A4/A4174 Hicks Gate Junction Improvements - Option Assessment Report

Prepared for

West of England Combined Authority

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Option Assessment Report

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Acronyms and Abbreviations

BANES	Bath and North East Somerset
DfT	Department for Transport
DMRB	Design Manual for Roads and Bridges
GBATS	Greater Bristol Area Transport Model
GWML	Great Western Main-Line
HE	Highways England
JLTP3	Joint Local Transport Plan 3 for West of England
JSS	Joint Spatial Strategy
JTB	Joint Transport Board
JTS	Joint Transport Study
LEP	Local Enterprise Partnership
LTB	Local Transport Body
NPPF	National Planning Policy Framework
OAR	Option Assessment Report
PRoW	Public Rights of Way
SAC	Special Area of Conservation
SDI	Social and Distributional Impacts
SDL	Strategic Development Location
SEBWP	South East Bristol and Whitchurch Package - OAR (Atkins)
SEP	Strategic Economic Plan
SGC	South Gloucestershire Council
SOBC	Strategic Outline Business Case
SSSI	Sites of Special Scientific Interest
WebTAG	DfT online Transport Analysis Guidance
WECA	West of England Combined Authority
WoE	West of England

1 Introduction

1.1 Purpose of this report

This is the Options Assessment Report (OAR) examining potential improvements to **Hicks Gate Roundabout** (A4/A4174) on the western side of Keynsham. It describes the process of analysing the transport challenges, defining corridor-specific objectives and identifying and assessing potential interventions to tackle these challenges. In developing the potential options for improving this junction it has been necessary to consider other proposed transport interventions having a direct impact on the highway design. These are as follows:

- The proposed construction of a new link road between the A4 Bath Road and the A37 at Whitchurch which, at its northern end, would connect to the existing A4174 Ring Road at Hicks Gate; and
- The proposed relocation of the existing Brislington Park and Ride site to a site further east along the A4 Bath Road, on land to the SW of Hicks Gate

The 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 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 to comply with best practice for transport studies, as documented in the Department for Transport's Transport Analysis Guidance (WebTAG)[2]. Specific guidance for transport studies is documented in the unit titled 'The Transport Appraisal Process'[3], which sets out a stepped process to 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 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.

This document sets out the OAR for improvements to **Hicks Gate Roundabout**. It is designed to follow the best practice in WebTAG and therefore provides an objective assessment of the transport challenges and identifies appropriate solutions to the challenges in the corridor. It should be read in conjunction with the wider OAR work for SE Bristol described in the '**South East Bristol and Whitchurch Package Options Assessment Report**' (SEBWP) - Atkins, as it forms a component part of

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

2 https://www.gov.uk/guidance/transport-analysis-guidance-webtag

3 https://www.gov.uk/government/publications/webtag-transport-appraisal-process

this package, with improvements here essential to attracting a high transfer of traffic transfer to the A4-A37 Link Road. In its current form it will otherwise continue to act as a significant 'bottleneck' and a barrier to growth.

1.1.1 Description of the Study

Figure 1.1 shows the extent of the study area on the A4 corridor to the north-west of Keynsham. The existing Hicks Gate junction is a partially signalled roundabout with an inscribed circle diameter (ICD) of 93 metres. Only the eastbound A4 Bath Road entry to the roundabout is un-signalled, with the very high traffic movement from this approach to the A4174 Ring Road catered for by a segregated left turn lane (SLTL) with a lane gain termination.

Most of the land surrounding Hicks Gate roundabout is undeveloped, with the exception of the Fire Brigade HQ site in the SE quadrant. Both the A4 Bypass and A4174 Ring Road arms are dual carriageway all-purpose roads (D2AP). To the north of the roundabout (circa 220 metres) the A4174 passes over the Great Western Main Line (GWML) and, shortly after, crosses the Avon Valley on a second bridge structure. The potential widening of this section of the Ring Road, insofar as it would affect either bridge, has not been considered in assessing potential improvement options for the Hicks Gate junction because of the very high potential delivery costs. As such, the railway bridge and the two-lane link capacity in each direction is a key design constraint, particularly in the northbound direction.

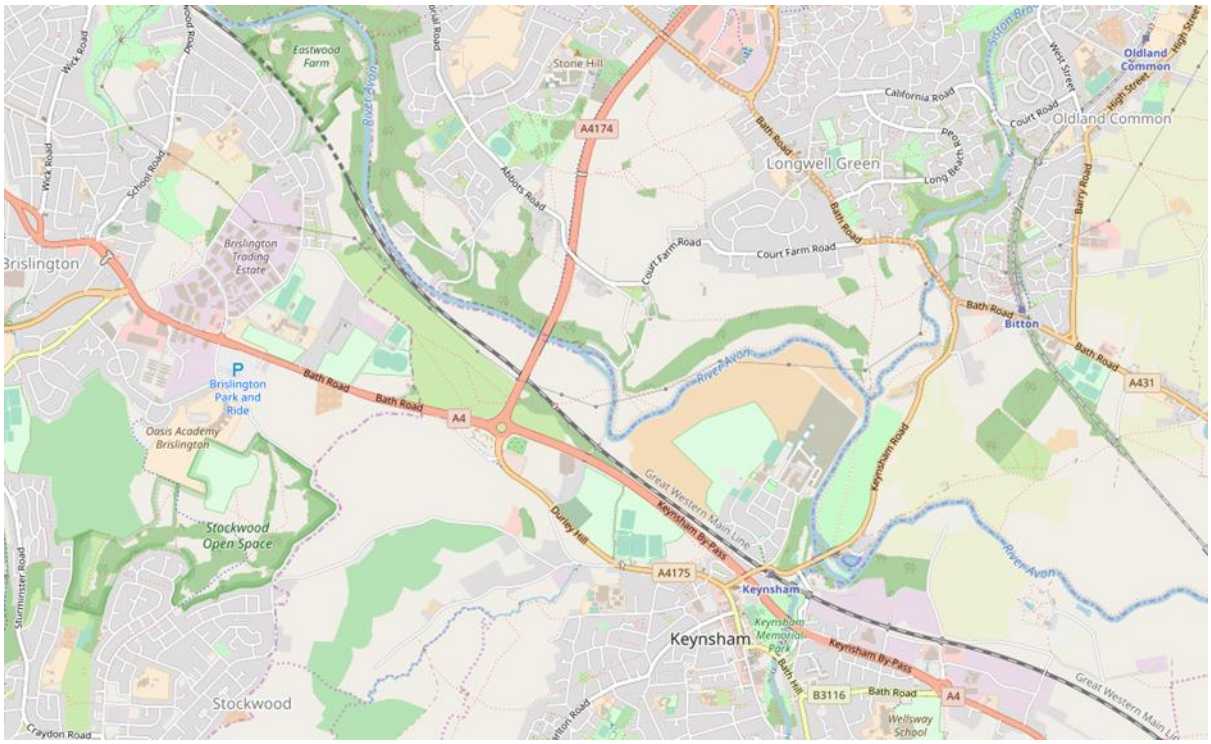

Figure 1.1: Study Area Location Plan

The improvements to the existing junction are needed to maximise the potential of the A4-A37 link road being considered as part of JSP. Without change, it can be expected that traffic usage of this new link will be hampered by the operation of the existing roundabout at Hicks Gate, which is already congested in the weekday peak periods.

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.

1.2.1 National Planning Policy Framework

The National Planning Policy Framework (NPPF)[4] 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:

Paragraphs 7 and 8 state that the planning system is to contribute to the achievement of sustainable development and recognise that to build a strong, responsive and competitive economy there is a requirement for provision of infrastructure;

Paragraph 22 recognises that strategic policies should look ahead over a minimum 15-year period and respond to long-term requirements and opportunities including those arising from major improvements in infrastructure.

Paragraph 104 states that in planning policies should be prepared with the active involvement of local highways authorities, other transport infrastructure providers and operators and neighbouring councils, so that strategies and investments for supporting sustainable transport and development patterns are aligned.

This OAR demonstrates how the proposed **Hicks Gate Roundabout** improvements will meet the requirements of the NPPF. Section 1.2.6 below explains how the tests of soundness (from NPPF Paragraph 35) are demonstrated through this report.

1.2.2 Joint Spatial Plan and Local Plans

The West of England Joint Spatial Plan (JSP)[5] 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 2019 and will include the proposed transport schemes required to support delivery of the Local Plan allocations, including the SDLs.

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4 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740506/National_Planning_Policy_Framework_print_version.pdf

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

This OAR demonstrates how the proposed transport interventions for Hicks Gate will support the proposed Local Plan allocations and meet the principles of sustainable travel described in the JSP.

1.2.3 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 January 2019.

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.

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

Table 1.1: JLTP3 Goals

This OAR will provide an overall assessment of how the schemes proposed for improving the Hicks Gate junction will address the JLTP3 goals set out above.

1.2.4 Relationship with Transport Topic Paper

A Transport Topic Paper has also been produced, which provides supporting transport evidence for the JSP. 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 infrastructure identified from this OAR for Hicks Gate Roundabout 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.

1.2.5 Approach to Options Assessment Reports

The Options Assessment Reports (OARs) demonstrate 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 good practice set out in WebTAG[6]. 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. Further sensitivity testing including the JSP and Local Plan proposals will be carried out in preparation for the Local Plan consultations.

1.2.6 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 (refer to Section 1.2.1) are addressed in the evidence in each chapter.

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	Need for intervention	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 https://www.gov.uk/government/publications/webtag-transport-appraisal-process

6	Option Development and Assessment	Approach to option development 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	TAG Appraisal Stage 1	Early Assessment and Sifting Tool Tables	Yes (appraisal against objectives)	Yes (appraisal of costs, benefits, impacts)	Yes (assess technical feasibility)	Yes (DfT EAST tool considers policy)
8	Early Assessment and Sifting Tool	Supporting Information	Yes (appraisal against objectives)	Yes (appraisal of costs, benefits, impacts)	Yes (assess technical feasibility)	Yes (DfT EAST too considers policyl)

Table 1.2: Structure of this report

2 Understanding the Current Situation

2.1 Description of the Study Area

2.1.1 Constraints - General

A constraints plan of the area surrounding the existing Hicks Gate Junction is included in **Appendix A.** (Drawing No. **674726.CA.51.01/001**). This includes the following:

- General Constraints: including landfill areas, greenbelt, sites of Nature Conservation Interest and other locally important designations;
- Flood Zones;
- Listed Buildings and Scheduled Monuments; and

The constraints plan shows that the junction lies within the Green Belt area between Keynsham and the eastern edge of Bristol. To the north of the junction there is a belt of woodland adjacent to the Great Western Main Line (GWML) which, although undesignated, forms part of the Avon Valley area of Nature Conservation Interest. To the NW of the junction a watercourse crosses the area, passing in culvert under the A4174 Ring Road and the A4 Bath Road. The area adjacent to it falls into Flood Zone 3, which would affect any proposal to extend highway works into this NW quadrant.

The Fire Station HQ building which lies to the SE of Hicks Gate has been developed on an area used formally for landfill. Another area of historic landfill within 500 metres of the junction exists to the north of the A4 Bath Road to the west.

2.1.2 Physical constraints

As shown in the constraints plan, the physical extent of highway improvement is influenced by the area of potential flooding to the NW of the roundabout. This falls into National Flood Zone designations 2 and 3, so is relatively high risk. To the north of the roundabout the A4174 Ring Road passes over the GWML and the Avon Valley on two bridges. The former represents a fixed point in terms of vertical alignment whilst, in the absence of widening this structure and the intervening cutting, it constrains the capacity of the Ring Road to the existing two lanes in each direction (D2AP). This is a marked constraint in the northbound direction, as the existing segregated left turn lane from the A4 Bath Road takes out one of the northbound lanes with its 'lane gain' termination.

2.1.3 Environmental constraints

2.1.3.1 Water Environment

The River Avon, a designated Main River[7], passes through the northern edge of the Study Area. A tributary to the River Avon passes under the A4174 approximately 140m to the north of Hicks Gate Roundabout. This flows in a westerly direction.

Land to the north east, south east and south west of Hicks Gate Roundabout lie predominantly within Flood Zone 1 (having less than 1 in 1,000-year annual probability of flooding). However, there are areas to the north west that lie within Flood Zone 3 (having less than 1 in 100-year annual probability of flooding), these areas include parts of the northern and western arms of the roundabout.

[7] 'Main rivers' are usually larger rivers and streams. The Environment Agency is responsible for maintenance, improvement or construction work on main rivers to manage flood risk.
https://environment.maps.arcgis.com/apps/webappviewer/index.html?id=17cd53dfc524433980cc333726a56386

2.1.3.2 Landscape and Ecology

Hicks Gate Roundabout is a soft landscaped roundabout with multiple lanes on approach and exit. The land to the west rises as it approaches the roundabout and falls away to the east. The existing roundabout has an area of grass, shrubs and trees in the centre, there are also areas of trees and vegetation on all sides of the roundabout.

No field surveys have been undertaken, however a review of available online information has indicated the areas surrounding the Hicks Gate Roundabout have the potential to support species of flora and fauna protected by European and National legislation. There are two nationally designated Sites of Special Scientific Interest (SSSI) '*Bickley SSSI*' and '*Cleeve Woods SSSI*', and two Local Nature Reserves (LNRs) '*Stock Wood Open Space LNR*' and '*Avon Valley Woodland LNR*' within 2km of the Roundabout.

2.1.3.3 Culture and Heritage

There are no World Heritage Sites or sites included on the Tentative List of Future Nominations for World Heritage Sites (July 2014), Scheduled Monuments, or Registered Battlefields within the Study Area.

There are 21 Listed Buildings within 200m of the roundabout, three of which are Grade II* Listed and 18 Grade II Listed. The Grade II* Listed structures consist of a Parish Church, Tithe Barn and Hanham Court and are located to the north east of Hicks Gate Roundabout in Hanham Abbots.

2.1.4 Non-car modes

The existing facilities for pedestrians and cyclists in the vicinity of Hicks Gate are relatively limited, but service the main 'desire lines' for movement between Keynsham (A4175), the A4 Bath Road and the A4174 Ring Road. **Figure 2.1** below shows the extent of these.

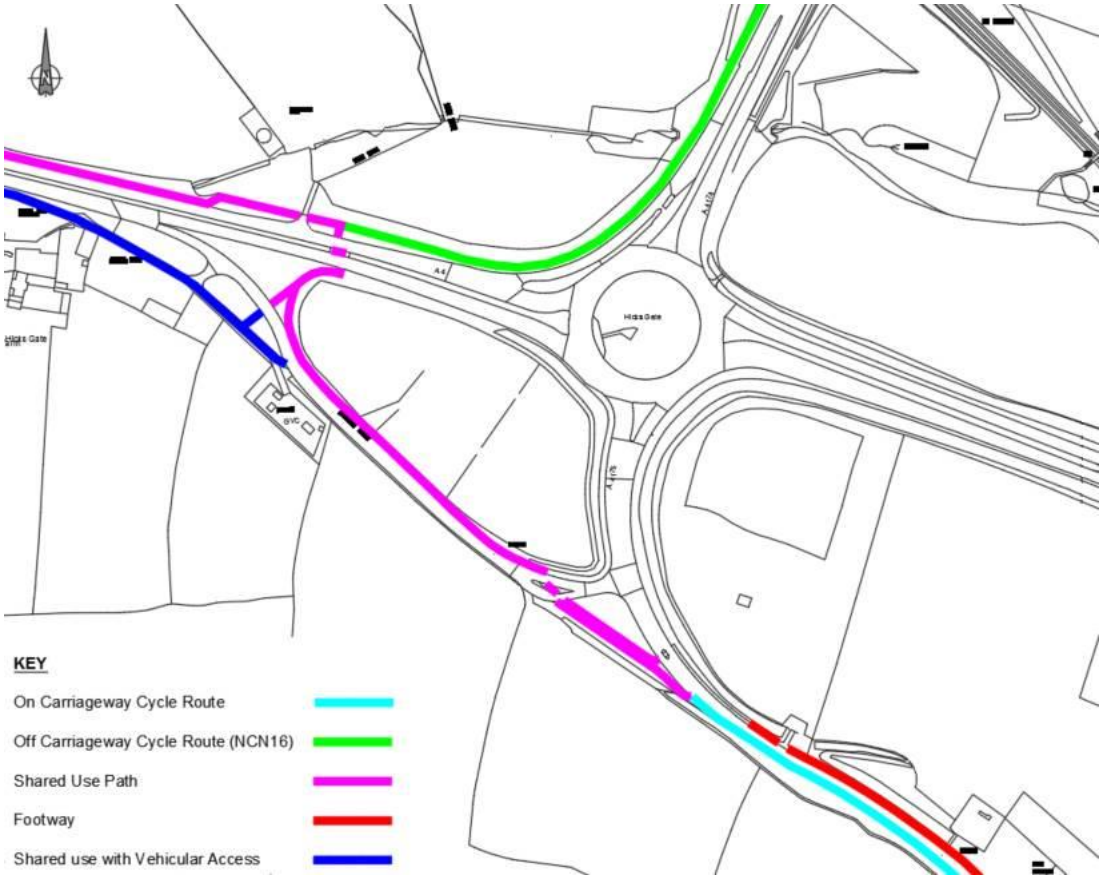

Figure 2.1 Existing Pedestrian/Cyclist Routes

There is an existing shared use pedestrian/cycle path on the west side of the A4174 Ring Road between Hicks Gate Roundabout and Kingsfield Roundabout at Longwell Green. This forms an important pedestrian/cycle connection between Keynsham and the retail/commercial development off Marsham Way (Gallagher Retail Park), and additionally provides connection/access points with Abbotts Road and the A431. Critically, it forms an important route crossing the GWML and the River Avon Valley on the two bridges built as part of this section of the A4174 Ring Road. This shared use route extends around the NW corner of Hicks Gate Roundabout to a Toucan crossing point on the A4 Bath Road to the west. From here the route connects with the lightly used section of Durley Hill between the A4175 and the A4 Bath Road.

On the A4175 Durley Hill approach there is an existing narrow footway on the north side. This extends just beyond the access junction to the Fire Station Headquarters, after which there is an uncontrolled crossing point with a refuge island providing access to the lightly trafficked section of Durley Hill. Cyclists from Keynsham are required to ride on the carriageway as far as the Fire Station access, but at this point there a cycle slip-lane linking to the quiet section of Durley Hill.

At the western end of Durley Hill the NMU routes uses the access lane to Hicks Gate Farm to achieve connection with the existing shared used footway running westwards on the south side of the A4 Bath Road to the Emery Road junction. There is a continuous footway on the north side of Bath Road as well, but shared use is limited to a length of 90 metres just west of the Toucan crossing on the approach to Hicks Gate Roundabout. This is to enable eastbound cyclists to leave the carriageway to access the shared route extending northwards along the Ring Road, or to access the crossing to get to Durley Lane (A4175).

It will be noted from the above that there is currently no controlled crossing provision for pedestrians/cyclists at Hicks Gate Roundabout, even though the junction is partially signal controlled. This is because, apart from the shared use footway running adjacent to the segregated left turn lane on the NW side of the roundabout, there is no footway provision running to the junction. At present, the lightly trafficked section of Durley Hill is used to cater for and segregate the NMU route from/to Keynsham (A4175) from traffic conflicts at the roundabout. With potential relocation of the Brislington Park and Ride site to the SW quadrant of Hicks Gate there is potential for this link to be cut when the site is closed and gated, unless a route useable by pedestrians/ cyclists is retained. This will therefore be an important design consideration in considering changes to Hicks Gate, particularly if the Durley Hill link is cut in accommodating a new Park and Ride site, and out-of-hours NMU access across this site considered undesirable for security reasons.

2.2 Current Vehicle Demands

Figure 2-12 in the SEBWP showed annual average daily flow (AADF) data collected at various sites in the area by the Department for Transport (DfT). The count point just north of Hicks Gate Roundabout on the A4174 Ring Road recorded 37,068 vehicles, whilst the flow on the A4 Bath Road to the west was almost identical at 37,065 vehicles. The count to the east on the A4 Keynsham Bypass was 27,662 vehicles, with the A4175 Durley Hill having an AADF of 13,653 vehicles. This shows a strong movement of vehicles across the junction from all arms.

A full manual classified turning count was done at the roundabout in June 2012. This was used in the development of the base S-Paramics traffic model of Keynsham, which has been used in separate work on the OAR for a proposed link road across the Broadmead Peninsula connecting the A4175 Keynsham Road and the A4 Bath Road to the east of the town. Whilst somewhat dated now, it does give an indication of the predominant movements through the Hicks Gate junction in the weekday peak hours. These are shown in Tables 2.1 and 2.2 below.

Table 2.1 A4/A4174 Hicks Gate Roundabout: Traffic Volumes - Weekday 8:00-9:00 am

Arm From	Arm To				
	A: A4 Bath Road	B: A4174 Ring Road	C: A4 Bypass	D: A4175 Durley Hill	TOTAL
A: A4 Bath Road	2	503*	383	419	1,307
B: A4174 Ring Road	794	0	350	211	1,355
C: A4 Keynsham Bypass	610	519	0	13	1,142
D: A4175 Durley Hill	232	442	121	0	795
TOTAL	1,638	1,464	854	643	4,599

Notes: * Segregated left turn filter lane

Table 2.2 A4/A4174 Hicks Gate Roundabout: Traffic Volumes - Weekday 5:00-6:00 pm

Arm From	Arm To				
	A: A4 Bath Road	B: A4174 Ring Road	C: A4 Bypass	D: A4175 Durley Hill	TOTAL
A: A4 Bath Road	0	808*	571	471	1,850
B: A4174 Ring Road	633	0	530	390	1,553
C: A4 Keynsham Bypass	429	650	0	44	1,123
D: A4175 Durley Hill	167	324	164	0	655
TOTAL	1,229	1,782	1,265	905	5,181

Notes: * Segregated left turn filter lane

The turning volumes show there is a very significant flow using the segregated left turn filter lane between the A4 Bath Road and the A4174, particularly in the evening peak hour. Other flows of significance are both right turning, these being the right turns from the A4174 Ring Road and the A4 Keynsham Bypass. It should be noted that very heavy right turning movements are typically the most difficult to deal with at signalled roundabouts or indeed normal traffic signal junction layouts. In the case of Hicks Gate Roundabout, the right turn from the Bypass is less of an issue in control terms as the A4 Bath Road arm is not signalled. However, the right turn from the Ring Road is generally held on red at the second circulatory stop-line adjacent to Durley Hill. This can cause excess queuing blocking back into the Bypass entry, with this further compounded by westbound exit blocking on the A4 Bath Road arm in the weekday morning peak hour.

2.3 Existing Transport Problems

The A4/A4174 Hicks Gate Roundabout is a key junction on the A4 between Bristol and Bath and is located at the western end of the Keynsham Bypass. This is also the terminal junction at the southern end of the A4174 Ring Road route through East Bristol and the North Fringe. Not unexpectedly it is heavily trafficked in the weekday peak periods and at other times.

In the weekday morning peak period the operation of this junction is heavily affected by westbound queuing back from the A4 Bath Road/Emery Road junction in Brislington, which ‘exit blocks’ the roundabout in this direction. As a result, traffic turning right from the A4174 Ring Road or proceeding straight-ahead from the Keynsham Bypass is unable to exit freely, leading to relatively static/slow moving circulatory queuing which extends around the south and east sides of the roundabout for extended periods. This westbound exit blocking on Bath Road also affects drivers attempting to turn left from Durley Hill. Furthermore, the ‘excess’ circulatory queuing created impedes traffic attempting the make the right turn movement from the Keynsham Bypass to the A4174, and also the straight-ahead and right turning movements from the A4175 Durley Hill.

In the weekday evening peak period the exit blocking problems associated with the A4 Bath Road do not occur. Although there is queuing on this approach to Brislington it is not generally extensive enough to 'block back' to Hicks Gate. There is, however, regular queuing on the A4174 Ring Road approach which does not always clear in the first available green period. It should be noted that westbound queuing on the A4 Bath Road sufficient to reach back to Hicks Gate does occur from time to time in the weekday inter-peak period and also on Saturdays.

It should be noted that, in developing improvement options for this junction, the current queuing back from the A4 Bath Road/Emery Road junction in Bristol is not something that can be solved by any improvements made to Hicks Gate alone. The A4 Bath Road/Emery Road junction has been recently improved by Bristol City Council, but the recurrent westbound congestion on the Bath Road approach is caused as much by capacity constraint on the downstream section of the A4 through Brislington and regular over-capacity conditions at the Brislington Hill/West Town Lane junction in particular. In other words, there is no simple fix to remove this occurrence of exit blocking affecting the operation of Hicks Gate Roundabout, notably in the weekday morning peak period.

In the weekday evening peak period the existing traffic flow data available shows that the approach eastbound flow on the A4 Bath Road is 1,850 vph between 5:00-6:00 pm. In link capacity terms this represents a close to or maximum throughput at the two-lane to one lane merge point just east of the existing Brislington Park and Ride exit. As such, there is very little potential for this approach volume to increase over this hour. At present there are no queuing problems on the A4 Bath Road approach to Hicks Gate Roundabout in either peak hour. Traffic routing via the roundabout is required to 'give way', with sufficient gaps in the circulating flow generally available. The high left turn flow to the A4174 Ring Road is accommodated via a segregated lane avoiding the roundabout with a 'lane gain' termination. The volume of traffic making this left turn is such that alternative termination using a merge onto the Ring Road could be problematic.

3 Understanding the Future Transport Situation

3.1 Future Land Uses and Policies

3.1.1 Committed development in Keynsham

The Local Plan for BANES (2011-2029) comprises two separate Development Plan Documents; the Core Strategy (adopted July 2014) and the Placemaking Plan (adopted July 2017). Volume 3 of the adopted Placemaking Plan focuses on Keynsham.

BANES Council is currently preparing a new Local Plan for the District. The new Local Plan 2016-2036 Issues and Options document was published for comment in November 2017. The document will undergo further rounds of consultation before formal adoption.

The adopted Core Strategy for BANES outlines a requirement for 12,956 houses which includes both the local plan delivery shortfall (1996-2011) and demographic need (2011-2029). 2,150 of these houses are to be provided in Keynsham, of which 1,600 will be provided through Strategic Sites.

1,600 new jobs will also be created between 2011 and 2029 primarily by increasing the stock of office floorspace in Keynsham, complemented by an extension to the Broadmead/ Ashmead/Pixash industrial Estate.

Strategic Sites in Keynsham are located to the south west and east of the town as shown in **Figure 3.1** below within the Core Strategy, land has also been removed from the Green Belt at East Keynsham and safeguarded for possible development in the future. Development of this land will be permitted only when allocated for development following a review of the plan.

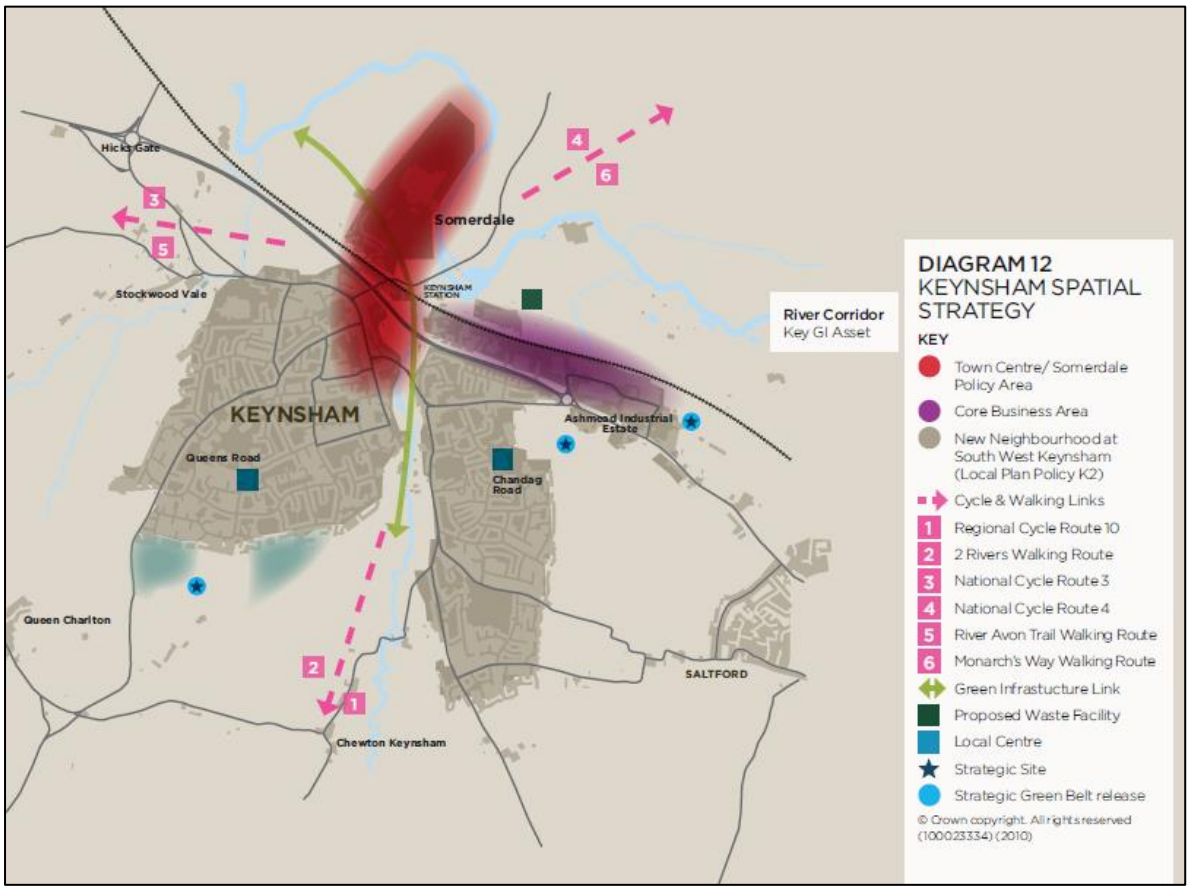

Figure 3-1: Keynsham Spatial Strategy (Core Strategy 2011-2029)

3.1.2 JSP proposals

In order to deliver the housing requirement for the West of England of 102,200 homes between 2016 and 2036, the JSP makes provision for the supply of at least 105,500 new homes, to enable flexibility. 14,500 of these dwellings are to be provided in Bath and North East Somerset. The Spatial Strategy also supports the delivery of 82,500 jobs across the West of England.

In order to achieve the JSP housing and job requirements, Strategic Development Locations have been identified across the region (**Figure 3.2**). Two are located within B&NES as follows:

- North Keynsham; and
- Whitchurch.

In addition to the two above sites in B&NES, the Strategic Development Location at Brislington within the Bristol City Council administrative area can also be expected to impact on future transport conditions at Hicks Gate. This is the land that is expected to be released when the existing Park and Ride site at Brislington is relocated eastwards to a new site in the vicinity of Hicks Gate Roundabout.

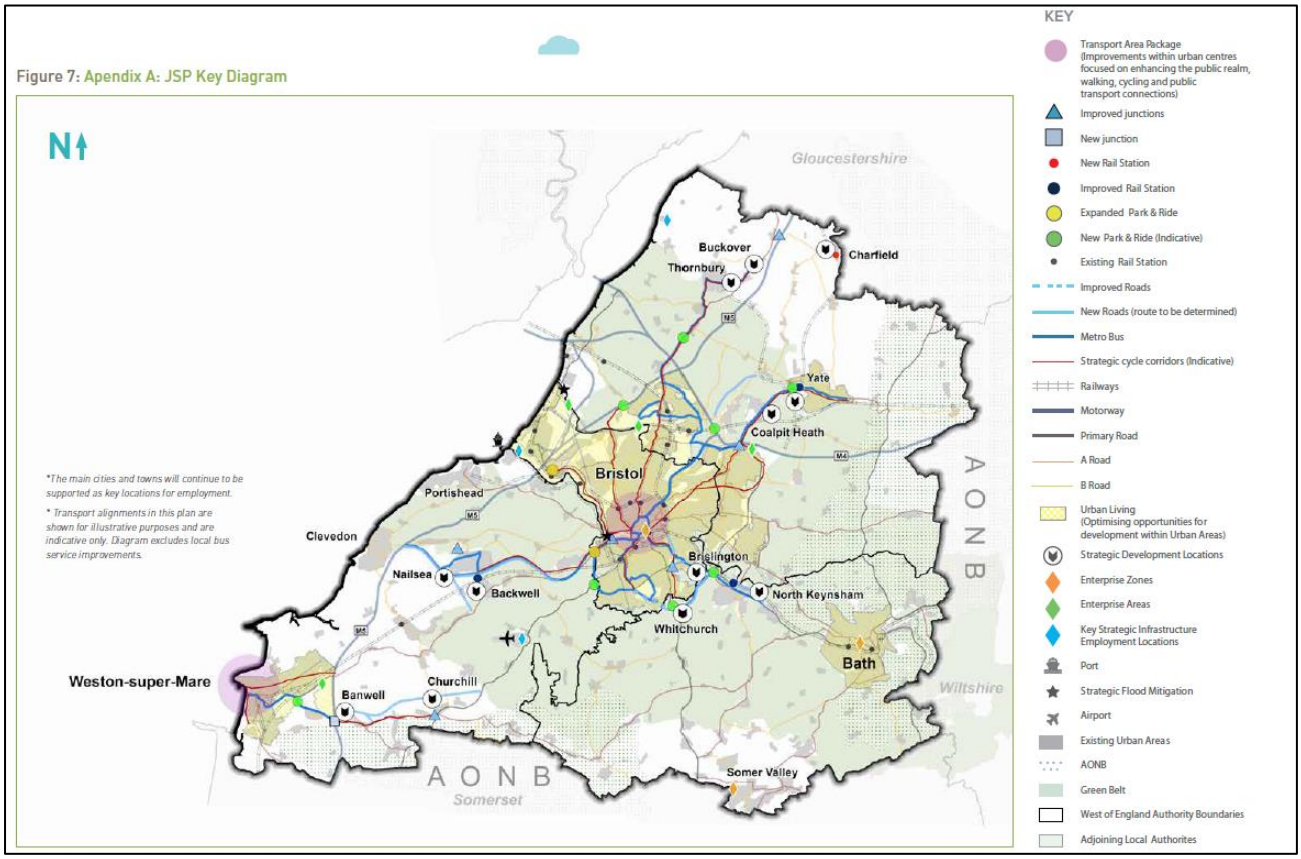

Figure 3-2: JSP Key Diagram, showing SDL locations

3.1.2.1 North Keynsham SDL

This SDL lies to the North East of Keynsham, between the town and the River Avon. The majority of the area lies between the river and the Great Western Main Line (GWML) with a smaller section between the railway and the A4. It also includes the land south of the A4 which is safeguarded for development through BANES Core Strategy (Policy KE3A).

Development at the North Keynsham SDL is expected to include:

- The delivery of around 1,500 new homes, with 1,400 homes built in the plan period, optimising densities and including affordable housing.
- Around 50,000 m^2 of employment floorspace.

- Creation of a new local centre to provide a focal point for the new community with an appropriate range of small-scale retail, services and facilities.
- A new primary school on site and financial contribution to the provision of a secondary education provision off site.
- New mixed tenure marina providing residential and leisure moorings.
- Provision of key transport infrastructure including:
  - A multi modal link from Avon Mill Lane (A4175) to the A4 Bath Road capable of performing a wider strategic function for traffic relief in Keynsham;
  - pedestrian and cycle connections in all directions which link the site with key services and facilities. These include Keynsham rail station, the town centre, the A4 public transport corridor, the A4175 Keynsham Road and the Bristol to Bath cycle path with the potential for new bridge connections across the River Avon;
  - where existing vehicle routes across the railway line are no longer required for continued use by motor traffic, seek to downgrade them to pedestrian and cycle only links;
  - Metrobus (high quality public transport) route from Bristol to Keynsham on the A4 corridor;
  - high frequency local bus service following an orbital route connecting the site to the town centre, Metrobus, rail and other local bus services;
  - improved passenger facilities at Keynsham rail station;
  - off-site junction improvements including at Hicks Gate; and
  - expanded or relocated A4 Bristol Park & Ride.

As the SDL site is constrained by both the railway line and river, new access is required in order for the site to be developable. The JSP states that:

"No housing will be completed at the North Keynsham SDL ahead of the Avon Mill Lane to A4 link, Keynsham rail station improvements and Metrobus (high quality public transport) route from Bristol to Keynsham on the A4 corridor being completed. This should not prejudice a full Transportation Assessment which will be required for each location."

3.1.2.2 Whitchurch SDL

The development of land at Whitchurch SDL will include:

- Around 2,500 new homes, optimising densities with 1,600 homes built in the plan period, including affordable housing.
- Employment, retail, education, provision of key transport infrastructure

No dwellings will be completed at the Whitchurch SDL ahead of:

- Park & Ride; and
- the multi-modal link A4-A37-south Bristol link, including as a potential pre-requisite, the Callington Road scheme being completed.

3.1.2.3 Brislington SDL

The JSP Emerging Spatial Strategy (Nov 2016) identified Brislington as accommodating 750 dwellings. The 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. As noted earlier, this site is dependent on the relocation of Brislington Park & Ride to a location further east on the A4 Bath Road.

3.2 Future Changes to the Transport System

3.2.1 Keynsham Transport Strategy

A new Keynsham Transport Strategy was approved in July 2016. The strategy looks to reduce the existing problems caused by congestion and support delivery of the Core Strategy, enabling growth. It also builds on the policies and measures included in successive Joint Local Transport Plans.

The strategy includes the following measures as high priorities in the short term to meet the vision and objectives:

- Improved cycle routes to the main schools.
- Improved pedestrian facilities in the town centre and to/from the centre and rail station.
- Continue to work with the bus operators on improved ticketing and simplified fare structure. The Council is to actively progress and monitor their Corporate Travel Plan at the Civic Centre.
- An improvement at the Wellsway, Bath Hill and Bath Road junction to increase its capacity.

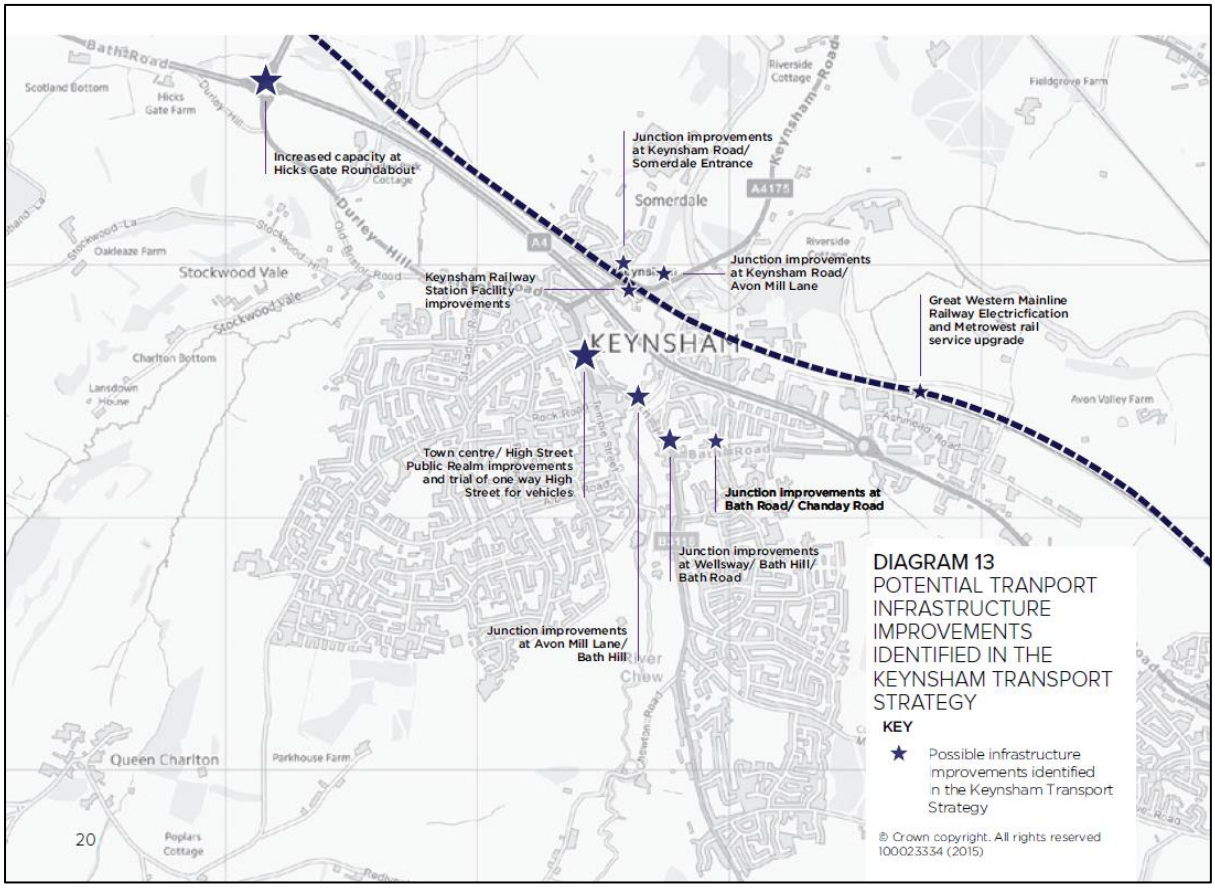

Figure 3-3: Potential transport infrastructure improvements (source: Volume 3 of the Place Making Plan for BANES)

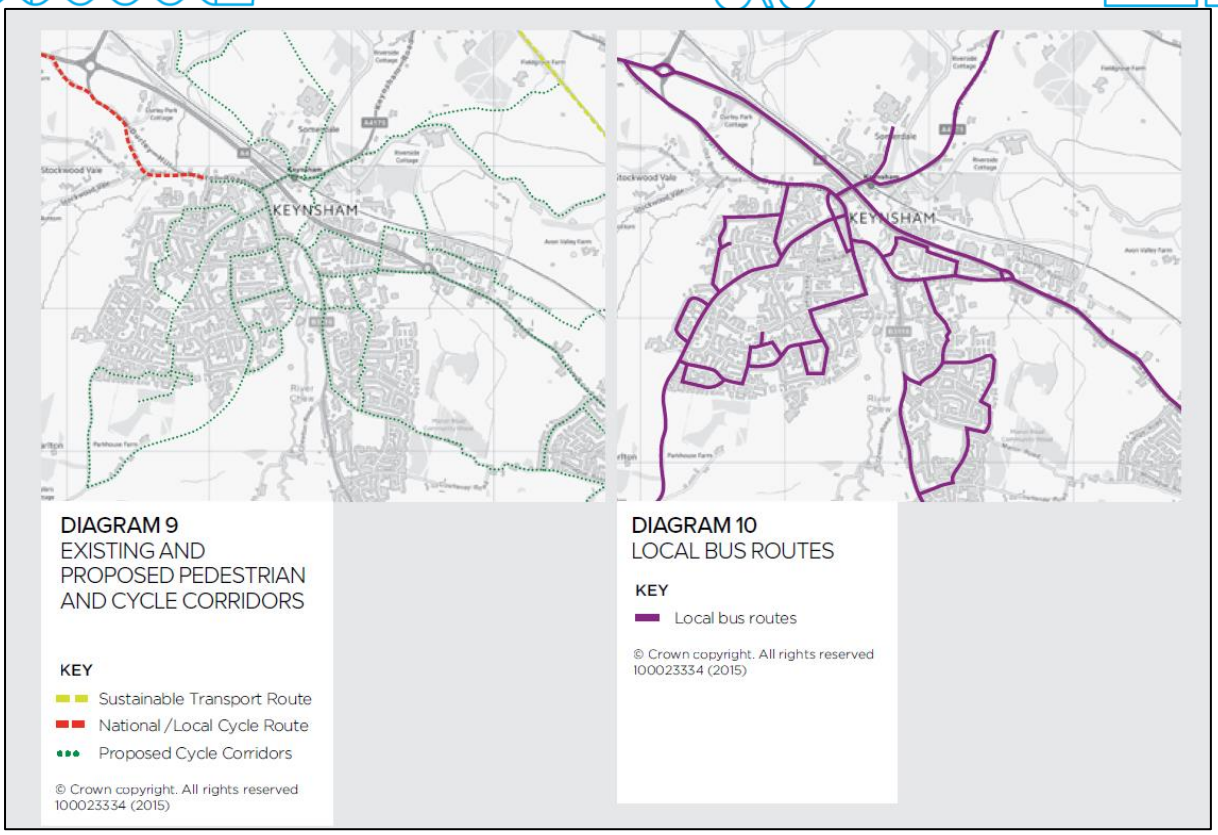

Figure 3-4: Current and proposed bus, pedestrian and cycle routes (source: Volume 3 of the Place Making Plan for BANES)

3.2.2 West of England Joint Transport Study

To aid 'joint working' The West of England Combined Authority (WECA) was established in May 2017 with the election of the new Metro Mayor. Comprising B&NES, Bristol and South Gloucestershire, it is working with partners including the West of England Local Enterprise Partnership, North Somerset Council and other local service providers. Critically, this new Mayoral body provides devolution of transport budgets, enabling the sub-region to potentially deliver more ambitious transport projects with greater certainty.

In addition to accommodating committed growth, the JSP recognises that the transport network will need to cater for the increased demand for travel resulting from employment and population growth in the wider catchment area. As such, the JSP is complemented by the Joint Transport Study (JTS), which sets out the transport vision required to deliver the spatial strategy in a sustainable manner. The JTS was endorsed by the West of England Joint Committee on 30th October 2017.

Building on the current West of England Joint Local Transport Plan (LTP) 2011-2026, it has been undertaken in parallel to develop strategic transport proposals for delivery up to 2036 that address current challenges on the network and to inform future development proposals.

The South East (Bath to Bristol) section of the JTS includes Keynsham, and priorities for this are to include:

- Improved orbital connectivity in South Bristol;
- Improved connectivity in the Bristol-Bath corridor;
- Reduced impacts to through traffic in Bath; and
- Improved regional connectivity to the south coast.

The proposals are shown on **Figure 3.5**.

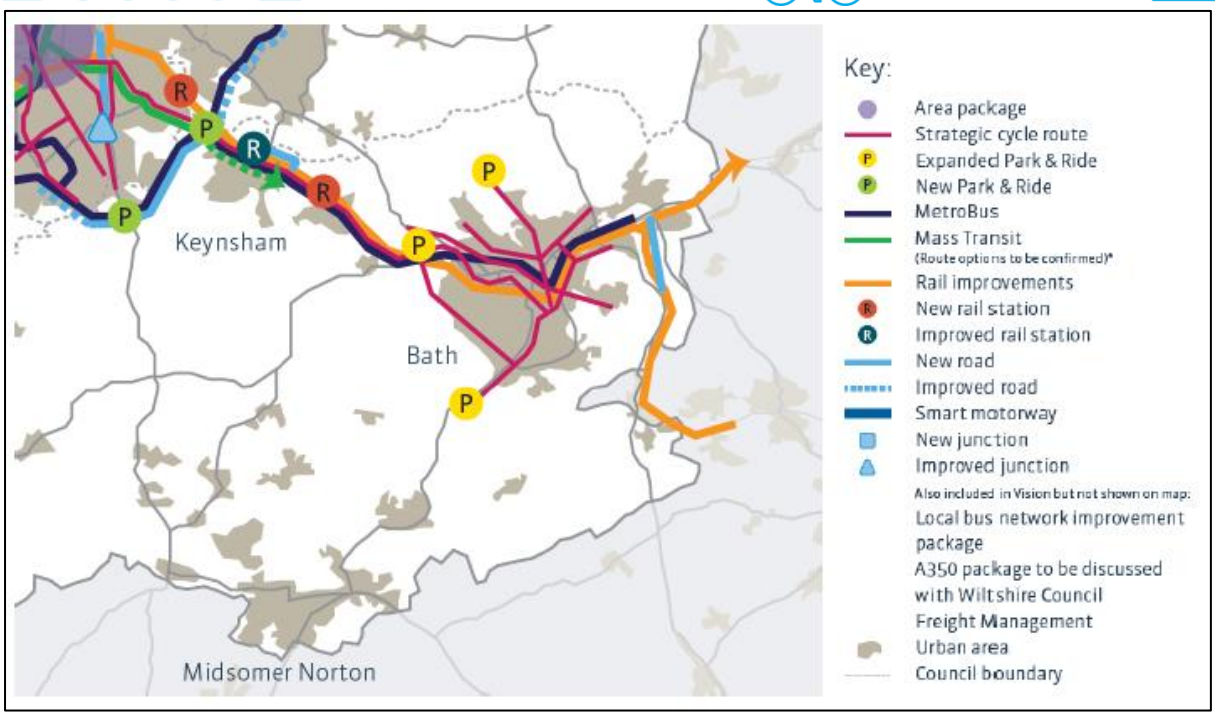

Figure 3-5: South East Area (Bath to Bristol)

The JTS includes a vision for the following local complimentary schemes:

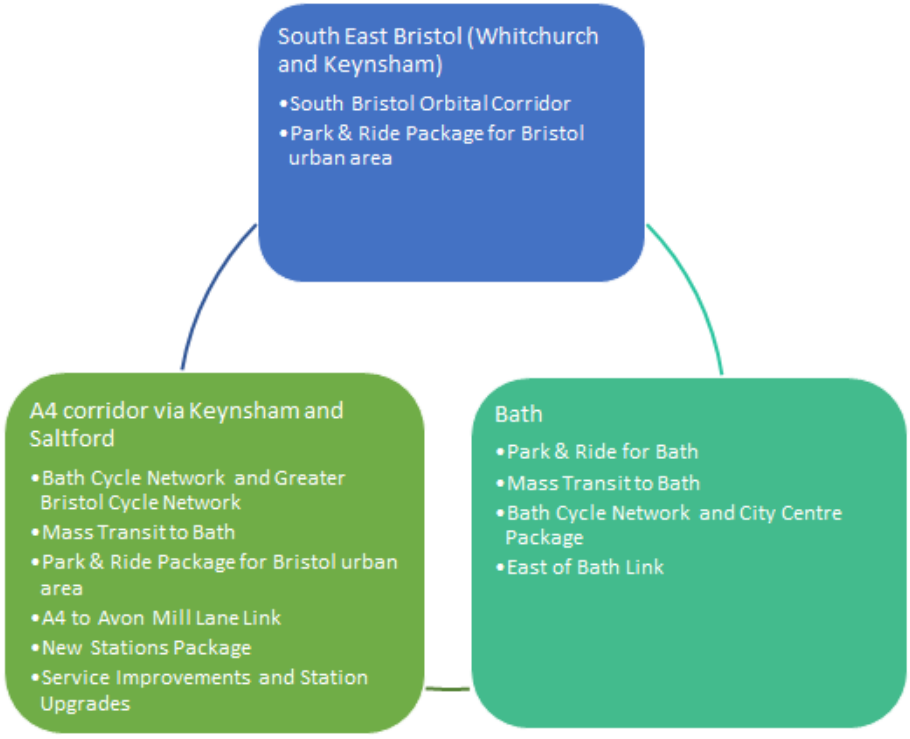

*Figure 3-6: **Complementary JTS proposed schemes***

With regard to the A4 corridor via Keynsham and Saltford, the JTS includes a proposal for *"mass transit between Bristol and Bath… to complement an improved rail corridor and better accommodate a wider range of trip patterns".* In addition, the focus of this study, a new highway connection from the A4 to the A4175 at Avon Mill Lane is included. The JTS states that "*this will provide access to the North Keynsham Strategic Development Location and will also provide traffic relief in Keynsham town centre*".

Appendix A of the JTS sets out the detailed assessment of the 34 major schemes included in the Transport Vision, including the A4 to Avon Mill Lane Link, Keynsham. Appendix A states that:

"Significant growth is planned at Keynsham in the existing Bath & North East Somerset Core Strategy. The Placemaking Plan for Keynsham includes provision for a new highway link between the A4 and A4175 via Avon Mill Lane, to ease congestion in the town and to provide access to development. The JSP also proposes strategic development at North Keynsham, which would require access via this route."

3.3 Future Traffic Demand

3.3.1 General

Transport models have played an important role in quantifying and understanding current and future travel demands in the WoE region, with the Greater Bristol Strategic Transport model (G-BATS4) model playing an important role in understanding the likely impact of growth at the strategic level.

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 analysis of 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.

3.3.2 Core Scenarios

As with the wider work for SE Bristol described in the '**South East Bristol and Whitchurch Package Options Assessment Report**' (SEBWP) - Atkins, this subsidiary OAR examining specific changes to the Hicks Gate junction has used the 2021 and 2036 Core Scenarios. These have been developed to be consistent with WebTAG Unit M4 on Forecasting and Uncertainty. This scenario was created using Reference Case travel demand reflecting 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 have been taken into account through the Variable Demand Model (VDM). This VDM process modifies the Reference Case demand forecasts to reflect the impacts of increasing congestion on the road network, so producing without-scheme (Do Minimum) scenarios.

The creation of the Core Scenarios (Atkins) 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 as to the likelihood that they will occur. Only changes which are considered 'near certain' or 'more than likely', are included in the Core Scenario. 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. As such, 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.

In reality, the concentrations of SDL development at Whitchurch, North Keynsham and Brislington can be expected to increase pressure locally on Hicks Gate, with the operation of any revised junction configuration here also critical to determining the level of expected traffic usage of the proposed A4-A37 Link Road options set out in the SEBWP OAR. However, introduction of these developments will most likely result in changes to wider routing of 'base' traffic, with some diversion away from Hicks Gate as a response to SDL generated traffic locally. In generating a set of 'Design Flows' for assessing the impact of changes to Hicks Gate it was important to ensure that any existing capacity constraint was removed here in the G-BATS4 modelling with an assumed A4-A37 Link Road connection in place. This yielded a maximum expected level of 'base' demand for design purposes, accepting that some of this would in time be displaced with the build-out of the SDL sites.

3.4 Future Transport Related Problems

The potential impacts of committed (non-JSP) and JSP growth on the highway network around Hicks Gate has been described in the wider G-BATS4 modelling work undertaken and described in the SEBWP OAR. In summary the future transport related problems linked to the existing congestion issues at Hicks Gate Roundabout are as follows:

- Existing delay problems at Hicks Gate will be significantly exacerbated as it is forced to accommodate increases in both radial and orbital traffic movements;
- Associated impacts as trips divert to the local network - particularly around Whitchurch;
- The effectiveness of a new A37-A4 Link Road, and westward connection to Whitchurch Lane (JSP) will be compromised by failing to alleviate 'bottleneck' conditions at the Hicks Gate junction. In short, the capacity of this junction must be significantly improved to cater for a significant change in orbital traffic demand.

4 Need for Intervention, Objectives and Geographical Scope

4.1 Summary of Current and Future Problems, Impacts and Outcomes

In summary, intervention is needed to address:

- Poor strategic transport links to/from South Bristol, with long journey times due to regular congestion impacting on business performance and constraining inward investment;
- Linked to the above, congestion and slow journeys caused by 'pinch-points' or 'bottlenecks' in the SE Bristol/Keynsham/Whitchurch area highway network. This includes Hick Gate Roundabout, the A4 Brislington Hill/West Town Lane junction and the A37/Staunton Lane traffic signals in Whitchurch village. This contributes to high levels of traffic use on unsuitable minor roads.
- High levels of orbital movement using urban roads due to a lack of an adequate alternative. This results in heavy traffic flows, including goods vehicles, routing via Brislington, causing congestion and poor air quality.
- Committed housing development and economic growth in Keynsham, which will exacerbate these problems. This will be further compounded by the SDL developments at Whitchurch in particular, and also those planned at North Keynsham and Brislington;
- Problems in reallocating road-space to improve options for active travel and public transport. The current transport network in SE Bristol limits these opportunities, with heavy traffic and congestion further hampering any removal of highway capacity to introduce walking, cycling and public transport measures.

It is accepted that improvements undertaken to Hicks Gate Roundabout as a 'standalone' scheme will not address these issues. However, improvements here will be needed as part of an intrinsic scheme with the A4-A37 Link Road to deliver an adequate level of orbital capacity on the extended Ring Road route.

4.2 Scheme Objectives and Outcomes

The JTS sets out the following objectives for the 'South Bristol Orbital Corridor (Road 5'):

- Improve strategic connectivity to South Bristol to improve business competitiveness and attractiveness to future business investment;
- Reduce traffic flows on busy urban roads to improve environmental conditions and enable road-space reallocation;
- Improve resilience in the wider transport network by enabling proactive management of traffic;
- Mitigate the effects of traffic generated by additional development;
- Support sustainable travel choices for new development in the JSP by reducing traffic entering the urban area and enabling reallocation of road-space.

These objectives have been reviewed and tailored into general and corridor/site specific objectives:

General Objectives

- Improve transport network resilience and journey time reliability by reducing existing congestion in this location, whilst maximising the potential for traffic transfer/use of a future A4-A37 Link Road connection.

Specific Objectives

- Remove the barrier to growth in houses and local jobs by providing a significant long-term uplift in capacity at Hicks Gate to locally mitigate traffic impacts arising from SDL developments at Whitchurch, North Keynsham and Brislington, whilst still providing a 'net' benefit to existing highway users (with the A4-A37 Link Road);
- Provide short term benefits in highway operation through delivery of an earlier Phase 1 or interim scheme. This will help to cater for existing committed development growth in Keynsham, and any early build-out of the North Keynsham SDL, which is not 'dependency linked' in the same way to the delivery of the A4-A37 Link Road;
- Facilitate relocation and integration of the Park and Ride site at Brislington, and the introduction of priority measures on the westbound A4 Keynsham Bypass approach to Brislington (Emery Road);
- Improve opportunities for contributing locally to improved NMU facilities and routes in the Hicks Gate area.

4.3 Measures for Success

The table below presents measures for success for each objective.

Objective	**What do we need to do to achieve this**	**How will we measure our success**
Improve transport network resilience and journey time reliability by maximising potential transfer/use of an A4-A37 Link Road	• Provide a suitable uplift in junction capacity at Hicks Gate to cope with expected 2036 traffic levels	Results of traffic modelling. PRC and delay estimates relative to an unimproved case - 2036.
Effectively enable growth associated with SDL sites at Whitchurch and Brislington	• As Objective 1 above	As Objective 1 above
Deliver 'short term' benefits by allowing early delivery of a Phase 1 or 'Interim' scheme	• Ensure that the scheme as proposed can be suitably phased to allow a Phase 1 'interim' scheme to be developed, with easy transition to a 'full' scheme with the A4-A37 Link Road	Results of traffic modelling. PRC and delay estimates relative to an unimproved case – 2021 Demonstrated Phasing Plan
Facilitate integration of a relocated Park and Ride site from Brislington, and effective priority access/bus priority.	• Maintain or improve priority access facilities for Park and Ride users, notably from the westbound A4; • Maintain westbound bus priority into Brislington on the A4 Bath Road; and • Ensure Park and Ride access can be obtained from the A4175 Durley Hill and the Link Road without necessary routing via Hicks Gate Roundabout.	Consideration during design process and developed proposals

Objective	What do we need to do to achieve this	How will we measure our success
Improve opportunities for contributing locally to improved NMU facilities and routes in the Hicks Gate area	• Improve 'desire lines' and the quality of routes	Consideration during design process and developed proposals

Table 4.1: Measures for Success

5 Generating and Initial Sifting of Options

5.1 Approach to Option Generation

The JTS has identified as part of the 'South East Bristol and Whitchurch Package' (SEBWP) the need for improvements to Hicks Gate Roundabout to address existing congestion problems in this location, whilst providing the capacity necessary to cater for SDL developments at Whitchurch, North Keynsham and Brislington. In doing so, any revised configuration would have to provide a capacity 'uplift' sufficient to cater for expected usage of an A4-A37 Link Road, such that it would not unduly constrain traffic transfer to what would be an extension of the orbital Ring Road route.

A number of options have this been developed based on:

- General and corridor/site specific objectives;
- Local capacity on the highway network;
- Land use planning aspects;
- High level environmental constraints; and
- Fit with existing local, regional and national programmes and strategies.

5.2 Results of Option Generation

Six possible 'long list' options considering both at-grade improvement and/or grade separation have been developed and examined. The set of concept design drawings developed for the long-list schemes are included in **Appendix B**. The included drawings are as follows:

- Drawing No **674726.CA.51.002**: Option 1 - General Arrangement: This is based on the scheme developed by CH2M in 2015. However, this did not consider the inclusion of a A4-A37 Link Road at the time;
- Drawing No **674726.CA.51.003**: Option 2 - General Arrangement: At-grade circulatory carriageway enlargement (gyratory) with cut-through link (Variant 1);
- Drawing No **674726.CA.51.004**: Option 3 - General Arrangement: At-grade circulatory carriageway enlargement (gyratory) with cut-through link (Variant 2);
- Drawing No **674726.CA.51.005**: Option 4 - General Arrangement: Replacement traffic signal controlled crossroads;
- Drawing No **674726.CA.51.006**: Option 5 - General Arrangement: Grade-separation on the east-west A4 axis (Fly-over); and
- Drawing No **674726.CA.51.007**: Option 6 - General Arrangement: Grade-separation between the A4174 Ring Road and the Link Road/A4175 Durley Hill

All the improvement options show the proposed northern end of the alignment of the A4-A37 Link Road (SEBWP). This link is shown on the drawings as D2AP standard, but this could equally be a single carriageway type (S2 or WS2) if the forecast AADT range suggests this would be adequate. The tie-in with the A4175 Durley Hill using a proposed roundabout and the spur connection to the Hicks Gate junction has been developed as part of this OAR, but this is common to all options. The Hicks Gate reconfiguration options are considered are described in greater detail in Table 5.1 below.

Option Ref	Description
1	This option involves the provision of a displaced link connection between the A4 Keynsham Bypass and the A4174 to the NE of the roundabout. The link is primarily intended to remove right turning traffic from the westbound A4 from the roundabout, thus removing the current impedance to this movement created by the circulatory queuing around the south and east sides of the junction in the morning peak hour. However, the infrastructure change proposed also includes a left filter link for traffic routing between the A4174 and the eastbound A4. The proposed arrangement will require new signalled junctions on the A4 Bypass and A4174 arms in the vicinity of the roundabout. On the westbound A4 approach this is needed to safely facilitate the right turn 'cross-over' conflict with the eastbound A4. On the A4174 approach an additional traffic signal controlled 'node' would be needed to safety cater for the right turning vehicles joining the Ring Road from the new link. Although the right turn 'feed' to the new link is only a single lane, two lanes are provided within the link itself in the direction of the A4174 to afford more queuing capacity. This is because the optimal co-ordination will not necessarily permit the right turning traffic entering the link to proceed uninterrupted through the downstream signals on a 'green wave', so sufficient 'holding' capacity for the right turn platoon would be essential. The new signals on the A4174 necessary to ensure safe right turn egress from the proposed link will require signalling the current 'free flow' left filter lane from the A4 Bath Road, as well as traffic exiting via the roundabout to the Ring Road.
2	This option proposes an extension of the circulating carriageway to the SE to create a larger gyratory configuration. The existing western side of the roundabout is, however, retained as a 'cut-through' link to cater for the movement between the A4 Keynsham Bypass and the A4174. This will remove this as a conflicting circulatory movement at the A4715/Link Road and A4 Bath Road entries, although it would be necessary to signal the exit from this link on the north side of the gyratory. The elongated circulatory sections on the north and south sides of the gyratory will give greater capacity for holding queuing traffic internally without risk of upstream entry blocking. This is particularly important on the south side, as the A4175 Durley Hill/Link Road approach will require a greater green time, so requiring the heavy right turn movement from the A4174 to the A4 Bath Road to be held at red at the circulatory stop-line here for a longer period. The segregated left turn lane on the A4 Bath Road approach is retained, with other traffic exiting to the A4174 required to merge. The flared four lane section of the A4174 Ring Road approach is extended, and a segregated left turn lane added.
3	This option also proposes an extension of the circulating carriageway to the SE to create a larger gyratory configuration, as with Option 2. The only difference from Option 2 is that the 'cut-through' link created in this case caters for the movements from the A4175/Link Road to the A4174 and the A4 Bypass. As such the right turn movement from the A4 Bypass to the A4174 is required to route via the main gyratory.
4	This option proposes replacement of the part signalled roundabout with a large signal-controlled cross-roads' junction. This would require a four stage Method of Control to deal safely with all vehicular conflicts. However, the addition of controlled crossing points for pedestrians/cyclists could add to complexity in staging, although unlikely. As shown, the NMU route between the A4175 Durley Hill and the A4174 uses the existing Toucan crossing on the A4 Bath Road to the west, which is indicated as retained. However, this could alternatively be accommodated by adding crossing facilities to the Bath Road arm of the junction, with a further controlled crossing provided on the segregated left filter lane. As part of the layout, a segregated left turn lane is also proposed on the A4174 Ring Road approach.
5	This option retains the existing roundabout circulatory extents, but grade separates the straight-ahead movements between the A4 Keynsham Bypass and the A4 Bath Road (E-W Axis). Structural retaining walls are shown in lieu of earthworks to reduce the 'footbridge' of the interchange. The existing 'staggered' Toucan crossing on the A4 Bath Road to the west would be lost, so requiring replacement crossing provision to be made on the west side of the roundabout.
6	This option retains the existing roundabout circulatory extents, but grade separates the straight-ahead movements between the A4174 and the A4175/Link Road (N-S Axis). A critical constraint is the GWML railway bridge and its carriageway level to the north, and the limited distance of around 220m to the north side of the roundabout. As such, achieving satisfactory vertical alignment will most likely require a corresponding lowering of the existing roundabout at Hicks Gate to achieve a suitable gradient and required headroom clearance at the bridge structure(s). Vertical tie-in on the south side is less of an issue as the land rises towards the proposed roundabout at the northern end of the A4-A37 Link Road. However, achieving a safe tie-in for the necessary southbound slip-road connection catering for movements from the A4 (to the A4175 and the Link Road) will be difficult, and could create road safety issues if too close to the 'give way' line due to necessary weaving/lane changing over a relatively short length.

Table 5.1: Long list of options

5.3 Derivation of Design Flows

An important element of this 'sifting' stage was determining the operating performance of the revised junction configurations in 2036. This is clearly key to satisfying two of the 'key' objectives, that of mitigating the effects of the SDL developments and also improving transport network resilience and journey time reliability by reducing existing congestion in this location. Both in part are dependent on maximising the potential for traffic transfer/use of a future A4-A37 Link Road connection. To do this the following approach was adopted in getting 2036 turning flow demands for the Hicks Gate junction:

- The 2013 'base' turning flows for Hicks Gate from G-BATS were compared with the MCC undertaken in June 2012 to assess the 'goodness' of fit. It was found that whilst the overall inflows into the junction were broadly compatible in the weekday AM (8:00-9:00 am) and PM (5:00-6:00 pm) peak hours there were some notable differences in the observed and modelled turning patterns. As such it was decided to apply the predicted 2013-2036 growth from the G-BATS model for these hours to the June 2012 volumes. In other words, direct application of the 2036 forecasts was avoided because of the 2013 calibration findings at Hicks Gate;
- The 2036 scenario tested assumed that an A4-A37 Link Road was in place. In order to ensure that traffic usage was not constrained by existing capacity limitations at Hicks Gate, the junction coding at the latter was adjusted to remove any impediment to assignment. This involved making it in effect a 'dummy' node with infinite capacity. This ensured that 2036 turning flows at Hicks Gate were only constrained by the capacity limitations of the surrounding network, and not by the signalled roundabout itself;
- As noted above, the predicted 2013-2036 growth for the weekday AM and PM peak hours was applied to the June 2012 turning flows (MCC) to get the 2036 'Design Flows' used for option evaluation. The derivation process and out-turn 2036 'Design Flow' matrices are included in **Appendix C**.

The results show that:

- In the AM peak hour, the predicted growth between 2012-2036 with the addition of an A4-A37 Link Road would increase inflow demand to Hicks Gate from 4,599 to 6,648 vph (+44.5%);
- In the PM peak hour, the predicted growth between 2012-2036 with the addition of an A4-A37 Link Road would increase inflow demand to Hicks Gate from 5,181 to 7,323 vph (+41.3%);
- In the AM peak hour, the predicted inbound flow on the A4 Bath Road towards Brislington is marginally higher than the 2012 MCC, albeit capacity here is already constrained and opportunity for further growth extremely limited. It may be inferred from this that, despite the construction of the A4-A37 Link Road, the level of flow on the westbound A4 Bath Road will still be sufficient to create a high risk of exit blocking affecting Hicks Gate in this period as now;
- In the PM peak hour, the flow on the A4 Bath Road from Brislington at 1,879 is virtually identical to the 2012 MCC (1,850). This is realistic as the one lane section between the marge at the current Park and Ride access and Ironmould Lane will continue to control and restrict this outflow; and
- Most of the growth in both periods is associated with the added orbital movements between the A4174 and the new A4-A37 Link Road. The other movements through Hicks Gate remain similar to current and, critically, are not shown to be reduced by the addition of the Link Road.

It should be noted that, as the GBATS source flows are WebTAG compliant in ignoring non-committed development, the traffic forecasts exclude specific consideration of the local traffic generation effects of the SDL sites at North Keynsham, Whitchurch and Brislington. However, this should not necessarily be assumed as necessarily 'additional' to the derived 'Design Flows' if specifically considered/assigned in GBATS. This is because this development traffic could reasonably be expected to have a suppression or re-assignment effect on 'base' traffic. However, achieving an

uplift capacity of +40-45% which is sufficient to meet these design flows would easily address any generated traffic effects of the SDLs at Hick Gate, whilst still providing a 'net' residual benefit to base-line conditions.

5.4 Approach to Initial Option Sifting

All scheme options have undergone a robust but proportionate sifting process to identify a short-list of the better performing schemes that justify more detailed development and consideration. The DfT '*Transport Analysis Guidance: The Transport Appraisal Process'*[8] outlines the approach to be taken for the initial sifting of options.

It states that '*an initial sift should… be undertaken to identify any 'showstoppers' which are likely to prevent an option progressing at a subsequent stage in the process'*. The process involves discarding options that:

- *'would clearly fail to meet the key objectives identified for intervention;*
- *do not fit with existing local, regional and national programmes and strategies, and do not fit with wider government priorities; and*
- *would be unlikely to pass key viability and acceptability criteria (or represent significant risk) in that they are unlikely to be:*
    - *deliverable in a particular economic, environmental, geographical or social context e.g. options which would result in severe adverse environmental impacts which cannot be mitigated against or where the cost of doing so is too high;*
    - *technically sound;*
    - *financially affordable; and,*
    - *acceptable to stakeholders and the public.'*

The initial long list of options has therefore been assessed against the defined scheme objectives, and against the five cases reported in a Transport Business Case. 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'.

In order to assess options against the five cases, the following supporting studies have been undertaken. These are included in the listed appendices:

- Environmental Baseline (**Appendix D**);
- Flooding (**Appendix E**); and
- Services (**Appendix F**).

The detailed (desk based) assessment within these studies has assisted with the identification of 'showstoppers', as referenced in the Transport Analysis Guidance. In particular, whether scheme options are deliverable or would result in severe adverse environmental impacts.

[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/431185/webtag-tag-transport-appraisal-process.pdf

5.5 Results of Initial Sifting

All of the options presented in Table 5.1 have been considered against scheme objectives and the five cases. Option Sifting Tables showing the analyses are included as **Appendix G**, with decision making/comments based on the constraints and technical work undertaken to date (presented in **Appendices C to F)**, The results of the initial sifting are summarised in **Table 5.2.**

Option	Strategic Case		Economic Case			Management Case		Details
	Support Objectives	Scale of Impact	Economic Growth	Environment	Well Being	Timescales	Deliverability	
1	Fail	Partial	Fail	Pass	Pass	Pass	Pass	**DISCARD based on failure to support 'Objectives' and 'Economic Growth'** LinSIG modelling of this option shows that the required signal junction on the north side of the roundabout (A4174), and expressly the necessary removal of the merge on this exit, would fail to provide the necessary northbound capacity for the straight-ahead movement from the Link Road/A4175 Durley Hill to the A4174 Ring Road using the 2036 'Design Flows'. As a result, this southern approach to Hicks Gate would be over-capacity in both peak hours, and particularly so in the AM peak hour. Queuing in the latter period would be sufficient to extend back through the upstream roundabout between the A4175 Durley Hill and the new Link Road. This capacity with this option would be inadequate, and it would fail in meeting the criteria for growth and network resilience.
2	Pass	Pass	Pass	Pass	Pass	Pass	Pass	**RETAIN**
3	Pass	Pass	Pass	Pass	Pass	Pass	Pass	**RETAIN**
4	Fail	Partial	Fail	Pass	Pass	Pass	Pass	**DISCARD based on failure to support 'Objectives' and 'Economic Growth'** LinSIG modelling of this option shows that the four stage Method of Control needed as a minimum to accommodate the various vehicle conflicts would result in operational capacity falling well below that necessary to accommodate the 2036 'Design Flow' volumes. As such, Option 4 would fail in meeting the criteria for growth and network resilience.
5	Partial	Partial	Pass	Fail	Pass	Pass	Fail	**DISCARD based on 'Deliverability', 'Environmental impact' and the ability to deliver growth** The construction of a fly-over structure on a E-W axis along the A4 would be visually intrusive, whilst it would not cater for the more logical orbital movements between the A4175/Link Road and the A4174 Ring Road which are predicted to be much higher in 2036. The 'Design Flows' in Appendix C show that the predicted two-way straight-ahead movements on the A4 in the AM/PM are 898 and 1,045 vph respectively, compared to 1,897 and 2,108 on the N-S axis between the A4175/Link Road and the A4174. In short, grade separating the A4 would offer much less relief whilst, in the AM peak hour, there is limited growth potential on the westbound Bath Road exit towards Brislington anyway. This situation which leads to exit blocking now is not expected to diminish in the future, such that the westbound part of the fly-over could simply serve to hold 'excess' queuing traffic clear of the roundabout. With this option the roundabout circulatory would remain largely unaltered, although the A4 Bath Road approach would need to be signalled to accommodate a controlled crossing (Toucan) to replace the existing stand-alone 'staggered' crossing to the west which would be lost. Taking into account the traffic removed by the grade-separation, there would still be a net increase in traffic inflow to the

Option	Strategic Case		Economic Case			Management Case		Details
	Support Objectives	Scale of Impact	Economic Growth	Environment	Well Being	Timescales	Deliverability	
								roundabout (2036) of +1,151 vph (AM) and +1,097 vph. LiinSIG modelling shows that this level of residual growth could not be accommodated with essentially the same at-grade roundabout configuration under the structure.
6	Pass	Partial	Pass	Fail	Pass	Pass	Fail	**DISCARD based on 'Deliverability' and 'Environmental Impact'** The construction of a fly-over structure on a N-S axis extending from a point close to the GWML bridge to the roundabout on the south side of Hicks Gate would be visually intrusive, whilst there will be significant deliverability issues in terms of vertical alignment. The need to retain the 'lane gain' termination for the segregated left turn lane between the A4 Bath Road and the A4174 would most likely limit the northbound capacity on the fly-over to a single running lane. Termination of the fly-over at its southern end could create safety issues with the need to additionally accommodate a slip-road merge connection (for traffic from the A4) close to the 'give way' line.

Table 5.2: Long list of schemes considered

The analyses show that Options 1 and 4 would both fail on operational grounds with the 2036 'Design Flows'. As such, congestion at Hicks Gate would continue to make it a 'bottleneck' junction in the weekday peak periods and at other busy times, with this deterring/constraining traffic usage of the A4-A37 Link Road. Both these options would therefore fail to satisfy key objectives in delivering improved network resilience and journey time reliability, and critically both would fall short in delivering the level of capacity required to mitigate the impact of SDL development at Whitchurch, North Keynsham and Brislington.

Option 5, which proposes grade-separation along the A4 axis, would not remove sufficient inflow (2036) from the underlying roundabout (retained largely as is) to prevent a high 'net' increase of circa 1,100 vph in the two peak hours. As such, this solution would not deal adequately with growth whilst grade separation, if provided, would ideally address traffic movements on the N-S 'orbital' axis which are much higher. However, Option 6, which examined the potential for grade-separation on the N-S axis, has significant obstacles to delivery in design terms, notably in respect of vertical alignment. There are also 'tie-in' issues in the northbound direction with the SLTL from the A4 Bath Road, and in the southbound direction at the proposed roundabout to the south of Hicks Gate. The latter is associated with a need to incorporate a slip-road merge (for movements from the A4) close to the 'give-way' line, leading to potential highway safety issues with necessary weaving/lane changing manoeuvres over a short length.

As such, the sifting assessment process has identified two 'short list' options for improving the Hick Gate junction which satisfy the defined objectives and have the greatest potential for deliverability. The shortlisted schemes identified are:

- **Option 2** - At-grade extension of the circulating carriageway to the SE to create a larger gyratory configuration. The existing western side of the roundabout is, however, retained as a 'cut-through' link to cater for the movement between the A4 Keynsham Bypass and the A4174. The segregated left turn lane on the A4 Bath Road approach is retained, with other traffic exiting to the A4174 required to merge. The flared four lane section of the A4174 Ring Road approach is extended, and a segregated left turn lane added; and
- **Option 3** - As Option 2, with the only difference being that the 'cut-through' link created in this case caters for the movements from the A4175/Link Road to the A4174 and the A4 Bypass. As such the right turn movement from the A4 Bypass to the A4174 is required to route via the main gyratory.

These selected scheme options have been developed and assessed further using the DfT Early Assessment and Sifting Tool. This assessment is presented in the following sections.

6 Option Development and Assessment

6.1 Approach to Option Development and Assessment

Preliminary highway design has been undertaken for the short-list link options using OS Land-Line base mapping and LIDAR contour information to examine horizontal and vertical alignment issues. This has been done to examine and, where possible, design out potential 'Departures from Standard' with respect to the Design Manual for Roads and Bridges (DMRB).

The set of preliminary design drawings developed for the short-list schemes are included in **Appendix H**. The included drawings are as follows:

- Drawing No **674726.CA.51.003**: Option 2 - General Arrangement;
- Drawing No **674726.CA.51.004**: Option 3 - General Arrangement
- Drawing No **674726.CA.51.010**: Possible 'Interim' Scheme Layout -PHASE 1 (Variant 1);
- Drawing No **674726.CA.51.011**: Possible 'Interim' Scheme Layout -PHASE 1 (Variant 2);

The two short-list options have duly been assessed with respect to the following:

- Engineering feasibility;
- Cost of construction;
- Key environmental impacts;
- Operational assessment to understand the level of potential traffic usage and relief offered to the surrounding road network; and
- Value for money through estimation of the Benefit Cost Ratio (BCR) for the two short-list options. This uses the overall time saving outputs from LinSIG to generate a Present Value Benefit (PVB) over 60 years, which is then compared with scheme costs.

6.2 Option Development

6.2.1 Option 2

Drawing No 674726.CA.51.003 shows the layout of the Option 2 scheme which extends the extent of the circulatory carriageway to the SW to create an enlarged gyratory. This has the advantage of improving internal queuing capacity on the circulating sections, notably on the elongated northern and southern sections of the gyratory. With growth to 2036 expected to significantly affect the traffic demand on the southern approach (A4175 Durley Hill/Link Road), so requiring a longer green time/capacity to service it, there will be an increased need to hold/stop the heavy right turning flow from the A4174 to the A4 Bath Road on the circulatory for longer. This layout achieves this objective by creating much improved queuing capacity on this internal section, thus reducing the risk of 'excess' queuing blocking back to the A4 Keynsham Bypass entry. Other key features of the layout as proposed are as follows:

- The former western side of the roundabout is retained as a 'cut through' link servicing the right turn movement from the A4 Keynsham Bypass. This takes out this circulating movement from the A4175/Link Road spur and A4 Bath Road entry signals, although there is a need to signal the exit from this link on the north side of the gyratory. This creates a further signalled 'node' on the gyratory;
- The four-lane section on the A4174 Ring Road approach is lengthened to improve capacity, particularly for the increased demand associated with the straight-ahead movement in both weekday peak hours. This capacity for 'ahead' movement is enhanced by taking out the left

turning movement from the roundabout, with this catered for by a separate segregated left filter lane (SLFL) with a merge termination onto the bypass;

- The existing SLTL from the A4 Bath Road to the A4174 is retained with its present 'lane gain' termination. As such, traffic exiting to the A4174 from the roundabout must merge from two lanes to one as now, although the merging length is shown increased and much longer than the existing arrangement. Effective use of both lanes upstream of the merge will be critical with the expected increase in the northbound flow from the A4175/Link Road by 2036;
- The approach geometry on the A4 Keynsham Bypass is little different to the present arrangement. However, traffic turning right into the 'cut-through' link for the A4174 is able to use two lanes, so not just the outer lane as now. As such, the outermost lane catering for 'ahead' traffic (Lane 3) can also be used by right turning vehicles. The nearside lane is intended to be used by left turners, or by buses or 'Park and Ride' users continuing ahead to the left-in access to the relocated site shown on the Bath Road exit. On reaching the latter, normal service buses would continue in a nearside bus lane extending close to the Emery Road junction in Brislington (currently the Park and Ride Access/Bus Lane). Park and Ride buses would join this bus lane via the western end of Durley Hill, with the section west of the relocated access to Hicks Gate Farm signed as 'Bus Only';
- The existing 'staggered' Toucan crossing on the A4 Bath Road to the west of Hicks Gate is removed. The replacement, more direct, NMU linkage between the A4175 and the shared use footway on the west side of the A4174 Ring Road is via the gyratory, with controlled crossings installed at the A4175/Link Road spur and A4 Bath Road junctions (and over the SLTL). The proposals as shown assume that the current NMU route along the lightly trafficked section of Durley Hill will be lost where it falls within the relocated Park and Ride site boundary (at least when the site is closed). As such a shared use footway 4.0 metres in width is shown extending around the SW side of the gyratory, with connection to the access lane serving Hicks Gate Farm at its western end;
- To the south of the Hicks Gate junction the A4-A37 Link Road (shown as D2AP) is shown terminating at a proposed roundabout, with the A4175 Durley Hill arm re-aligned to suit. A spur connection is then used to link this roundabout with the Hicks Gate gyratory. The forecast 2036 'Design Flows' show that the predominant movements will be between the 'spur' and the Link Road, so signing and marking will need to cater for making the respective left and right turns in two lanes to maximise entry lane efficiency and usage; and
- The general traffic exit from the relocated Park and Ride site would be onto the Link Road as shown. Drivers travelling southwards to the A37 would be able to 'U' turn at the roundabout, so removing the need for an access junction layout incorporating a right turn out. The layout as shown could be modified to permit a right turn in, so allowing drivers from Keynsham (A4175) to access the Park and Ride site via this entrance (currently show as left in/left out only). This would avoid a necessary route via Hicks Gate to the access on the Bath Road exit.

Traffic modelling and the operational impact of Option 2 is covered in a subsequent sub-section of this chapter.

6.2.2 Option 3

The description of the scheme and principal design issues is the same as Option 2. As such, it is not repeated here for brevity. The only difference is the treatment of the 'cut through' link, which is modified to service the northbound movement from the A4175 Spur to the A4174 Ring Road, and also the right turn from this spur to the A4 Keynsham Bypass. Reconfiguration of this link will cater for a heavier movement than the right turn from the A4 Keynsham Bypass (Option 2). The Options 3 layout is shown on Drawing No 674726.CA.51.004.

As with Option 2, the operational impact of this option is considered separately in the sub-section on traffic modelling.

6.2.3 Interim Scheme Development: Phase 1

A key objective of the works transition at Hicks Gate is the delivery of a Phase 1 or 'Interim' scheme prior to full completion and opening of a A4-A37 Link Road. This is in recognition of the congestion problems that already exist at Hicks Gate in the weekday peak hours, albeit these are in part due to exit blocking as a result of excess queuing on the westbound A4 Bath Road towards Brislington (AM). However, whilst the Whitchurch SDL is incumbent on the delivery of the A4-A37 Link Road, development of the SDL sites at North Keynsham and Brislington is not. The former in particular can be expected to have a net adverse impact on the prevailing highway conditions at Hicks Gate in both weekday peak periods, notwithstanding the delivery of the A4-A4175 Link Road to the north of Keynsham.

Drawing No 674726.CA.51.010 shows the proposed layout of the Phase 1 or 'Interim' scheme. This specific variant is based on 'full' scheme Option 2, so the cut-through link to the gyratory serves the heavy right turn movement from the A4 Keynsham Bypass to the A4174. The alternative variant for the interim scheme is shown on Drawing No 674726.CA.51.011. This creates the cut-through linkage between the southern arm (A4175) and the A4174 Ring Road at the outset. However, in the pre-Link Road scenario (A4-A37), the volume of straight-ahead traffic from the A4175 Durley Hill using this cut-through linkage will be much lower than the right turning flow from the A4 Keynsham Bypass. In view of this, an interim or Phase 1 layout form based on Variant 1 (Drawing No 674726.CA.51.010) is preferable and recommended.

Comparison of this interim (Phase 1) scheme layout with the 'full' scheme Option 2 and Option 3 layouts (Phase 2) shows that the following subsequent alterations would be needed to connect with a completed A4-A37 Link Road alignment:

- Construction of a new roundabout at the northern end of the Link Road;
- Re-alignment of the A4175 Durley Hill arm southwards to connect with the aforementioned roundabout; and
- Realignment works to create a spur road connection from the Hicks Gate gyratory to the new roundabout to the south. This will result in the stopping up of some of the existing highway along the current A4175 Durley Hill alignment.

As noted in the full description of Option 2, the general traffic egress from the relocated Park and Ride is proposed to be off the A4-A37 Link Road in the long term. If the desired timetable for delivery of the relocated Park and Ride site is likely to precede the completion of this link, then it will be necessary to see what temporary arrangement would be possible with the interim scheme. A possible solution would be using the access junction to the A4175 from the lightly trafficked part of Durley Hill to the west, with movements restricted to 'left in/left out' only. Drivers leaving the site and requiring the A4175 towards Keynsham could 'U' turn at Hicks Gate. In short, all movements from/to the A4, A4174 and A4175 would be possible, making this a viable interim arrangement.

6.3 Traffic Modelling

As noted earlier in this OAR, the G-BATS4 strategic model was used to derive 'Design Flows' for the 2036 scenario. For the purposes of this OAR, the improvements at Hicks Gate are considered in isolation. As such, it was assumed in the modelling that the A4-A37 Link Road was constructed in the 2036 scenario. Furthermore, to ensure that coding parameters applied to the Hicks Gate junction did not unduly restrain the traffic assignment, a 'dummy' or unrestrained node was assumed. As noted earlier, this yielded a maximum expected level of 'base' demand for design purposes. Section 5.3 and Appendix C explained this process of obtaining the 2036 'Design Flows' and findings/outcome results.

The approach to traffic modelling and economic assessment has needed to consider the evolving scheme at Hicks Gate, so not just the 'full' scheme implementation. In other words, the benefits stream will start from opening of the interim or Phase 1 scheme, with traffic patterns and operating

conditions changing significantly when the A4-A37 Link Road is built and opened to traffic. With this in mind, 2021 G-BATS4 'runs' were undertaken to estimate the demand flows likely with the interim scheme in place. This includes all committed growth expected by this year. As with the 2036 'Design Flow' forecasts, the G-BATS 2013-2021 growth was applied to the observed June 2012 turning counts (MCC). The resulting 'Design' or forecast flows for 2021 are also included in Appendix C.

As noted earlier when discussing the option 'sifting', the program LinSIG has been used to model the existing and proposed signalled roundabout/gyratory arrangements. Whilst SATURN (G-BATS) does allow for coding and modelling of junction within the 'simulation' network, it cannot readily model signal-controlled roundabouts and gyratory systems with the same level of detail. Reasons for this are as follows:

- It cannot differentiate between the lanes available to different traffic movements on the approaches to the signalled roundabout, with this external lane marking and the downstream routing through the internal circulatory sections a key factor governing expected operation in practice;
- The effect of 'excess' queuing within specific lanes on the circulatory sections is not handled with enough precision, nor can the model parameters be adjusted easily via the optimisation process to ensure timings take a preferential view of the internal circulating section to keep queuing here within defined limits; and
- It does not model 'flared' approach geometries and capacities as well as LInSIG, and notably how this capacity changes with different signal timings and turning flows. LinSIG can explicitly model 'lane starvation' effects, which can result as vehicle access to 'short' lanes is potentially impeded or blocked or queuing builds up in the 'feeder' lanes. It can also mimic the changing discharge and effect on the saturation flow with differing lengths of green time.

In view of the above it was considered that LinSIG should be used to explicitly model and assess the existing and proposed 'full' layouts (Options 2 and 3) in the 2036 scenario, and an interim or Phase 1 layout in 2021. The Variant 1 layout shown in Drawing No 674726.CA.51.010 was used for the latter. Summary LinSIG results for the following scenarios are included in **Appendix I**:

- Existing Layout: AM/PM - 2021;
- Proposed Phase 1 or 'Interim' Scheme: AM/PM - 2021;
- Existing Layout: AM/PM - 2036;
- Proposed Phase 2 or 'Full' Scheme (Option 2): AM/PM - 2036; and
- Proposed Phase 2 or 'Full' Scheme (Option 3): AM/PM - 2036.

Key Statistics from the LinSIG assessments are shown in **Table 6.1** and **Table 6.2** below:

Table 6.1 A4/A4174 Hicks Gate Roundabout: LinSIG Assessments - Key SUMMARY Statistics - Weekday 8:00-9:00 am

Scenario Description	Optimised Cycle Time	Practical Reserve Capacity (PRC)	Approaches: Mean Maximum Queue (Total - All Lanes - VEH)	Approaches: Maximum Degree of Saturation (DoS) - >90% is CAPACITY	Overall Delay (PCU-Hrs/Hr)
Existing Layout: 2021	80	-1.4%	A4174 Ring Road: 30 A4 Bypass: 22 A4175 Durley Hill: 13 A4 Bath Road: 1	A4174 Ring Road: 91.3% A4 Bypass: 89.5% A4175 Durley Hill: 70.3% A4 Bath Road: 44.9%	55.80
Interim or Phase 1 Layout (Option 2): 2021	58	+20.8%	A4174 Ring Road: 9 A4 Bypass: 14 A4175 Durley Hill: 10 A4 Bath Road: 8	A4174 Ring Road: 73.2% A4 Bypass: 71.9% A4175 Durley Hill: 67.6% A4 Bath Road: 61.2%	40.71

Existing Layout: 2036	85	-16.5	A4174 Ring Road: 27 A4 Bypass: 58 A4175 Durley Hill: 24 A4 Bath Road: 1	A4174 Ring Road: 85.5% A4 Bypass: 104.9% A4175 Durley Hill: 89.9% A4 Bath Road: 47.9%	103.99
Full or Phase 2 Layout (Option 2): 2036	73	+3.2%	A4174 Ring Road: 17 A4 Bypass: 18 A4175/Link Road: 22 A4 Bath Road: 14	A4174 Ring Road: 75.1% A4 Bypass: 85.8% A4175/Link Road: 77.7% A4 Bath Road: 77.3%	82.19
Full or Phase 2 Layout (Option 3): 2036	73	+4.4%	A4174 Ring Road: 18 A4 Bypass: 18 A4175/Link Road: 28 A4 Bath Road: 9	A4174 Ring Road: 75.1% A4 Bypass: 85.8% A4175/Link Road: 83.3% A4 Bath Road: 56.7%	83.89

Table 6.2 A4/A4174 Hicks Gate Roundabout: LinSIG Assessments - Key SUMMARY Statistics - Weekday 5:00-6:00 pm

Scenario Description	Optimised Cycle Time	Practical Reserve Capacity (PRC)	Approaches: Mean Maximum Queue (Total - All Lanes - VEH	Approaches: Maximum Degree of Saturation (DoS) - >90% is CAPACITY	Overall Delay (PCU-Hrs/Hr)
Existing Layout: 2021	85	0.2%	A4174 Ring Road: 27 A4 Bypass: 24 A4175 Durley Hill: 11 A4 Bath Road: 4	A4174 Ring Road: 85.1% A4 Bypass: 89.8% A4175 Durley Hill: 75.1% A4 Bath Road: 65.8%	63.03
Interim or Phase 1 Layout (Option 2): 2021	50	+20.6%	A4174 Ring Road: 9 A4 Bypass: 12 A4175 Durley Hill: 9 A4 Bath Road: 9	A4174 Ring Road: 68.7% A4 Bypass: 70.0% A4175 Durley Hill: 71.9% A4 Bath Road: 69.4%	41.57
Existing Layout: 2036	85	-32.2	A4174 Ring Road: 21 A4 Bypass: 104 A4175 Durley Hill: 14 A4 Bath Road: 5	A4174 Ring Road: 88.4% A4 Bypass: 118.9% A4175 Durley Hill: 80.2% A4 Bath Road: 66.1%	138.45
Full or Phase 2 Layout (Option 2): 2036	80	+6.1%	A4174 Ring Road: 18 A4 Bypass: 19 A4175/Link Road: 28 A4 Bath Road: 21	A4174 Ring Road: 84.5% A4 Bypass: 84.8% A4175/Link Road: 80.3% A4 Bath Road: 84.1%	88.82
Full or Phase 2 Layout (Option 3): 2036	70	+6.2%	A4174 Ring Road: 16 A4 Bypass: 17 A4175/Link Road: 24 A4 Bath Road: 14	A4174 Ring Road: 83.7% A4 Bypass: 81.5% A4175/Link Road: 76.7% A4 Bath Road: 73.5%	85.51

Not unexpectedly, the 'full' Option 2 and 3 schemes perform similarly in respect of predicted delay savings compared to the base-line or 'Do Nothing' case in 2036. Operating conditions with the existing layout are most critical in the PM peak hour assessment, with conditions on the A4 Keynsham Bypass approach expected to deteriorate significantly with increased demand for orbital movement from the A4714 to the new Link Road.

In the case of the 2021 scenario, both the 'base' and 'scheme' tests used the same 2021 forecast flows. However, in the case of the 2036 scenario, initial examination of the results showed that use of the full 'Design Flows' applied to the 'base' or existing layout gave very high and potentially unrealistic results in terms of probable driver acceptance/tolerance of delay levels. As such, the flows used in the 2036 'base' case were scaled back to reflect a lower level of expected routing through Hicks Gate as follows:

- AM Peak Hour: The 'ahead' flows between the Link Road (A4-A37) and the Ring Road in both directions were reduced to 80% of the 'Design Flow' values; and
- PM Peak Hour: The 'ahead' flows between the Link Road (A4-A37) and the Ring Road in both directions were reduced to 50% of the 'Design Flow' values.

Note that the full 'Design Flows' derived for 2026 were applied in the LinSIG models of the Option 2 and Option 3 layouts. As noted in the results in Table 6.1, both are shown to operate with a residual degree of reserve 'spare' capacity in each weekday peak hour.

Whilst it is entirely reasonable to expect that an improved Hicks Gate junction would attract a higher level of traffic and usage of the orbital route, the effect on the economics and the Value for Money (VfM) assessment needs to be borne in mind. This is because the localised junction modelling done to calculate overall delay time in the 'base' and 'scheme' scenarios is not based on a common or fixed turning flow assumption in 2036. The implications of this, and how findings should be treated/viewed as a result, are discussed in Section 6.4 below.

6.4 Cost Estimating and Economic Assessment

6.4.1 Cost Estimating

A breakdown of the scheme costs by 'Series' and showing contingency/risk allowances made is included as **Appendix J.**

Costs for the various options have been estimated using the standard Method of Measurement for Highway Works determined using a mixture of direct CAD measurements and manual take offs. Wherever possible, rates have been taken from the B&NES / Skanska Highway Maintenance and Improvement Works Term Maintenance Contract Schedule of Rates. Statutory undertaker (C2) records (**Appendix F**) have been used to provide an informed level of contingency allowance for services diversion or in-site protection works.

The outcome construction costs (2018 base) of the two short-listed options incorporating land acquisition, preparation and supervision costs are set out below. This assumes an interim scheme (Phase 1-Variant 1) is built first, and later modified to create the 'full' Option 2 or Option 3 scheme with the A4-A37 Link Road. Note that the costs associated with the Link Road and its roundabout junction with the A4175 Durley Hill are excluded. However, the costs associated with the spur connection to Hicks Gate are:

- Option 2: **£9.23 M**; and
- Option 3: **£9.53 M**

6.4.2 Economic Assessment

Derivation of scheme benefits is based on the travel time savings obtained from the LinSIG modelling for the weekday periods 8:00-9:00 am and 5:00-6:00 pm. Peak hour to peak period factors from TUBA have been used to expand the benefits to cover the 'shoulder' hours in each case. It is thus important to note that potential network benefits of the junction improvements in the weekday inter-peak period are not considered. Vehicle operating cost savings and accident cost savings have similarly not been accounted for in the economic assessment.

The benefits stream has been assessed for a 60-year period from an assumed scheme Opening Year of Phase 1 in 2021. The delay savings resulting from the 'full' schemes with the A4-A37 Link Road in

place have been assessed at 2036, with expected time savings over the period 2021-2036 interpolated by year using the 2021 and 2036 estimates.

For the purposes of the economic assessment an appropriate level of Optimism Bias has been made in line with the Stage of the project and level of design (Stage 1: 44%).

An EXCEL spreadsheet approach has been used to estimate the Present Value of Benefits (**PVB**), the Present Value of Costs (**PVC**) and the Benefit Cost Ratio (**BCR**) for each of the short-listed options. Standard WebTAG values have been used for journey purpose splits in the weekday AM and PM peak periods and corresponding values of time (VOT). The outcome BCR estimates show the following 'Value for Money' categorisation for the two options:

- Option 2: Medium Value for Money; and
- Option 3: Medium Value for Money.

However, it is important to note that this assessment relates to the 'stand-alone' works at Hicks Gate, which may be considered conservative for the following reasons:

- As noted earlier, the benefits assessment only takes account of the weekday peak periods, so no account is taken of time savings in the inter-peak period;
- The localised LinSIG modelling of the 'scheme' case in the 2036 scenario assumes higher levels of traffic inflow in both the AM and PM peak hours than the comparable 'Do Nothing' situation with the existing layout. In short, the full 'Design Flows' were not applied to the 'Do Nothing' case to ensure that levels of congestion/delay at the junction in its unimproved state were not unrealistically high. However, in doing this, the wider delay saving benefits to the surrounding highway network in drawing this additional traffic off existing urban roads in SE Bristol and Keynsham to the orbital corridor are similarly ignored; and
- Removing congestion at Hicks Gate will encourage a higher traffic transfer to the A4-A37 Link Road, so improving the economic case for this specific infrastructure element. This element of benefit 'uplift' achievable by the Link Road is not considered in this OAR for Hicks Gate, but it will clearly be facilitated by the Option 2 or Option 3 improvement schemes. Whilst Hicks Gate is only considered in isolation in this OAR, it will clearly form an intrinsic part of the A4-A37 Link Road scheme and the wider benefits accruing from this.

7 TAG Appraisal Stage 1- Early Assessment and Sifting Tool Tables

7.1 Introduction

DfTs Early Assessment and Sifting Tool is a defined step in the appraisal process set out in TAG. The Early Assessment and Sifting Tool is an early comparison of options and tools being considered, prior to the more detailed appraisal which will enable recommendations to be made for funding decisions.

DfT sets out that the Early Assessment and Sifting Tool should be used to:

- Help refine options by highlighting adverse impact or unanticipated consequences;
- Compare options, for example, within or across modes, geographical areas and networks;
- Identify trade-offs between objectives aiding package development;
- Filter the number of options, i.e. discount non-runners early on to ease the appraisal burden and avoid resources being spent unnecessarily; and
- Identify key uncertainties in the analysis and areas where further appraisal efforts should focus.

A full guidance document supporting the Tool is available to view at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/4475/east-guidance.pdf.

When undertaking an Early Assessment and Sifting Tool appraisal, it is often at a very early stage in the scheme development work and therefore only high-level information is available.

The two short listed options have been assessed using the Early Assessment Sifting Tool, with results presented in the following figures, and further details outlined in the next chapter.

Early Assessment and Sifting Tool (EAST) - *Expanded Print View*

Option Name/No.	**Opt.2**	
Date	10/03/2018	
Description	Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	
Strategic		
Identified problems and objectives	Problems • Poor strategic transport links to/from South Bristol • Long journey times due to regular congestion in the SE Bristol/Keynsham/Whitchurch area highway network • High levels of traffic use on unsuitable minor roads including goods vehicles, routing via Brislington, causing congestion and poor air quality • Committed housing development and economic growth in Keynsham, which will exacerbate these problems. This will be further compounded by the SDL developments at Whitchurch, North Keynsham and Brislington • Limitation in reallocating road-space to improve options for active travel and public transport, with heavy traffic and congestion further hampering any removal of highway capacity to introduce walking, cycling and public transport measures Objectives • Improve transport network resilience and journey time reliability • Provide a long- term capacity uplift at Hicks Gate - SDL Mitigation • Enable short term benefits in highway operation through delivery of an earlier Phase 1 or interim scheme • Facilitate relocation and integration of the P&R site at Brislington, and the introduction of priority measures • Improve opportunities for contributing locally to improved NMU facilities and routes in the Hicks Gate area	
Scale of impact	4	Long- term capacity uplift, relocation of Brislington P&R, improve opportunities for contributing locally to improved NMU facilities
Fit with wider transport and government objectives	4	Stimulates growth, ensures resilience, delivers infrastructure capacity
Fit with other objectives	4	Meet all scheme objectives
Key uncertainties	See key risks	
Degree of consensus over outcomes	2	No consultation has been carried out yet
Economic		
Economic growth	**5. Green**	Unlock committed developments and planned SDLs, reduce journey time and cost though providing capacity uplift and removing a bottleneck at the end of the planned A4-A37 Link Road
Carbon emissions	**4. Amber/green**	Modification of an existing roundabout, better air quality due to reduced congestion
Socio-distributional impacts and the regions	**4. Amber/green**	The scheme is a modification of an existing roundabout, not expected to have considerable impacts
Local environment		
Well being	**4. Amber/green**	Improved access to goods, service, people and place, slight decrease in accidents
Expected VfM category	3. Medium 1.5-2	BCR estimated to be 1.52
Managerial		
Implementation timetable	6. 5-10 years	Phase 1 (interim scheme) delivered 2019-2021, 'Full' scheme to be delivered 2026-2028
Public acceptability	3	Not expected to be controversial but no specific consultation has taken place.
Practical feasibility	3	Would require planning permission. Works are all at-grade and avoid any need for expensive structures. A key 'practicality' issue will be the phasing of the works and allied Traffic Management to ensure that construction delays are minimised and existing traffic movements maintained as far as practicable. Off-line works to the SW will assist in this, as well as the fact that the existing roundabout is largely retained within the expanded gyratory
What is the quality of the supporting evidence?	4	Detailed LinSIG models developed and used to assess operating performance, with 'Design Flows' derived from model 'runs' with the G-BATS strategic model. Desktop baseline info for environmental impacts and C2 utilities searches
Key risks	· Dependant on the final approval of reginal plans (SDLs and the A4-A37 Link Road) · Need for the scheme to be prioritised in the WoE · Need to secure funding and include scheme within Local Transport Plans · Feasibility of any preferred option to be confirmed in further work, including an Outline Business Case · Land take required, and ownership of required land · Additional environmental mitigation required following further work · Relevant consents to be secured · Impact on National Flood Zones 2 and 3 · Public support unknown · Inflated or additional scheme costs, including land purchase and utilities diversion · Lack of resources (people, material, expertise, not funding) to progress the scheme	
Financial		
Affordability	4	WECA is expected to fund the scheme-JTLP3 includes 11 major transport schemes worth £600M of investment
Capital Cost (£m)	03. 5-10	£7.57m
Revenue Costs (£m)		Revenue costs
Cost profile	Not available	
Overall cost risk	3	
Other costs		
Commercial		
Flexibility of option	1. Static	Inflexible due to surrounding constraints. The scheme has already been refined to present the most feasible option for Hicks Gate which deliver the required operating performance in 2036
Where is funding coming from?	It is assumed that WECA will fund the scheme. Match funding contributions have not been considered as the proposed scheme benefits all travel modes seeking to access the local region rather than connecting to specific individual developments.	
Any income generated? (£m)	No	

Early Assessment and Sifting Tool (EAST) - *Expanded Print View*

Option Name/No.	**Opt.3**	
Date	10/03/2018	
Description	Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	
Strategic		
Identified problems and objectives	Problems • Poor strategic transport links to/from South Bristol • Long journey times due to regular congestion in the SE Bristol/Keynsham/Whitchurch area highway network • High levels of traffic use on unsuitable minor roads including goods vehicles, routing via Brislington, causing congestion and poor air quality • Committed housing development and economic growth in Keynsham, which will exacerbate these problems. This will be further compounded by the SDL developments at Whitchurch, North Keynsham and Brislington • Limitation in reallocating road-space to improve options for active travel and public transport, with heavy traffic and congestion further hampering any removal of highway capacity to introduce walking, cycling and public transport measures Objectives • Improve transport network resilience and journey time reliability • Provide a long- term capacity uplift at Hicks Gate - SDL Mitigation • Enable short term benefits in highway operation through delivery of an earlier Phase 1 or interim scheme • Facilitate relocation and integration of the P&R site at Brislington, and the introduction of priority measures • Improve opportunities for contributing locally to improved NMU facilities and routes in the Hicks Gate area	
Scale of impact	4	Long- term capacity uplift, relocation of Brislington P&R, improve opportunities for contributing locally to improved NMU facilities
Fit with wider transport and government objectives	4	Stimulates growth, ensures resilience, delivers infrastructure capacity
Fit with other objectives	4	Meet all scheme objectives, expected to offer better capacity uplift
Key uncertainties	See key risks	
Degree of consensus over outcomes	2	No consultation has been carried out yet
Economic		
Economic growth	**5. Green**	Unlock committed developments and planned SDLs, reduce journey time and cost though providing capacity uplift and removing a bottleneck at the end of the planned A4-A37 Link Road
Carbon emissions	**4. Amber/green**	Modification of an existing roundabout, better air quality due to reduced congestion
Socio-distributional impacts and the regions	**4. Amber/green**	The scheme is a modification of an existing roundabout, not expected to have considerable impacts
Local environment		
Well being	**4. Amber/green**	Improved access to goods, service, people and place, slight decrease in accidents
Expected VfM category	3. Medium 1.5-2	BCR estimated to be 1.51
Managerial		
Implementation timetable	6. 5-10 years	Phase 1 (interim scheme) delivered 2019-2021, 'Full' scheme to be delivered 2026-2028
Public acceptability	3	Not expected to be controversial but no specific consultation has taken place.
Practical feasibility	3	Would require planning permission. Works are all at-grade and avoid any need for expensive structures. A key 'practicality' issue will be the phasing of the works and allied Traffic Management to ensure that construction delays are minimised and existing traffic movements maintained as far as practicable. Off-line works to the SW will assist in this, as well as the fact that the existing roundabout is largely retained within the expanded gyratory
What is the quality of the supporting evidence?	4	Detailed LinSIG models developed and used to assess operating performance, with 'Design Flows' derived from model 'runs' with the G-BATS strategic model. Desktop baseline info for environmental impacts and C2 utilities searches
Key risks	· Dependant on the final approval of reginal plans (SDLs and the A4-A37 Link Road) · Need for the scheme to be prioritised in the WoE · Need to secure funding and include scheme within Local Transport Plans · Feasibility of any preferred option to be confirmed in further work, including an Outline Business Case · Land take required, and ownership of required land · Additional environmental mitigation required following further work · Relevant consents to be secured · Impact on National Flood Zones 2 and 3 · Public support unknown · Inflated or additional scheme costs, including land purchase and utilities diversion · Lack of resources (people, material, expertise, not funding) to progress the scheme	
Financial		
Affordability	4	WECA is expected to fund the scheme-JTLP3 includes 11 major transport schemes worth £600M of investment
Capital Cost (£m)	03. 5-10	£7.67m
Revenue Costs (£m)		Revenue costs
Cost profile	Not available	
Overall cost risk	3	
Other costs		
Commercial		
Flexibility of option	1. Static	Inflexible due to surrounding constraints. The scheme has already been refined to present the most feasible option for Hicks Gate which deliver the required operating performance in 2036
Where is funding coming from?	It is assumed that WECA will fund the scheme. Match funding contributions have not been considered as the proposed scheme benefits all travel modes seeking to access the local region rather than connecting to specific individual developments.	
Any income generated? (£m)	No	

8 Early Assessment and Sifting Tool - Supporting Information

This chapter presents any supporting information which has been used to complete the DfT Early Assessment and Sifting Tool scoring.

8.1 Strategic Case

8.1.1 Scale of Impact

Table 8.1 shows the scale of impact of the scheme options.

Option	Scale of Impact	Justification
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	4 - Expected to significantly alleviate the problem	See scoring in Table 8.3
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	4 - Expected to significantly alleviate the problem	See scoring in Table 8.3

Table 8.1: Scale of Impact

Response options are:
1 – Very small overall impact – would have a very small positive impact, possibly with undesirable consequences
2 – Minor impact – Would have a modest overall impact
3 – Moderate impact – Expected to have a reasonably significant impact on the problem identified
4 – Significant impact – Expected to significantly alleviate the problem
5 – Very significant impact – Expected to alleviate the problem

8.1.2 Fit with wider transport and government objectives

Regional objectives are outlined within the WoE LEP SEP and JTS.

Strategic objectives outlined within the WoE LEP SEP are:

- Create the right conditions for business to thrive. Give confidence and certainty to our investors to attract and retain investment to stimulate and incentivise growth.
- Ensure a resilient economy, which operates within environmental limits. That is a low carbon and resource efficient economy, increases natural capital, and is proofed against future environmental, economic and social shocks.
- Create places where people want to live and work, through delivery of cultural infrastructure and essential infrastructure, including broadband, transport and housing to unlock suitable locations for economic growth.
- Shape the local workforce to provide people with skills that businesses need to succeed and that will provide them with job opportunities.
- Ensure all our communities share in the prosperity, health and well-being and reduce the inequality gap.

JTS (Final Report, October 2017) objectives include:

- EC2: Improve the resilience of road and rail networks to incidents and the impacts of climate change.
- EC4: Deliver the transport infrastructure capacity needed to enable job creation and business growth.
- CA1: Provide a transport network which is low carbon and resource efficient in operation.
- AC1: Improve access for all to employment, education and training.
- EV2: Minimise the impacts of transport and travel on the rural environment.

Both proposed options will stimulate growth and support new housing delivery therefore largely support the objectives of the WoE LEP SEP.

The two are largely located within highway boundaries with limited impact on the natural environment. Both options are a modification to an existing roundabout, but they encourage low carbon transport by reducing delays.

Table 8.2 shows how the scheme options fit with the wider transport and government objectives.

Option	Fit objectives	Justification
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	4 – Good fit	Stimulates growth, ensures resilience, delivers infrastructure capacity.
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	4 – Good fit	Stimulates growth, ensures resilience, delivers infrastructure capacity.

Table 8.2: Fit against transport and government objectives

Response options are:
1 – Low fit, 5 = High fit

8.1.3 Fit with scheme objectives

The scheme options are all seeking to address the same problems and meet the same objectives. Finalised general scheme objectives are:

- Improve transport network resilience and journey time reliability by reducing existing congestion in this location, whilst maximising the potential for traffic transfer/use of a future A4-A37 Link Road connection.
- Provide a significant long-term uplift in capacity at Hicks Gate to locally mitigate traffic impacts arising from SDL developments at Whitchurch, North Keynsham and Brislington, whilst still providing a 'net' benefit to existing highway users (with the A4-A37 Link Road);
- Provide short term benefits in highway operation through delivery of an earlier Phase 1 or interim scheme. This will help to cater for existing committed development growth in Keynsham, and any early build-out of the North Keynsham SDL, which is not 'dependency linked' in the same way to the delivery of the A4-A37 Link Road;
- Facilitate relocation and integration of the Park and Ride site at Brislington, and the introduction of priority measures on the westbound A4 Keynsham Bypass approach to Brislington (Emery Road);
- Improve opportunities for contributing locally to improved NMU facilities and routes in the Hicks Gate area.

Table 8.3 shows how the scheme options fit with the scheme objectives.

Option	Improve transport network resilience & journey time reliability	Provide a long- term capacity uplift	Enable short term benefits in highway operation (an earlier Phase 1)	Facilitate relocation Brislington P&R site	Improve opportunities for contributing locally to improved NMU facilities	Overall score
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	5 - Improved journey time reliability on extended orbital route. Traffic relief to surrounding urban networks in Whitchurch and Brislington	4 – Expected Practical Reserve Capacity of +3.2% and +6.1% (AM & PM peaks) compared to -16.5% and -32.2% (AM & PM peaks) for the Do min	5 - Gyratory enlargement can form a substantive Phase 1 scheme in its own right, with later modifications to the south to enable connection of the A4-A37 Link Road	4 – Can accommodate a relocated Brislington P&R site	4 – Enhances connectivity and reduces traffic movements on unsuitable roads, enhances NMU facilities crossings through the roundabout	4 – Good fit
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	5 - Improved journey time reliability on extended orbital route. Traffic relief to surrounding urban networks in Whitchurch and Brislington.	4 - Expected Practical Reserve Capacity of +4.4% and +6.2% (AM & PM peaks) compared to -16.5% and -32.2% (AM & PM peaks) for the Do min	5 - Gyratory enlargement can form a substantive Phase 1 scheme in its own right, with latter modifications to the south to enable connection of the A4-A37 Link Road	4 - Can accommodate a relocated Brislington P&R site	4 – Enhances connectivity and reduces traffic movements on unsuitable roads, enhances NMU facilities crossings through the roundabout	4 – Good fit

Table 8.3: Fit with Scheme Objectives

Response options are:
1 – Low fit, 5 = High fit

8.1.4 Key uncertainties

The key risks for the project are outlined in Section 8.3.5 (Key Risks). The feasibility of any option taken forward would need to be confirmed at a later stage, within the Full Outline Business Case.

8.1.5 Degree of consensus over outcomes

Consultation on the preferred option will need to be carried out at a later stage. Table 8.4 shows anticipated degree of consensus over outcome, which reflect current understanding after meeting the project team.

Option	Early Assessment and Sifting Tool Response	Justification
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	2	No consultation has been carried out yet apart from discussion with the project team
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	2	No consultation has been carried out yet apart from discussion with the project team

Table 8.4: Degree of consensus over outcomes

Response options are:
1 – Little or no consultation has taken place yet, or consultation has revealed a high level of disagreement about the option's ability to deliver the stated outcomes
2 – Little consultation and/or strong reasons to suggest the outcomes are controversial.
3 – Some consultation has taken place with some agreement
4 – Wide consultation and broad agreement on the outcomes, possibly one or two areas of disagreement remaining
5 – Extensive consultation has taken place with a high degree of consensus on the outcomes

8.1.6 Summary of strategic case

A review of the headings under the strategic case indicate that both options fit in with the scheme objectives.

8.2 Economic Case

8.2.1 Approach

In line with WebTAG guidance a proportional approach was taken in the derivation of Transport Economic Efficiency (TEE) impacts associated with the scheme. Derivation of scheme benefits is based on the travel time savings obtained from LinSig models for the weekday AM (08:00 - 09:00) and PM (17:00 - 18:00) peak hours, with these expanded to cover the peak periods using standard factors in TUBA. It is important to note that potential network benefits of the increased junction capacity either during the weekday inter-peak period (10:00 am to 4:00 pm) or weekends are not considered. Vehicle operating cost savings and accident cost savings have similarly not been accounted for in the economic assessment.

The existing highway network and the proposed schemes were modelled in LinSig as previously described. This software produced estimates for the total network delay for 2021 and a 2036 forecast year, and critically the time savings relative to the 'base' or Reference case. Assumptions used in the economic analyses were as follows:

- Scheme Opening Year: An opening year of 2021 was assumed for the interim scheme, with opening of the A34-A37 Link Road and transition works to create the 'full' Option 2 or Option 3 schemes assumed to occur by 2028;
- Modelled years: 2021 and 2036, with 'Design Flows' at Hicks Gate derived from runs undertaken with the G-BATS4 model (SATURN). As noted in Section 6.3, the flows used in the 2036 'base' case were scaled back to reflect a lower level of expected routing through Hicks Gate as follows:
  - AM Peak Hour: The 'ahead' flows between the Link Road (A4-A37) and the Ring Road in both directions were reduced to 80% of the 'Design Flow' values; and
  - PM Peak Hour: The 'ahead' flows between the Link Road (A4-A37) and the Ring Road in both directions were reduced to 50% of the 'Design Flow' values.
- Appraisal period: 60 years;
- Price base year for discounting: 2010;
- Discount rate 3.5% for 30 years from scheme opening and 3% thereafter; and
- Optimism bias added to scheme costs: 44% (as defined in TAG Unit A 1.2 – Table 8); and
- Value of Time assumptions WebTAG databook December 2017 (WebTAG Table A 1.3.2).

8.2.2 Economic growth

The West of England has a substantial economic growth agenda which is being developed through the Strategic Economic Plan. The current share of national economic growth (GVA) is the highest of any core city region at 3.1%. The overall vision is to build on this economic growth through a range of interventions including improving access to major employment sites for the skilled workforce catchment.

The population is expected to exceed 1.1 million by 2026, and new housing sites will need to be developed to accommodate this growth. The city region needs to make sure its transport infrastructure is not only fit for purpose but, in addition, has the ability to respond to increasing demand and therefore maximise potential for continued economic growth.

2,150 of the houses outlined in the BANES Cores Strategy are to be provided in Keynsham, of which 1,600 will be provided through Strategic Sites. 1,600 new jobs will also be created between 2011 and 2029 primarily by increasing the stock of office floorspace in Keynsham, complemented by an extension to the Broadmead/ Ashmead/Pixash industrial Estate.

Both scheme options would improve resilience by removing congestion at a recognised 'bottleneck' junction on the A4174 Ring Road. This will help to ensure that usage of the A4-A37 Link Road, when constructed to the south, is not constrained or discouraged by congestion and delay problems persisting at Hicks Gate if unimproved.

Both options will assist in delivering the proposed SDL sites at Whitchurch, North Keynsham and Brislington. A major uplift in capacity at Hicks Gate will be necessary to address and mitigate generated traffic impacts associated with routing through this key junction and, in addition, provide a wider benefit to existing users. The level of assessed capacity uplift in the weekday peak hours (circa +40%) shows that both schemes are capable of satisfying this dual objective.

An accident analysis has not been undertaken for the two short-listed options at this stage. However, both will relieve pressure on other surrounding roads in Keynsham/SE Bristol and improve reliability overall. It is therefore envisaged that both options will lead to a decrease in incidents.

Option	Impact to end to end journey time	Impact to cost of travel (time & money)	Impact to transport reliability & resilience	Impact on incidents	Delivery of housing	Wider economic impacts	Accessibility changes	Overall RAG
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	Decrease	Decrease	Improve	Likely decrease	Required to serve proposed SDL sites	Maximises the potential use of the A4-A37 Link Road by removing what would otherwise remain a key local 'bottleneck' if unimproved	Neutral	Green
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	Decrease	Decrease	Improve	Likely decrease	Required to serve proposed SDL sites	Maximises the potential use of the A4-A37 Link Road by removing what would otherwise remain a key local 'bottleneck' if unimproved	Neutral	Green

*Table 8.5: **Economic growth***

8.2.3 Carbon emissions

The impacts of the scheme options are as follows:

- Increase in the volume of non-public transport trips, due to additional highway provision.
- Significant construction work required.
- Reduction in vehicle-km and stop-start driving due to reduction in congestion; and
- Decongestion benefits to the surrounding urban roads networks in Keynsham and SE Bristol

					Overall effect on carbon emissions		
Option	**Vehicle km change**	**Significant construction work required**	**Lower carbon fuel**	**Fuel per vehicle km**	**Non-traded (diesel, petrol and bio fuel)**	**Traded (electric)**	**Overall RAG**
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	No significant change	Yes	No change	Decrease due to reduced congestion	No change	No change	Amber/green
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	No significant change	Yes	No change	Decrease due to reduced congestion	No change	No change	Amber/green

Table 8.6: Carbon Emissions

8.2.4 Local environment

Appendix D is the Preliminary Environmental Report for the scheme, which documents the environmental baseline and the sources used to obtain the information, to assist with the early identification of any environmental impacts that may constraint scheme options; or that will need to be addressed as part of the design process.

Chapters 4 to 10 of the report provides a high-level summary of key policy and legislation; and describes the environmental baseline for each technical area under consideration as part of Early Appraisal and Sifting Tool (EAST).

A review of the information held on the Defra Local Air Quality management (LAQM) website[9] has been conducted. The closest Air Quality Management Areas (AQMAs) to the scheme is Bristol City Centre AQMA, which is approximately 1.5 km to the west of the Hicks Gate Roundabout on the A4 at Brislington at its closet point. Giving consideration to the distance from the Scheme, and the scale and nature of the Scheme is unlikely that any of the Options under consideration will have any disenable effect on AQMAs. However, modelling would be required to further assess if changing traffic patterns increase or decrease exceedances in AQMAs in the wider area.

Whilst it cannot be said with certainty that the Scheme will impact on existing NIAs (as noise modelling has not been undertaken), the aim of the Scheme is to reduce congestion in an area that is currently congested, and which has a number of noise Important Areas (nIAs). The closest nIA is located approximately 440m to the west on the A4 Bath Road. There is a further nIA located

9 https://uk-air.defra.gov.uk/aqma/list

approximately 200m further to the west of the roundabout also on the A4, Bath Road. The proposed Scheme will likely reduce congestion in this area and thus could potentially impact on the NIA.

Table 8.7 shows the impact of the respective options on the local environment in terms of air quality and noise.

Desk based study has identified the area as being of high archaeological importance. Where works are outside of the existing highway; and or into undeveloped land it is considered there is a high possibility of encountering archaeological remains. Within the existing highways estate, it is considered less likely that archaeological remains will be present as they will have already been removed or truncated by previous development of the road network.

The desk study has identified areas surrounding the Hicks Gate Roundabout that have the potential to support species of flora and fauna protected by European and national legislation (i.e. protected species). No field surveys have been undertaken to date, however these will be required in advance of any works to identify actual presence; or likely absence of protected and or notable species. Depending upon the results of field surveys, mitigation measures may be required to avoid impacts to protected and or notable species (refer to Appendix D for more detail on potential mitigation).

Table 8.8 illustrates the impact on the natural and urban environment more generally.

Option	Impact to air quality	Impact to existing AQMAs	Is it likely scheme will create an AQMA	Impact to noise	Impact to natural and urban environment	Environmental value of land affected	Overall RAG
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	No change	No	No	Negative	Negative See Table 8.8	Medium	Amber
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	No change	No	No	Negative	Negative See Table 8.8	Medium	Amber

Table 8.7: Local environmental impacts

Option	Water Quality	Flooding	Landscape	Ecology	Visual	People and Community	Heritage
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	Low impact	Medium impact The scheme does not impact or further encroach into land to the north west of Hicks Gate in National Flood Zones 2 and 3. However, the existing approach to the roundabout from the A4, bath Road is within flood zone 2/3and the Option does include construction of embankments potentially within flood zone 2/3 (to the north east of the existing roundabout).With mitigation any potential loss of flood storage can likely be compensated.	Medium impact The scheme involves land take of previously undeveloped land to the SW of the existing Roundabout; and recreational land to the north east, there is also some loss of trees and hedgerows. Main settlements, isolated properties, farmsteads and recreational facilities are within 500m of the scheme	Medium impact The scheme involves land take of previously undeveloped land to the SW of the existing Roundabout. No field surveys have been undertaken therefore at this stage it is not known if this Option directly impacts protected or notable species.	Medium impact It is not anticipated there would be many notable impacts on townscape as a result of the scheme due to its proximity to urban areas Recreational areas within 500m may experience some minor degradation in visual quality, but mitigation planting would reduce these over time	Low impact Scheme does not bisect communities Some PROW in the area	Medium to High impact Does not directly impact on any designated heritage assets. However, does involved land take of previously undeveloped land to the SW of the existing Roundabout where there is potential for disturbance of unknown heritage assets.
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	Low impact As Option 2	Medium impact As Option 2	Medium impact As Option 2	Medium impact As Option 2	Medium impact As Option 2	Low impact As Option 2	Medium impact As Option 2

Table 8.8: Natural and Urban Environment

8.2.5 Socio-distributional and regionals impacts

Table 8.9 shows the likely socio-distributional and regional impacts of the options.

Both options will have a similar impact on Keynsham and the wider population in SE Bristol. The scheme will improve accessibility and offer opportunities for reallocating road space for sustainable modes by drawing traffic off unsuitable urban roads onto the extended orbital route.

North and central areas of Keynsham do not have high proportions of children, disabled people, Black and Minority Ethnic communities, people without access to a car or people on low incomes. Keynsham does have a number of 2011 census 'Super Output Areas' (SOA) in the top 20% for populations over 65. There should be a slight positive impact on this group through improved accessibility.

There are few households adjacent to the proposed options, so impacts on categories such as severance and security will be minimal. It is noted, however, that there is a direct impact on Hicks Gate Farm as a result of changes to the section of Durley Hill currently used for access. This would be the result of relocating the Park and Ride site to land in the SE quadrant of Hicks Gate, as opposed to a direct result of the junction highway works. In the absence of the relocated Park and Ride, existing access/egress via this lightly trafficked section of Durley Hill could remain, with a new minor access junction created with the spur road between the two roundabouts.

Option	SDI	Justification
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	Slight positive	Keynsham has a number of SOAs in top 20% for population over 65
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	Slight positive	Keynsham has a number of SOAs in top 20% for population over 65.

Table 8.9: Social distributional impacts

Option	Social distributional impact	Regeneration	Regional imbalance	Economic growth	Overall RAG
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	No change	No change	N/A – strong region	Positive	Amber/green
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	No change	No change	N/A – strong region	Positive	Amber/green

Table 8.10: Regional impacts

8.2.6 Well being

The well-being assessment considers Severance, Physical Activity, Changes to Accidents, Impact to crime/fear of crime and Access to goods, service, people and place. These matters are considered in turn.

	Impacts						
Option	**Severance**	**Physical Activity Level**	**Changes to Accidents**	**Impact to crime/fear of crime**	**Access to goods, service, people and place**	**Terrorism**	**Overall RAG**
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	No impact	No impact	Slight decrease	No change	Slight positive	No impact	Amber/green
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	No impact	No impact	Slight decrease	No change	Slight positive	No impact	Amber/green

Table 8.11: Impacts on well being

8.2.7 Value for Money

The capital and revenue costs have been compared to the scale of benefits to estimate likely Value for Money. Value for Money categorisation is as follows:

- Poor – Benefit to Cost Ratio less than 1
- Low - Benefit to Cost Ratio between 1 and 1.5
- Medium - Benefit to Cost Ratio between 1.5 and 2
- High - Benefit to Cost Ratio between 2 and 4
- Very High - Benefit to Cost Ratio greater than 4

Appendix J contains the standard economic assessment tables for the two scheme options. Table 8.12 details the VfM category for the scheme options. Both options deliver medium VfM. Any land value uplift benefits associated with the two options have not been included in this assessment.

Option	Value for Money Categorisation
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	Medium value for money
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	Medium value for money

Table 8.12: Value for Money Categorisation

8.2.8 Summary of economic case

The work undertaken indicates that both Options 2 and 3 offer medium value for money. However, it should be noted that this assessment is at best conservative for the following reasons:

- The benefits assessment only takes account of the weekday peak periods, so no account is taken of time savings in the weekday inter-peak period or weekends. The addition of these delay savings over a period of 60 years would be likely to result in a high VfM if additionally assessed;
- The localised LinSIG modelling of the 'scheme' case in the 2036 scenario assumes higher levels of traffic inflow in both the AM and PM peak hours than the comparable 'Do Nothing' situation with the existing layout. In short, the full 'Design Flows' were not applied to the 'Do Nothing' case to ensure that levels of congestion/delay at the junction in its unimproved state were not unrealistically high. However, in doing this, the wider delay saving benefits to the surrounding highway network in drawing this additional traffic off existing urban roads in SE Bristol and Keynsham to the orbital corridor are ignored; and
- Removing congestion at Hicks Gate will encourage a higher traffic transfer to the A4-A37 Link Road, so improving the economic case for this specific infrastructure element. This element of benefit 'uplift' achievable by the Link Road is not considered in this OAR for Hicks Gate, but it will clearly be facilitated by the Option 2 or Option 3 improvement schemes. Whilst Hicks Gate is only considered in isolation in this OAR, it will clearly form an intrinsic part of the A4-A37 Link Road scheme and the wider benefits accruing from this.

8.3 Managerial Case

8.3.1 Implementation Timetable

Both scheme options have the same proposed implementation timetable. A preferred 'full' scheme option would need to be included in LTP4 and delivered 2026-2028 (the LTP3 period) after an earlier Phase 1 (interim scheme) delivered 2019-2021.

All scheme options have all therefore been scored 6 (5-10 years).

8.3.2 Public acceptability

Consultation on the JTS revealed that the majority of people support the delivery of improved road infrastructure. The scheme is therefore not expected to be controversial to residents in Keynsham or areas of SE Bristol. However, consultation on the scheme options presented in this OAR has not taken place.

Option	Level of public acceptability	Justification
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	3	Not expected to be controversial but no specific consultation has taken place.
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	3	Not expected to be controversial but no specific consultation has taken place.

Table 8.13: Public acceptability

Response options are:
1 – Low, 5 = High

8.3.3 Practical feasibility

The assessment of practical feasibility of the two short-listed options has been based on the work undertaken to date, in particular a desk-based assessment of constraints and services, which are included as Appendices. A key delivery factor will be sequencing or phasing of the works to ensure that existing traffic movements are maintained as far as practical at what is a 'key' existing junction in this part of the highway network during construction.

Both options may require planning permission before construction could begin, although it might be possible to implement either as a junction improvement scheme under the Highways Act 1980 powers. Both are located within the Green Belt and national planning policy outlines that a scheme in the Green Belt should not be approved except in "*very special circumstances*". However, this is effectively an extension of an existing junction and needed for effective northern termination of the A4-A37 Link Road, which will itself traverse Green Belt (SEBWP - OAR). Both elements are also needed to actively bring forward the SDL development at Whitchurch, and also to assist in mitigating the local generated traffic impacts of the North Keynsham and Brislington SDL sites.

Both options would be delivered, operated and maintained by BANES council, who have a strong track record in delivering major projects.

As the options are refined and further technical work is undertaken, the extent and detail of the practical feasibility will be better known.

Option	Level of practical feasibility	Comments
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	3 – Feasible	May require planning permission. Works are all at-grade and avoid any need for expensive structures. A key 'practicality' issue will be the phasing of the works and allied Traffic Management to ensure that construction delays are minimised and existing traffic movements maintained as far as practicable. Off-line works to the SW will assist in this, as well as the fact that the existing roundabout is largely retained within the expanded gyratory.
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	3 - Feasible	As Option 2 above.

Table 8.14: Practical feasibility

Response options are:
1 – Low, 5 = High

8.3.4 Quality of Supporting Evidence

To date, the scheme options have been developed to establish feasibility.

Consideration of options have been informed by the JTS and technical work undertaken to date including traffic modelling work outlined in Appendix I. The level of detail considered to complete the following has been taken into consideration:

- Baseline information – desk based – appropriate for this stage of work;
- Costs – high level with considerable levels of risk applied - appropriate for this stage of work;
- Feasibility – high level - appropriate for this stage of work;
- Impacts – high level - appropriate for this stage of work; and
- Traffic modelling – fairly detailed – detailed LinSIG models developed and used to assess operating performance, with 'Design Flows' derived from model 'runs' with the G-BATS strategic model.

As a result, the quality of supporting evidence for all options has scored 4 overall (good level of supporting evidence, possibly including some modelling and/or sensitivity testing demonstrating robust outcomes).

8.3.5 Key risks

The key risks for the project include:

- Need for the scheme to be prioritised in the WoE;
- Need to secure funding and include scheme within Local Transport Plans;
- Feasibility of any preferred option to be confirmed in further work, including an Outline Business Case;
- Land take required, and ownership of required land;
- Additional environmental mitigation required following further work;
- Relevant consents to be secured;
- Impact on National Flood Zones 2 and 3;
- Public support unknown;
- Inflated or additional scheme costs, including land purchase and utilities diversion; and
- Lack of resources (people, material, expertise, not funding) to progress the scheme.

8.3.6 Summary of management case

In summary, both scheme options are considered achievable and thus have a 'management case'. Public consultation on the preferred option has not yet been undertaken, although the scheme was included within the JTS, which did undergo a period of public consultation.

8.4 Financial Case

8.4.1 Affordability

The estimated cost of scheme options is outlined in Table 8.16. Both options require moderate investment, but this is broadly equivalent to a number of other major projects recently delivered.

Option	Affordability	Justification
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	4	JTLP3 includes 11 major transport schemes worth £600M of investment.
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	4	JTLP3 includes 11 major transport schemes worth £600M of investment.

Table 8.15: Affordability

1 = Not Affordable, 5 = Affordable

8.4.2 Capital Cost

For the purpose of this Early Assessment and Sifting Tool appraisal estimated capital costs for the scheme options are presented in Table 8.16.

Costs for the options have been estimated using the standard Method of Measurement for Highway Works determined using a mixture of direct CAD measurements and manual take offs. Appendix I presents the initial high-level costing of the scheme options

Option	Total Capital Cost (£m)
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	**£9.23**
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	**£9.53**

Table 8.16: Capital cost (£m)

8.4.3 Revenue costs

Revenue costs are not available at this stage.

8.4.4 Cost Profile

Capital costs are included in Table 8.16. Cost profile information is not available at this stage.

8.4.5 Overall cost risk and other costs

Costs are currently high level, and include fees, considerable contingency and land purchase.

The scheme costs are all effected by the following risks:

- Land purchase;
- Environmental mitigation;
- Environmental, utilities and other constraints – only desk-based review to date;
- Delays to implementation timetable;
- Required construction sequencing and phasing
- Lack of resources; and
- Funding secured and timing.

Option	Overall cost risk
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	3 – Medium risk
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	3 – Medium risk

Table 8.17: Cost Risk

Cost risk has been assessed on a scale of "1 high risk" to "5 low risk".

8.4.6 Summary of financial case

In summary, both schemes are considered to be financially affordable and thus have a 'financial case'.

8.5 Commercial Case

8.5.1 Procurement

The scheme would be delivered by B&NES Council, and standard procurement routes would be adhered to. B&NES Council has a strong record in procuring and delivering major infrastructure projects.

8.5.2 Flexibility of option

Both scheme options are deemed to be inflexible due to surrounding constraints, which have been outlined in previous sections. Scheme options have already been refined to present the most feasible options for Hicks Gate which deliver the required operating performance in 2036.

All options have therefore been scored 1 - 'Static'.

8.5.3 Funding sources

It is assumed that WECA will fund the scheme. Match funding contributions have not been considered as the proposed scheme benefits all travel modes seeking to access the local region, rather than connecting to specific individual developments.

8.5.4 Income generation

None of the scheme options would generate an income.

8.5.5 Summary of commercial case

In summary both scheme options are considered commercially viable, and thus have a 'commercial case'.

8.6 Summary

In summary, the key strengths for the Business Case are:

- Need for the scheme identified in emerging policy;
- Increased capacity and resilience of road network;
- Necessary in conjunction with the A4-A37 Link Road to deliver the SDL site at Whitchurch;
- The ability to deliver a Phase 1 or 'Interim' scheme prior to full completion of the A4-A37 Link Road will assist in reducing existing congestion problems at Hicks Gate, whilst helping to mitigate the generated traffic impact of the North Keynsham SDL (in conjunction with a A4-A4175 Link Road to the north of Keynsham);
- It facilitates the relocation of the Brislington Park and Ride to land in the SW quadrant of Hicks Gate, thus allowing the Brislington SDL to come forward; and
- Medium BCR of both Options 2 and 3 'in isolation'. Wider benefits are achievable in practice as localised modelling using lower traffic inflows in the 2036 'base-case' ignores the wider delay savings on the surrounding network with increased diversion to the orbital route in the 'scheme' cases. The delivery of improvements to Hicks Gate will also maximise the potential attractiveness and usage of the A4-A37 Link Road, so creating an 'uplift' in benefits when considering these two infrastructure elements as a whole.

Option	Strategic case	Economic case	Financial case (£m)	Commercial case	Management case
2 - Gyratory Configuration with A4 Bypass to A4174 'Cut Through' Link	Meets strategic objectives	Medium BCR	Financially Affordable	Has a commercial case, scheme would be progressed by BANES	Has a management case. Planning permission may be required, although it might be possible to implement as a junction improvement scheme under the Highways Act 1980 powers.

Option	Strategic case	Economic case	Financial case (£m)	Commercial case	Management case
3 - Gyratory Configuration with A4175/Link Road to A4174 'Cut Through' Link	Meets strategic objectives	Medium BCR	Financially Affordable	Has a commercial case, scheme would be progressed by BANES	Has a management case. Planning permission may be required, although it might be possible to implement as a junction improvement scheme under the Highways Act 1980 powers.

Table 8.18: Summary of how the scheme options meet the five cases

9 Conclusions

Following examination of the two 'short-list' options, it is considered that Option 3 (**Drawing No 674726.CA.51.004**) is overall the best performing option in the long term and should be taken forward for further detailed consideration in the Strategic Outline Business Case (SOBC). This is because, with the A4-A37 Link Road in place, the 'cut through' link for northbound traffic from the A4175 Spur Road (south arm) to the A4174 Ring Road is more beneficial than a link through the gyratory serving the movement from the A4 Keynsham Bypass to the A4174.

Whilst both options provide a similar level of operating benefit, the strategic aim should be to promote ease of movement along the north-south orbital corridor. Option 3 best meets this objective, with the 'cut-through' servicing the heavy flow expected from the A4175/Link Road to the A4174 Ring Road.

In the pre-Link Road scenario it is considered that an interim or Phase 1 scheme should adopt the form shown on **Drawing No 674726.CA.51.010.** This is because the 'cut-through' link catering for the right turn from the A4 Keynsham Bypass to the A4174 will be of more benefit operationally at this time. With the opening of the A4-A37 Link Road, and completion of the accommodation works to the south of Hicks Gate, a transition to the 'full' Option 3 can be easily made (or the Option 2 form retained if desired).

However, the relocation of the Brislington P&R site is clearly needed to directly accommodate the Brislington SDL on the existing site, and what alternative form an initial scheme at Hicks Gate could ideally take will depend on the timing of this. In the absence of the A4-A37 Link it would be necessary to consider how egress from the relocated site would be achieved if coming forward earlier. This could be via the existing lightly trafficked section of Durley Hill and its junction with the A4175, using a reconfigured LT in/LT out major-minor junction. However, a better solution might be to build the 'full' Option 2 scheme at Hicks Gate and use the western arm of the new southern roundabout as an access/egress to the P&R pending the delivery of the A4-A37 Link Road. This access to the P&R site could then be reconfigured during the subsequent construction of the Link Road. It should be noted, however, that this sequencing has not been tested economically in this OAR, with later transition works from the Phase 1 to 'full' scheme assumed. Furthermore, the cost of the new roundabout to the south of Hicks Gate is taken to form part of the A4-A37 Link Road scheme and delivered as such as part of these works and not earlier. In other words, whilst there may be cost savings in avoiding the later transition works, the roundabout to the south of Hicks Gate would have to be constructed earlier and form part of these works. So not the later A4-A37 Link Road works.

Appendix A - Constraints Plan

Appendix B - 'Long List' Option Drawings

Appendix C – Derivation of Design Flows

Appendix D - Environmental Base-line

Appendix E - FRA/Drainage Note: Stage 1

Appendix F - Services Drawings

Appendix G – Long List Option Sifting Tables

Appendix H – 'Short-List' Option Design Drawings

Appendix I - Traffic Modelling

Appendix J - Cost Estimates and Economic Assessment