetroBus option has been selected as having the strongest alignment to the assessment criteria. This option incorporates segregated bus and cycle facilities where necessary, but is a proportionate approach and avoids additional infrastructure provision where there would be little benefit.

The enhanced bus service has been selected as there are no previous assessments available to determine the likely demand for an orbital service, or the relative benefits of a MetroBus Standard route compared a conventional bus service, which may serve more destinations although with a slower journey time.

The shortlisted options for the Orbital Service scheme are:

MetroBus – Emerson's Green – Whitchurch via new transport link (Silver Standard).
Enhanced bus service – Emerson's Green – Whitchurch via new transport link.

5.3.2.3. Whitchurch Railway Path MetroBus

The Whitchurch Railway Path runs broadly parallel to the A37 and currently forms part of National Cycle Network. An option has been identified to provide an offline MetroBus route on this alignment. A high-level assumption at this stage is that a continuous cycle route would also be retained.

As the route is already offline, although would require the re-adjustment of some local roads, only a gold option for MetroBus was considered. This was quickly discounted on assessment because of deliverability challenges due to engineering constraints, where sections of the original railway alignment have been built over, and also significant cost.

The sifting assessment is summarised in Table 5-8.

Whitchurch Railway Path MetroBus Sifting Outcome

There are no shortlisted options for the Whitchurch Railway Path MetroBus scheme.

5.3.2.4. A37 Public Transport

Potential improvements to public transport options for the A37 corridor have been identified and include an online MetroBus route (gold, silver and bronze standard), bus services improvements along the A37 corridor, or an extension of the North Fringe - Hengrove MetroBus route (a committed scheme) to serve the Whitchurch area.

The sifting assessment is summarised in Table 5-9.

A37 Public Transport Sifting Outcome

The MetroBus options along the A37 have been discounted, due to considerable physical constraints obstructing delivery of a MetroBus standard route. The continuation of the North Fringe to Hengrove MetroBus option is selected for further consideration, however it recognised that there may be challenges to delivering a MetroBus standard route at this stage. This option does however introduce a good choice of destinations from the Whitchurch area. An enhanced bus service on the A37 (or similar alternative routing depending on other scheme options) is also taken forward, as it is recognised that with the Whitchurch SDL there will be increased demand for direct service in Bristol city centre and the current bus service (half hourly) is unlikely to be sufficient.

Gating of the A37 has been identified as a potential option providing benefits to public transport journey times and reliability – this will be considered as the A37 enhanced bus service scheme is developed and assessed further.

The shortlisted options for the A37 Public Transport scheme are:

MetroBus – Extension of North Fringe - Hengrove route to Whitchurch
Enhanced bus service on the A37 corridor.

Table 5-8 Whitchurch Railway Path and Cycle Route Options Sifting Summary

No.	Whitchurch Railway Path and Cycle Route	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support Objective 1?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
42	Offline MetroBus route from Whitchurch to the city centre via the old Railway Path with strategic cycle route infrastructure – Gold standard.	Pass	Pass	Fail	Fail	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	Extremely difficult to deliver due to engineering constraints, and also very expensive.

Table 5-9 A37 Public Transport Options Sifting Summary

No.	A37 Public Transport	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support Objective 1?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
38	MetroBus route from Whitchurch to the city centre – Gold standard.	Pass	Pass	Pass	Fail	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	Significant engineering and width constraints.
39	MetroBus route from Whitchurch to the city centre – Silver standard.	Pass	Pass	Pass	Fail	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	Significant engineering and width constraints.
40	MetroBus route from Whitchurch to the city centre – Bronze standard.	Pass	Pass	Pass	Fail	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	Significant engineering and width constraints.
41	Enhanced bus service on the A37 corridor.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		With the development of the Whitchurch SDL, it is likely there is demand for more frequent direct services into the city centre. The exact route needs to be determined, also in the context of other schemes taken forward and how this impacts the level of traffic on different roads.
57	Extension to North Fringe Hengrove MetroBus.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Requires further assessment to determine the relative attractiveness of this route compared to other route options. Engineering challenges to achieve MetroBus standard route to Whitchurch, but remainder of route already a committed scheme.

5.3.3. Active Travel

5.3.3.1. Whitchurch Railway Path Cycle Route

An option for improvements to the Whitchurch Railway Path cycle route has been identified. The Whitchurch Railway Path runs broadly parallel to the A37 and currently forms part of National Cycle Network. As such, it is well signed and offers a reasonable level of service to cyclists. However, targeted improvements could deliver a continuous secure high-quality cycle route between Whitchurch and Bristol city centre.

The sifting assessment is summarised in Table 5-10.

Whitchurch Railway Path Cycle Route Sifting Outcome

The shortlisted options for the Whitchurch Railway Path Cycle Route scheme are:

Targeted improvements to cycle route from Whitchurch to the city centre.

Table 5-10 Whitchurch Railway Path Cycle Route Option Sifting Summary

No.	Whitchurch Railway Path Cycle Route	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support Objective 1?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
43	Targeted improvements to the strategic cycle route from Whitchurch to the city centre via the old Railway Path.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		This option is deliverable as there is already a cycle route along the Railway Path, it is just not of a consistent standard.

5.3.4. Park & Ride Options

The JTS identified that Park & Ride sites will play an important role in enabling people living outside of the urban areas, who do not have easy access to public transport near to where they live, to interchange and access the public transport network for their onward journey into the urban areas. The Park & Ride sites could also facilitate interchange between radial and orbital bus and MetroBus services, allowing transfer between services for journeys to various destinations.

In the south east Bristol and Whitchurch area, two Park & Ride locations are proposed – one at Hicks Gate and one at Whitchurch.

5.3.4.1. Hicks Gate Park & Ride

The Hicks Gate site would replace the existing Park & Ride at Brislington which has been identified as a potential SDL, requiring the Park & Ride to be relocated. The existing site has 1,300 spaces.

Moving the site to Hicks Gate will accommodate existing users, and be accessible from the A4174 Ring Road and potential new orbital route to Whitchurch. Relocating the Park & Ride site could also help to better manage congestion that currently forms around the current site access.

Eight site options have been identified, these are illustrated in Figure 5-4. The sifting assessments are based upon the deliverability and operational potential of the site locations, with an assumption that a high-quality onward link is provided along the A4 to the city centre. Expansion of the existing Brislington site is included for completeness.

The new Hicks Gate Park & Ride site should have the potential capacity for 1,700 – 1,800 spaces in total, with at least 1,300 spaces initially to accommodate users of the existing Brislington Park & Ride[40].

Table 5-11 provides a summary of the sifting assessments for Hicks Gate P&R.

[40] This figure is taken from the JTS 'Proposed Park & Ride for Greater Bristol' Technical Note which suggests 1,700-1,800 spaces would be an appropriate number based on expected demand for the area.

Figure 5-4 Hicks Gate P&R Site Options

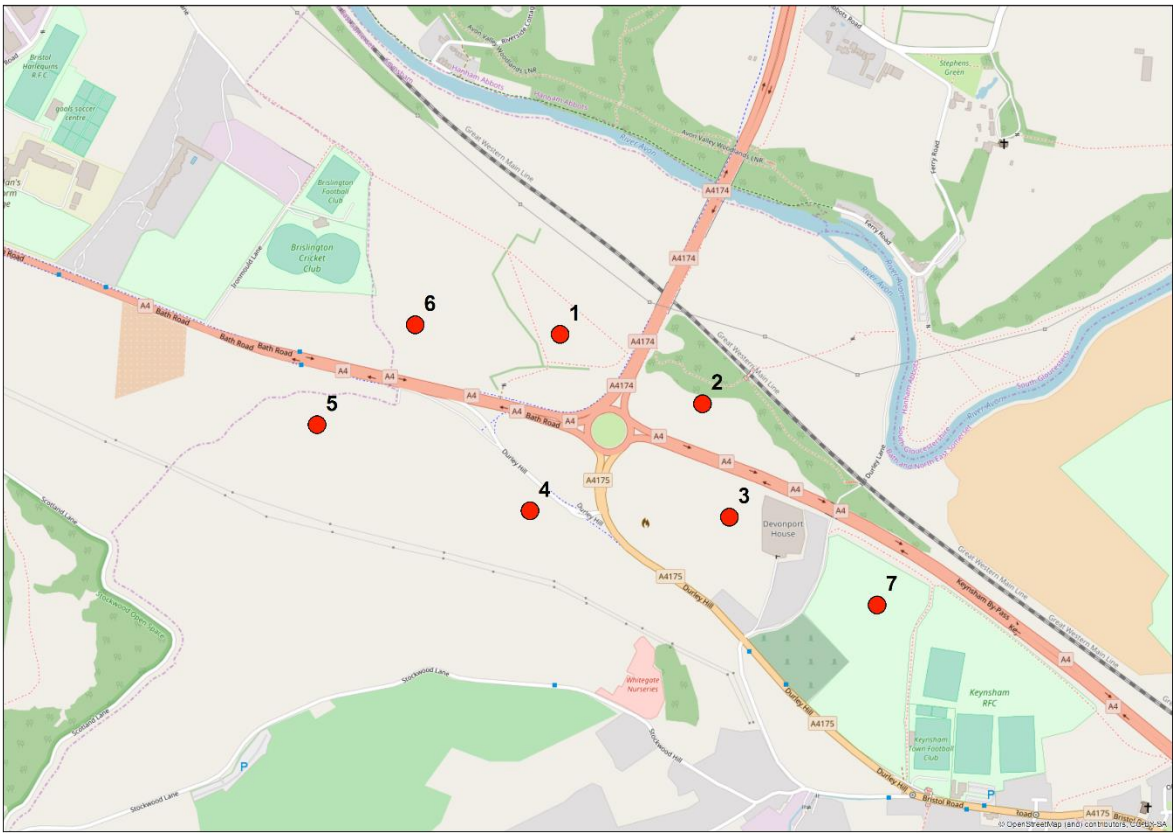


Table 5-11 Hicks Gate Park & Ride Options Sifting Summary

No.	Hicks Gate P&R	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support Objective 1?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
22	Increase the capacity of existing site only.	Fail	Fail	Pass	Fail	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	Fail as this scheme is not deliverable due to this land being designated for development.
50	Site 1 NW quadrant of Hicks Gate roundabout.	Fail	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Greatest demand for this P&R is likely to be from the Bath direction, and this would require users to cross Hicks Gate junction and the A4 to enter the site. Significant environmental risks as much of the southern part of the site is in Flood Zone 3 (high risk of flooding).
51	Site 2 NE quadrant of Hicks Gate roundabout.	Pass	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Constrained highway space for right turn lane into the site, thus fails due to poor access to site.
52	Site 3 SE quadrant of Hicks Gate roundabout.	Pass	Pass	Pass	Fail	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	Site is too small to accommodate required capacity due to the Avon Fire and Rescue Service Station to the west and constrained by Durley Park to the east.
53	Site 4 SW quadrant of Hicks Gate roundabout, next to Durley Hill.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		This area has the least constraints in terms of access to the site and environment (flood zones). There is also the potential for a direct link to any orbital route between the A4 and A37.
54	Site 5 SW quadrant of Hicks Gate roundabout, west of roundabout towards Bristol south of A4.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		This area has the least constraints in terms of access to the site and environment (flood zones). There is also the potential for a direct link to any orbital route between the A4 and A37. There is a small risk it could be constrained by Brislington development to the west.
55	Site 6 NW quadrant of Hicks Gate roundabout, west of roundabout towards Bristol north of A4.	Pass	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Greatest demand for this P&R is likely to be from the Bath direction, and this would require users to cross Hicks Gate junction and the A4 to enter the site. No direct access from Hicks Gate roundabout, requires more highway space as would need a filter lane into the site.
56	Site 7 SE quadrant of Hicks Gate roundabout, east of roundabout towards Bath south of A4.	Pass	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	No direct access from Hicks Gate roundabout. Would not serve potential orbital trips.

Hicks Gate P&R sifting outcome

Two site options have been selected for further consideration, both of which are located in the south west quadrant of Hicks Gate roundabout. This area has the least constraints in terms of access to the site and environment (flood zones). There is also the potential for a direct link to any orbital route between the A4 and A37.

The shortlisted options for the Hicks Gate P&R scheme are:

Site 4 SW quadrant of Hicks Gate roundabout, next to Durley Hill
Site 5 SW quadrant of Hicks Gate roundabout, west roundabout towards Bristol south of A4

5.3.4.2. Whitchurch Park & Ride

The JTS identifies a P&R site at Whitchurch as a strategic option to enable interchange for journeys from south of Bristol. Ten site options have been identified, these are illustrated in Figure 5-5.

The sifting assessments are based upon the deliverability and operational potential of the site locations, with an assumption that a high-quality onward link is provided to the city centre. Various service routing options exist namely via the A37, via a new orbital route to Hicks Gate if progressed and along the A4, or via an extension to the North Fringe – Hengrove MetroBus. These routing options will be assessed in later stages of this report. A summary of the sifting is provided in Table 5-12.

Figure 5-5 Whitchurch P&R Site Options

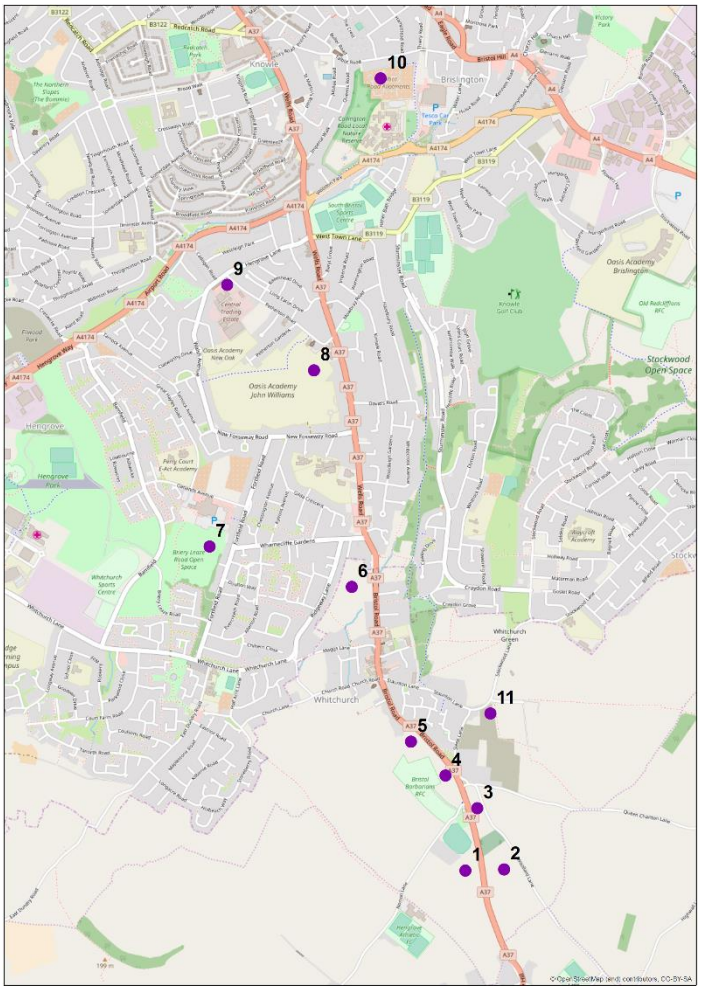


Table 5-12 Whitchurch Park & Ride Options Sifting Summary

No.	Whitchurch P&R	Strategic Case		Management Case		Phase 1 Outcome		Economic Case			Financial Case	Phase 2 Outcome		Details	
	Transport Option	Support Objective 1?	Support all Strategic objectives?	Timescales	Deliverability	Overall assessment (as calculated)	Taken forward to Phase 2?	Economic Growth	Environment	Wellbeing	Financial Case	Overall assessment (as calculated)	Taken forward for detailed assessment?	Main Failing Case	Commentary on failing case
44	Site 6 to the west of the A37 between Ridgeway Lane and Maggs Lane.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Fail	Pass	Pass	Fail	No	E	Fails due to environmental factors, as the site has ecological value and generates significant townscape impact on nearby properties.
45	Site 7 between Fortfield Road and Bamfield, south of Asda Whitchurch store.	Fail	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	The site is a long distance from the A37, and access would be through a residential area. It is unlikely to cater that well for the SDL.
46	Site 8 to the west of the A37 north of New Fosseway Road.	Fail	Pass	Pass	Fail	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	Fails due to delivery risk as site is currently school playing fields.
47	Site 9 at industrial estate on the corner of Hengrove Lane and Petherton Road.	Fail	Fail	Pass	Fail	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	Fails due to delivery risk as site would require relocation of existing business premises.
48	Site 10 at sports ground north of the A4174 to the west of Tesco Extra.	Fail	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	This site would cater for traffic from both the A4 and A37 direction - however its proximity to the city means that trips are still required to negotiate congested parts of the network. Short onward journey to P&R unlikely to be attractive option.
49	Site 11 south of Staunton Lane between Sleep Lane and Newlands.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Fail	Pass	Pass	Fail	No	E	Fails due to environmental factors, as this site would generate significant townscape impact on nearby properties.
60	Site 1 west of A37, south of Norton Lane, south of the cricket pitch.	Fail	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Constraints on site access options. Significant landscape impact.
61	Site 2 east of A37, land adjacent to the Cemetery.	Fail	Fail	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	S	Constraints on site access options. Significant impact on existing cemetery.
62	Site 3 east of A37, north of Cemetery.	Fail	Pass	Pass	Pass	Fail	No	n/a	n/a	n/a	n/a	n/a	n/a	M	Potential to link with orbital routes dependant on alignments. Significant impact on existing cemetery. Site is in green belt land. Site is small with limited capacity for future expansion.
63	Site 4 west of A37, north of Norton Lane.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Site has good access to the A37. The site would be an extension of the current Whitchurch Village, so would have smaller environmental impacts., although it would still have some negative impact on the landscape. Further consideration of site location is required as the Whitchurch SDL masterplan is developed.
64	Site 5 west of A37, south of Church Road.	Pass	Pass	Pass	Pass	Pass	Yes	Pass	Pass	Pass	Pass	Pass	Yes		Site has good access to the A37. The site would be an extension of the current Whitchurch Village, so would have smaller environmental impacts, although it would still have some negative impact on the landscape. Further consideration of site location is required as the Whitchurch SDL masterplan is developed.

Whitchurch P&R Sifting Outcome

Of the ten site options, two have been selected for further consideration. Both are located to the west of the A37, adjacent to the proposed SDL location. Strategically these sites should capture traffic from the south before it enters the urban environment, and can be easily accessible from the A37, and any potential orbital routes. All the potential site options are located within the greenbelt, and consideration will be given to mitigating the impacts of the P&R on the greenbelt.

As the form and extent of the proposed SDL is developed it may become apparent that alternative sites are more appropriate, and better integrate with the emerging local context. In those circumstances, consideration of alternative sites should be encouraged, on condition that access to the site and operational performance are not compromised.

The shortlisted options for the Whitchurch P&R scheme are:

Site 4 west of A37, north of Norton Lane.
Site 5 west of A37, south of Church Road.

5.4. Shortlisted scheme options for further assessment

The sifting assessment process has identified those scheme options with the greatest potential to address the issues in the south east Bristol and Whitchurch strategic package, and achieve the objectives that have been defined. The selected scheme options will be developed and assessed further to better understand their potential – these assessments are presented in the following sections.

The shortlisted schemes identified to address the issues in the south east Bristol and Whitchurch strategic package, are:

Highway schemes (new links and improvements to existing network) including scheme options for:

- **Orbital route - A4-A37 Link**
  - North Alignment 3 (Blue) – south-west alignment from Hicks Gate following local topography
  - South Alignment 1 (Purple) – single carriageway with direct alignment through the potential SDL 40mph link providing access to the SDL and significant measures to provide connectivity across the link
  - South Alignment 2 (Purple) – single carriageway with direct alignment through the potential SDL 50mph link with no access to the SDL and limited measures to provide connectivity across the link. Potentially compatible with future dualling
- **Orbital route - West of A37 Link**
  - A37-Washing Pound Lane (Grey) – single carriageway with parallel pedestrian and cycle route
  - A37 – Half Acre Lane (Orange) – single carriageway with parallel pedestrian and cycle route
- **Hicks Gate junction improvements**
  - At-grade junction improvement - link between A4 Keynsham and A4174

Public Transport schemes, including scheme options for:

- **Orbital Service (MetroBus and bus service)**
  - MetroBus – Emerson's Green – Whitchurch via new transport link (silver standard)
  - Bus service – Emerson's Green – Whitchurch via new transport link
- **A37 Corridor Public Transport**
  - MetroBus – Extension of North Fringe - Hengrove route to Whitchurch
  - Enhanced bus service on the A37 corridor

Active Travel schemes, including scheme options for:

- **Whitchurch Railway Path Cycle Route**
  - Targeted improvements to cycle route cycle route from Whitchurch to the city centre

Park & Ride schemes, including scheme options for:

- **Hicks Gate P&R**
  - Site 4 SW quadrant of Hicks Gate roundabout, next to Durley Hill
  - Site 5 SW quadrant of Hicks Gate roundabout, west roundabout towards Bristol south of A4
- **Whitchurch P&R**
  - Site 4 west of A37, north of Norton Lane
  - Site 5 west of A37, south of Church Road

5.4.1. Scheme option groups

The shortlisted schemes have been grouped for assessment purposes and are presented in the following chapters under the following themes.

Orbital Highway Link:

Orbital Route - A4-A37 Link:

Option A - Orbital Route A4-A37 (40mph road providing intermediate junction access to SDL).

Option B - Orbital Route A4-A37 (50mph road with no intermediate junction access to SDL provided).

Orbital Route - West of A37 link:

Option C - Orbital Route West of A37 (Washing Pound Lane) – Grey route.

Option D - Orbital Route West of A37 (Half Acre Lane) – Orange route.

Hicks Gate Junction Improvement:

Option E - Hicks Gate Junction Improvement (A4 Keynsham to A4174).

A37 Corridor Public Transport

A37 Corridor Public Transport (Whitchurch - Bristol);

Option J – Enhanced Bus service;

Whitchurch P&R

Option K1 - Site 4 west of A37, north of Norton Lane
Option K2 - Site 5 west of A37, south of Church Road

Orbital Multi-modal Corridor

Orbital Corridor Public Transport (Hengrove – Whitchurch – Emersons Green);

Option L - Orbital multi-modal corridor, Hengrove to Emersons Green via Whitchurch (comprising orbital highway link & enhanced bus service between Hengrove and Emersons Green)

Active Travel

Whitchurch Railway Path Cycle Route

Targeted improvements to cycle route cycle route from Whitchurch to the city centre

6. Orbital Highway Scheme

6.1. Introduction

This chapter sets out the development and assessment of the highway scheme options within the transport package.

Through the option sifting and packaging process set out in Chapter 5, three stand-alone highway schemes have been selected for further assessment. This chapter presents the outcome of an assessment of these options. Two of the options comprise new link roads providing new orbital links – each with two option variants. One is a standalone junction improvement scheme:

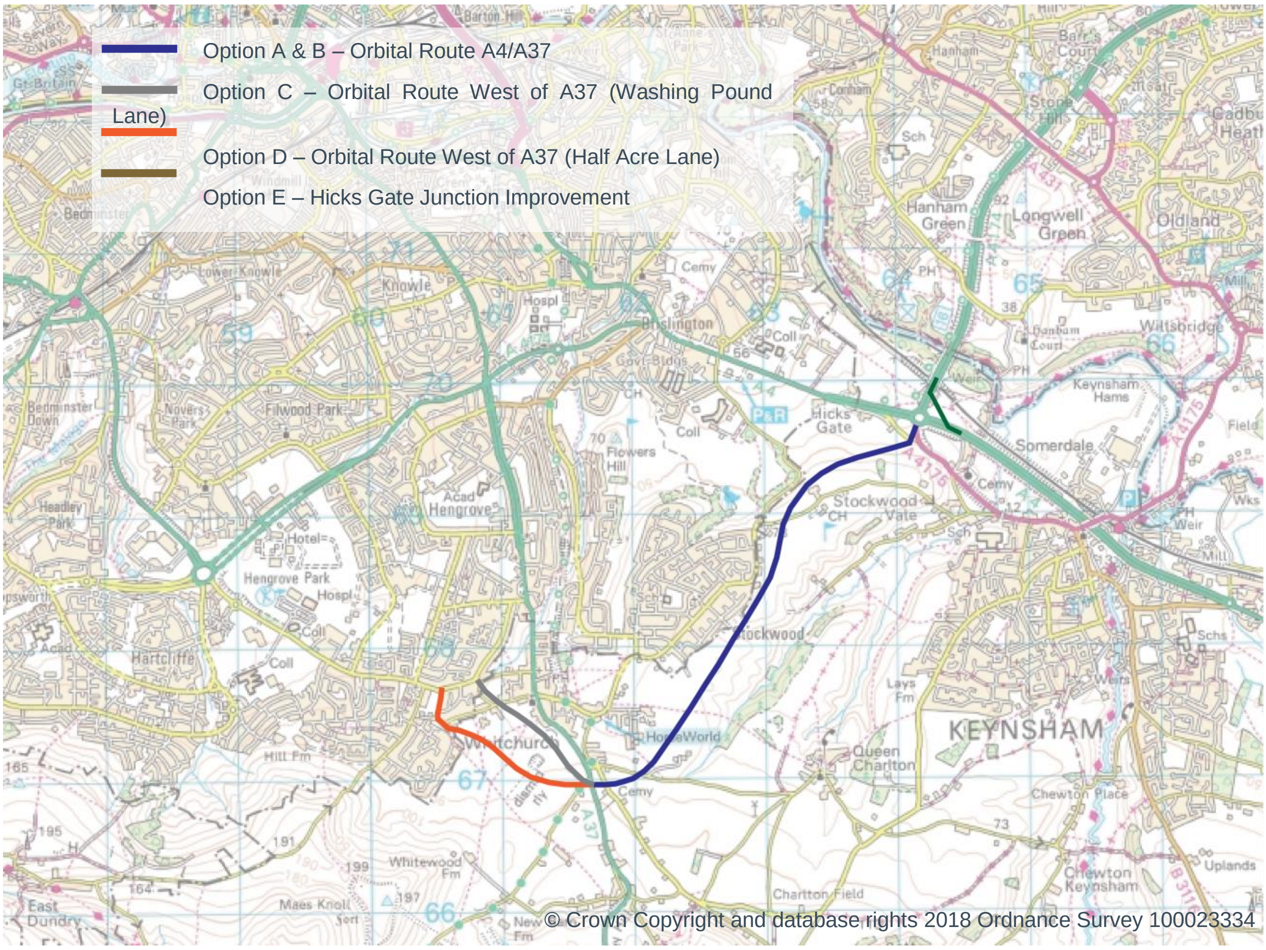
Orbital Route - A4-A37 Link – Blue route :
- Option A - Orbital Route A4-A37 (40mph road providing intermediate junction access to SDL).
- Option B - Orbital Route A4-A37 (50mph road with no intermediate junction access to SDL provided).

Orbital Route - West of A37 link:
- Option C - Orbital Route West of A37 (Washing Pound Lane) – Grey route.
- Option D - Orbital Route West of A37 (Half Acre Lane) – Orange route.

Hicks Gate Junction Improvement:
- Option E - Hicks Gate Junction Improvement (A4 Keynsham to A4174) - Brown route

The shortlisted scheme options are shown in Figure 6-1.

Figure 6-1 Overview of highway schemes for further assessment



The key stages of option development and assessment comprise:

Option Development	Option Assessment
• Engineering Design Development and evaluation	• *Strategic* Case (objectives fit) • *Economic* Case (economic benefits and costs, social, environmental) • *Financial* Case (capital and operating costs) • *Commercial and Management* Cases (risks, deliverability, acceptability)

6.2. Option development

Concept designs have been developed for each scheme option, to an appropriate level to provide understanding of potential engineering deliverability, environmental, cost and other issues. The assessments of each scheme option are in accordance with the principles and requirements of WebTAG, and reflect the NPPF tests of soundness where relevant.

New highway link option development

Due to the nature and purpose of the link roads under consideration – mainly rural links with little or no frontage and with a primary focus on movement – the Design Manual for Roads and Bridges (DMRB) was used as appropriate design standards for the links. Initially, assessments of forecast traffic flow against TA46/97 were made to establish an appropriate carriageway standard in terms of width and number of lanes. Two-dimensional designs were then developed to translate the shortlisted alignments into designs consistent with DMRB requirements for corner radii etc. given the design speed of the link. Finally, 3D concept designs, were produced, using the Environment Agency's open-data LIDAR Digital Terrain Model (DTM) as a base. The 3D designs ensure appropriate gradients are provided for the new links, and allows an estimate of the scale of any cuttings or embankments required to be understood. Note that a detailed topographical survey has not been undertaken at this stage, as the base OS and LIDAR DTM data is considered appropriate to the early stage of scheme development.

Junction improvement option development

A range of concept designs for improvements to the Hicks Gate junction were previously developed in 2015 by CH2M[41]. The design for the strongest option from the 2015 study has been shortlisted and used as the basis for assessment. The assessment takes account of the potential for the scheme to be a stand-alone scheme, or incorporated into works for the A4/A37 link to Whitchurch, and potentially beyond. Should the link road be progressed, the movement patterns at the junction would be significantly different to those assumed in the previous study, and if necessary, further junction improvement options will be revisited as part of the link road scheme development.

6.2.1. Engineering design

6.2.1.1. Orbital Route – A4-A37 Link

A summary of the scheme options is shown in Figure 6-1. Concept design plans are provided in Appendix 6:1.

Both A4-A37 Link scheme options follow the same overall alignment – the difference is their relationship with the proposed SDL at Whitchurch. The shortlisted alignment was selected to avoid more significant environmental impacts of alternative alignments, particularly in terms of landscape and water.

Masterplanning of the Whitchurch SDL is at an early stage; hence the arrangement of the proposed SDL is currently uncertain. The alignment presented in this study will either pass through the area of development, or between the SDL and the existing Bristol urban edge. [Note: alternative alignment to the south-east of the SDL have been considered and discounted due to operational and environmental concerns – see Section 5].

[41] A4/A4174 Hicks Gate Roundabout Improvement Options, 2015. http://www.bathnes.gov.uk/sites/default/files/sitedocuments/Planning-and-Building-Control/Planning-Policy/Evidence-Base/Transport/hicks_gate_improvement_options_technical_report.pdf

The relationship between the link road and the SDL needs to balance:

the need for a degree of segregation (to deliver a functional strategic transport link with minimal delay to movement along it), and;
- the avoidance of severance (where the link becomes a barrier to movement across it, severing the SDL from Bristol and wider surroundings).

These factors are considered in the design of the link, inclusion of opportunities for movement across it, the adjacent land uses, and the traffic volume and speed once operational. As a result, two design approaches were defined that represent different approaches to the balance of segregation and separation:

Option A – Orbital Route A4-A37 (Intermediate access to SDL)

This option provides a link that is of an equivalent standard to other existing orbital links through south Bristol via Whitchurch Lane and the South Bristol Link. The link is designed to reflect its function as a locally strategic transport link, but also providing access to the SDL, with features to mitigate potential severance impact between the SDL and Whitchurch/Bristol.

Hicks Gate to Stockwood:
- 7.3m Single carriageway
- 50mph design speed
- Left in-left out junctions with Stockwood Lane
- Parallel 4m Shared Use Path for pedestrians/cyclists

Stockwood to A37:
- 7.3m Single carriageway
- 40mph speed limit
- Intermediate junction providing access to SDL and crossing opportunity
- Other existing roads join via A37
- Parallel 4m Shared Use Path for pedestrians/cyclists

Option B – Orbital Route A4-A37 (No intermediate access to SDL) (protected dual-carriageway corridor)

This design approach reflects a potential future scenario where the link becomes part of a more strategic route (recognising potential aspirations for a further southern orbital link to Bishport Avenue, or the A38). This is likely to have a greater severance impact, and could influence the choice of suitable adjacent land uses in the SDL masterplanning.

Hicks Gate to Stockwood:
- 7.3m Single carriageway
- 50mph design speed
- Left in-left out junction with Stockwood lane
- Parallel 4m Shared Use Path for pedestrians/cyclists

Stockwood to A37:
- 7.3m Single carriageway
- 50mph design speed
- No intermediate junction with SDL, or at grade formal crossing opportunity
- Parallel 4m Shared Use Path for pedestrians/cyclists

The northern section between Hicks Gate and Stockwood is consistent between the two options. A left-in-left out junction where the new link severs Stockwood Lane is provided to accommodate local access, whist avoiding delay and conflicts from right-turn movements. The link road joins Hicks Gate roundabout at the existing southern arm, with a roundabout junction with Durley Road provided approximately 120m to the south.

The proposed alignment of the southern section may change subject to more detailed masterplanning of the SDL layout. The alignment presented meets DMRB requirements for a 50mph design speed. Option A, providing access to the SDL, includes an indicative signalised junction with an SDL distributor road, which also provides a formal crossing opportunity.

Option B, with no access to the SDL, is an alignment which could include a protected corridor for dualling in the future. Detailed design should consider the potential benefits of constructing the earthworks, structures and utilities to accommodate a dual carriageway. However, for the purposes of this assessment, construction of a single carriageway alignment only is considered.

At the southern end for both options, a roundabout junction with the A37 is provided.

Both options include a 4m parallel shared use path (SUP) for pedestrians and cyclists. Given the nature of the route, good quality off-carriageway provision is appropriate. The northern section of the route will be a relatively isolated rural route, and hence may not prove an attractive route for pedestrians and cyclists – offline improvements on Stockwood Lane may prove to be more beneficial and should be considered in future detailed design phases. The SUP is included at this stage so that a robust cost estimate can be provided.

Other scheme options under consideration, such as Hicks Gate P&R, Whitchurch P&R, and orbital public transport services may require associated infrastructure and access on this link – interdependencies are considered against the relevant scheme.

6.2.1.2. Orbital Route – West of A37 Link

A summary of the scheme options for a link between the A37 and Whitchurch Lane to the west is shown in Figure 6-1. Concept design plans are provided in Appendix 6:1.

The two options join Whitchurch Lane at Washing Pound Lane or Half Acre Lane. Both include a roundabout junction with the A37. Although assessed as separate stand-alone schemes, the roundabout design used is consistent with the A4-A37 Link to the east.

Both alignments have been designed to the same specification:

7.3m Single carriageway;
30mph design speed; and

- Parallel 4m SUP for pedestrians/cyclists.

Option C – Orbital route west of A37 (Washing Pound Lane)

This alignment follows north-westerly from the A37 for approximately 1.1km, ending with a roundabout junction at the existing Whitchurch Lane junction with Washing Pound Lane. The route does not follow the alignment of Washing Pound Lane and a priority access with the new link would be required to maintain access. The route crosses Church Lane close to an existing no-though route restriction, hence severing this route at this location will have no impact upon existing access.

A 4m parallel SUP for pedestrians and cyclists is included. Given the nature of the route, good quality off-carriageway provision is appropriate. Depending on the final arrangement of the SDL, the route will be a relatively isolated rural route, and hence may not prove an attractive route for pedestrians and cyclists although would provide good links to local quiet routes.

Option D – Orbital route west of A37 (Half Acre Lane)

This alignment follows a westerly direction for approximately 1.1km, joining to a new roundabout junction with Half Acre Lane and Stoneberry Road. The route then follows the existing alignment of Half Acre Road for a further 0.4km to a new roundabout junction with Whitchurch Lane. Existing accesses are maintained. The concept design shows some minor realignment and re-levelling of the existing Half Acre Lane. However, the design has been produced in the absence of a full topographic survey, and this requirement should be reassessed once more detailed information regarding the exiting layout is available. As the route is currently a distributor road that is very constrained with private frontages, an assumption has been made that the existing alignment will be adequate on this section.

A 4m parallel SUP for pedestrians and cyclists is included between the A37 and Half Acre Lane. Given the nature of the route, good quality off-carriageway provision is appropriate. Depending on the final arrangement of the SDL, the route will be a relatively isolated rural route, and hence may not prove an attractive route for pedestrians and cyclists. No onward on or off-carriageway cycle provision is made, and should this option be progressed, the provision of continuous cycle links within a coherent local network will need to be considered.

Whitchurch Lane

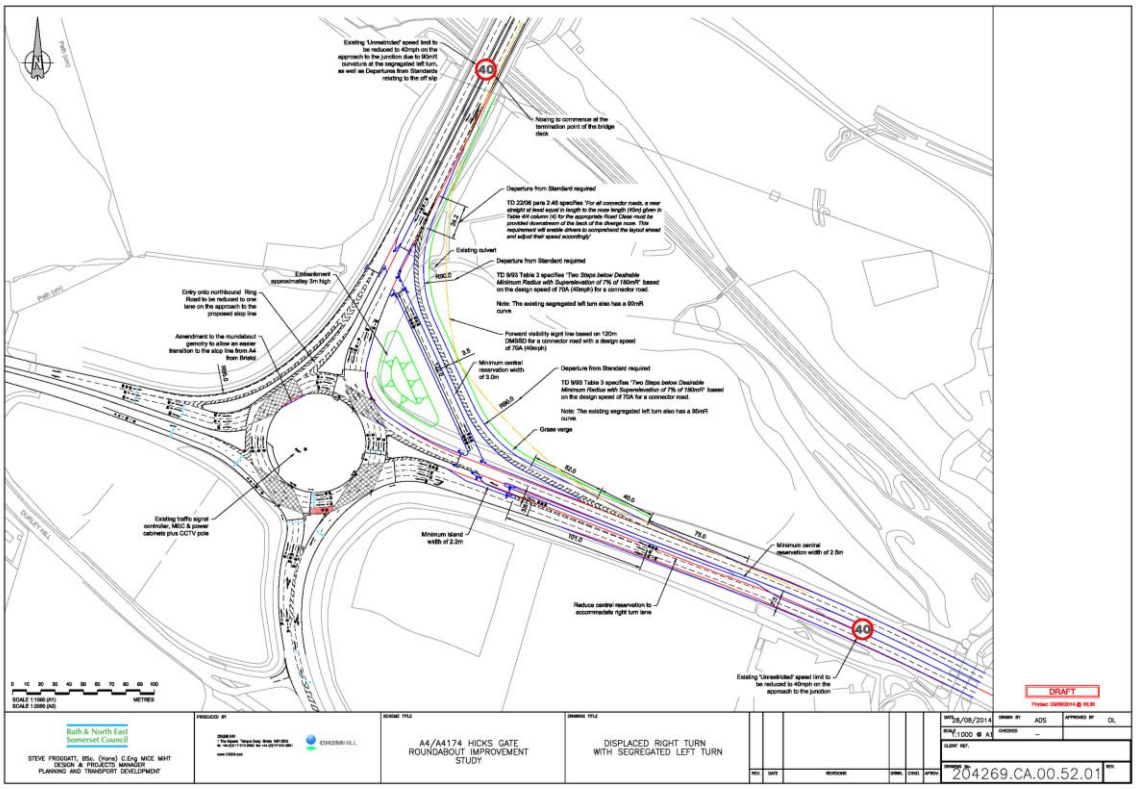
Both options seek to provide improved access to Whitchurch Lane for orbital movements. Parts of Whitchurch Lane are fronted by residential properties, and have been subject to significant traffic calming works and a 20mph speed limit. If the route is to be promoted as an orbital route, a review of the existing traffic calming to identify any alternative (or further) mitigation that may be appropriate should be included in

later detailed design phases. To the east the junctions of Ridgeway Lane/Wharnecliffe Gardens and Ridgeway Lane/ A37 Wells Road may need revising to encourage use of the new link.

6.2.1.3. Hicks Gate at-grade junction improvement

The design under assessment was developed by CH2M in 2015[42] (see Figure 6-2). The full concept design plan provided in Appendix 6:1.

Figure 6-2 Hicks Gate at-grade junction improvement



The design introduces a new link connection between the A4 Keynsham Bypass and A4174 north of the existing junction, intercepting movements between these arms before they pass through the existing roundabout. New signalised junctions are provided to control east to north movements at each end of the new link, and in particular allow right-turn movements safety and with sufficient priority. It is noted that coordination will be required between the signals to maintain efficient entry flow to the roundabout, and prevent blocking back through the roundabout on these arms. A left-turn filter slip road is included for north to east movements. The design includes a number of departures from standard to deliver this filter lane, particularly the length of diverge and radius of the bend, and these will need to be considered in detailed design phases.

Should the link road to A37 be progressed, the movement patterns at the junction would be significantly different to those assumed in the previous study, and if necessary, further junction improvement options will be revisited as part of the link road scheme development.

6.2.1.4. Combined Highway Scheme

Throughout the following assessments, a ‘combined highway scheme’ also presented where relevant. This represents a full orbital highway link including Hicks Gate junction improvements (Option E), the A4/A37 Link (Option A/B), and West of A37 Link (Option C/D). This recognises the potential for a full orbital route to be progressed together, and captures any benefits/issues beyond considering each element in isolation. Where

[42] A4/A4174 Hicks Gate Roundabout Improvement Options, 2015. http://www.bathnes.gov.uk/sites/default/files/sitedocuments/Planning-and-Building-Control/Planning-Policy/Evidence-Base/Transport/hicks_gate_improvement_options_technical_report.pdf

assessments would differ dependant on the component option selected, this is noted in the assessments, as well as any assumptions.

6.2.1.5. Concept design evaluation

An evaluation of the key considerations relating to each highway scheme option is provided in Table 6-1.

Table 6-1 Highway scheme concept design evaluation

A	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C – Orbital Route West of A37 (Washing Pound Lane)	Option D – Orbital Route West of A37 (Half Acre Lane)	Option E – Hicks Gate Junction Improvement (A4 Keynsham to A4174)
Construction issues	Significant earthworks required due to gradient south of Hicks Gate Roundabout.		None identified		Works within existing cutting and adjacent to existing railway overbridge. Some earthworks required.
Departures from Standards	None: DMRB compliant route		None: DMRB compliant route	DMRB compliant route between A37 and existing Half Acre Lane. Although it acts as a local distributor road, geometry of existing Half Acre Lane may be slightly below standard requirements – subject to assessment with full topographic survey.	East to north movement link and signalised junctions are compliant. North to east left turn filter lane is constrained by short diverge and tight corner radii. Detailed design and assessment may be able to mitigate the issue.
Key feasibility risks and unknowns	Woollard Lane and Queen Charlton Lane assumed to be routed to join via SDL/A37, although junction(s) with link road can be considered at detailed design, and as SDL masterplan become clear. Unknown ground conditions and utilities.	Woollard Lane and Queen Charlton Lane assumed to be routed to join SDL/A37. Junction(s) with link road not compatible with design approach. Access to be considered at detailed design, and as SDL masterplan become clear. Unknown ground conditions and utilities. .	Access to Washing Pound Lane will be impacted. Sections of Whitchurch Lane with existing traffic calming will be below the standard of other section of an orbital route. Unknown ground conditions and utilities.	Sections of Whitchurch Lane with existing traffic calming will be below the standard of other section of an orbital route. Unknown ground conditions and utilities.	Unknown ground conditions and utilities.
Land ownership	Land purchase required – Subject to confirmation, alignment would have a significant impact on a small number of landowners.		Land purchase required – Subject to confirmation, alignment would have a significant impact on a small number of landowners.		Small land purchase required.

6.3. Option assessment

6.3.1. Overview

This section presents the following assessments against the DfT's five case model:

•Strategic Case	•Economic Case	○Financial Case	•Commercial and Management Cases
• Contribution to corridor objectives • Contribution to JLTP objectives	• Economic impacts • Social impacts • Environmental impacts • Summary VfM assessment	• Capital costs • Operating costs	• Commercial considerations • Risks • Deliverability • Acceptability

6.3.2. Strategic case

This section sets out performance of the orbital highway schemes against corridor objectives and JLTP goals.

Table 6-2 outlines performance of options against package objectives. All scheme options perform strongly, as performance against objectives formed part of the sifting in Chapter 5.

Table 6-3 outlines performance of options against JLTP objectives.

Table 6-2 Contribution to package objectives

Assessment Criteria	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4	Combined Orbital Highway Scheme (A/B + C/D + E)
Mitigate increased travel demand enabling planned growth (JSP and non-JSP)	**Large beneficial ✓✓✓** Option provides new highway infrastructure for Whitchurch SDL, connecting it to the rest of the network. Intermediate junctions on the route for this option, improves direct access for the Whitchurch SDL.	**Moderate beneficial ✓✓** Option provides new highway infrastructure for Whitchurch SDL, connecting it to the rest of the network. However, there are only junction connections at either end of the SDL, and not via intermediate junctions in between.	**Moderate beneficial ✓✓** Both options provide a direct and good standard route from the A37 to Hengrove and the west, removing traffic from the local roads in Whitchurch. Option could provide direct access to the Whitchurch SDL via the roundabout with the A37.		**Moderate beneficial ✓✓** Option significantly improves capacity at the junction, addressing existing and forecast future capacity concerns. This junction is a key part of the network serving the Brislington and Keynsham SDLs and the Whitchurch SDL via the potential new A4-A37 Link.	**Moderate beneficial ✓✓** The combined scheme provides increased capacity in the local network to accommodate forecast growth, and mitigate forecast issues for connectivity to/from Keynsham, Whitchurch and Brislington SDLs.
Provide a range of convenient and attractive journey options for south-east Bristol to key destinations such as Bristol city centre and Keynsham, and for orbital movements, to enable mode shift	**Moderate beneficial ✓✓** Option would significantly improve orbital connectivity from Whitchurch to Keynsham, the East Fringe, Bath and beyond. Inclusion of cycle lanes will improve cycle provision between Whitchurch and Keynsham. Scheme would facilitate Orbital MetroBus services which could utilise it.	**Moderate beneficial ✓✓** Option would significantly improve orbital connectivity from Whitchurch to Keynsham, the East Fringe, Bath and beyond. Inclusion of cycle lanes will improve cycle provision between Whitchurch and Keynsham. Scheme would facilitate Orbital MetroBus services which could utilise it.	**Slight beneficial ✓** Both options would provide a higher quality route for travelling orbitally than currently available via Ridgeway Lane. If the link connects directly to the A4-A37 Link, it would also provide good access from Hengrove and the West to Keynsham and the East Fringe.		**Slight beneficial ✓** Option would increase capacity at the junction for movements on all arms. There is an opportunity to ensure the cycle network is not hindered and integrated as well as possible with the junction.	**Slight beneficial ✓** The combined scheme provides new pedestrian and cycle links for orbital movements. By drawing traffic from less appropriate routes, non-car travel on other parts of the network will be benefitted.
Increase orbital connectivity to improve access around south-east Bristol, reduce delays on the existing network and minimise inappropriate movements on local roads	**Moderate beneficial ✓✓** Scheme would significantly improve the attraction of travelling orbitally from Whitchurch to Keynsham, the East Fringe, Bath and beyond. Both options should also capture a large number of movements that would previously have used the A37/A4174/A4 route or a local road alternative. However, there is a potential that this option could lead to more use of local roads to the west of the A37 (without the west of A37 Link). Delays on the A37 to Woollard Lane (route through to Keynsham) should be reduced, as fewer people will be queueing to turn left from the A37 as they should divert via the new link road.		**Moderate beneficial ✓✓** Option should remove use of inappropriate local roads such as Maggs Lane and Ridgeway Lane, and a roundabout should provide greater capacity for movements from the south to the west, and thus reducing delays on this section of the A37.	**Slight beneficial ✓** *Read for Option C, plus:* There is the potential that this option could increase some use of local roads in the residential area to the south of Whitchurch Lane.	**Slight beneficial ✓** An improved junction, even without the new A4-A37 Link road, would improve orbital connectivity by increasing the capacity of the junction and thus reducing queueing time.	**Moderate beneficial ✓✓** The combined scheme provides a complete locally strategic transport link that addresses an existing gap in the network. Traffic will be drawn from less appropriate local routes, although Whitchurch Lane will experience higher traffic flows.
Improve journey time reliability for public transport along the corridor and orbital movements	**Slight beneficial ✓** Both options should remove car traffic from A37 and A4, thus should improve journey times for current bus services on these routes. The scheme enables a new route for public transport, however does not include the actual services themselves, thus impact on orbital public transport movements is not large without associated new services. In particular it will improve journey times between Whitchurch and Keynsham areas.		**Slight beneficial ✓** Both options should remove car traffic from A37, thus should improve journey times for current bus services on this route. The option itself does not include bus services, but could enable an extension of the North Fringe to Hengrove MetroBus.		**Slight beneficial ✓** The junction already has a bus only link for east-west services, so the improvements will not have a huge impact. For west-east services, this option should increase the time that that the arm signals are on green (as vehicles using it from other arms will be reduced thus not requiring as long a green phase), and thus reduce queueing to the junction and increase the number of buses that move through the roundabout.	**Slight beneficial ✓** Increased capacity in the network and reduced traffic on key public transport corridors will improve journey time reliability.

Table 6-3 Contribution to JLTP Objectives

Assessment Criteria	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4	Combined Orbital Highway Scheme (A/B + C/D + E)
Reduce carbon emissions	**Neutral -** Scheme results in reduced travel distance and time across the network. Scheme increases highway capacity and therefore there is a risk of travel demand increasing to meet the new capacity.		**Neutral -** Scheme results in reduced travel distance and time across the network. Scheme increases highway capacity and therefore there is a risk of travel demand increasing to meet the new capacity.		**Neutral -** Scheme results in reduced congestion at the junction. Scheme increases highway capacity and therefore there is a risk of travel demand increasing to meet the new capacity.	**Neutral -** Scheme results in reduced travel distance and time across the network. Scheme increases highway capacity and therefore there is a risk of travel demand increasing to meet the new capacity.
Support economic growth	**Slight beneficial ✓** Both options would strongly support the economy of the new Whitchurch development by offering good access to the road network to the site. Increased network capacity should support economic growth as reduced congestion and travel distances will reduced lost ravel time. Option offers reduction in congestion across the network and a more direct route for orbital movement, thus reducing times for journeys and reducing the time vehicles are on the road.		**Slight beneficial ✓** Both options would support the economy through providing a more direct, faster and reliable route for users, reducing time spent in congestion and improving journey times.		**Slight beneficial ✓** A reduction in congestion and improvement of journey time through the junction should support economic growth by reducing time spent by people in vehicles and thus increasing productive time and reducing delays to services.	**Moderate beneficial ✓✓** Both options would strongly support the economy of the new Whitchurch development by offering good access to the road network to the site. Increased network capacity should support economic growth as reduced congestion and travel distances will reduced lost ravel time. Option offers reduction in congestion across the network and a more direct route for orbital movement, thus reducing times for journeys and reducing the time vehicles are on the road.
Contribute to better health, safety and security	**Slight beneficial ✓** A parallel cycle route will improve active ravel options, and offer health benefits to users. Reduced traffic on nearby residential routes will improve safety and air quality in these areas.		**Moderate beneficial ✓✓** A parallel cycle route will improve active ravel options, and offer health benefits to users. Reduced traffic on routes in Whitchurch will improve safety and air quality in these areas		**Slight beneficial ✓** Reducing the number of people attempting to pass through the junction should improve safety. Reduction in queueing time has positive impact on people's health.	**Slight beneficial ✓** The new route should reduce traffic from less suitable local roads, thus improving the safety of these roads. The new routes will have high quality pedestrian and cycle facilities and crossing points, with good lighting.
Promote accessibility	**Moderate beneficial ✓✓** The route should improve accessibility to current settlements at Whitchurch and Keynsham, and provide good accessibility to the wider road network for the SDL at Whitchurch.		**Slight beneficial ✓** The route should provide improved accessibility to Whitchurch Village, and offer an improved link to potential new employment at Whitchurch SDL.		**Slight beneficial ✓** Small impact on improving accessibility through reducing congestion and time spent traversing the junction.	**Moderate beneficial ✓✓** The combined scheme would improve accessibility for current settlements and users, as well as provide good accessibility to destinations for the Whitchurch SDL.
Improve quality of life and a healthy natural environment	**Slight adverse x** The natural environment will be severed by the new road. However, this option will be more integrated with the SDL, offering more road junctions and crossing points.	**Moderate adverse xx** The natural environment will be severed by the new road. The option will be less integrated with the SDL than Option A.	**Slight beneficial ✓** Should reduce traffic and congestion in Whitchurch, creating a more attractive environment for the settlement. However, the natural environment will be severed by the new road.		**Neutral -** Improving junction interchange will have little impact on this objective.	**Slight adverse x** Whilst the natural environment will be severed by the new road, this can be mitigated to an extent through landscape improvements and crossing points for those wishing to cross. Quality of life should be improved as people will have greater highway links, and because the scheme should remove some traffic from local residential roads.

6.3.3. Economic case

6.3.3.1. Modelled impacts

The scheme options have been modelled using the GBATS-4 strategic highway model.

Two different future growth scenarios have been assessed:

- **Spatially Neutral (SN) Growth**: This scenario represents a level of growth based on TEMPRO but an even uplift across the entire study area is assumed – this provides the basis for WebTAG compliant assessment of the scheme options; and

- **JSP Growth:** This second scenario accounts for JSP developments, specifically including those forecast at Whitchurch (1,600 dwellings), Brislington (750 dwellings) and Keynsham (1400 dwellings and 14 Ha of employment land). It should be noted that these dwellings are to some extent captured in the SN scenario but are spread across the conurbation; this test assumes the specific SDLs.

Appendix 6:2 outlines the modelling approach and associated assumptions in further detail.

Network statistics are provided in Table 6-4, with flow difference plots in Figure 6-3 and Figure 6-4.

Options A & B - Orbital Route A4-A37

Given the strategic nature of the GBATS-4 strategic highway model, particularly at this peripheral location, there is negligible difference between the options in modelling terms. The relatively small impact (in strategic terms) of an additional junction on the proposed link to serve the SDL will not be reliable captured, particularly in the SN scenario where the SDL is not included. Hence these two options have been modelled as a single scenario.

The A4/A37 Link results in a reduction in the total travel time and the total distance travelled by providing a high quality direct orbital link, particularly in the PM peak. There is a reduction in the queue lengths in the AM, Inter-peak and PM peak hours. The link also results in a reduction in traffic volumes on Stockwood Lane, and Charlton Lane and Wellsway Road through Keynsham, although there is an increase in flow on the A37 to the south of the new road. Overall it achieves the objectives to provide additional highway capacity in the network, and reduce traffic on less appropriate local routes.

Option C - Orbital Route West of A37 (Washing Pound Lane)

This option results in reasonable improvements during the three modelled time periods in terms of reduced travelled time and vehicle travel distance. The AM peak hours reductions are higher than the PM and Inter-peak hours. This West of A37 Link option results in a reduction in traffic on the A37 and Ridgeway and Maggs Lane. However, it results in a significant increase in traffic to the east of the scheme on Whitchurch Lane.

Option D - Orbital Route West of A37 (Half Acre Lane)

This option performs more strongly of the two West of A37 link options in terms of reducing overall travel time and distance in the network. Again, this West of A37 Link option is successful in reducing traffic in Whitchurch on the A37 and Ridgeway and Maggs Lane. However, it results in an increase in traffic to the east of the scheme on Whitchurch Lane.

Option E – Hicks Gate at-grade improvement A4174/A4

Although tested for completeness and consistency with other transport package options, the impacts of this option are not fully represented in the GBATS-4 strategic highway model. The nature of the scheme requires close coordination of adjacent signal controlled junctions, which cannot be fully represented in the strategic model. Hence, the results presented for the standalone scheme are informed by the previous study in which the scheme was developed. This previous assessment of this option, using a more appropriate micro-simulation modelling tool able to better represent the scheme impacts showed significant reduction in total vehicle travel time. This was predominantly on the movements served by the new link between A4 Keynsham and A4174 N, although both A4 approaches also showed benefits. It should be noted the previous study was based on growth forecasts to 2024, which are therefore lower than those being considered in this study.

Combined Highway Scheme (A/B + C/D + E)

The combined scheme provides a complete orbital route, and therefore generates significant network benefits in terms of travel time and distance as trips are diverted from more onerous, less direct routes.

Forecast demand (traffic) flow difference plot for the SN scenario is provided in Figure 6-3. It indicates that the combined link is effective at removing orbital traffic from other parts of the network (A4147 West Town Lane), although expected reductions on the westbound A4 between Hicks Gate and A4174 are not realised. Whitchurch Lane experiences a large increase in traffic as expected. The (upgraded) Hicks Gate junction is shown to operate well, although it should be noted again that the strategic model is not designed to assess complex junction improvements.

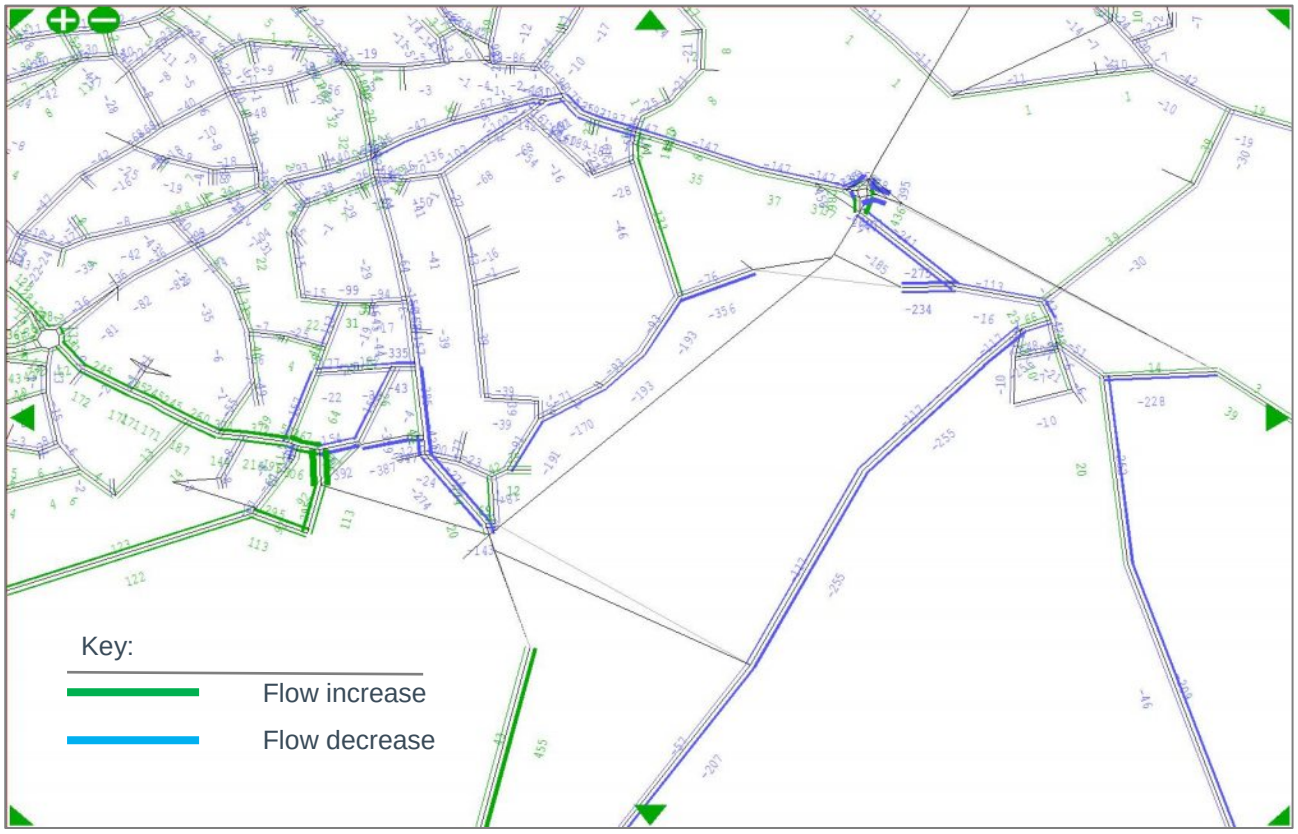
The 'With JSP' scenario forecast demand (traffic) flow difference plot is provided in Figure 6-4. It shows a similar pattern of movements to the SN scenario, albeit with greater flows on the new orbital link as growth is concentrated in nearby SDLs. Forecast flows on the combined link (c.1500 vehicles two-way, AM peak hour) are compatible with a single carriageway, although if further, more strategic orbital route options around south Bristol are considered, there may be a case to dual the A4/A37 link in the future.

Table 6-4 Modelled impacts (network statistics)

	Option A – Orbital Route A4-A37 (Access to SDL) Option B – Orbital Route A4-A37 (No access to SDL)		Option C: West of A37 – Washing Pound Lane		Option D: West of A37 – Half Acre Lane		Option E: Hicks Gate at-grade improvement A4174-A4[43]		Combined Orbital Highway Scheme (A/B + C/D + E)		Combined Orbital Highway Scheme (A/B + C/D + E) JSP	
Input Data / Key Performance Indicators	**AM Peak Hr**	**PM Peak Hr**	**AM Peak Hr**	**PM Peak Hr**	**AM Peak Hr**	**PM Peak Hr**	**AM Peak Hr**	**PM Peak Hr**	**AM Peak Hr**	**PM Peak Hr**	**AM Peak Hr**	**PM Peak Hr**
Total vehicle travelled time (pcu hrs)	*-54*	*-182*	*-123*	*-54*	*-116*	*-79*	*N/A*	*N/A*	*-300*	*-273*	*-155*	*-365*
Total vehicle travelled distance (pcu kms)	*-319*	*-2,198*	*-1,002*	*-306*	*-1,246*	*-862*	*N/A*	*N/A*	*-2101*	*-2394*	*-640*	*-2423*

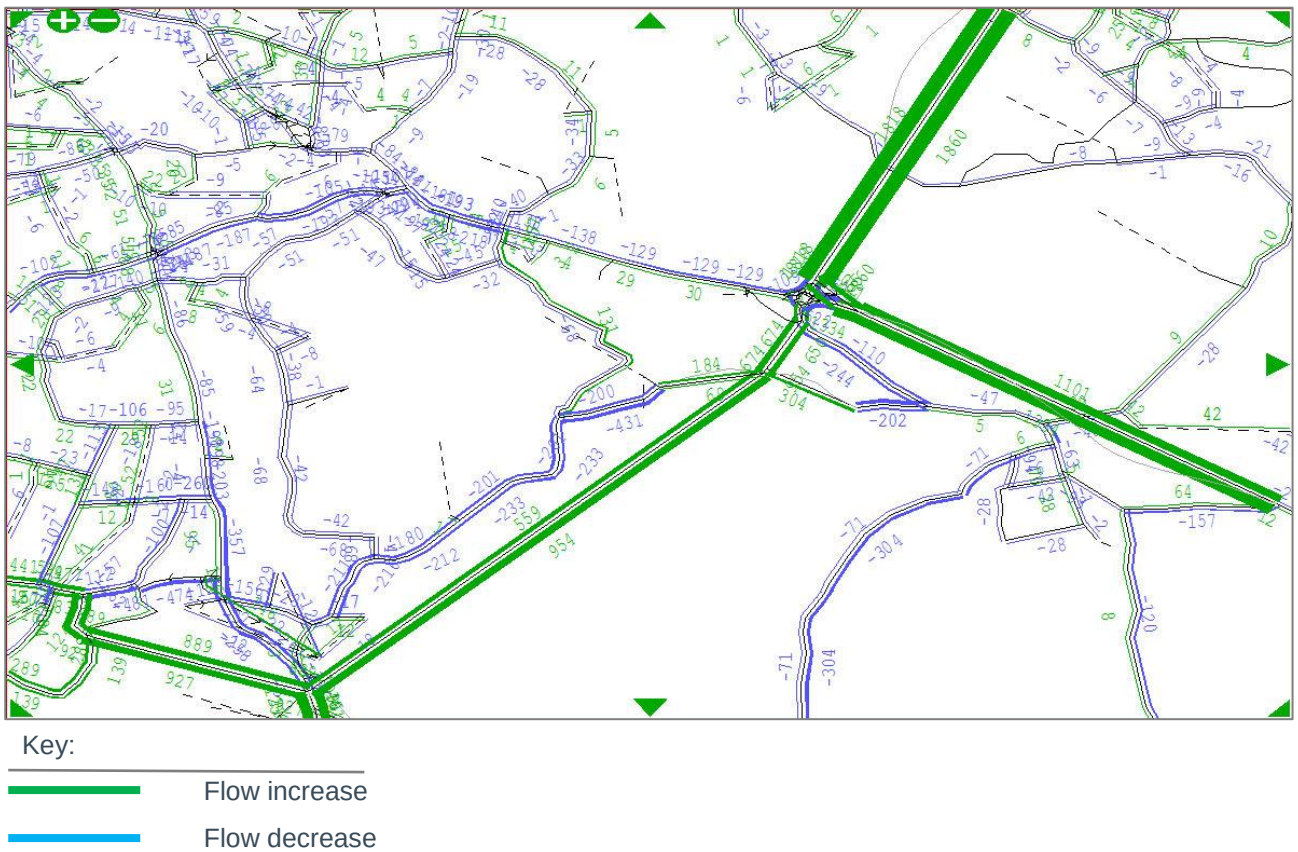
[43] Strategic traffic model has not fully represented the performance of the scheme

Figure 6-3 Demand (Flow) Difference Plot (AM Peak) – Combined Scheme (SN)



Note: Scheme is not present in SN base model and so no flow difference is recorded on the scheme alignment

Figure 6-4 Demand (Flow) Difference Plot (AM Peak) – Combined Scheme (JSP)



6.3.3.2. Headline economic impacts

The key economic impacts for the scheme options and combined scheme are presented in Table 6-5.

The cost and benefit elements presented are comprised of the following elements:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)
• Preparatory (including detailed design and survey work); • Construction (excluding utility diversions); • Site Supervision; • Land; • Risk Budget; • Maintenance and renewal costs; and • Inflation.	• Highway decongestion benefits; • Economic Efficiency; • Greenhouse Gases; and • Indirect Tax Revenues.

Cost elements are discussed in the Financial Case in Section 6.3.4.

The stand-alone A4-A37 Link (Options A and B) deliver a **low VfM** (Benefit Cost Ratio (BCR) between 1 and 1.5) due to the fact they represent only a partial solution to gap in the orbital network with no solution to the pinch point at Whitchurch, and therefore do not alleviate the full range of congestion to the extent that the benefits significantly outweigh the costs. Being tested in the SN scenario, the demand from adjacent SDLs is not represented (although much of the growth is within the SN model, albeit distributed).

Both West of A37 links deliver **high VfM**, with BCRs over 2. They offer significant benefits to the congested networks in Whitchurch and therefore there is adequate benefit to justify the cost. Option C Washing Pound Lane has a higher BCR of the two options, due to lower cost. Option D to Half Acre Lane generates higher benefits of the two, but not sufficient to outweigh the higher costs and achieve a higher BCR than Option C.

Option E when assessed in a previous study using a micro-simulation modelling tool showed very significant benefits, albeit based on growth assumptions up to 2024 rather than the 2036 scenarios used for this study. However, it is considered that the scheme offers **high VfM**.

As a combined scheme, the orbital highway route, including the Hicks Gate junction improvements, delivers **high VfM** (BCRs over 2). The BCR of 2.7 is slightly lower than Option C as a stand-alone scheme (2.8) – however, the total benefits generated are likely to be under-estimated as the benefits of the Hicks Gate junction improvements will not be fully captured. Further model development may increase the total benefits and BCR to be greater than the individual elements. The additional local demand from the SDLs in the JSP scenario results in a small increase in BCR, demonstrating the mitigation offered by the scheme to the SDL development.

Table 6-5 Headline scheme benefits summary, PV, £million (A4-A37 Link, West of A37, Hicks Gate)[44]

Assessment Criteria	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4	Combined Orbital Highway Scheme (B + D + E) (Highest Cost Options) [SN]	Combined Orbital Highway Scheme (B + D + E) (Highest Cost Options) [with JSP]
Present Value of Benefits (PVB)	£76.8		£68.3	£71.8	N/A	£177.0	£185.9
Present Value of Costs (PVC)	£53.7		£24.1	£32.9	£1.9	£66.0	£66.0
Net Present Value (NPV)	£23.1		£44.3	£38.9	N/A	£111.0	£119.9
BCR	**1.4**		**2.8**	**2.2**	N/A	**2.7**	**2.8**
Value for Money category[45]	**Low**		**High**	**High**	**(High) ***	**High**	**High**
Comments					* Previous assessments have indicated High VfM.	Sum of costs take account of some items duplicated in stand-alone schemes, such as a junction with the A37. Benefits of the Hicks Gate junction improvements are likely to be under-estimated – further model development may increase benefits and BCR.	

[44] Modelling outputs give an order of magnitude and can be used for comparative purposes. However, absolute numbers should not be used for planning purposes or be quoted due to the level of model noise in GBATS and the early stage of development of the costs. Numbers are not yet assured and may therefore change.
[45] VfM categories = Very High ≥4; High 2-4; Medium 1.5-2; Low – 1-1.5; Poor 0-1; Very Poor ≤0.

6.3.3.3. Social impacts

Social impacts for each scheme option are assessed qualitatively in**Error! Not a valid bookmark self-reference.** Table 6-6 using the Social impacts headings in WebTAG Transport Appraisal Process Guidance[46]. A seven-point qualitative scale has been used with the following categories:

xxx large adverse

xx moderate adverse

x slight adverse

- neutral

✓ slight beneficial

✓✓ moderate beneficial

✓✓✓ large beneficial

[46] Transport Analysis Guidance: The Transport Appraisal Process, 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/431185/webtag-tag-transport-appraisal-process.pdf

Table 6-6 Social impacts (A4-A37 Link, West of A37, Hicks Gate)

Assessment Criteria	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4	Combined Orbital Highway Scheme (A/B + C/D + E)
Non-business users	**Moderate beneficial ✓✓** Journey time reliability and connectivity of non-work and non-commuting journeys will be improved by both options.		**Moderate beneficial ✓✓** Journey time reliability and connectivity of non-work and non-commuting journeys will be improved by both options.		**Slight beneficial ✓** Journey time reliability and connectivity of non-work and non-commuting journeys will be improved by this option. There will be a greater flow of vehicles able to pass through the junction than currently. Most benefits will be in the peak hours when the junction is congested.	**Moderate beneficial ✓✓** Journey time reliability and connectivity of non-work and non-commuting journeys will be improved by both options.
Physical activity	**Large beneficial ✓✓✓** This route will offer a continuous orbital cycle link; (note: it may be that the most appropriate routes is not adjacent to the link road but on local roads in Stockwood. The non-strategic nature of this Option Leans the cycling and walking route on the road should connect well into the Whitchurch SDL.	**Moderate beneficial ✓✓** This route will offer a continuous orbital cycle link; (note: it may be that the most appropriate routes is not adjacent to the link road but on local roads in Stockwood. The strategic nature of this route means there is likely to be some challenges to connectivity for walking/cycling from the new Whitchurch SDL.	**Moderate beneficial ✓✓** The rural nature of most of this road means cycle provision is likely to only have a slight beneficial impact as it will not generate a large number of new cycle trips. However, removing car trips from Whitchurch centre will have a significant benefit in that location.		**Neutral -** Unlikely to be a change to the length and number of walking and cycling trips made in this location.	**Large beneficial ✓✓✓** This route will offer a continuous orbital cycle link; (note: it may be that the most appropriate routes is not adjacent to the link road but on local roads in Whitchurch/Stockwood. The route will incorporate appropriate features to connect the SDL to local networks (dependant on the status of the link). Removing car trips from Whitchurch centre will have a significant benefit in that location.
Journey quality	**Moderate beneficial ✓✓** Scheme is expected to improve journey quality for car users due to reduced and more reliable orbital journey time and less congestion.		**Large beneficial ✓✓✓** Scheme is expected to improve journey quality for car users due to reduced and more reliable orbital journey time and less congestion. Non-car users should experience improved journeys due to fewer cars on local roads such as Maggs Lane and Ridgeway Lane.		**Moderate beneficial ✓✓** An improved interchange resulting in less congestion and quicker journey times should increase customer satisfaction.	**Large beneficial ✓✓✓** Scheme is expected to improve journey quality for car users due to reduced and more reliable orbital journey time and less congestion. Non-car users should experience improved journeys due to fewer cars on local roads such as Maggs Lane and Ridgeway Lane.
Accidents	**Moderate beneficial ✓✓** Option is expected to significantly reduce the number of accidents on alternative routes via A4, A4174, A37 and local roads in Stockwood, by removing a high amount of traffic and conflicting movements.		**Moderate beneficial ✓✓** Option is expected to significantly reduce traffic flow on local roads which are currently being used as rat runs, in particular Ridgeway Lane and Maggs Lane, and hence improve safety for all users.		**Slight beneficial ✓** This scheme is expected to remove a large number of conflicting movements from the Hicks Gate roundabout, although some movements are already signal controlled	**Moderate beneficial ✓✓** Scheme is expected to significantly reduce the number of accidents on alternative routes via A4, A4174, A37 and local roads in Stockwood and Whitchurch, by removing a high amount of traffic and conflicting movements.
Security	**Neutral -** Unlikely to be a change of crime incidence or fear of crime due to this option.		**Neutral -** Unlikely to be a change of crime incidence or fear of crime due to this option.		**Neutral -** Unlikely to be a change of crime incidence or fear of crime due to this option.	**Neutral -** Unlikely to be a change of crime incidence or fear of crime due to this option.
Access to services	**Slight beneficial ✓** Provides new orbital link addressing evidenced gap in the network. This scheme would facilitate new orbital public transport services.		**Slight beneficial ✓** Provides new orbital link addressing evidenced gap in the network. This scheme would facilitate new orbital public transport services.		**Neutral -** Unlikely to have an impact on public transport accessibility.	**Slight beneficial ✓** Provides new orbital link addressing evidenced gap in the network. This scheme would facilitate new orbital public transport services.
Affordability	**Slight beneficial ✓** Travel costs should be slightly reduced, due to users being able to take a more direct route to their destination, and reducing travel costs by reducing the time users are on the road network.		**Slight beneficial ✓** Travel costs should be slightly reduced, due to users being able to take a more direct route to their destination, and reducing travel costs by reducing the time users are on the road network.		**Slight beneficial ✓** Travel costs should be slightly reduced, due to users being able to traverse the junction more quickly.	**Slight beneficial ✓** Travel costs should be slightly reduced, due to users being able to take a more direct route to their destination, and reducing travel costs by reducing the time users are on the road network.
Severance	**Slight adverse x** Slight negative impact on severance as the new road will separate development on either side - however this Option Lay include numerous crossing points and junctions to balance the needs of movement along and across the link.	**Moderate adverse xx** Moderately negative impact on severance as the new road will separate development on either side. The more strategic nature of this option would have a greater emphasis on movement along the link than across it	**Moderate beneficial ✓✓** Option alignment generally only passes through rural land, however close to the access with Whitchurch Lane there are some nearby houses, and the new road would slightly increase their severance to the community on the other side. However, there would be a much larger beneficial severance impact to the communities which see a traffic reduction.	**Slight beneficial ✓** Option alignment runs through rural land until it hits Half Acre Lane, which is in a residential area. The severance due to an increase of traffic on this road, which is currently low. However, there would be a much larger beneficial severance impact to the communities which see a traffic reduction.	**Neutral -** Option would result in little change to the current severance impact.	**Neutral -** Assessment depends on nature of the A4/A37 link and level of opportunity to cross it. There would be a significant benefit to the communities which see a traffic reduction.
Option and non-use values	**Neutral -** No impact as scheme does not directly result in new public transport services.		**Neutral -** No impact as scheme does not directly result in new public transport services.		**Neutral -** No impact as scheme does not directly result in new public transport services.	**Neutral -** No impact as scheme does not directly result in new public transport services.

6.3.3.4. Environmental impacts and mitigation

The options have been assessed against environmental impacts from WebTAG:

- Noise
- Air Quality
- Landscape
- Townscape
- Water Environment
- Heritage.

The level of assessment is proportionate to the early stage of scheme development. WebTAG worksheets have been used, except for Noise and Air Quality where proformas consistent with WebTAG principles have been utilised. This is because WebTAG Noise and Air Quality worksheets require Noise and Air Quality modelling which is not appropriate to OAR stage. Level 1 Flood Risk assessments have also been produced to ensure the environmental assessment provides a comprehensive analysis of the risks, commensurate to the level of scheme design.

The full environmental assessments are provided in Appendix 6:3.

Table 6-7 summarises the outputs of the environmental assessment. The focus of the table is to compare schemes against each other, where there is no discernible difference of the impacts on the environmental factors, the commentary has just been provided once.

Proposed mitigation for the highway schemes is outlined in Table 6-7. A key design principle for mitigation, has been to seek to minimise environmental impacts through careful selection of route alignments and consideration of the location of new features within the proposals, particularly in urban areas where opportunity for mitigation measures will be restricted. Note that environmental mitigation is not included in the designs due to the early stage of scheme development, this should be planned for the next stages of scheme development.

A number of assessments do not take into account mitigation. Noise and Air Quality do not account for mitigation as Noise and Air Quality modelling was not carried out; Water is dependent on hydraulic modelling, and heritage is dependent on fieldwork.

Table 6-7 Summary of environmental impacts and mitigation considerations (highway scheme options)

Assessment Criteria	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4
Noise	**Slight Adverse x** There are approximately 65 noise sensitive receptors located within 200m of the proposed route alignment, and facades of these receptors could be exposed to an increase in noise directly from the scheme, however a number of these same noise sensitive receptors may also benefit from decreases in noise on other facades due to the rerouting of traffic. There is the potential for minor to moderate increases in noise at properties located in Bifield Road due to the bypass itself, with the potential for nearby properties located on Stockwood Lane to experience a minor decrease due to traffic rerouting.		**Slight Adverse x** There are approximately 340 noise sensitive receptors within 200m of the proposed route alignment that could be exposed to an increase in noise directly from the scheme, of which ~16 are located within a designated noise important area. Properties located on Washing Pound Lane, Churchways, Charnwood Road, and Maggs Lane might be expected to experience a minor to moderate increase in noise due to the introduction of the new link.	**Slight Adverse x** There are approximately 470 noise sensitive receptors within 200m of the proposed route alignment, and could be exposed to an increase in noise directly from the scheme. Properties located on Stoneberry Road, Church Road, Half Acre Lane, and Charnwood Road might be expected to experience a minor to moderate increase in noise due to the introduction of the new link.	**Neutral -** No noise important areas or noise sensitive receptors are located within 200m.
Mitigation	*To be identified in next stages of work.*		*To be identified in next stages of work.*	*To be identified in next stages of work.*	*To be identified in next stages of work.*
Air Quality	No AQMA within 200m of the link road alignment. The Bristol AQMA (encompassing the A4 and the A37) could benefit if traffic is redirected from the A4174 to the link road. An increase in traffic on the A4174, the A4175 and the A37 could adversely affect air quality at over 2,000 sensitive receptors, however the potential reduction in traffic on alternative routes could positively affect 6,600 sensitive properties. There may be an overall reduction in NO2 and PM10, depending on the magnitude of traffic changes.		No AQMAs or designated ecological sites within 200m of the link road. There are sensitive properties (340 for Option C and 470 for Option D) within 200m of the link road itself which would have a deterioration in air quality. The expected reduction in traffic in residential areas could result in an improvement at 4,200 sensitive properties whilst the increase of traffic on Whitchurch Lane could adversely affect 1,000 sensitive properties. There may be an overall reduction in NO2 and PM10, depending on the magnitude of traffic changes.		No AQMAs, sensitive properties or designated ecological sites within 200m of the proposed junction changes.
Mitigation	*To be identified in next stages of work.*		*To be identified in next stages of work.*		*To be identified in next stages of work.*
Landscape	**Slight – Moderate Adverse x/xx** Minor impacts are anticipated on the Greenbelt. The route would cut through the landscape pattern with loss of pastoral agricultural land, trees and hedgerows. Recreational routes within 500m may experience some minor degradation in visual quality. Rural areas would experience some increased disturbance as a result of the scheme.		**Slight Adverse x** Minor impacts are anticipated on the Greenbelt. The route would cut through the landscape pattern with some loss of pastoral agricultural land, trees and hedgerows. There is partial visual connectivity with cultural features such as Maes Knoll and impacts on its setting are likely to be adverse due to the proximity to the scheme. Main settlements, isolated properties, farmsteads and associated recreational facilities are within 1km of the scheme, some of which are directly adjacent, particularly the Rugby Club. Recreational routes within 500m may experience some minor degradation in visual quality. Rural areas would experience increased disturbance as a result of the scheme.		**Neutral – Slight Adverse -/x** There will be minor loss of hedgerows and trees, however no impacts are anticipated to landscape pattern, tranquillity, or on any designated sites. Very minor impacts anticipated on regionally designated Greenbelt. Earthworks would slightly alter the local pattern of the landscape and landform within the adjacent vicinity. Small impacts on tranquillity are expected immediately adjacent to the scheme for road, PRoWs and trail users. Recreational routes within 500m may experience some minor degradation in visual quality. Keynsham Motocross site and the Avon Fire and Rescue centre would experience visual impacts.
Mitigation	Careful design of new alignment and earthworks. Mitigation planting for screening for nearby receptors, and to re-create linear features and copses for connectivity to offsite vegetation.		Careful design of new alignment and earthworks. Mitigation planting for screening for nearby receptors, and to re-create linear features and copses for connectivity to offsite vegetation.		Mitigation planting to provide screening for the site to nearby receptors and to the wider landscape.
Townscape	**Slight Adverse x** There would be visual disturbance on townscape features south east of Whitchurch, south of Stockwood and Queen Charlton. However, this impact would be small as the scheme is already located in close proximity to urban areas.		**Slight Adverse x** There would be some visual disturbance on the setting of some cultural features to the edge of Whitchurch, and visual disturbance on townscape features south of Whitchurch. However, this impact would be small as the scheme is already located near urban areas		**Neutral -** No anticipated notable impacts.
Mitigation	Careful placement of new features. Planting for screening of views from urban edges.		Careful design and location of elements within the urban edge. Planting for visual screening and to recreate severed landscape features within the rural area.		N/A
Biodiversity	**Slight Adverse x** Scheme has potential for impacts on Special Areas of Conservation for Bats. This is through loss of commuting or foraging habitat for bats within the local area. The scheme may result in loss of deciduous woodland, hedgerows and agricultural habitats. There is a Granted European Protected Species Application within 1km of the scheme, this is for common pipistrelle, soprano pipistrelle, lesser horseshoe, serotine and whiskered bats. Loss of trees, hedgerow, grassland, scrub habitats and ponds could result in loss of areas potentially suitable for associated protected species.		**Slight Adverse x** Scheme has potential for impacts on Special Areas of Conservation for Bats. This is through loss of commuting or foraging habitat for bats within the local area. The scheme may result in loss of deciduous woodland, hedgerows and agricultural habitats. Loss of hedgerow, grassland, scrub habitats and ponds could result in loss of areas potentially suitable for protected species.		**Neutral –** No anticipated notable impacts.
Mitigation	Re-planting of hedgerows lost.		Re-planting of hedgerows lost.		N/A

Assessment Criteria	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4
Water Environment	**Significant Adverse xx** The route is entirely located within Flood Zone 1, and would cross a number of small watercourses and overland flow routes. There is a potential for a loss of floodplain storage within these floodplain areas. There will be increased runoff resulting from increase in impermeable area from the proposed link road, with a discharge of pollutants with potential impacts on water quality of the watercourse. Overall, excluding mitigation, the scheme is considered to have a significant adverse impact on the water environment as it has the potential to increase flood risk to residential and commercial properties, and impact water quality.		**Very Significant Adverse xxx** The route is entirely located within Flood Zone 1, and also sits within the upper reaches of the Brislington Brook catchment, a tributary of the River Avon. At least three Ordinary Watercourses cross the route, whose impact would require some form of hydraulic modelling / mitigation testing. There is a potential for a loss of floodplain storage, and any watercourse diversions would need to ensure conveyance of flows is maintained and floodplain storage is not reduced. There will be increased runoff resulting from increase in impermeable area from the proposed link road, with a discharge of pollutants with potential impacts on water quality of the watercourse. Overall, excluding mitigation, the scheme is considered to have a significant adverse impact on the water environment as it has the potential to increase flood risk to residential and commercial properties, and impact water quality.	**Very Significant Adverse xxx** *Read impacts as per Option C, plus:* The longer route length of this Option Leans the increase in runoff is likely to be greater with a bigger impact and more potential to increase flood risk to properties. Thus also would require greater mitigation.	**Very Significant Adverse xxx** A small proportion of the embankment works on the north-west side of the existing roundabout falls within Flood Zone 2 and 3, and the scheme crosses the Scotland Bottom watercourse (extension of an existing crossing). The majority of the site however is in Flood Zone 1. Increased runoff resulting from increase in impermeable area from the new road embankment. Also could increase the discharge of pollutants from road runoff. There is potential for loss of floodplain storage.
Mitigation	A WFD (Water Framework Directive) assessment may be needed for the minor watercourse crossings/diversions. Mitigation measures such as SuDS and potentially flood compensatory storage would be required as part of the scheme; these would need to be tested as part of the Flood Risk Assessment and Drainage Strategy.		A WFD assessment is likely to be required given the requirement for watercourse crossings/diversions. Mitigation measures such as SuDS and potentially flood compensatory storage would be required as part of the scheme; these would need to be tested as part of the Flood Risk Assessment and Drainage Strategy.		Mitigation measures such as SuDS and potentially flood compensatory storage would be required as part of the scheme - these would need to be tested as part of the Flood Risk Assessment and Drainage Strategy. The extended watercourse crossing needs to ensure that conveyance of flows is maintained and floodplain storage is not reduced.
Heritage	**Slight Adverse x** The adverse effects relate to the potential physical impacts on designated heritage assets (two registered parks and four conservation areas) as the scheme runs along the existing A4 which these assets border. Creating a new link road between Stockwood and Queen Charlton will harm the rural setting that currently still exists between the two settlements.		**Slight Adverse x** There is potential for adverse impacts on the setting of designated heritage assets. The assets are likely to have visibility to and from the proposed scheme.		**Slight Adverse x** There is potential for temporary impacts on the setting of listed buildings during construction, particularly those which may have visibility to and from the proposed scheme.
Mitigation	Appropriate design to avoid impacting on the boundaries of these designated heritage assets could potentially reduce the overall effect to neutral.		Sensitive design and appropriate mitigation such as screening could reduce the overall effect of the scheme to neutral.		Sensitive design and appropriate mitigation such as screening could reduce the overall effect of the scheme to neutral.

6.3.3.5. Summary VfM assessment

The schemes are currently at an early stage of development and it is anticipated that the following considerations may influence the case for progressing these schemes:

The orbital highway schemes take traffic off less appropriate orbital routes, reducing traffic on local roads, and therefore provides quicker, more reliable journeys across the study area.

Hicks Gate junction improvements have been shown by a previous study to deliver significant additional capacity at the junction and at least a high value for money category (BCR) as a stand-alone scheme. Assessment of the scheme as part of the wider orbital link within a strategic traffic model has NOT identified any concerns with the design or capacity of the junction, although further study using a micro-simulation traffic model is required to verify the scheme is compatible with the orbital link, particularly if there is a desire to deliver it to a faster timescale, given existing congestion concerns.

The West of A37 link delivers a high value for money categorisation and is effective in reducing traffic through Whitchurch on less appropriate routes. It has slight-moderate beneficial social impacts. Significant landscape and water environment mitigation will be required.

The A4/A37 link provides low Value for Money as a stand-alone scheme. The alignment chosen minimised the environmental impact of the scheme, although significant water environment mitigation will still be required. As the Whitchurch SDL masterplan is developed the southern alignment of the road may be adjusted, maintaining suitable design standards. The preferred option in terms of the strategic nature of the route will largely depend on potential future aspirations for a southern orbital link to the A38 and airport. The scheme progressed should seek to minimise severance, whilst maintain a movement function along the link suitable for its eventual status in the network.

The combined highway scheme delivers high value for money, with each of the orbital links performing better than as stand-alone schemes. When assessed in the JSP scenario, accounting for the local SDLs at Whitchurch, Brislington and Keynsham, the benefits and VfM assessment are improved.

6.3.4. Financial case

6.3.4.1. Capital costs

The schemes have been costed on the basis of 3D concept designs, to take account of estimated levels of cut and fill. Costs for the Hicks Gate junction improvements have been taken from the previous study, uplifted to the current year to be compatible with other costings.

Works costs have been built up on a 'per m^2' or 'per m^3' basis for different elements. This approach is a proportionate hybrid between a high level 'per km of road' costing and a full Bill of Quantities (BoQ). 3D designs have enabled the volume of cut and fill to be estimated to inform excavation and disposal costs. It should be noted, that the schemes designed in 3D are to concept design level, not detailed design.

The rates used have been derived from competitive market rates that we have from similar projects, both pre- and post-contract. A percentage of the total scheme costs have been used for items such as fencing, landscaping and utility diversions, which have been calculated using an average percentage found on similar projects.

Structures have been calculated at a high level based on the works we would expect them to encompass, and have amended where necessary dependant on the size and location.

Percentage allowances have been included as follows:

Preparation (design, business case) – 10% of construction cost;
Site supervision – 6% of construction cost.
Risk budget – 40% of construction cost;
Environmental mitigation (part of the construction cost) – 10% of works cost.

Land costs are based on a unit rate of £40k/per hectare for land with development potential. Note there have been no discussions with landowners at this stage.

To derive outturn costs, the schemes costs have been profiled as follows

Preparation costs have been evenly split over the preparation period;
Construction costs have been evenly split over the construction period;
Land costs are assumed to be incurred the year before construction commences.

Scheme opening years are generally based on previous work by the Councils, with adjustment if the opening year has needed to be extended to allow for preparation and design.

Table 6-8 Scheme capital costs

Cost Item	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4	Combined Orbital Highway Scheme (B + D + E) (Highest cost options)
Preparatory (including detailed design and survey work)	£5.1m	£5.2m	£2.3m	£3.1m	£0.2m	£8.2m
Construction (excluding utility diversions)	£28.2m	£29.1m	£12.7m	£17.4m	£1.2m	£44.8m
Site Supervision	£1.7m	£1.7m	£0.8	£1.0m	£0.07m	£2.8m
Land	£0.7m	£0.7m	£0.08m	£0.1m	£0.03m	£0.8m
Risk Budget	£11.3m	£11.6m	£5.1m	£7.0m	£0.5m	£18.7m
Total – 2017 prices	**£46.9m**	**£48.4m**	**£21.0m**	**£28.6m**	**£2.0m**	**£75.4**
Inflation	£18.2m	£18.7m	£8.1m	£11.1m	£0.2m	£29.2m
Total – Outturn prices (outturn year)	**£65.1m**	**£67.1m**	**£29.1m**	**£39.7m**	**£2.2m**	**£104.6m**

6.3.5. Management and commercial case

6.3.5.1. Programme & phasing

Potential scheme opening years have been referenced from work undertaken by the unitary authorises in relation to the proposed housing trajectories in the JSP, and potential transport mitigation trigger points to help support the proposed development. Appropriate construction and design periods have been specified ahead of opening year, and including a period back to present day for preparatory work on developing a business case and gaining funding, planning permission and land purchase.

The assumed scheme programme is shown in Table 6-9, and is the basis for the economic assessments and profiling for outturn costs.

Table 6-9 Highway scheme option programme

	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4
2018					
2019					
2020					
2021					
2022					2022
2023					
2024					
2025					
2026					
2027					
2028	2028	2028	2028	2028	
2029					
2030					
2031					
2032					
2033					
2034					
2035					
2036					

Preparatory (Business Case & Funding)		Preparatory (Design)	
Construction		Opening Year	2018

If progressed, it is assumed Options A-D – the orbital highway routes A4-A37 Link and West of A37 link would be delivered concurrently with an opening year of 2028, preceded by 3-year construction programme and 2-year design process. This provides adequate opportunity to develop the business case and obtain funding planning permission and land purchase. Other scheme options for orbital public transport routes are

dependent on the delivery of these schemes, although any necessary bus priority measures could be delivered concurrently.

If progressed, Option E Hicks Gate junction improvement could be progressed faster as it is a smaller scale scheme, with an opening year of 2022 assumed, preceded by a 1-year construction period, and 1-year design period. Note: the junction design was developed in a previous study that did not account for the potential orbital link road. Whilst this study has not identified any evidence that the junction design under consideration is not compatible with the orbital link road, further study using a micro-simulation traffic model is required to verify this.

6.3.5.2. Deliverability and acceptability

Table 6-10 Public or stakeholder consultation has not yet been undertaken with regard to these scheme options, and therefore acceptability assessments are based upon likely issues expected to be encountered, and known public opinion to date. Table 6-10 provides a high-level categorisation of public acceptability for each scheme option (not publicly acceptable; likely to encounter strong issues; some issues, but could be acceptable overall; acceptable to most but with some minor issues; acceptable to most with very limited or no issues).

Table 6-10provides a high-level categorisation of the degree of delivery challenges faced by each scheme option (very challenging; moderate challenges; minor challenges; very limited challenges). Key deliverability issues are also discussed in Section 6.2, and Table 6-1.

Public or stakeholder consultation has not yet been undertaken with regard to these scheme options, and therefore acceptability assessments are based upon likely issues expected to be encountered, and known public opinion to date. Table 6-10 provides a high-level categorisation of public acceptability for each scheme option (not publicly acceptable; likely to encounter strong issues; some issues, but could be acceptable overall; acceptable to most but with some minor issues; acceptable to most with very limited or no issues).

Table 6-10 Deliverability and acceptability assessment – highway schemes

	Option A – Orbital Route A4-A37 (Access to SDL)	**Option B – Orbital Route A4-A37 (No access to SDL)**	**Option C: West of A37 – Washing Pound Lane**	**Option D: West of A37 – Half Acre Lane**	**Option E: Hicks Gate at-grade improvement A4174-A4**
Deliverability assessment	**Moderate delivery challenges** relating to water mitigation and the alignment crossing a strategic gas pipeline – the full impact of which will be assessed in the next stages of scheme development		**Minor delivery challenges** relating to water & landscape mitigation.		**Moderate delivery challenges** relating to water mitigation, and achieving a safe design with departures from standard due to topography constraints.
Acceptability assessment	**Likely to encounter strong issues**; new highway infrastructure in green belt, impacting in local quiet routes.		**Likely to encounter strong issues;** new highway infrastructure in green belt, impacting on local landscape and landmarks. Increased traffic through Whitchurch Lane. Perception of clear link to relieving congestion in Whitchurch Village.		**Very limited or no issues;** improvement to locally strategic highway link. Area already dominated by highway infrastructure.

6.3.5.3. Key risks

An initial risk register has been developed. Table 6-11 lists the key risks identified to-date – key risks generally relate to the schemes being at an early stage of development. It is important that these risks are factored into plans for the next stage.

Table 6-11 Key risks – highway schemes

Key Risk	Option A	Option B	Option C	Option D	Option E
Whitchurch masterplanning is at an early stage of development.	✓	✓	✓	✓	-
Corridor not currently protected from future development.	✓	✓	✓	✓	-
Scheme potentially could face public opposition.	✓	✓	✓	✓	-
Land Assembly – crosses multiple land owners who are yet to be engaged with.	✓	✓	✓	✓	-
Close to cemetery.	✓	✓	✓	✓	-
Development in Green Belt.	✓	✓	✓	✓	-
Water mitigation – engagement needed with Environment Agency.	✓	✓	✓	✓	✓
Severance of local routes – to be incorporated into SDL networks.	✓	✓	-	-	-
Schemes are at early level of development (e.g. no ecological surveys, no noise or air quality modelling) and no environmental design.	✓	✓	✓	✓	✓
Statutory undertakers – no C2 searches carried out to-date.	✓	✓	✓	✓	✓
Crosses gas and water pipeline at Hicks Gate – unknown impact	✓	✓	-	-	-
Scheme tested without A4-A37 Link – if link is delivered, scheme operation needs reassessing with micro-simulation modelling.	-	-	-	-	✓
Departures from standard required for left-turn filter.	-	-	-	-	✓

6.3.5.4. Commercial

Table 6-12 sets out commercial considerations in relation to delivery organisation and construction procurement. Note that if an orbital public transport service is provided, utilising the link road, it is likely any construction works would form part of the A4-A37 Link package.

Table 6-12 Commercial assessment – highway schemes

	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4
Delivery Agency	Bath & North East Somerset. As the route traverses close to the county boundary, there will be cross boundary impacts which will require joint working with Bristol City Council.		Bath & North East Somerset. As the route traverses close to the county boundary, there will be cross boundary impacts which will require joint working with Bristol City Council.		Bath & North East Somerset.
Construction procurement	Project could be delivered through a range of procurement models. No significant commercial barriers identified.		Project could be delivered through a range of procurement models. No significant commercial barriers identified.		Project could be delivered through a range of procurement models. No significant commercial barriers identified.
Public transport procurement	N/A – see orbital public transport corridor chapter.		N/A – see orbital public transport corridor chapter.		N/A

6.4. Conclusions

Table 6-13 summarises performance of the schemes against the DfT's five case model.

Table 6-13 Summary performance against the five cases[47]

Case	Criteria	Option A – Orbital Route A4-A37 (Access to SDL)	Option B – Orbital Route A4-A37 (No access to SDL)	Option C: West of A37 – Washing Pound Lane	Option D: West of A37 – Half Acre Lane	Option E: Hicks Gate at-grade improvement A4174-A4	Combined Orbital Highway Scheme (A/B + C/D + E)
Strategic	Package Objectives	• Strong alignment – option provides additional network capacity and orbital connectivity • Provides good links to/from SDL	• Strong alignment – option provides additional network capacity and orbital connectivity • Less connectivity directly with SDL, but accommodates future option for strategic southern orbital route	• Strong alignment – in particular it should remove traffic from local roads, and increase the orbital connectivity to the west.		• Moderate alignment – option increases capacity of the roundabout and reduces delay for all movements.	• Strong alignment – option provides additional network capacity and orbital connectivity • By drawing traffic from less appropriate routes, non-car travel on other parts of the network will be benefitted.
		The decision regarding the nature and standard of link road to be progressed is largely dependent on potential future aspirations to develop a strategic southern orbital route to the A38/airport. Without this, a route that balances the needs of movements across the link with those upon it may be appropriate, but this approach is not compatible with a more strategic link.					
	JLTP Objectives	• Moderate alignment -particularly in improving accessibility. • Negative alignment with regard to natural environment		• Moderate alignment -particularly in improving accessibility, and improving accessibility		• Slight alignment - particularly in improving accessibility, and improving accessibility	• Moderate alignment -particularly in improving accessibility. • Negative alignment with regard to natural environment
Economic	Economic Impacts	• **Low VfM** (as a stand-alone scheme)	• **Low VfM** (as a stand-alone scheme)	• **High VfM** (as a stand-alone scheme)	• **High VfM** (as a stand-alone scheme)	• Note: previous study using micro-simulation modelling suggested at least **High VfM**	• **High VfM** Modelling with JSP scenario to include SDLs increases VfM assessment
	Social Impacts	• Positive contribution, particularly towards physical activity, journey quality and safety • Minimises severance of SDL from existing Bristol area.	• Positive contribution, particularly towards physical activity, journey quality and safety • Risks significant severance of SDL from existing Bristol area.	• Positive contribution, particularly towards physical activity, journey quality, safety, and reducing severance caused by traffic on existing routes in Whitchurch.		• Small positive contribution particularly towards journey quality	• Significant positive contribution, particularly towards physical activity, journey quality, safety, and reducing severance caused by traffic on existing routes.
	Environmental Impacts	Without mitigation, assessed to have slight adverse impacts, with: • moderate landscape impact, and • significant water environment impact, due to run-off, crossing water courses and water quality.		Without mitigation, assessed to have slight adverse impacts, with: • very significant water environment impact, due to run-off, crossing water courses and water quality.		Without mitigation, assessed to have neutral or slight adverse impacts, with: • very significant water environment impact, due to proximity to flood zone2/3, run-off, crossing water courses and water quality.	Without mitigation, assessed to have neutral or slight adverse impacts, with: • moderate landscape impact and • very significant water environment impact, due to proximity to flood zone2/3, run-off, crossing water courses and water quality.
Financial	Capital Costs	• 2017 prices: £46.9m • Outturn: £65.1m	• 2017 prices: £48.4m • Outturn: £67.1m	• 2017 prices: £21.0m • Outturn: £29.1m	• 2017 prices: £28.6m • Outturn: £39.7m	• 2017 prices: £2.0m • Outturn: £2.2m	• 2017 prices: £75.4m [48] • Outturn: £104.6m
Commercial		• Likely local authority scheme promoter	• Likely local authority scheme promoter	• Likely local authority scheme promoter	• Likely local authority scheme promoter	• Likely local authority scheme promoter	• Likely local authority scheme promoter
Management	Risks	• Relationship with Whitchurch SDL unknown • Land assembly • Development in Green Belt • Crosses gas and water pipeline at Hicks Gate		• Relationship with Whitchurch SDL unknown • Land assembly • Development in Green Belt •		• Departures from standard required • Scheme tested without A4-A37 Link – compatibility to be verified with more detailed assessment	• Relationship with Whitchurch SDL unknown • Land assembly • Development in Green Belt • Crosses gas and water pipeline at Hicks Gate • Hicks Gate junction scheme tested without A4-A37 Link – compatibility to be verified with more detailed assessment
	Deliverability	• Moderate delivery challenges relating to water mitigation and the alignment crossing a strategic gas pipeline		• Minor delivery challenges relating to water & landscape mitigation		• Moderate delivery challenges relating to water mitigation, and departures from standard due to topography constraints	• Moderate delivery challenges relating to water and landscape mitigation, the alignment crossing a strategic gas pipeline, and departures from standard
	Acceptability	• Likely to encounter strong issues; new highway infrastructure in green belt, impacting in local quiet routes		• Likely to encounter strong issues; new highway infrastructure in green belt, impacting on local landscape and landmarks. Increased traffic through Whitchurch Lane		• Very limited or no issues; improvement to locally strategic highway link	• Likely to encounter strong issues; new highway infrastructure in green belt, impacting on local landscape and landmarks. Increased traffic through Whitchurch Lane

[47] Modelling outputs give an order of magnitude and can be used for comparative purposes. However, absolute numbers should not be used for planning purposes or be quoted due to the level of model noise in GBATS and the early stage of development of the costs. Numbers are not yet assured and may therefore change.
[48] Based on highest cost options (B+D+E) in line with OAR summary paper approach

7. A37 Public Transport Corridor

7.1. Introduction

Through the option sifting and packaging process set out in Chapter 5, three public transport corridors have been selected within the transport package for further assessment – A4, A37 and orbital.

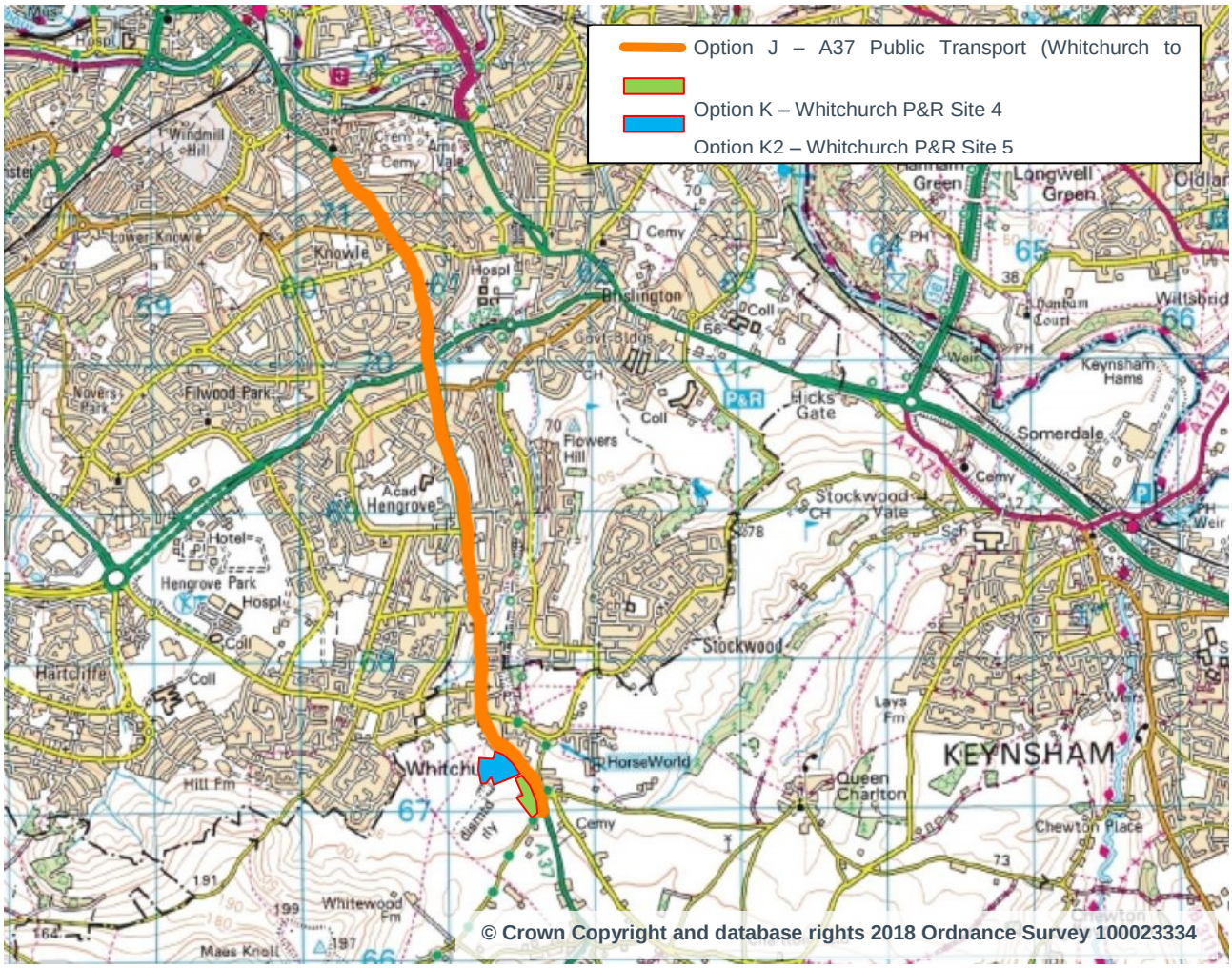
This chapter sets out the development and assessment of public transport scheme options for the A37 corridor.

The A37 corridor comprises options to provide a high-quality public transport service from the Whitchurch area into Bristol and develop a new Park & Ride site at Whitchurch.

Thus, the shortlisted scheme options are listed below, and shown on Figure 7-1:

- Option J – Enhanced bus service on A37 (Whitchurch - Bristol); and
- Whitchurch P&R:
    - Option K1 – Site 4 west of A37, north of Norton Lane
    - Option K2 – Site 5 west of A37, south of Church Road.

Figure 7-1 Overview of A37 public transport schemes for further assessment



The key stages of option development and assessment comprise:

Option Development	Option Assessment
• Service routing and specification • Engineering design development and evaluation • P&R Sites	• *Strategic* Case (objectives fit) • *Economic* Case (economic benefits and costs, social, environmental) • *Financial* Case (capital and operating costs) • *Commercial and Management* Cases (risks, deliverability, acceptability)

7.2. Option development

Service estimates and concept designs and have been developed for each scheme option, to an appropriate level to provide understanding of potential engineering deliverability, operational viability, environmental, cost and other issues. The assessments of each scheme options are in accordance with the principles and requirements of WebTAG for early stage development and reflect the National Planning Policy Framework (NPPF) tests of soundness where relevant.

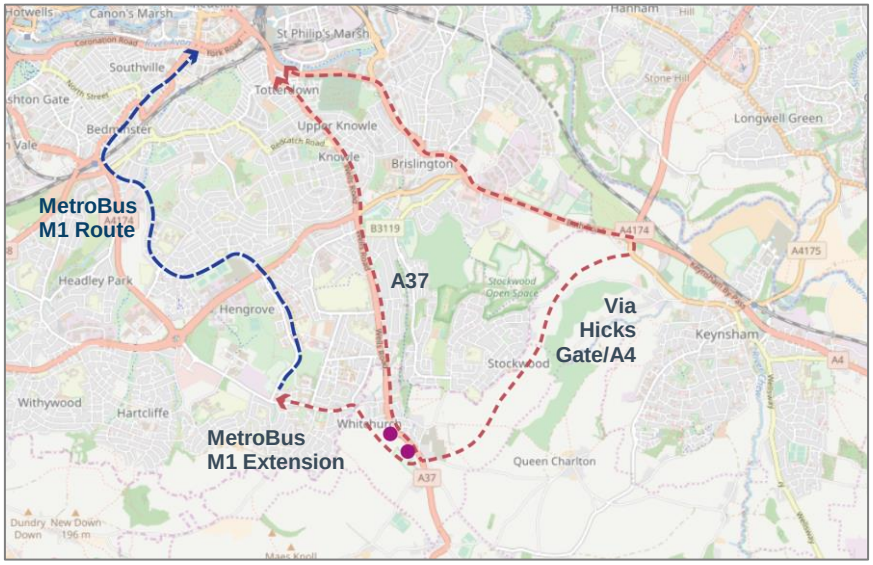
7.2.1. Service routing and specification

Routing of public transport services has been defined based on previous JTS work, the previous JSP Strategic Delivery Assessment, and new assessments as part of this study. Different routing options have been considered and are presented below. Existing bus stop and timetable information has been used to inform service journey times, with adjustments to reflect existing MetroBus service stop spacing. Service frequencies have been defined. Best practice and experience elsewhere shows that P&R sites are most commercially viable when served by existing passing bus services. Hence, assessments are based on the assumption that the A37 service will serve the P&R site, and provide a fast, limited stop service to the city centre.

A number of routing options for the service into Bristol have been considered, and are shown in Figure 7-2:

- Extension of MetroBus M1 (North Fringe to Hengrove) service to Whitchurch (via West of A37 highway link);
- An enhanced bus service routing via the A37; and
- A bus service routing via Hicks Gate (on the A4/A37 link) and the A4.

Figure 7-2 A37 Public Transport service routing options



The estimated service journey times to Temple Meads are shown in Table 7-1. These journey times assume the service follows a city centre loop (as the existing Brislington P&R service), and that half the journey time for the loop are attributed to inbound and outbound (13 minutes each way).

Table 7-1 A37 Route option journey times (minutes)

[Journey time to/from Temple Meads, excluding city centre loop shown in brackets]

	Inbound		Outbound	
Route Option	**AM**	**PM**	**AM**	**PM**
Extension to MetroBus M1[60]	c.48 *[35]*	c.48 *[35]*	c.48 *[35]*	c.48 *[35]*
A37 Bus[61]	36 *[23]*	37 *[24]*	33 *[20]*	38 *[25]*
Via Hicks Gate/A4[62]	36 *[23]*	35 *[22]*	34 *[21]*	39 *[26]*

The direct service along the A37 has the quickest journey time, and also serves locations along the corridor that would otherwise not receive an improved public transport service. It is therefore seen as the preferred routing option, benefiting users along the whole corridor and having the strongest commercial potential.

Routing via Hicks Gate and the A4 has comparable journey times than the A37. However, this option fails to serve locations other than Whitchurch on the A37 corridor, and would require either dedicated stand-alone Whitchurch P&R service (not commercially viable), interchange at Hicks Gate (inconvenient to users), or reduced services to Keynsham, with the A4 MetroBus instead routing to Whitchurch (fails to provide service for Keynsham) – none of which are considered viable options.

Extending the planned MetroBus M1 services to Whitchurch results in a significantly longer journey time and is not considered a preferred option at this stage. However, with much of the MetroBus standard service and infrastructure already delivered, it may offer a commercially viable option to serve the Whitchurch area, with only limited additional operational costs over the planned MetroBus M1 service and should be considered at later stages of scheme development once actual journey times are established. Whilst not a preferred option as a stand-alone link to the city centre, this option does form part of the Orbital service discussed in Chapter

[60] MetroBus M1 route Hengrove to Temple Meads:8.5km. Assume 17kph = 30mins. Extension to Whitchurch: 5mins. Half of city centre loop: 13mins.
[61] A37 Whitchurch to Temple Meads referenced from 376 timetable. Half of city centre loop: 13mins.
[62] A4 Hicks Gate to Temple Meads referenced on existing services. Hicks Gate to Whitchurch 8.2mins on new link road. Half of city centre loop: 13mins.

, and benefits such as the additional destination choices it offers in south Bristol and serving the SDL are captured there.

7.2.2. Public Transport Infrastructure

A high-level assessment for the potential to provide new lengths of bus lane on the A37 was undertaken, based upon OS mapping to give an indication of the available highway width. Limited opportunities to introduce new bus lanes were identified between Airport Road and Whitecross Avenue – predominately through removing existing on-street parking. Existing journey-time data was reviewed and showed that northbound bus lanes on approach to Airport Road and New Fosseway Road could generate a small journey time saving (c.1min). Bus lanes in other locations would not generate a journey time saving.

At this stage of scheme development, given the very limited potential benefit and potential delivery risks due to removal or parking, no new bus lanes have been included in the scheme design. However, as the schemes are considered in more detail, the relative merits of bus lanes at Airport Road and New Fosseway Road could be reviewed.

7.2.3. Whitchurch P&R site options

Concept designs for P&R sites were developed based on OS mapping to give an indication of the available plot size and local highway attributes.

Design development has focused on plot extents to achieve the required parking capacity based on a gross area per space, and junction/access arrangements to the surrounding network. Detailed parking layouts have not been developed at this stage.

The site options under assessment are close to a potential new orbital highway link, and hence access options from the new link have also been considered, although all assessments presented in this section are based on access to the existing highway network (A37). Plot boundaries take account of the potential new highway link alignments. Full concept plans, including option with access from potential new links roads, are provided in Appendix 7:1

The concept designs in this study have been designed to facilitate full access into the site by a dedicated bus service and also allow bus access and egress in both directions. Alternative arrangements, with bus stop options on the mainline or periphery of the site would likely be considered in future design stages as it is currently intended the site be served by a combined A37 bus service (rather than a dedicated P&R service). In order to ensure that bus access to and egress from the site is as efficient as possible so that services do not incur a time penalty for accessing/egressing Park & Ride facilities, a fully signalised junction would be required, and bus priority would also form part of the junction design/configuration.

Design of the accesses for each site will require consideration of the potential layout of the site and facilities to be provided. It is recommended that further work is undertaken in the next phase of work, however, it is considered that there are no fundamental physical and operational constraints to delivering a solution.

Another critical consideration when assessing the Park & Ride sites is the nature of traffic using each corridor, and the scope to intercept car trips and transfer these trips onto new bus services. Previous assessment work in the Joint Transport Strategy reviewed the GBATS4 strategic transport model to identify the numbers of trips heading towards the city centre and other locations that could be served by a Park & Ride site on the A37. A 10% factor was applied to this market to develop an initial estimate of the numbers of trips that could potentially transfer to Park & Ride. These trips were identified as in-scope trips that could form a potential market for Park & Ride at each location.

Based on this assessment the ultimate target capacity for the Whitchurch site options was defined as 500 spaces. Experience from previous studies identifies that the gross area required for a Park & Ride site is approximately 26.2m^2 per space, therefore the required maximum area for each site, excluding variables such as any buildings/infrastructure and access roads is 13,100m^2. Public transport mode choice modelling for this study has forecast lower P&R patronage levels, of c.80-100 users in the AM peak period. This suggests a 500-space facility would provide more parking capacity than is required. Hence cost estimates in this analysis are based on providing a 200-space car park, whilst providing the infrastructure and securing the land for potential future expansion up to 500 spaces.

Figure 7-3 and Figure 7-4 show the engineering concept designs for the two shortlisted Park & Ride sites; Option K1 and Option K2. They illustrate the land parcels (for a maximum 500 space facility) and a potential configuration of the parking and access onto the A37.

Figure 7-3 Option K1 – Whitchurch P&R Site 4 west of A37, north of Norton Lane

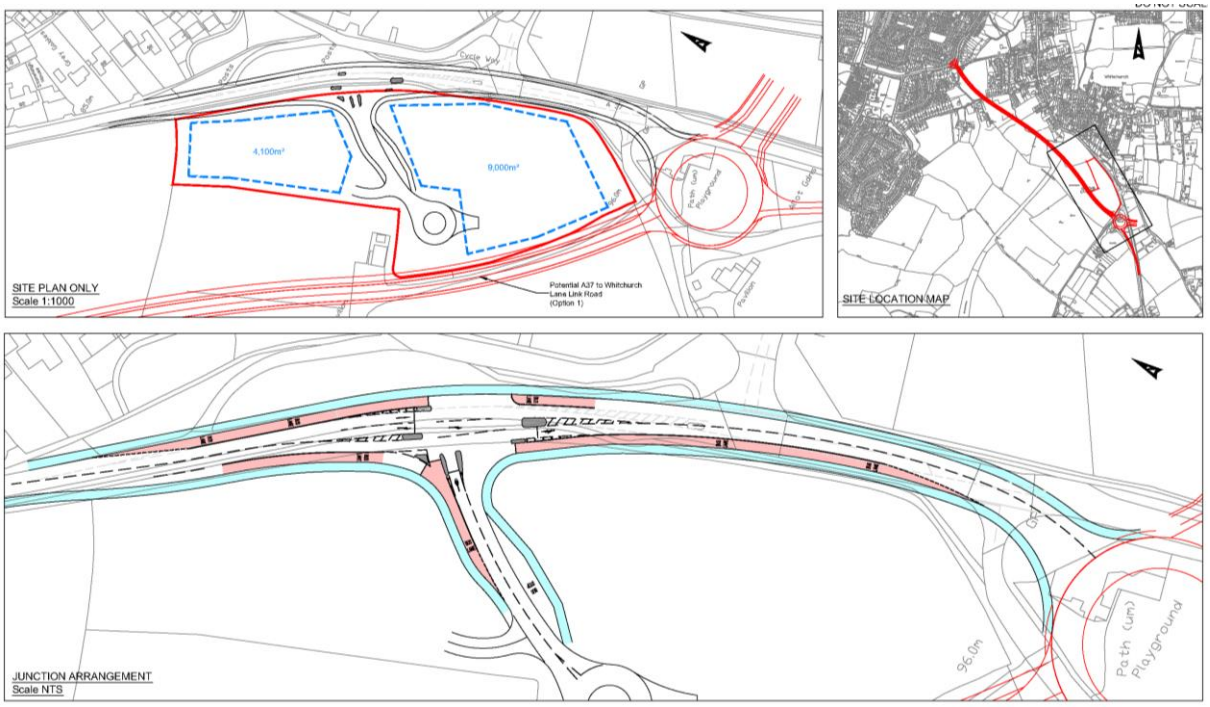
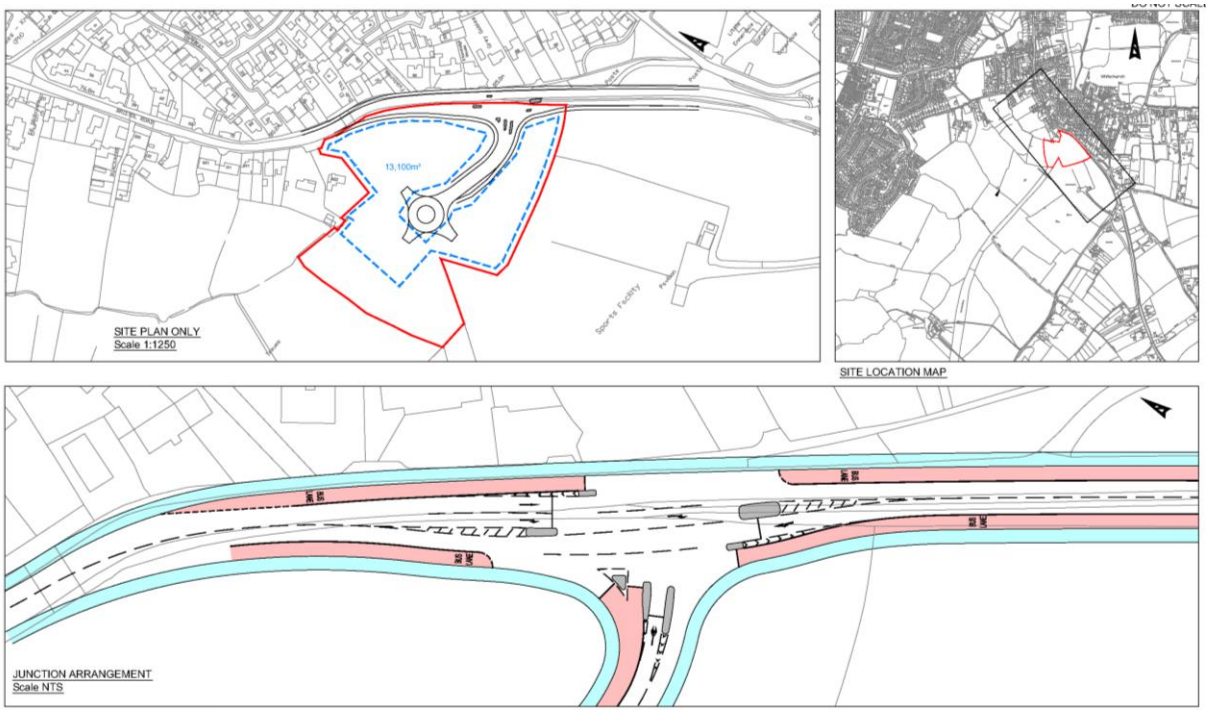


Figure 7-4 Option K2 – Whitchurch P&R Site 5 west of A37, south of Church Road



7.2.4. Concept design evaluation

An evaluation of the key considerations relating to each element of the A37 public transport scheme options is provided in Table 7-2 .

Table 7-2 Concept design evaluation

Assessment Criteria	Option J – Enhanced bus service on A37	Option K1: Whitchurch P&R Site 4	Option K2: Whitchurch P&R Site 5
Construction issue	n/a – no construction work	Flat site with no significant construction issues identified.	
Departures from Standards	n/a	Development in Green Belt.	
Key feasibility risks and unknowns	n/a	Unknown ground conditions and utilities.	If West of A37 link to Washing Pound Lane is progressed, it is marginal as to whether site can accommodate the maximum 500 space capacity. Unknown ground conditions and utilities.
Land ownership	n/a	Land parcel large enough to accommodate required capacity. Land purchase required.	
P&R Access/Visibility	n/a	New signalised junction required on A37. Bus lanes to stop lines are possible on all approaches giving very good priority for all movements. Site can be accessed from orbital link road (or Site 4 from its junction with A37) if delivered. Links with existing/potential footways and SUPs. Good visibility on edge of existing urban fringe, accessed from A37.	

7.2.5. Public transport service specification

The existing 376 service on the A37 runs half hourly (2 buses per hour, BPH) from approximately 7am-midnight between Bristol and Street, Somerset.

The core service specification tested provided a new 6BPH service serving the Whitchurch P&R and SDL providing a limited stop service (replicating MetroBus stop spacing) on the A37 (in addition to the 376 services so 8BPH in total on the corridor).

A sensitivity test is also presented to show the potential impact of further optimising the commercial viability of the service. This assumes a 4BPH service – 2BPH provided by the existing 376 service (serving the SDL/P&R), and 2 additional buses per hour added to provide a minimum level of service required for the P&R to be a viable journey choice.

Table 7-4 presents a summary and evaluation of the operational aspects of the public transport service, comprising the following items.

Bus operating costs

Atkins' bespoke bus operating costing tool was used to guide the assessment of operating costs. The key inputs for the bus operating costing tool comprise:

Frequency;
Round trip journey time – using the journey time assumptions outlined above (Although there is no journey time saving, the proposed increase in frequency is reflected in the assessments through a reduced waiting time);
Vehicle type – the assumption has been made that a single-decked vehicle will be used; and
Round trip distance – using the routing assumptions outlined above.
Existing services that can be merged or replaced to balance operational costs

Revenue

A mode-choice model has been developed and used by Atkins to estimate bus patronage in the AM peak on the A37 corridor. This is informed by 2011 travel to work data, with uplifts to represent growth in the corridor (in line with TEMPRO forecasts, spatially neutral). To convert patronage from AM peak only to an annual figure, observed data from work with other authorities that shows an average indicative uplift has been utilised.

To derive annual revenues, assumptions were made about revenue per passenger (observed data is commercially sensitive for operators). This was based an assessment of published fares by First Bus, covering adult and child single, return, daily, weekly and monthly tickets, and an assumption regarding the level of concessionary reimbursement that the operator could expect to receive. Table 7-3 summarises the revenue per boarder assumed. For the 4BPH sensitivity test assumptions have been used rather than full modelling. To give an indication of the potential impact revenue is assumed to reduce by 20%, compared to the scenario with 8BPH on the corridor.

Table 7-3 A37 Bus and Park & Ride service revenue per boarder

Journey	Revenue per Boarder Assumed
A37 (Whitchurch) Park & Ride to City Centre	£1.75
Whitchurch to City Centre	£1.75

Table 7-4 Public transport service performance[63]

	Option J: A37 Enhanced Bus Service [8BPH on corridor]	**Option J: A37 Enhanced Bus Service [4BPH on corridor]**
Route (brief description)	Whitchurch to Temple Meads, via the A37/Wells Road, with city centre loop following existing Brislington P&R service route. Serves Whitchurch, Whitchurch P&R, Hengrove, Knowle, Totterdown, Temple Meads and City Centre	
Frequency	8BPH on corridor: New 6BPH service + existing 2BPH 376 service	4BPH on corridor: Existing 2BPH 376 service supplemented with additional 2BPH.
Journey Time (With Scheme)	33- 38mins Inbound: AM 36mins; PM 37mins Outbound: AM 33mins; PM 38mins	33- 38mins Inbound: AM 36mins; PM 37mins Outbound: AM 33mins; PM 38mins
JT Saving vs. Do-Minimum (%)	0%	0%
Peak Vehicle Requirement	8 over current services	3 over current services
Annual Operating Cost	**£1.3m over existing services**	**£435k over existing services**
Forecast Patronage on corridor (Trips in AM peak period)	2337 (c.**120 over current services**) c.40 Additional bus users c.80 Additional P&R users	Assumed to reduce compared to 8BPH due to frequency reduction. Service provision has not modelled.
Forecast Revenue	£2.4m (**£0.2m** over current services)	Additional revenue assumed to reduce by 20% to reflect reduced patronage/frequency. Actual service provision not modelled.[64]
Operational Costs vs Revenue	**Subsidy is likely required** Forecast change in revenue is significantly less than forecast change in cost **(c.£1.0m deficit)**	**Subsidy is likely required** Forecast change in revenue is significantly less than forecast change in cost **(c.£260k deficit)**

[63] Modelling outputs give an order of magnitude and can be used for comparative purposes. However, absolute numbers should not be used for planning purposes or be quoted due to the level of model noise in GBATS and the early stage of development of the costs.
[64] 50% frequency x elasticity of 0.4 for bus service miles = 20% revenue reduction

		assuming a 20% reduction in revue as a result of reduced frequency.

The 4BPH sensitivity test shows a revenue deficit remains, although it is forecast to be of a similar scale to that paid for similar services in the past whilst they become established, and contributions could be sought from various funding streams.

Further service optimisation options have been considered including excluding the city centre loop, with services terminating to the south of the city centre near Temple Meads. This facilitates a return journey in under 1 hour and reduced the peak vehicle requirement and operating costs. However, a review of existing commercial services shows all services currently continue to the city centre, indicating a commercial case for doing so. More detailed modelling of this option in subsequent stages of scheme development many be beneficial to confirm the cost/revenue implications, but at this stage this option is not considered to offer a net benefit.

7.3. Option assessment

7.3.1. Overview

This section presents the following assessments against the DfT's five case model:

•Strategic Case	•Economic Case	○Financial Case	•Commercial and Management Cases
• Contribution to corridor objectives • Contribution to JLTP objectives	• Economic impacts • Social impacts • Environmental impacts • Summary VfM assessment	• Capital costs • Operating costs	• Commercial considerations • Risks • Deliverability • Acceptability

7.3.2. Strategic case

This section sets out performance of the A37 corridor schemes against package objectives and JLTP3 goals.

Table 7-5 outlines performance of options against package objectives. All scheme options perform strongly, as performance against objectives formed part of the sifting in Chapter 5.

Table 7-6 outlines performance of options against JLTP3 objectives.

Table 7-5 Contribution to package objectives

Assessment Criteria	Option J: A37 Enhanced Bus Service	Option K1: Whitchurch P&R Site 4	Option K2: Whitchurch P&R Site 5
Mitigate increased travel demand enabling planned growth (JSP and non-JSP)	**Slight beneficial ✓** An enhanced service with increased frequency provides a high quality, direct bus public transport choice serving the Whitchurch SDL. Existing bus priority will contribute to relatively fast and reliable journey times, although services will be impacted by congestion on the corridor. Patronage forecast is relatively low.	**Moderate beneficial ✓✓** Removes car trips from the A37 corridor and mitigates impact of traffic growth.	
Provide a range of convenient and attractive journey options for south-east Bristol to key destinations such as Bristol city centre and Keynsham, and for orbital movements, to enable mode shift	**Moderate beneficial ✓✓** Provides an improved, attractive service to the city centre, with increased frequency compared to existing.	**Moderate beneficial ✓✓** Provides new public transport interchange option for those travelling to Bristol from south-east. If orbital public transport services are provided and serve the site, destination choices will be significantly increased, and assessment could increase to Significant Beneficial.	
Increase orbital connectivity to improve access around south-east Bristol, reduce delays on the existing network and minimise inappropriate movements on local roads	**Neutral -** Limited impact on orbital connectivity.	**Neutral -** Could be served by orbital services. Unlikely to have an impact on minimising inappropriate movements on local roads.	
Improve journey time reliability for public transport along the corridor and orbital movements	**Neutral -** Limited impact on journey time as the route itself is not being improved significantly. However, the increased frequency of buses means waiting times will be reduced.	**Neutral -** Removes car trips from the A37 corridor and mitigates impact of traffic growth.	

Table 7-6 Contribution to JLTP objectives

Assessment Criteria	Option J: A37 Enhanced Bus Service	Option K1: Whitchurch P&R Site 4	Option K2: Whitchurch P&R Site 5
Reduce carbon emissions	**Slight beneficial ✓** Slight benefits due to opportunity to mode shift to public transport and providing sustainable travel options for SDL.	**Slight beneficial ✓** New P&R option to help reduce carbon emissions by reducing car use through increasing mode shift to bus.	
Support economic growth	**Moderate beneficial ✓✓** Supports economic growth as more frequent services facilitates movement and provides sustainable travel choice between the SDL and city centre.	**Slight beneficial ✓** New P&R option to enable reduction in congestion which supports economic growth. Also, may be a reduction in travel costs.	
Contribute to better health, safety and security	**Slight beneficial ✓** A reduced waiting time improves feelings of safety and security at the bus stop.	**Neutral -**	
Promote accessibility	**Moderate beneficial ✓✓** Slight improvement to connectivity for existing non-car users. Significant benefit to accessibility of SDL.	**Slight beneficial ✓** Small reduction in travel costs due to reduction of time spent in congestion in car promotes inclusivity and improves accessibility.	
Improve quality of life and a healthy natural environment	**Slight beneficial ✓** The bus services will use the existing A37 infrastructure so will not have a big impact on the natural environment. Impact on quality of life will be small.	**Neutral -** New P&R option to help enable mode shift to sustainable travel.	

7.3.3. Economic case

7.3.3.1. Modelled impacts

A mode-choice model has been developed and used by Atkins to estimate the number of bus boarders and P&R users in the AM and PM peak on the A37 corridor and to calculate public transport benefits. The model allocates a particular catchment to bus services, with demand informed by 2011 travel to work data with uplifts to represent planned growth in the corridor.

Without any new infrastructure and improvement in journey time, the improvements compared to existing services (frequency improvements) results in a modest increase in bus patronage (c.40 trips, 2%).

The new P&R facility represents a new mode choice for trips on the corridor and is forecast to attract c.80 users in the AM peak period.

Decongestion benefits resulting from mode shift to bus and P&R have been modelled (using the GBATS-4 strategic highway model) through matrix reductions based on the outputs of the mode-choice model, reducing the number of in-scope trips on the corridor.

Two different future growth scenarios have been assessed:

- **Spatially Neutral Growth (SN)**: This scenario represents a level of growth based on TEMPRO but an even uplift across the entire study area is assumed; and
- **JSP Growth (JSP):** This second scenario accounts for JSP developments, specifically including those forecast at Whitchurch (1,600 dwellings), Brislington (750 dwellings) and Keynsham (1400 dwellings and 14 Ha of employment land). It should be noted that these dwellings are to some extent captured in the SN scenario but are spread across the conurbation; this test assumes the specific SDLs.

Network statistics are provided in Table 7-7. Appendix 6:2 outlines the modelling approach and associated assumptions in further detail.

Table 7-7 Modelled impacts (network statistics)

	Option J: A37 Enhanced Bus Service [SN]		Option J: A37 Enhanced Bus Service [JSP]	
Input Data / Key Performance Indicators	**AM Peak Hr**	**PM Peak Hr**	**AM Peak Hr**	**PM Peak Hr**
Total vehicle travelled time *(pcu hrs)*	*-21* *(-0.0%)*	*40* *(+0.1%)*	*-7* *(-0.0%)*	*-38* *(-0.1%)*
Total vehicle travelled distance *(pcu kms)*	*160* *(+0.0%)*	*290* *(+0.0%)*	*420* *(+0.0%)*	*480* *(+0.0%)*

7.3.3.2. Headline economic appraisal results

The key economic impacts for the scheme options are presented in

Table 7-8. It should be noted that the benefits presented are limited to transport benefits and the wider economic impacts are not included, which would improve value for money. Also, non-monetised impacts should be considered when assessing value for money, rather than limiting the consideration to monetised benefits.

The cost and benefit elements presented are comprised of the following elements:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)
• Preparatory (including detailed design and survey work); • Construction (excluding utility diversions); • Site Supervision; • Land; • Risk Budget; • Operating costs/revenues • Maintenance and renewal costs; and • Inflation.	• Highway decongestion benefits; • Public transport benefits • Economic Efficiency; • Greenhouse Gases; and • Indirect Tax Revenues.

Cost elements are discussed in the Financial Case in section 7.3.4. The following economic assessment includes P&R Option K1, and a new 6BHR service in addition to the existing 2BPH 376 as the basis for the assessment. Further improvements can be considered in the value for money assessment through considering non-monetised benefits and the sensitivity tests presented in Table 7-9.

Table 7-8 Headline scheme benefits summary PV, 2010 prices £million (A37 Public Transport) [65]

Assessment Criteria	Option J – Enhanced A37 bus service [SN] (inc. P&R Option K1)	Option J – Enhanced A37 bus service [JSP] (inc. P&R Option K1)
Present Value of Benefits (PVB)	£12.9.	£13.2
Present Value of Costs (PVC)	£26.7	£26.8
Net Present Value (NPV)	-£13.9	-£13.6
BCR	**0.5**	**0.5**
Value for Money category considering only monetised benefits[66]	**Poor**	**Poor**

The scheme delivers a poor BCR, predominantly due to the significant deficit in operating costs compared to revenue generated to run the services, which account for £21.2m (79%) of the PVC. **Were a revenue neutral service achieved, the costs of delivering the P&R site and associated infrastructure result in a BCR of approximately 2.3 (High),** and therefore subsequent work to optimise the scheme should focus on bus service optimisation on the corridor as a whole – particularly given potential changes to existing service routings/operations once the MetroBus M1 service is operational and the impact on public transport use and service synergy opportunities as a result of it is known.

In the JSP scenario, bus and P&R patronage are forecast to be slightly higher and hence the scheme assessments are slightly improved. Inclusion of the Whitchurch SDL does not lead to a significant increase in forecast bus patronage – a result of the moderate size of the SDL development (1600 houses in plan period), and relatively long service journey time.

In addition to the analysis of the main option, approaches to enhance the performance of the scheme have been identified. The value for money for Option J could be improved by:

- **Reducing corridor service frequency to 4 buses per hour –** as presented in Table 7-4, a 4BPH service, with the existing 376 providing two of those services, results in a significantly reduced peak vehicle requirement (3 additional buses). Were the city centre loop excluded, this further reduces to 2 additional vehicles.
- **Exclusion of city-centre loop:** Including a city centre loop, following the model of the Brislington P&R service, adds a significant amount of time to the return journey, and in turn increases the peak-vehicle demand to run the service. Removing the city centre loop, with services terminating at Temple Meads / Redcliffe Way would reduce the return journey time to under an hour and reduce the peak vehicle requirement to 6 (from 8) for a 6BPH service. However, it is noted that existing commercial services include the loop, and it is therefore likely there is a commercial case for doing so. Further modelling is required to confirm the relative cost/benefit impact of this option.
- **Optimisation of corridor-wide service provision, taking account of MetroBus M1 service** – introduction of the M1 service may provide opportunity to re-define and optimise services across the corridor, within which a commercially viable solution to serve the P&R and Whitchurch SDL may be identified.
- **Consideration of package in combination;** the orbital highway links discussed in Chapter 6 were shown to reduce congestion and delay on the A37 in Whitchurch (where the in no available space for bus priority measures). This will reduce delay to bus journeys and provide a faster, more reliable journey time into the city centre, which may help to attract more patronage.

[65] Modelling outputs give an order of magnitude and can be used for comparative purposes. However, absolute numbers and BCRs should not be used for planning purposes or be quoted due to limitations in the robustness of the PT model to predict passenger numbers in detail, due to the level of model noise in GBATS and the early stage of development of the costs.
[66] VfM categories = Very High ≥4; High 2-4; Medium 1.5-2; Low – 1-1.5; Poor 0-1; Very Poor ≤0.

The potential impact of reducing the frequency to 4BPH has been considered at a high level and the outputs of this sensitivity test is presented in Table 7-9. It should be noted that this scenario has not been fully modelled and is an assumptions-based test to give an indication only.

Table 7-9 Scheme benefits summary – indicative sensitivity test

Sensitivity test	**4 Bus per Hour Service** **Existing 2BPH 376 service supplemented with additional 2BPH**	
Assumptions applied	Peak additional vehicle requirement reduced to 3, with 2 buses per hour provided by existing 376 service. Revenue assumed to be reduced by 20% from 8BPH on corridor forecasts[67]. PVB reduced by 25% to reflect reduced PT patronage/mode shift	
	Option J – Enhanced A37 bus service **[SN]** (inc. P&R Option K1)	**Option J – Enhanced A37 bus service** **[JSP]** (inc. P&R Option K1)
BCR	**0.9**	**1.0**
Value for Money category considering only monetised benefits[68]	**Poor**	**Low**
Operational Costs vs Revenue	**Subsidy is likely required** Forecast change in revenue is significantly less than forecast change in cost **(c.£265k deficit)**	**Subsidy is likely required** Forecast change in revenue is less than forecast change in cost **(c.£225k deficit)**

The sensitivity tests show there is some potential to improve the BCR and VfM assessment for this scheme options in later stages of scheme development, where the feasibility to optimise the bus service operation can be assessed in more detail. The significant deficit in operating costs compared to revenue generated remain the key issue resulting in a low BCR, although it is forecast to be of a similar scale to that paid for similar services in the past whilst they become established, and contributions could be sought from various funding streams.

Excluding the city centre loop would further reduce operating costs by approximately £135k/year although is likely to also reduce revenue and scheme benefits.

The BCR and monetised benefits should be considered alongside non-monetised benefits to arrive at overall VFM categorisation, particularly in this case the Strategic Case impacts from delivering a frequent public transport service on the corridor, directly serving the SDL and supporting the sustainable growth of the city.

In addition, related policy measures, additional traffic restraint in central Bristol (e.g. Clean Air Zone), and potential orbital links and public transport services at Whitchurch may increase demand (and VfM assessment) in the future. This assessment also considers only planned growth in the JSP period, which includes 1600 houses in the Whitchurch SDL. There is potential for a further 900 units at this location beyond the JSP plan period which would contribute to increased patronage and improved VfM assessments.

7.3.3.3. Further benefits to be considered

In subsequent stages of scheme development, further sources of scheme benefits can be assessed. The monetised elements will likely increase the PVB to a degree, and therefore the BCR and VfM.

[67] 50% frequency x elasticity of 0.4 for bus service miles = 20% revenue reduction
[68] VfM categories = Very High ≥4; High 2-4; Medium 1.5-2; Low – 1-1.5; Poor 0-1; Very Poor ≤0.

Table 7-10 Further scheme benefits to be assessed in subsequent stages

Scheme benefits source	Monetised/Non-monetised	Likely scale of impact
Land-value uplift	Monetised	Low
Construction impacts	Monetised	Low
Safety	Monetised	Low
Wider economic impacts	Monetised	Low
Reliability	Monetised	Low

7.3.3.4. Social impacts

Social impacts for each scheme option are assessed qualitatively in Table 7-11 using the social impacts headings in WebTAG Transport Appraisal Process Guidance[69]. A seven-point qualitative scale has been used with the following categories:

xxx	large adverse	**-**	neutral	✓	slight beneficial
xx	moderate adverse			✓✓	moderate beneficial
x	slight adverse			✓✓✓	large beneficial.

Table 7-11 Social impacts for A37 public transport options

Assessment Criteria	Option J: A37 Enhanced Bus Service	Option K1: Hicks Gate P&R Site 4	Option K2: Hicks Gate P&R Site 5
Non-business users	**Slight beneficial ✓** Limited impact on journey time reliability – but improvement seen in reduced waiting time at bus stops due to frequency increase.	**Moderate beneficial ✓✓** Will offer a regular service, providing a good connection to Bristol. Comparable overall journey to car.	
Physical activity	**Neutral -** No new cycling or walking infrastructure expected as part of this option.	**Neutral -** No new cycling or walking infrastructure expected as part of this option.	
Journey quality	**Slight beneficial ✓** Small beneficial impact as the route would provide a 'turn up and go' service frequency.	**Moderate beneficial ✓✓** A new option for car drivers from the south, will offer a good quality service into Bristol.	
Accidents	**Neutral -** Limited impact on the number of collisions.	**Neutral -** Unlikely to have an impact on the number of severity of collisions.	
Security	**Neutral -** Not likely to result in a change of crime incidence or fear of crime.	**Neutral -** Unlikely to be a change of crime incidence or fear of crime.	
Access to services	**Neutral -** This is not a new route, hence is not significantly improving accessibility.	**Moderate beneficial ✓✓** P&R will provide improve accessibility to Bristol from the south and also Whitchurch and the SDL.	
Affordability	**Neutral -** Unlikely to be a change in cost of travelling	**Slight beneficial ✓** Provides an alternative option for car drivers, which	

[69] Transport Analysis Guidance: The Transport Appraisal Process, 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/431185/webtag-tag-transport-appraisal-process.pdf

Assessment Criteria	Option J: A37 Enhanced Bus Service	Option K1: Hicks Gate P&R Site 4	Option K2: Hicks Gate P&R Site 5
	to users.	could provide cost savings compared to onward car-travel and parking costs.	
Severance	**Neutral -** Unlikely to have an impact on severance.	**Neutral -** Unlikely to have a large impact on severance.	
Option and non-use values	**Moderate beneficial ✓✓** Frequent bus service serving the SDL and Whitchurch would provide a valuable option for local residents.	**Slight beneficial ✓** Will offer new public transport provision for the corridor.	

7.3.3.5. Environmental impacts

The options have been assessed against environmental impacts from WebTAG:

- Noise
- Air Quality
- Landscape
- Townscape
- Water Environment
- Heritage.

The level of assessment is proportionate to the early stage of scheme development. WebTAG worksheets have been used, except for Noise and Air Quality where proformas consistent with WebTAG principles have been utilised. This is because WebTAG Noise and Air Quality worksheets require Noise and Air Quality modelling which is not appropriate to OAR stage. Level 1 Flood Risk assessments have also been produced to ensure the environmental assessment provides a comprehensive analysis of the risks, commensurate to the level of scheme design.

The full environmental assessments are provided in Appendix 7:2.

Table 7-12 summarises the outputs of the environmental assessment for the Whitchurch P&R sites. The A37 enhanced bus service does not include any new infrastructure so has not been subject to environmental assessments. The focus of the table is to compare scheme options against each other; where there is no discernible difference of the impacts on the environmental factors, the commentary has just been provided once.

Proposed mitigation for the P&R sites is also outlined in Table 7-12. A key design principle for mitigation has been to seek to minimise environmental impacts through careful selection of site locations and consideration of the location of new features within the proposals, particularly in urban areas where opportunity for mitigation measures will be restricted. Note that environmental mitigation is not included in the designs due to the early stage of scheme development, this should be planned for the next stages of scheme development.

Table 7-12 Environmental impacts (Whitchurch P&R Options)

Assessment Criteria	Option K1: Whitchurch Site 4	Option K2: Whitchurch Site 5
Noise	**Neutral -** No noise important areas and 76 noise sensitive receptors within 200m of the proposed park & ride site. There may be slight noise increase at these receptors due to the park & ride, but the impact is likely to be small.	**Neutral -** One noise important area and 186 noise sensitive receptors within 200m of the proposed park & ride site. There may be slight noise increase at these receptors due to the park & ride, but the impact is likely to be small.
Mitigation	*To be identified in next stage of work.*	*To be identified in next stage of work.*
Air Quality	There are no AQMAs or designated ecological sites within 200m of the option. There are sensitive properties within 200m of the site (75 for Option K1, 185 for Option K2) which could be affected by a deterioration in air quality arising from additional traffic emissions. The potential reduction of traffic on the roads within 1km of the A37 bus route which would serve the P&R could positively affect up to 23,800 sensitive properties. Overall, there may be neutral impact on NO2 and PM10 depending on the magnitude of changes in traffic flow.	
Mitigation	*To be identified in next stage of work.*	
Landscape	**Slight adverse x** Minor impact on Greenbelt. Some alterations to the pattern of the landscape and loss of hedgerows and trees. Small negative impact on the tranquillity of the area due to the Park & Ride.	
Mitigation	Careful design and siting of new features. Mitigation planting for screening and recreating severed or lost linear elements.	
Townscape	**Neutral – slight adverse x** Some visual disturbance on properties and cultural features south east of Whitchurch.	
Mitigation	Careful design of layout & implementation of planting to screen the site from nearby urban elements.	
Biodiversity	**Neutral -** Unlikely to be an impact on biodiversity. Unlikely to impact on Special Areas of Conservation or SNCIs. May result in loss of hedgerows and agricultural habitats but this is unlikely to have a significant impact.	
Mitigation	*N/A*	
Water Environment	**Significant adverse xx** The site is in Flood Zone 1. Mapping indicates there are no overland flow routes or watercourses/ditches, but there are floodplains shown approximately 300m north of the site. There is the potential for increased runoff and discharge of pollutants.	**Highly significant adverse xxx** The site is in Flood Zone 1. Mapping indicates the site is crossed by a small watercourse/ditch, which has an associated floodplain. Therefore, there is a potential for loss of floodplain storage. New culverts or watercourse diversions are likely to be required. There is the potential for increased runoff and discharge of pollutants.
Mitigation	Mitigation measures such as SuDS and potentially flood compensatory storage would be required as part of the scheme – these would need to be tested as part of the Flood Risk Assessment and Drainage Strategy.	
Heritage	**Slight adverse x** There is potential for adverse impacts on the setting of designated heritage assets. The assets are likely to have visibility to and from the proposed scheme.	
Mitigation	Sensitive design and mitigation screening to limit impact on heritage assets.	

7.3.3.6. Summary VfM assessment

The schemes are currently at an early stage of development and it is anticipated that the following considerations may influence the case for progressing these schemes:

- A public transport service routing via the A37 offers the quickest journey times between Whitchurch (including potential P&R and SDL sites) and Bristol city centre.
- There is little opportunity for further bus priority measures on the A37 corridor. Delays on the approach to Airport Road and New Fosseway Road could be avoided with a bus lane, generating journey time saving of approximately 1 minute - these measures have not been considered at this stage as the journey time savings are unlikely to generate significant benefit.
- A more frequent bus service on the A37 to Whitchurch has limited benefit to existing users, as the remaining corridor further inbound is already well served by frequent services. However, the Whitchurch SDL would experience a significant benefit from a more frequent bus service directly serving the SDL, which facilitates sustainable travel choices from the SDL. Serving the P&R with passing bus service (rather than introducing additional specific services) reduces the number of buses required and operational costs.
- The modest markets and no improvement to journey times over existing generate only modest patronage forecasts, and therefore modest forecast revenue. Compared to the high operating costs of providing a new 6BPH limited stop service (in addition to the existing 2BPH 376), the service operation generates a very high operating cost deficit and is not sustainable either commercially or with the level of subsidy required.
- With a new 6BPH service (8BPH in total on corridor) the operational deficit accounts for 79% of PVC, and has a very significant impact on the BCR, resulting in it being poor (0.5/0.5 (SN/JSP).
- Initial considerations of options to optimise the service and improve the commercial viability and case (reducing the proposed frequency on the corridor to 4BPH and incorporating the existing 376 to provide 2 of the 4BPH) show that the operating costs can be reduced although more detailed optimisation and full demand forecasting of different frequencies is required to confirm service viability.

  There is potential through subsequent stages of scheme development to increase the VfM assessment of the schemes. This is dependent on the findings of more detailed assessments confirming potential opportunities identified are realised. The opportunities identified for further assessment include;

  Exclusion of city-centre loop to reduce return journey time and peak vehicle requirement
  Optimisation of corridor-wide service provision, taking account of MetroBus M1 service
  Consideration of package in combination with improved A37 journey times due to orbital highway links.

  Consideration of non-monetised benefits will also improve the VfM assessment, particularly in this case the Strategic Case impacts from delivering a frequent public transport service on the corridor, directly serving the SDL and supporting the sustainable growth of the city
- Options to serve the P&R sites with multiple services (such as orbital services, MetroBus M1 extension) offering a range of destination choices have not been assessed and could increase the attractiveness and therefore patronage from the sites.

7.3.4. Financial case

7.3.4.1. Capital costs

Park & Ride scheme options have been costed based on 2D concept designs of P&R access junction designs, with a 'per m2' allowance made for the P&R site footprint. Allowance has been made for passenger facilities including a small waiting area with toilets. This approach is a proportionate hybrid between a high-level costing and a full Bill of Quantities (BoQ).

The rates used have been derived from competitive market rates that we have from similar projects, both pre- and post-contract. A percentage of the total scheme costs have been used for items such as fencing, landscaping and utility diversions, which have been calculated using an average percentage found on similar projects.

Percentage allowances have been included as follows:

Preparation (design, business case) – 10% of construction cost;
Site supervision – 6% of construction cost;
Risk budget – 40% of construction cost; and
Environmental mitigation (part of the construction cost) – 10% of works cost.

Land costs are based on a unit rate of £40k/per hectare for land with development potential. Note there have been no discussions with landowners at this stage.

To derive outturn costs, the schemes costs have been profiled as follows:

Preparation costs have been evenly split over the preparation period;
Construction costs have been evenly split over the construction period; and
Land costs are assumed to be incurred the year before construction commences.

Scheme opening years are generally based on previous work by the Councils, with adjustment if the opening year has needed to be extended to allow for preparation and design. Table 7-13 presents capital costs for the A37 corridor, both in 2017 prices and outturn (with inflation).

Note that Option J: Enhanced bus service on the A37 is a service improvement only with no new infrastructure. This means there are operational costs but no capital cost. The P&R site options are costed on the basis of providing the necessary access and land for a maximum 500 space car park, although initially only construction of 200 spaces is costed as the full 500 space car park is not yet required according to demand forecasts.

Table 7-13 Capital Costs

Cost Item	Option J: A37 Enhanced Bus Service	Option K1: Whitchurch P&R Site 4	Option K2: Whitchurch P&R Site 5
Preparatory (including detailed design and survey work)	N/A	£0.6m	£0.6m
Construction (excluding utility diversions)	N/A	£3.1m	£3.2m
Site Supervision	N/A	£0.2m	£0.2m
Land	N/A	£0.07m	£0.07m
Risk Budget	N/A	£1.2m	£1.3m
Total – 2017 prices	**N/A**	**£5.2m**	**£5.2m**
Inflation	N/A	£0.5m	£0.5m
Total – Outturn prices	**N/A**	**£5.7m**	**£5.7m**

7.3.5. Management and commercial case

7.3.5.1. Programme & phasing

Potential scheme opening years have been referenced from work undertaken by the unitary authorities in relation to the proposed housing trajectories in the JSP, and potential transport mitigation trigger points to help support the proposed development. Appropriate construction and design periods have been specified ahead of opening year and including a period back to present day for preparatory work on developing a business case and gaining funding, planning permission and land purchase.

The assumed scheme programme is shown in Table 7-14, and is the basis for the economic assessments and profiling for outturn costs.

Table 7-14 A37 corridor options programme

	Option J: A37 Enhanced Bus Service	Option K1: Whitchurch P&R Site 4	Option K2: Whitchurch P&R Site 5
2018			
2019			
2020	2020		
2021		2021	2021
2022			
2023			
2024			
2025			

Preparatory (Business Case & Funding)		Preparatory (Design)	
Construction		Opening Year	2018

Bus service improvements to the A37 corridor require no infrastructure and an opening year of 2020 has been assumed at this stage. However, it will be beneficial to wait until the P&R is constructed and Whitchurch SDL begins to be occupied so that there is an emerging market for the service to maximise commercial viability.

7.3.5.2. Deliverability and acceptability

Table 7-15 provides a high-level categorisation of the degree of delivery challenges faced by each scheme option (very challenging; moderate challenges; minor challenges; very limited challenges).Key deliverability issues are discussed in Section 7.2.4, and Table 7-2.

Public or stakeholder consultation has not yet been undertaken with regard to these scheme options, and therefore the following assessments are based upon likely issues expected to be encountered and known public opinion to date. Therefore Table 7-15 also provides a high-level categorisation of public acceptability for each scheme option (not publicly acceptable; likely to encounter strong issues; some potential issues, but could be acceptable overall; acceptable to most but with some minor issues; acceptable to most with very limited or no issues).

Table 7-15 Deliverability and acceptability assessment – A37 schemes

	Option J: A37 Enhanced Bus Service	Option K1: Whitchurch P&R Site 4	Option K2: Whitchurch P&R Site 5
Deliverability assessment	**Very challenging** in terms of demonstrating a commercially viable service. Very limited delivery challenges otherwise.	**Minor challenges** due to water mitigation required.	**Moderate challenges** due to water mitigation required, also potential for the site to be too small for the potential maximum 500 space capacity, dependent on the final alignment of the West of A37 link road.
Acceptability assessment	**Acceptable to most with very limited or no issues**.	**Some issues but could be acceptable overall**; this site is close to residential areas of south Whitchurch, so likely to be some local issues regarding site placement.	**Some issues but could be acceptable overall**; this site is close to residential areas of south Whitchurch, so likely to be some local issues regarding site placement. Site is close to a cemetery so could encounter opposition from disturbing the tranquillity. There are some nearby rural houses.

7.3.5.3. Key risks

An initial risk register has been developed. Table 7-16 lists the key risks identified to-date; these risks generally relate to the schemes being at an early stage of development. It is important that these risks are factored into plans for the next stage.

Table 7-16 Key risks – A37 corridor schemes

Key Risk	Option J	Option K1	Option K2
Significant subsidy forecast to be required depending on outcome of the mode choice modelling – risk of lower (or higher) patronage in reality as this is based on a forecast. Service optimisation may not identify a commercially viable service.	✓	✓	✓
Yet to engage with landowners of potential P&R sites – potential objections	-	✓	✓
Development in Green Belt	-	✓	✓
Schemes are at early level of development (e.g. no ecological surveys, no noise or air quality modelling) and no environmental design	-	✓	✓
Statutory undertakers – no C2 searches carried out to-date	-	✓	✓
If West of A37 Option 1 is delivered, this site may not have sufficient area to achieve 500 space capacity	-	-	✓
Whitchurch SDL masterplan yet to be confirmed. Potential opportunities to consider alternative P&R sites within the SDL masterplan, conditional that the transport benefits are not compromised.	-	✓	✓

7.3.5.4. Commercial

Table 7-17Table 8-14 sets out commercial considerations in relation to delivery organisation and construction procurement.

Table 7-17 Commercial assessment – A37 corridor schemes

	Option J: A37 Enhanced Bus Service	Option K1: Whitchurch P&R Site 4	Option K2: Whitchurch P&R Site 5
Delivery Agency	Local Authorities (Bath & North-East Somerset, Bristol City Council). As a cross-boundary scheme, this will joint-working by the local authorities. This model is already proven.	Local Authorities (Bath & North East Somerset, Bristol City Council). As a cross-boundary scheme, this will joint-working by the local authorities. This model is already proven.	
Construction procurement	N/A	Project could be delivered through a range of procurement models. No significant commercial barriers identified. Consider relationship with Whitchurch SDL development	
Public transport procurement	Bus service options could be delivered through a range of procurement models. For delivery of services, options could include Quality Partnership Scheme or franchising. Service is not forecast to be commercially viable with a significant (potentially unsustainable) subsidy required for the service to operate.	Commercial procurement models will be required to deliver different elements of the project Local authorities and bus operators have experience of successfully collaborating to deliver current P&R services	

7.4. Conclusions

Table 7-18Table 8-15 summarises performance of the A37 schemes against the DfT's five case model.

Table 7-18 Summary performance against the five cases

Case	Criteria	Option J: A37 Enhanced Bus Service	Option K1: Whitchurch P&R Site 4	Option K2: Whitchurch P&R Site 5
Strategic	Corridor Objectives	**Moderate alignment** –provides a range of journey mode options on the corridor. Also mitigates Whitchurch SDL travel demand, although forecast patronage is modest.	**Moderate alignment** - provides a new journey mode option on the corridor, and mitigating demand growth.	
	JLTP Objectives	**Moderate alignment** – supports economic growth and promotes accessibility by providing sustainable travel options for the Whitchurch SDL.	**Slight alignment** – supports economic growth and contributes to reducing carbon emissions through enabling mode shift on the corridor.	
Economic	Economic Impacts	• High cost of providing a new 6 bus per hour service dwarfs the forecast revenue and scheme benefits, resulting in a poor BCR. If operating costs are excluded, the scheme generates a high BCR c.2.3. • Opportunities to optimise the commercial viability of the service could result in the VfM assessment being raised to **Medium** when considering only monetised benefits, subject to more detailed appraisal of service operation on the corridor.		
	Social Impacts	**Neutral/Slight beneficial** – with small improvements to journey quality and option values	**Moderate/Slight beneficial** – with improvements for non-business travel options, to journey quality and access to services.	
	Environmental Impacts	• Scheme does not include any new infrastructure so has not been subject to environmental assessments	Without mitigation, assessed to have slight/neutral impacts, with: • significant water environment impact, due to potential for increased runoff and discharge of pollutants.	Without mitigation, assessed to have slight/neutral impacts, with: • highly significant water environment impact, due to being crossed by a small watercourse/ditch, and associated floodplain and therefore a potential for loss of floodplain storage.
Financial	Capital Costs	n/a	• 2017 prices: **£5.2m** • Outturn: **£5.7m**	• 2017 prices: **£5.2m** • Outturn: **£5.7m**
	Operating Costs	<u>New 6BPH service in additional to existing 2BPH 376 service [8BPH total on corridor]:</u> Opex: **£1.3m over existing services** Revenue: **£0.2m** over existing services **Service is not commercially viable – significant unsustainable subsidy is likely required (c.£1.0m)**	<u>Indicative Sensitivity test: 4BPH on corridor, incorporating existing 376 (2BPH):</u> Opex: **£435k over existing services** Revenue: Assumed to reduce compared to 8BPH due to frequency reduction – actual service provision not modelled. **Service is not commercially viable – significant subsidy is likely required (c.£260k [SN], c.£225k [JSP])**	
Commercial		Likely local authority scheme promoter Public transport service is not forecast to be commercially viable and represents a significant viability risk to the scheme, subject to further service optimisation.	Likely local authority scheme promoter	
Management	Risks	Service optimisation may not identify a commercially viable service.	Land assembly Development in Green Belt	Land assembly Development in Green Belt Water mitigation requirements
	Deliverability	**Very challenging** in terms of demonstrating a commercially viable service. Very limited delivery challenges otherwise.	**Minor challenges** due to water mitigation required.	**Moderate challenges** due to water mitigation required, also potential for the site to be too small for the potential maximum 500 space capacity, dependent on the final alignment of the West of A37 link road.
	Acceptability	**Acceptable to most with very limited or no issues**	**Some issues but could be acceptable overall**; this site is close to residential areas of south Whitchurch, so likely to be some local issues regarding site placement.	**Some issues but could be acceptable overall**; this site is close to residential areas of south Whitchurch, so likely to be some local issues regarding site placement. Site is close to a cemetery so could encounter opposition from disturbing the tranquillity. There are some nearby rural houses.

8. Orbital Multi-Modal Corridor

8.1. Introduction

Through the option sifting and packaging process set out in Chapter 5, three public transport corridors have been selected for further assessment – A4, A37 and orbital.

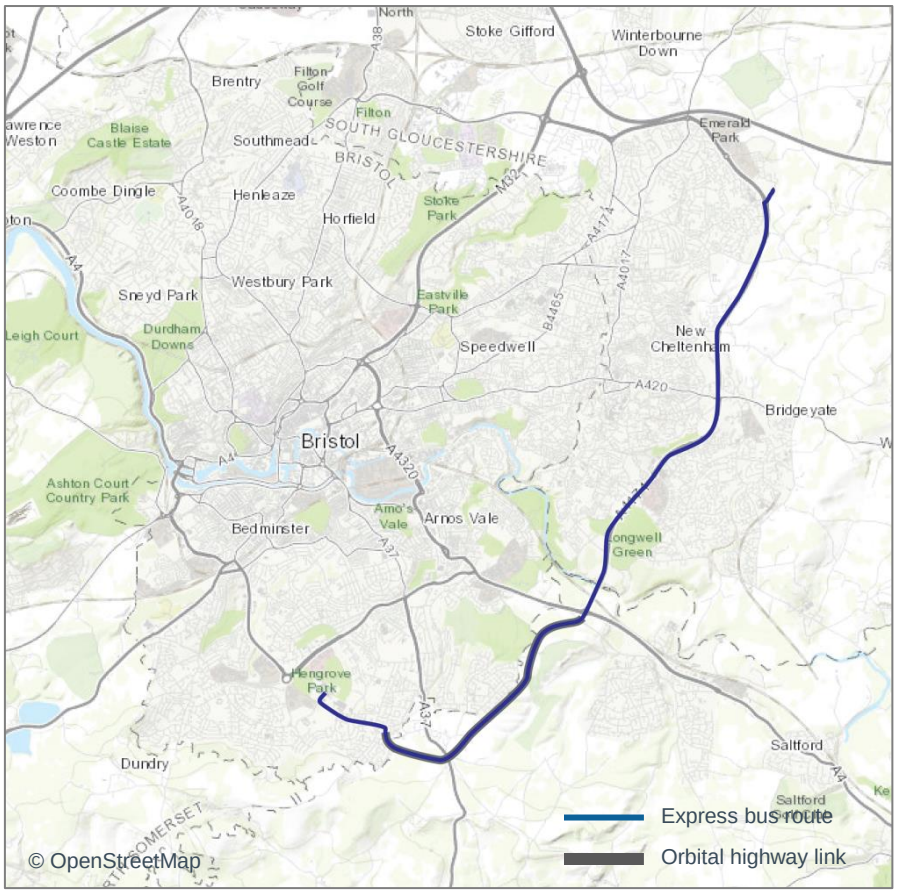
The orbital corridor is dependent on construction of the orbital highway link, which is presented independently in Chapter 6. Hence, this chapter sets out the development and assessment of public transport scheme options as part of an orbital corridor multi-modal package in conjunction with the combined highway scheme (comprising options A/B + C/D + E presented in Chapter 6.

The orbital public transport corridor comprises of a high quality express bus service from Hengrove to Emersons Green, linking into MetroBus routes under construction at either end.

Note: During the option siting process, the orbital corridor comprised of only the Whitchurch to Emersons Green section. However, extending the NFH service to Whitchurch, via the West of A37 Link, has been considered as an option for the A37 corridor. Initial modelling assessment indicated that the NFH- extension performed well, however not as well as a direct bus service following the A37. Therefore, the NFH extension to the orbital route has been grouped with the wider public transport orbital scheme, providing a complete orbital corridor which is shown on Figure 8-1. The final configuration of this service will relate to potential services on the A37 corridor and therefore development of both schemes will need to be iterative and linked as the schemes progress.

Option L– Orbital multi-modal corridor, Hengrove to Emersons Green via Whitchurch.

Figure 8-1 Overview of orbital multi-modal corridor scheme for further assessment



The key stages of option development and assessment comprise:

Option Development	Option Assessment
• Service routing and specification • Engineering design development and evaluation	• *Strategic* Case (objectives fit) • *Economic* Case (economic benefits and costs, social, environmental) • *Financial* Case (capital and operating costs) • *Commercial and Management* Cases (risks, deliverability, acceptability)

8.2. Option development

Service estimates and concept designs and have been developed to an appropriate level to provide understanding of potential engineering deliverability, operational viability, environmental, cost and other issues. The assessments of the scheme option are in accordance with the principles and requirements of WebTAG for early stage development and reflect the National Planning Policy Framework (NPPF) tests of soundness where relevant.

8.2.1. Service routing and specification

Routing of public transport services has been defined based on previous work in the JTS and the previous Strategic Delivery Assessment and is shown on Figure 8-1.

The Orbital service is a route between the NFH terminus at Hengrove Park to Lyde Green P&R at Emersons Green, via the proposed orbital highway scheme described in Chapter 6, and the existing A4174 Ring Road.

The Orbital service assessed is dependent on the delivery of the orbital highway scheme as there are no suitable alternative routes between Hengrove and the A4. Alternative routing patterns for this section on the existing network were rejected in the previous sifting process due to the indirect routing and poor journey time.

Frequency

Initial assessments were made based the MetroBus service standards aspiration to provide a 'turn up and go' frequency (min 6 buses per hour). However, the forecast demand on this corridor was not sufficient to support this level of services, and alternative service standards have been assessed to maximise the commercial viability of the service. The assessment presented are based on the minimum frequency to still provide a viable transport option for users – 2 buses per hour. Therefore, the following frequencies have been assumed:

Monday - Sunday: 2BPH (buses per hour) between 07:00 and 23:00

This service specification falls below the MetroBus standard, and instead offers an express bus service.

Stopping pattern

A stopping pattern consistent with the MetroBus schemes currently being delivered in Bristol has been assumed, and therefore the stopping pattern is much less frequent than conventional bus services.

The orbital service follows the existing A4174 Ring Road and therefore there are limited locations where a stop would be accessible and beneficial. For the purposes of this assessment, it has been assumed a stop is provided at each of the existing junctions on the A4174 as well at Whitchurch, Whitchurch Lane, and the terminus at Hengrove Park. The orbital service would serve the P&Rs at Whitchurch, Hicks Gate and Lyde Green, providing alternative designation choices from these sites, although these trips have not been considered in these assessments. It is assumed that the orbital and NFH services would be aligned to provide appropriate interchange.

8.2.2. Bus priority infrastructure

Assessment of the orbital service has focused on operational viability and therefore high-level design assumptions have been made regarding infrastructure design.

The service would run on the existing A4174 Ring Road from Emerson's Green to Hicks Gate. No concept design work has been undertaken on this section, but cost, environment and operational assessments have been undertaken based on an assumption of 200m bus lanes provided on approach to each junction on the ring road, with stops also provided at each junction.

The service is dependent on the potential A4-A37 Link road scheme orbital route being delivered for the Hicks Gate to Whitchurch section. Concept designs for the A4-A37 Link are provided in Appendix 6:1 and include 200m bus lanes on approach to the junctions, providing bus priority where congestion and queuing may occur.

The service is also dependent on the potential West of A37 Link being delivered from the A37 to Whitchurch Lane. Concept designs for this link are provided in Appendix 6:1. Bus lanes and bus priority are not included on this section as delay is not anticipated on the new link road, and the main reason for extending the orbital service route from Whitchurch to Hengrove is to provide interchange with the NFH route. On the final part of the route Whitchurch Lane to Hengrove Park, the orbital service would benefit from the priority measures being delivered for the NFH MetroBus scheme.

8.2.2.1. Concept design evaluation

An evaluation of the key considerations relating to the scheme option is provided in Table 8-1.

Table 8-1 Public transport infrastructure concept design evaluation

Key Consideration	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch
Construction issue	As for combined highway scheme in Chapter 6, plus: Feasibility of design assumption of bus lanes on approach to all junctions has not been assessed, although challenges exist. Bus lanes could be provided ahead of junctions with bus gates to achieve same level of priority if physical constraints exist at junctions.
Departures from Standard	As for combined highway scheme in Chapter 6, plus: None identified at this stage.
Key risks	As for combined highway scheme in Chapter 6, plus: Unknown ground conditions, utilities and feasibility.
Land ownership	As for combined highway scheme in Chapter 6, plus: Further land purchase required to provide bus lanes.

8.2.3. Public transport operational specification

Table 8-2 presents a summary and evaluation of the operational aspects of the public transport service, comprising the following items.

Journey time

The express bus journey time is based on existing travel times on the corridor, and estimated travel time for the new highway link. The journey time estimate takes account of assumptions for journey time savings due to assumed bus priority measures, with allowance for dwell time and layover.

Bus operating costs

Atkins' bespoke bus operating costing tool was used to guide the assessment of operating costs. The key inputs for the bus operating costing tool comprise:

Frequency – assumed to be 2 buses per hour.;
Round trip journey time – using the journey time assumptions outlined above;
Vehicle type – the assumption has been made that a high-quality single-decked vehicle will be used; and
Round trip distance – using the routing assumptions outlined above.

As a new route not replicated by any existing services, the costing exercise has assumed the Orbital express bus is a new stand-alone service and does not replace any existing services.

Revenue

A mode-choice model has been developed and used by Atkins to estimate bus patronage in the AM peak on the orbital corridor. This is informed by 2011 travel to work data, with uplifts to represent growth in the corridor (in line with TEMPRO forecasts, spatially neutral). To convert patronage from AM peak only to an annual figure, observed data from work with other authorities that shows an average indicative uplift has been utilised.

To derive annual revenues, assumptions were made about revenue per passenger (observed data is commercially sensitive for operators). This was based an assessment of published fares by First Bus, covering adult and child single, return, daily, weekly and monthly tickets, and an assumption regarding the level of concessionary reimbursement that the operator could expect to receive. The assumed yield per passenger is therefore assumed to be £1.75.

Table 8-2 presents the operational specification and costing for the public transport services.

Results indicate that revenue would be significantly less than operating costs on the orbital service, and hence a significant annual subsidy would be required for the service to operate. There is no opportunity to optimise the service through integration with other existing services, and at 2BPH, any further reduction in frequency would severely impact the attractiveness of the service to users. The likelihood of the service operating on a commercial basis is therefore considered to be very low.

Table 8-2 Orbital transport service performance[70]

	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch **Express bus service**
Route (brief description)	Hengrove to Emersons Green via Whitchurch (running on proposed new highway link, and the A4174 Ring Road)
Frequency	2BPH
Journey Time (With Scheme)	23- 24 minutes
JT Saving vs. Do-Minimum (%)	n/a
Peak Vehicle Requirement	2
Annual Operating Cost	£0.40m
Forecast Patronage on corridor (Trips in AM peak period)	645 (c.**75 over current services**)
Forecast Revenue	£0.13m (from new patronage)
Operational Costs vs Revenue	**Subsidy is likely required:** Forecast revenue is significantly lower than forecast costs (c.£0.26m)
Notes:	Corridor patronage represents total trips on corridor in both directions. Base patronage on corridor is trips between some zones served by existing services (e.g. Service 17).

[70] Modelling outputs give an order of magnitude and can be used for comparative purposes. However, absolute numbers and BCRs should not be used for planning purposes or be quoted due to limitations in the robustness of the PT model to predict passenger numbers in detail, due to the level of model noise in GBATS and the early stage of development of the costs. Numbers are not yet assured and may therefore change.

8.3. Option assessment

8.3.1. Overview

This section presents the following assessments against the DfT's five case model:

•Strategic Case	•Economic Case	○Financial Case	•Commercial and Management Cases
• Contribution to corridor objectives • Contribution to JLTP objectives	• Economic impacts • Social impacts • Environmental impacts • Summary VfM assessment	• Capital costs • Operating costs	• Commercial considerations • Risks • Deliverability • Acceptability

8.3.2. Strategic case

This section sets out performance of public transport schemes against package objectives and JLTP3 goals.

8.3.2.1. Contribution to package objectives

Table 8-3 outlines performance of the scheme option against package objectives - it performs strongly.

Table 8-3 Contribution to package objectives

Assessment Criteria	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch
Mitigate increased travel demand enabling planned growth (JSP and non-JSP)	**Moderate beneficial ✓✓** As for combined orbital highway scheme, plus: Option provides a dedicated and fast service between the East Fringe and Hengrove, Whitchurch and the Whitchurch SDL, providing and new link to cater for orbital movements. However, forecast demand is limited, though in the future as radial movements become more constrained there is potential for momentum to grow on Orbital movements. Would help mitigate the growth from the Whitchurch, Brislington and Keynsham SDLs.
Provide a range of convenient and attractive journey options for south-east Bristol to key destinations such as Bristol city centre and Keynsham, and for orbital movements, to enable mode shift	**Moderate beneficial ✓✓** As for combined orbital highway scheme, plus: Option provides a new direct and reliable travel choice for orbital trips, giving an option for car for trips that would previously have used the A37/A4174/A4 route or a local road alternative. Good onward journey links via the NFH service to the North Fringe, as well as connections to services on the A37 and A4.
Increase orbital connectivity to improve access around south-east Bristol, reduce delays on the existing network and minimise inappropriate movements on local roads	**Large beneficial ✓✓** As for combined orbital highway scheme, plus: Option would significantly improve the attraction of travelling orbitally by bus e.g. from Hengrove, Whitchurch, Keynsham, the East Fringe, and beyond. A mode shift to bus should reduce the number of vehicles on the route and reduce delays.
Improve journey time reliability for public transport along the corridor and orbital movements	**Moderate beneficial ✓✓** As for combined orbital highway scheme, plus: There is not currently an orbital bus service to compare, but it is likely this option would result in good journey time reliability for an orbital express bus service based on the embedded assumption of bus priority at each point of significant delay. This option should capture some of the trips that are currently being made via the A37/A4174/A4 route, and thus have a small impact on journey times on these roads.

8.3.2.2. Contribution to JLTP objectives

Table 8-4 outlines performance of options against JLTP3 objectives.

Table 8-4 Contribution to JLTP objectives

Assessment Criteria	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch
Reduce carbon emissions	**Slight beneficial ✓** As for combined orbital highway scheme, plus: Express bus service provides an alternative option to private car trips, which would have a positive impact on air quality.
Support economic growth	**Moderate beneficial ✓✓** As for combined orbital highway scheme, plus: Provides a new public transport link to employment and leisure areas, providing access (particularly those without cars). Good connectivity to NFH service provides an improved links to employment in the North Fringe.
Contribute to better health, safety and security	**Slight beneficial ✓** As for combined orbital highway scheme, plus: Limited impact
Promote accessibility	**Moderate beneficial ✓✓** As for combined orbital highway scheme, plus: This service would provide access for people who do not have access to a private car, helping to promote equality, although demand is forecast to be limited.
Improve quality of life and a healthy natural environment	**Slight adverse x** As for combined orbital highway scheme, plus: Offers a slight improvement to quality of life to residents as it is offering a new direct connection to currently indirectly served areas.

8.3.3. Economic case

8.3.3.1. Overview

This section sets out the following Option Assessment findings against the Economic Case, specifically:

Summary modelled impacts;
Headline economic appraisal results;
Social impacts;
Environmental impacts; and
Summary VfM statement.

8.3.3.2. Modelled impacts

A mode-choice model has been developed and used by Atkins to estimate the number of bus boarders in the AM and PM peak on the orbital corridor and to calculate public transport benefits through the journey time savings offered to passengers. The model allocates a particular catchment to bus services, with demand informed by 2011 travel to work data with uplifts to represent planned growth in the corridor.

Using models available the new route and service is forecast to generate an increase in bus patronage of c.75 trips (9%), on the corridor.

Decongestion benefits resulting from mode shift to the new service have been modelled (using the GBATS-4 strategic highway model) through matrix reductions based on the outputs of the mode-choice model, reducing the number of in-scope trips on the corridor.

Two different future growth scenarios have been assessed:

- **Spatially Neutral Growth**: This scenario represents a level of growth based on TEMPRO but an even uplift across the entire study area is assumed; and
- **JSP Growth:** This second scenario accounts for JSP developments, specifically including those forecast at Whitchurch (1,600 dwellings), Brislington (750 dwellings) and Keynsham (1400 dwellings and 14 Ha of employment land). It should be noted that these dwellings are to an extent captured in the SN scenario but are spread across the conurbation; this test assumes the specific SDLs.

Appendix 6:2 outlines the modelling approach and associated assumptions in further detail.

The change in overall network statistics calculated by the model, compared to a do-nothing scenario are provided in Table 8-5.

Table 8-5 Modelled impacts (network statistics)

	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch [SN]		**Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch [JSP]**	
Input Data / Key Performance Indicators	**AM Peak Hr**	**PM Peak Hr**	**AM Peak Hr**	**PM Peak Hr**
Total vehicle travelled time (pcu hrs)	*-290 (-0.5%)*	*-290 (-0.5%)*	*-70 (-0.1%)*	*-480 (-0.7%)*
Total vehicle travelled distance (pcu kms)	*-2460 (-0.1%)*	*-2940 (-0.1%)*	*7570 (+0.2%)*	*-2390 (-0.1%)*

8.3.3.3. Headline economic appraisal results

The key economic impacts for the scheme are presented in Table 8-6. It should be noted that the benefits presented are limited to transport benefits and the wider economic impacts are not included, which would improve the value for money assessment.

The cost and benefit elements presented are comprised of the following elements:

Present Value of Costs (PVC)	Present Value of Benefits (PVB)
• Preparatory (including detailed design and survey work); • Construction (excluding utility diversions); • Site Supervision; • Land; • Risk Budget; • Maintenance and renewal costs; and • Inflation.	• Highway decongestion benefits; • Public transport benefits; • Economic Efficiency; • Greenhouse Gases; and • Indirect Tax Revenues.

Cost elements are discussed in the Financial Case in 8.3.4.

Table 8-6 Headline scheme benefits summary PV, 2010 prices £million (Orbital Public Transport) [71]

Assessment Criteria	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch [SN]	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch [JSP]
Present Value of Benefits (PVB)	£191.3	£193.5
Present Value of Costs (PVC)	£89.7	£89.7
Net Present Value (NPV)	£101.7	£103.8
BCR	**2.1**	**2.2**
Value for Money category considering only monetised benefits[72]	**High**	**High**

Together the highway and PT scheme deliver high value for money. Additional costs to deliver bus lanes and public transport infrastructure are roughly off-set by the additional public transport benefits, and whilst the public transport elements do not generate a high VfM in isolation, the overall scheme performs strongly and including public transport provision provides sustainable travel options for the SDLs and for orbital movements that can help support the sustainable growth of the city.

Testing in the JSP scenario, with housing and employment growth concentrated close to the orbital corridor, the public transport benefits and VfM assessment both increase.

The BCR and monetised benefits should be considered alongside non-monetised benefits to arrive at overall VfM categorisation, particularly in this case the Strategic Case impacts from providing new orbital links that support the sustainable growth of the city and Option Values described below.

8.3.3.4. Further benefits to be considered

In subsequent stages of scheme development, further sources of scheme benefits can be assessed. The monetised elements will likely increase the PVB to a degree, and therefore the BCR and VfM. Further aspects to be considered, and their likely impact are identified in Table 8-7.

Table 8-7 Further scheme benefits to be assessed in subsequent stages

Scheme benefits source	Monetised/Non-monetised	Likely scale of impact
Cycle health benefits	Monetised	Low
Cycle de-congestion benefits	Monetised	Low
Land-value uplift	Monetised	Medium
Construction impacts	Monetised	Medium
Safety	Monetised	Low
Wider economic impacts	Monetised	Medium
Reliability	Monetised	Low

[71] Modelling outputs give an order of magnitude and can be used for comparative purposes. However, absolute numbers and BCRs should not be used for planning purposes or be quoted due to limitations in the robustness of the PT model to predict passenger numbers in detail, due to the level of model noise in GBATS and the early stage of development of the costs. Numbers are not yet assured and may therefore change.
[72] VfM categories = Very High ≥4; High 2-4; Medium 1.5-2; Low – 1-1.5; Poor 0-1; Very Poor ≤0.

8.3.3.5. Social impacts

Social impacts of the scheme are assessed qualitatively in Table 8-8 using the social impacts headings provided in WebTAG Transport Appraisal Process Guidance[73]. A seven-point qualitative scale has been used with the following categories:

xxx	large adverse	**-**	neutral	✓	slight beneficial
xx	moderate adverse			✓✓	moderate beneficial
x	slight adverse			✓✓✓	large beneficial.

Table 8-8 Social impacts for Orbital Multi-modal corridor

Assessment Criteria	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch
Non-business users	**Moderate beneficial ✓✓** As for combined orbital highway scheme, plus: Journey and mode choice options and connectivity of non-work and non-commuting journeys will be improved.
Physical activity	**Large Beneficial ✓✓✓** As for combined orbital highway scheme, plus: Limited additional impact from public transport elements.
Journey quality	**Large beneficial ✓✓✓** As for combined orbital highway scheme, plus: Significant benefit for orbital public transport journey experience, as it will offer a quick, direct and reliable service, on high quality buses with good bus stop infrastructure, reducing time spent on the bus and interchanging. The link to the NFH will provide good onward journey quality.
Accidents	**Moderate Beneficial ✓✓** As for combined orbital highway scheme, plus: Limited additional impact from public transport elements.
Security	**Neutral -** As for combined orbital highway scheme, plus: Not likely to result in a change of crime incidence or fear of crime.
Access to services	**Large beneficial ✓✓✓** As for combined orbital highway scheme, plus: This is a new route which would directly serve a new community (Whitchurch SDL), providing it with access to the wider network, as well as offer an improved and direct service between existing communities (Hengrove, Whitchurch, Keynsham and East Fringe), and good onward links via connecting services on the A4, A37 and NFH route.
Affordability	**Moderate beneficial ✓✓** As for combined orbital highway scheme, plus: New route, thus reduction in cost due to removing need to interchange. Cost is also reduced due to a reduction in time spent travelling.
Severance	**Slight beneficial ✓** As for combined orbital highway scheme, plus: No additional severance impact from public transport route or infrastructure. Service offers new destination choices for public transport users., and new links between existing communities as well as for SDLs.
Option and non-use values	**Moderate beneficial ✓✓** As for combined orbital highway scheme, plus: Provides a new dedicated, fast, and reliable service across the orbital corridor, with good links to radial routes (via A4, A37 and NFH).

[73] Transport Analysis Guidance: The Transport Appraisal Process, 2014 https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/431185/webtag-tag-transport-appraisal-process.pdf

8.3.3.6. Environmental impacts

The scheme option has been assessed against environmental impacts from WebTAG:

- Noise
- Air Quality
- Landscape
- Townscape
- Water Environment
- Heritage

The level of assessment is proportionate to the early stage of scheme development. WebTAG worksheets have been used, except for Noise and Air Quality where proformas consistent with WebTAG principles have been utilised. This is because WebTAG Noise and Air Quality worksheets require Noise and Air Quality modelling which is not appropriate to OAR stage. Level 1 Flood Risk assessments have also been produced to ensure the environmental assessment provides a comprehensive analysis of the risks, commensurate to the level of scheme design.

The full environmental assessments are provided in Appendix 6:3.

Table 8-9 summarises the outputs of the environmental assessment for the orbital multi-modal corridor. Proposed mitigation is also outlined in Table 8-9. A key design principle for mitigation has been to seek to minimise environmental impacts through careful selection of route alignments and consideration of the location of new features within the proposals, particularly in urban areas where opportunity for mitigation measures will be restricted. Note that environmental mitigation is not included in the designs due to the early stage of scheme development, this should be planned for the next stages of scheme development.

A number of assessments do not take into account mitigation. Noise and Air Quality do not account for mitigation as Noise and Air Quality modelling was not carried out; Water is dependent on hydraulic modelling, and heritage is dependent on fieldwork.

Table 8-9 Environmental impacts (orbital corridor)

Assessment Criteria	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch
Noise	**Slight Adverse x** As for combined orbital highway scheme, plus: Neutral impact from public transport elements There are seven noise important areas and 2200 noise sensitive receptors within 200m these are likely to not experience a great impact from the scheme.
Mitigation	*To be identified in next stages of work.*
Air Quality	As for combined orbital highway scheme, plus: No AQMAs within 200m of the route which could be affected by changes in air quality. The Bickley Wood SSSI crosses the route north of the junction with the A4. There are approximately 2,200 sensitive properties within 200m of the route which could be affected by an increase in traffic emissions. Overall, there may be a positive change in NO2 and PM10, depending on the magnitude of traffic changes.
Mitigation	*To be identified in next stages of work.*
Landscape	**Slight – Moderate Adverse x/xx** As for combined orbital highway scheme, plus: Slight – Moderate Adverse impact from public transport elements The route is large in scale with alteration to pattern of landscape and loss of landscape elements (hedgerows, trees). Minimal impacts anticipated on designated sites, in particular Bickley Ancient Woodland and Common Land at Kingswood. Minor impacts anticipated on regionally designated Greenbelt.
Mitigation	Careful design and sifting of new features. Mitigation planting for screening and recreating severed or lost linear elements.
Townscape	**Slight Adverse x** As for combined orbital highway scheme, plus: Slight Adverse impact from public transport elements Small adverse impact on the new link as density & mix will increase slightly with the introduction of a new visually intrusive urban element to the edge of Stockwood, Whitchurch and Keynsham. It is anticipated that there would be visual disturbance to townscape features SE of Whitchurch, S of Stockwood and Queen Charlton. Neutral townscape impact on the route section north of Hicks Gate roundabout.
Mitigation	Careful design and location of new features, along with mitigation planting where space exists.
Biodiversity	**Slight Adverse x** As for combined orbital highway scheme, plus: Neutral impact from public transport elements There are two SSSIs, two SNCIs, one LNR and a number of priority habitats within 1km the scheme route, but it considered unlikely that these will be impacted.
Mitigation	Considering the on-line nature of this scheme it is considered unlikely that it will result in impacts on surrounding habitats. Mitigation is unlikely to be required.
Water Environment	**Very Significant Adverse xxx** As for combined orbital highway scheme, plus: Significant Adverse impact from public transport elements The majority of the scheme is in Flood Zone 1, with three parts of the scheme crossing Flood Zone 2 and 3. The majority of the route is predicted to be at high risk of surface water flooding.
Mitigation	Mitigation measures such as SuDS and potentially other surface water mitigation for the additional area that would be required for public transport infrastructure as part of the scheme – these would need to be tested as part of the Flood Risk Assessment and Drainage Strategy.
Heritage	**Slight Adverse x** As for combined orbital highway scheme, plus: Slight Adverse impact from public transport elements There is potential for temporary impacts on the setting of listed buildings located along the existing A4174. Such assets are likely to have visibility to and from the proposed scheme. No significant adverse setting impacts on designated heritage assets are anticipated.
Mitigation	As no significant setting impacts to these listed buildings are anticipated once the scheme is operational, the scheme is anticipated to have a reduced overall effect of Neutral.

8.3.3.7. Summary VfM assessment

The Value for Money Assessment of a scheme considers both monetised and non-monetised impacts. The scheme is currently at an early stage of development and it is anticipated that the following considerations may influence the case for progressing this scheme:

The combined orbital highway scheme takes traffic off less appropriate orbital routes, reducing traffic on local roads, and therefore provides quicker, more reliable journeys across the study area. It fills an evidenced gap in the local primary route network and provides good connectivity to existing and planned communities.

An orbital public transport service offers a new public transport link not currently offered by alternatives. It may help facilitate economic growth on this corridor away from key radial routes into the city centre, and thus enable more sustainable overall city growth – further assessment with dynamic land-use modelling could be used to understand this further if considered proportionate.

An orbital express bus service would serve the Whitchurch SDL, and help to mitigate impact on highway network, providing travel options to locations other than the city centre. When considered as a combined package, the orbital multi-modal corridor delivers high VfM considering only monetised impacts.

The assessments are based upon a 2 bus per hour frequency, which is below the 'turn-up and go' service standard expected for MetroBus standard routes. Despite this, forecast operation costs outweigh forecast revenue and hence the service is unlikely to be commercially viable, and a subsidy would likely be required.

Viability may be improved by serving Whitchurch, Hicks Gate and other P&R sites on the ring road (Lyde Green) as this would provide additional potential patronage and interchange opportunity, and increased destination choices from the P&Rs.

8.3.4. Financial case

8.3.4.1. Capital costs

The public transport infrastructure on the new highway links (additional carriageway for bus lanes) has been costed on the basis of 3D designs to enable the volume of cut and fill to be estimated to inform excavation and disposal costs. It should be noted, that the schemes designed in 3D are to concept design level, not detailed design. Works costs have been built up on a 'per m^2' or 'per m^3' basis for different elements.

Works on the existing network are based on a high-level 'per km' cost based on current MetroBus works as no concept designs have been produced at this stage.

The rates used have been derived from competitive market rates that we have from similar projects, both pre- and post-contract. A percentage of the total scheme costs have been used for items such as fencing, landscaping and utility diversions, which have been calculated using an average percentage found on similar projects.

Structures have been calculated at a high level based on the works we would expect them to encompass and have amended where necessary dependent on the size and location.

Percentage allowances have been included as follows:

Preparation (design, business case) – 10% of construction cost;
Site supervision – 6% of construction cost;
Risk budget – 40% of construction cost; and
Environmental mitigation (part of the construction cost) – 10% of works cost.

Land costs are based on a unit rate of £40k/per hectare for land with development potential. Note there have been no discussions with landowners at this stage.

To derive outturn costs, the schemes costs have been profiled as follows:

Preparation costs have been evenly split over the preparation period;
Construction costs have been evenly split over the construction period; and
Land costs are assumed to be incurred the year before construction commences.

Scheme opening years are generally based on previous work by the Councils, with adjustment if the opening year has needed to be extended to allow for preparation and design.

Table 8-10 presents capital costs for the orbital scheme, both in 2017 prices and outturn (with inflation). Note that the costs to cover the provision of bus lanes on the new highway link (over and above the cost of the link itself) and the assumed works on the on the existing A4174 Ring Road are provided, as well as the total multi-modal corridor scheme cost including the new highway links.

Table 8-10 Capital costs

Cost Item	**Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch** (additional cost excluding new highway link)	**Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch** (total cost including new highway link)
Preparatory (including detailed design and survey work)	£2.2m	£10.4m
Construction (excluding utility diversions)	£9.9m	£54.7m
Site Supervision	£0.6m	£3.4m
Land	£0.09m	£0.9m
Risk Budget	£7.7m	£26.4m
Total – 2017 prices	**£20.4m**	**£95.8m**
Inflation	£7.9m	£37.2m
Total – Outturn prices[74]	**£28.3m**	**£133.0m**

8.3.5. Management and commercial case

8.3.5.1. Programme & phasing

Potential scheme opening years have been referenced from work undertaken by the unitary authorities in relation to the proposed housing trajectories in the JSP, and potential transport mitigation trigger points to help support the proposed development. Appropriate construction and design periods have been specified ahead of opening year, including a period back to present day for preparatory work on developing a business case and gaining funding, planning permission and land purchase.

The assumed scheme programme is shown in Table 8-11, and is the basis for the economic assessments and profiling for outturn costs.

[74] Outturn cost shown to be lower than the base costs in TUBA is likely due to a collation of different tender price indices (Road Construction TPI data if available, or else Public Sector Building TPI, for 2017 onwards).

Table 8-11 Orbital Multi-modal corridor programme

	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch
2018	
2019	
2020	
2021	
2022	
2023	
2024	
2025	
2026	
2027	
2028	**2028**
2029	
2030	
2031	
2032	

Preparatory (Business Case & Funding)	
Preparatory (Design)	
Construction	
Opening Year	**2028**

If progressed, the orbital public transport service is dependent on new highway links discussed in Chapter 6 being delivered. It is assumed the design and construction of any bus priority infrastructure is included in the highway design/construction process, and the services are able to start running once the new link roads are open – hence the programme reflects that set out for the roads.

8.3.5.2. Deliverability and acceptability

Table 8-12 provides a high-level categorisation of the degree of delivery challenges faced by each scheme option (very challenging; moderate challenges; minor challenges; very limited challenges). Key deliverability issues are discussed in Section 8.2, and Table 8-1.

Public or stakeholder consultation has not yet been undertaken with regard to this scheme option, and therefore the following assessments are based upon likely issues expected to be encountered and known public opinion to date. Table 8-12 provides a high-level categorisation of public acceptability for each scheme option (not publicly acceptable; likely to encounter strong issues; some potential issues but could be acceptable overall; acceptable to most but with some minor issues; acceptable to most with very limited or no issues).

Table 8-12 Deliverability and acceptability assessment – orbital corridor scheme

	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch
Deliverability assessment	**Moderate delivery challenges** as outlined in Table 6-13. Feasibility of works on existing network have not been considered at this stage.
Acceptability assessment	**Likely to encounter strong issues** as outlined in Table 6-13 Some issues are likely to be encountered relating to construction of bus lanes on existing A4174 ring-road, most construction would be within highway boundary, and therefore this element could be acceptable overall.

8.3.5.3. Key risks

An initial risk register has been developed.

Table 8-13 lists the key risks identified to-date; these risks generally relate to the schemes being at an early stage of development. It is important that these risks are factored into plans for the next stage.

Table 8-13 Key risks – Orbital Multi-modal corridor scheme

Key Risk	Option L
Relating to public transport elements and multi-modal corridor;	
Service forecast is not commercially viable and further optimisation is required	✓
Whitchurch masterplanning is at an early stage of development.	✓
Public transport service is dependent on construction of the potential orbital highway link between Whitchurch Lane and Hicks Gate.	✓
No design feasibility assessment has been undertaken on bus priority measures on the existing A4174 ring road.	✓
Schemes are at early level of development (e.g. no ecological surveys, no noise or air quality modelling) and no environmental design.	✓
Statutory undertakers – no C2 searches carried out to-date.	✓
Relating specifically to highway elements;	
Corridor not currently protected from future development.	✓
Scheme potentially could face public opposition.	✓
Land Assembly – crosses multiple land owners who are yet to be engaged with.	✓
Proposed alignment close to cemetery at Whitchurch.	✓
Development in Green Belt.	✓
Water mitigation – engagement needed with Environment Agency.	✓
Severance of local routes – to be incorporated into SDL networks.	✓
Crosses gas and water pipeline at Hicks Gate – unknown impact	✓
Hicks Gate scheme tested without A4-A37 Link – combined operation needs reassessing with micro-simulation modelling.	✓
Departures from standard required for Hicks Gate left-turn filter.	✓

8.3.5.4. Commercial

Table 8-14 sets out commercial considerations in relation to delivery organisation, construction procurement and public transport service procurement.

Table 8-14 Commercial assessment – Orbital Multi-modal corridor scheme

	Option L– Orbital Multi-modal: Hengrove to Emersons Green via Whitchurch
Delivery Agency	Local Authorities (Bath & North-East Somerset, Bristol City Council). As a cross-boundary scheme, this will joint-working by the local authorities. This model is already proven.
Construction procurement	Project could be delivered through a range of procurement models. No significant commercial barriers identified.
Public transport procurement	For delivery of services, options could include Quality Partnership Scheme or franchising. However, the service if not forecast to be commercially viable and hence further service optimisation is required to understand of a sustainable service that can operate without subsidy can be provided.

8.4. Conclusions

Table 8-15 summarises performance of the schemes against the DfT's five case model.

Table 8-15 Summary performance against the five cases

Case	Criteria	Option L– Orbital Multi-modal corridor: Hengrove to Emersons Green via Whitchurch
Strategic	Corridor Objectives	• Moderate/strong alignment – particularly due to providing a new convenient, orbital travel option, directly serving the Whitchurch SDL, and enabling orbital movements that support sustainable economic growth.
	JLTP Objectives	• Moderate/slight alignment – particularly by supporting economic growth and accessibility through providing a new public transport route option.
Economic	Economic Impacts	High VfM Additional costs beyond pure highway link option to deliver public transport elements are roughly off-set by the additional benefits
	Social Impacts	• Moderate/large potential benefits through improving journey choice and quality for orbital movements, and access to services.
	Environmental Impacts	Without mitigation, assessed to have slight adverse/neutral impacts, with: • Very significant adverse water environment impact, due to proximity to flood zone2/3, and high risk of surface water flooding. • Slight-moderate adverse landscape impact, due to loss of existing natural features.
Financial	Capital Costs	• 2017 prices: **£95.8m** (of which £20.4m for PT elements excl. new highway link) • Outturn: **£133.0m** (of which £28.3m for PT elements excl. new highway link)
	Operating Costs	Public transport operating costs: £0.40m Public transport revenue: £0.13m Service is not commercially viable and a subsidy or further growth in patronage is likely required
Commercial		• Likely local authority scheme promoter • Public transport service is not forecast to be commercially viable and hence further service optimisation is required to understand if a sustainable service that can operate without subsidy can be provided.
Management	Risks	• Public transport service if not forecast to be commercially viable and hence further service optimisation is required • Public transport service dependent on construction of the potential orbital highway link between Whitchurch Lane and Hicks Gate. • No design feasibility assessment has been undertaken on bus priority measures on the existing A4174 ring road. • Relationship with Whitchurch SDL unknown • Land assembly • Development in Green Belt • Crosses gas and water pipeline at Hicks Gate • Hicks Gate junction scheme tested without A4-A37 Link – compatibility to be verified with more detailed assessment
	Deliverability	• Moderate delivery challenges relating to water and landscape mitigation, the alignment crossing a strategic gas pipeline, and departures from standard • Feasibility of works on existing network have not been considered at this stage
	Acceptability	• Likely to encounter strong issues; new highway infrastructure in green belt, impacting on local landscape and landmarks. Increased traffic through Whitchurch Lane

9. Active Travel

9.1. Introduction

This chapter sets out the assessment of Active Travel scheme options.

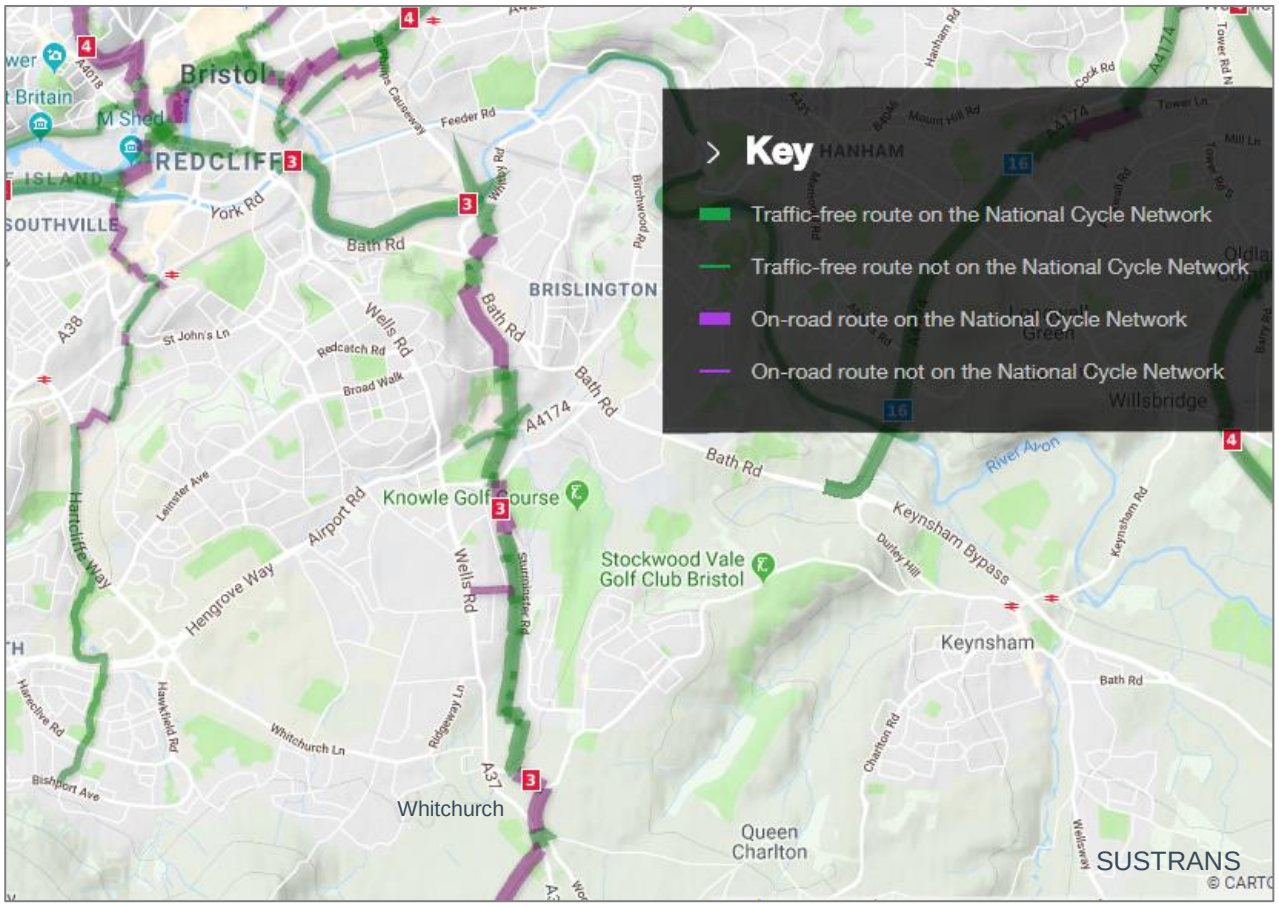
Active travel measures and infrastructure are included within the other mode scheme options presented in previous Chapters (although associated monetised benefits have not been calculated), notably:

Off-carriageway path along the orbital corridor between Hengrove and Hicks Gate

The shortlisting process outlined in Chapter 5 identified a stand-alone active travel scheme; targeted improvements to the Whitchurch Railway Path.

The Whitchurch Railway Path is highlighted as a key radial cycle route in the West of England Joint Transport Vision, and it already forms part of the National Cycle Network (NCN3). Figure 9-1 shows the route alignment; the path generally follows the alignment of a former railway line between the River Avon and Whitchurch, although parts of the route are on parallel residential roads.

Figure 9-1 National Cycle Network Route 3 (Whitchurch Railway Path)



The route is generally of adequate standard, but improvements could be made to make cycle journeys, quicker and more convenient. At 7.5km from Whitchurch (and the proposed SDL) to the city centre, on a relatively flat profile, cycling is a viable mode choice for the corridor. Despite this, as evidenced in Chapter 2, there are relatively few cycle trips made on the corridor.

Given the strategic importance of cycling within the Transport Vision, and opportunity for this route to offer mitigation to the Whitchurch SDL, relevant assessments relating to targeted route improvements are recorded in this Chapter for completeness. However, given that a relatively good cycle route already exists, these improvements are not presented as part of the strategic transport package as they are not considered a strategic level intervention. Hence, they have not been subject to the same level of design or detail of assessment as those options presented in previous chapters.

9.2. Option discussion

A high-level assessment of the existing route has been made based upon OS mapping and aerial photography. This assessment has identified the potential priority for improvements to the route being between A4174 Callington Road and A4 Bath Road at Arnos Vale cemetery, and Sturminster Road between Manston Close and Hither Bath Bridge. Further, more detailed assessment of the route will be required to confirm those locations on the route that would benefit from improvements.

Potential stand-alone active travel schemes include:

Construction of a walking/cycling only link along the potential Callington Road link alignment; and
Upgrades to the existing NCN3 route via Hampstead Road – particularly at Bath Road/Sandy Park Road/St Phillips Causeway junction.
Upgrades to the existing NCN3 route at Sturminster Road between Manston Close and Hither Bath Bridge.

Typical upgrades that could be considered include improved signage, small scale improvements in natural legibility, raised tables, crossings and minor works along the route.

These schemes could be delivered in isolation or together – however, delivering both schemes on the A4174 Callington Road to A4 Bath Road section would result in parallel routes close together with limited benefit from the duplication.

No concept design work has been undertaken for these options, and hence environmental and costing assessments have not been undertaken to the same level of detail as those schemes in prevision chapters. However, a summary of considerations for each option is provided in Table 9-1 against the five-case model headings.

Table 9-1 Active Travel scheme: performance against the five cases

Case	Criteria	New walking/cycling only link (Shared Use Path) A4174 Callington Road to A4 Bath Road at Arnos Vale cemetery on Whitchurch railway alignment	Upgrades to the existing NCN3 route via Hampstead Road and at Sturminster Road
Strategic	Corridor Objectives	**Strong alignment** – particularly to providing a range of travel options, and mitigating travel demand from planned growth.	
	JLTP Objectives	**Very strong alignment** – particularly to improving health, accessibility for non-car users, and healthy natural environment	
Economic	Economic Impacts	*No economic assessments undertaken. Subsequent study could capture health benefits and de-congestion benefits (using DfT propensity to cycle tool to derive demand)*	
	Social Impacts	Positive contribution – particularly with regard to physical activity and journey quality.	Positive contribution – particularly with regard to physical activity.
	Environmental Impacts	Minor adverse impact on water environment due to scheme crossing Flood Zone 2 and 3 and Surface Water floodplains,	Negligible
Financial	Capital Costs	£5.5m (2018 prices) (Based on £/km, and applying appropriate preparation, supervision, ancillary and risk costs as for other schemes).	Concept not specified sufficiently to provide a cost estimate. Nominal figure £0.6m (2018 prices)
Commercial		Likely local authority scheme promoter	Likely local authority scheme promoter
Management	Risks	• Demonstrating value for money and securing funding as a stand-alone scheme • Land assembly • Benefits of CRL to A4 public transport corridor.	• None identified
	Deliverability	Minor delivery challenges relating to water mitigation	None identified
	Acceptability	**Acceptable to most but with some minor issues** – relatively low impact development on surrounding properties. New cycle links generally supported.	**Acceptable to most with very limited or no issues** – Relatively minor works on public highway, within existing paths/ carriageways.