



A4440 Worcester Southern Link Road Phase 4

Full Business Case

December 2018



Worcestershire
Local Enterprise Partnership

 **worcestershire**
county council

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Preface

Worcestershire County Council (WCC) and Worcestershire Local Enterprise (WLEP) are pleased to be able to submit a Full Business Case (FBC) to the Department for Transport to obtain construction funds from the Large Local Major Transport Schemes' fund. The scheme being promoted by WLEP/WCC is the completion of the dualling of the A4440 Worcester Southern Link Road (SLR). This Full Business Case builds on the work presented in the Outline Business Case and subsequent Addendum report, presented to the department in January 2018.

The scheme is the final phase of the four phase programme which upgrades the A4440 Worcester SLR to dual carriageway standard. Prior to the commencement of the upgrade programme, the A4440 Worcester SLR was largely a single carriageway route that was subject to congestion and unreliable journey times meaning that long distance trips currently use the City centre infrastructure to cross Worcester. The upgrade of the whole route to dual-2 carriageway standard with associated junction improvements will significantly increase the attractiveness of the bypass route making it the route of choice for East West movements.

Hence, the scheme will reinforce the role of the bypass as a strategic East West route, as well as a bypass to the City centre, and underpins the market confidence in the public sectors ability to deliver this key infrastructure required to drive the delivery of the economic growth ambitions contained in the Worcestershire Strategic Economic Plan (SEP) and the Local Development Plans.

The A4440 Worcester SLR Phase 4 scheme is supported by a robust case for change, demonstrates very high value for money, has a sound commercial footing, is very well supported by stakeholders and is deliverable by 2021, as illustrated by the comment below:

"As a global business based in St John's Worcester, we would welcome any infrastructure improvements that will help our employees, suppliers and customers to access our site. We currently experience extreme delays on this stretch of road; Phase 4 completion is therefore essential to the economic growth of our business and Worcester as a whole."

Source: Letter of support from Joy Global (worldwide leader in high-productivity mining solutions)

Phases 1 and 2 have already been successfully completed, with Phase 3 in construction and almost complete. However, the fourth phase is a large and potentially transformative local scheme that is outside the financial limits placed on WLEP within the regular Growth Deal allocations. Without the Large Local Major Transport Schemes fund, this regionally important scheme could not be funded.

The A4440 Worcester SLR is the main route that takes traffic to and from Junction 7 of the M5 motorway into South West Worcestershire and towards our County borders. Growth in this area has meant that for many years, this road has been operating at well over 120% of its original design capacity. Many large employers' key concern is that the resultant congestion is a significant factor in deciding whether to locate to, or more worryingly away from, the county's high tech employment sites spawned by the likes of Qinetiq. Strategically the scheme addresses the key national priorities as follows:

- **Congestion Relief:** Improvements to the A4440 Worcester SLR will reduce the negative effects of congestion and improve accessibility and journey times across south Worcestershire. Overall the scheme increases traffic flow on the A4440 Worcester SLR by 45 to 66% and journey times on the A4440 would improve by 53% in the AM/PM peaks in 2031.
- **Economic Growth:** The scheme will not only secure existing businesses but would also enable WLEP/WCC aspirations for the expansion of county's 'Gamechanger' sites such as Malvern Hills Science Park, South Worcester etc. The scheme will support economic growth by releasing an additional 15 ha of employment land. In addition, relieving Worcester City congestion enabling the addition of 2000- 3,000 jobs in the City over time and repositioning the City as a leading Cathedral City,. Finally, and not least, the scheme can remove the perception that Worcester is 'closed' at time of serious flood.
- **Housing Growth:** A4440 Worcestershire SLR Phase 4 will help advance Policy SWDP45/1 Broomhall Community and Norton Barracks Community (Worcester South urban extension) which will comprise

2,600 dwellings and 20 Ha employment together with supporting services and facilities. This quantum of development could sustain more than 3,600 jobs and generate nominal GVA in the region of £195m per annum upon completion. In addition, A4440 Worcester SLR Improvements Phase 4 will help to unlock the development of 2,150 dwellings, 5Ha of employment land and a range of supporting services and facilities including a neighbourhood centre as part of the Worcester West urban extension (see: Policy SWDP45/2 Temple Laughern – (Worcester West) urban extension). This quantum of development could sustain more than 900 jobs and generate nominal GVA in the region of £49m per annum upon completion. Further, the SLR is considered critical to unlocking development at North East Malvern (see Policy SWDP 56), where 800 homes and 10ha of employment land will be delivered. This quantum of development could sustain more than 1,800 jobs and generate nominal GVA in the region of £97m per annum upon completion. In total, these strategic development sites could generate 5,600 new homes and 35ha of employment land, supporting in excess of 6,300 jobs and providing GVA uplift of £340m per annum.

In addition to above, the connectivity to the Strategic Road Network from the west is notably poorer in the peak periods, in the Worcester area, due to congestion. This has meant that employment development to the West of Worcester is not attractive. Indeed, there has been a case where a site allocated for employment use has been developed for residential use due to lack of market interest in employment development to the West of Worcester. Feedback from the business community has shown this is due to connectivity, particularly lack of certainty of travel times to the Strategic Road Network. The scheme would address this issue.

The unattractiveness due to congestion and unreliability on the A4440 Worcester SLR results in trips routeing through the City, rather than using the Southern Link Road. Worcester's current high levels of congestion reduce the attractiveness of the City as a location for business and thus growth and regeneration opportunities are not taken forward. Removing strategic traffic from the city centre will enable Worcester to meet its socio-economic aspirations.

As set out above, the improvements to the A4440 Worcester SLR (Phase 4) will provide much needed network resilience to combat River Severn flooding, which has impacted the city centre during recent floods in 2003, 2007, 2012 and 2014.

Chapter 1:

Introduction



1 Introduction

1.1 Full Business Case (FBC)

The A4440 Worcester SLR Phase 4 scheme is supported by a robust case for change, a strong economic case, is well supported by stakeholders and is deliverable. It is embedded within both the Local Transport Plan 4 (and previous Local Transport Plan) and the South Worcestershire Development Plan (SWDP) and as such has a clear policy context. It also has strong community support and political backing and is a key part of the Worcestershire Strategic Economic Plan (SEP). The SEP has highlighted the A4440 Worcester SLR scheme as a critical element of the infrastructure package required to support planned levels of development in Worcester and therefore has a highly important role to play in supporting the economic growth of the local area.

As such, Worcestershire County Council (WCC) is committed to delivering the much needed improvements to the highly constrained A4440 Worcester SLR; a key network corridor linking the M5 Junction 7 and the eastern side of Worcester with Worcestershire's Primary Road Network (PRN) to the west of Worcester.

The Corporate Plan (2017-2022) states "Our continued investment in Worcestershire's transport and digital infrastructure is essential to provide businesses with improved access to markets and to support economic growth.

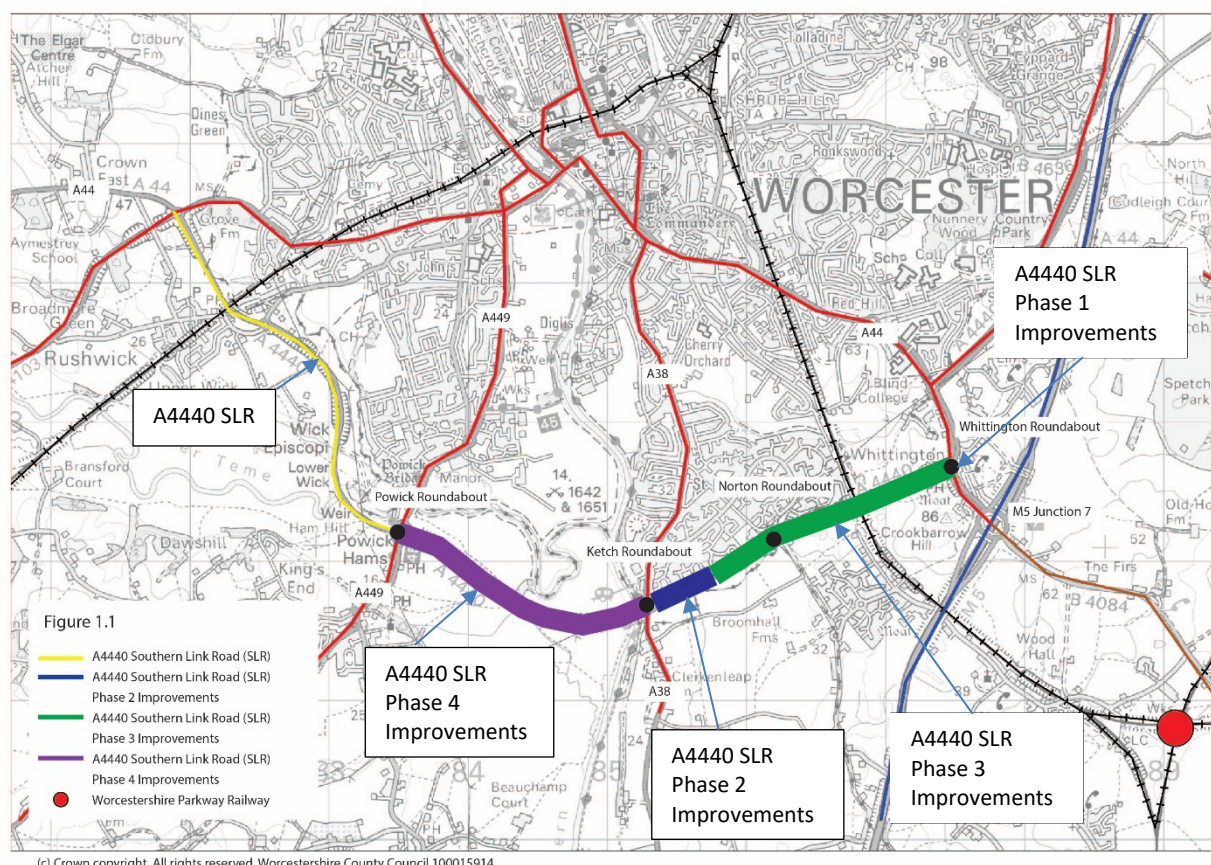
Transport infrastructure investment will be targeted to unlock the potential of key employment and housing development sites across the county.

Reducing journey times across the county and beyond is a key ambition, with investment focusing on improving access to national and global markets and enhancing connectivity between key economic centres."

This strategically important link is one of only two river crossings in and around Worcester with the other in the highly congested city centre. The A4440 Worcester SLR is currently a significant constraint to growth in Worcestershire with the situation only set to worsen. Due to the limited number of river crossings, current network resilience is poor, particularly in times of flooding.

The first two phases of the planned improvements have been delivered and the third phase commenced construction in October 2015 and is due for completion in 2019/2020 (the location and phasing of the improvements are shown in Figure 1.1).

Figure 1.1: Scheme Location



The A4440 Worcester Southern Link Road Improvements Phase 4 (the “scheme”) includes (see visualisation of the scheme in Figure 1.2):

- Construction of an additional carriageway adjacent to the existing single carriageway to form a 1.2 mile (1.9km) dual-2 carriageway from Ketch Roundabout to Powick Roundabout;
- Two new bridge structures to carry the additional 2 lane carriageway, at Carrington Bridge and at Powick Common viaduct;
- Capacity Improvements and junction revisions to allow dual carriageway connections at Ketch Roundabout;
- Widening of the existing footway to accommodate a shared pedestrian/cycle route on northern side;
- New road markings, some widening of carriageway on west approach to accommodate movements to new dual carriageway section at Powick Roundabout;
- Upgrade of dedicated left hand turn to Malvern to fully segregated facility at Powick Roundabout;
- Provision of a foot/cycle bridge linking the north and south cycle routes, located on the west approach, at Powick Roundabout; and
- Upgrade of grade separated pedestrian route for north to south movements at Ketch Roundabout.

Figure 1.2: Scheme visualisation



This Full Business Case (FBC) for the scheme updates the detailed scheme appraisal presented in the Outline Business Case, and is undertaken in line with WebTAG guidance.

The planned improvements are a key component of the Worcester Transport Strategy (WTS) which is a multi-modal response to increasing traffic volumes and development pressures in Worcester and surrounding areas. To deliver the WTS in full, WCC and partners would have needed to secure over £200 million of investment. Clearly, the possibility of accruing this level of funding at any one time was impossible. Therefore, the Council has adopted a strategy of delivering the full Worcester Transport Strategy through a phased approach, delivering parts of the strategy as funding becomes available.

Phase 4 of the improvements to the A4440 Worcester SLR is the final stage of a programme of works to increase the capacity of the A4440 Worcester SLR route between Powick Roundabout and Whittington Roundabout. This phase includes improvements to the river crossing and unlocks the potential of the A4440 Worcester SLR improvement strategy by increasing the future year traffic by between 45% and 66%. This additional capacity is taken by East West trip diverting from the city centre, trips re-routing from less suitable routes and from new economic and housing growth to the west of Worcester.

The significant increase in future traffic released by A4440 Worcester SLR Improvements Phase 4 provides a number of real benefits to residents and businesses in and around Worcester and the wider Worcestershire area including:

- Reduced journey times on the A4440 Worcester SLR. In the 2031 Do Something forecast journey times are 4-8.5 minutes less than the 2031 Do Minimum journey times
- Increased journey time reliability, as the congestion delays are minimised; and
- Improved access to Malvern, Worcester and the surrounding areas therefore increasing attractiveness of sites for development and aiding the delivery of South Worcestershire Development Plan, thus stimulating economic growth.

Evidence of the impacts of the scheme are documented in Sections 3 and 4 of this FBC.

The design of the A4440 Worcester SLR Phase 4 Scheme improvements has been developed to DMRB design standards based upon the predicted traffic flows from the latest 2031 WTM traffic flows. Highway cross sections, 2D roundabout layouts, and 2D highway alignments have been included within Appendix A of this Full Business Case.

The scheme is strongly supported by businesses.

“The development of the Southern Link Road (A4440) is crucial to supporting local businesses and to removing barriers to economic growth.”

Source: Letter of support from Worcestershire LEP.

1.2 Background to the scheme

The A4440 Worcester SLR forms part of Worcestershire's Primary Road Network (PRN). It passes to the south of the existing urban area. It links the Strategic Road Network (SRN) at M5 Junction 7 and the eastern side of Worcester with the A38, A449, A4103 and A44 and the associated radial corridors to/from Worcester and the wider area to the west and south of the City. In providing this orbital link, it provides for journeys between radial routes in Worcester as well as longer distance trips within the County and beyond.

The A4440 Worcester SLR also serves existing development and employment areas and the South Worcestershire Development Plan (SWDP) major residential allocations on the southern and western side of Worcester City and in Malvern Hills District to the west. Most notably, the A4440 Worcester SLR programme is associated with the South Worcester Urban Extension (SWUE), which is located immediately to the south. The A4440 Worcester SLR provides a vital highway link between the M5 (and the wider SRN) and South and West Worcester, Great Malvern, the wider Malvern Hills District, Ledbury, Upton and Herefordshire.

Constructed in the 1980's, the A4440 Worcester SLR was designed to a single carriageway standard, with a series of at-grade junctions with key radial routes to/from Worcester city centre. These junctions were of roundabout form with some widening of the A4440 Worcester SLR on the approaches to provide additional stop line capacity. With the growth of Worcester in more recent years, the original design standard has resulted in severe delays during peak periods, a problem which transport model forecasts are indicating will worsen as a result of the development growth planned for South Worcestershire and the wider county and region. Transport modelling has also shown that the original design standard has become a constraint on the use of the A4440 Worcester SLR and some trips are finding alternative, less appropriate, routes around or indeed through Worcester. The Worcester city river crossing accommodates 40,000 daily trips compared to 30,000 on the A4440 Worcester SLR

The scale of the A4440 Worcester SLR and associated Worcester traffic problems and the costs that these impose on the businesses, transport operators and users are such that, if left unresolved, will constrain the ability of south Worcestershire to accommodate planned development and support economic growth. Hence, the scheme will address a significant constraint on the performance of the transport network in Worcester and wider South Worcestershire. It will provide additional link and junction capacity over a key section of the A4440 Worcester SLR.

The scheme will increase capacity of the SLR and make access to the west of Worcester significantly quicker and more reliable. This will in turn make development sites, such as Worcester West Urban Extension and North-East Malvern more attractive and thus more development to be realised (3,000 dwellings and 15 Hectares of employment land).

The scheme is a component part of the WTS. Through the preliminary assessment of the WTS and recognising that it was not possible to be granted funding for the complete WTS at one time, an exercise was undertaken to identify an initial Phase 1 package and then subsequent components which complemented and enhanced the benefits that could be realised from the initial Phase 1 package. As these subsequent phases are each significant projects in their own right, it was further necessary to programme the schemes to meet with funding availability. Hence, through this process, WTS was divided into the following phases:

- WTS Phase 1: The appraisal showed it to deliver strong positive benefits across DfT appraisal criteria (this phase included the sustainable measures in the City and A4440 Worcester Southern Link Road Phase 1 and Phase 2 schemes); and
- Subsequent phases of WTS: The case for the subsequent phase of the WTS is as robust as Phase 1 in terms of the value for money offered (this phase includes the A4440 Worcester Southern Link Road Phase 3 and Phase 4 schemes).

A4440 Worcester Southern Link Road improvements have been split into four phases, these are shown on Table 1.1 .

Table 1.1: A4440 Southern Link Road Phasing

Phase	Scheme	Status
Phase 1	Whittington Junction minor Improvements	Completed
Phase 2	Ketch Junction improvements and provision of 600 metres of dualling towards Norton Roundabout	Completed
Phase 3	Norton Roundabout improvements and completion of dualling between Whittington and Ketch junctions	To be completed by Autumn 2019
Phase 4	Further capacity enhancements between Powick and Ketch junctions	To be implemented by 2021 – subject of this FBC

Phase 1 of the A4440 Worcester SLR improvements were completed in July 2012 and consisted of capacity enhancements to the Whittington Roundabout. Phase 2 works have recently been completed and provide enhancements to the Ketch Roundabout and 600 metres of dualling of the A4440. Phase 3 comprises dualling between Whittington and Ketch junctions and Norton Roundabout improvements.

1.2.1 History of the A4440 Worcester SLR strategy

The A4440 Worcester SLR strategy has been in development for some time. Previous work pertinent to the conception and the development of the Southern Link Road schemes includes:

- 2006 – Local Transport Plan 2;
- 2010 – Worcester Transport Strategy (2010);
- 2010 – Worcester Transport Strategy – Preliminary Appraisal Report (2010);
- 2011 – Local Transport Plan 3;
- 2014 – Phase 3 Business Case;
- 2015 – Phase 4 SOBC considered by the LEP;
- 2016 (May) - Phase 4 SOBC and ASR issued to DfT;
- 2016 (July): Phase 4 Emerging OBC issued to DfT;
- 2016 (October): Phase 4 LLM £500K Development Funding awarded;
- 2017 (January): Phase 4 OBC issued to DfT;
- 2017 (November): Local Transport Plan 4 adopted;
- 2017 (November): Phase 4 DfT Programme Entry Gained; and
- 2018 (April): Planning Consent Granted.

1.2.2 Structure of Business Case

The Appraisal Framework that is being used in this study is based on DfT's Transport Business Case Guidance and uses the best practice five case model approach. The methodology adopted for the following cases is as follows:

- Strategic case – this sets out the rationale of the proposal, making the case for change at the strategic level. This will facilitate the assessment to the degree to which the locally developed objectives and other relevant local, regional and national objectives are expected to be achieved.
- Economic case – this sets out the value for money that each option delivers. Evidence on economic, environmental, social and distributional impacts should be identified.

- Financial case – this presents the financial profile of the different options and the impact of the proposed funding arrangements.
- Management case – this assesses whether a proposal is deliverable by testing the project planning, governance structure, risk management, communications and stakeholder management, benefits realisation and assurance.
- Commercial case – this sets out the financial implications of the proposed procurement strategy, presenting evidence on risk allocation and transfer, contract timescales and implementation timescales.

1.3 Structure of remainder of this document

Following this introductory section, the report is structured as follows:

- Section 2: Strategic Case;
- Section 3: Transport modelling;
- Section 4: Economic Case;
- Section 5: Commercial Case;
- Section 6: Financial Case; and
- Section 7: Management Case.

Chapter 2:

Strategic Case



2 Strategic Case

2.1 Introduction

The A4440 Worcester Southern Link Road (SLR) improvement strategy has a very strong strategic case. It is a scheme that is embedded within both the Local Transport Plan 4 (and previous Local Transport Plans) and the South Worcestershire Development Plan (SWDP) as an integral component of the future highway network in Worcestershire and as such has a clear policy context. It also has strong business community support and political backing and is seen as a scheme that is vital to achieving the Worcestershire Strategic Economic Plan (SEP). That is, the Worcestershire SEP has highlighted the A4440 Worcester SLR scheme as a critical element of the infrastructure package required to support planned levels of development in Worcester and therefore has an important role to play in supporting the economic growth of the local area. The improvement of the A4440 Worcester SLR has been divided into four phases and with Phases 1 to 3 either complete or underway, this Business Case is prepared in respect of phase 4.

This section sets out the strategic case for Phase 4 of the A4440 Worcester SLR Improvement schemes in detail. It explains the wider context, presents the rationale for the scheme and makes the case for why the investment is required. Specifically it:

- Describes the business strategy and relevant business/economic plans it has taken into consideration (Section 2.2);
- Look at various similar economic and transport studies around Worcester (Sections 2.3 to 2.5);
- Describes the problems identified and the justification for intervention (Section 2.6);
- Explains the impact/consequences of not changing (Section 2.7);
- Explains the strategic scheme impact (Section 2.8)
- Outlines the objectives and how they align with Worcestershire's strategic aims (Section 2.9);
- Presents the key measures for success for the scheme (Section 2.10);
- Sets out the scope of the project (Section 2.11);
- Identifies high level constraints (Section 2.12);
- Explains the factors (interdependencies) upon which the successful delivery of the project is dependent (Section 2.13);
- Outlines how stakeholders and the local community have been involved in the development of the scheme (Section 2.14); and
- Sets out all the options identified and explains how the option now being taken forward was identified (Section 2.15).

2.2 Business strategy

The programme of A4440 Worcester SLR improvement schemes is described within the Worcestershire SEP, WTS, Worcestershire's adopted Local Transport Plan (LTP3 and LTP4) and the SWDP and associated Infrastructure Delivery Plan (SWIDP). It is a key element of transport strategy designed to meet the challenges of increased demand for travel as a result of economic growth including significant new housing and employment development.

The delivery of the A4440 Worcester SLR improvement strategy is a priority for WCC, the Worcestershire Local Enterprise Partnership (WLEP), Herefordshire and Worcestershire Chamber of Commerce, Members of Parliament and the Worcestershire District Authorities. The A4440 Worcester

SLR improvement strategy is aligned with agreed priorities, in particular in terms of supporting economic growth in Worcestershire.

The Worcestershire SEP identifies the A4440 Worcester SLR as one of the top transport priorities for Worcestershire. The LEP has, within its funding remit and using funds from other sources, progressed the other priority schemes including Worcestershire Parkway and Hoobrook Link Road schemes such that a full funding commitment has been made. For the A4440 Worcester SLR the County Council has committed funds to complete Phases 1-3 (in addition to funding from developers), which fall within its funding remit. Due to its scale, the LEP cannot fund the A4440 SLR Phase 4 scheme, thus it remains the outstanding priority.

The scheme also has strong support from the neighbouring Marches Local Enterprise Partnership (MLEP) which covers Herefordshire. The A4440 Worcester SLR is regarded as a key strategic route connecting Hereford and Leominster with the motorway network and current congestion has an effect on businesses and jobs.

2.2.1 Worcestershire LEP SEP

The SEP (2014), prepared by the WLEP, aims to create a world class location, world class skills and world class innovation in order to achieve the overall vision for Worcestershire which is “To be an internationally recognised, highly competitive and innovative business location by stimulating investment, improving productivity and supporting the creation of sustainable economic growth and employment in Worcestershire.” The ten year strategy sets ambitious targets: 25,000 new jobs, 10,000 apprenticeships, 9,400 homes and a £2.9 billion increase in GVA by 2025 – overall growing the economy over the 10 year period by a third.

The ambition of the SEP is already being realised. The 2017 Annual Report of the LEP states the following, WLEP is

- 1st strongest growth in higher level workforce skills (Of all LEPs between 2010 – 2015)
- 1st highest growth in productivity (Of all LEPs between 2010 – 2015)

The 2016 Annual Report of the LEP states that “WLEP is responsible for developing and delivering Worcestershire’s 10-year Strategic Economic Plan which was agreed by all partner organisations and submitted to Government in March 2014. WLEP is, therefore, working to create 25,000 jobs, increase Gross Value Added (GVA) by £2.9bn and contribute towards the delivery of 21,500 new homes by 2025.”.

Supporting economic growth through the provision of reliable infrastructure networks is a key priority. The SEP recognises that pinch points to the strategic transport networks are constraining economic growth and that investment in Worcestershire’s transport infrastructure and service networks is essential to provide businesses with improved access to markets and employees and to encourage economic growth.

The SEP identifies four major schemes transport related infrastructure projects. These are:

- Hoobrook Link;
- M5 Junction 6;
- Worcestershire Parkway; and
- A4440 Worcester SLR Improvements (Phases 1-4).

Progress is being made on three of these four schemes, but the A4440 Worcester SLR Phase 4 scheme cost is beyond that for which WCC and WLEP can fund, hence the bid to DfT under the Large Local Majors programme is being made to allow the completion of this scheme.

Indeed, the SEP specifically notes that *“Over the medium term (to 2020/21) investment will be targeted to complete the dualling of the A4440 Worcester SLR across the Carrington Bridge.”*

Without the A4440 Worcester SLR Phase 4 scheme, the ambitions for economic growth set out in the SEP, will not be realised. For example, key employment locations, such as Worcester City Centre and Malvern Hills Science Park will not be provided with the high quality transport networks they require to reach their full economic potential as thus growth will be constrained.

The importance of the scheme is also confirmed by stakeholders, as illustrated below.

“The resulting congestion on the bridge not only means that commuters who use the road on a daily basis to travel to work face unpredictable and often costly delays in their journey, but puts significant strain on businesses such as ours who cannot avoid using the A4440 to get our products to our UK customers but also adds significant uncertainty in ensuring the timely delivery of >90% of our sales (£100million) to our customers around the world, prejudicing our hard won market-leading position in key markets such as the USA, China and Japan.”

Letter of support from Malvern Instruments Limited

“As a business owner living in Malvern, I have travelled regularly along this road at all times of the day. I find it time consuming and frustrating that the road is slow during the day and at times static. The roundabouts at either end can be treacherous to join.

I now actively avoid this route and will continue to do so until the conditions improve. This adds time and associated costs to my journey, but the impact on my day is worth it.

Failure to complete Phase 4 will negatively impact the development of this area, and the regions feeding into it.

I am considering expanding my business to include a facility which will need good road links for logistics. I cannot consider any site which involves transport using this road, at present, because of the impact on journey times, both of goods and people.”

Letter of support from Alimenti Food Sciences Ltd.

The Worcestershire LEP, in conjunction with Worcestershire County Council, has identified four strategic investment or ‘Gamechanger’ sites.

The ‘Gamechanger’ employment sites are the top level of new employment location. The three categories or portfolio of sites are targeted at three potential markets:

- International and National markets – sites with the scale and wider business environment attractive to footloose and or foreign direct investment, characteristics include the need to be located close to a large urban area with excellent links to the SRN and railway network;
- National and Regional markets, where location and scale of site target specific requirements where ease of access to SRN and larger urban areas remain key; and
- Local Markets, where occupiers know local infrastructure networks, often supplying local markets and able within the grain of existing locations.

The work on the Gamechanger programme with key sites at Malvern Science and Technology Park, Worcester 6 (in the south of the County), Redditch Eastern Gateway and the Kidderminster Employment Zone is expected to underpin up to 16,000 new jobs across Worcestershire.

2.2.2 The Marches Local Enterprise Partnership Strategic Economic Plan

The Marches Strategic Economic Plan (SEP) reports the LEP are aiming to improve connectivity to national and regional markets and airports, support their growth ambitions. The SEP vision for The Marches is of a strong, diverse and enterprising business base, operating in an exceptional and connected environment, where the transfer of technology and skills foster innovation, investment and economic growth. The SEP identifies transport as a barrier to growth.

The Executive Summary of The Marches SEP, states:

“The Marches is also faced with challenges. There are high levels of young unemployed people who are not in work or further education or training. Companies report finding the right people for their business more difficult. The road and rail network needs upgrading with infrastructure that in many places is stymying the high levels of housing and employment development that is possible. As cited by the Chair

of a local business board, just getting from A to B in the Marches is a problem. Our road and rail network is not good enough for our businesses to really excel. “

A letter from The Marches LEP is included in Appendix Q of the FBC, which states:

“... we support proposals for progressing a dual carriageway at Carrington Bridge noting the potential benefits it could provide for the economic prosperity of Herefordshire.”

2.2.3 “Shaping Worcestershire’s Future” – Corporate Plan 2017 - 2022

An updated Corporate Plan for 2017-2022 has been produced. The Corporate Plan contains four main priorities:

- Open for Business;
- Children and Families;
- The Environment; and
- Health and Well-Being.

Encouraging economic growth is a key theme which is continued by the WCC Corporate Plan. A key theme within the Corporate Plan relates the County being ‘Open for Business’. The plan states “Our continued investment in Worcestershire’s transport and digital infrastructure is essential to provide businesses with improved access to markets and to support economic growth.

Transport infrastructure investment will be targeted to unlock the potential of key employment and housing development sites across the county.

Reducing journey times across the county and beyond is a key ambition, with investment focusing on improving access to national and global markets and enhancing connectivity between key economic centres.”

The Corporate Plan states the one of the priorities for investment is:

“Completing the dualling of the Southern Link Road (A4440) from the M5 across the River Severn to the Powick roundabout”.

As part of the environment priority the Corporate Plan says that there is a “commitment to improve our transport networks and deliver resilient infrastructure”. The Plan also says that “a sustainable environment is important for people’s wellbeing, the economy and for the natural environment”. The Plan also recognises that there is an ongoing need to “minimise the impact of flooding” on the Worcestershire transport network and reduce the impact of closures related to flooding so that people will be able to continue to undertake business and commerce.

2.2.4 Worcestershire LTP

2.2.4.1 LTP3 (2011 to 2026)

Worcestershire's LTP3 highlights that an efficient multi-modal transport network is important in sustaining economic success in modern economies, and that slow and unreliable transport networks will inhibit economic performance. The economic objective of the LTP3 is to support Worcestershire’s economic competitiveness and growth through:

- Prioritising limited funding towards improving the transport infrastructure and services and reducing transport costs along the busiest /most used transport corridors and in congested urban areas, such that the Worcestershire economy obtains the greatest benefits from investment; and
- Dealing with 'pinch points' on Worcestershire's transport networks, to ensure the efficient movement of people and goods around Worcestershire.

The need for the A4440 Worcester SLR Improvements Phase 4 scheme is specifically identified in the LTP3.

2.2.4.2 LTP4 (2018-2030)

WCC adopted its fourth Local Transport Plan (LTP) in November 2017.

The A4440 Worcester SLR is listed as a proposed major transport scheme during the LTP 4 period. LTP4 introduces the proposal to create a Worcester Western Link Road scheme to link the A4440 to Martley Road (B4204). This will serve existing and new development to the west of Worcester. The scheme links to the A4440 Worcester SLR resulting in a high quality route for journeys to the SRN and Worcestershire Parkway. Hence the A4440 Worcester SLR phase 4 scheme will, in the future, also be a link to an improved highway network to the west of Worcester.

2.2.5 South Worcestershire Development Plan (SWDP)

The SWDP is the Joint Local Plan of Malvern Hills District, Worcester City and Wychavon District Councils. The plan was adopted and published on 25 February 2016. The SWDP aims to improve, protect and manage sustainable growth through a set of overarching aims:

- Delivering economic prosperity with Worcester at the heart;
- Locally justified housing; and
- Infrastructure-led development.

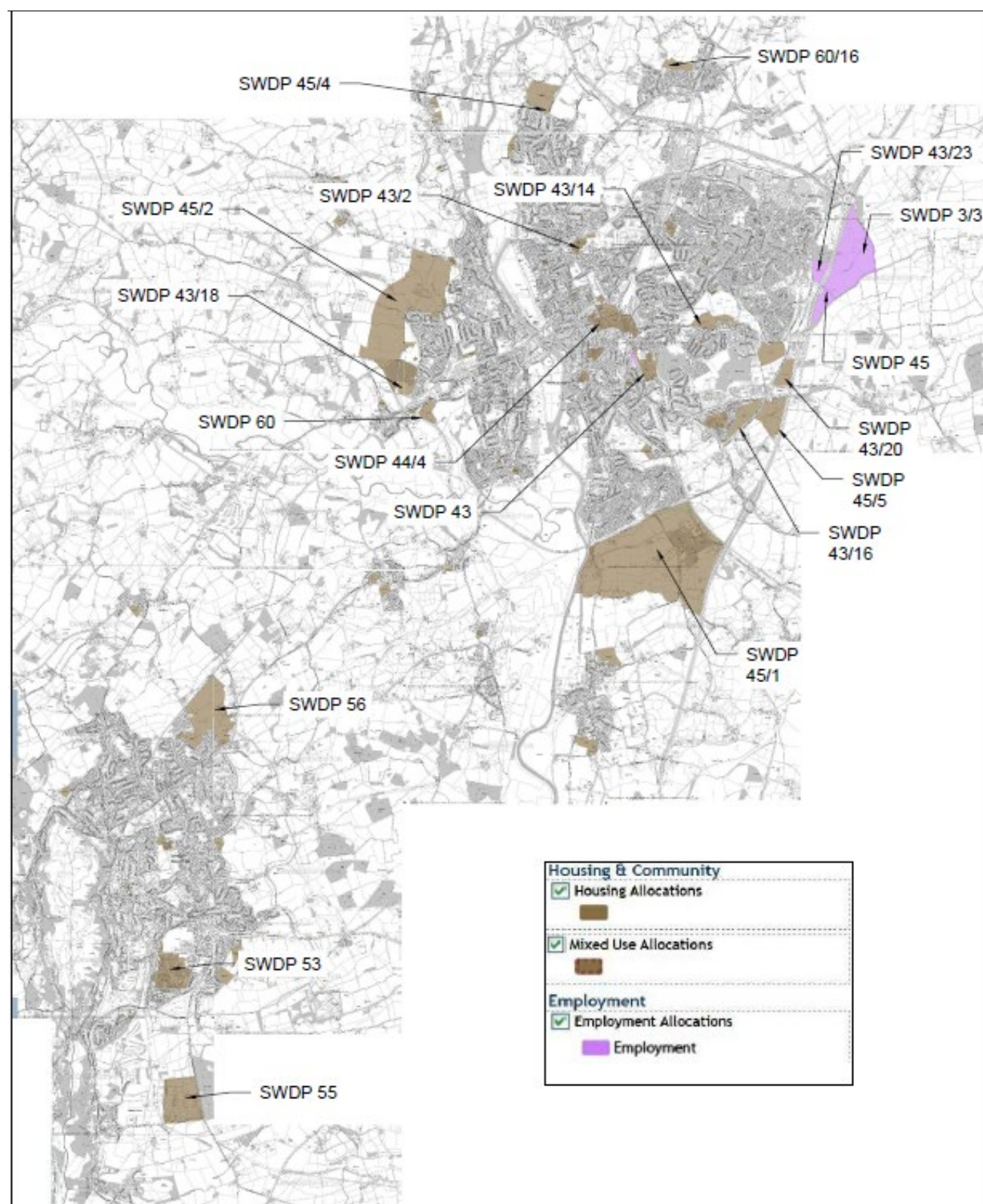
The SWDP identifies the land allocations for various housing, employment and mixed-use development schemes over the plan period.

Figure 2.1 shows the location of development allocations in the Worcester area.

The SWDP policies of particular note to the scheme are:

- Policy SWDP 3 sets out the proposed employment and housing allocations. Following the Inspector's Stage 1 feedback, the housing allocation has increased from 23,200 to 28,400. The majority of this increased in the Wider Worcester area.
- Policy SWDP45/2 Temple Laugherne (Worcester West Urban Extension) outlines the development of 2,150 dwellings, 5Ha of employment land and a range of supporting services and facilities including a neighbourhood centre. The Policy states the requirements include:
Measures, including proportionate contributions directly related to the development, to support and safeguard the implementation of relevant schemes set out in the Worcestershire LPT3, including the adopted Worcester Transport Strategy, such as: improvements to the A4440 (including phased dualling)
- Policy SWDP45/1 Broomhall Community and Norton Barracks Community (Worcester South urban extension) which indicates 2,600 dwellings and 20 Ha employment together with supporting services and facilities. The policy also states that improvements to the A4440 including phased dualling will be required to support the development.
- Policy SWDP 56: Development at North-East Malvern which indicates 800 dwellings and 10Ha of employment-generating uses.

Figure 2.1: Proposed SWDP Development Allocations



The relationship and dependency of the proposed development on capacity improvements to the A4440 Worcester SLR was considered in the development of the SWDP.

The plan to increase the capacity of the A4440 Worcester SLR is a specific transport infrastructure improvement stated within the SWDP and associated South Worcestershire Infrastructure Development Plan (SWIDP). The need to improve the capacity of the A4440 Worcester SLR is also referenced by the Highways England in their comments on the SWDP and their inputs to the SWIDP.

The SWDP highlights that the four Phases of improvements to the A4440 Worcester SLR form a critical integrated element of the Plan's transport schemes identified to support growth in South Worcestershire. The SWDP policy which sets out the approach to providing transport infrastructure is: SWDP 4 - Moving around South Worcestershire. This is the key transport policy within the plan. Also, specifically, the "A4440/Southern Link Road capacity enhancements (phases 3 & 4, Whittington - Ketch – Powick/)" scheme is included in the SWDP Infrastructure Delivery Plan.

In the section of Policy SWDP 4; Delivering transport infrastructure to support economic prosperity it states that:

"Phase 1 of the Worcester Transport Strategy only addresses existing transportation needs at 2010 along with projected background growth in travel demand. The provision of 12,200 dwellings and 120Ha of employment land in the Wider Worcester Area up to 2030 will, therefore, require the phased implementation of additional elements of the Worcester Transport Strategy, including:

- i. Dualling of the A4440 Southern Link Road between Powick Hams and Whittington, including the Carrington Bridge."*

The combination of transport improvements and new development sites will attract inward investment, which will have a direct effect on the economic growth within the County.

Furthermore, Policy SWDP 45/1 Broomhall Community and Norton Barracks Community (Worcester South Urban Extension) specifically states that deliverability of SWUE is contingent on proposed improvements to the A4440 Worcester SLR. The Proposed Modifications state that "The rate of delivery will be dependent upon the phased implementation of the Worcester Transport Strategy and in particular the dualling of relevant sections of the A4440 Southern Link Road." This site has the following applications:

- Wellbeck application 2204 dwelling and associated infrastructure (13/00656/OUT); and
- St Modwen application 225 dwellings (13/01617/OUT).

The importance of dualling the A4440 Worcester SLR is also mentioned in Policy SWDP45/2 Temple Laugherne (Worcester West Urban Extension). The rate of delivery of this site will be dependent upon the phased implementation of the Worcester Transport Strategy and, in particular, the dualling of relevant sections of the A4440 Southern Link Road. The disposition of proposed uses within the allocation boundary will need to ensure the comprehensive development of the allocation as a whole and provide an integrated and cohesive urban design facilitating movements within the site and to / from the City. The current applications in for:

- Bloor Homes (16/01168/out) – 1400 Homes; and
- Hallam Land (15/01419/OUT) – 975 dwellings, employment land and primary school.

2.3 Worcester City Centre Regeneration Progress Review, Zeta Economics

Zeta Economics undertook a review for Worcester City Council of the progress of regeneration since the production of the Masterplan in 2011. The report stated that Worcester City Council has undertaken a lot of work to facilitate the Masterplan delivery, whilst improving the wayfinding and environmental quality of the City centre.

The report states:

"The bulk of development projects identified as progressing or emerging can be expected to be realised between now and 2020/2025. Future city centre masterplan projects can attract more than £800 - £855 million of private sector investment with required public sector funding estimated between £31 and £53 million. The public sector funding would therefore leverage more than £16 of private sector development finance per £1 invested.

This could create an estimated 8,700 completely new net additional FTE jobs in the Worcestershire economy generating £480 - £670 million of GVA per year and other benefits (e.g. public realm related pedestrian user benefits and additional regeneration benefits).

The city centre masterplan can be expected to contribute to narrowing the wealth gap between Worcester and the national average measured by GVA. Public sector leadership of the Masterplan delivery would increase the Strategic Value Added and would address some of the identified information asymmetry and uncertainty market failures associated with larger scale delivery in Shrub Hill Opportunity Area."

This assessment aligned to the SWDP objective to "promote the sub-regional role of Worcester as the major leisure, retail, tourist and university centre and support the sustainable growth of the city."

2.4 The Marches Strategic Transport Corridors Report, May 2016

This study recognises four 'Strategic Road Corridors'. The Wales and Marches to Midlands corridor is seen as being based on the A4103, A4440/M5 and A44/ A4440/ M5 routes. These routes are seen as providing connections to the West Midlands, North West and South West. The Wales and Marches to Midlands corridor provides an important link between the historically close areas of Herefordshire and Worcestershire, and then onward to the West Midlands conurbation. The A44 and A4103 (from Leominster and Hereford respectively) are important links to the M5 motorway at Worcester. The report notes that the A44 / A4103 / A4440 roads provide "a vital link to the whole of the West Midlands conurbation for freight movements in particular. The areas to the south and west of Birmingham are particularly important as they are easily accessible from the M5 / M42".

The reports identified priority investment projects in each of the Strategic Road Corridors as those which, on the basis of existing evidence, are likely to provide good value for money and be deliverable within realistic timescales. For each corridor the pipeline is split into Category 1 (projects for which there is an existing evidence base) and Category 2 (projects requiring further development). The Worcester Southern Link Road Improvement Scheme is specifically identified as a Category 2 scheme in the report.

The Wales and Marches to Midlands Strategic Road Corridor objectives are:

- Enabling greater economic integration between The Marches and Worcestershire through support to the priority sectors.
- Providing additional transport capacity where there are physical constraints, in order to deliver faster and more reliable journeys for commuters and freight flows.
- Providing transport infrastructure to support the growth of Leominster, and to improve its links to Worcester and the M5 motorway.

The benefits of the scheme to The Marches are seen as:

- (1) Greater certainty / acceleration of planned growth in Worcester, which could benefit residents and business in The Marches through closer economic links.
- (2) Reduces costs of freight transport for business by enabling faster / more reliable access to the motorway network.

The report notes that the Worcester Southern Link Road Improvement Scheme is "to be progressed by Worcestershire LEP and Worcestershire County Council, with support from The Marches LEP and local authorities will be an important aspect of cross-boundary collaboration".

Cabinet Member for Infrastructure, Herefordshire Council (March 2015)

"The bridge sits on one of the key strategic transport routes linking Herefordshire and the South Worcestershire towns of Ledbury and Malvern to Worcester city centre, key industrial sites on the

outskirts of Worcester and junction 7 of the M5.....If people wish to travel from Herefordshire or South Worcestershire to reach the M5 North motorway they have no choice but to travel on this route, or face a minimum of 30 extra miles on their journey by going to the M50, then joining the M5 a mile outside Tewkesbury. We support proposals for progressing a dual carriageway at Carrington Bridge noting the potential benefits it could provide for the economic prosperity of Herefordshire.”

2.5 Midlands Connect

2.5.1 Economic Impact Study, May 2015

This report, prepared by Atkins for the Midlands Connect Partnership’s, considers the Midlands area and the connectivity of key centres within the area and to adjoining areas. The report divides the various linkages into a series of corridors, which are assessed for both road and rail journey times.

It is notable that the reporting of road journey times shows that the corridor to the south west quadrant of Birmingham does not feature on the fastest journey times, and the corridor between Worcester and Hereford is reported for slow journey times. The report identifies the benefits of decreases in Generalised Journey Time for the corridors identified. For the South West corridor, that includes Worcester, the report suggests that improving highway connectivity could help unlock 19,000 jobs by 2031.

2.5.2 Emerging Strategy November 2016 – Midlands Connect Strategy

In March 2017, Midlands Connect published the ‘Midlands Connect Strategy: Powering the Midlands Engine’. This strategy describes the benefits of investment in transport infrastructure, and particularly recognises investment in highway capacity to address slow journey times as a result of congestion and improve journey time reliability. The main emphasis of the Midlands Connect Strategy is to capture the benefits and opportunities over the whole of the Midlands created by HS2. The Midlands Connect Strategy has recognised the importance of east west links in the area and specifically notes improvements to the A4440 Worcester SLR - ‘Through our engagement with the Welsh Assembly, connectivity between north and south Wales has been identified as one of their economic Priorities... this includes improvement to the Worcester southern ring road in order to provide improved links within this south western corridor to locations such as Hereford’.

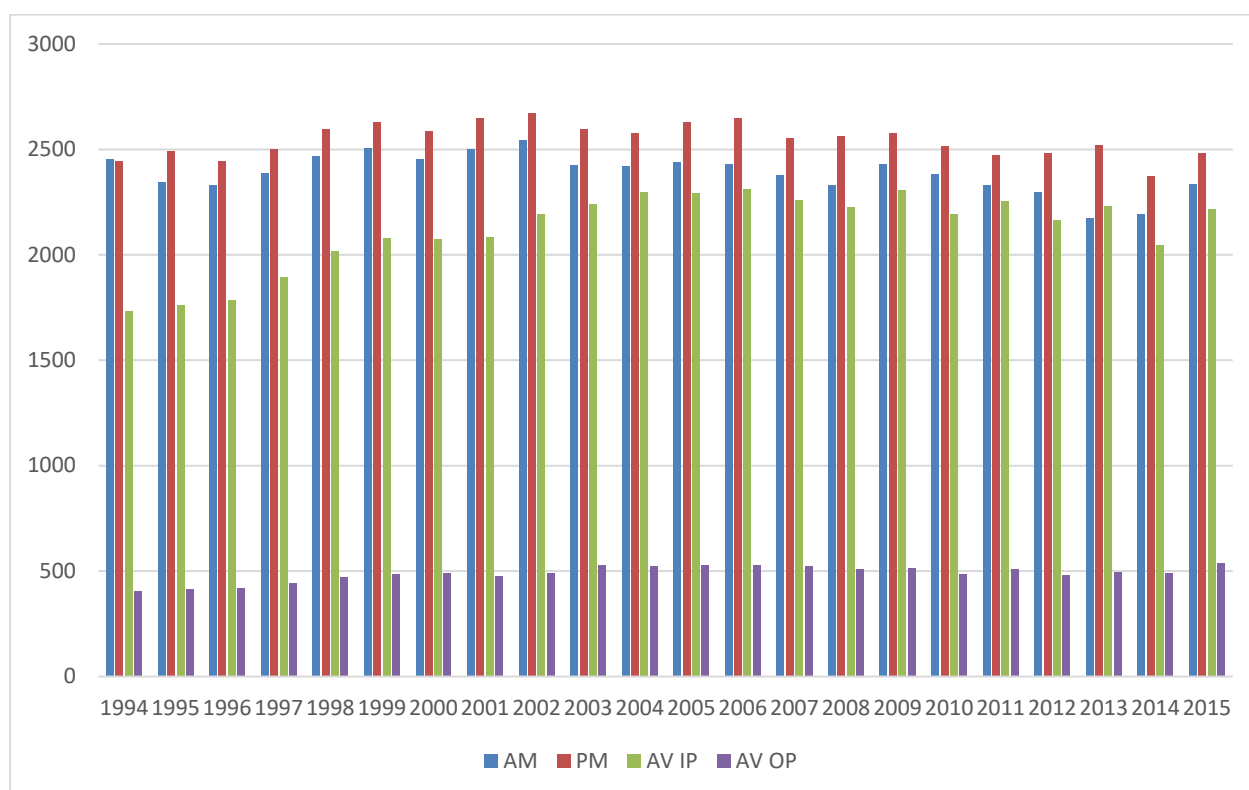
2.6 Problems identified

2.6.1 Congestion

As identified in the Worcestershire LTP2, and subsequently in LTP3 and LTP4 as well as in the SEP, a number of individual sections of the Worcester highway network are performing poorly in terms of congestion and delays. This includes the A4440 Worcester SLR. The congestion currently identified through data is confirmed by daily experience. This was recognised in LTP4, which focuses on delivering transport infrastructure and services to tackle congestion and improve the quality of life. In particular, the LTP identifies key pinch points which act as barriers to economic growth.

Figure 2.2 shows Peak Hour and Inter-peak Traffic Flows 1994 – 2015 on the A4440 Worcester SLR Temeside Way section. Analysis of this historical traffic data from 1994 to 2015 indicates that a peak hour flow in the region of 2400 - 2600 vph has been recorded since 1994. This peaked at just over 2500 vph in 2002 in the AM peak and 2670 vph also in 2002 for the PM peak and has stabilised in more recent years. The inter-peak traffic count has shown a steady increase since 2001 and is close to reaching AM peak averages. The increase in inter-peak movements further highlights congestion along the A4440 Worcester SLR along the Phase 4 section, as it appears that “peak spreading” is occurring.

Figure 2.2 : A4440 Temeside Way Peak Hour and Inter-peak Traffic Flows 1994 – 2015



Figures 2.3-2.6 show journey time and speed data from the County Councils C2 monitoring data. The data is averaged over 15 mins and collected between August-September 2015. The graphs illustrate that the current performance of the A4440 Worcester SLR is poor in the peak periods.

Figure 2.3: WB Ketch to Powick journey time data (averages over 15 mins Aug-Sept 2015 C2 data)

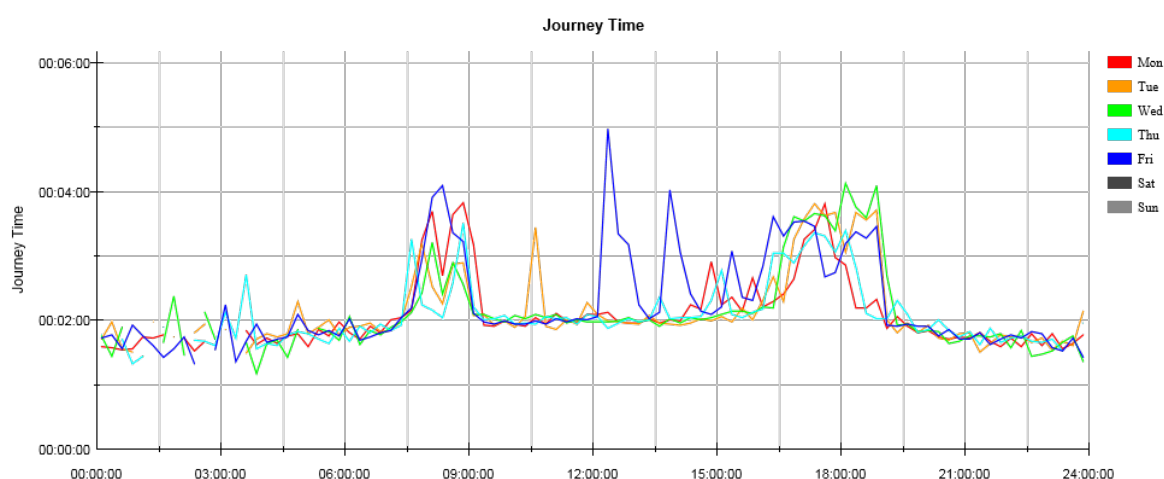


Figure 2.4: WB Ketch to Powick speed data (averages over 15 mins Aug-Sept 2015 C2 data)

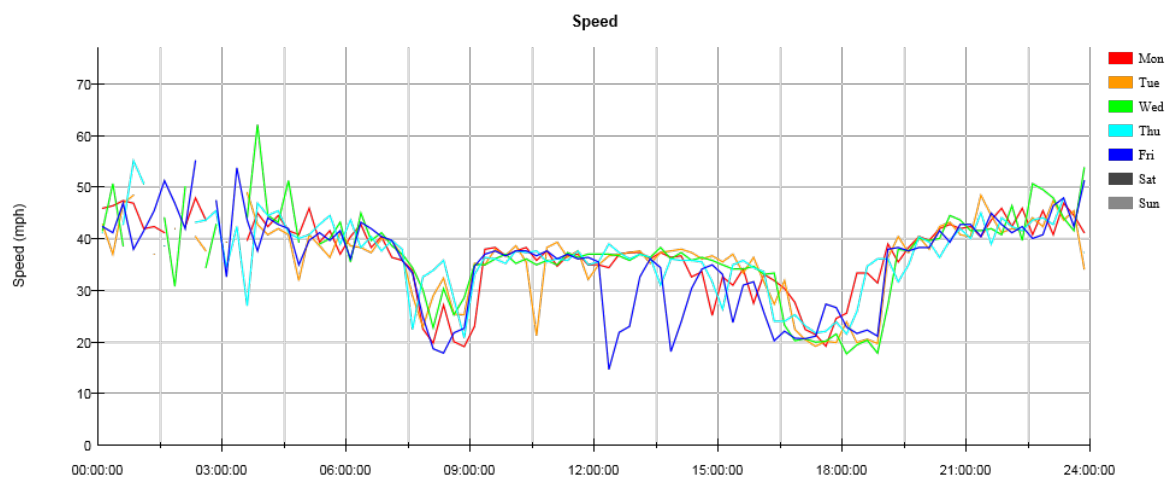


Figure 2.5: EB Powick to Ketch journey time data (averages over 15 mins Aug-Sept 2015 C2 data)

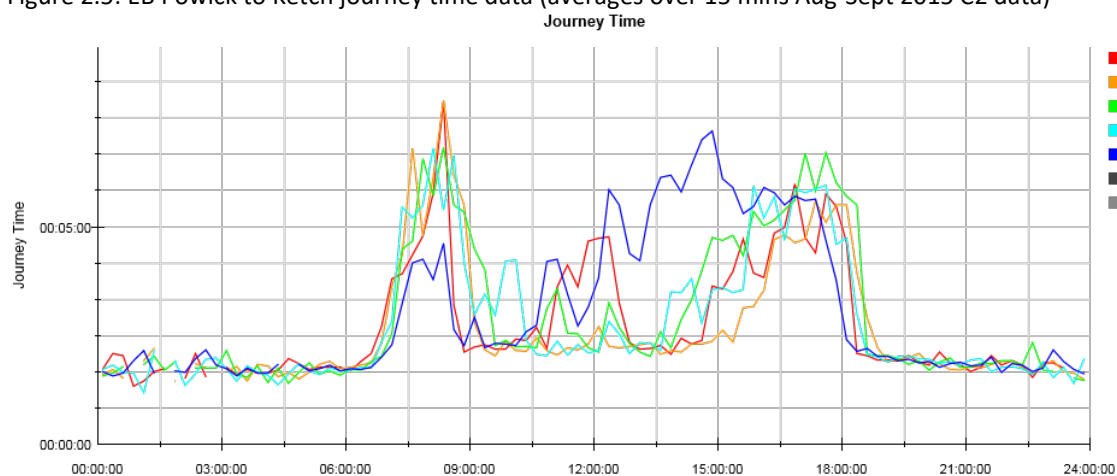
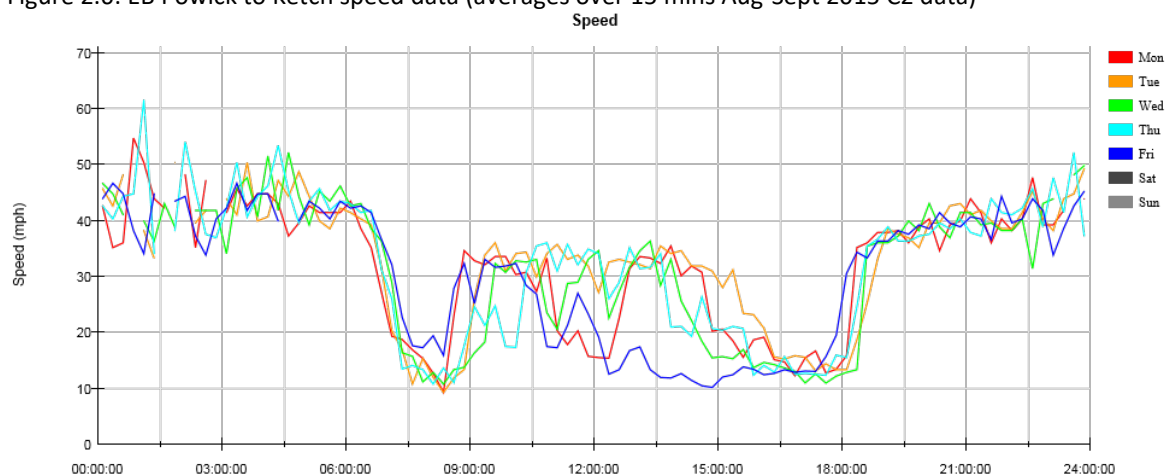


Figure 2.6: EB Powick to Ketch speed data (averages over 15 mins Aug-Sept 2015 C2 data)



Figures 2.7 to 2.10 show a snapshot of the impact from January 12th 2016 in terms of the typical levels of congestion experienced, taken from Worcestershire County Council JTMS system, the AM peaks show traffic conditions at 08:45, whilst in the PM peak this is taken as 17:30.

Figure 2.7: EB Crown East Roundabout to Whittington Roundabout (AM Peak – 08:45)

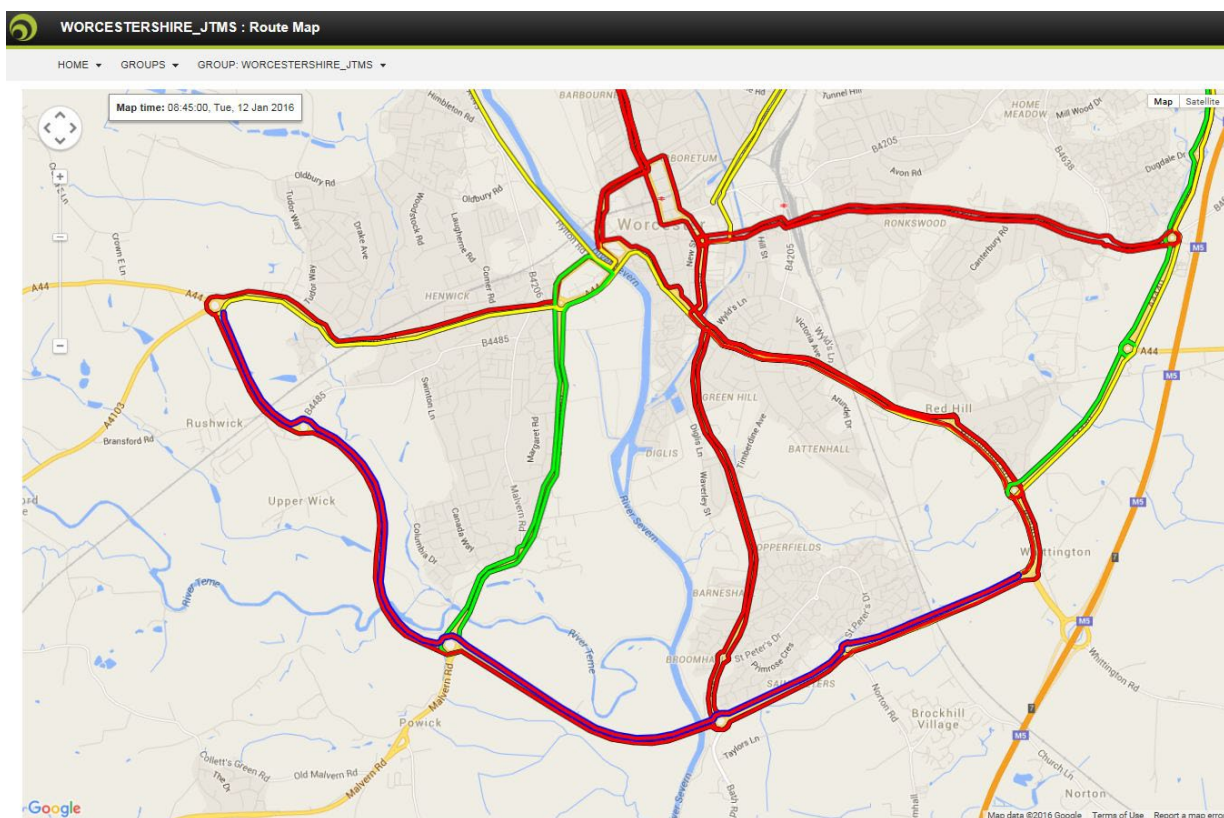
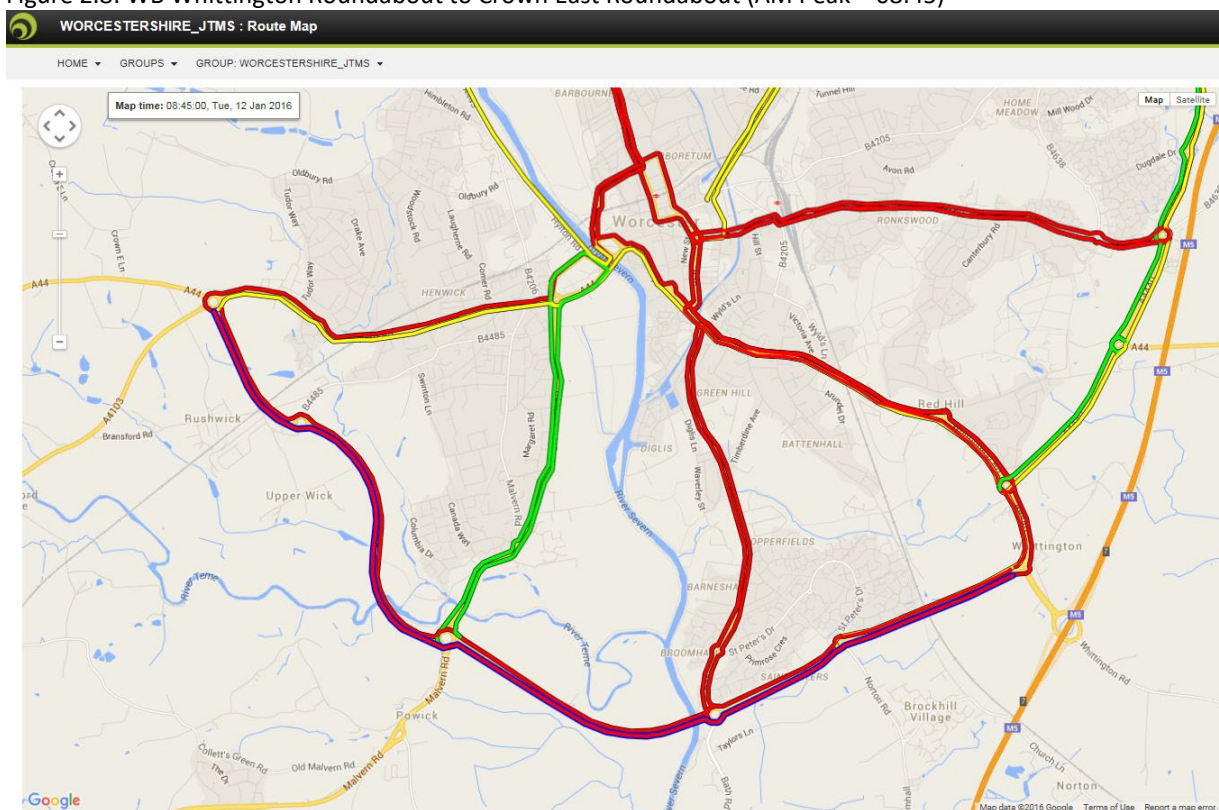
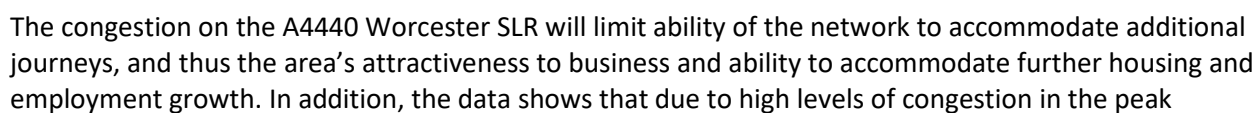
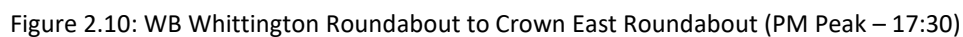


Figure 2.8: WB Whittington Roundabout to Crown East Roundabout (AM Peak – 08:45)





periods, journey time reliability is poor. The inter-peak data is showing that as traffic volumes approach capacity and congestion occurs, journey times can increase significantly and quickly in an erratic manner which means users suffer from uncertain journey times leading to a lack of confidence in the network.

2.6.2 Lack of strategic highway connectivity

The connectivity to the Strategic Road Network from the west is notably poorer in the peak periods, in the Worcester area, due to congestion. This has meant that the take up of employment development sites to the West of Worcester is not attractive to new or relocating businesses. There are been a case where a site allocated for employment use has been developed for residential use due to lack of market interest in employment development to the West of Worcester. Feedback from the business community has shown this is due to connectivity, particularly lack of certainty of travel times to the Strategic Road Network.

With the improvements to the A4440 Worcester SLR between the Ketch roundabout and M5, the overall performance of the Powick to Ketch section of the A4440 Worcester SLR will worsen, due to additional demand. That is, the Powick to Ketch section of the A4440 Worcester SLR becomes a pinch point on the corridor for strategic movements. Therefore as more traffic is attracted to the Ketch to M5 section of the route, the capacity of the Powick to Ketch section becomes a more significant constraint. Thus, there would be accessibility problems for the areas to the west of Worcester due to increased journey times and poor journey time reliability.

2.6.3 Current economic issues

South Worcestershire covers the largely rural districts of Malvern Hills and Wychavon, and the predominantly urban area of Worcester City. Although south Worcestershire has relatively high levels of economic participation and low levels of unemployment, economic trends in the sub-region over the past decade have been mixed. The area's employment grew slowly between 2003 and 2008, prior to the global economic downturn. The September 2015 WCC Economic Summary noted that the unemployment claimant level in Worcestershire was at the level recorded before the recession started. The August 2018 WCC Economic Summary highlights that the unemployment claimant level in Worcestershire is now 1.5% of the 16-64 population ¹.

Longer term, the SEP (March 2014) notes that Worcestershire has seen one of the highest long-term growth rates in Gross Value Added (GVA) (1997-2011) outside the Greater South East. However, the SEP stated that, despite this longer term trend, the county has not realised its full potential and has been 'punching below its weight'. This trend is consistent with more up to date information presented below.

Specifically concerning highway connections, the SEP notes that parts of the County are well-connected to other parts of the UK, particularly through the Highways England managed Strategic Road Network (SRN) including the M5, M42 and M50 motorways and the A46 Trunk Road. These run through the centre and east of the County and provide good access to London, Birmingham (and the North), and to Wales and the South West. However, access to/from the SRN is constrained in parts of the county due to capacity constraints on the local highway network, with Worcester having particularly acute problems.

Malvern, which is located to the south west of Worcester, is particularly remote from the SRN and the main highway links to the SRN use the A4440 Worcester SLR. The congestion and unreliability of the A4440 Worcester SLR therefore impacts on the attractiveness of Malvern as a location for new business, as well as impacting on the businesses that are currently located in the Malvern area. Malvern Hills Science Park state:

"The variability of journey times between MHSP and the M5 is now a cause for concern and may limit the growth of MHSP. It is 9.7 miles from here to Junction 7 of the M5 and it can take anywhere from 16 minutes to 50 minutes, depending upon the time of day. For example, this means that the bulk of the

¹ http://www.worcestershire.gov.uk/info/20044/research/673/information_on_the_worcestershire_economy

journey from MHSP to Birmingham Airport is the first 9.7 miles taking 50 minutes, with the remaining 34 miles taking just 35 minutes. The situation is now so bad that some tenants have taken to heading south to Junction 8 in order to head north on the M5. If we are to succeed as a business, we need this problem addressed in the very near future."

Therefore, the scheme is essential to releasing housing and commercial development and addresses problems related to:

- The barrier effect that transport and existing infrastructure is having in terms of constraining economic growth;
- Congestion and the cost of delay;
- The way in which transport and inadequate infrastructure limits housing and employment growth; and
- The way that traffic currently routes inappropriately through the city centre.

WCC's Local Economic Assessment helps to give an overview of economic activity. Figure 2.11 shows Gross Value Added (GVA) per resident head relative to England and Figure 2.12 shows GVA relative to neighbouring authorities. Despite total GVA increasing over time, until the recession, both the West Midlands and Worcestershire were decreasing in comparison to England. However, following the recession, the GVA for both the West Midlands and Worcestershire began to increase in comparison to England, with a faster rate of increase in Worcestershire. GVA per head in Worcestershire is; however, historically lower than its neighbours, such as Warwickshire and Gloucestershire.

Considering this data, the assessment notes that to make the Worcestershire economy stronger and reduce the difference between Worcestershire and England attention needs to be focused on improving the skill levels of the population and encouraging and supporting new business creation. However, it is important to note that a lack of available employment land in the county could be a limiting factor in increasing GVA per resident head.

Figure 2.11: GVA per resident head relative to England (England = 100), Office for National Statistics. Regional Accounts

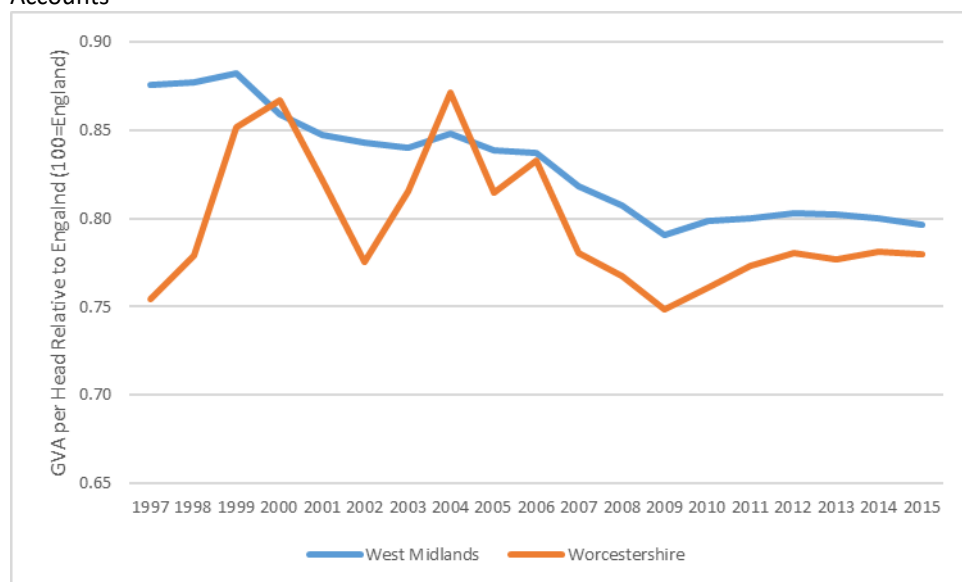
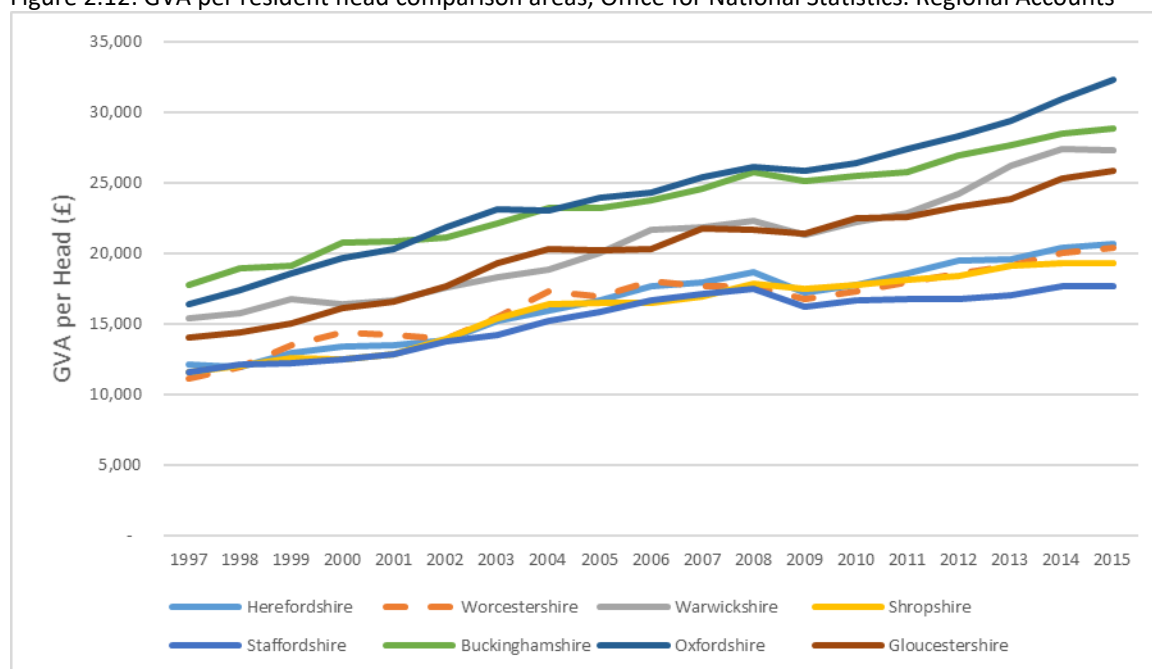


Figure 2.12: GVA per resident head comparison areas, Office for National Statistics. Regional Accounts



2.6.3.1 How the scheme directly affects the local jobs

There are two ways in which this scheme directly affects local jobs. Firstly, as a result of the scheme, there will be people employed to plan, design and construct the scheme. Additionally, the scope of the construction phase will aim to provide new jobs to the area, it is important that the scheme contributes to the local economy, including potential to reduce welfare spending by the procurement of works. WCC are looking at how to optimise local economic impact through the procurement process. The procurement will seek to ensure local contractors are utilised to support the main contractor", while training initiatives, such as apprenticeships, will be a contractual requirement.

Secondly, the scheme will provide improved network capacity and resilience which will enable housing growth, employment growth. This growth will provide employment during the planning, design and construction of the developments, as well as unlocking the wider benefits.

2.6.3.2 Constraint to development

As reported in the A4440 Worcester Southern Link Road Dualling Phase 3: Strategic Outline Business Case (May 2013), the core reasons for south Worcestershire's poor performance against its employment and housing targets are beyond the consequences of a weak economic climate. In particular, the area's poor transport infrastructure, including the highway network, is identified as a major constraint to bring forward development sites which are critical for achieving south Worcestershire's growth aspirations. That said, the prevailing economic conditions, which impact the financial viability of developments, significantly reduce the prospect of private sector led investment and delivery of important highways (and other transport) infrastructure, which is typically classed as a "public good".

In response, the adopted SWDP and supporting SWIDP has identified the need for approximately £226.3 million for SWDP transport schemes. The £226.3million plan includes:

- £20.4 million of Highways England schemes; and
- £205.9 million of local road network infrastructure, of which £170.8 million is related to the Worcester Transport Strategy.

The capacity issues on the A4440 Worcester SLR result in some longer distance trips routing through the City, rather than use the Southern Link Road. This illustrates the issue that congestion on the A4440 Worcester SLR is preventing it fulfilling its role as a primary route, avoiding the City centre. The resulting levels of congestion in the City centre constrains business growth and regeneration

opportunities. Removing strategic traffic from the City centre will enable Worcester to meet its socio-economic aspirations.

2.6.4 Poor network resilience (River Severn Flood Impact)

Worcester Bridge is located close to the centre of Worcester and carries the A44 over the River Severn. The A44 corridor carries a significant volume of traffic both to and from and through the centre of Worcester. This strategic corridor is constrained at Worcester Bridge as a number of routes meet to use the bridge to cross the River Severn. The approach roads to the bridge (Hylton Road, New Road and North Parade) are within the flood plain of the River Severn. Hylton Road, New Road and North Parade have been flooded and impassable during recent floods in 2000, 2003, 2007, 2012 and Feb 2014. See photographs below.

Figure 2.13: Flood Event, looking from Hylton Road towards Worcester Bridge



Figure 2.14: Flood Event taken from Worcester Bridge looking towards North Parade/Newport Street



In each of these flood events one or all of the roads has had to be closed due to the river levels being high enough to make the roads impassable to traffic. This has the effect of traffic being forced to use one of the two remaining bridges, either the already congested Carrington Bridge located approximately 3 miles to the south of the City resulting in a detour of approximately 6 miles and significant delays, or via the Holt Fleet bridge located 8 miles to the north and a detour of approximately 16 miles.

The closer proximity of the Carrington Bridge and the A4440 Southern Link Road means that the bulk of the traffic chooses to use the Carrington Bridge, which creates a much higher demand than normal conditions, or alternatively people do not travel into the City centre overall.

Whilst the impact of the flooding tends to be short term and typically only lasts one or two weeks, the long term impact on the Worcester economy is much greater, and this is set out in the following section for both a short term closure and the longer term impact should the Worcester Bridge be destroyed by flood water.

It is noted that a small scale scheme was implemented to reduce the impact of flooding in New Road, Worcester. This scheme was developed to address the local need to retain, if possible, some limited capacity to cross the River Severn at times of flood. The scheme revises the traffic management arrangements on two sections of one-way road to allow temporary two way operation, and the raising of the level of a section of highway to make it less prone to flooding. The capacity of the scheme is much reduced from normal operation, but the significance of the scheme is to maintain a limited connectivity between the City centre and west Worcester. As a result, despite this scheme maintaining some accessibility to the City centre, reduced capacity at Worcester Bridge is likely to cause considerable ongoing pressure at Carrington Bridge in the wake of a flood event, even with a small scale scheme in place.

In relation to the economic impacts of a flood event, even with provision the small scale alleviation scheme mentioned above, there are three key areas to consider:

- Direct impacts – capital damage to property, equipment and infrastructure.
- Indirect impacts (i) –business downtime as firms recover from the direct consequences of flooding and short term closure of Worcester Bridge.
- Indirect impacts (ii) – wider economic resilience in the wake of flooding and longer term or permanent closure of Worcester Bridge. This relates to severance between communities on either side of the River Severn in the event of Worcester Bridge becoming unsafe to use. This would restrict access to Worcester City centre and the wider communities in central Worcester for residents in West Worcester. Similarly, access to west Worcester's local centres such as St John's and nearby employment sites would be restricted for residents on the eastern bank of the River Severn in Worcester.

A high level appraisal has been undertaken of the economic impact of flooding of the River Severn on Worcester's economy. In relation to the scheme for Southern Link Road Phase 4, consideration should be given to the indirect impacts in the short term (flooding), and long term (bridge resilience), identified as bullet points two and three above. In particular, emphasis should focus on the economic resilience elements of the assessment which relate to long-term or permanent closure of Worcester Bridge, as detailed in the third bullet point above. A technical note providing further information on the high level appraisal is set out in Appendix B, however the key findings are:

- Central Worcester has 1,425 businesses, of which 1,105 (78% are classed as micro businesses employing fewer than ten employees, with the remainder in the SME category, employing up to 250 employees;
- Micro and SME businesses are disproportionately affected by flood impacts and more prone to closure as a result of flooding than large enterprises;
- The 1,425 businesses generate an estimated £77 million per annum of GVA, and there is a retail expenditure of nearly £350 million, with £64 million of this from west of Worcester;

- £1.5 million of GVA per week is at risk, due to business downtime as a result of flood impact on central Worcester's economy;
- In the wake of long term bridge closure,
 - £1.2 million of retail expenditure per week is at risk in Worcester city centre from residents in west Worcester;
 - £1.8 million of GVA per week is at risk in central Worcester from employees who reside in west Worcester;
 - £20k of retail expenditure per week is at risk in St John's local centre from residents in east Worcester;
 - £430k of lost GVA per week is at risk in west Worcester from employees who reside in east Worcester;
- There is a risk that a proportion of the figures above may not return after a flood event as business, labour market trends and retail spend transfer away from Worcester, although this would need to be quantified; and
- Completion of the A4440 Worcester SLR improvement programme will give real and perceived benefits to the flood resilience of Worcester City and the County in mitigating the impact of future severe weather events. There is a risk to future levels of inward investment into Worcester should the resilience of opportunities to cross the River Severn not be increased.

The calculation of the direct financial impact of flooding events is difficult to calculate as the scale of the impacts are widespread and a result of direct impact and secondary knock impacts. A comprehensive assessment undertaken by the Worcestershire Partnership on the 2004 flood events in Worcestershire concluded that the economic impact on the County was estimated to be £6.4million per week.

2.6.5 Failure to meet planned housing growth targets

The housing need assessment that lead to the housing demand forecasts used to inform the SWDP results in challenging housing growth targets. Covering the administrative areas of Malvern Hills District Council, Wychavon District Council and Worcester City Council, the SWDP, over the plan period 2006 to 2030, makes provision for 28,400 dwellings.

In addition, the Hereford Local Plan Core Strategy, adopted in October 2015, covers the plan period 2011 to 2031 and over this period the Herefordshire plan has a target to deliver a minimum of 16,500 homes. Hereford is the focus for new housing development to support its role as the main centre in the county. Outside Hereford, new housing development will take place in the market towns of Bromyard, Kington, Ledbury, Leominster and Ross on Wye, on existing or new allocations to enhance their roles as multi-functional centres for their surrounding rural areas. It is notable that Bromyard, Kington and Leominster are on the A44 which directly connects to the A4440 Worcester SLR.

To meet the housing allocations in these plans, development sites will need to be attractive to secure investment from developers. The poor connectivity is a known issue; this may discourage investment in these areas. Specifically, the poor connectivity will make development sites, such as Worcester West urban extension and North-East Malvern, less attractive to future residents/employers and thus developers. This would mean that the full plan allocations may not realised (2,950 dwellings and 15 Hectares of employment land).

2.6.6 Perceptions of transport issues

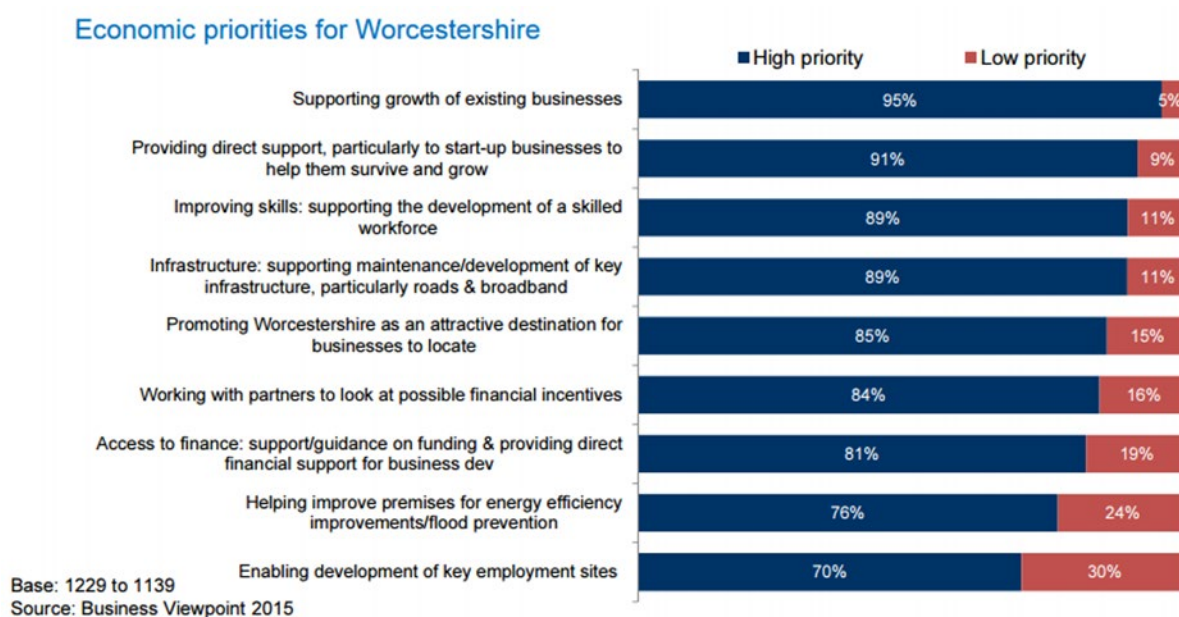
The perceptions of both businesses and residents have been considered. Consistently, the importance of roads/highways is raised in WCC public engagement.

2.6.6.1 Views from Businesses

A Business Viewpoint survey targeting the economic priorities of mixed (micro to large) local businesses in Worcestershire was conducted between May and June 2015. The results of this survey show that transport infrastructure is considered a high economic priority; 89% of business participants stated that supporting maintenance/development of key infrastructure, particularly roads as a high priority. Figure 2.15 is taken from the September 2015 survey and shows the comparison between other economic priorities.

Furthermore, the survey highlighted the likelihood of increased demand on the road network as 22% of the local businesses are looking to increase their workforce over the next 12 months. The SLR is already at capacity and the A4440 Worcester SLR Improvements Phase 4 scheme will seek to minimise the impact additional commuters will bring to the road network.

Figure 2.15: Economic priorities for Worcestershire

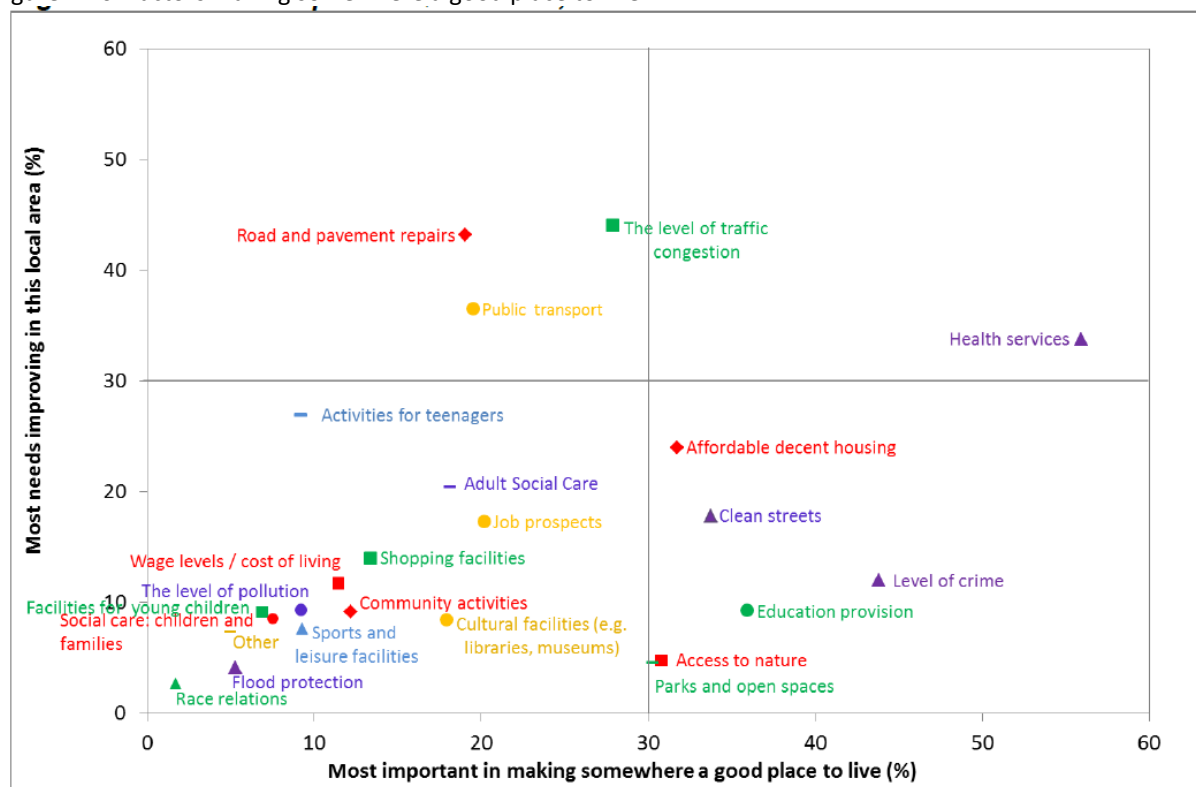


Further detail at: <http://worcestershire.moderngov.co.uk/documents/Economy and Environment Overview and Scrutiny Panel>

2.6.6.2 Views from Residents

A countywide survey was conducted by WCC in May/June 2016 to gather perceptions help by local residents regarding perceptions of the local area and public services. A total of 2,371 responses were received from panel members and households across the seven districts.

Figure 2.16: Factors making somewhere a good place to live



*Base: 2,022 responses for most important; 2,259 responses for most need improving

**Note the lines creating quadrants (arbitrarily at 30% on each axis) are to aid visual interpretation and do not define specific categories

Source: Worcestershire Viewpoint Survey 2017

The issue of “the level of traffic congestion” was rated as the issue most in need of improvement in the local area by participants.

2.7 Impact of not changing

Without the scheme the problems and issues outlined above will continue and, in the longer term, be exacerbated as described below.

- Development sites, such as Worcester West urban extension and North-East Malvern will not be attractive and thus planned development will not be realised (2,950 dwellings and 15 Hectares of employment land);
- Economic development would be constrained, particularly in the centre of the City. Inability to attract private sector investment to realise redevelopment/regeneration opportunities and support increased socio-economic activity. Growth of existing businesses may be compromised;
- Congestion will continue to increase, leading to increased delay and more irregular journey times resulting in cost to both individuals and businesses;
- Negative long-term impact on Worcester’s economy due to lack of network resilience, resulting in long term change to retail and labour market trends; and
- Traffic will continue to find alternative routes to avoid congestion resulting in traffic levels through sensitive areas of the City (including designated Air Quality Management Areas) continuing to rise.

This would jeopardise the ability to meet the overall aims of the WTS, Worcestershire LTP, the Worcestershire SEP and the SWDP.

2.8 Scheme impact

The impact of the scheme will be felt both locally in Worcester and over a wider area to the west of Worcester. The A4440 Worcester SLR Phase 4 scheme includes improvements to one of limited number of River Severn crossing points and will result in a new high capacity crossing. The impacts of realising this scheme are set out below.

2.8.1 Less congestion

The scheme will result in less congestion in the City centre and on the A4440 SLR. When compared to the Do Minimum scenario, the dualling of the A4440 Worcester SLR between Powick and Ketch and the improvements to the roundabouts at each end will reduce travel times, especially during peak hours, thus benefiting business travellers and haulage, as well as commuters. The benefit is measured as a change in the road user cost due to the time savings for the users pre and post dualling. On a broader scale, the dualling of the A4440 Worcester SLR between Powick and Ketch will impact a wider consumer group through reduced congestion and improved traffic operations.

The transport modelling shows that with the scheme in place, traffic flows could increase by between 45% and 66% on the A4440 Worcester SLR. Also modelled journey times on the A4440 Worcester SLR improve as a result of the scheme modelled through the Do Something scenario. In the 2031 Do Something forecast journey times are 4-8.5 minutes less than the 2031 Do Minimum journey times.

2.8.2 Improved access and connectivity

The scheme is the final phase of the four phase programme which upgrades the A4440 Worcester SLR to dual carriageway standard. Failure to deliver the A4440 Worcester SLR Phase 4 will adversely impact realisation of benefits of the earlier investment in Phases 1-3. This final phase ensures the route attracts trips currently using the City centre infrastructure to cross Worcester. It completes a major upgrade to the A4440 Worcester SLR, which reinforces the role of the SLR as a strategic East West route, as well as a bypass to the City centre.

The completion of the dualling of the A4440 Worcester SLR also supports the Worcestershire Parkway scheme by improving access from west of Worcester to the location of the new station. The scheme also provides better connection to the M5 for residents and businesses to the west of Worcester. Linking the SLR then provides better access to:

- Birmingham Airport; and
- the proposed HS2 station at Birmingham Interchange, located close to Birmingham Airport/M42.

Figures 2.17 and 2.18 illustrate the journey time benefits of the scheme. They show that the opening of the scheme results in reduced journey times, over current experience, to locations to the west of Worcester including Malvern District. The plots show that as a result of the scheme a significant proportion of the A44, A4103 and A449 now fall within a 20 minute journey time to the SRN at Worcester.

Figure 2.17: 2014 AM Peak Journey times by car

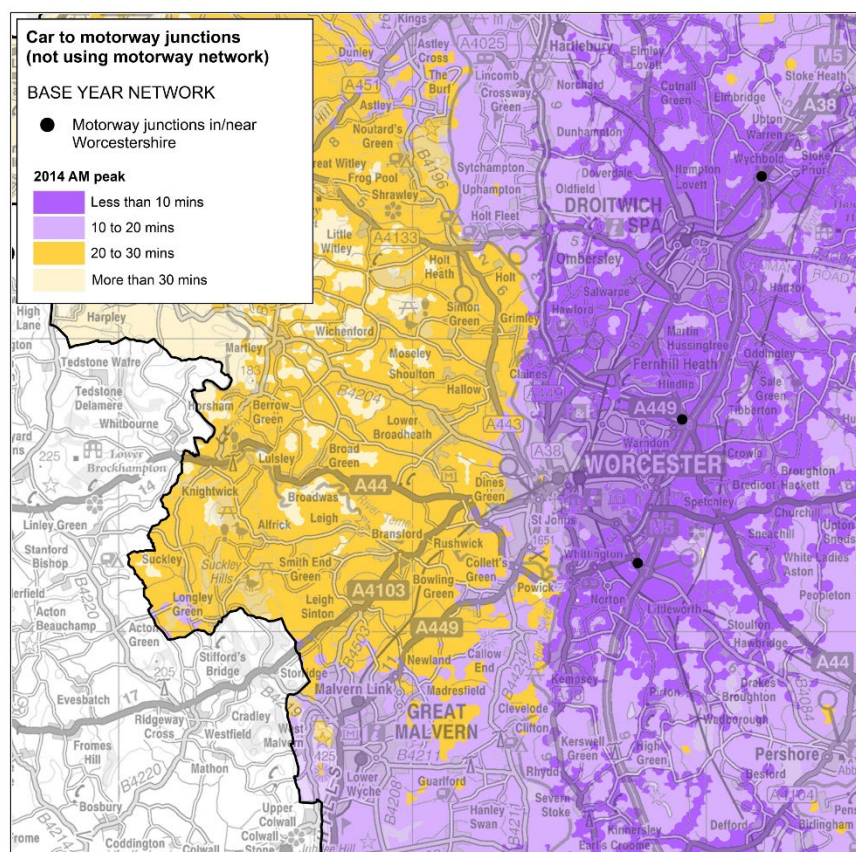
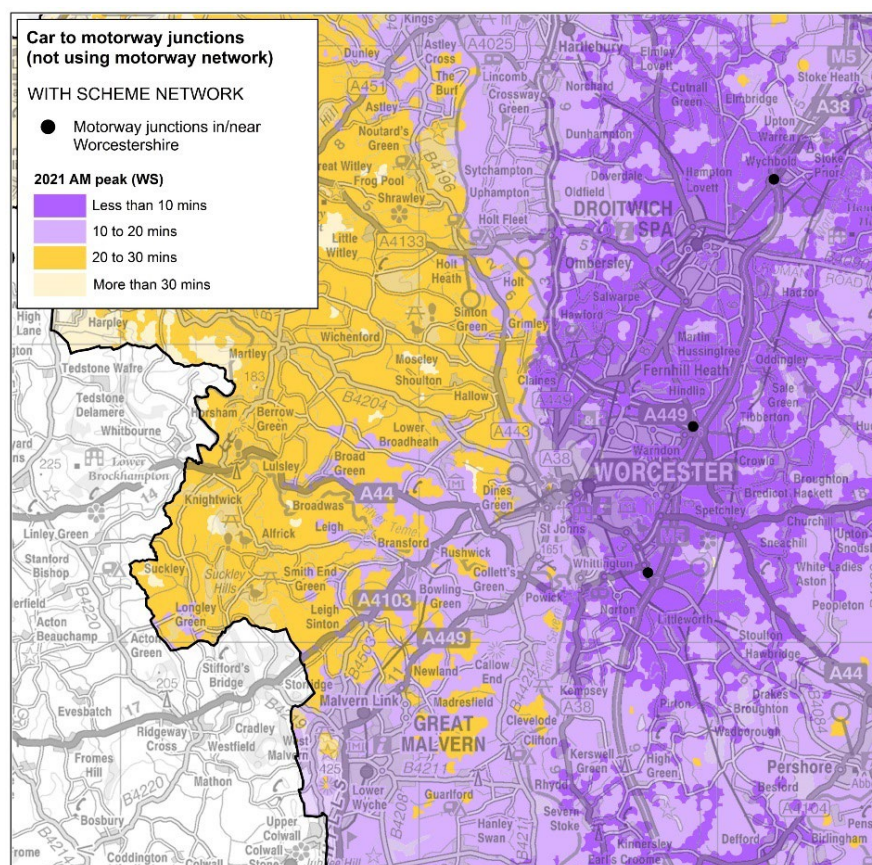


Figure 2.18: 2021 AM Peak Journey times by car, With Scheme



2.8.3 Unlocking economic growth

The A4440 SLR Phase 4 scheme unlocks economic growth in a variety of ways. These include:

- Improved access to housing and employment development sites;
- Improved access to existing employment areas to the west of Worcester; and
- The ability to enhance the environment in Worcester, because of the removal of through traffic.

The Strategic Economic Plan (SEP) for Worcestershire will see an addition 25,000 jobs, and additional £2.9bn GVA and 21,500 new homes built by 2025. The SEP recognises that pinch points to the strategic transport networks are constraining economic growth and that investment in Worcestershire's transport infrastructure and services is essential to provide businesses with improved access to markets and employees and to encourage economic growth.

Worcestershire LEP, in conjunction with WCC has identified four strategic investment or 'Gamechanger' sites. The work on the Gamechanger programme with key sites at Malvern Science and Technology Park, Worcester 6 in the south of the County and Redditch Eastern Gateway and the Kidderminster Employment Zone is expected to underpin up to 16,000 new jobs over time. The SLR scheme removes barriers to investment in the south of the County, supporting the delivery of related Gamechanger sites. The scheme also enables Worcester City to realise its ambition to contribute significant additional jobs.

Worcester has the ability to become an attractive place for development. It has a strong cultural heritage including a Cathedral which provides a real opportunity for additional and exciting growth including significant new employment and potential for additional City centre living as well as accommodating urban extensions. However, the capacity of the A4440 Worcester SLR has meant that some trips route through the City, rather than use the bypass route meaning that Worcester's high levels of congestion constrains business growth and regeneration opportunities.

The completion of the programmed improvements on the A4440 Worcester SLR will enable it to fulfil its purpose as a strategic bypass to Worcester City. In turn, this will provide opportunity to develop demand management measures at select locations in the City to address air quality issues and enhance the environment. The enhanced environment will allow greater priority to be given to pedestrians and cyclists, with the consequential health benefits. The opportunity to introduce demand management measures to reduce the impact of vehicles in the City centre will result in economic and environmental benefits. It will create a more attractive environment for visitors to the City centre which in turn will help encourage growth and maintain the vitality of the City centre.

The completion of the programmed improvements on the A4440 Worcester SLR also enables an additional 15 Ha of employment land to be brought forward. Furthermore, the certainty of improved access to the SRN opens up the wider employment land allocations in Malvern and west of Worcester.

The opportunities that will be generated by National and International inward investments on the Gamechanger sites are considerable. However, the potential number of sites that could be brought forward is currently suboptimal; a principle demonstrated by the number of employment sites outside the 20 minute isochrones in Figures 2.17 and 2.18. These sites include for example 5Ha at West of Worcester, 6Ha at University Park Worcester and 10Ha at Newlands in Malvern. In addition, the scheme also overcomes constraints on existing businesses, for example Joy Mining PLC, Malvern Instruments and Morgan Cars, who, as market leaders in their respective sectors, are significant exporters to world markets and who suffer the frustration of absolute and variation in journey times for customers and supplies/goods to and from the SRN.

The Worcestershire SEP notes that "Worcester City – the main urban area and civic and cultural centre of the County - has the potential to develop as an 'engine' for growth.....Access improvements, both by road and rail, will be key to realising this potential". The Strategic Economic Plan (SEP) for Worcestershire will see an addition 25,000 jobs, and additional £2.9bn GVA and 21,500 new homes built by 2025. The SEP recognises that pinch points to the strategic transport networks are constraining economic growth. Work has begun on a new masterplan for the City that could see several thousand new jobs in the city with the development of Shrub Hill railway station, the development of key sites

along the river front and the creation on new professional office quarter – providing commercial accommodation for a missing part of the Worcester City economy.

2.8.4 Improved network resilience

The A4440 Worcester SLR Phase 4 scheme provides additional highway capacity over the River Severn as a result of the dualling the existing carriageway. This additional capacity provides much needed resilience if there is a problem close to or on the river crossing in the City centre. This is particularly true at times when the River Severn has flooded the roads leading to the City centre bridge meaning that it is no longer available.

2.8.5 Realise planned housing growth

Without the scheme the growth identified in the SWDP for 28,400 dwellings and the Hereford Local Plan Core Strategy for a minimum of 16,500 homes could not be fully realised. To meet the allocations in these plans, development sites will need to be attractive to secure investment from developers. The poor connectivity is a known issue; this may discourage investment in these areas.

Looking at a wider geography, the SEP outlines a priority to improve the routes linking with Herefordshire in order to create better access and enhance strategic links between the two geographical areas. This aspect is mainly important for businesses trading and/or supplying other businesses or customers within the local geographic area. With enhanced links, trading and deliveries can be made more easily and more reliably. Given the strategic importance of the A4440 Worcester SLR linking Worcester, Worcestershire and Herefordshire with the M5, the benefits would span the West Midlands and beyond.

2.9 Objectives

Due to the way in which this scheme has originated it is important that the specific scheme objectives are seen in the context of the WTS. Two sets of objectives are therefore set out below. Strategic objectives (the objectives of the WTS) to which this scheme will contribute and scheme objectives which are more specific.

2.9.1 WTS objectives

It is important that the A4440 Worcester SLR Improvement Phase 4 scheme is seen in the wider context of the WTS which, as a broad package of measures, aims to:

- Deliver an integrated and balanced network of transport infrastructure and services which supports the delivery of National, Regional and Local Government policies on climate change, sustainable economic growth and sustainable transport;
- Support the local economy through long term job creation and retention and support successive growth of the central technology belt;
- Consolidate and expand the City's role as one of the nation's premier cathedral cities, providing a focus for tourism and investment;
- Create balanced and sustainable communities in which people can live and work;
- Deliver a better quality of life for the City's residents and visitors through significantly improved and sustainable accessibility to services, facilities and opportunities in a manner which enhances the health of the individual and vitality of the area;
- Form the basis for achieving the levels of sustainable housing in 'self-contained communities' and employment growth identified for Worcester; and
- Provide transport improvements which make a positive contribution to local air quality, road safety, accessibility and traffic congestion.

The WTS objectives specifically note, in respect of the A4440 Worcester SLR dualling strategy, that the scheme is specifically intended to address the following objectives:

- Reduce current congestion issues at the Powick, Ketch, Norton and Whittington Roundabouts; and
- Deliver significant primary route network capacity enhancements at key pinch points along this route, through dualling of the existing carriageway whilst meeting relevant highway design standards where economically achievable.

2.9.2 Scheme specific objectives

The A4440 Worcester SLR Worcester Phase 4 scheme will:

- Unlock the potential of the A4440 Worcester SLR by removing the capacity constraint at Temeside Way;
- Support the growth of the economy of Worcestershire and the surrounding area by reducing travel times and costs imposed on businesses, transport operators and other network users by the current and forecast traffic congestion on the A4440 Worcester SLR;
- Improve the resilience of the transport network to extreme weather events and unforeseen disruptions, particularly flood incidents;
- Support the delivery of the planned growth set out in SWDP up to 2030. This includes development sites, such as Worcester West urban extension and North-East Malvern (totaling 3,000 dwellings and 15 hectares of employment land);
- Improve the performance and attractiveness to users of the A4440 Worcester SLR as a bypass for Worcester City centre, thereby helping to better manage traffic conditions in the constrained central area;
- Improve access to the Strategic Road Network from areas to the west and north west of Worcester, including Malvern Hills District, Herefordshire and parts of the Welsh Marches;
- Improve access to key hubs, including Birmingham International Airport and Worcestershire Parkway Station (and therefore further improving important links to Manchester, Cross Country the south); and
- To reduce transport-related emissions of carbon dioxide and other greenhouse gases in Worcester City centre.

2.10 Measures for success

Table 2.1 presents the key measures for success for the A4440 Worcester SLR Improvements Phase 4 scheme.

Table 2.1: Measures for Success

Objective	What success will look like	How measured
Unlock the potential of the Southern Link Road	Reduced travel time and more reliable travel times Higher volumes of traffic on the SLR	Journey time surveys Traffic flow data to show total volume of traffic being carried by the SLR
Support the growth of the economy	Reduced travel time and more reliable travel times	Journey time data
Improve network resilience	Increased traffic on the SLR when there are disruptions on the transport network	M monitoring of traffic flows on the SLR and identify changes

Table 2.1: Measures for Success

Objective	What success will look like	How measured
		resulting from network disruptions.
Support the delivery of the SWDP and its planned growth to 2030	SWDP allocations are realised with predicted future traffic conditions	Development applications
Improve the performance and attractiveness to users of the A4440 Worcester SLR as a bypass for Worcester City centre	Reduction in through traffic in City centre	Traffic count data. Data to show total volume of traffic being carried by the SLR, key city centre routes and crossing screenlines and cordons
Improve access to the Strategic Road Network from areas to the west and north west of Worcester, including Malvern Hills District, Herefordshire and parts of the Welsh Marches	Reduction in congestion on SLR at peak time	Stakeholder surveys and journey time data
Improve access to key hubs, including Birmingham International Airport, High Speed 2 stations and Worcester Parkway station	Reduced travel time and more reliable travel times	Stakeholder survey and journey time data
To reduce transport-related emissions of carbon dioxide and other greenhouse gases in Worcester City centre.	Reduction in through traffic in the City centre	Stakeholder surveys (and other relevant surveys as specified in the Environmental Statement) in the City centre and on A4440 Worcester SLR

2.11 Scope

The A4440 Worcester SLR forms a key part of Worcestershire's Primary Road Network (PRN) and links the SRN (M5, J7) and the eastern side of Worcester City with the A38 (to Tewkesbury), A449 (to Great Malvern), A4103 (to Hereford) and A44 (to Leominster). In doing so, it also acts as an important link between existing and planned residential and commercial developments on the southern and western side of the City. It is important to note that the A4440 Worcester SLR is one of only two road crossings of the River Severn at Worcester and as such provide a key link between east and west Worcester as well as an important bypass around the south of the City for longer distance traffic movements.

The proposed scheme includes:

- Construction of an additional carriageway adjacent to the existing single carriageway to form a 1.2 mile (1.9km) dual-2 carriageway from Ketch Roundabout to Powick Roundabout.
- Two new bridge structures to carry the additional 2 lane carriageway, at Carrington Bridge and at Powick Common viaduct;
- Capacity Improvements and junction revisions to allow dual carriageway connections at Ketch Roundabout;
- Widening of the existing footway to accommodate a shared pedestrian/cycle route on northern side;
- New road markings, some widening of carriageway on west approach to accommodate movements to new dual carriageway section at Powick Roundabout;
- Upgrade of dedicated left hand turn to Malvern to fully segregated facility at Powick Roundabout;

- Provision of a foot/cycle bridge linking the north and south cycle routes, located on the west approach, at Powick Roundabout; and
- Upgrade of grade separated pedestrian route for north to south movements at Ketch Roundabout.

The outline scheme layout is shown in a series of plans in Appendix A.

The project also aims to meet the criteria outlined by CEEQUAL. CEEQUAL is a sustainability assessment tool, which can be used to assess civil engineering, infrastructure, landscaping and public realm projects. It uses evidence-based criteria as well as external verification in order to provide results that can then be presented to the public. Additionally, integrating the CEEQUAL assessment within the development of a project can produce positive results.

The benefits of using CEEQUAL include:

- Embedding sustainable practices from early in a project's life, often resulting in long-term cost savings
- Reputational benefits and reducing reputational risk
- Demonstration of delivery of environmental, sustainability and/or corporate social responsibility policies, and positive reinforcement of high performance - Measurement of the sustainability of development projects and their comparison with other inhouse projects and competitors

Using CEEQUAL provides a single standard industry benchmark for sustainability performance. Helping to develop a positive performance attitude and promoting project team cohesiveness

2.12 Scheme Constraints

There are a number of constraints that have defined the parameters within which the scheme has to be designed. In general terms, the effects of constraints can either be eliminated or mitigated through the design process. However, the final design layout of a scheme is largely defined by its specific constraints. Mitigating constraints is a matter of balancing the physically achievable with the economic and environmental impacts, whilst working within acceptable parameters of Highway Design standards. The aim of the design development is to establish how the scheme objectives can be achieved in the most economically advantageous way within the constraints. Table 2.2 presents a summary of the key constraints.

Table 2.2: Key Constraints

Constraint	Issue	Design Response
Flood plain	The scheme falls within a flood plain	Designers are to ensure flooding mitigation issues are understood and accommodated within the design. Consultation with statutory environmental bodies undertaken and Flood Mitigation planning conditions has been discharged. Close liaison with Environment Agency to continue.
Common Land	The scheme is located through Powick Hams Common.	After consultation with the Commoners and the relevant landowner appropriate Exchange Land has been identified, is being secured through legal processes and is in the process of being de-registered.
Highway design standards	The design will not result in an upgrade to the existing carriageway width to minimise scheme costs, new carriageway to be built to current standards	Apply for appropriate departure from standards if required for existing carriageway. Early engagement with TAA.
Registered Battlefield	The scheme is close to a registered battlefield	Scheme designed to avoid impacting on registered battlefield.

Constraint	Issue	Design Response
Navigation of River Severn	River Severn is a navigation route at this location	New structure is to consider design requirement for River Severn traffic. Continue consultation with Canals & River Trust.
Underground Services	Investigations are required	Utility searches undertaken and negotiations are well underway
Drainage and SUD's	Consideration of attenuation required	Ensure drainage mitigation needs are understood accommodated. Close consultation with Environment Agency undertaken. LDC to be obtained.
Proximity of Residential Property	Property is located close to Temeside Way, and a number of properties are located close to the Ketch Roundabout	Ensure impacts of new scheme are identified and mitigated in accordance with DfT guidelines and good practice.

2.12.1 Electricity Pylon

At the time of the OBC, the electricity pylon located to the west of Carrington Bridge was raised as a constraint, however this constraint has now been resolved.

A meeting was held with Western Power and Distribution (WPD) in order to decide whether the pylon to the south of Carrington Bridge could remain in place as part of the permanent scheme works. However, it was decided that because this existing pylon would be so close to the new road alignment and due to the extensive civil engineering work required to provide a suitable retaining wall option, the pylon would be relocated.

This enabling work to relocate the pylon took place from June to September 2018 ahead of the main construction work. It was completed during the summer as this work could only be undertaken in low electrical demand periods.

If not relocated, the pylon would have been impacted by the new embankment that will be built south of the existing. Therefore, the existing pylon was replaced by a new pylon approximately 47m to the west of the existing pylon, and the foundations of the existing pylon dismantled and removed. Re-conductor works on the double circuit overhead line, which passes over the A4440, were also necessary. This involved installing a safety net catenary under the existing 132kV cables across the road and night-time road closures to install and remove the safety net.

Figure 2.19 and Figure 2.20 show images during the pylon replacement and after the pylon has been relocated removing this significant constraint and schedule risk from the project.

Figure 2.19: Image of Scaffold Erection South of Carrington Bridge



Figure 2.20: Aerial view showing relocated new pylon



2.13 Inter-dependencies

2.13.1 Worcester south and west urban extension areas

The SWDP contains major proposals for urban extensions to the south and the west of Worcester. As urban extensions, they will have a close relationship with the A4440 Worcester SLR.

The importance of dualling the A4440 Worcester SLR is mentioned in Policy SWDP 45/2 Worcester West Urban extension. The site allocation is at Temple Laugherne which is situated on the western edge of Worcester, within Malvern Hills District area. Access to the M5 and Worcestershire Parkway would be via the A4440 Worcester SLR.

Housing dependency analysis has been undertaken and is reported in the economic case.

2.13.2 Worcester Transport Strategy

There is an inter dependency between the elements of the WTS.

In LTP2 (2006-2011) it was noted that Worcester City has been identified to take a sub-regional role from 2011 and beyond. To elevate Worcester to this new role it was noted that Worcester would have to accommodate significant growth. Thus, a major land use and transportation study was carried out to identify how the already constrained transport network could accommodate such growth. The outcome of this study identified a transport strategy for the next plan period 2011-16. The strategy that resulted from this study was the WTS. Notwithstanding the work that was undertaken on this strategy, the LTP2 documentation had already identified the A4440 Worcester SLR as a congested corridor and suggested that to achieve the growth anticipated, schemes to enhance the capacity of the A4440 Worcester SLR would be necessary. The development of the WTS strategy reinforced this requirement.

The WTS has been developed to identify a comprehensive programme of investment in transport infrastructure for Worcester, to address existing and future transport challenges, whilst contributing towards the long-term prosperity of Worcester and south Worcestershire to 2030.

The WTS involves a package of investment in a wide range of transport infrastructure and service enhancements. This will deliver benefits not only locally, but also across the wider region, improving access and network efficiency for all users travelling into, through and/or around the Worcester transport network. In particular, this investment will make Worcester more attractive to business, supporting the local and regional economy.

The composition of the WTS has been driven by a set of 'desired outcomes' (economic growth, increased accessibility, reduced congestion and more sustainable travel) which in turn have been derived from agreed policies and objectives. In addition, it was necessary to consider the future development of Worcester and the future transport needs of the City. Inputs included the then Regional Spatial Strategy (RSS) for the West Midlands and the South Worcestershire Joint Core Strategy (SWJCS) which was developed to plan the delivery of this growth (this was a predecessor to the current SWDP).

In developing and updating the WTS, it was apparent that without increased transport capacity, Worcester's ability to grow and remain a key centre in Worcestershire and the wider region would be significantly constrained. Traffic congestion was forecast to increase, access to key services reduced, and negative environmental impact would occur due to reduced air quality, resulting in a decline in the quality of life for residents and reduction in the overall attractiveness of the City for businesses and visitors.

Bringing together the desired outcomes, issues and policy guidance, WCC is aware that a wide-ranging package of transport measures is required to deliver improvements to the existing network, including the following measures:

- Highway infrastructure improvement schemes to increase transport capacity for local and strategic movements, supporting proposed new land-use developments;
- Improvements to multi-modal transport infrastructure along key corridors;

- New walk and cycle schemes, including improvements to the public realm in the city centre;
- Adoption of an intelligent transport system to maximise the capacity of the existing road network and including elements such as real time passenger information for bus passengers and variable message signing for car drivers;
- Improved bus stop facilities and information;
- Smarter Choices measures to encourage sustainable travel; and
- Measures aimed at reducing traffic demand.

2.14 Stakeholders

The scheme is well supported by key stakeholders and local businesses, as illustrated in the letters of support presented in Appendix Q.

2.14.1 Stakeholder Management and Engagement Plan

The Southern Link Road: Phase 4 Stakeholder Management and Engagement Plan, December 2018 is presented in Appendix C.

The Plan has been put together to pinpoint the communication channels that should be utilised to ensure all relevant parties are kept informed as the project develops. Communications will be tailored to meet the needs of each stakeholder and will take into consideration the objectives for the scheme.

2.14.1.1 Audiences

The key audiences for the Stakeholder Management and Engagement Plan are:

- Worcestershire County Council (Councillors/Staff)
- Worcestershire Local Enterprise Partnership
- Herefordshire and Worcestershire Chamber of Commerce/Federation of Small Businesses/Institute of Directors
- Worcester Business Improvement District
- Department for Transport
- Secretary of State for Transport
- Worcester City Council
- Wychavon District Council
- Malvern Hills District Council
- Local Councillors
- Parish and Town Councils
- Herefordshire Council
- The Marches Local Enterprise Partnership
- Highways England
- Environment Agency
- Developers
- Local Members of Parliament
- Local residents
- Commuters

- Local businesses
- Local media and Trade Press organisations
- Road Haulage Association
- Sustrans and local cycling promotion groups
- Living Streets
- RoSPA
- Ramblers Association
- Campaign for Protection of Rural England
- Open Space Society
- Natural England
- Historic England
- Wildlife Trust
- Canals and Rivers Trust
- Bus/taxi Operators
- Education establishments (e.g. sixth forms, University of Worcester)

In addition to the stakeholders listed above, the project development has included a number of detailed consultations with the following stakeholders:

- Discussions with Statutory Undertakers (C3 Estimates) – National Grid (Nov 2016); Severn Trent Water (Dec 2016); CLH (Oil Pipeline) (Nov 2016); BT Openreach (Nov 2016);
- Discussions with Western Power Distribution regarding pylon relocation process (Nov 2016);
- Environment Agency Consultation regarding Flood Risk Assessment;
- Environment Agency Consultation regarding Flood Modelling Assessments;
- Place Partnerships initial liaison with main land owner for land affected by scheme and commoners;
- Meeting with WCC Development Control – Re Planning Application requirements in relation to Environmental scoping;

As part of Environmental Assessment, meetings undertaken with Malvern Hills District Council; County Ecologist, County Archaeologist, Environment Agency, Worcestershire Regulatory Service, Historic England, Natural England, Worcester City Council, Worcestershire Wildlife Trust, the Severn River Trust.

2.14.2 Support from stakeholders

The scheme is well supported, as evidenced by the letters of support presented Appendix Q, and extracts below.

Harriett Baldwin MP, MP for West Worcestershire (writing to WCC in November 2018)

“...there are still significant delays at the pinch point of the A4440 where the road crosses the river Severn and I still receive complaints, particularly from members of the business community, about serious day-time congestion for drivers travelling from Malvern and its surrounding areas towards the west of Worcester and the M5”

Robin Walker MP, MP for Worcester (writing to WCC in October 2015)

"It is the number one transport priority for businesses in my constituency and is considered vital by many of my constituents to reduce congestion in the city of Worcester."

"The substantial investment that has already been made in dualling, the upgrade of our motorway junctions and the delivery of Worcestershire Parkway Station will only deliver their full potential if this work is completed."

"The completion of Phase 4 is essential to the economic growth of our businesses and Worcester as a whole but also of the wider South Worcestershire area."

"The dualling of this route would substantially improve flood resilience."

Nigel Huddleston MP, MP for Mid Worcestershire (writing to WCC in October 2015)

"If the bid is successful, it will greatly benefit Worcestershire's economic growth agenda and increase accessibility for businesses and other users, which will benefit the whole of Worcestershire."

Worcestershire LEP (writing to WCC, November and December 2018)

"...The Phase 4 improvements to the SLR (dualling of the A4440 between the Ketch and Powick Roundabouts including the Carrington Bridge) is absolutely necessary to reduce congestion and improve journey times which currently cause difficulties to many businesses.

This scheme would also help the economy further as it will enable development sites, both commercial and residential (delivering jobs and new homes), and improve transport links which would allow businesses to attract and retain skilled staff and engage with customers more easily across a wider geographical area."

"Reduced congestion, increasing journey time reliability and better connectivity with lower transport costs will benefit everyone in Worcester City, as well as the wider area, and the Business Board believes that the benefits that Phase 4 would bring to the local economy are critical."

"The A4440 Phase 4 Bid will support our 10 year Strategic Economic Plan"

The Marches LEP (writing to Robin Walker MP, March 2015) and Cllr Price, Cabinet Member for Infrastructure, Herefordshire Council (writing to Robin Walker MP, March 2015)

"We support proposals for progressing a dual carriageway at Carrington Bridge noting the potential benefits if could provide for the economic prosperity of Herefordshire."

Worcester Council (writing to WCC, October 2015)

Confirms the Authority's support for Phase 4 and notes that "Theme 1 of our Corporate Plan 2015-2020 is 'increasing prosperity through successful business and great jobs'. In order for us to fulfil this aim we must have the infrastructure in place that supports business success and growth."

Cllr Linda Robinson, Leader of Wychavon District Council (writing to WCC, October 2015)

"The South Worcestershire Councils and the Worcestershire Local Economic Partnership share the common goals of delivering economic prosperity, business growth, inward investment, job creation and the release of strategic housing sites. Phase 4 of the Worcester Southern Link is both vital and integral to all of these goals."

"The implementation of Phase 4 of the Worcester Southern Link would directly support the release of strategic urban extensions at Worcester, as well as game changer and strategic employment site in key employment sectors in both Wychavon and Malvern Hills Districts. We are also mindful that implementation of this project could also have positive benefits for the operation and success of planned investment in the Malvern Hills Science Park and the Worcestershire Parkway Station to the south east of Worcester."

“...we are also conscious that this particular project has other wide ranging benefits across south Worcestershire and beyond, such as the importance of the Worcester southern link with respect to motorway access from Herefordshire.”

“...there is unlikely to be another project with such area wide benefits and strategic importance as the planned improvements associated with Phase 4 of the Worcester Southern Link.”

Fortis Living, largest social housing provider in Worcestershire

“Our ability to attract the right quality staff to key positions has been adversely affected by the problems of the Southern Link Road, particularly crossing the Carrington Bridge, and dualling of the Bridge and the A4440 would make a massive difference to our business.”

Joy Global, global business based in St John’s Worcester

“We currently experience extreme delays on this section of road; Phase 4 completion is therefore essential to the economic growth of our business and Worcester as a whole.”

Malvern Instruments Limited (writing to WCC, Oct 2015)

“The resulting congestion on the bridge...puts significant strain on businesses such as ours who cannot avoid using the A4440 to get our products to our UK customers.”

“Without completion of this ‘missing link’, the key issues of inadequate logistics will continue and the challenge of recruiting and retaining highly-skilled staff who will avoid at all costs talking up roles in companies where a commute across the bridge is required” will also continue.

“There is no doubt that the growth potential of our company, together with that of many others in the county is being compromised by this long-standing bottleneck and I believe it is the single most important infrastructure investment in the country that will have a very rapid payback through the acceleration of economic growth.”

Alimenti Food Sciences Ltd. November 2018

“Failure to complete Phase 4 will negatively impact the development of this area, and the regions feeding into it. I am considering expanding my business to include a facility which will need good road links for logistics. I cannot consider any site which involves transport using this road, at present, because of the impact on journey times, both of goods and people.”

Worcestershire Regulatory Service - body that undertakes local air quality management duties on behalf of all six Worcestershire authorities (writing to WCC, November 2018)

“Providing a more attractive alternative for drivers undertaking unnecessary journeys through the City Centre is considered a key requirement to improving poor air quality within the City and the health of local residents.”

Environmental Health & Licensing. November 2018

“Providing a more attractive alternative for drivers undertaking unnecessary journeys through the City Centre is considered a key requirement to improving poor air quality within the City and the health of local residents.”

Heart of Worcestershire College. November 2018

“Improving access to the Strategic Road Network from areas to the west of Worcester, including the Malvern Hills District, Herefordshire and parts of the Marches, helping businesses, such as HoW College, to attract quality staff and opening up the possibility of gaining customers from further afield.”

Microferm Ltd, November 2018

“Congestion on the route needs to be addressed to improve journey times and costs to our businesses. We export in excess of 2,000 tonnes / annum mainly containers which need to travel along this route and for us to control transport costs journey times from Malvern Link to the motor way network must be reduced.

It is difficult to recruit staff in Malvern so subsequently we target staff from Worcester but it's problematic attracting people due to daily congestion on the A4440 at peak times with traffic queuing back up the Malvern Road from Powick roundabout, significantly increasing journey times.”

Counter Point Courses. November 2018

“Counterpoint is an SME in consultancy and training, and our livelihood depends on us travelling to clients or training venues.With the current situation of only single lane traffic on the Carrington bridge, we are often held up in traffic and, even if we are not, we have to factor in time to allow for hold ups. This causes a huge waste of time to our business. It would therefore make a great improvement in efficiency to our business if Phase 4 of improvements to the SLR were to be completed.”

Highways England (writing to WCC, December 2018)

“...The SLR is the key local route for distributing traffic to and from the M5 Motorway at this location. As we have previously identified in our observations on the South Worcestershire Development Plan existing congestion on the SLR has negative impacts upon the operation of M5 Junction 7. The planned improvement scheme will therefore be beneficial for the operation of our network as well as wider transport networks in south Worcester.”

Wychavon District Council (writing to WCC, December 2018)

“By completing the dualling scheme, Phase 4 will help to:

- Ensure that development sites (both for housing and employment) as set out in the South Worcestershire Development Plan can be brought forward
- Reduce congestion and improve journey times in the South Worcestershire area and access to the west of the county– helping to reduce the cost to businesses
- Improve access to the Strategic Road Network from areas to the west of Worcester
- Improve the attractiveness of the A4440 as a bypass for Worcester City Centre
- Improve access to key international hubs, including Birmingham International Airport.”

“...The A4440 Phase 4 Bid will certainly support the County Council's objectives outlined in the Corporate Plan since it will support the economy through reducing congestion and increasing journey time reliability.”

Herefordshire and Worcestershire Chamber of Commerce (writing to WCC, December 2018)

“...believe that this scheme is essential for the delivery of business, economic sustainability and growth.”

“...express my strong support for the Worcester Southern Link Road Phase 4, which I believe will greatly reduce congestion, improve journey times throughout the whole south Worcestershire area – helping to reduce cost to business, and improve the business productivity/efficiency.”

2.15 Options

The option development work for the A4440 Worcester SLR Phase 4 scheme is set out in the Option Assessment Report (January 2017) and subsequent addendum report, see Appendix E. This section provides a brief overview of this work.

Scheme options were firstly considered within the context of Worcester Transport Strategy (WTS). Then high level options on how the upgrade for Phase 4 of the A4440 Worcester SLR improvements could be achieved were considered. These options then went through an initial appraisal for any issues that would potentially impact on their deliverability and operation and resulted in the conclusion that the dualling scheme was preferred. This analysis can be found in Table 5.1 of the Options Assessment Report (January 2017).

Following this appraisal, a number of key design options were considered. The full list of options can be found in Table 5.2 of the Options Assessment Report (January 2017). This analysis concluded that the scheme should have a design speed of 60mph, provide additional carriageway on the southern side of the existing road and provide a new bridge for westbound carriageway and use the existing structure for eastbound traffic.

Junction layout options for Ketch and Powick roundabouts were then considered based on turning movements from the Worcestershire Traffic Model. These were analysed against strategic fit, technical soundness, stakeholder acceptability, deliverability and value for money (further detail of the analysis process can be found within table 5.3 of the Options Assessment Report). Following this initial sift, options that were considered viable were taken forward to be considered further and modelled to produce a preferred option for both roundabouts.

2.16 Summary of Strategic Case

In summary, this Section sets out a robust case for change that fits with wider public policy objectives. The scheme has a clear business strategy and is closely aligned with the aims of WCC and the WLEP. The scheme is also supported by the Marches LEP. The scheme addresses a number of problems relating to the economy, transport and infrastructure as a barrier to economic growth, congestion and constraints to development (e.g. Worcester West urban extension and other developments to the west of Worcester) and network resilience.

Improvements to the A4440 Worcester SLR will reduce the negative effects of congestion and improve accessibility and journey times across south Worcestershire. In turn, the area's attractiveness to business and ability to accommodate more housing will increase.

South Worcestershire Development Plan (SWDP) makes provision for 28,400 dwellings for the plan period 2006 to 2030 and the Hereford Local Plan Core Strategy, aims to deliver a minimum of 16,500 homes over the period 2011 to 2031. To meet the development allocations set in the SWDP, development sites will need to be attractive to secure investment.

The connectivity to the Strategic Road Network from the west is notably poorer in the peak periods, in the Worcester area, due to congestion. This has meant that employment development to the West of Worcester is not attractive. Indeed, there has been a case where a site allocated for employment use has been developed for residential use due to lack of market interest in employment development to the West of Worcester. Feedback from the business community has shown this is due to connectivity, particularly lack of certainty of travel times to the Strategic Road Network. The scheme would address this issue.

The unattractiveness due to congestion and unreliability on the A4440 Worcester SLR results in trips routing through the City, rather than using the A4440 Worcester SLR. Worcester's current high levels of congestion reduce the attractiveness of the City as a location for business and thus growth and regeneration opportunities are not taken forward. Removing strategic traffic from the City centre will enable Worcester to meet its socio-economic aspirations.

Improvements of the A4440 SLR Phase 4 will provide much needed network resilience against River Severn flooding, which has impacted the City Centre during recent floods in 2003, 2007, 2012 and 2014.

The scheme is the final phase of the four phase programme which upgrades the A4440 SLR to dual-carriage standard between Powick roundabout and the M5. This final phase ensures the routes attract trips currently using the city centre infrastructure to cross Worcester. It completes a major upgrade to the A4440 Worcester SLR, which reinforces the role of the SLR as a strategic East West route, as well as a bypass to the city centre.

The scope of the scheme includes:

- Construction of an additional carriageway adjacent to the existing single carriageway to form a 1.2 mile (1.9km) dual-2 carriageway from Ketch Roundabout to Powick Roundabout.
- Two new bridge structures to carry the additional 2 lane carriageway, at Carrington Bridge and at Powick Common viaduct;
- Capacity Improvements and junction revisions to allow dual carriageway connections at Ketch Roundabout;
- Widening of the existing footway to accommodate a shared pedestrian/cycle route on northern side;
- New road markings, some widening of carriageway on west approach to accommodate movements to new dual carriageway section at Powick Roundabout;
- Upgrade of dedicated left hand turn to Malvern to fully segregated facility at Powick Roundabout;
- Provision of a foot/cycle bridge linking the north and south cycle routes, located on the west approach, at Powick Roundabout; and
- Upgrade of grade separated pedestrian route for north to south movements at Ketch Roundabout.

Due to the nature of the scheme, it is not possible to disaggregate this scheme into smaller packages of work.

Chapter 3:

Transport Modelling



3 Transport Modelling

3.1 Introduction

This section provides information on:

- Section 3.2 – Transport modelling methodology overview; and
- Section 3.3 – Summary of modelled scheme impacts.

3.2 Overview of the transport modelling work undertaken since the Outline Business Case

The OBC report was submitted in January 2017 and was based on modelling forecasts that used TEMPro v7.0. Following revisions to the TEMPro datasets for Worcestershire and other counties and subsequent release of TEMPro version 7.2 in February 2017, an addendum report of the traffic modelling and forecasts was submitted to the DfT in March 2017. DfT sought clarifications on the modelling and economics and a response was submitted in July 2017. In November, 2017 the DfT announced funding of £54.5m for the scheme and development of the Full Business Case (FBC).

As part of the FBC submission, DfT recommended further tests are reported:

- To demonstrate the impacts of changes to webTAG databook (May 2018 at the time of analysis undertaken) since the OBC ('Forthcoming changes to webTAG values November 2016 released in July 2016);
- To see the impact of long term extrapolation of benefits; and
- To see changes to the Road Traffic Forecasts (2018) on freight growth.

These tests are reported in Section 3.6.8. Since the submission of the OBC in January 2017, the assumptions for the Central Case (Section 3.5 of OBC) has been superseded. The FBC reports on the Core scenario forecasts constrained to TEMPro v7.2 and the high and low growth sensitivity tests as reported in the addendum to the OBC submitted in March 2017; and further sensitivity tests outlined above.

3.3 Transport modelling methodology overview

The transport modelling work undertaken to support this Business Case has primarily been undertaken using the 2014 Worcester Transport Model (WTM). WTM is a detailed travel demand model using EMME4 software, linked to a highway assignment model developed in SATURN and public transport assignment model also in EMME4. The demand model is an incremental multinomial logit model that uses the base year trip costs and forecasts reference trip patterns assuming no change in travel costs. It then pivots travel costs off the base year to generate forecast demand based on future network changes to:

- Values of Time (VoT) due to income changes;
- forecast fuel costs;
- car fuel efficiency; and
- increasing network congestion.

The model is based primarily on data collected in October 2014 and where data comes from another year or month it has been normalised using seasonal factors from long term traffic count data to create a base year model representing October 2014 conditions. Three time periods were developed:

- AM peak hour (8.00-9.00am);
- Inter-peak hour (average hour between 10.00am - 4.00pm); and
- PM peak hour (5.00-6.00pm).

The hours represent the peak hours for highway traffic on an average weekday in a neutral month.

It is recognised that the nature of this scheme is such that a multi-modal model approach is not strictly necessary. However, the model structure is such that the demand forecasting process is integrated into the WTM complete assignment process meaning that to run the model as a standalone highway model is not possible without changes to the model structure.

3.3.1 WTM model scenarios

The transport modelling work to assess the scheme has been undertaken using the Worcester Transport Model. The scheme has been considered as a With Scheme (WS) scenario and results compared against a Without Scheme (WoS) scenario.

The forecast growth in travel demand is based on a combination of the housing and employment allocations as determined by the adopted South Worcestershire Development Plan (SWDP), which also contained information on completions and existing commitments, and also by comparison to NTEM (TEMPRo v7.2) growth. Only the developments identified as 'near certain' or 'more than likely' have been included in the 'core' development scenario. In addition, many developments identified in the SWDP have had planning applications submitted and approved, under construction or built-out since the model base year (2014). These developments too are included in forecasting the reference case demand.

In addition, in line with webTAG guidance unit M4- Forecasting and Uncertainty, sensitivity tests undertaken for **Low growth** and **High growth** scenarios around the Core Scenario as detailed in Appendix I – Traffic Forecasting Report. The high/low growth scenarios are created by applying % changes to core scenario converged matrices as per Section 4.2 of webTAG unit M4- Forecasting and Uncertainty. The change is calculated as follows:

- $\pm 2.5\% \times \text{the square root of the number of years from the base year, for highway matrices};$
- the required matrix adjustment is determined by applying the calculated % change to the base observed matrices and adding to / subtracting from the forecast matrices and the model re-run to convergence.

Growth rates from the forecasts DfT provided in October 2016 were used to constrain the 'Core' scenario to NTEM (TEMPRo v7.2) growth rates at district level within South Worcestershire as well as Local authority levels. All other model areas adopted TEMPro v7.2 growth factors.

In addition to the 2014 base year model, the following model scenarios were developed for the Core Scenario and low and high growth sensitivity tests:

- 2021 WoS Scenario (AM, IP and PM peaks);
- 2021 WS Scenario (AM, IP and PM peaks);
- 2031 WoS Scenario (AM, IP and PM peaks);
- 2031 WS Scenario (AM, IP and PM peaks).

The above tests were reported in the addendum to the OBC submitted in March 2017. The additional sensitivity tests requested by DfT to understand the impact of changes in guidance on the modelled results comprise of:

- 2031 WS scenario (AM, IP and PM peak) to test impact of May 2018 webTAG tables;
- 2038 WoS and WS scenarios (AM, IP and PM peaks) forecasts to assess long term extrapolation of benefits; and
- 2031 WoS and WS scenario (AM, IP and PM) to assess impact of 2018 Road Traffic Forecasts.

3.3.2 WTM reporting

The WTM development is reported in the following supplementary documents:

- WTM 2014 – Report of Surveys;
- WTM 2014 – Highway Local Model Validation Report;
- WTM 2014 – Public Transport Local Model Validation Report; and
- WTM 2014 – Demand Model Report.

Appendix I contains A4440 Worcester Southern Link Road Improvements Phase 4 Forecasting Report.

3.4 Network Changes

The WoS scenario elements are detailed below for both the highway and public transport networks. The WoS scenario schemes have been identified based on various schemes identified in line with webTAG Uncertainty guidelines with only ‘Near Certain’ or ‘More than Likely’ schemes included in the WoS scenario. The Highway and PT network improvement schemes identified below are included in both 2021 and 2031 forecast years.

3.4.1 WoS Highway Network

3.4.1.1 Multi-Modal Corridor Improvements

- Route 1 - B4204 Martley Road/A443 Henwick Road/Hylton Road - from Lower Broadheath to Tybridge Street gyratory;
- Route 3 - A449 Malvern Road/Bromwich Road – from South of Old Malvern Road, Powick to New Road Island;
- Route 4 - A38 Worcester Road/Bath Road/Commandery Road – from Broomhall Lane to Sidbury;
- Route 4b - Norton Road, including the Norton Road pedestrian/cycle link – from St Peter’s Drive to Bath Road;
- Route 8 - Woodgreen Drive/Middle Hollow Drive/Tolladine Road/Lowesmoor;
- Route 9 - A449 Ombersley Road - Claines Roundabout to A38 Droitwich Road junction;
- Route 7a - B4550 Astwood Road/Rainbow Hill/Lowesmoor – B4482 Bilford Road to Pheasant Street.

3.4.1.2 Highway Improvements

- New signalised junction on A44 London Road (Waitrose);
- Highway alterations on A44 Worcester (Cathedral Square);
- Cornmarket scheme;
- Tolladine Road/Middle Hollow Drive;
- Tolladine Road/Woodgreen Drive;
- New roundabout on Blackpole Road;
- Dualling of Southern Link Road between Whittington and Ketch;
- Ketch Roundabout improvements;
- Norton Roundabout improvements;
- New Roundabout on A4538 (Worcester 6);
- A4538/B4636 Plough Road Roundabout improvements;
- M5 J6-J4a Smart motorway scheme improvements;
- M5 Junction 5 improvements;
- M5 Junction 6 improvements;
- M5 Junction 7 signalisation;
- A44 London Road junction with Spetchley Road;
- New roundabout on B4636 Newtown Road to serve potential development;

- Alterations to existing roundabout on B4636 by the hospital site;
- Alterations to Newton Road/Grange Way Roundabout on A4440;
- New roundabout on A44 to facilitate the West of Worcester Development; and
- Traffic signal priority for buses at
 - Newtown Road / Midland Road / Sherriff Street;
 - Newtown Road / Canterbury Road (W);
 - Newtown Road / Canterbury Road (E).

3.4.1.3 Rail Station Improvements

- Inclusion of Worcestershire Parkway station and associated access junction.

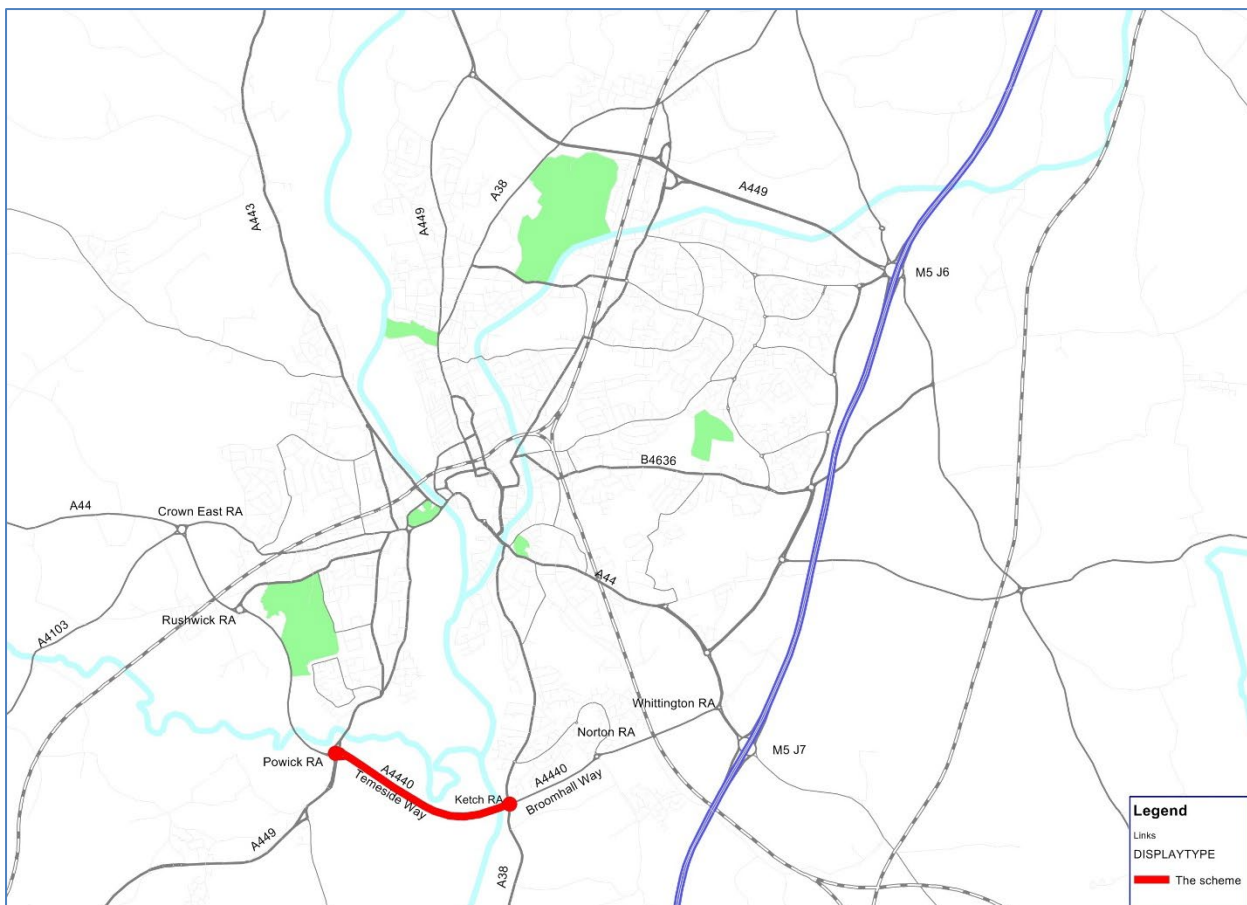
3.4.2 WS Transport Network

Worcester city is bifurcated by the River Severn flowing from north to south. There are only two River crossings, one in the city centre and another on the SLR. As a result, the SLR has been identified as a key route for improvement due to the high level of congestion and poor journey time reliability it currently experiences and the links it provides to employment centres. The following improvements are proposed as part of Phase 4 of the SLR dualling:

- Improvements to Powick and Ketch Roundabouts including widening approach lanes and circulatory lanes to provide additional capacity; and
- Dualling of the SLR between Powick and Ketch roundabout.

The scheme location (highlighted in 'red' in **Figure 3-1**) is expected to alleviate congestion and increase journey time reliability thereby increasing the attractiveness of Worcester, west of Worcester and the wider region for businesses.

Figure 3-1: WS Schemes



3.5 Summary of modelled scheme impacts

This section provides information about the transport modelled impacts of the scheme on the A4440 Worcester SLR and other parts of the network. Information is provided on:

- Network wide statistics;
- Link flow analysis;
- A4440 Worcester SLR Select Link Analysis; and
- Analysis of A4440 Worcester SLR future year journey times.

The analysis of the modelling work undertaken provides a summary of the main impacts of the A4440 Worcester SLR Improvements Phase 4 scheme in Worcester and the surrounding area. Information is provided to set out how the distribution of trips across the highway network changes as a result of the proposed scheme. The distribution of trips is analysed further in the form of select link analysis plots to understand the function of some of the key routes through and around Worcester City centre.

The transport modelling analysis is focussed on the 2031 forecast year for the Core scenarios. This provides a commentary on how the scheme operates with the demand arising from the full growth as well as constraining to TEMPro v7.2 up to 2031.

3.6 Core Scenario - scheme impacts

Network wide statistics are provided to understand the overall journey time and distance travelled on the highway network. Further details regarding the journey times for A4440 Worcester SLR users are also provided.

3.6.1 Network Wide Statistics

Network wide statistics from Highway Assignment model scenarios for the AM and PM peaks are presented in **Table 3.1** whilst details about the IP are presented in Appendix I.

Table 3.1 : Network wide statistics from Highway Assignment model scenarios

Description	Units	2014 Base		2031 WoS		2031 WS	
		AM	PM	AM	PM	AM	PM
Transient Queues	pcu. hrs./hr.	2407	2367	2931	3137	3007	3050
Over-capacity Queues	pcu. hrs./hr.	1509	1406	3651	3849	3538	3809
Total Travel Time	pcu. hrs./hr.	15308	15207	19097	19914	19098	19872
Travel Distance	pcu. kms./hr.	805363	813203	878241	894134	886609	905672
Overall Average Speed	Kph	53	54	46	45	46	46
Total Trips Loaded	pcu/hr	81987	80911	90244	88919	90264	88945
Average Travel Time	Mins	11	11	13	13	13	13

Description	Units	2031 WoS vs Base		2031 WS vs 2031 WoS	
		AM	PM	AM	PM
Transient Queues	pcu. hrs./hr.	21.8%	32.6%	2.6%	-2.8%
Over-capacity Queues	pcu. hrs./hr.	1142.0%	173.8%	-3.1%	-1.0%
Total Travel Time	pcu. hrs./hr.	24.8%	31.0%	0.0%	-0.2%
Travel Distance	pcu. kms./hr.	9.0%	10.0%	1.0%	1.3%
Overall Average Speed	kph	-12.5%	-16.1%	0.9%	1.6%
Total Trips Loaded	pcu/hr	10.1%	9.9%	0.0%	0.0%
Average Travel Time	mins	13.3%	19.2%	0.0%	-0.2%

Note: Over Capacity Queues occur where vehicle arrival rate is greater than the departure rate (capacity as a result of the cycle time or gap availability) resulting in one or more vehicles always being in queue. Transient queues. – are as per over capacity queues, but queue dissipates every simulation cycle – transitional queuing

2014 Base Year Models vs 2031 WoS Models

Analysis of the Network Wide statistics extracted from the Highway Assignment model shows an increase in the number of trips of between 9.9% and 10.1% over the period between the 2014 base year and the 2031 forecast year.

The increase in the number of trips on the highway network leads to an increase in the amount of time spent queuing in transient and over-capacity queues. This in turn leads to an increase in the overall travel time in the model which increases by between 24.8% and approximately 31.0% between 2014 and 2031 in the AM and PM peaks respectively. Due to the additional delay in the 2031 forecast year models the overall average speed of vehicles in the highway model is reduced (by up to 16.7%) compared to the base year model.

The increased number of trips on the highway network compared to the 2014 base year also leads to an increase in the total distance travelled across the modelled highway network. The increase in the total distance travelled is just over 9% across the modelled peak hours.

2031 WoS Models vs 2031 WS Models

Analysis of the Network Wide statistics from the WoS and the WS scenarios shows a slight increase in the number of trips on the highway network under the WS scenario compared to the WoS scenario.

There is a marginal change in the overall number of vehicles in transient queues and over capacity queues under the WS scenario compared to the WoS scenario. The transient queues increase by 2.6% in the AM peak whilst they decrease by 2.8% in the PM peak. The over-capacity queues however decrease in both peak periods. These changes lead to a slight decrease in the overall travel time on the modelled highway network in PM peak periods with AM peak remaining almost same. Compared to the WoS scenario there is a slight increase in the overall average vehicle speed in the WS scenario during the PM peak. In line with the travel time, speed in AM remains at the same level. A review of the models show that the increase in capacity, both at Ketch and Powick along with the dualling of the link between them attracts significant volumes of traffic towards the scheme and re-routing across the network. These changes result in transient queues and over-capacity queues increasing in various parts of the model network as a result. Some of the areas they increase include Norton roundabout, Whittington roundabout, Rushwick roundabout as well as other junctions such as M5 J6, Holt Heath (A443/A4133) and Ombersley.

In the WS scenario, there is a slight increase in the total distance travelled on the modelled highway network. This can be attributed to vehicles routing via longer (but faster) distance routes to avoid congested locations in the modelled network – i.e. vehicles routing via the bypass routes (such as the A4440 Worcester SLR) to avoid congested city centre locations.

3.6.2 Forecast link flow analysis

The Highway Assignment program (SATURN) has been used to produce images of the changes in traffic flow between model scenarios. By comparing WoS and WS scenarios, this analysis usefully indicates the areas of the road network most affected by the scheme.

Figure 3-2 shows the AM peak 2031 traffic flow difference between the WoS and WS scenarios, with traffic volumes shown as band widths. Blue indicates a decrease in flow and green an increase.

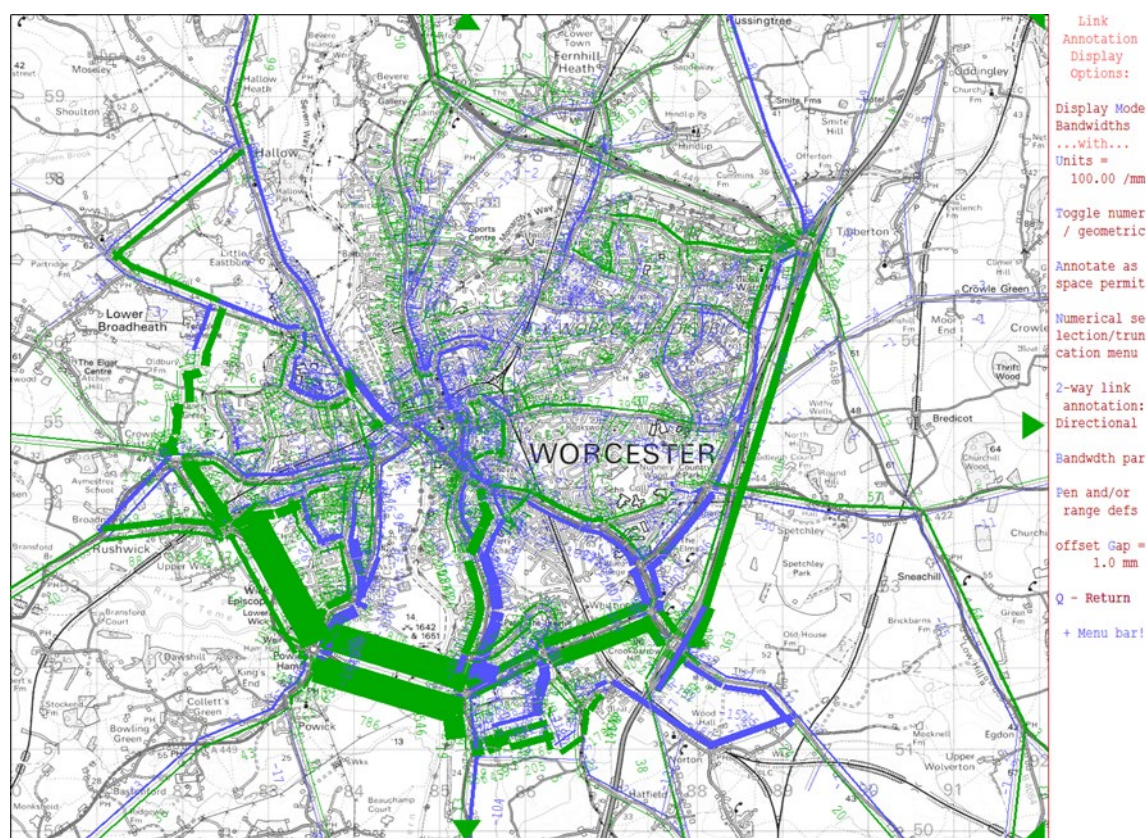
Figure 3-2: 2031 - AM WS minus WoS link volumes

Figure 3-2 shows that, as expected, eastbound and westbound vehicle flows significantly increase on the Phase 4 section of A4440 Worcester SLR in the AM peak hour. Overall, the scheme is shown to have the desired impact in terms of maximising the use of strategic roads for strategic traffic, thereby reducing rat-running on inappropriate roads that were impacted upon as a result of the traffic growth in the area. There is generally a reduction in traffic in the city centre, thereby giving more opportunity for schemes to be implemented to encourage the use of more suitable modes as set out in the WTS.

To the east of the scheme, there is an increase in forecast traffic flows on the M5 between Junction 6 and 7, whilst traffic on the eastern bypass is forecast to reduce. To the west of the A4440 Worcester SLR Phase 4 scheme, between Powick and the A4103/A44 junction, the scheme results in an increase in flow as a result of the composition of traffic on the Powick to Ketch section changing. That is, the increase in eastbound traffic as a result of the scheme results in a reassignment of traffic from the A449 to the A4103 for traffic travelling from the south.

Within Worcester (defined as within the bypass network) the redistribution of traffic to the A4440 Worcester SLR is evident as shown by the reduction in traffic flows on the A449 between Powick Roundabout and the city centre. The model also shows that there is a general reduction of traffic in the city centre; a result of more trips being able to travel via the A4440 Worcester SLR.

Figure 3-3 shows the PM peak 2031 WoS and WS scenarios, with traffic volumes shown as band widths.

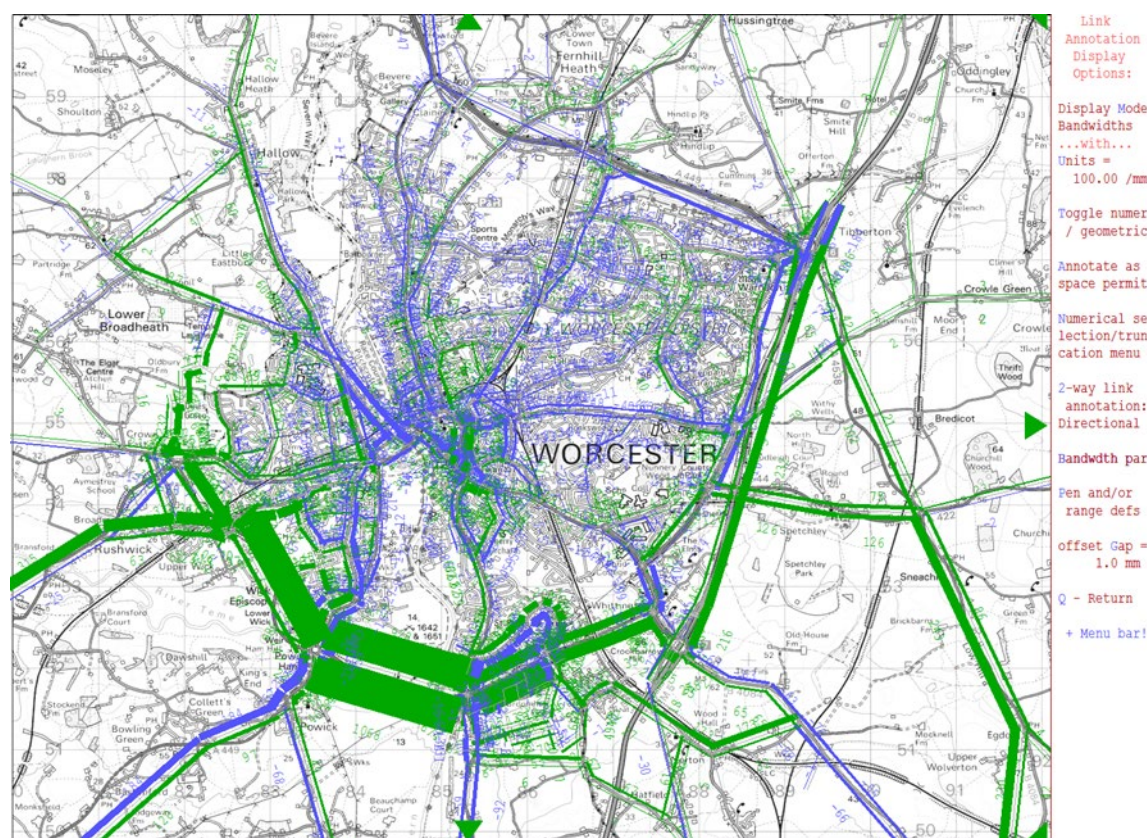
Figure 3-3: 2031 - PM WS minus WoS link volumes

Figure 3-3 shows that, as with the AM peak hour, eastbound and westbound vehicle flows increase significantly on the section of A4440 Worcester SLR that is the scheme in the PM peak hour. To the west of Worcester there is an increase in traffic volumes on links from A44/A4103 junction as was similar in the AM peak hour.

Within Worcester (defined as within the bypass network) the scheme does have an impact in terms of traffic distribution. Modelled traffic flows show a reduction in the number of vehicles northbound on the A449 (Malvern Road) as they switch to the alternative route on the west to avoid congestion at Powick. North of Worcester city centre there is a general reduction in traffic flows on all the main corridor routes including Barbourne Road (A449), Droitwich Road (A38), Rainbow Hill (B4550) and northbound Tolladine Road (B4205). This traffic re-routes to the M5 between junction 6 and 7, and then continues on the improved A4440 Worcester SLR section. There are slight increases and decreases in traffic flows along a few local routes around the city centre.

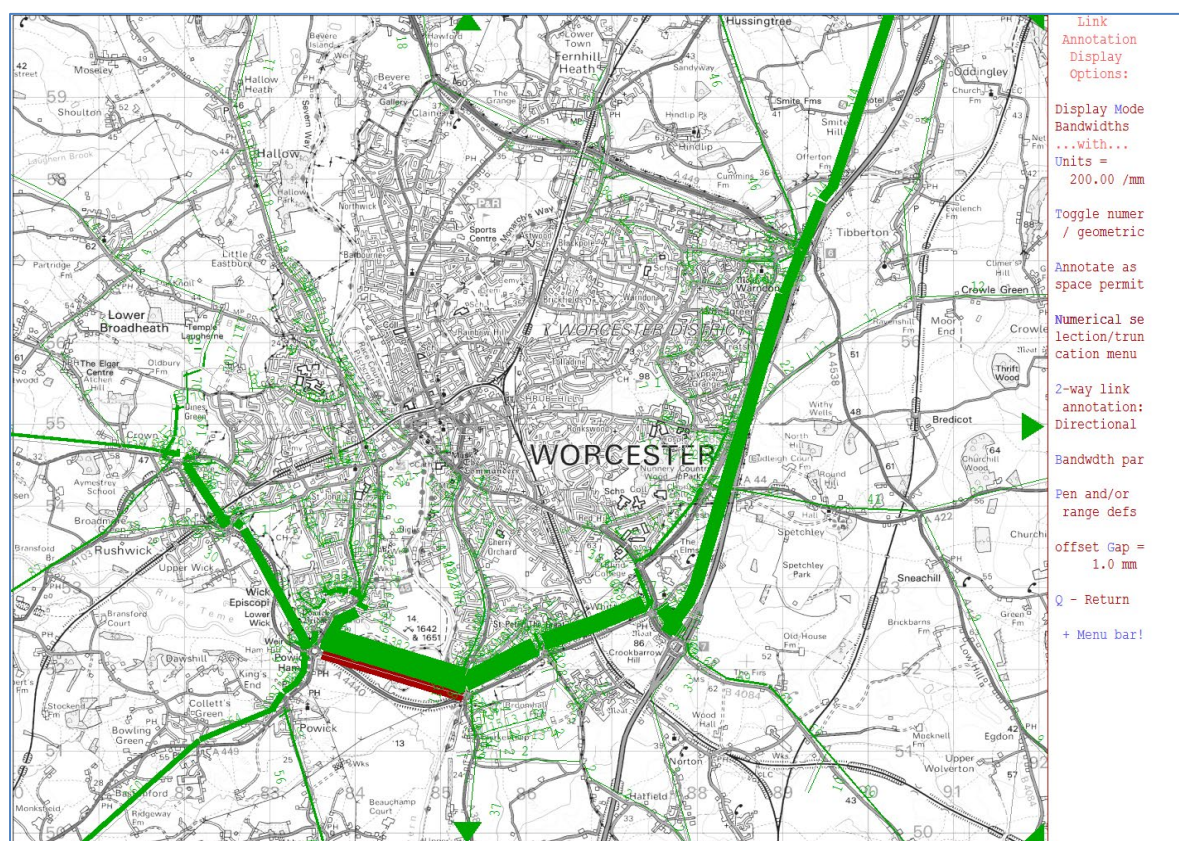
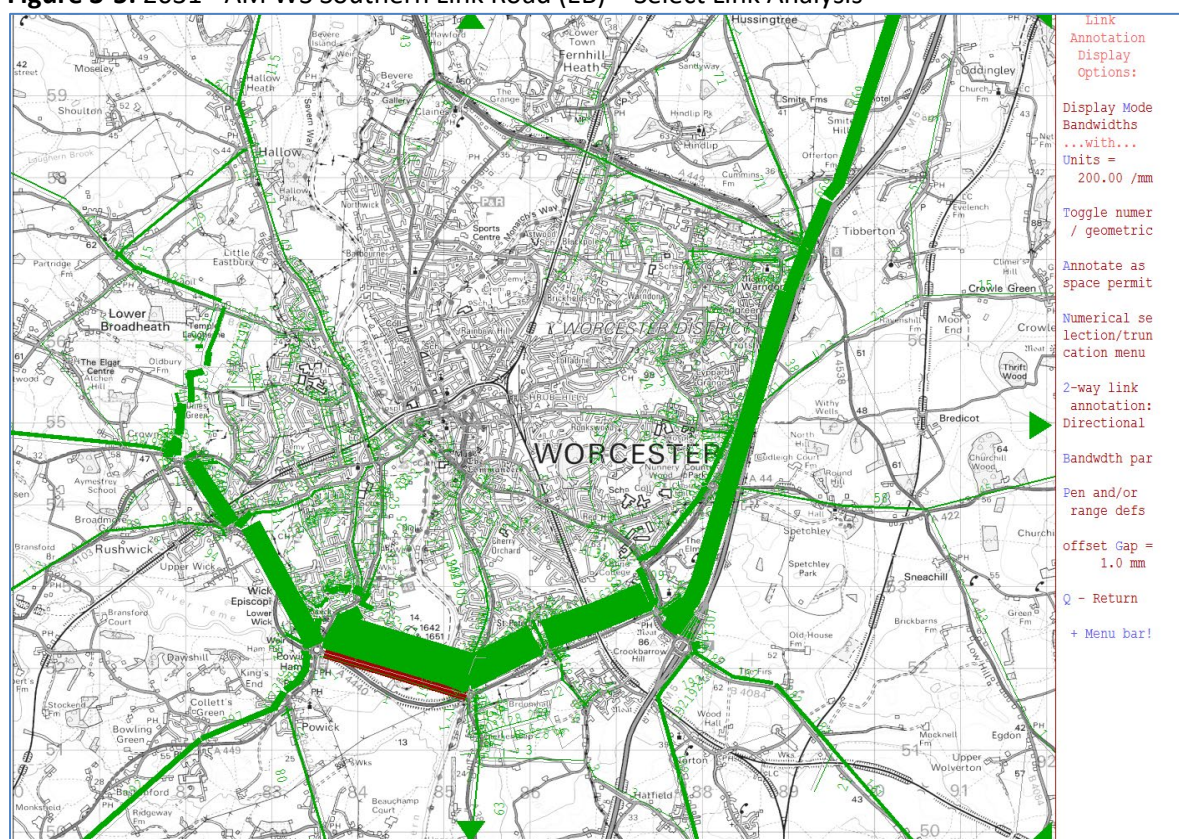
The model also shows that there is a general reduction of traffic in the city centre; a result of more trips being able to travel via the SLR.

Due to the increased attractiveness of the scheme, the resulting changes in traffic patterns increase the traffic demand in the vicinity of the scheme. These changes could result in the need to identify additional mitigation measures on the surrounding network to ensure the strategic nature of the SLR route is maintained.

3.6.3 A4440 Worcester SLR Phase 4 'select link analysis'

The traffic movement trends as a result of the scheme improvements described in the previous section considered all traffic movements. The analysis provided below specifically identifies where the additional trips are coming from and where they are going to and any changes in these patterns between the modelled scenarios, using Select Link analysis.

In the following plots (**Figure 3-4** to **Figure 3-7**) the band widths shown have been kept to a consistent scale, thus changes in width are a result of changes in volume.

Figure 3-4: 2031 - AM WoS Southern Link Road (EB) – Select Link Analysis**Figure 3-5: 2031 - AM WS Southern Link Road (EB) – Select Link Analysis**

The routing pattern of trips using the Worcester Southern Link Road under the WS scenario shows trips route to the section via similar routes. There is an increase in the number of trips routing from the A449 (south west of Worcester), the A38 (and Worcester Road, south of Worcester) and the A449 (Malvern Road) west of Worcester city centre, A44 Bromyard Road and Bransford Road. Also, the A4440

Worcester SLR is accommodating a large proportion of more local trips that are currently rat-running on local roads to avoid the congested A4440 Worcester SLR.

The destination of trips using the eastbound Worcester Southern Link Road in the AM peak period is predominantly similar in the WoS and WS scenarios. The main trips destinations under both scenarios are:

- Worcester Eastern bypass (A4440);
- M5;
- A4538 / A38 towards Droitwich;
- B4636;
- A44; and
- Whittington Road towards Pershore.

Figure 3-6: AM WoS Southern Link Road (WB) – Select Link Analysis

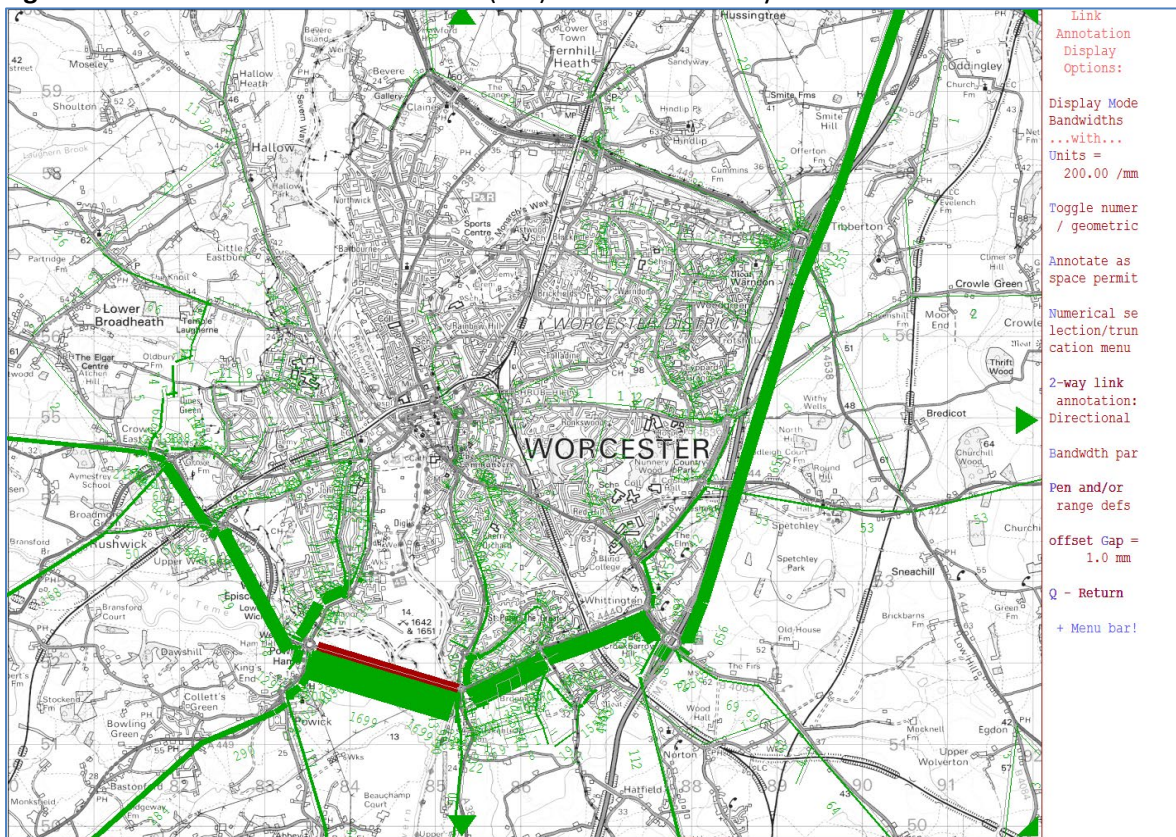
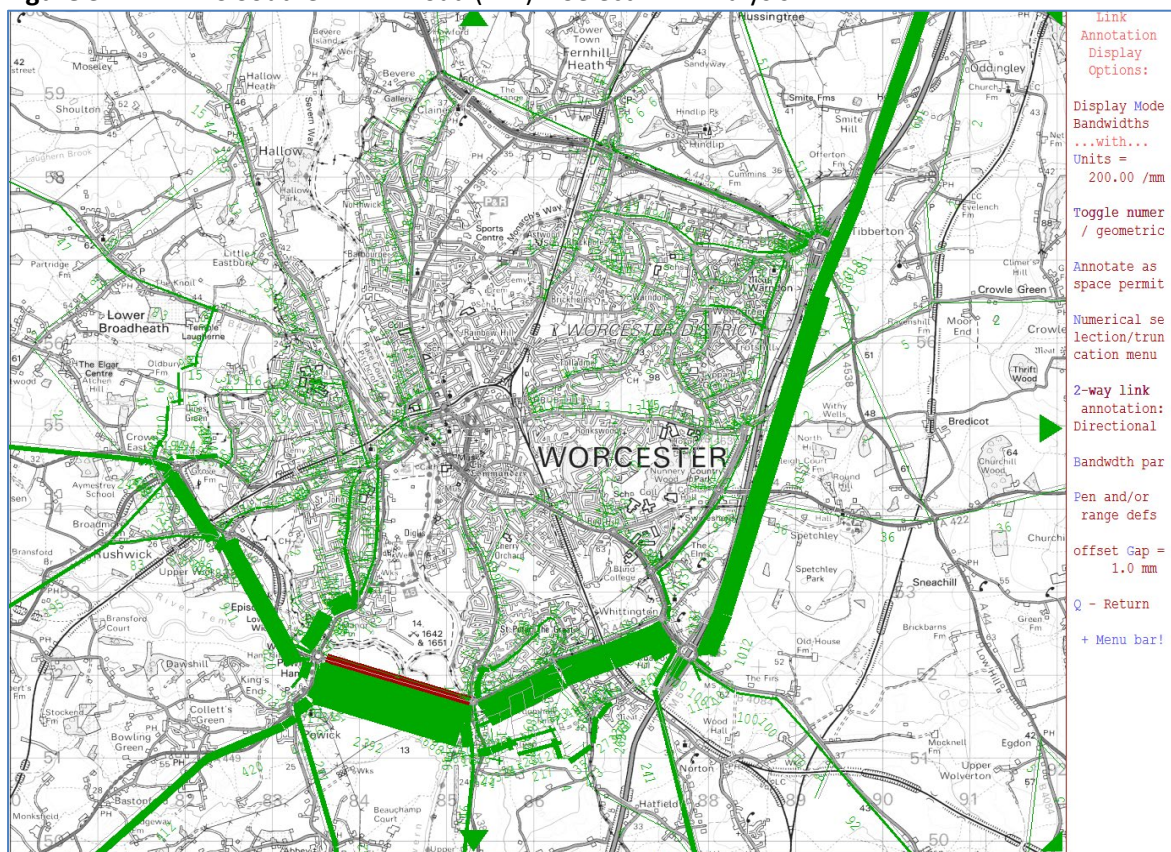


Figure 3-7: AM WS Southern Link Road (WB) – Select Link Analysis

The predominant trip origins of vehicles using the route are as follows:

- Worcester Eastern bypass (A4440);
- M5;
- A4538 / A38 from Droitwich;
- A38 (Worcester Road, south of Worcester);
- A44; and
- Whittington Road towards Pershore.

The destination of trips using the selected link is also modelled to be relatively similar between scenarios. Destinations under both scenarios are as follows:

- Worcester City Centre (via A449 – Malvern Road);
- A449 Malvern Road (south west of Worcester);
- A4103; and
- A44.

The destination of trips using the selected link is also shown to be relatively similar between scenarios.

3.6.4 Traffic flow and link capacity assessments

Traffic flows on the scheme link extracted from the model for the base year and 2031 are shown in **Table 3.2**.

Table 3.2: AM and PM Traffic Flows 2014 and 2031

	2014		2031 WoS		2031 WS		
	AM	PM	AM	PM	AM	PM	
Powick to Ketch	896	1207	1383	1398	2189	2326	
Ketch to Powick	1580	1600	1754	1800	2540	2868	
Abs Difference							
			WoS vs Base		WS vs Base		WS vs WoS
Powick to Ketch			487	191	1293	1119	806 928
Ketch to Powick			174	200	960	1268	786 1068
% Difference							
			WoS vs Base		WS vs Base		WS vs WoS
Powick to Ketch			54%	16%	144%	93%	58% 66%
Ketch to Powick			11%	13%	61%	79%	45% 59%

Table 3.2 indicates that without the improvement scheme traffic flows increase by 13%-54% from the 2014 base year to the 2031 forecast year. This increase is primarily as a result of the SLR Phase-3 improvements that provide additional capacity between Ketch and Whittington junctions. With the scheme in place, however, the additional capacity allows for significant traffic growth of between 61% and 144% from the base year to 2031 forecast year. Compared to the WoS scenario, traffic growth in 2031 under the WS scenario ranges between 45% and 66% percent with the eastbound flows showing higher growth than the westbound flows. This additional capacity will help accommodate the growth in predicted traffic.

In addition, the SATURN highway model has been used to assess the performance of the scheme in terms of comparing the volume of traffic to the capacity of the road link between Powick and Ketch roundabouts. As the volume/capacity ratio shown by SATURN approaches 100% the performance of the section of network where the ratio approaches 100% can deteriorate when the highest peak flow is encountered, though the occurrence of performance issues can only be established through more detailed assessment of junction operation as SATURN averages network performance over an hour time period. **Table 3.3** shows the volume-capacity ratios for the base and 2031 model performance.

Table 3.3 : Volume/capacity Ratios (%) for the Powick to Ketch SLR section.

	2014		2031 WoS		2031 WS	
	AM	PM	AM	PM	AM	PM
Powick to Ketch	120	112	116	118	104	65
Ketch to Powick	88	89	97	100	71	80
Abs Difference						
			WoS Vs Base		WS Vs WoS	
Powick to Ketch			-4	6	-12	-53
Ketch to Powick			9	11	-26	-20
% Difference						
Powick to Ketch			-3%	5%	-10%	-45%
Ketch to Powick			10%	12%	-27%	-20%

In line with results earlier in the assessment the results indicate that the Powick to Ketch section of the SLR is shown to be under pressure currently which worsens up to the forecast year of 2031 such that the v/c ratio under WoS scenario is in the range 97%-118%.

With the implementation of the scheme, the V/C ratio under the WS scenario falls significantly to levels between 65% and 80% in all time periods except 2031 AM. In the 2031 AM peak hour the section between Powick and Ketch is forecast to experience a volume/capacity ratio over 100% in the eastbound direction, as a result of the Ketch roundabout junction operating at capacity.

3.6.5 Analysis of Worcester Southern Link Road Journey Times

In order to understand the impact of the scheme to the vehicles using the A4440 Worcester SLR, modelled journey times have been extracted. **Table 3.4** shows the difference in the time taken to travel along the A4440 Worcester SLR corridor between A44/A4103 junction in the west and Whittington junction in the east during the modelled peak periods.

Table 3.4 : Highway Assignment Model SLR Forecast Journey Times (minutes)

	2014		2031 WoS		2031 WS	
	AM	PM	AM	PM	AM	PM
SLR Eastbound	16.3	21.0	16.3	15.9	10.8	7.5
SLR Westbound	9.5	14.0	11.2	14.5	7.2	8.9
Abs Difference						
			WoS Vs Base		WS vs WoS	
SLR Eastbound			0.0	-5.1	-5.6	-8.4
SLR Westbound			1.7	0.5	-3.9	-5.7
% Difference						
			WoS Vs Base		WS vs WoS	
SLR Eastbound			0%	-24%	-34%	-53%
SLR Westbound			17%	4%	-35%	-39%

The modelled journey times on the A4440 Worcester SLR show the journey time benefits on the route as a result of the scheme when compared to the WoS.

The most significant impact in terms of journey time improvements is shown west to east in the PM peak period. This is as a result of the SLR-Phase 3 improvements. However, in the westbound direction, travel times in the Without Scheme scenario increase by 1.6 minutes. This is due to the increase in capacity from Phase 3 improvements meaning more traffic is able to pass from Whittington Roundabout to Ketch roundabout, and is thus then constrained by the single carriageway section to the west of the Ketch Roundabout, before traffic volumes split onto the routes to Malvern and West Worcester at Powick Roundabout.

The modelled time taken to travel from A44/A4103 Roundabout in the west to Whittington Roundabout in the east during the AM peak 2031 Without Scheme forecast year scenario is 16.3 minutes. Under the 2031 With Scheme scenario the modelled time taken to travel the same route is 10.8 minutes, thereby showing a journey time saving of 5.6 minutes (a 34% decrease) compared to the 2031 Without Scheme scenario.

The modelled time taken to travel westbound from Whittington to A44/A4103 Roundabout during the AM peak 2031 Without Scheme forecast year scenario is 11.2 minutes. Under the 2031 With Scheme scenario the modelled time taken to travel the same route is 7.2 minutes, thereby showing a journey time saving of 3.9 minutes (a 35% decrease) compared to the 2031 Without Scheme scenario.

Travel times between A44/A4103 and Whittington junction in the PM peak under the With Scheme scenario provide similar savings in both directions. Travel times in the eastbound direction drop from 15.9 minutes in the Without Scheme to 7.5 minutes (a 53% decrease) in the With Scheme scenario. Similarly, in the westbound direction, they drop from 14.5 minutes in the Without Scheme to 8.9 minutes (a 39% decrease) in the With Scheme scenario.

In all cases, it is significant that the forecast journey times in 2031 are all lower than the respective base year observed journey times in 2014. This represents a major improvement in overall journey time, a reduction in variability and a significant increase in reliability despite the growth in traffic demand of over 10% across the model network, and an increase range of 61% to 144% in the section between Powick and Ketch roundabouts.

3.6.6 Public transport impacts

The public transport network performance has also been reviewed from a network wide perspective under the WS scenario. **Table 3.5** contains the summary network statistics.

The table indicates that in the WoS scenario there is a significant decrease in the total number of bus boarding passengers in 2031 compared to the base year in line with the TEMPro v7.0 forecast reduction in PT growth. Under the WoS scenario, highway improvement measures and other public transport measures such as signal priority help average journey times to reduce in 2031.

The scheme is seen to decrease the total number of bus passengers by up to 0.3% in 2031 compared to the WoS scenario. The average journey time per passenger remains similar to WoS conditions.

Table 3.5 : Public Transport- Summary Statistics – 2031

Metric	2014		2031 WoS		2031 WS	
	AM	PM	AM	PM	AM	PM
Bus						
Total Number of Boarding Passengers	1548	1692	1272	1352	1271	1351
Average Journey Time per Passenger (hours)	0.27	0.25	0.24	0.23	0.24	0.23
Total Passenger kilometres	11115	10950	7880	8277	7874	8270
Rail						
Total Number of Boarding Passengers	1082	530	901	436	901	435
Average Journey Time per Passenger (hours)	0.66	0.83	0.65	0.82	0.65	0.82
Total Passenger kilometres	42766	26447	35230	21397	35183	21356
Metric	2031 WoS vs 2014		2031 WS vs 2031 WoS			
	AM	PM	AM	PM		
Bus						
Total Number of Boarding Passengers			-17.8%	-20.1%	-0.1%	-0.1%
Average Journey Time per Passenger			-12.8%	-6.9%	0.0%	0.0%
Total Passenger kilometres			-29.1%	-24.4%	-0.1%	-0.1%
Rail						
Total Number of Boarding Passengers			-16.7%	-17.7%	0.0%	-0.2%
Average Journey Time per Passenger			-0.9%	-1.1%	-0.1%	0.0%
Total Passenger kilometres			-17.6%	-19.1%	-0.1%	-0.2%

3.6.7 Sensitivity tests – High and Low Growth

In addition to the Core Scenario, further sensitivity tests were undertaken on the highway network to determine the robustness of the core scenario. The additional tests undertaken were low growth and high growth demand in line webTAG guidance to account for uncertainty in NTEM forecasts.

The high/low growth scenarios are created by applying % changes to core scenario converged matrices as per Section 4.2 of webTAG unit M4- Forecasting and Uncertainty. The change is calculated as follows:

- $\pm 2.5\%$ x the square root of the number of years from the base year, for highway matrices;
- the required matrix adjustment is determined by applying the calculated % change to the base observed matrices and adding to / subtracting from the forecast matrices and the model re-run to convergence.

As would be expected, the low growth scenario tends to decrease the level of trip making and the high growth increases the levels of trip making. The results show a general symmetry when comparing the High and Low outturn trip levels due to the symmetric growth assumptions employed. In 2021, the change in trip levels vary between -6.2% under low growth and 6.5% under high growth compared to the core scenario. The corresponding range in 2031 is between -8.9% under low growth and 9.5% under high growth.

The resulting patterns whilst more similar for the vehicle-kilometre growth, varies for the total travel time and overall network speeds due to increased congestion under high growth scenario. Under the high growth scenario, the change in total travel time (increase) and average network speeds (decrease)

are generally greater than the corresponding change under the low growth scenario. In 2031, for a 9% reduction in demand, the total travel time reduces between 13.3% and 18.4% under low growth, but for a similar increase in demand under high growth, the total travel times increase between 15.1% and 19.5%. Comparison tables of Highway network performance statistics of the low and high growth scenarios against the core scenario are given in **Table 3.6** and **Table 3.7**.

Table 3.6: Summary Highway Network Performance- WoS and WS- Low Growth Vs Core Scenario - 2031

Scenario	Parameter	Unit	2031 WoS		2031 WS	
			AM	PM	AM	PM
Core	Total Travel Time	pcu. hrs./hr.	19097	19914	19098	19872
	Travel Distance	pcu. kms./hr.	878241	894134	886609	905672
	Overall Average Speed	kph	46	45	46	46
Low Growth	Total Travel Time	pcu. hrs./hr.	15957	16248	16011	16406
	Travel Distance	pcu. kms./hr.	841472	864341	848194	874686
	Overall Average Speed	kph	53	53	53	53
% Diff	Total Travel Time		-16.4%	-18.4%	-16.2%	-17.4%
	Travel Distance		-4.2%	-3.3%	-4.3%	-3.4%
	Overall Average Speed		14.6%	18.5%	14.2%	16.9%

Table 3.7: Summary Highway Network Performance- WoS and WS- High Growth Vs Core Scenario - 2031

Scenario	Parameter	Unit	2031 WoS		2031 WS	
			AM	PM	AM	PM
Core	Total Travel Time	pcu. hrs./hr.	19097	19914	19098	19872
	Travel Distance	pcu. kms./hr.	878241	894134	886609	905672
	Overall Average Speed	kph	46	45	46	46
High Growth	Total Travel Time	pcu. hrs./hr.	22658	22922	22824	23312
	Travel Distance	pcu. kms./hr.	914695	941419	924113	957058
	Overall Average Speed	kph	40	41	41	41
% Diff	Total Travel Time		18.6%	15.1%	19.5%	17.3%
	Travel Distance		4.2%	5.3%	4.2%	5.7%
	Overall Average Speed		-12.2%	-8.5%	-12.7%	-9.9%

3.6.8 Additional Sensitivity Tests

In addition to the WS scheme evaluated as part of the forecasting process, further sensitivity tests were undertaken on the highway network to determine the robustness of the core scenario. The additional tests undertaken were identified, through current guidance as follows:

- Impact of the May 2018 webTAG Data book values on VoT and VOC;
- Long term extrapolation of benefits over appraisal period based on Section 2.4 of webTAG unit A1.1 Cost-Benefit Analysis (May 2018); and
- Impact of 2018 Road Traffic Forecasts data.

3.6.8.1 Impact of May 2018 webTAG Data book values

In May 2018, webTAG data book was updated by the DfT. As part of the FBC, DfT requested a sensitivity test be undertaken to assess the impact of the webTAG values on the traffic forecasts. Accordingly, JACOBS (legacy CH2M) undertook a sensitivity test considering the VoT and VOC values based on May 2018 Data Book. The test was undertaken only for 2031 WS scenario and compared against the previous 2031 WS scenario which was based on 'TAG data book- forthcoming change, November 2016' released in July 2016. The **Table 3.8** shows the vehicle values of time and distance in terms of pence per minute (PPM) and pence per kilometre (PPK).

Table 3.8 : Vehicle Values of Time 2014 prices (pence per minute/km)

Purpose	Jul-16		May-18	
	PPM	PPK	PPM	PPK
HBW/HBO	27.11	6.76	25.28	7.01
EMP	48.45	11.97	45.19	11.98
HGV	32.89	48.8	30.67	48.47

The table shows that the VoT for the various purposes have declined slightly but VOC are similar to previous webTAG values for all user classes.

Table 3.9 : Public Transport Values of Time 2014 prices (person pence/min)

Purpose	Jul-16		May-18	
	Bus	Rail	Bus	Rail
HBW	25.05	25.05	23.41	23.41
HBO	11.43	11.43	10.69	10.69
EMP	21.2	61.7	19.81	57.67

The **Table 3.9** shows that VoT for PT modes follows a similar pattern to private vehicles with slight decline across all purposes since the 2016 release.

The 2031 with Scheme demand model was rerun with the new cost. It shows very little impact on Highway and PT network performance. Following tables show the performance comparison between the old and the new cost.

Table 3.10: Highway Network Summary Statistics Comparison

Description	Units	2031 (July 2016)		2031 (May 2018)	
		AM	PM	AM	PM
Transient Queues	pcu. hrs./hr.	3007	3050	2990	3061
Over-capacity Queues	pcu. hrs./hr.	3538	3809	3563	3819
Total Travel Time	pcu. hrs./hr.	19098	19872	19086	19875
Travel Distance	pcu. kms./hr.	886609	905672	885400	904725
Overall Average Speed	Kph	47	46	46	46
Total Trips Loaded	pcu/hr	90264	88945	90279	88967
Average Travel Time	Mins	13	13	13	13

Description	Units	July 16 vs May 18	
		AM	PM
Transient Queues	pcu. hrs./hr.	-0.6%	0.4%
Over-capacity Queues	pcu. hrs./hr.	0.7%	0.3%
Total Travel Time	pcu. hrs./hr.	-0.1%	0.0%
Travel Distance	pcu. kms./hr.	-0.1%	-0.1%
Overall Average Speed	kph	-0.4%	-0.2%
Total Trips Loaded	pcu/hr	0.0%	0.0%
Average Travel Time	mins	-0.1%	0.0%

Table 3.10 shows that the impact of the May 2018 VoT and VOC values on the WTM highway network is negligible with the various network statistics showing minimal variations compared to the core scenario forecasts. There are slight increases in over capacity queues and total travel time during the peaks due

to the decrease in VoT making urban routes get more attractive. In line with the findings **Figure 3-8** shows the insignificant flow differences in all peaks due to changes in generalised cost. The plots show link flows on the longer and faster routes reduce slightly due to the reduction in VoTs. Urban routes characterized by lower speeds are shown to experience slight increases in flow as a result.

Figure 3-8: Actual Flow Difference Plots (AM,IP,PM) for 2031 WS between July 2016 and May 2018 Generalised Cost

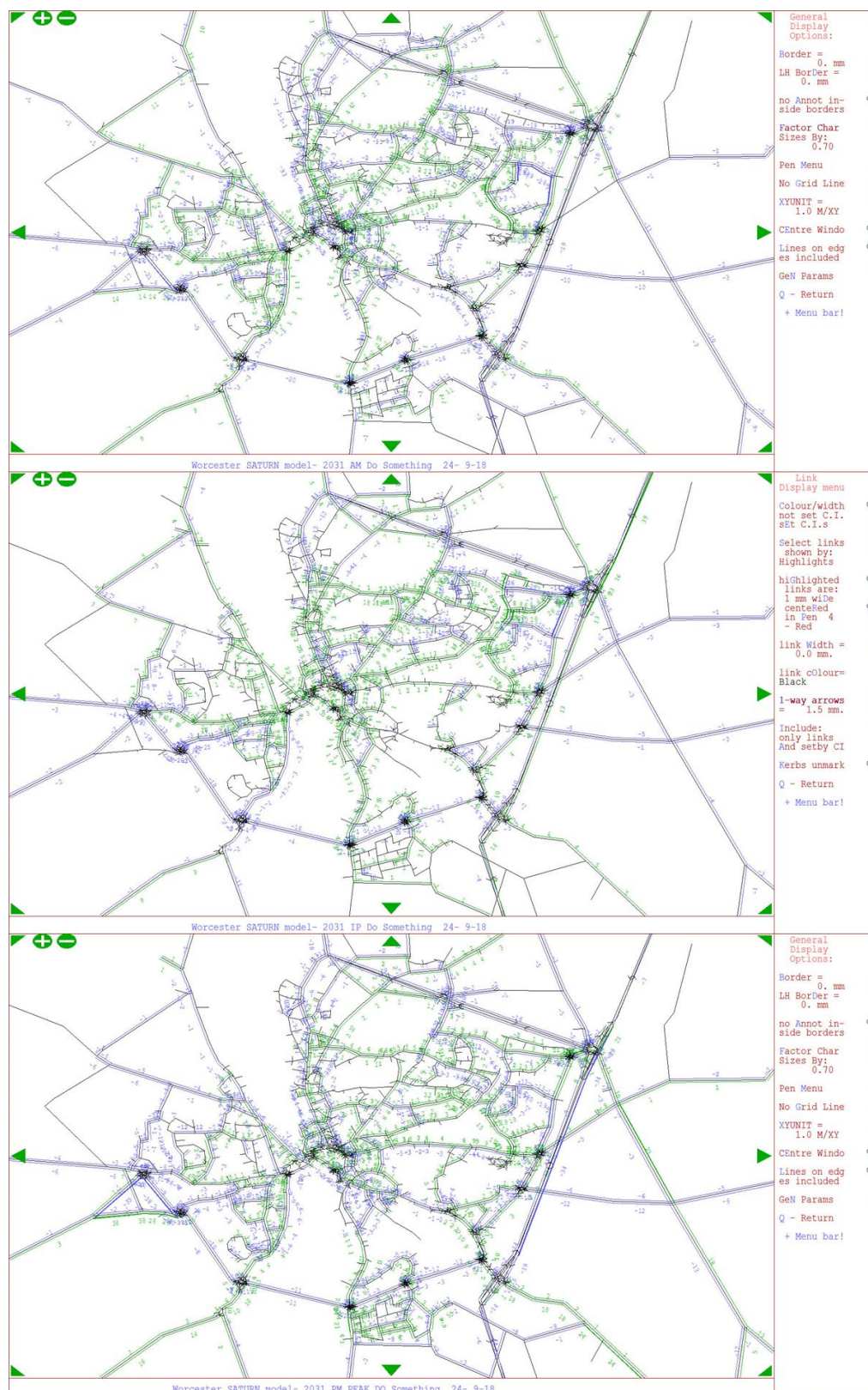


Table 3.11 compares the summary statistics for public transport trips due to the changes in webTAG data values. It shows a slight reduction (2.9% to 3.4%) in the total number of boarding passengers across all time periods with average journey times per passenger remaining comparable. The impact of new VoT and VOC are negligible.

Table 3.11 : Public Transport Network Summary Statistics Comparison

Metric	2031 (July 2016)		2031 (May 2018)	
	AM	PM	AM	PM
Total Number of Boarding Passengers	1271	1351	1229	1312
Average Journey Time per Passenger (hours)	0.24	0.23	0.23	0.23
Total Passenger kilometres	7874	8270	7529	8014
Average Operating Speed of Buses (kph)	35.9	37.2	35.9	37.2

Metric	July 16 vs May 18	
	AM	PM
Total Number of Boarding Passengers	-3.3%	2.9%
Average Journey Time per Passenger	-4.2%	0.0%
Total Passenger kilometres	-4.4%	3.1%
Average Operating Speed of Buses (kph)	0.0	0.0

3.6.8.2 Long term extrapolation of benefits – 2038 forecasts

DfT published new guidelines on Cost Benefit Analysis in May 2018 that includes a new section on assessing longer term benefit in the horizon of 20 years from scheme appraisal year. For this Full Business Case, the scheme appraisal year is 2018. A 2038 forecast model was therefore developed to assess the long-term benefits of the scheme.

The model forecasts for 2021 and 2031 were based on the adopted South Worcestershire Development Plan (2016-2031) and constrained to TEMPro v7.2 forecasts. The 2038 forecasts were based on growth factors from TEMPro v7.2 for the period 2031 to 2038 for light vehicles and the 2015 NTM forecasts for heavy vehicles. The 2038 forecast demand was assigned to both WoS and WS scenarios and outputs extracted for highway network performance and public transport network summary statistics.

Table 3.12 : 2038 Highway Network Summary Statistics

Description	Units	2014 Base		2038 WoS		2038 WS	
		AM	PM	AM	PM	AM	PM
Transient Queues	pcu. hrs./hr.	2407	2367	3149	3361	3265	3307
Over-capacity Queues	pcu. hrs./hr.	1509	1406	4315	4536	4221	4512
Total Travel Time	pcu. hrs./hr.	15308	15207	20396	31314	20487	21325
Travel Distance	pcu. kms./hr.	805363	813203	898017	915912	908109	927168
Overall Average Speed	Kph	53	54	44	43	44	44
Total Trips Loaded	pcu/hr	81987	80911	93808	92447	93818	92479
Average Travel Time	Mins	11	11	13	20	13	14

Description	Units	2038 WoS vs Base		2038 WS vs 2038 WoS	
		AM	PM	AM	PM
Transient Queues	pcu. hrs./hr.	30.8%	42.0%	3.7%	-1.6%
Over-capacity Queues	pcu. hrs./hr.	186.0%	222.6%	-2.2%	-0.5%
Total Travel Time	pcu. hrs./hr.	33.2%	105.9%	0.4%	-31.9%
Travel Distance	pcu. kms./hr.	11.5%	12.6%	1.1%	1.2%
Overall Average Speed	kph	-17.0%	-20.4%	0.7%	1.2%
Total Trips Loaded	pcu/hr	14.4%	14.3%	0.0%	0.0%
Average Travel Time	mins	18.2%	84.5%	0.8%	-32.0%

Table 3.12 shows that transient queue in WS scenario increases in AM peak but decreases in PM peak while compared to WoS scenario. Overcapacity queue decreases in both peaks. The overall speed also increases in WS scenario in all peak periods.

Table 3.13 : 2038 Public Transport Network (Bus) Summary Statistics

Metric	2038 WoS		2038 WS	
	AM	PM	AM	PM
Total Number of Boarding Passengers	1132	1218	1132	1217
Average Journey Time per Passenger (hours)	0.23	0.23	0.23	0.23
Total Passenger kilometres	6793	7382	6788	7377
Average Operating Speed of Buses (kph)	36.0	37.1	36.0	37.0

Metric	2038 WoS vs 2038 WS	
	AM	PM
Total Number of Boarding Passengers	0.0%	-
Average Journey Time per Passenger	0.4%	0.1%
Total Passenger kilometres	-0.1%	-
Average Operating Speed of Buses (kph)	0.0	0.1%

From Table 3.13 it also can be concluded that the impact of scheme on bus network in 2038 is negligible.

3.6.8.3 Impact of 2018 Road Traffic Forecasts

The Road Traffic Forecast 2018 from the National Traffic Model (NTM) was released in September 2018. A sensitivity test was undertaken to understand the impact of new traffic forecast. The test utilised the previous 2031 with scheme and without scheme scenario by replacing the HGV demand with the 2018 forecasts. The previous RTF forecast indicated that goods vehicle traffic is estimated to grow by between 6.6 % and 16.8% by 2021 and 2031 respectively. The 2018 NTM reveals that the HGV forecast is predicted to grow by between -0.63 % and 0.30% by 2021 and 2031 respectively in the model area. The test was undertaken only for 2031 scenario and the results presented in **Table 3.14** and **Table 3.15**.

Table 3.14 : Network Statistics Comparison for 2031 WoS Scenario

Description	Units	OBC NTM		2018 NTM	
		AM	PM	AM	PM
Transient Queues	pcu. hrs./hr.	2931	3137	2871	2815
Over-capacity Queues	pcu. hrs./hr.	3651	3849	3167	2907
Total Travel Time	pcu. hrs./hr.	19097	19914	18547	18693
Travel Distance	pcu. kms./hr.	878241	894134	875313	898614
Overall Average Speed	Kph	46	45	47	48
Total Trips Loaded	pcu/hr	90244	88919	89644.8	88513
Average Travel Time	Mins	13	13	12	13

Description	Units	OBC NTM vs 2018 NTM	
		AM	PM
Transient Queues	pcu. hrs./hr.	-2.0%	-10.3%
Over-capacity Queues	pcu. hrs./hr.	-13.3%	-24.5%
Total Travel Time	pcu. hrs./hr.	-2.9%	-6.1%
Travel Distance	pcu. kms./hr.	-0.3%	0.5%
Overall Average Speed	kph	2.6%	6.9%
Total Trips Loaded	pcu/hr	-0.7%	-0.5%
Average Travel Time	mins	-4.6%	-2.3%

Table 3.15 : Network Statistics Comparison for 2031 WS Scenario

Description	Units	OBC NTM		2018 NTM	
		AM	PM	AM	PM
Transient Queues	pcu. hrs./hr.	3007	3050	2971	2794
Over-capacity Queues	pcu. hrs./hr.	3538	3809	3037	2989
Total Travel Time	pcu. hrs./hr.	19098	19872	18559	18837
Travel Distance	pcu. kms./hr.	886609	905672	883983	910418
Overall Average Speed	Kph	47	46	48	48
Total Trips Loaded	pcu/hr	90263.8	88945	89673	88570
Average Travel Time	Mins	13	13	12	13

Description	Units	OBC NTM vs 2018 NTM	
		AM	PM
Transient Queues	pcu. hrs./hr.	-1.2%	-8.4%
Over-capacity Queues	pcu. hrs./hr.	-14.2%	-21.5%
Total Travel Time	pcu. hrs./hr.	-2.8%	-5.2%
Travel Distance	pcu. kms./hr.	-0.3%	0.5%
Overall Average Speed	kph	2.1%	5.9%
Total Trips Loaded	pcu/hr	-0.7%	-0.4%
Average Travel Time	mins	-2.4%	-4.5%

As per 2018 NTM forecast the HGV growth from Base year 2014 to 2031 is almost zero. As a result of reduced HGV demand, both the WS and WoS scenario are showing improved network performance as expected. **Figure 3-9** and **Figure 3-10** shows the actual flow differences in WoS and WS network respectively for the AM, IP and PM peak hours compared to the core scenario forecasts. In both the AM and IP peaks, flow changes are negligible in the WoS and WS scenarios in the local road network. The changes on the M5 are more pronounced. In the PM peak, the flow changes are greater in both WoS and WS along most routes compared to other peaks. The highest changes along the M5 reflective of strategic nature of HGV trips. Further, as the HGV demand is not modelled through the VDM process, the changes in the WoS and WS scenarios are of similar magnitude when compared to the core scenario forecasts. In all cases the changes in flows along the scheme link is negligible.

Figure 3-9: Actual Flow Difference Plots (AM, IP, PM) for 2031 WoS between Previous NTM and 2018 NTM Growth

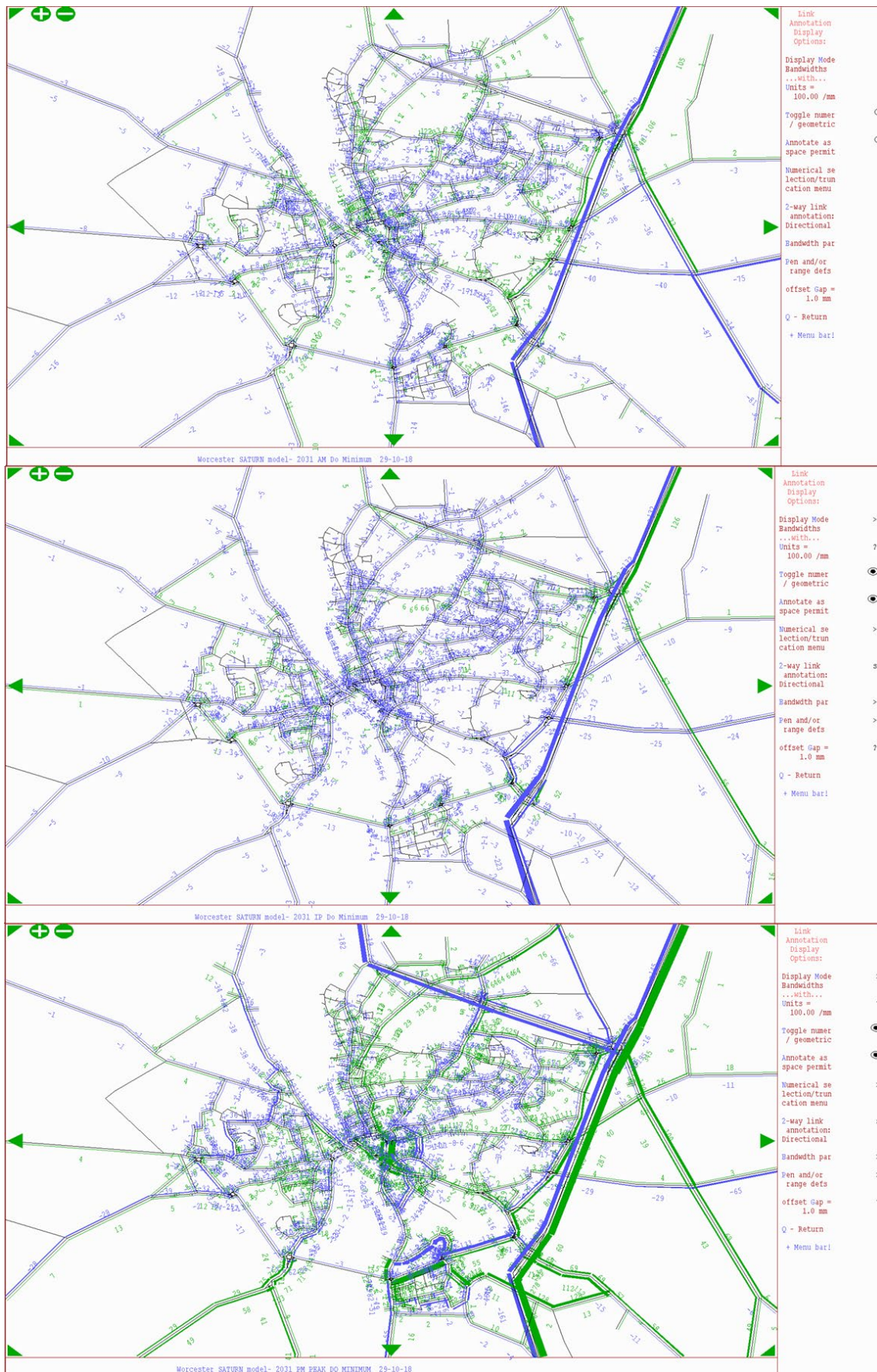
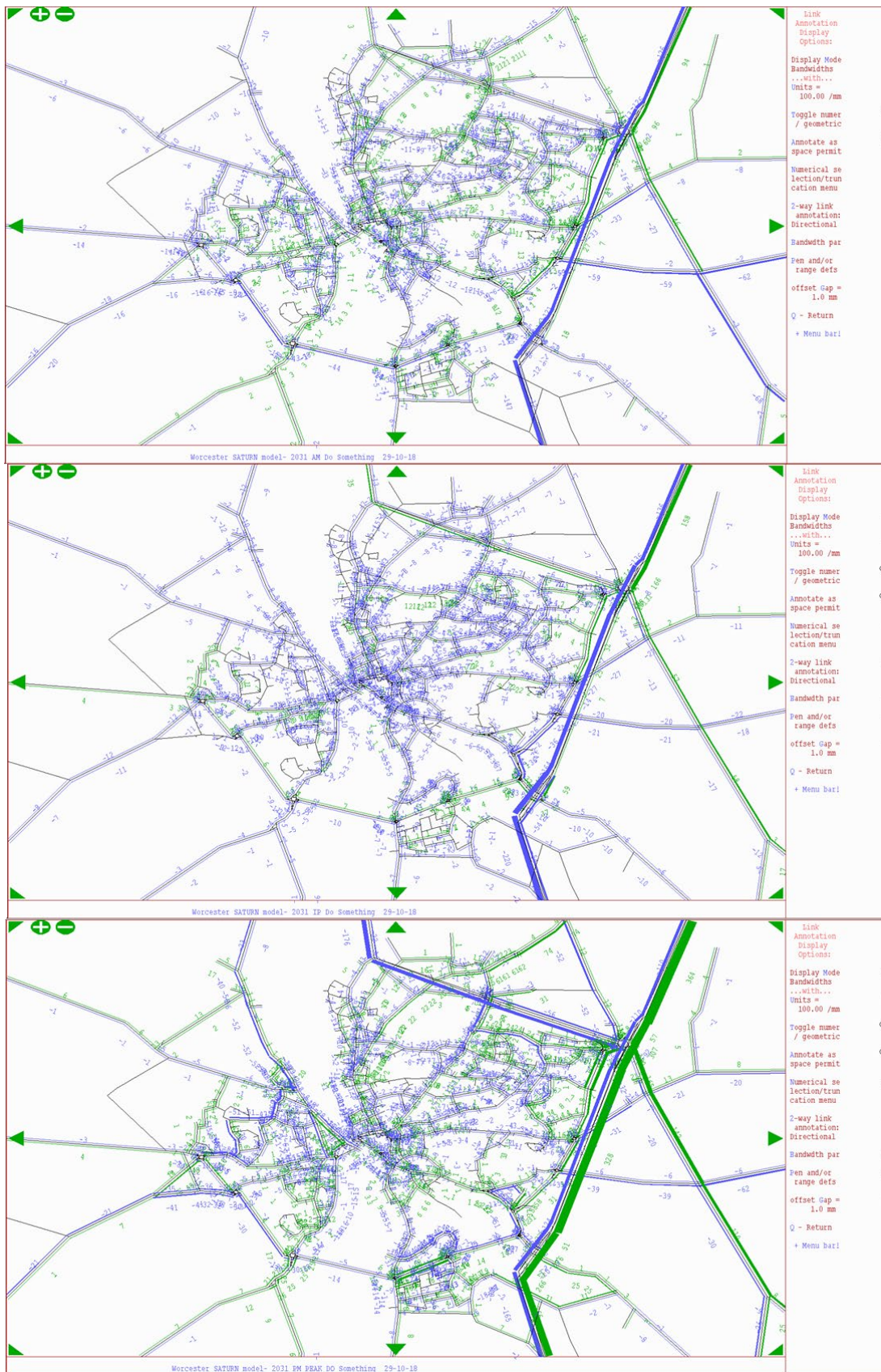


Figure 3-10: Actual Flow Difference Plots (AM, IP, PM) for 2031 WS between Previous NTM and 2018 NTM Growth



3.7 Summary of Traffic Modelling

Analysis of the traffic modelling work undertaken has shown that the provision of additional highway capacity on the A4440 Worcester SLR in the WS scenarios results in additional trips routing via the scheme compared to the WoS scenario.

The A4440 Worcester SLR Improvements Phase 4 scheme, and the additional vehicle trips it attracts, results in a re-distribution of trips compared to the WoS scenario. This re-distribution of trips in turn results in a decrease in the number of trips on the radial routes through Worcester city centre and an increase in trips on the Southern Link Road.

Due to the significant increase in overall trip growth expected within Worcester and Worcestershire, traffic flows on the A4440 Worcester SLR with the Phase 4 scheme in place, increase by between 45% and 66% compared to the WoS scenario.

Journey times on the A4440 Worcester SLR improve as a result of the scheme modelled through the WS scenario. In the 2031 WS forecast journey times are 4-8.5 minutes less than the 2031 WoS journey times. This means that the 2031 WS forecast journey times are better than base year conditions and thus represents a significant improvement which will be realised in the form of journey time saving and journey time reliability.

The outline business case was submitted in February 2017 followed by an addendum in March 2017. Since then, new webTAG Data book and National Traffic Model forecast tables have been published along with new approach to transport appraisal guidelines for long-term benefit extrapolation. In order to understand the impact of these changes, additional sensitivity tests were undertaken in addition to webTAG recommended standard sensitivity tests. The results show that the changes to the webTAG tables have negligible impact on the model forecasts. The change in HGV growth rates lead to reduced demand resulting in slight flow reduction in the urban networks and greater changes on the motorway network.

Chapter 4:

Economic Case



4 Economic Case

4.1 Introduction

The Economic Case for the scheme has been considered in line with the principles set out in webTAG. The scheme has been considered as a With Scheme (WS) scenario against a Without Scheme (WoS) scenario. The details of the scheme included in the WS scenario are provided as part of the Strategic Case. This section provides information on:

- Section 4.2 – Economy impacts;
- Section 4.3 – Environment impacts;
- Section 4.4 – Social impacts;
- Section 4.5 – Public Account impacts;
- Section 4.6 – Summary of impacts of the core case; and
- Section 4.7 – Sensitivity tests.

4.1.1 Overview of the changes since the economic case presented in the OBC

The OBC report was submitted in January 2017 and the economic results were based on modelling forecasts that used TEMPro v7.0. Following revisions to the TEMPro datasets for Worcestershire and other counties and subsequent release of TEMPro version 7.2 in February 2017, an addendum report to the Economic Appraisal report was submitted to the DfT in March 2017. DfT sought clarifications on the Economics Appraisal Report and a response was submitted in July 2017. In November, 2017 the DfT announced funding of £54.5m for the scheme and development of the Final Business Case (FBC).

As part of the FBC submission, DfT recommended further tests on the traffic modelling:

- To demonstrate the impacts of changes to TAG databook (May 2018 at the time of analysis undertaken) since the OBC ('Forthcoming changes to TAG values November 2016 released in July 2016);
- To see the impact of long term extrapolation of benefits; and
- To see changes to the Road Traffic Forecasts (2018) on freight growth.

The results of the above tests showed that the impacts on the traffic forecasts were negligible compared to the Core scenario reported in the addendum to the OBC in March 2017. As a result, the following changes and tests have been undertaken to the economic case:

- Update the economic benefits of the scheme using values from the latest TAG data book (May 2018 at the time of analysis) and TUBA software (v1.9.11);
- Update the accident benefits using latest version of COBALT; and
- Appraise the impact of long term extrapolation of benefits

Since the submission of the OBC in January 2017, the assumptions for the Central Case (Section 4.2 of OBC) have been superseded. The FBC reports on the Core scenario forecasts constrained to TEMPro v7.2 and the high and low growth sensitivity tests as reported in the addendum to the OBC submitted in March 2017; and additional sensitivity test on the long term extrapolation of benefits outlined above.

4.2 Core Case Economy Impacts

4.2.1 Assessment approach and key assumptions

DfT's Transport Appraisal Guidance (TAG) has been followed for the economic case of the A4440 Worcester SLR Phase 4 scheme. TUBA (Transport Users Benefit Appraisal), a DfT modelling appraisal tool has been used to compute an appraisal of transport schemes. Comparing the base (or Without Scheme scenario) to the scheme, TUBA assesses the difference in costs and travel time by journey purpose as well as change in fuel costs and CO₂ emissions. TUBA summary analysis forms a benefit-cost ratio which quantifies the benefit received to the economy for every £1 invested in the scheme.

4.2.2 Key Modelling Assumptions

The TUBA economic appraisal takes outputs (demand, travel time and distance travelled with and without scheme) from the Highway and public transport models and uses the following standard economic parameters with the assumed parameter(s) for this assessment:

- Start of scheme preparation: 2018
- Scheme opening year: 2021
- Modelled year: 2021 and 2031
- Appraisal period: 60 years
- Price base and base year for discounting: 2010
- Discount rate: 3.5% for 30 years from scheme opening year and 3% thereafter
- Vehicle classes: HGV and three car classes (commuter, business, other)
- Annualisation factors – AM 655 hours, PM 700 hours, IP 1,518 hours and weekends 852 hours as set out in the Economic Assessment Report.
- Value of Time (VoT) – based on TAG data book released in May 2018
- TUBA version 1.9.11 that incorporates the changes to the VoT in line with TAG databook

Construction disruption costs associated with Traffic Management are included within the Present Value of Costs (PVC) whilst those associated with user delays are included in the PVB.

Scheme costs have 15% and 23% optimism bias for Standard infrastructure and the bridges respectively applied (stage 2).

4.2.3 Business users & transport providers

The key economic impact included in the present value of benefits is the time saving benefit. Dualling the A4440 Worcester SLR between Powick and Ketch and improving the roundabouts at each end will reduce travel times, especially during peak hours, thus commuters will value the savings derived from this road improvement scheme. It is expected that the highway network in the city centre too will benefit from reduced congestion as a result of the scheme thus benefitting public transport users too. The benefit is measured as a change in the road user cost due to the time savings for the users pre and post dualling. On a broader scale, the dualling of the A4440 Worcester SLR between Powick and Ketch will impact a wider consumer group through reduced congestion and improved traffic operations.

The benefits to public transport users have been modelled and quantified in this part of the economic assessment, even though the transport user benefits of the schemes will be largely for private car users.

This scheme generates £73.42 million of business user and transport provider travel time benefits, £2.38 million of vehicle operating cost benefits, £2m of user charges benefits to public transport business users and £-0.926 million of benefits during construction and maintenance. This equates to a total business user benefit of £74,888 million. Further details of the breakdown of these benefits are provided in the Transport Economic Efficiency (TEE) Table 4-1 below.

The Transport Economic Efficiency tables indicates car and freight vehicles take up over 99.8% of user benefits. It is envisaged that the reduced volumes of traffic in the City Centre will provide an improved highway network for buses to operate and give the opportunity for bus priority measures beyond that found under the current arrangement.

Table 4-1: TEE Table (£000s)

Non-business: Commuting		ALL MODES	ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL	Private Cars and LGVs	Passengers	Passengers		
Travel time	62,896	62,896	0	0		
Vehicle operating costs	-81	-104	23	0		
User charges	12	0	15	-3		
During Construction & Maintenance	-495	-495				
COMMUTING	62,333	(1a) 62,298	38	-3		
Non-business: Other		ALL MODES	ROAD	BUS and COACH	RAIL	OTHER
User benefits	TOTAL	Private Cars and LGVs	Passengers	Passengers		
Travel time	90,163	90,163	0	0		
Vehicle operating costs	1,081	874	207	0		
User charges	105	0	132	-27		
During Construction & Maintenance	-1,108	-1,108				
NET NON-BUSINESS BENEFITS: OTHER	90,240	(1b) 89,928	339	-27		
Business		BUS and COACH		RAIL		
User benefits		Goods Vehicles	Business Cars & LGVs	Passengers	Freight	Passengers
Travel time	73,423	39,988	33,435	0		0
Vehicle operating costs	2,389	-202	2,588	3		0
User charges	2	0	0	3		-1
During Construction & Maintenance	-926	0	-926			
Subtotal	74,888	(2) 39,786	35,097	5	0	-1
Private sector provider impacts		Road	Bus	Rail		
Revenue	-478	0	-253.9327454	-223.5994823		
Operating costs	0	0	0	0		
Investment costs	0	0	0	0		
Grant/subsidy	0	0	0	0		
Subtotal	-478	(3) 0	-254	-224		
Other business impacts		Road	Bus	Rail		
Developer contributions	-5,694	(4) -5694	0	0		
NET BUSINESS IMPACT	68,716	(5) = (2) + (3) + (4)				
TOTAL						
Present Value of Transport Economic Efficiency Benefits (TEE)	221,290	(6) = (1a) + (1b) + (5)				

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values

4.2.4 Reliability impacts on Business users

The DfT gave advice for Local Transport Decisions Makers (2013) about how to quantify reliability benefits in this case. A qualitative assessment, based around the estimation of network stress has been undertaken using the traffic flows forecast from the traffic model. A comparison between the predicted Average Annual Daily Traffic (AADT) and the Congestion Reference Flow (CRF) is undertaken which provides a guide on the likely level of reliability impact of the scheme. Details of the reliability assessment undertaken is given in the 'A4440 Worcester Southern Link Road Improvements Phase 4 -Economic Assessment Report'.

The assessment undertaken is summarised in Table 4-2 which indicates there would be a moderate beneficial impact on reliability based on Tag guidance and assessments.

Table 4-2: Estimated Business User and Transport Provider Reliability Benefits (£000s)

	Scheme
Business Travel Time Benefits	73,423
Reliability Impact	Moderate Beneficial
Reliability Percentage	10%
Business User and Transport provider Reliability benefits	7,342

The importance of journey time reliability of business is illustrated by the following quote from Malvern Hills Science Park:

“The variability of journey times between MHSP and the MS is now a cause for concern and may limit the growth of MHSP. It is 9.7 miles from here to Junction 7 of the MS and it can take anywhere from 16 minutes to 50 minutes, depending upon the time of day. For example, this means that the bulk of the journey from MHSP to Birmingham Airport is the first 9.7 miles taking 50 minutes, with the remaining 34 miles taking just 35 minutes. The situation is now so bad that some tenants have taken to heading south to Junction 8 in order to head north on the MS. If we are to succeed as a business, we need this problem addressed in the very near future.”

4.2.5 Wider impacts

Transport schemes have impacts and benefits beyond their direct effects on users. In determining the case for investment in transport, such impacts need to be considered alongside other assessments. Collectively these are known as wider impacts. The methodology adopted is in line with guidance in TAG Unit A2.1 and follows a similar process used in assessments of Wider Impacts (WIs) for previous SLR business cases. This section outlines key steps and assumptions in estimating the Wider Impacts that are additional to transport user benefits, as well as the results. The Wider Impacts Assessment is focused on the following three areas:

- Agglomeration – By reducing journey times, the relative agglomeration of business in this area will increase. This will have a direct impact on the productivity and GDP of the UK and is a central element to the estimation of Wider Impacts;
- Output change in imperfectly competitive markets – A reduction in the costs of transport allows businesses to operate more efficiently, improves their output and intensity of business practices, and hence allows for benefits; and
- Labour supply impacts – This captures tax revenues arising from the welfare effects to the UK economy of having a wider human resource pool. As travel costs are reduced, more workers will be attracted to the workplace from either new areas accessible by the scheme or areas that are already connected receiving an improved service.

The assessment approach is set out in **Appendix J**. The work shows that the:

- Agglomeration impacts were estimated for 2021 and 2031, profiled across the appraisal period between 2021 and 2081, and then discounted to 2010 prices and values. Overall the agglomeration impacts are estimated to be £18.434m.
- The value of imperfect competition impact is estimated at £10.749m.
- The value of the tax revenues from labour supply effects impact was estimated at £0.459m.

The total wider impacts of the A4440 SLR Phase 4 scheme is forecast to be £29.643m for the appraisal period (unchanged from the OBC forecast).

4.2.6 Regeneration

Further benefits of the scheme come from two sources. Firstly the unlocking of residential and commercial land around south Worcester, west Worcester and Malvern Hills. Secondly improving the accessibility across the region. There are no changes to the assumptions in the development assumptions since the OBC and the assumptions therefore remain unchanged.

Aligning with the Worcestershire SEP, the completion of the dualling of the A4440 Worcester SLR between M5 and Powick roundabout will address pinch points on the Worcester SLR allowing for the early delivery of housing and employment sites, as well as improving links with the wider road network, enhancing user experience by decreasing travel times and increasing reliability.

The SWDP targets delivery of 280 ha of employment land 28,400 new homes between 2006 and 2030. The scheme will contribute to unlocking strategic development sites will deliver a significant portion of these ambitious targets.

Specifically, Policy SWDP45/1 Broomhall Community and Norton Barracks Community (Worcester South urban extension) which will comprise 2,600 dwellings and 20 Ha employment together with supporting

services and facilities. This quantum of development could sustain more than 3,600 jobs and generate nominal GVA in the region of £195m per annum upon completion.

In addition, A4440 Worcester SLR Improvements Phase 4 will help to unlock the development of 2,150 dwellings, 5Ha of employment land and a range of supporting services and facilities including a neighbourhood centre as part of the Worcester West urban extension (see: Policy SWDP45/2 Temple Laughern – (Worcester West) urban extension). This quantum of development could sustain more than 900 jobs and generate nominal GVA in the region of £49m per annum upon completion.

Further, the SLR is considered critical to unlocking development at North East Malvern (see Policy SWDP 56), where 800 homes and 10ha of employment land will be delivered. This quantum of development could sustain more than 1,800 jobs and generate nominal GVA in the region of £97m per annum upon completion.

In total, these strategic development sites could generate 5,600 new homes and 35ha of employment land, supporting in excess of 6,300 jobs and providing GVA uplift of £340m per annum. Given the range of site-specific and complementary investments required to facilitate development at these sites, it would not be appropriate to attribute all of these regeneration impacts to dualling of the SLR. Nevertheless, the Scheme is considered to remove a critical barrier to development in the area. Within this context, the Scheme will play a key role in unlocking development and promoting investment and regeneration in South Worcestershire.

In the absence of the Scheme, development would not come forward as quickly or at the same scale, meaning South Worcestershire would not be able to capitalise on significant opportunities for growth and regeneration. The estimated 6,300 jobs and £340m annual uplift in GVA would not materialise.

Looking at accessibility, the Scheme will improve connectivity east to west and north to south across Worcestershire. Analysis of changes in average journey times demonstrates that trips between various parts of the county will significantly quicker and easier with delivery of the Scheme. In particular, trips between Malvern Hills and Redditch, Bromsgrove, Wyre Forest and Wychavon will all be quicker with Phase 4 of the SLR in place. Further, journeys between Wyre Forest and Worcester will also benefit from reduced journey times. This will mean that more jobs will be accessible to the workforce across Worcestershire, whilst simultaneously a larger, more skilled labour pool will be available to employers in the county. This could drive inward investment and business relocation as firms try to take advantage of improved labour catchments.

Linked to accessibility, the SEP outlines a priority to improve the routes across a wider geography. For example, there is a desire to enhance linkages with Herefordshire in order to create better access and augment strategic links between the two geographical areas. This aspect is mainly important for businesses trading and/or supplying other businesses or customers within the local geographic area. With enhanced links, trading and deliveries can be made more easily and more reliably. Given the strategic importance of the A4440 Worcester SLR linking Worcester, Worcestershire and Herefordshire with the M5, the benefits would span the West Midlands and beyond.

It is important to recognise that the ambition of the SEP is already being realised.

The ambition of the SEP is already being realised. The 2017 Annual Report of the LEP states the following, WLEP is

- 1st strongest growth in higher level workforce skills (Of all LEPs between 2010 – 2015)
- 1st highest growth in productivity (Of all LEPs between 2010 – 2015)

The 2016 Annual Report of the LEP states that “Worcestershire continues to climb the league tables due to our performance and is well on track to exceed our target to increase GVA by £2.9bn, enable over 21,500 new homes and create an additional 25,000 jobs all by 2025”.

The regeneration policy and prospect as mentioned in OBC still prevails.

4.3 Environment

The environmental surveys and assessment have been to inform an Environmental Statement for the scheme. Information is presented for the following technical areas:

- Noise;
- Air Quality;
- Greenhouse Gases;
- Landscape and Townscape;
- Heritage of Historic Resources;
- Biodiversity; and
- Water Environment.

This work is documented in full in the Environmental Statement for the OBC, in **Appendix H**. In addition to the Environmental Statement, TAG assessments have been undertaken and the workbooks are presented in **Appendix F**

The OBC for the current scheme was produced whilst EIA assessment work was ongoing. A preliminary ES was produced by CH2M to feed into the OBC. However, since the OBC was produced, further work has been completed to inform the full business case and another ES has been produced by TACP for this purpose, with more up to date information. Due to this, the information in the Environment Statement within the FBC is more up to date than the information contained within the OBC. This more recent TACP ES includes some differences with the conclusions from the preliminary ES used in the OBC, the main differences being in the air quality and landscape conclusions.

The Environmental Impact Assessment (EIA) procedures in European Union member states are based on the European Community Directive, 'The Assessment of the Effects of Certain Public and Private Projects on the Environment' (85/337/EEC) as amended by Council Directive 97/11/EC, Directive 2003/35/EC and Directive 2009/31/EC (subsequently replaced in 2011 by a new Codified EIA Directive 2011/92/EU) – collectively termed the 'EIA Directive. Following review, this new EIA Directive finally came into force on 15 May 2014 as Directive 2014/52/EU.

The Directive was implemented in the UK through the Town and Country Planning (Assessment of Environmental Effects) Regulations 1988 (SI No 1199). This has subsequently been superseded by the Town & Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 2011 (SI No 1824) (hereafter referred to as the EIA Regulations).

Schedule 1 of the EIA Regulations identifies those developments for which environmental assessment is mandatory. The scheme for this application site does not fall into this category.

Schedule 2 of the EIA Regulations lists developments which require environmental assessment if the proposed scheme is likely to have significant effects on the environment 'by virtue of its nature, size or location'. The process of determining whether a Schedule 2 development requires an environmental impact assessment is referred to as "screening". Under Regulation 5 of the EIA Regulations the applicant may request a Screening Opinion from the relevant Planning Authority to determine whether the proposed development requires an EIA. Alternatively, the applicant can voluntarily prepare an EIA normally following consultation with the relevant planning authority.

The Local Planning Authority ((LPA)(Worcestershire County Council)) has been consulted with regards to the Environmental Impact Assessment (EIA). Following consultation with the LPA a Screening Opinion has not been sought because the scheme is located immediately adjacent to the River Teme Site of Special Scientific Interest (SSSI). The scheme's proximity to the SSSI increases the risk of significant impacts and hence the requirement for EIA. Further to this, the site lies within a Registered Battlefield (Battle of Worcester 1651) and flood plain. An Environmental Statement (ES) will therefore be prepared to accompany the Planning Application for the proposed scheme. A scoping report will be submitted to the LPA detailing the proposed scope of the ES and the consultation undertaken to date.

To inform both the scoping and the Environmental Statement, surveys have been undertaken at appropriate times of the year. These surveys include: ecological surveys; noise monitoring surveys; and air quality surveys. Figure 4-1 shows key designations in the vicinity of the scheme.

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4.3.1 Noise

The scheme has the potential to generate noise and vibration from its construction and operation as a result of the associated traffic movements. In addition, the existing noise climate needs to be considered to ensure that noise sensitive receptors are protected.

A noise monitoring survey was undertaken which monitored existing noise levels at a number of locations. The monitoring locations were established with Worcester Regulatory Services and included sensitive receptors, such as residential properties. The monitoring results were then used to inform the environmental assessment for the scheme. To the west of the River Severn the existing baseline environment is predominantly agricultural with a number of isolated properties. To the east is the St Peters residential estate, Ketch Caravan Park and Moorings and the Ketch Public House. Further to preparation of the Environmental Scoping report it has been identified that there is one Noise Important Areas within the scheme extents and two further just outside the extents.

Alterations to a road and changes to the noise climate also have the potential to bring with them claims under Parts I and II of the Land Compensation Act 1973. The assessment therefore:

- Examined the situation where the authority may have a duty to provide noise insulation (Part II claims); and
- Provided data through noise measurements prior to the alterations that could be used by the authority to compare with post completion measurements. These could be used to defend any claims under Part I of the Act.

The ES report found significant increases in the short term to noise levels and attempts to mitigate these adverse impacts through scheme design, for example the inclusion of low noise surfacing. Noise barriers were also considered as mitigations at two locations, however they were not included due to the adverse visual impacts that they would have. Of 1251 properties that were assessed, 1248 would experience a minor or negligible change in noise levels, which is classified as insignificant in the opening year of the scheme (2021). Three locations would experience moderate increases in noise in 2021, which would be considered significant. However, by 2036 all of the properties assessed are predicted to experience minor or negligible changes in noise level, which is considered not significant. It is unlikely that any dwellings along the route will be eligible under the Noise Insulation Regulations. Impacts at night are likely to be similar to day time impacts.

After assessment it was concluded that vibration impacts are unlikely.

The OBC assessment of noise stated that the A4440 Worcester SLR Improvements Phase 4 scheme is likely to create significant noise impacts in the short term. This is considered a pessimistic scenario, given the assessment undertaken for the ES.

4.3.2 Air quality

During operation, potential air quality impacts will be due to changes in traffic movements on the roads, giving rise to a change in the nature and location of vehicle emissions, with consequent impacts on local air quality.

Under the Local Air Quality Management regime Local Authorities have a duty to make periodic reviews of local air quality against the air quality objectives. Where this indicates that the objectives are not expected to be achieved, they are required to designate an Air Quality Management Areas (AQMA). An Air Quality Action Plan (AQAP) must then be formulated, outlining a plan of action to meet the air quality objectives in the AQMA.

A desk based search has been undertaken to determine whether there are any Air Quality Management Areas (AQMA) within close proximity of the scheme. There are three existing AQMA's within Worcester, these are:

- 1) Bridge Street/Dolday;
- 2) Lowesmoor/Rainbow Hill; and
- 3) St John's Centre.

Further assessment of deteriorated air quality is currently ongoing in the Butts, the Tything, the Cross and London Road, which may result in further future declarations of AQMA.

Consultation with Worcester Regulatory Services was carried out and an appropriate set of monitoring locations and an appropriate programme were agreed. This information along with the traffic data was used to produce the air quality section within the Environmental Statement. Air Quality Monitoring began at ten locations in May 2016 for 6 months. Modelling of air quality impacts with and without the scheme has also been completed and reported in full within the ES report.

An Air Quality Technical Note has been produced for the FBC. This note explains why there are differences between the air quality conclusions from the preliminary ES prepared by CH2M for the OBC and the ES produced after the OBC by TACP. It had been found that there were few major differences between the two reports that would change the conclusions drawn. One main difference was that the preliminary ES report produced by CH2M predicted negative impacts for air quality in Whittington, whereas the TACP ES report identified only benefits in this area. The Air Quality Note found that the preliminary ES report used to inform the OBC and the TPAC ES report, used different traffic models to base their air quality assessment on. The traffic volumes used by the TPAC ES had lower traffic flows predicted along Whittington road than in the traffic model used to produce the air quality conclusions within the preliminary ES report for the OBC. This meant that different receptors were identified in the two assessments and resulted in the differing conclusions.

Overall, with mitigations such as dust suppression and low site-speed limits the impact on air quality is expected to be low across all receptors within 350m of the scheme and there should be a net positive impact on air quality within the wider Worcester City area.

4.3.3 Greenhouse gases.

The assessment shows that there is an overall net increase in CO₂ emissions associated with the scheme due to an increase in traffic flows on the local road network.

The transport modelling work undertaken shows the following carbon benefits:

- Change in non-traded carbon over 60y (CO₂e)-22,646
- Change in traded carbon over 60y (CO₂e)-327

The total monetised dis-benefit is -£1.046m.

In summary, the A4440 Worcester SLR Improvements Phase 4 scheme is likely to have a slight adverse greenhouse gas impact. The greenhouse gas benefits/dis-benefits output by TUBA are shown in Table 4-3 and Table 4-4.

Table 4-3: CO₂ emissions by time period (untraded)

Submode	Year	Emissions (tonnes)			cost (£000s)		
		DM	DS	Increase	DM	DS	Increase
AM peak	2021	418168	418447	279	17675	17686	12
AM peak	2031	394676	394560	-116	14831	14827	-4
PM peak	2021	413479	413478	-1	17476	17476	0
PM peak	2031	385567	385529	-38	14489	14487	-1
Inter-peak	2021	896585	896727	142	37896	37902	6
Inter-peak	2031	867037	867374	336	32581	32594	13
Weekend	2021	491774	491948	174	20786	20793	7
Weekend	2031	475963	476169	206	17885	17893	8
AM peak	Total	22206460	22202299	-4161	995292	995096	-196
PM peak	Total	21510962	21509090	-1872	963637	963552	-85
Inter-peak	Total	49246932	49264435	17503	2208769	2209559	790
Weekend	Total	26924989	26936165	11176	1207445	1207947	502

Table 4-4: CO2 emissions by time period (traded)

Submode	Year	Emissions (tonnes)			cost (£000s)		
		DM	DS	Increase	DM	DS	Increase
AM peak	2021	1212	1214	2	9	9	0
AM peak	2031	3954	3957	3	149	149	0
PM peak	2021	1342	1344	2	10	10	0
PM peak	2031	4403	4408	5	165	166	0
Inter-peak	2021	2140	2141	1	16	16	0
Inter-peak	2031	7210	7217	7	271	271	0
Weekend	2021	1166	1167	1	9	9	0
Weekend	2031	4105	4109	4	154	154	0
AM peak	Total	153796	153921	124	6466	6471	5
PM peak	Total	170155	170363	208	7150	7159	9
Inter-peak	Total	283073	283367	295	11934	11947	13
Weekend	Total	164284	164458	174	6956	6964	8

4.3.4 Landscape and townscape

The Malvern Hills is a designated Area of Outstanding Natural Beauty (AONB) and whilst the scheme is not in close proximity to the AONB it has the potential to impact upon setting and views. Impacts to users of the Public Right of Way (PROW) will need to be considered and a visual envelope will be established. Consultation with the relevant authorities will be required to ensure that their views are captured and any mitigation is developed into the design. The site sits within National Character Area Severn and Avon Vales.

Work was carried out as part of the TACP ES report, which includes a detailed assessment of the quality and value of the landscape and visual resources of the site, identification of the visual envelope of the site and to assess the effects of the scheme.

The context of the application site is predominantly rural fringe, although existing developments in the vicinity already influence the rural setting to a certain extent. Significant effects on the landscape features of the site would largely occur during construction, where there would be loss of vegetation along the existing southern embankment alongside other impacts. Significant visual effects of the scheme would be at Ketch Viewpoint, the Severn Way and Three Choirs National Trails and PROW in close proximity to the Scheme and Common Land on its southern side. Here, impacts during construction would be moderate/large adverse with those moderating to impact during operation after mitigation of moderate beneficial at the Ketch Viewpoint and would be slight adverse for the users of the Severn Way and Three Choirs Way.

Mitigation measures have been introduced through the CEMP to reduce construction related impacts on the landscape. Generally, mitigation reduces every identified impact on landscape character to Neutral after 15 years.

In summary, the A4440 Worcester SLR Improvements Phase 4 scheme is likely to have a slight to moderate adverse impact on the landscape but a neutral impact on the townscape.

4.3.5 Heritage of historic resources

The site of the proposed scheme and the area surrounding has a number of historical designations of at least local and in some cases national importance. To the north of the A4440 is the site of the First and Last battles of the English Civil War and a registered battlefield of national importance, which will be intersected by the north side of the scheme.. Powick Bridge, which played an important part in both battles, is still extant as a Scheduled Monument and Grade I Listed Building. The Old Bridge lies adjacent to the Grade II listed Powick New Bridge and sits by Powick Mills a Grade II* listed Hydro-electric plant. As with the designated battlefield the impacts these assets will undergo will be negligible; no direct impact will occur and the proposed scheme will not overly change their current settings.

Non-designated assets within the area surrounding the scheme range from Mesolithic finds to Second World War aircraft landing obstacles. The creation of the dual carriageway, footbridge and the enabling works all have the potential to intersect and damage non-designated assets. World War Two defence features and assets at Temeside cottage will undergo direct impacts, though with proper mitigation the impact to these will be negligible. The footprint of the proposed scheme intersects with a possible Roman Road route from Gloucester to Worcester; if found and properly investigated this would be a beneficial impact as it would confirm the course of the road and provide insight into its use.

Alongside these known archaeological features, there is a potential for unknown archaeology and palaeoenvironmental remains. These could be valuable and provide a greater understanding of the history and past environment in the area. Further detailed assessment could potentially use Electro-Magnetic survey or geo-physics to determine the extent of below-ground archaeology. Trial trenching could be utilised after non-invasive techniques to further investigate any potential assets and the known archaeology in proximity of the scheme. The extent of archaeology will be limited adjacent to the A4440 because of previous construction and enabling works from the original construction of the A4440.

In summary, the A4440 Worcester SLR Improvements Phase 4 scheme is likely to have a slight adverse impact upon heritage of historic resources.

4.3.6 Biodiversity

The work to date indicates that the proposed scheme has the potential to affect the condition and function of ecological resources present on and surrounding the site. These may occur through direct impacts, such as loss of habitat or species, or indirect impacts such as disturbance effects. These issues will be identified and quantified in full within the Environmental Statement (ES).

Ecological surveys have been completed including:

- Ecological Appraisal;
- Bat Surveys;
- Otter Surveys;
- Great Crested Newt Surveys;
- Reptile Surveys; and
- Badger Surveys.

A desk based survey has been carried out to identify any statutory designated sites that could be impacted upon during both the construction and operation of the scheme.

There are three statutory designated sites within 2km of the scheme. These are:

1. The River Teme SSSI - is the second largest tributary of the River Severn, draining a hilly, predominantly rural catchment of Silurian and Devonian rocks. The notified channel is of special interest as a representative, near-natural and biologically-rich river type associated with sandstone and mudstones. It supports several protected species. The River Teme is located adjacent to the proposed scheme at its nearest point.
2. The Laugherne Brook is a designated Local Nature Reserve 0.3km to the north of the proposed scheme and comprises woodland, scrub, hay meadows and amenity grassland. It is a tributary of the River Teme.
3. Cherry Orchard is a designated Local Nature Reserve 1 km to the North of the proposed scheme. Cherry Orchard is situated in the Diglis area of Worcester on the River Severn flood plain to the south of the city. A mosaic of habitats has emerged through colonisation. Flower rich grassland and scrub dominate, contributing to the green corridor that extends into the city from the south.

Additionally, two non-statutory Local Wildlife Sites (LWSs) are located in close proximity to and are likely to be impacted by the proposed scheme, namely:

1. The River Severn flows under proposed scheme at Carrington Bridge. It is a major ecological corridor running north to south for the whole length of the county. Most of the river is tree lined and there are significant amounts of contiguous semi-natural habitat which augment the value of the watercourse itself, making the corridor extremely important in a county context. The Severn supports a rich and varied fauna including the rare club-tailed dragonfly, salmon and otters.
2. Carey's Brook is located approximately 0.3km south of the proposed scheme. In combination with small areas of contiguous semi-natural vegetation this brook forms a valuable wildlife corridor through the landscape. Information on associated species of interest is limited but otters are likely to be present.

Habitats recorded within the proposed scheme extents comprise: built structures and hardstanding with no intrinsic ecological value; arable land, improved grassland, amenity grassland, ditches, ponds and hedgerows of importance within the immediate zone of influence only; semi-improved neutral grassland, tall ruderal vegetation, broadleaved woodland and scrub of local importance; standard trees of local, District and National importance; and watercourses of County and National importance for nature conservation.

Protected species surveys have been carried out for the proposed scheme, but the results so far indicate the following:

- A 'good' population of slow worm and a 'low' population of grass snake are present along the north verge of the A4440 between Carrington Bridge and Powick Roundabout;
- At least 10 badger setts are present within the proposed scheme area, including a main sett, an annex sett and at least 8 outlier setts;
- Otters are known to be present along the Rivers Severn and Teme. Footprints were recorded close to one of the outlier badger setts. This sett could potentially be used by otters as aholt;
- Value of habitats within the proposed scheme for otters was valued as low.
- Impacts of freshwater pearl mussel have been considered and are classified as medium value due to potential upstream effects related to salmon migration;
- No bat roosts have been recorded within the scheme extents. At least seven species of bat have been recorded foraging/commuting within the scheme extents, with the highest levels of activity along the River Severn corridor;
- Value of bat roost features have been classified as low and the value of the River Severn corridor for foraging bats has been classified as medium; and
- Suitable nesting bird habitat is present throughout the proposed scheme. Suitable nesting habitat for kingfisher has been recorded along the River Teme, but not along the River Severn.

Although the scheme is not expected to impact directly on any designated sites, there will potentially be some indirect effects to sites such as the River Teme SSSI and the Severn Estuary and River Clun Special Areas of Conservation. Indirect effects would also likely to impact on habitats within the area such as broadleaved woodland as well as on protected species such as nesting birds. With mitigation measures, the only residual impact would be on the River Teme SSSI, which would be slightly adverse in the short and medium term. Long term mitigations, for example 1.4 ha replacement woodland and habitat enhancement measures, are expected to achieve a net gain for biodiversity.

The scheme is likely to have an adverse impact upon designated sites, habitats and species during construction and operation primarily as a result of land take, pollution, species disturbance and increased road crossing mortality.

The impact on the River Teme SSSI/LWS from increased airbourne pollutants due to increased area of road surface was assessed in the ES report as being slightly adverse (with mitigation).

The ES report differs from the preliminary ES report as it uses DMRB terminology for valuing features, whereas the older report makes use of CIEEM terminology.

In summary, once mitigation and compensation measures have been put in place (which is outlined in the ES Nature Conservation chapter), the A4440 Worcester SLR Improvements Phase 4 scheme is likely to have a slight adverse impact upon biodiversity.

4.3.7 Water environment

The proposed scheme has the potential to impact upon three Water Framework Directive (WFD) waterbodies, including the River Severn (medium value), River Teme (high value) and Careys Brook (low value) which have been evaluated within a WFD assessment. The confluence of the River Severn and the River Teme is located approximately 580 metres upstream from the proposed scheme, to the north of Carrington Bridge. The River Teme is a SSSI and therefore a protected area for conservation which gives rise to its high value as a water receptor. The site lies within a surface water Nitrate Vulnerable Zone (NVZ). A groundwater body is identified under the WFD however the area is not designated as a groundwater Source Protection Zone (SPZ), nor are there any SPZs within 1km of the site.

In terms of land drainage and flood risk, residual effects have been determined to be negligible (with mitigation). This has been downgraded from 'minor adverse' effects within the preliminary ES report due to more information being known about site compounds and modelling undertaken showing negligible impacts as the flood mechanism is dominated by conveyance not flood storage. In addition, after the preliminary ES report was produced, changes were made to the permanent design to include widening of the embankment to south side. This design change avoided the impacts of working in the River Teme Floodplain.

The ES report Flood Risk Assessment found that the impact upon floodplain will be negligible but that a like-for-like compensatory area of floodplain will be provided anyway as this would provide part of the biodiversity benefits. Consultation with the Environment Agency, Severn Trent Water and WCC has been undertaken to ensure that the proposed flood mitigation and drainage strategy meets their requirements.

A Construction Environmental Management Plan (CEMP) has been prepared to ensure best practice measures are implemented and adverse impacts on the water environment are minimised during construction. Work activities should be carried out in a controlled manner through the adoption of best management practices and standard pollution measures in accordance with industry good practice regarding pollution prevention.

During the operation of the proposed scheme, impacts may include alteration of the run-off characteristics and patterns of surface water drainage within the site, presenting a potential increase in flood risk. Furthermore, the discharge of polluted road drainage (arising from collisions, general vehicle and road degradation and leaks of oil, fuel or other pollutants) may impact upon water quality. Impacts are also likely to the River Severn where there will be another bridge structure built next to the existing one, Carrington Bridge, to accommodate the dual carriageway. Physical impacts of the scheme were likely to be not significant. This is despite physical impacts to the drain flowing into Carey's Brook due to widening of the drain being identified.

Outfall 1 (to Carey's Brook) failed water quality assessment for soluble copper, sediment bound pollutants and the Environmental quality standard (EQS) for Copper. Filter drains and a Vortex Separator have been proposed as mitigation. These methods of treatment don't provide any removal of soluble copper therefore the impact after mitigation is Minor Adverse.

Drainage design has changed since the OBC and filter drains are now proposed within the scheme. A quantitative assessment for risks to groundwater has therefore been carried out within the ES report. In addition, twelve drainage catchments and three outfalls are now included within the scheme design.

The assessment has concluded that providing the recommended mitigation measures are adopted during construction and operation then the proposed scheme is likely to have a slight adverse impact to the water environment.

4.4 Social

Social assessments have been undertaken to support the development of the scheme. The assessments are provided in the following sections:

- Commuting and Other users and Reliability impacts on Commuting and Other users;

- Physical Activity;
- Journey Quality;
- Accidents;
- Security;
- Access to Services; and
- Severance.

A Social and Distributional Impacts has not been undertaken for this OBC, but will be considered in a subsequent business case.

4.4.1 Commuting and Other users

This scheme provides significant social benefits, generated primarily from travel time savings to commuters and other users, reliability and estimated reduction in number of accidents.

Economic impacts on commuters and other users have been assessed using outputs from the traffic model. These have been input into TUBA and the following (dis)benefits of each of the scheme options have been identified from the TEE tables given in Table 4-1. These are provided in Table 4-5 below.

Table 4-5: Commuters and Other users impacts (£000s)

Purpose	Impact	Scheme
Commuting	Travel time	62,896
	Vehicle operating costs	-81
	User charges	12
	During Construction & Maintenance	-495
	Total	62,333
Other	Travel time	90,163
	Vehicle operating costs	1,081
	User charges	105
	During Construction & Maintenance	-1,108
	Total	90,240
Total		152,573

4.4.2 Commuting and Other - Reliability Impacts

The same approach was adopted for calculating the reliability benefits for commuting and other users as for business users outlined in Section 4.2.3. It is expected reliability will add £15.30m to the benefits resulting from the scheme for commuting and other users. Table 4-6 shows the reliability benefits for commuting and other users.

Table 4-6: Estimated Commuting and Other User Reliability Benefits (£000s)

	Scheme
Commute Travel Time Benefits	62,896
Other – Travel Time Benefits	90,163
Total Social Travel Time Benefit	153,059
Reliability Impact	Moderate Beneficial
Reliability Percentage	10%
Business User and Transport provider Reliability benefits	15,306

4.4.3 Physical activity

There is a recognition of an interrelation between transport, the environment and health. One of the key aspects of transport and health relates to the propensity to make use of active travel modes, namely walking and cycling. Health implications of transport proposals can therefore be assessed by considering changes in the opportunities for increased physical activity through walking and cycling. More walking and cycling can also give benefits by improving the physical environment within communities, in turn helping to foster community spirit, with implications for health.

As a highway scheme, the A4440 Worcester SLR Phase 4 scheme is not overtly aimed at increasing opportunities for walking and cycling. Also, located as it is on the periphery of the city, there is not much current demand for walking and cycling movements in the area. This is unlikely to change as a result of the scheme, but notwithstanding this, the scheme will provide improvements to the walking and cycling environment that will encourage greater use, and generate some (limited) benefits.

The existing shared cycle and pedestrian path between Powick and Ketch Roundabout will remain present on the city side of the carriageway, but will be subject to significant enhancement. It is currently narrow in width (1.2m), so any improvements will be subject to environmental constraints. Recent pedestrian and cycle counts have shown that the current demand along and across the SLR is low (generally less than 10 pedestrians/cycles per hour). Pedestrian and cycle demand will increase with proposed development to the South of Worcester.

A new pedestrian/cyclist footbridge will be provided on the western side of Powick roundabout (Hams Way), this will provide a north south grade separated connection for pedestrians and cyclists to cross the SLR, replacing a current requirement to cross at-grade.

At the Ketch roundabout, an existing grade separated route that passes under the Carrington Bridge (Severn Way) will be upgraded and better linked to routes either side of the SLR, providing enhanced opportunities for north to south movements.

Assessment of the effects on physical activity have made use of guidance in TAG Unit A4.1 'Social Impact Appraisal' and TAG Unit A5.5 'Highway Appraisal', **Appendix A** 'Assessment of impact on active modes', and followed a proportional approach because the numbers of effected users and potential impacts are small. A completed TAG worksheet for physical activity, which highlights the key elements of the scheme that affect physical activity (grade separated pedestrian/cyclist crossings) is presented in **Appendix F**.

In summary, the A4440 Worcester SLR Phase 4 scheme is likely to have a neutral impact to physical activity.

4.4.4 Journey Quality

TAG Unit A4.1 'Social Impact Appraisal' defines journey quality as "a measure of the real and perceived physical and social environment experienced while travelling", noting that this includes various factors related to peoples' experience on journeys such as information provision and the perception of safety. Note though that 'journey quality' considered in this assessment do not include those covered elsewhere in the appraisal (such as severance, security, accidents, journey times, journey reliability, etc). There are three key elements to journey quality impacts:

- Traveller care – such as cleanliness, facilities, information and the general environment – this aspect only relates to public transport journeys, so is not taken further in this assessment;
- Travellers' views – pleasantness of surroundings en route – views are not considered from a landscape and visual impact point of view of the scheme as a whole, but from the perspective of travelers along the road. Commentary is made on this in the appraisal, but given that the scheme consists of works along an existing road corridor, the impacts are minimal; and
- Traveller stress – frustration, fear of accidents and route uncertainty.

The main journey quality impacts considered in this assessment therefore relate to 'traveller stress'. A completed TAG worksheet for journey quality is presented in **Appendix F**

- Frustration: When the scheme is in operation drivers will experience improvements in predictability of journey times; reduction in delays; and reduced stop starting which when combined will reduce levels of frustration for vehicle users. Slight to moderate beneficial;
- Fear of Accidents: Improvements in the road layout will reduce travellers' fear of accidents. Slight beneficial; and
- Route Uncertainty: Clear lane markings will assist route certainty for vehicle travellers. Overall therefore, the improvement in route certainty is considered to be Slight to moderate beneficial.

Once the proposed scheme is fully operational, the provision of improved signs and lane demarcation will reduce congestion, decrease the levels of frustration, fear of accidents and route uncertainty, overall resulting in an improvement in driver stress and thus journey quality.

In summary, the A4440 Worcester SLR Phase 4 scheme is likely to have a slight to moderate beneficial impact to journey quality for a large number of users, so a large beneficial effect overall.

4.4.5 Accidents

WCC's accident records show that between 01/01/2010 and 29/02/2016 there were the following accidents in the vicinity of the scheme:

- Severity slight: 42
- Severity serious: 1
- Severity fatal: 0

The transport modelling work shows that there will be an overall increase in vehicle demand from the Without Scheme to With Scheme scenario. This is likely to increase the forecast accident numbers associated with the 'junctions' as a result of the scheme and higher traffic volumes, but a decrease the number of accidents associated with the 'links' of the scheme as well as others parts of the network that are likely to experience reduction in traffic due to reassignment. The scheme should also attract traffic from less suitable routes/road standards.

The pedestrian/cyclist footbridge on the western side of Powick Roundabout will reduce the conflicts between motorists and pedestrians/cyclists crossing the Southern Link Road.

Accident Analysis was undertaken using the DfT's COBALT tool (v2018.1) for a 60-year assessment period. The casualty summary is given in Table 4-7 below. It shows that the scheme will reduce accidents and provide benefits of £4.9 million.

Table 4-7: Forecast Casualty Summary (60-yr assessment period)

	Severity		
	Fatal	Serious	Slight
Total Without-Scheme Casualties	51	506	4,587
Total With-Scheme Casualties	49	484	4,560
Casualties saved by scheme	2	22	27

4.4.6 Security

TAG unit A4.1 notes that changes brought about in the implementation of a transport scheme may affect the security of users. This is especially so in the case of public transport schemes, where a number of guidelines exist in relation to bus and rail operations, especially at stops and stations. It goes on to indicate though that there are no formal guidelines for road users, but that a series of points to note when considering these security indicators are potentially common to all schemes, including in relation to road users. In particular, road users are more vulnerable to crime where users:

- Need to stop vehicles or travel at slow speeds (such locations could include the approaches to signals or in generally congested conditions); and

- Have to leave their vehicles (for example, at service stations, laybys and car parks).

The location and nature of the road (such as urban versus rural) affects the importance of each indicator.

The A4440 Worcester SLR Phase 4 scheme will not alter the existing road alignment at all, adding a new carriageway to the existing single carriageway currently extant. The alignment will remain relatively straight with good sight lines and no 'hidden' sections for pedestrians or stopped vehicles. Vehicles will have to slow to enter the roundabouts at Powick and Ketch, with some stoppages required depending on the amount of traffic and directions of turning movements at the time. Notably, no existing are located on this section of road, and no new service areas or lay-bys are proposed as part of the scheme. Surveillance provisions will remain the same as at present. The scheme will include a full lighting design to BS 5489, which will both enhance and extend the current road lighting layout.

Provision of new grade separated walking and cycling facilities at Powick (footbridge) and Ketch (underpass) roundabouts are included in the scheme, so these have been considered separately to the highway elements of the scheme. The new routes will be high standard provision, with good sight lines for users and lighting where needed. Note that the underpass at Ketch is not a subway, but an existing riverside footpath that passes underneath the existing Carrington Bridge. As such, it has an open aspect that will be enhanced by better connectivity to the existing highways to the north and south of Ketch roundabout.

A completed TAG worksheet for security of the highway itself, and a completed TAG worksheet for the walk/cycle facilities included in the scheme are presented in **Appendix F**.

For road users the impact of the A4440 Worcester SLR Phase 4 scheme on security is neutral. For walk/cycle users there is a slight beneficial impact to security. Overall, the assessment is neutral.

Distributional impacts of security are considered further in Section 4.4.8.

4.4.7 Access to services by public transport

The stretch of the Southern Link Road between Powick and Ketch Roundabout, which is the subject of A4440 Worcester SLR Phase 4 scheme, affects the bus services¹ 362, 364 and 365 (at Ketch Roundabout) and 44, 44 a/b/c, 363, 373 (at Powick Roundabout). The scheme reduces journey times along the A4440 Worcester SLR, but it is possible this may increase journey times north/south through the Ketch and Powick Roundabouts. The decongestion impact as a result of the additional capacity provided by the scheme will have small effects on the wider highway network, trip patterns could alter and as a result other bus services across the city will receive benefits.

The A4440 Worcester SLR improvement strategy is closely aligned to the Worcestershire Parkway project which is outlined in the Worcestershire Growth Deal as having £7.5 million allocated for its delivery. Worcestershire Parkway will provide Worcestershire with a new mainline station that will improve connectivity to a range of major centres. The Worcestershire Parkway rail station is currently scheduled to be completed by 2019, by which time it will incorporate a 500 space capacity car park. The A4440 Worcester SLR Phase 4 scheme will ensure that highway access to Worcestershire Parkway rail station is enhanced. This will contribute to a reduction in greenhouse gas emissions as trips previously undertaken in their entirety by private car, instead choose to switch to rail services.

The enhancement to the cycle route along the SLR, together with significant enhancement of cycle facilities at the Powick Hams junction will deliver a much more attractive, direct route between Powick/west Worcester, upgrade of the grade separated pedestrian route at Ketch Roundabout and Worcestershire Parkway.

In summary, the A4440 Worcester SLR Phase 4 scheme will have a slight beneficial impact to accessibility.

4.4.8 Severance

Community severance is defined in TAG Unit A4.1 as the separation of residents from facilities and services they use within their community caused by substantial changes in transport infrastructure or by changes

¹ Correct at the date of OBC submission

Table 4-8: Initial Screening Outcomes

Impact Area	Conclusion	Next Step
Noise	SLR Phase 4 seeks to reduce traffic congestion and in conjunction with this noise, however it is anticipated that there may be some localised negative impacts for properties adjacent to areas in which traffic increases are expected.	Progress to Step 2
Air Quality	The rationale for air quality is based upon the same principles as those associated with noise.	Progress to Step 2
Accidents	Based on the alterations in traffic flows that are recorded within the modelled area it can be concluded that there is potential for distributional impacts in relation to accidents.	Progress to Step 2
Security	SLR Phase 4 will incorporate enhancements to lighting and landscapes. Informal pedestrian routes will be improved.	Progress to Step 2
Severance	There are anticipated to be significant benefits for the local communities that are situated in close proximity to the proposed bridge crossings. The remainder of benefits are widespread as a result of the traffic reductions that are anticipated along the radial routes and in the city centre.	Progress to Step 2
Accessibility	SLR Phase 4 is expected to have some limited impact upon accessibility as a result of travel time savings and improved crossing facilities.	Progress to Step 2
Affordability	The existing analysis available suggests that overall there will be little impact in terms of affordability. Consequently conducting further analysis was considered to be disproportionate.	AST Overall Assessment: Neutral: No further screening required

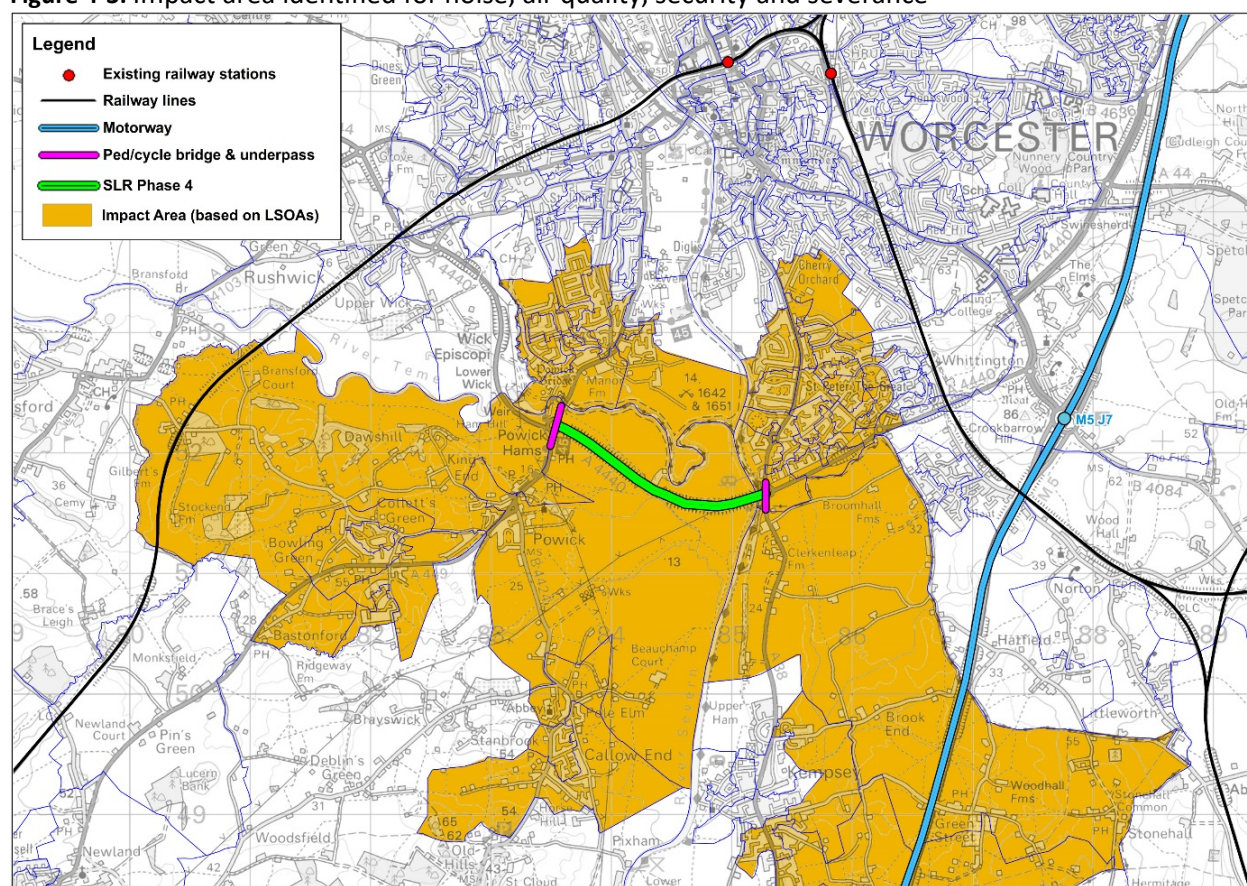
Step 2a: Confirmation of areas impacted by the intervention

The proposals involve dualling of the A4440 SLR between the Ketch and Powick roundabouts. Due to the strategic nature of this route in the context of Worcestershire traffic flows, it is plausible to anticipate impacts to extend across a relatively large geographical area.

- **User Benefits:** As part of the appraisal investigation of the scheme, a detailed modelling exercise has been undertaken using the WTM. This established the changes in costs of travel for users in terms of time-based costs and financial costs across the network. Taking into account the changes across the network, the extent of the model is required to fully represent the area of impact for user benefits as a result of the proposals. However, for the purposes of distributional analysis the geographical area of impact has been limited to Worcestershire.
- **Noise:** In order to determine the impact area for noise, the WTM's have been utilised to calculate changes in the Annual Average Daily Traffic (AADT). This approach demonstrates that there are number of changes that are dispersed widely across the modelled area. There are however more concentrated impacts to properties situated adjacent to areas in which traffic flows are expected to increase significantly, namely those in close proximity to the A4440 SLR. Figure 4.3 shows the extent of the impact area for noise (note that this area extends well to the south of the A4440 SLR due to the low population impacting the LSOA boundaries).
- **Air Quality:** The area of impact for air quality was defined using the same methodology as described above for noise, consequently the area of impact is considered to be the same.
- **Accidents:** As with user benefits the extent of the model is required to fully represent the area of impact for accidents as a result of the proposals. However, for the purposes of distributional analysis the geographical area of impact has been limited to Worcestershire.
- **Security:** The area of impact for security is local to the SLR Phase 4 intervention itself. The key areas of interest are the highway alignment between the Ketch roundabout and Powick roundabout, along with the proposed footbridges and the routes that immediately adjoin these. The area defined in Figure 4-3 is considered adequate to represent the impact area for security.

- **Severance:** There are localised impacts for communities that are adjacent to the locations of the proposed bridge crossings of the A4440 SLR. Beyond these localised impacts, the AADT flow changes calculated by the WTMIs indicate that traffic reductions will occur across the wider highway network. The area defined in Figure 4.3 is considered adequate to represent the impact area for severance.
- **Accessibility:** As a result of the widely dispersed impacts associated with decongestion the Worcestershire region has been identified as the area of impact for accessibility.

Figure 4-3: Impact area identified for noise, air quality, security and severance



Step 2a: Identification of social groups in the impact area

This section provides an assessment of the social groups affected by the proposals, based on the potential impacts identified in the screening assessment in Step 1 and the 'affected areas' identified in Step 2a. The social groups considered in relation to each impact follow the guidance provided in TAG Unit A4.2. Details are presented in **Appendix K** through a series of GIS maps of the scheme and surrounding areas. Table 4-9 summarises the identification of social groups in the area, with respect to impacts.

Step 2c: Identification of amenities in the impact area

Based on the anticipated impacts of SLR Phase 4, the locations of a series of amenities in the impact areas have been identified, including schools/nurseries, playgrounds, parks and open spaces, hospitals, care homes/day centres and community centre. Details are presented in **Appendix K** through a series of GIS maps of the scheme and surrounding areas.

Step 3: Appraisal

The impacts and impact areas identified in Steps 1 and 2 were considered as to whether they are likely to significantly affect the social groups/establishment, which determined the scale of appraisal necessary for each impact. The resulting Matrix of Distributional Impacts is presented in Table 4-10.

Table 4-9: Step 2 Output Summary

Social group and amenities indicators			User Benefits	Noise	Air quality	Accidents	Security	Severance	Accessibility	Local Authority	England
Resident population in impact area	Income distribution quintiles	0-20%	10%	0%	2%					10%	20%
		20-40%	17%	0%	10%					17%	20%
		40-60%	20%	20%	30%					20%	20%
		60-80%	29%	11%	26%					29%	20%
		80-100%	24%	69%	32%					24%	20%
	Children (<16)			17%	17%	18%	17%	17%	18%	18%	19%
	Young adults (16-24)					11%			11%	11%	13%
	Older people (70+)			16%		13%	16%	16%	13%	13%	12%
	People with a disability						17%	17%	18%	18%	18%
	Black Minority Ethnic						3%		4%	4%	15%
	No car households							10%	17%	17%	26%
	Households with dependent children								28%	28%	29%
	Indicator population in the impact area		566,169	13,838	56,888	566,169	13,838	13,838	566,169	566,169	53,012,456
Amenities present within the impact area	Schools/nurseries			✓	✓	✓	✓	✓	✓	-	-
	Playgrounds			✓	✓	✓	✓	✓	✓	-	-
	Parks and open spaces			✓	✓	✓	✓	✓	✓	-	-
	Hospitals			-	-	✓	-	-	✓	-	-
	Care homes/day centres			✓	✓	✓	✓	✓	✓	-	-
	Community centre			-	✓	✓	-	-	✓	-	-

Table 4-10: Distributional Impacts: Appraisal Matrix

	Distributional impact of income deprivation					Are the impacts distributed evenly?	Key impacts - Qualitative statements (example below)
	0-20%	20-40%	40-60%	60-80%	80-100%		
User benefits	✓✓	✓✓	✓✓	✓✓✓	✕✕	No	There are a high level of user benefits and they are distributed relatively evenly between all income groups, except in the least deprived areas.
Noise	-	-	✕✕	✕✕	✕✕✕	NoNo	The area in the immediate vicinity of scheme which will see increases in noise does not contain any income deprived communities
Air quality (NO ₂)	-	✓✓✓	✓✓✓	✕✕	✕✕	No	In the area of impact, residents in the relatively deprived income 20%-40% & 40%-60% quintiles experience benefits.
Affordability						N/A	Not assessed.
Accessibility	✓	✓	✓	✓	✓	Yes	Impacts are small, but considered to be sufficiently widespread that all income groups will stand to benefit on a relatively equal basis.

AST entry	Social groups						User groups				Qualitative statement (including any impact on residential population AND identified amenities)
Impact	Children & young people	Older people	Carers	Women	Disabled	BME	Pedestrians	Cyclists	Motor-cyclists	Young male drivers	
Noise	-	✕									Some adverse impacts to properties near to the scheme, but no significant concentrations of children in the areas affected.
Air Quality	-										Largely neutral air quality impacts, with some benefits and adverse impacts to near to the scheme, but no significant concentrations of children in the areas affected.
Accidents	-	-					✓✓	✓✓	-	-	Slight overall decrease in accidents is spread across the network. New bridge and underpass crossings will provide greater protection to the most vulnerable user groups.
Security	✓	✓		✓		✓					Enhanced lighting and formalised pedestrian and cycle routes benefit all potential users, especially south of the scheme.
Severance	✓	✓	✓		✓						Bridge crossings will benefit all potential users, especially south of the scheme.
Accessibility	✓	✓	✓	✓	✓	✓					Impacts are small, but considered to be sufficiently widespread that all income groups will stand to benefit on a relatively equal basis.

4.5 Public Accounts

4.5.1 Broad Transport Budget

Information and the scheme costs is presented in Section 6. Table 4-11 shows the Public Accounts (PA) tables. Further details are presented in the Economic Assessment Report in **Appendix J**.

Table 4-11: Public Accounts (PA) table

	ALL MODES	ROAD	BUS and COACH	RAIL	OTHER
	TOTAL	INFRASTRUCTURE			
Local Government Funding					
Revenue	0	0			
Operating Costs	2,521	2,521			
Investment Costs	13,395	13,395			
Developer and Other Contributions	-5,694	-5,694			
Grant/Subsidy Payments	0	0			
NET IMPACT	10,222 (7)	10,222			
Central Government Funding: Transport					
Revenue	0	0			
Operating costs	0	0			
Investment Costs	39,955	39,955			
Developer and Other Contributions	0	0			
Grant/Subsidy Payments	0	0			
NET IMPACT	39,955 (8)	39,955			
Central Government Funding: Non-Transport					
Indirect Tax Revenues	-2,069 (9)	-2,317	283	-35	
TOTALS					
Broad Transport Budget	50,177 (10) = (7) + (8)				
Wider Public Finances	-2,069 (11) = (9)				
Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers. All entries are discounted present values in 2010 prices and values.					

4.5.2 Indirect Tax Revenues

Indirect tax revenues, as shown in Table 4-11 are calculated from summing the total kilometre change and applying the marginal external cost value (in pence/car km). This is translated in the pounds/car km, discounted and is summed to £2.069m over the 60 year appraisal period.

4.6 Summary of impacts of the core scenario

4.6.1 Value for Money Statement

Table 4-12 sets out the Value for Money Statement for the A4440 Worcester SLR Improvements Phase 4 scheme for the Core Scenario.

Table 4-12: Value for Money Statement – Core Case

Criteria	A4440 Worcester SLR Phase 4 scheme
Value for Money	The scheme offers: Very High Value for Money (unadjusted), Very High Value for Money (adjusted)
NPV	The scheme has a NPV of: £ 176,427,305
Initial BCR	The scheme has an initial BCR of 4.516
Adjusted BCR (With reliability and output change for imperfectly competitive markets)	The scheme has an adjusted BCR 12.7
Summary of the benefits and costs	<p>Benefits</p> <ul style="list-style-type: none"> • Highway transport user benefits associated with improved journey times • Reliability benefits • Regeneration benefits • Wider impacts benefits • Dependency development benefits
Significant non-monetised impacts	None
Key risks, sensitivities and uncertainties underlying the appraisal	None

4.6.2 Analysis of Monetised Costs and Benefits (AMCB) Tables

Table 4-13 sets out the Analysis of Monetised Costs and Benefits for the A4440 Worcester SLR Improvements Phase 4 scheme under the core scenario.

Table 4-13: Analysis of Monetised Costs and Benefits (£000s)

Noise	-491	(12)
Local Air Quality	-155	(13)
Greenhouse Gases	-1,011	(14)
Journey Quality	0	(15)
Physical Activity	0	(16)
Accidents	4,903	(17)
Economic Efficiency: Consumer Users (Commuting)	62,333	(1a)
Economic Efficiency: Consumer Users (Other)	90,240	(1b)
Economic Efficiency: Business Users and Providers	68,716	(5)
Wider Public Finances (Indirect Taxation Revenues)	2,069	(11) - sign changed from PA table, as PA table represents costs, not benefits
Present Value of Benefits (see notes) (PVB)	226,605	(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)
Broad Transport Budget	50,177	(10)
Present Value of Costs (see notes) (PVC)	50,177	(PVC) = (10)
OVERALL IMPACTS		
Net Present Value (NPV)	176,427.305	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	4.516	BCR=PVB/PVC

Note : This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Combining the present value of scheme costs, it is possible to calculate a benefit cost ratio; that is, the ratio of benefits and costs where a value of one shows a project 'break-even' point where for every £1 invested in the scheme, there are £1 benefits received. Therefore, any BCR above one shows value for money in terms of receiving medium benefit for every £1 of invested cost.

Table 4-13 shows the summary results from the economic appraisal, just including benefits for the user and provider (time savings and vehicle operating costs, both fuel and non-fuel). Car Other and business users are estimated to be the main beneficiaries of the scheme with the highest benefits (41% and 31% respectively) of the total benefits and Car commuters see slightly lower impact with 28.0% of the total benefits (maybe because commuters do not receive inter-peak benefits). The scheme shows a **Very High** value for money with a BCR of **4.51**.

4.6.2.1 Adjusted BCR

The quantified benefits of reliability and output change in imperfectly competitive markets should not be included in a BCR calculation, however these can be included in an adjusted BCR. This is shown in Table 4-14. Adding both these additional benefits increases the schemes value for money to an **adjusted BCR of 12.7 (Very High value for money)**.

Table 4-14: Analysis of Monetised Costs and Benefits with adjusted BCR (Cost/Benefits figures in £000)

Present Value of Benefits (PVB)	226,605
Present Value of Costs (PVC)	50,177
Reliability Benefits	22,648
Wider Benefits	26,610
Dependency Development Benefits	361,164
Adjusted PVB	637,027
Adjusted Net Present Value (NPV)	586,850
Adjusted Benefit to Cost Ratio (BCR)	12.70

4.6.3 Appraisal Summary Table (AST)

Table 4-15 is the Appraisal Summary Table for the Core Scenario.

Appraisal Summary Table						Date produced:		05/12/2018		Contact:		
Name of scheme:		A4440 Worcester Southern Link Road Phase 4								Name	Nigel Hudson	
Description of scheme:		The scheme comprises of dualling the A4440 Worcester SLR from Ketch Roundabout to Powick Roundabout and associated structures and improvements for NMUs.								Organisation	Worcestershire County Council	
										Role	SRO (business case)	
Impacts		Summary of key impacts				Assessment						
						Quantitative		Qualitative	Monetary £(NPV)	Distributional 7-pt scale/ vulnerable grp		
Economy	Business users & transport providers	The scheme will deliver time saving benefits to business trips. The TUBA outputs have been has been utilised to provide these results. The scheme, and the additional vehicle trips it attracts, results in a re-distribution of trips compared to the Do Minimum scenario.which results in a decrease in the number of trips on the radial routes through Worcester city centre and an increase in trips on the SLR.				Value of journey time changes(£)		£73.420		Not applicable	£74.89	Moderate Beneficial - evenly spread except moderate adverse for least deprived quintile of income domain
						Net journey time changes (£)						
						0 to 2min	2 to 5min	> 5min				
						£11.697m	£58.928m	£16.854m				
	Reliability impact on Business users	Car business and good vehicle travel times will benefit from reliability improvements as traffic flows and congestion are reduced. This has not been separated out into user class so quantification is given under the social benefits.				Taken 10% of total user time saving benefits proportioned to businesses by share of total time savings proportioned to share of time savings for commuters and other purposes		Not applicable	£7.342m			
	Regeneration	The scheme is expected to unlock development at two key sites: West Worcester Urban Extension (WWUE) and North East Malvern. This will support the delivery of 28,400 new dwellings and 280ha of employment land targetted by the adopted SWDP. The scheme is expected to improve employment opportunities across the county, by increasing the size of the accessible work force to employers and increasing the number of accessible jobs for labour market participants.				At a high level, around 7,800 dwellings and 77 ha employment land is contingent on this scheme (based on cost proportionality from the SWIDP). The net increase in accessible workforce for firms in the regeneration area will be 711. The net increase in accessible jobs for labour market participants in the regeneration area will be 755.		Large beneficial	Not applicable			
	Wider Impacts	Wider economic impacts including agglomeration, output change for imperfectly competitive markets and tax revenues from labour supply impacts have been evaluated for the scheme. The methodology adopted is in line with guidance in WebTAG Unit A2.1, and is based on demographic data as well as generalised travel demand and costs for business and commuting trips.				Results indicate that there would be additional Wider Impacts attributable to the scheme in all three assessed areas: agglomeration, £18.434m, imperfectly competitive markets, £10.749m and labour supply impacts, £0.459m.		Not applicable	£29.643m			
Environmental	Noise	The increase in noise at some locations is caused by an increase in traffic, and on some links there is also an increase in traffic speed due to the relieving of congestion. The reductions in noise are caused by a reduction in traffic flow on some links. Night time impacts are likely to be similar to those from the day. No properties are likely to be eligible for noise insulation.				Households experiencing increased daytime noise in forecast year: 159 Households experiencing reduced daytime noise in forecast year: 23 Households experiencing increased night time noise in forecast year: 62 Households experiencing reduced night time noise in forecast year: 12		Not used for noise (ref: Unit A3, para 2.4.2)	-£0.49m	Slight adverse - evenly spread across upper three income domain quintiles (no impact on two lower income domain quintiles)		
	Air Quality	There are three AQMAs within 5km of the scheme. The scheme is expected to have positive and negative effects for air quality: a beneficial impact on air quality associated with the reduction of congestion and with the redistribution of traffic volumes on the existing road network (which is expected to reduce traffic on the A449 and in the city centre and St Johns); a negative impact due to the increase of traffic flows on the dualled road, and other links in the wider network. The scheme is likely to have a mostly positive impact in Worcester city centre and in its existing and potential AQMAs, and an adverse impact on air quality at some receptors located along the SLR. The scheme has the potential to generate one new exceedance of the NO2 limit in Whittington, in proximity of the junction with the M5. The WebTAG scores are slightly adverse, indicating a net worsening aggregated over the 4,852 receptors assessed for this. Of the 258 properties assessed in detail, the scheme is likely to reduce the level of exceedance for a number where the EU Limit Value for nitrogen dioxide is breached in Worcester City.				A total of 42 receptors out of 258 assessed will be potentially exposed to 'Moderate' or 'Substantial' changes in air quality, according to the IAQM significance criteria. 33 will have significant beneficial effects, and 9 will have adverse effects. WebTAG Scores: - Change in NO ₂ in the Opening Year: +115 µgm ⁻³ (+2.56% compared to Do Minimum) - Change in PM ₁₀ in the Opening Year: +63 µgm ⁻³ (+4.65% compared to Do Minimum)		Beneficial in terms of EU Compliance	-£155,688	Neutral impact overall - two upper income quintiles have adverse impacts, lowest quintile no impact, middle two quintiles have benefits - numbers of affected households small in all areas		
	Greenhouse gases	Overall there is a net increase in CO2 emissions associated with the scheme due to an increase in traffic flows on the local road network. CO2 emissions have been calculated using TUBA.				Change in non-traded carbon over 60y (CO2e)		-30.290		Not applicable	-£1.401m	
						Change in traded carbon over 60y (CO2e)		-178				
	Landscape	Predominantly rural fringe landscape character with some features of good quality. Landscape character impacts are likely as a result of loss of predominantly roadside vegetation including some mature trees within the scheme's footprint. These short term impacts can be mitigated by replacement planting. Potential for visual impacts relating to changes in recognisable views of Malvern Hills AONB as a result of additional highway features including new bridges. Cumulative adverse landscape effects are likely due to combining the increased scale of the existing road along with the proposed mixed use development area into the rural fringe land to the south of the site (by others) and therefore extending the urban fringe south into the rural landscape.				Not Applicable		Likely to be slight to moderate adverse	Not Applicable			
	Townscape	The scheme is adjacent to the southern urban edge of Worcester. The quality of the townscape character has not been established, but there is likely to be no direct impacts on Townscape.				Not Applicable		Likely to be neutral	Not Applicable			
	Historic Environment	The scheme has the potential to affect the setting of a nationally significant registered Battlefield (Battle of Worcester, September 1651), a Scheduled Monument and Grade I listed building, a Grade II and Grade II* listed building.This should be a minor impact overall, as it will only slightly add to the setting impact presented by the current A4440. There is an, as yet, unquantified potential for artefactual or ecofactual remains associated with the battlefield and other periods to exist within the footprint of the scheme.				Conclusively despite thedesignated assets in close proximity, there is only a minor impact expected to the setting the cultural heritage resource and there is expected to be a minor impact to unknown archaeology resulting from the construction and operation.		Likely to be slight adverse	Not applicable			
	Biodiversity	Ecology surveys are in progress. The scheme is adjacent to a Site of Special Scientific Interest (River Teme SSSI) and within a Local Wildlife Site (River Severn LWS) and therefore there is potential for impacts during both construction and operation. A good population of slow worm and a low population of grass snake are present within the north verge. The slow worm population will be lost without mitigation. At least five badger setts are present within or near to the proposed scheme footprint. At least four of these setts will be lost to the proposed scheme. Otters are known to be present along the Rivers Severn and Teme - resting sites may be lost and foraging/commuting routes disrupted. At least seven species of bat have been recorded within the proposed scheme footprint. Bat foraging/commuting habitats will be lost/severed. Bird nesting habitat will be lost. The following habitats present within the proposed scheme boundary are likely to be lost without avoidance or compensation measures; broadleaved and mixed woodland, semi-improved grassland, scrub, tall ruderal and mature trees.				Not possible at this stage.		Likely to be slight adverse	Not possible at this stage			
Water Environment	The land adjacent to the proposed scheme is subject to a high risk of fluvial flooding due to its location within a floodplain of the River Severn (comprises Flood Zone 3, as shown on the Enviroment Agency's website). There is also the potential for some surface water flooding from rainfall. The scheme has the potential to impact upon three Water Framework Directive (WFD) waterbodies, including the River Severn (medium value), River Teme (high value) and Careys Brook (low value) which have been evaluated within a WFD assessment. The River Teme is a SSSI and therefore a protected area for conservation which gives rise to its high value as a water receptor. Potential impacts of the scheme include upon water quality, flood risk and physical impacts. An outline Flood Risk Assessment (FRA), preliminary Drainage Strategy and HAWRAT assessment have been completed as part of the Environmental Statement. A Construction Environmental Management Plan (CEMP) will be prepared to ensure best practice measures are implemented and adverse impacts on the water environment are minimised during construction. The inclusion of grass ditches and a vortex separator has been proposed to reduce the impacts of sediment pollution from routine road runoff during operation.				Not possible at this stage.		Likely to be slight adverse	Not possible at this stage				
Social	Commuting and Other users	The TUBA outputs have been has been utilised to provide these results. The scheme, and the additional vehicle trips it attracts, results in a re-distribution of trips compared to the Do Minimum scenario.which results in a decrease in the number of trips on the radial routes through Worcester city centre and an increase in trips on the SLR.				Value of journey time changes(£)		£153.06m		Not applicable	£152.57m	Moderate Beneficial - evenly spread except moderate adverse for least deprived quintile of income domain
						Net journey time changes (£)						
						0 to 2min	2 to 5min	> 5min				
						£28.385m	£111.252m	£38.257m				
	Reliability impact on Commuting and Other users	Commuters and other users will benefits from increased reliability from the scheme as traffic flows are increased and congestion decreased				Taken 10% of total user time saving benefits proportioned to businesses by share of total time savings proportioned to share of time savings for commuters and other purposes		Not applicable	£15.306m			
	Physical activity	The Powick footbridge and Ketch underpass will provide pedestrians and cyclists safe, grade separated, access across the SLR, replacing current at-grade facilities. Numbers affected are low and improvements small, so the impact is 'neutral' overall, but locally important for affected movements.				Not applicable		Neutral	Not applicable			
	Journey quality	Traveller Stress: Slight to moderate beneficial Route uncertainty: Slight to moderate beneficial				Fear of accidents: Slight beneficial		Not applicable	Not applicable	Not assessed		
	Accidents	The transport modelling work shows that there will be an overall increase in vehicle demand from the Without Scheme to With Scheme scenarios. This is likely to increase the forecast accident numbers from the junctions as a result of the scheme and higher traffic volumes, but a decrease the accident numbers forecast for the links of the scheme as well as others parts of the network that are likely to experience reduction in traffic due to reassignment. The scheme should also attract traffic from less suitable routes/road standards.				Not Applicable		Likely to be neutral	£4.903m	Not assessed		
	Security	The scheme will not alter the existing alignment which is relatively straight with good sight lines and no 'hidden' sections for pedestrians or stopped vehicles. No service areas or lay-bys proposed as part of the scheme, whilst surveillance provisions are considered to be broadly consistent with the baseline.Proposed walk/cycle crossings will be designed to minimise security concerns, but represent an improvement over the existing facilities, and numbers affected are comparatively small.				Not applicable		Neutral	Not applicable	Not assessed		
	Access to services	There are no public transport services which run along the Phase 4 SLR stretch but there are bus services which run north/south at Powick and Ketch roundabout which are likely to experience a increase in journey times. However, improvements to the wider network and trip patterns as a result of the scheme will outweigh any disbenefits. The enhancement to the cycle route along the SLR, together with significant enhancement of cycle facilities at the Powick Hams junction will deliver a much more attractive, direct route between Powick/west Worcester, upgrade of the grade separated pedestrian route at Ketch Roundabout and Worcestershire Parkway.				Not applicable		Slight beneficial	Not applicable	Not assessed		
Affordability	No material change to the cost of transport in Worcester, although there is potential for a slight reduction associated with decongestion on the local highway network.				Not applicable		Not applicable	Not applicable	Not required			
Severance	The affected population is assumed to be in communities located immediately south of the A4440. The benefit is indicated as slight, in spite of the numbers concerned, because the location of the development area is more closely aligned with SLR Phase 3, and its Crookbarrow Way footbridge. There is also potential for the Ketch underpass to used for access to employment within the SWUE.				Not applicable		Slight beneficial	Not applicable	Slight beneficial - new crossings will provide local benefits, no particular vulnerable groups affected			
Public Account	Option and non-use values	Option values can apply to roads, but only where material and significant changes are made in road networks. This does not apply to this scheme.				Not applicable		Not applicable	Not applicable			
	Cost to Broad Transport Budget	Costs include risk and optimism bias at 44% and for QRA. Costs to include 88% from Central Government and 12% from Local Developers.						Not applicable	£50.177m			
	Indirect Tax Revenues	Based on an increase in vehicle km and increase in fuel consumption from higher capacity and utilisation, resulting in a gain in tax						Not applicable	£2.069m			

4.7 Sensitivity tests – Long Term Benefit

4.7.1 Sensitivity tests – Long Term Benefits

DfT published updated guidance on Cost Benefit Analysis in May 2018 that includes a new section on assessing longer term benefits of a scheme 20 years from scheme appraisal year. For this Full Business Case, the scheme appraisal year is 2018. A 2038 forecast model of the core scenario was therefore developed to assess the long-term benefits of the scheme and appraised using TUBA. The TEE, PA and AMCB tables has been calculated for Core Scenario using three model forecast years (2021, 2031 and 2038) and shown in Table 4-16 to Table 4-19 below.

The results show that the Long term PVB have increased while compared to the standard Core Scenario and the BCR also increases to 4.713.

Table 4-16: Public Accounts (PA) table - Long term extrapolation of benefits Core Scenario (Figures in £000)

	ALL MODES	ROAD	BUS and COACH	RAIL	OTHER
Local Government Funding	TOTAL	INFRASTRUCTURE			
Revenue	0	0			
Operating Costs	2,521	2,521			
Investment Costs	13,395	13,395			
Developer and Other Contributions	-5,694	-5,694			
Grant/Subsidy Payments	0	0			
NET IMPACT	10,222 (7)	10,222			
Central Government Funding: Transport					
Revenue	0	0			
Operating costs	0	0			
Investment Costs	39,955	39,955			
Developer and Other Contributions	0	0			
Grant/Subsidy Payments	0	0			
NET IMPACT	39,955 (8)	39,955			
Central Government Funding: Non-Transport					
Indirect Tax Revenues	-3,095 (9)	-3,289	208	-14	
TOTALS					
Broad Transport Budget	50,177 (10) = (7) + (8)				
Wider Public Finances	-3,095 (11) = (9)				
Notes: Costs appear as positive numbers, while revenues and 'Developer and Other Contributions' appear as negative numbers. All entries are discounted present values in 2010 prices and values.					

Table 4-17: TEE Table - Long term extrapolation of benefits Core Scenario (Figures in £000)

Non-business: Commuting		ALL MODES	ROAD	BUS and COACH	RAIL	OTHER	
<u>User benefits</u>		TOTAL	Private Cars and LGVs	Passengers	Passengers		
Travel time	61,157		61,157	0	0		
Vehicle operating costs	-657		-679	23	0		
User charges	13		0	16	-3		
During Construction & Maintenance	-495		-495				
COMMUTING	60,018	(1a)	59,983	39	-3		
Non-business: Other		ALL MODES	ROAD	BUS and COACH	RAIL	OTHER	
<u>User benefits</u>		TOTAL	Private Cars and LGVs	Passengers	Passengers		
Travel time	99,564		99,564	0	0		
Vehicle operating costs	-880		-1,084	205	0		
User charges	119		0	146	-27		
During Construction & Maintenance	-1,108		-1,108				
NET NON-BUSINESS BENEFITS: OTHER	97,695	(1b)	97,372	350	-27		
Business			Goods Vehicles	Business Cars & LGVs	BUS and COACH	RAIL	
<u>User benefits</u>					Passengers	Freight	Passengers
Travel time	78,743		40,803	37,939	0		0
Vehicle operating costs	859		-1,375	2,232	3		0
User charges	3		0	0	3		-1
During Construction & Maintenance	-926		0	-926			
Subtotal	78,678	(2)	39,428	39,245	6	0	-1
Private sector provider impacts			Road	Bus	Rail		
Revenue	-348		0	-259,1327333	-89,26645998		
Operating costs	0		0	0	0		
Investment costs	0		0	0	0		
Grant/subsidy	0		0	0	0		
Subtotal	-348	(3)	0	-259	-89		
Other business impacts			Road	Bus	Rail		
Developer contributions	-5,694	(4)	-5694	0	0		
NET BUSINESS IMPACT	72,636	(5) = (2) + (3) + (4)					
TOTAL							
Present Value of Transport Economic Efficiency Benefits (TEE)	230,350	(6) = (1a) + (1b) + (5)					

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values

Table 4-18: AMCB Table - Long term extrapolation of benefits Core Scenario (Figures in £000)

Noise	-491	(12)
Local Air Quality	-155	(13)
Greenhouse Gases	-1,667	(14)
Journey Quality	0	(15)
Physical Activity	0	(16)
Accidents	4,903	(17)
Economic Efficiency: Consumer Users (Commuting)	60,018	(1a)
Economic Efficiency: Consumer Users (Other)	97,695	(1b)
Economic Efficiency: Business Users and Providers	72,636	(5)
Wider Public Finances (Indirect Taxation Revenues)	3,095	- (11) - sign changed from PA table, as PA table represents costs, not benefits
Present Value of Benefits (see notes) (PVB)	236,034	$(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)$
Broad Transport Budget	50,177	(10)
Present Value of Costs (see notes) (PVC)	50,177	$(PVC) = (10)$
OVERALL IMPACTS		
Net Present Value (NPV)	185,857	$NPV = PVB - PVC$
Benefit to Cost Ratio (BCR)	4.704	$BCR = PVB / PVC$

Note : This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

The quantified benefits of reliability and output changes in imperfectly competitive markets included in the adjusted BCR as shown in Table 4-19 results in additional benefits increasing the schemes value for money to an **adjusted BCR of 12.9 (Very High value for money)**

Table 4-19: Adjusted BCRs based Long term extrapolation of benefits (Figures in £000)

	Long term extrapolation of benefit test
Present Value of Benefits (PVB)	236,034
Present Value of Costs (PVC)	50,177
Reliability Benefits	23,946
Wider Impact Benefits	26,610
Housing Dependency Benefits	361,164
Adjusted PVB	647,755
Adjusted Net Present Value (NPV)	597,577
Adjusted Benefit to Cost Ratio (BCR)	12.91

Note: Figures in £000. *2010 price based and discounted

4.7.2 Sensitivity tests – High and Low Growth

In addition to the core scenario, uncertainty tests were carried out to assess the benefits of the scheme under low and high traffic growth scenarios around the Core scenario. The results of the TUBA analysis and other monetised impacts for each scenario is shown in Table 4-20.

Table 4-20: Economic Sensitivity tests (2010 prices and values £000s)

	Low Growth	Core Scenario	High Growth
Noise	-491	-491	-491
Local Air Quality	-155	-155	-155
Greenhouse Gases	-3,500	-1,011	-6,725
Journey Quality	0	0	0
Physical Activity	0	0	0
Accidents	-2,051	4903	6,001
Economic Efficiency: Consumer Users (Commuting)	29,059	62,333	16,736
Economic Efficiency: Consumer Users (Other)	48,638	90,240	15,693
Economic Efficiency: Business Users and Providers	35,585	68,716	26,936
Wider Public Finances (Indirect Taxation Revenues)	7,036	2,069	15,854
Present Value of Benefits (see notes) (PVB)	114,121	226,605	73,850
Broad Transport Budget	50,177	50,177	50,177
Present Value of Costs (see notes) (PVC)	50,177	50,177	50,177
OVERALL IMPACTS			
Net Present Value (NPV)	63,944	176,427	23,672
Benefit to Cost Ratio (BCR)	2.274	4.516	1.472

Chapter 5:

Commercial Case



Commercial Case

5.1 Introduction

The delivery of A4440 Worcester Southern Link Road Improvements, including Phase 4, is a priority for Worcestershire County Council (WCC), the Worcestershire LEP, Herefordshire and Worcestershire Chamber of Commerce, local Members of Parliament and the Worcestershire District Authorities. The programme is aligned with agreed priorities, in particular in terms of supporting economic growth in Worcestershire.

The scheme set out in Section 1, includes widening the A4440 Worcester Southern Link Road between Ketch and Powick roundabouts and the construction of a new bridge, to carry the second carriageway, over the River Severn. The design and construction methodology for the widening element needs to prevent differential settlement across the widened carriageway where the new carriageway works are being constructed on the flood plain and new embankment. Key constraints include the environmental matters associated with the Site of Special Scientific Interest (SSSI) and the battlefield. In addition, the construction methodology needs to manage the safety risks associated with working at height, near to water and the design must be optimised to allow the bridge to be built economically.

The Commercial Case for the project takes into account the resources available to WCC, the risks associated with the delivery and the procurement routes available to successfully deliver the project in the most efficient way possible. This section describes the commercial strategy for delivering the A4440 Worcester Southern Link Road Improvements Phase 4 scheme. The commercial case updates the information presented in the OBC including the steps already completed to prepare for the successful delivery of the scheme.

5.2 Output Based Specification

The Commercial Case is based on a number of key objectives and outcomes, against which alternative procurement options are assessed. These include:

- Achieving 'cost confidence' that the project can be delivered within the available funding constraints;
- Delivering the project to realise the Local Transport Plan and the benefits in the Worcestershire Strategic Economic Plan;
- Meeting the scheduled construction completion date of Spring 2021;
- Minimising further preparation costs with respect to project design;
- Including contractor input into the project development, planning, design and construction to encourage innovation and reduce capital costs;
- Including contractor input to the risk management strategy and appraisal process to reduce risk;
- Minimising future maintenance costs; and
- Safety.

The detailed specification is appended in Appendix L (Annex A).

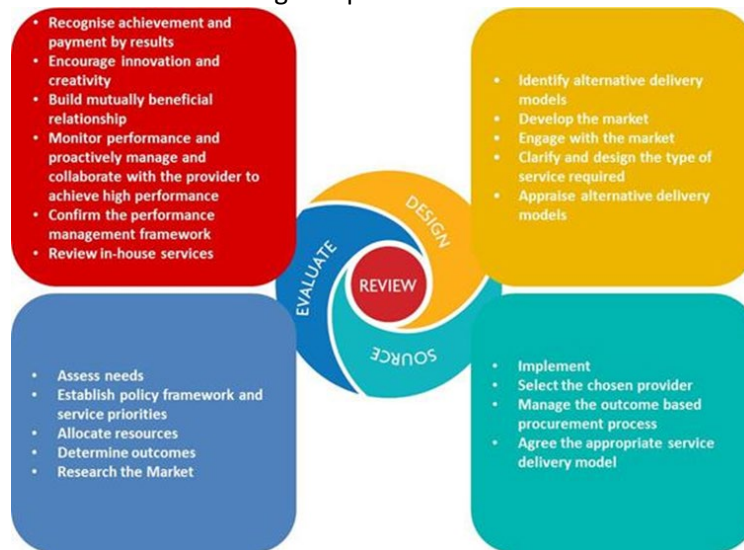
5.3 Procurement Strategy

WCC has extensive in-house strategic and technical procurement expertise and a wealth of knowledge and experience, with a proven track record of delivery with different types of contracts.

WCC is a strategic commissioning organisation and has a commercial vision to "drive commercial excellence through developing an open, challenging and pro-active culture and deploying effective commissioning strategies to source the right service from the right provider at the right cost."

Figure 5.1 shows WCC's approach to commissioning and procurement and has influenced the choice of the strategic procurement approach to the SLR project.

Figure 5.1: WCC Approach to commissioning and procurement



5.4 Strategic Procurement Options

A number of options were available to WCC to deliver the project. In deciding the preferred option there were a number of key considerations, these being:

- **Price Certainty** - ensuring WCC secures best value throughout the project and not just at tender award;
- **Whole Life Cost** - balancing investment cost with future maintenance costs to achieve best value over the life of the project;
- **Innovation** - improving value and reducing overall cost;
- **Incentives** - encouraging the supply chain to seek continuous improvement and cost down initiatives throughout delivery of the project;
- **Supply Chain Integration** - reducing potential for project delays with all suppliers working to one plan;
- **On Time Delivery** - ensuring that disruption to road users and local communities is kept to a minimum;

- **Lean Contract Management** - minimising project resource requirements through effective and efficient contract management with single points of contact;
- **Risk Sharing** - ensuring the ownership of risk is apportioned in line with securing best value;
- **Social Value** - optimising content against WCC's corporate priorities (see Table 5.1).

Table 5.1: WCC Corporate Priorities

Open For Business <ul style="list-style-type: none"> • Local Multiplier Effect (LM3) • Local Job Creation • Creation of skills and training opportunities • Apprenticeships • Work placement scheme for NEETs • Opportunities for long term unemployed 	Children & Families <ul style="list-style-type: none"> • Opportunities for NEETs (not in education, employment & training) • Promoting & encouraging community engagement and building community resilience
Environment <ul style="list-style-type: none"> • Reduction of carbon footprint • Use of local suppliers • Waste minimisation / recycling 	Health & Wellbeing <ul style="list-style-type: none"> • Healthy workforce • Healthy communities

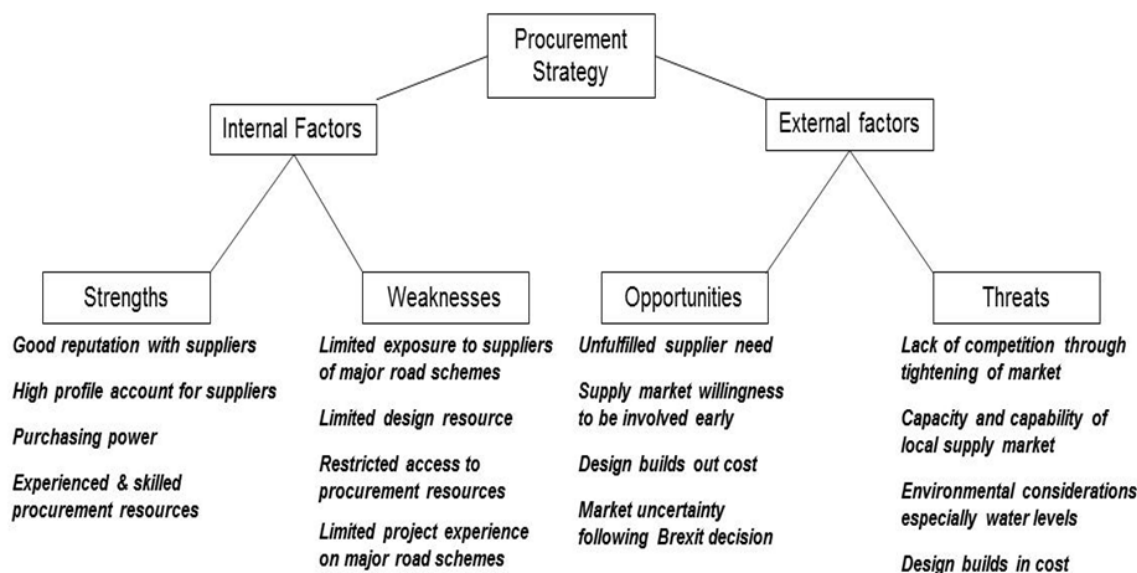
Given these considerations, the procurement options that were taken into account to deliver the services necessary to develop and realise the design and undertake construction of this type of project were:

- Traditional Approach - Client undertakes or commissions design and appoints construction contractor;
- Traditional Approach Plus Early Contractor Involvement (ECI) - Client undertakes or commissions design and appoints construction contractor with early contractor involvement. ECI allows the Contractor to be appointed before details of what is to be constructed have been fully developed and priced;
- Design and Build Single stage - Single Award to Single Supplier for detailed design and construction post planning and development;
- Design and Build Two stage - Two stage award to Single Supplier for project development (including ECI) and then detailed design and construction; and
- Private Finance Investment (PFI) - Given that funding has been applied for from the DfT, this option has not been pursued.

Use of WCC's existing term contracts for construction was not possible for this scheme due to the size and scale of works.

SWOT analysis was used to provide a critique of the internal and external environment in delivering the project via the four options. Internal factors were seen as Strengths and Weaknesses, external factors as Opportunities and Threats. The analysis has helped to inform how best to match the resources, capabilities and market conditions to the strategic options and selection of best strategic approach, in line with the following model.

Figure 5.2: Analysis of internal and external factors of procurement strategy



WCC have developed a "5Cs" tool to assist in determining which procurement strategy was right for the project and WCC. These "5Cs" being:

- Clout To give WCC the best negotiation position
- Credibility To make a real difference to social and environmental requirements
- Capacity To make best use of resources
- Capability To maximise the skills and experience available
- Competition The strategy that most suits WCC stance on collaboration

The results of the analysis are included at Annex A in Appendix L.

5.5 Further Consideration of Procurement Options

Having identified potential strategic procurement options, a more detailed consideration of the ability to deliver the commercial objectives was undertaken and is included at Annex B in Appendix L.

Market engagement activities found ECI and two-stage contracting to be popular with contractors and the research established that similar methods have been used to good effect by the Welsh Government for comparable infrastructure projects. It is known that High Speed 2 is using a similar approach for its civil engineering contracts.

Finally, legal advice was sought to test the suggested methodology and risks and this was used to inform the details of the procurement process and contracting process. The advice concurred with the proposed model and provided valuable suggestions to manage and mitigate risk.

5.6 Recommended Procurement Strategy

The Early Contractor Involvement two-stage procurement approach was recommended prior to the submission of the OBC. Furthermore, given ground conditions represent a significant risk; a Baseline Geotechnical Report was included. The stages of the procurement approach are:

- Stage 1a which related to the development of the outline design, preparation for and submission of the planning application, refinement of the Stage 2 target price, publication of draft Orders documentation and associated environmental documentation such as the Environmental Statement and preparation of Stage 1b.
- Stage 1b involves completion of statutory processes, including publication of the draft Orders, Orders Exhibitions, dealing with objections and representations, final agreement of the Stage 2 target price and detailed preparation for Stage 2 deliverables.
- Stage 2 involves the detailed design / construction period for all works including environmental, landscape and ecological requirements. Note Stage 2 will proceed subject to the satisfactory completion of the statutory procedures, the availability of finance, agreement of the Stage 2 contract and the Minister's decision as to whether the Orders should be made.

WCC has implemented a Commercial and Commissioning Board (previously Procurement Board), and independent gateway reviews, to provide senior management challenge, control, measurement and governance on significant procurement projects. The strategy received full Procurement Board approval in July 2016.

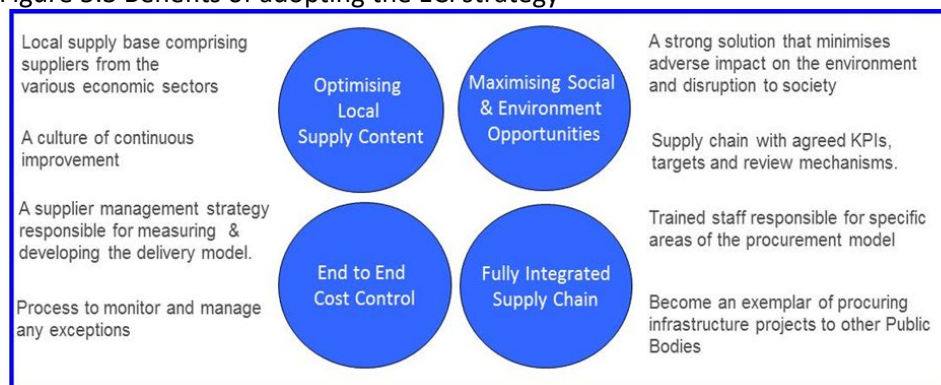
The Early Contractor Involvement (ECI) two stage procurement approach complements WCC's strategic approach to commissioning. The output of the SWOT analysis clearly informs that ECI maximises on WCC strengths and procurement opportunities.

As a consequence of adopting ECI it will provide WCC the best opportunity to:

- Give the best negotiation position (Clout)
- Make a real difference to social values (Credibility)
- Make best use of resources (Capacity)
- Maximise the skills and experience available (Capability)
- Suit the stance on collaboration (Competition)

In addition to delivering the benefits shown on Figure 5.2

Figure 5.3 Benefits of adopting the ECI strategy



5.7 Sourcing Options

A review of sourcing options was undertaken, with consideration given to any frameworks or existing contracts offering the preferred contracting model along with the best value for money outcome. WCC concluded that an Open tender was the best solution for the main contract and published the tender on

19th October 2016. Six tenders were received in January 2017 and, following evaluation, Alun Griffiths Contractors Ltd was awarded the first-stage contract in May 2017 and subsequently Stage 1b. In addition, a selection of WCC's existing contracts are being used to provide support and specialist functions to enable the scheme delivery.

Updated costs

For the submission of the A4440 Worcester SLR Phase 4 OBC, it was possible to take advantage of the initial review of tendered prices for the detailed project development (Stage 1) and design and construction (Stage 2) costs.

This enabled a comparison to be made with scheme costs estimates previously prepared and thus an updated estimate prepared. That is, the prices submitted by tenderers, which formed the basis of any contractual assessment of the Stage 2 pricing with the successful contractor, enabled a more robust assessment of the potential cost of key scheme elements (based on recent construction market experience). This provided greater confidence in the overall project costs presented in this Business Case.

Since then, the Contractor has progressed the scheme design for planning and planning consent was secured in May 2018. As such, the scheme and its constraints have become better defined and understood and confirmed that the original estimated scheme cost remains robust.

5.8 Payment Mechanisms, pricing framework and charging mechanisms

A method of payment allowing for monthly assessments of the costs accrued has been adopted as this allows for optimal cash flow for the supplier, the supply chain and WCC. Similarly, quality and standard of final construction has been managed through retention clauses, defects correction requirements and sample inspections.

Clauses requiring fair payment terms throughout the supply chain along with measures to audit this in contract form an integral part of the terms and conditions.

Incentives to optimise the price for stage two are included in the Stage 1 contracts, along with other mechanisms to share the benefits of ECI and innovation during the project development and design processes. These processes enable fair and open assessments of change as the project develops and in turn, the scope, programme and target price for stage 2 are more accurately prepared. For example, an agreed or instructed change to the scope is submitted by the contractor, assessed by WCC's cost consultant, agreed and implemented, adjusting the Stage 2 target price up or down.

5.9 Risk Allocation and Transfer

WCC undertook an assessment of how the types of risk are apportioned or shared, with risks allocated to the party best placed to manage them, subject to achieving value for money. The contract includes clauses to facilitate the transfer of appropriate risks from WCC to the contractor, such as risks associated with ground conditions. The project costs include contingency consistent with the Quantified Risk Assessment (Included as Appendix P) which has been updated in conjunction with the Contractor for the FBC.

SECTION 5 – COMMERCIAL CASE

The risk of costs being higher than predicted is mitigated through the early involvement of the contractor and agreement of the final Stage 2 contract Target Price including Evaluation Events resulting from changes since tender.

The allocation of risks resulting from the contractual and procurement arrangements is included in the QRA described above and key risks are summarised in Table 5.2. Ticks indicate where each risk type rests or whether these risks are shared between the parties to the contract.

Table 5.2: Risk allocation

Risk Category	WCC	Supplier	Shared
Design		✓	
Construction		✓	
Contract management and administration	✓		
Inflation	✓		
Main contractor financial standing	✓		
BREXIT impact on supply of goods/services			✓
Implementation			✓
Operations	✓		
Termination			✓
Financing	✓		
Legislative			✓

Prior to award there was a perception that a two-stage tender process may result in programme slippage and a gradual erosion of WCC's bargaining power as Stage 1 progressed. However, this risk was managed by:

- Developing a close working relationship with the Contractor and their design partners regularly reviewing and monitoring the scheme programme and ensuring clarity of work-scope requirements (Appendix L) for the second stage within the Stage 1 tender;
- Requiring agreement on the Stage 2 appointment conditions of contract as part of the Stage 1 tender;
- Providing clarity for the parties' respective rights and obligations upon conclusion of the Stage 1 process, if either Party does not wish to proceed to Stage 2;
- Maintaining competitive tension within the tender procedure by:
 - Evaluating change to the Stage 2 price using the competitive pricing information submitted pursuant to Stage 1;
 - Allowing the Contractor to share in any saving between the tendered price for stage 2 and the fixed stage 2 price; and

- Ensuring the successful bid included a strong design function to properly investigate, analyse and develop WCC's design requirements and the Contractor's corresponding proposals for the project and manages a robust value engineering process.

Once the contractor was appointed to deliver the project, the NEC3 Engineering and Construction Contract, main option C (Target Price) contract ensured that all parties share in the ownership of project risks and that they are motivated to minimise costs. The party best able to manage the risk is assigned to manage and mitigate the risk but the associated costs are shared. During stage 1a and Stage 2, the benefit of savings (i.e. costs are lower than the target price) is shared equally by WCC and the contractor. If costs exceed the target, the Parties share up to a maximum of 10% and any costs above this are borne by the contractor. Thus, WCC's exposure is limited to 5% above target except for any agreed variations, as defined by the contract. For stage 1b, (the statutory processes), a cost reimbursable mechanism is used as this would be a costly risk to attempt to transfer.

5.10 Contract Length

A programme of contract duration has been developed, as detailed in Appendix O.

5.11 Human Resource Issues

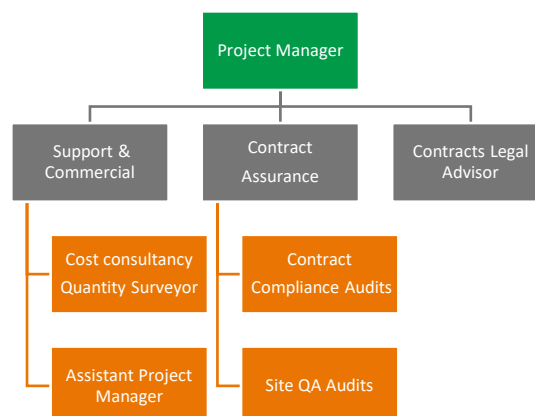
No relevant personnel/people management/trade union implications, including Transfer of Undertakings (Protection of Employment) Regulations 1981 (TUPE) regulations have been identified for this project.

5.12 Contract Management

Essential to the successful running of the contract are high-quality project management skills, complemented by specialist cost control expertise and sufficient support resources. These are required from the outset of tender development and evaluation, through project development and up to post-completion.

The project has a dedicated team with specific accountabilities for the contract, led by the Project Manager. This is demonstrated in figure 5.4.

Figure 5.4: Project team



The support and commercial service is provided by WCC's term professional services provider, using experienced and qualified professionals. WCC operates a contract assurance programme across term contracts and major projects, with sample compliance audits being undertaken by in-house officers who are NEC contracts specialists. This project is included in that programme. Legal support is available both internally at WCC and from external providers for more specialised contractual advice.

Both the Stage one and Stage two contracts have specific arrangements for the operational management of the contract, including:

- Co-location of Council staff with Contractor to support timely and open communication
- Monthly contract progress meetings with specified reporting requirements
- Technical working groups to refine and finalise the technical development of the scheme
- Financial Review workshops
- Risk management workshops
- Programme reviews

Whilst these are generally monthly meetings, the programme and frequency is adjusted according to the current status of the project.

These arrangements are discrete from the project's general arrangements described in the Management Case and are specifically to manage the processes from a contractual perspective, however, the project governance structure (more fully described in the Management Case) provides an additional layer of support, challenge and direction.

5.12.1 Social Value

The contractor's proposals to provide social value and support WCC's objectives formed a key element of the tender evaluation, specifically focussed on Stage 2 when the contractor will have significant presence in the County. Alun Griffiths Contractors Limited committed to providing a wide range of undertakings and benefits and the highlights are detailed in the table below: Table 5.3: Contractor commitments

Commitment	Benefit
Recruit 12 local people	Reduce local unemployment by creating better paid, sustained jobs
Identify and employ at least four industry new entrants to enrol on the Griffiths Apprentice+ Programme	Reduce the number of 16-24 year olds claiming Job Seekers Allowance
Provide 52 person-weeks of work experience and invite eight local young people to join our Ready4Work Programme	Increase the number of young people contributing towards and benefiting from increased prosperity in Worcestershire
Spend 80% on goods and services from within Worcestershire	Minimises environmental impact while increasing the Local Multiplier Effect

Commitment	Benefit
Support four local NEETs into full-time work through our Ready4Work Programme	Reduce the number of 16-24 year olds claiming Job Seekers Allowance
Visit six local schools with Sally Safesteps and/or the ICE Bridge community regeneration programmes	Promoting the importance of Science, Technology, Engineering and Maths subjects in schools
Undertake four community regeneration programmes	Improve community communal areas, improve access to quality recreational green space and increase volunteer hours in Worcestershire
SLR4-sponsored Bike Ride	Promote a healthy and active lifestyle for local people and increase the use of the Local Cycle Network

These commitments are formulated into a social value plan for the contract and the contractor provides updates on this at progress meetings throughout Stage 2. At conclusion of the works, a full case study of the social value outcomes will be produced to demonstrate delivery.

5.13 Summary

The Commercial Case has been subject to review since the production of the SOBC and subsequent OBC. The key objective of the procurement strategy development has been to review possible procurement routes to establish a method of gaining the expertise of a contractor early in the design process whilst retaining some flexibility following the design stage. The ECI two stage contract approach is providing the desired contractor involvement as well as flexibility.

The appointment of the contractor Alun Griffiths to the project via the recommended procurement approach has resulted in the following successes:

- Early re-location of the electricity pylon, and thus removal of a key constraint;
- Gaining planning consent for the scheme;
- Early discharging of some key planning conditions, such as flood mitigation requirements.

The adoption of a two-stage contract will mean that the project will be able to quickly transition to Stage 2 (detailed design / construction) following the award of funding from the DfT associated with this FBC.

Also, it should be noted that Alun Griffiths have contributed to this business case, particularly regarding the environmental assessment, programme, organisation matters, risk management and by participating in the contractual mechanisms, further cost certainty.

Chapter 6:

Financial Case



6 Financial Case

6.1 Introduction

The delivery of A4440 Worcester Southern Link Road Improvements, including Phase 4, is a priority for WCC, the Worcestershire LEP, Herefordshire and Worcestershire Chamber of Commerce, local Members of Parliament and the Worcestershire District Authorities. The programme is aligned with agreed priorities, in particular in terms of supporting economic growth in Worcestershire, and further information is set out within this business case as to the proposed scheme details. In summary the scheme provides the following new infrastructure:

- Construction of an additional carriageway adjacent to the existing single carriageway to form a 1.2 mile (1.9 km) dual-2 carriageway from Ketch Roundabout to Powick Roundabout.
- Two new bridge structures to carry the additional 2 lane carriageway, at Carrington Bridge and at Powick Common viaduct;
- Capacity Improvements and junction revisions to allow dual carriageway connections at Ketch Roundabout;
- Widening of the existing footway to accommodate a shared pedestrian/cycle route on northern side;
- New road markings, some widening of carriageway on west approach to accommodate movements to new dual carriageway section at Powick Roundabout;
- Upgrade of dedicated left hand turn to Malvern to fully segregated facility at Powick Roundabout;
- Provision of a foot/cycle bridge linking the north and south cycle routes, located on the west approach, at Powick Roundabout; and
- Upgrade of grade separated pedestrian route for north to south movements at Ketch Roundabout.

The delivery of the A4440 Worcester SLR Phase 4 Improvement scheme entails a three-stage cost lifecycle, as follows:

- Preparation costs from 2017 through to construction of scheme (for the purpose of economic appraisal all costs prior to April 2018 have been assumed to be sunk cost);
- Construction & Land Costs (including site supervision); and
- On-going liabilities including highways and bridge maintenance costs, scheme monitoring and evaluation.

The estimated outturn cost of the scheme is £62m (excluding Part 1 claims).

6.2 Update to the financial case since the OBC

The OBC financial case was developed from scheme costs based on estimates on the designs at the time. Since the development of the OBC, Stage 1 of the ECI contract has been awarded to Alun Griffiths Contractors Ltd and design has been progressed and planning permission obtained. The costs presented in this chapter are therefore updated to reflect this progress and include the Contractor's Target Cost further increasing cost certainty.

6.3 Scheme costs

The estimated scheme capital out-turn cost comprises of preparation costs, construction costs, contingency for risk and allowance for future inflation leading up to the opening of the project in Spring 2021.

The construction costs comprise highway, geotechnical and structure costs, and have been developed, in the main, using the Contractor's Target Cost for the agreed scheme. This covers the majority of the works costs however there are some smaller items not directly included in Contractor's Target Cost and these have

been based on latest estimates (e.g. statutory utility diversions). All costs have a baseline of Quarter 1 2017 which is consistent with the rates in the Contractor's tender submission. See Appendix N for further details.

Note that for the purpose of the economic case, sunk costs have been assumed up to April 2018.

The key costs of the project are:

- Highway Construction Costs – These are based on the Contractor's Target Cost adjusted to allow for inflation;
- Project Preparation Costs – These costs include project management, design, environment, planning and legal costs;
- Land Costs (Including common land costs); and
- Site Supervision & Contract Management Costs – these are costs to oversee the construction phase.

Monitoring and evaluation costs have been excluded and have been estimated to be 0.5% of the construction cost.

6.3.1 Optimism Bias & Quantified Risk Assessment

Optimism Bias has not been included in the costs reported in this section, optimism bias is accounted for in the Economic Case.

A Quantified Risk Assessment (QRA) has been undertaken which recognises additional costs associated with provision works and risk events. The QRA has been included within the total costs of the scheme (£9,354,067 excluding inflation; £11,001,730 including Inflation).

6.3.2 Inflation

Table 6.1 sets out the assumed inflation information for the proposed scheme costs; the inflation that has been calculated based upon a varied value for each of the next year are:

Table 6.1 – Inflation Assumptions

Inflation	2018	2019	2020	2021	2022
Construction Inflation	4.4%	4.34%	4.14%	4.14%	4.14%
Construction Labour	10.70%	9.20%	7.70%	6.30%	4.80%
Professional Services	3.06%	2.96%	2.76%	2.76%	2.76%
Land Values	4.44%	4.34%	4.14%	4.14%	4.14%

The figures in Table 6.1 have been estimated and calculated as follows:

6.3.2.1 Construction Inflation

Construction inflation has been applied to Works Cost and QRA elements of the overall scheme cost. For construction inflation the most recent data set from the Office of National Statistics (ONS) for Construction Output Price Indices (COPIs) was used. Reliable data was available for the period January 2014 to June 2018. It was assumed that the baseline level of inflation in 2018, across all indices, is equal to the most recently recorded level of annual inflation which, for all indices used, was July 2018. Construction price inflation is assumed to be equal to the Q1 level of inflation in 2018 (4.44%) and is then assumed to change in line with the Bank of England's forecasted changes in CPI inflation (from the Bank of England's August 2018 inflation report) from 2019 to 2020. Subsequently, construction price inflation is set to flatline.

6.3.2.2 Professional Services

For professional services data from ONS on average weekly earnings (AWE) for Professional, Scientific and Technical Services was used. Time series data was available from Q1 of 2000 to Q2 of 2018. For

professional services, the same method of inflation forecasting outlined above is applied; the forecasted inflation in professional services costs is equal to the Q1 level of inflation in 2018 (3.06%) and then changes in line with the Bank of England's CPI inflation forecasts for 2019-2020. Inflation in professional services costs is then set to flatline.

6.3.2.3 Land Values

No data specific to land value inflation was available, so land value inflation was assumed to be the same as COPI inflation. Land values were not assessed separately as these are difficult to forecast with accuracy. As a result the expected land value inflation has been set to be consistent with construction inflation.

The Bank of England forecast increase in CPI is set out in Table 6.2:

Table 6.2 Bank of England Forecast Inflation (Table 5.G – Q4 CPI Inflation)

-	Mode	Median	Mean
2018 Q4	2.3 (2.2)	2.3 (2.2)	2.3 (2.2)
2019 Q4	2.2 (2.1)	2.2 (2.1)	2.2 (2.1)
2020 Q4	2.0 (2.0)	2.0 (2.0)	2.0 (2.0)

Source: Bank of England Inflation Report, August 2018

As the table above shows the forecast levels of inflation is expected to fall between 2018 and 2019 (2.3 to 2.2, 4.35%) and then fall again between Q4 of 2019 and Q4 of 2020 (2.2 to 2.0) this is a fall of 9.09%). This profile has been used to forecast inflation between 2018 and 2020. As noted above, it is expected that the construction price, land value and professional services inflation will flatline from 2021 onwards.

6.3.2.4 Inflation Methodology

The inflation information has then been compounded taking into account a baseline cost year of Quarter 1 2017. The compounded interest rates are outlined in Table 6.3.

Table 6.3 – Compounded Inflation

Cost Item	2017/18	2018/19	2019/20	2020/21	2021/22
Works Cost	1.0444	1.0908	1.1381	1.1852	1.2343
Land Cost	1.0444	1.0908	1.1381	1.1852	1.2343
Preparation	1.0306	1.0621	1.0936	1.1238	1.1548
Supervision	1.0306	1.0621	1.0936	1.1238	1.1548
QRA	1.0444	1.0908	1.1381	1.1852	1.2343

The inflation rates set out above have been applied to the various elements of the scheme costs breakdown as set out in Table 6.4.

Table 6.4: Scheme development costs (£'000)

Cost type	2017 Q1 Baseline costs	2017/18	2018/19	2019/20	2020/21	2021/22	Total
Preparation	£4,660	£1,337	£1,597	£1,316	£596	£144	£4,990
Construction (incl. land)	£37,939	£536	£2,616	£19,092	£20,199	£1,493	£43,936
Site Supervision	£1,864	£0	£50	£904	£952	£166	£2,072
Total cost without QRA	£44,463	£1,873	£4,263	£21,312	£21,747	£1,803	£50,998
QRA	£9,354	£0	£248	£2,962	£6,304	£1,488	£11,002
Total cost including QRA	£53,817	£1,873	£4,511	£24,274	£28,051	£3,291	£62,000

Notes:

1 Where known, Actual Costs have been used (e.g. 2017/18 costs) and “deflated” to provide equivalent 2017 Q1 Baseline Cost.

2 Monitoring and Evaluation (assumed to be 0.5% of the construction cost) and Part 1 claims excluded.

6.3.2.5 Budgets and funding cover

The scheme has identified contributions from local developers of 12.1% of total scheme costs, but the majority of funding is sought from the DfT. Table 6.5 shows the breakdown of funding by source.

Table 6.5: Funding Sources (£'000)

Cost	2017/18	2018/19	2019/20	2020/21	2021/22	Total
Local Authority Contribution	£0	£0	£0	£0	£0	£0
Department for Transport	£1,873	£4,500	£21,417	£26,709	£0	£54,499
Third Party Contribution (from Developments)	£0	£11	£2,857	£1,342	£3,291	£7,501
Totals	£1,873	£4,511	£24,274	£28,051	£3,291	£62,000

The total funding being sought from DfT is £54,499,000. In order to continue to progress the project to our ambitious delivery programme, following the successful ‘bid for construction funding’ outcome WCC sought agreement with DfT to drawdown funding from September 2017. This request resulted in £3.0m being drawn down in 2018/19.

6.4 Contributions Strategy

In line with the South Worcestershire Development Plan Policy 4 “Financial Contributions from development towards transport infrastructure will be secured either through the Community Infrastructure Levy charging schedule or developer contributions as appropriate.”

Annex I of the SWDP strategy sets out the Infrastructure Plan for Worcester, based upon schemes in the Worcester Transport Strategy, including contributions towards A4440 Worcester Southern Link Road Phases 3 and 4. The overall value of improvements required is set out at £121.21 million. The proposed highway scheme is set out as Essential Infrastructure.

Specifically in the SWDP 45/2 Policy with regards to the Temple Laugherne site, it states that the delivery of around 2,150 dwellings will be provided. “The rate of delivery will be dependent upon the phased implementation of the Worcester Transport Strategy and, in particular, the dualling of relevant sections of the A4440 Southern Link Road.”

Further the policy sets out “ Measures, including proportionate contributions directly related to the development, to support and safeguard the implementation of relevant schemes set out in the Worcestershire Local Transport Plan 3, including the adopted Worcester Transport Strategy, which includes

the phased dualling of the A4440 Southern Link Road; the delivery of a road within the site between the A44 and the Martley Road; and improved accessibility by non-car modes to Worcester city centre.”

The SLR4 is also included in LTP4 (policy SWST5).

In the SWDP it was stated that “Planning obligations through Section 106 agreements will continue to be sought to provide funding to mitigate negative impacts relating to specific developments. A Developer Contributions SPD will be produced to provide detailed guidance to be used in conjunction with the Community Infrastructure Levy charging schedule.”

In addition to the Temple Laugharne site (West of Worcester Urban Extension), under current planning legislation it is possible to obtain contributions towards highways infrastructure from a total of 5 development sites. Identified sites at this stage include:

- West of Worcester Strategic Urban Extension (Bloor Homes). The current status is that this has been approved at Planning Committee, pending legal agreement, for the sum of £9,761,920.00
- West of Worcester Strategic Urban Extension (Hallam Land). This is due to go to Planning Committee in January 2019, with an agreed contribution sum of £8,065,873.56
- North East Malvern Strategic Site. This is due to go to Planning Committee in January 2019, with an agreed contribution of £2,213,027.26
- Grove Farm. This has achieved planning consent with an agreed contribution of £1,045,920.00.

It must be noted that not all of the above figures are to be attributed to this scheme, but it does demonstrate that we have certainty of sufficient funding available from developers. Due to the nature of the South Worcestershire Development Plan, additional contributions can be allocated to other schemes that form the Infrastructure Delivery Plan.

It is acknowledged that the contribution levels identified are based 100% on developer funding, as this cost is likely to be loaded to a key milestone date in the delivery of the sites set out above, there is likely to be a requirement for Worcestershire County Council to fund this in the short term until the developer contribution is paid. Thus it is proposed that this would be undertaken via cash flow management through the normal capital programme borrowing requirements following cabinet approval.

6.5 Whole life costs

Consideration has been given to the additional maintenance costs and annual costs associated with the new structures, carriageway and footway elements of the proposed Worcester SLR Phase 4 Improvement scheme.

Table 6.6 sets out the maintenance base costs for the structures which form part of the A4440 Worcester Southern Link Road Phase 4 Improvement Scheme. Table 6.7 sets out the highway and footway maintenance costs assumed.

Table 6.6 – Hams Way Footbridge Maintenance and operation costs

Maintenance Item	Assumed Year(s) of maintenance item	Base Cost Per Cycle
Metalwork maintenance repainting (Footbridge Only)	2036, 2066	£28,000
Whole structural metalwork repainting (Footbridge Only)	2051	£240,000
Drainage/Bearing shelf cleaning (Not Required for Footbridge)	2026, 2031, 2036, 2041, 2046, 2051, 2056, 2061, 2066, 2071, 2076	£1,600
Parapet Replacement (River Bridge & Viaduct)	2071	£271,200
Expansion Joint Renewal (River Bridge & Viaduct)	2046, 2071	£72,000
Routine Maintenance	Annual	£1,400
Deck resurfacing and re-waterproofing (Footbridge Only)	2041, 2066	£16,000
Deck resurfacing and re-waterproofing (River Bridge &	2051	£360,000

Table 6.6 – Hams Way Footbridge Maintenance and operation costs

Maintenance Item	Assumed Year(s) of maintenance item	Base Cost Per Cycle
Viaduct)		
Bearing Renewal (Footbridge Only)	2051	£40,000
Bearing Renewal (River Bridge & Viaduct)	2071	£384,000
Concrete repairs (Viaduct Only)	2051	£40,000
Concrete and Steel repairs (River Bridge Only)	2051	£120,000

Table 6.7 – Highway & Footway Maintenance and operation costs

Maintenance Item	Assumed Year(s) of maintenance item	Base Cost Per Cycle
Resurfacing of additional Link Road; Ketch Roundabout; Powick Roundabout and approach carriageway	2031, 2051, 2071	£303,224
Resurfacing footway	2031, 2051, 2071	£13,509
Deep Inlay of additional Link Road; Ketch Roundabout; Powick Roundabout and approach carriageway	2041, 2061	£1,242,857
Deep Inlay footway	2041, 2061	£44,034

The maintenance costs with the exception of the Traffic Management items has been fed into the TUBA modelling presented in the economic case. The Traffic Management items have been factored into the QUADRO modelling.

6.6 Section 151 Officer Sign off

This Full Business Case submission has been reviewed by, and a declaration received from, Worcestershire County Council's Section 151 Officer and has been appended, as Appendix S.

6.7 Summary of Financial Case

The Financial Case sets out the project costs and funding sources to deliver the scheme.

The Case demonstrates that WCC has considered all aspects of the schemes costs and has included within the project costs an assessed amount for contingency to cover project risks.

Chapter 7:

Management Case



7 Management Case

7.1 Introduction

The delivery of A4440 Worcester Southern Link Road Improvements, including Phase 4, is a priority for WCC, the Worcestershire LEP, Herefordshire and Worcestershire Chamber of Commerce, local Members of Parliament and the Worcestershire District Authorities. The programme is aligned with agreed priorities, in particular in terms of supporting economic growth in Worcestershire.

The scope of the scheme includes:

- Construction of an additional carriageway adjacent to the existing single carriageway to form a 1.2 mile dual-2 carriageway from Ketch Roundabout to Powick Roundabout.
- Two new bridge structures to carry the additional 2 lane carriageway, at Carrington Bridge and at Powick Common viaduct;
- Capacity Improvements and junction revisions to allow dual carriageway connections at Ketch Roundabout;
- Widening of the existing footway to accommodate a shared pedestrian/cycle route on northern side;
- New road markings, some widening of carriageway on west approach to accommodate movements to new dual carriageway section at Powick Roundabout;
- Upgrade of dedicated left hand turn to Malvern to fully segregated facility at Powick Roundabout;
- Provision of a foot/cycle bridge linking the north and south cycle routes, located on the west approach, at Powick Roundabout; and
- Upgrade of grade separated pedestrian route for north to south movements at Ketch Roundabout.

This section sets out how WCC proposes to deliver the A4440 Worcester SLR Phase 4 scheme. It explains:

- The capability and capacity of the authority to deliver the scheme, drawing on evidence from other similar projects (section 7.2);
- The way in which the project complements other schemes (note the scheme is not dependent on any other works) (section 7.3);
- Arrangements for project governance, including organisational structure and allocation of roles, decision-making powers and project management (section 7.4);
- The planning strategy (section 7.5);
- The project programme, which has been carefully planned to ensure that it is realistic and deliverable (section 7.6);
- The process being used to ensure that all the necessary assurance and approvals are obtained in a timely and efficient manner, and associated reporting (Sections 7.7, 7.9, 7.10);
- The strategy for effective communication and stakeholder management (section 7.8);
- The strategy and approach adopted to ensure effective risk management including key issues for implementation (section 7.11);
- Monitoring and evaluations (Section 7.12);
- Benefits realisation strategy (section 7.13);
- Contingency plan for the Common Land De-Registration Delay (section 7.14);
- Summary of the management case (section 7.15).

7.2 Evidence of similar projects

WCC has considerable experience of:

- Delivering major transport schemes on time and on budget;
- Successfully obtaining consents for major infrastructure schemes;
- Developing and maintaining good working relationship with key partners and stakeholders; and
- Resourcing and governance requirements for major schemes.

The scheme is a component part of the WTS, which is described in the strategic case. The WTS is divided into two phases:

- WTS Phase 1: The appraisal showed it to deliver strong positive benefits across DfT appraisal criteria (this phase included the sustainable measures in the City and A4440 Worcester Southern Link Road Phase 1 and Phase 2 schemes); and
- WTS Phase 2: The case for the subsequent phase of the WTS is as robust as Phase 1 in terms of the value for money offered (this phase includes the A4440 Worcester Southern Link Road Phase 3 and Phase 4 schemes).

Phase 2 of the WTS is now being implemented, as a series of sub-phases, when funding permits. Worcester Southern Link Road improvements are part of the Phase 2 works, and have been split into four phases. These are shown on Table 7.1.

Table 7.1: A4440 Worcester Southern Link Road Phasing

Phase	Scheme	Status
Phase 1	Whittington Junction minor Improvements	Completed
Phase 2	Ketch Junction improvements and provision of 600 metres of dualling towards Norton Roundabout	Completed
Phase 3	Norton Roundabout improvements and completion of dualling between Whittington and Ketch junctions.	To be completed 2019/2020
Phase 4	Further capacity enhancements between Powick Junction and the M5 including dualling between Powick and Ketch junctions	To be implemented by 2021 – subject of this FBC

Phase 1 of the A4440 SLR improvements were completed in July 2012 and consisted of capacity enhancements to the Whittington Roundabout. Phase 2 works were completed in 2016 at the Ketch Roundabout and dualling of the A4440 to 300 metres from Norton Roundabout.

Examples of schemes implemented by WCC include the following:

- Hoobrook Link Road Phase 2, in South Kidderminster Enterprise Park. The £16 million scheme became operational in 2016;
- Worcester Southern Link Road Phase Dualling Phase 3– Norton to Whittington . The dualling is complete with work on pedestrian and farm bridges underway for installation 2019/20;
- Extension to Railway Bridge (as part of SLR Phase 3) – successfully installed in May 2018
- Evesham Abbey Bridge, completed in 2014;
- Middle Hollow Drive/Woodgreen Drive in Worcester, scheme completed in 2015;
- Worcester Southern Link Road Phase 1 – Whittington Roundabout; and
- Worcester 6 Access Road.

- WTS Phase 1 (£19.56) including:
 - Intelligent Transport Systems (ITS) scheme – Variable Message Signing (VMS) implemented on key approaches to the City (complete);
 - Public realm improvements in Lowesmoor (complete);
 - Improvements to Worcester Foregate Street and Malvern Link Railway Stations (complete);
 - Ketch Roundabout Improvements (complete).
- Multi-Modal Corridor enhancement schemes along two key radial corridors in Worcester (both implemented in 2010/11);
- Newtown Road Corridor, funded through LTP2 & Section 106;
- Bromyard Road Corridor funded through Communities Infrastructure Funding Round 2 (CIF2);
- Walk & cycle schemes, implemented as part of Worcestershire’s Safer Routes to School programme;

These projects were complex and demanding and required new ways of working with partners and stakeholders.

7.3 Project dependencies

Physical project dependencies are described in the Strategic Case. In the Management Case the relationship and third party project dependencies are described.

A number of decisions and deliverables have been identified that are required from other parties in order for the A4440 Worcester SLR Phase 4 scheme to progress. These require permissions and/or legal processes in order to allow the project to progress. The issues are detailed in Table 7.2.

Table 7.2: Project Dependencies

Issue	Nature of dependency	Action being taken
Obtaining Large Local Major Funding	Final Approval is required to progress the scheme to Stage 2 (Detailed Design and Construction)	Submission of this business case to DfT in line with guidance
SLR Phase 3	Full benefit of Phase 3 will not be realised if Phase 4 is not complete	Construction of Phase 3 is well progressed with dual- 2 lanes open in both directions.
Land ownership	Land acquisition is required for the scheme. The land is anticipated to be acquired by negotiation and negotiations are well advanced including terms agreed. A CPO has been made, no objections remain and it is confirmed that a Public Inquiry is NOT required.	Negotiation with land owners in final stages & CPO made - awaiting confirmation
Common Land	Common Land is in the process of being de-registered. After consultation with the Commoners and the relevant landowner appropriate Exchange Land has been identified and is being secured through legal processes.	After consultation with the Commoners and the relevant landowner appropriate Exchange Land has been identified, is being secured through legal processes and is in the process of being de-registered.
Planning permission and discharge of conditions	Planning permission is required for the proposed scheme and was granted in April 2018.	Work continues to discharge planning conditions. Details are provided in an extract of the latest Register of Environmental Actions and Commitments in Appendix M.
Commencement of Stage 2 of the ECI contract	WCC and ECI contractor to commit to Stage 2 of the contract (D&B)	Preparation of contract is well advanced. Advance work covered within Stage 1a and 1b contracts. Stage 2 contract will be ready to

Issue	Nature of dependency	Action being taken
		commence on confirmation of full funding

7.4 Governance, Organisation Structure/Roles and Project Management

The management for the A4440 Worcester SLR Phase 4 project is based on PRINCE2 principles. Specific attention has been given to governance, to provide a clearly defined structure for the role of the Programme Board, Project Board, Project Manager and Project Teams, as set out in the WCC Project Operating Model shown in section 7.7 and Figure 7.3.

It has been specifically tailored to meet the requirements of the scheme and its component projects and is based on the structure successfully adopted for recent WCC major projects including Worcester Transport Strategy Phase 1, A4440 Worcester SLR Dualling Phase 3, Hoobrook Link Road Phase 2 and Worcestershire Parkway. The Project Management Plan summarises the following key areas:

- Project Organisation and Responsibilities - involved parties and their roles;
- Presentation of Project – deliverables, division into work units and time plan;
- Project Planning and Control – technical approval, progress measurement and monitoring; and
- Communications Plan – meetings, decisions & action logs, highlight reports and open issues log.

7.4.1 Cabinet

WCC's Cabinet has ultimate authority for the project and approved the scheme on 2nd February 2017. The Cabinet meets on a monthly basis and regular updates are provided to the Cabinet Member with Responsibility for Economy and infrastructure and through WCC corporate routes. The Cabinet comprises:

Table 7.3: Members of Cabinet

Name	Responsibility
Simon Geraghty	Leader of the Council and Cabinet Member with Responsibility for Finance
Alan Amos	Cabinet Member with Responsibility for Highways
Adrian Hardman	Cabinet Member with Responsibility for Adult Social Care
Marcus Hart	Cabinet Member with responsibility for Education and Skills
Lucy Hodgson	Cabinet Member with Responsibility for Communities
Karen May	Cabinet Member with Responsibility for Transformation and Commissioning
Tony Miller	Cabinet Member with Responsibility for Environment
Ken Pollock	Cabinet Member with Responsibility for Economy and Infrastructure (and infrastructure projects)
Andrew Roberts	Cabinet Member with Responsibility for Children and Families
John Smith	Cabinet Member with Responsibility for Health and Well-being

7.4.2 Project Board

The scheme development is being overseen by a Project Board. The Project Board role is one of governance, accountability and decision making. The Project Board comprises officers with responsibility for delivery of the A4440 Worcester SLR Phase 4. Officers from a wide delivery team are involved in a number of elements of the project including the risk workshop, package sifting and public consultation. The Project Board meet

regularly and will meet at key milestones throughout the life of the project to ensure Project Assurance objectives are met. The composition of the board will evolve as the scheme progresses and others are asked to report to the board as required, e.g. land and legal specialists.

Membership of the Board is detailed in Table 7.4.

Table 7.4: Membership of Project Board

Name	Role
Rachel Hill	Senior Responsible Officer & Chair
Nigel Hudson	Head of Strategic Infrastructure and Economy
Andrew Baker	Transport Planning Manager
Emily Barker	Strategic Planning Manager
Stephanie Walton	Procurement Manager
Sally Everest	Network Manager
Nick Twaite	Asset Manager
Jo Dalton	Communications Manager
Abhi Bhasin	Business Case Manager
Mark Broomby	Project Manager
Richard Bruten	Contractor's Project Director

7.4.3 Project Manager

The Project Manager leads the management and delivery teams providing an interface between the various approval boards and delivery teams in accordance with WCC Project Operating Model (POM). They monitor and evaluate project progress against milestones, assess outcomes and provide support and direction to the work package managers. The Project Manager is a member of the Project Board.

The role of the Project Manager is to:

- Lead and coordinate the project team and its work-streams;
- Ensure appropriate resources and technical expertise are in place for the project;
- Make decisions and approve changes within agreed tolerances or seek authorisation if required;
- Procure consultants and contractors;
- Prepare and report project budgets;
- Manage project risks and issues;
- Report to and receive feedback from the responsible officer; and
- Produce periodic progress reports to relevant committees.

7.4.4 Project Teams

The Project Manager is supported by a project team covering all related disciplines. In most cases a discipline has a lead manager who is, where relevant, supported by a co-ordinator and wider team. The high level Project Organogram is shown in Figure 7.1; Figure 7.2 provides a more detailed overview of the Client Agent and Contract Administration structure whilst Figure 7.3 details the structure the detailed design and construction.

Figure 7.1: High Level Project Organogram

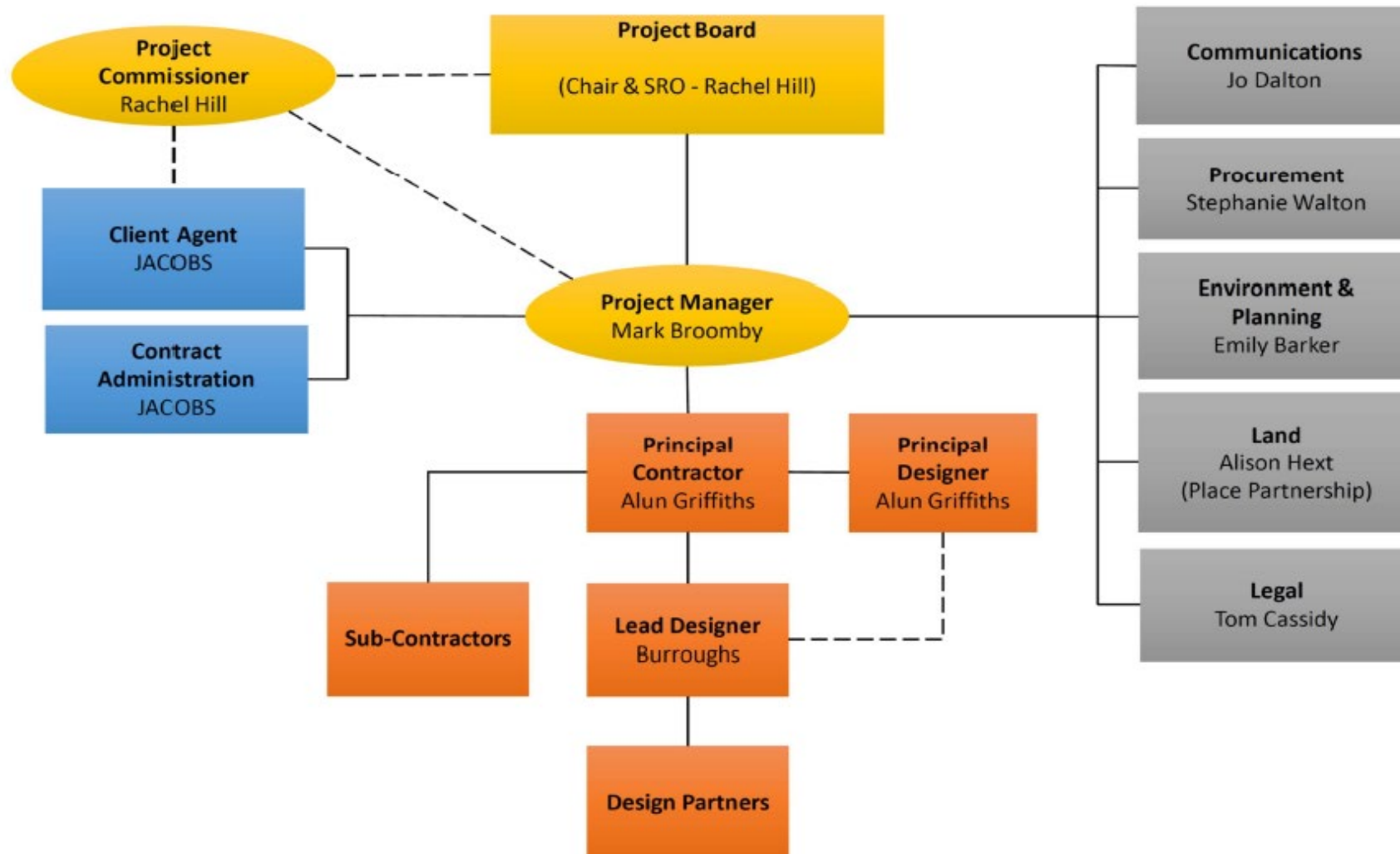


Figure 7.2: Project Organogram (Client Agent and Contract Administration)

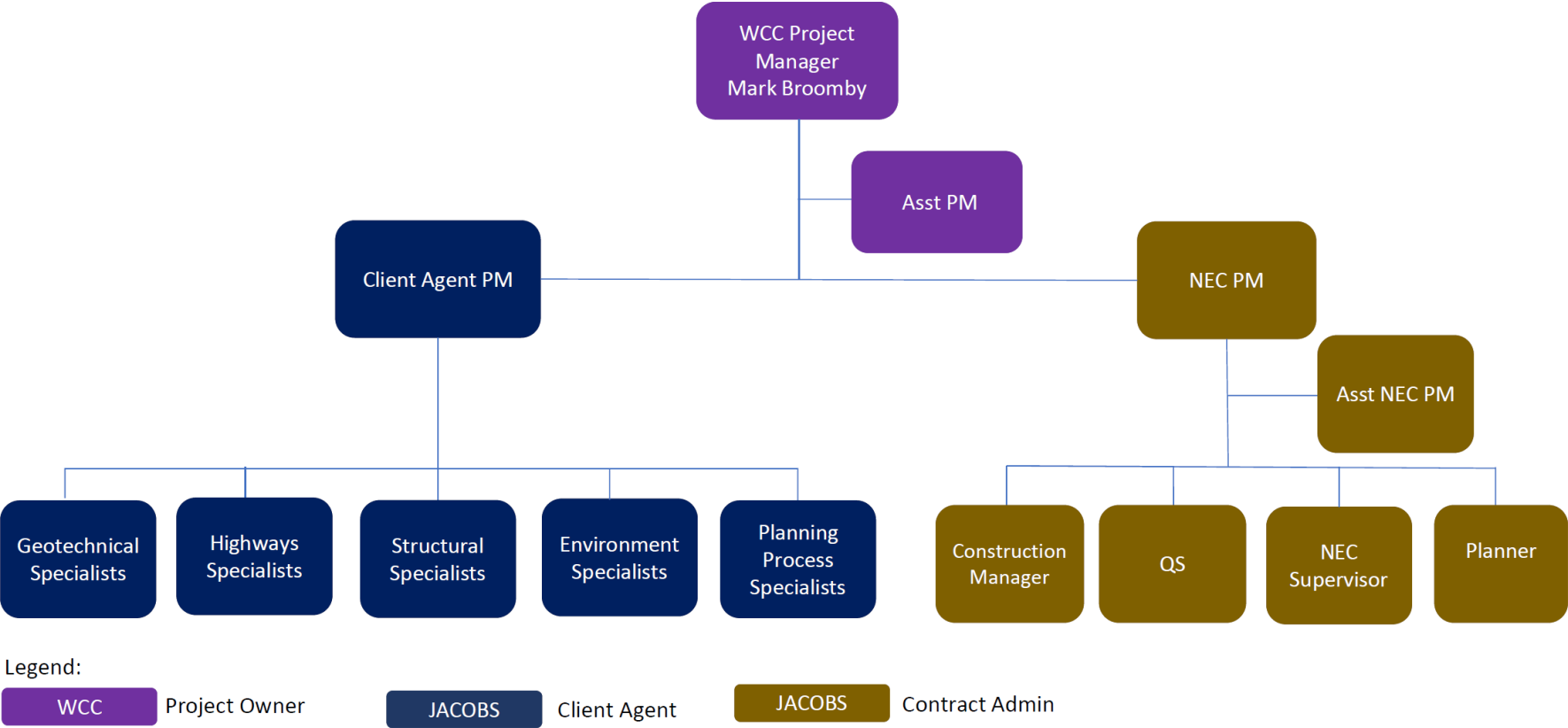
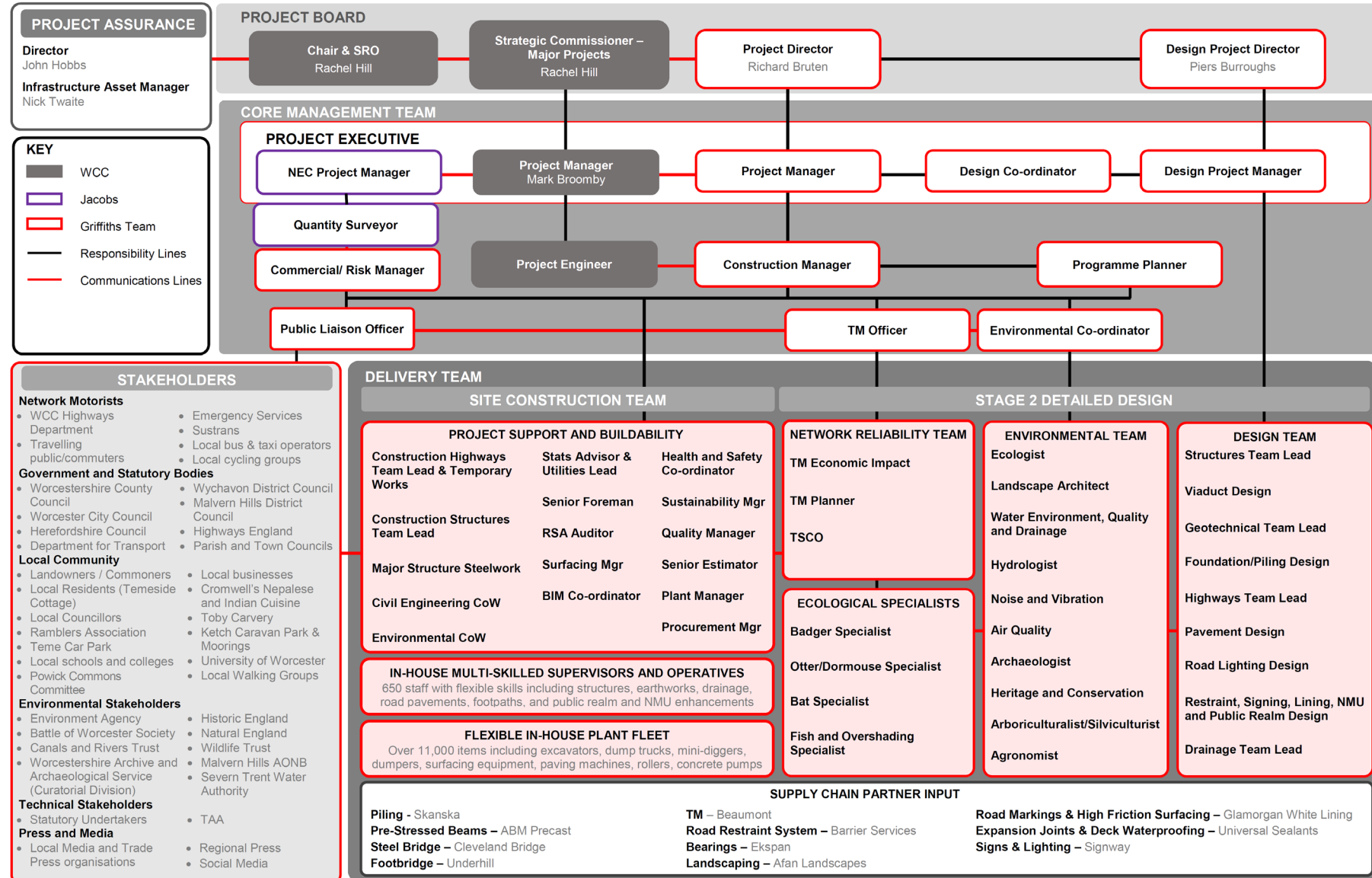


Figure 7.3: Project Organogram (Detailed Design and Construction)



7.5 Planning strategy

Worcestershire County Council is responsible for planning applications and lawful development certificates for:

- The County Council's own developments;
- Waste Developments;
- Minerals Developments.

Planning consent for the scheme was granted by Worcestershire County Council on 5th April 2018. The planning application was subject to an Environmental Impact Assessment (EIA) due to the size of the project and the proximity of the River Teme SSSI. Planning permission was granted with certain conditions which are provided in Appendix M. These planning conditions include, among others, that:

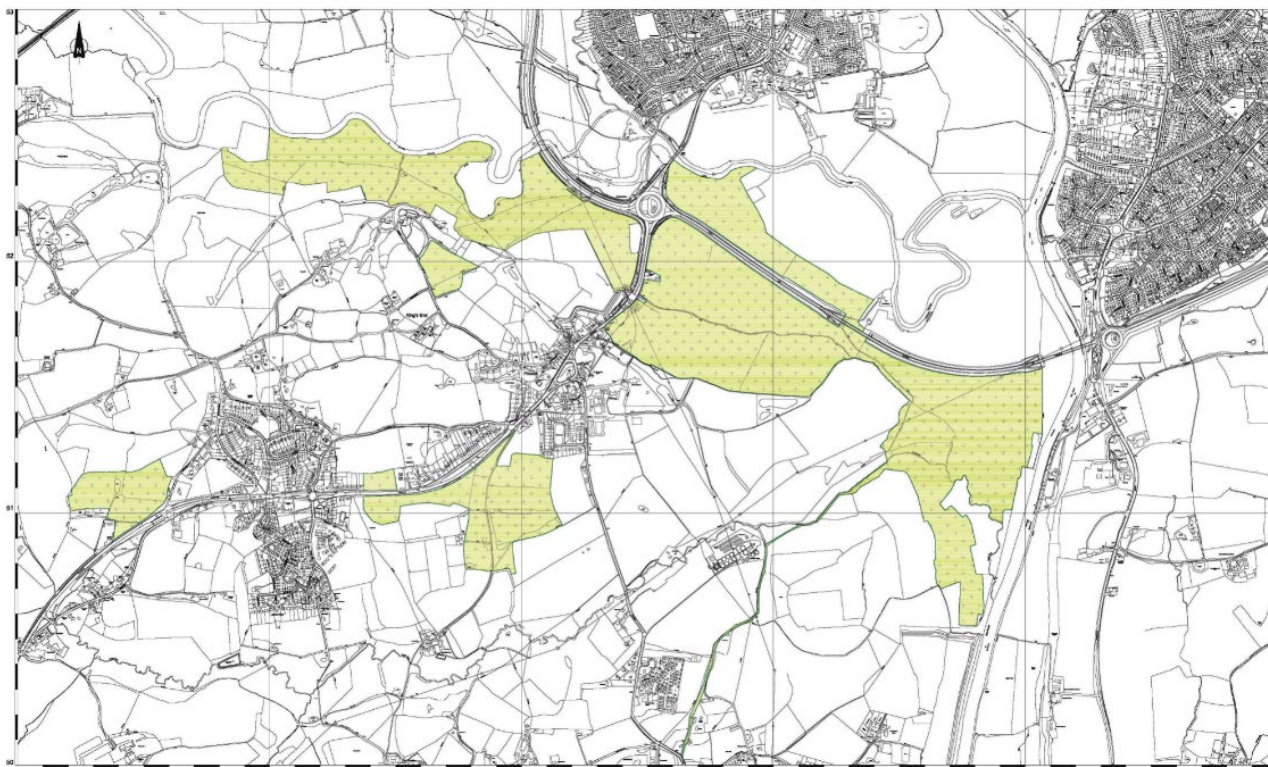
- A Community Liaison Group (CLG) be established;
- The development must begin within 3 years of the date that planning permission has been granted; and
- The development is carried out in accordance with the drawings available in Appendix A.

The exact extent of the land required to be achieved to deliver the scheme is fully known and negotiations to acquire the land are well advanced. As a backup to negotiations, a Compulsory Purchase Orders (CPO) was made in May 2018. There was one objection to the to the CPO, which has now been withdrawn, consequently the Planning Inquiry has been cancelled.

Part of the scheme is located in the Powick Hams Common. The original area of Common Land is 177 Hectares and there are 59 registered rights over the land, all of which are rights to pasture. The Common Land predominantly adjoins agricultural land. Figure 7.4 shows the Common Land around the scheme.

After consultation with the Commoners and the relevant landowner appropriate Exchange Land has been identified and is being secured through legal processes. Common Land is in the process of being de-registered through Section 16 applications and the Planning Inspectorate has confirmed that a Planning Inquiry is not needed for the land to be de-registered between Ketch and Powick Roundabout. Further details of the planning strategy are set out in Appendix M.

Figure 7.4: Powick Hams Common



In addition to the land acquisition (draft contracts agreed in principle), planning consent (secured) and de-registering of Common Land (well in progress), the following are required:

- Temporary Traffic Regulation Order's; and
- Badger Protected Species Licence (obtained).

7.6 Project plan

A project plan has been developed for delivery of the A4440 Worcester SLR Phase 4 scheme, setting out the main project stages between Programme Entry and full scheme completion and their anticipated timescales. The plan defines key milestones, dates, identifies dependencies between work streams and approvals and highlights the Critical Path. The high level and detailed project plans are shown in Appendix O.

A number of key principles have been determined, which provide the overall framework for the programme. These are the DfT approvals process, Gateway Review stages, scheme design, procurement processes, publishing Traffic Regulation Orders and the construction period. The Table below outlines the key dates to scheme opening. The programme for the scheme is being kept under review to reflect ongoing progress. However, the overall scheme implementation programme and most notably opening date has a strong political intent and the project team is charged with addressing the project issues as they arise with the intention that the opening date is achieved.

Table 7.5: Project Programme

Milestone	Target completion date
Strategic Outline Business Case	25/01/2016
Outline Business Case (including Addendum for TEMPPO update)	31/03/2017
Stage 1a Contract Awarded	04/05/2017
DfT Programme Entry notified	09/11/2017
Planning decision	05/04/2018
DfT Full Approval	18/02/2019
Stage 2 commencement (Detailed Design & Main Construction) - excludes advanced Detailed Design & enabling works for critical path items undertaken under Stage 1b	01/03/2019
Scheme Opening	31/03/2021

7.7 Assurance and approvals plan

The Project Board is responsible for Project Assurance, ensuring that the project remains on target in terms of business, user and technical objectives. This includes conducting Gateway Reviews at key stages in the project life cycle to determine whether or not the project can proceed to the next stage.

Project Board members receive regular Highlight Reports from the Project Manager to aid them in this process. The scheme will also be subjected to regular Peer Review by the Directorate of Economy and Infrastructure Programme Board which includes Senior Officers from a range of disciplines including business, strategic and technical officers. Key gateway decision points such as proceeding to detailed design and construction will be made by the Strategic Infrastructure Group in accordance with Worcestershire County Council Project Operating Model (POM) as detailed in Figure 7.5.

In addition to the Project Board Assurances, Gateway reviews have been undertaken prior to the OBC and FBC submission independently of the project team, the outcome of these reviews is appended to the business case Appendix T. The most recent Gateway Review was a Stage 3 Gateway Review carried out by Local Partnerships on 21-23rd November 2018. In summary, they found that:

"The project is well run and under control"

"The project should deliver the majority of the benefits sought"

"There are challenging timeframes but these are largely mitigated and plans (if not already in place) will need to be developed to deal with the key risks:

- Weather . Flooding;
- Brexit / Supply Chain impacts;
- Delays due to public inquiry, CPO and other associated legal acquisition matters....."

The Review Team made five recommendations, these are summarised below:

- Responsibility for DfT liaison should be vested within the delivery team.
- Re-circulate ToR and membership details and schedule of CLG meetings early to ensure the group provides a positive contribution to the scheme development going forward.
- Ensure all legal matters are concluded as a matter of urgency to ensure there is no slippage in the programme and the submission of the FBC to DfT is not delayed. It is also advisable to reconfirm the target submission date for the FBC with DfT.
- Review project capacity and resources to ensure greater project resilience and knowledge transfer is achieved.

- Better definition should be given to the outcomes so that they can be monitored and evaluated. A process for monitoring and evaluation should be put in place, in particular. Social Value delivery and reporting at key project milestones

In addition, the Review Team commented as follows:

In relation to Governance: "This system does appear to function well as there is good knowledge of the project and its status / progress at all levels both politically and amongst officers."

In relation to Delivery: "The project programme is continuously reviewed, monitored and updated to reflect the project status at the Project Board and through a series of sub-group meetings. There is a high level of confidence in the SRO to oversee a successful outcome to deliver the scheme."

In relation to Stakeholder Management and Engagement: " The approach to the management of key stakeholders does seem to be effective as the project was viewed by all those interviewed to be top-priority for the Council with political support found to be strong.

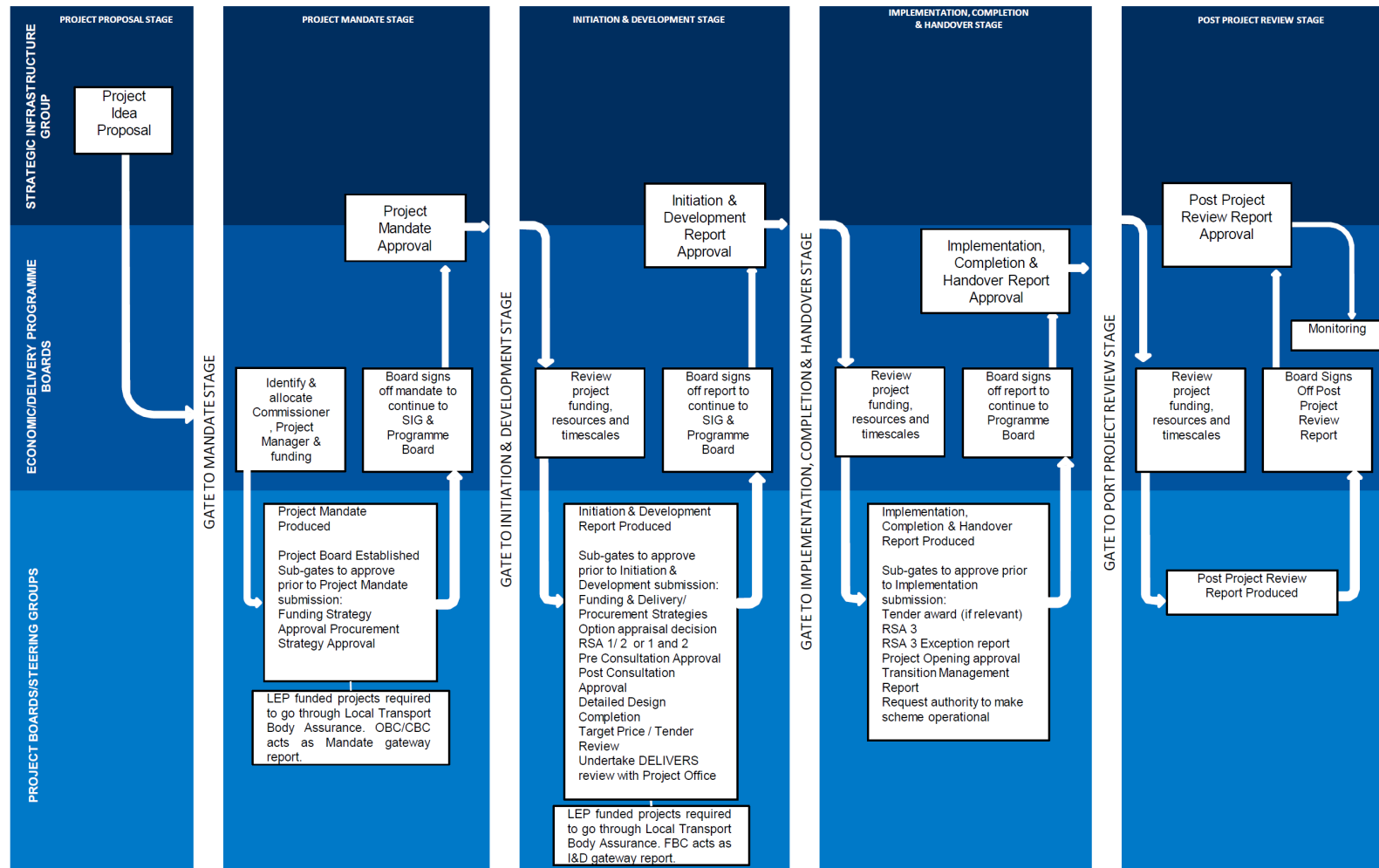
There was evidence of very strong working relationships with the LEP and, in particular, the partnering districts to the South of the County."

In relation to Communications: "Following useful experience gained on previous phases and other major projects the Communications Strategy is robust, multi-functional, engaging on different platforms and reaches a wide audience."

In relation to the Contractor: " The Contractor has a robust supply chain in place and they have a pro-active approach to this project in all aspects."

In relation to Risk Management: " The Review Team found that there is a comprehensive approach to risk management with a detailed risk register that identifies most of the expected range of risks. Risks are regularly reviewed by the working groups and reported to the Project Board. The process is supported by strong risk management policy and risks appear to be well understood by all those interviewed."

Figure 7.5: Worcestershire County Council Project Operating Model (POM)



7.8 Communication and Stakeholder Management

7.8.1 Overview

Having a Stakeholder Management and Engagement Plan in place is an essential component of good project management. The Stakeholder Management and Engagement Plan presented in Appendix C identifies key stakeholders and helps explain how, throughout the project they will be informed, what the purpose of the communication will be, the method for communication, who will do the communicating, and the frequency of the communication.

Communication is often a very effective way to solve problems, deal with risks, and ensure that tasks are completed on time. Successful plans will leave nothing to chance. According to best practice, 75%-90% of a Project Team's time is spent communicating. Since communications is a significant aspect of the Project Team's job, having a Stakeholder Management and Engagement Plan is essential.

The Stakeholder Management and Engagement plan presented in Appendix C contains information on:

- Stakeholder Analysis
- The Communications Challenge
- Communications Strategy
 - Strategy
 - Audiences
 - Objectives
 - Key Messages
- Implementation
- Media
- Timeline / Action Plan
- Budget
- Key Project Contacts
- Project Communications Toolkit

The key elements of the ongoing communications challenge are:

- Creating an environment where project parties (particularly the County Council) provide an open and consistent approach to stakeholder management and communications through a clear and up to date Stakeholder Management and Engagement Plan;
- Promoting advocacy for the proposals from key external stakeholders by engaging on an ongoing basis as the project progresses, communicating and promoting the benefits and dealing with any concerns in a timely way;
- Publicising the project within the context of wider improvements;
- Ensuring users and residents are aware of any planned disruption as a result of the works, in good time to be able to plan alternative travel if necessary;
- Carrying out sufficient early consultation to ensure a smooth passage of delivery, having first considered any reasonable requests for mitigation measures pertaining to the scheme; and
- Presenting a united front between WCC and stakeholders on the scope, delivery and ultimate operation of the facility.

The Stakeholder Management and Engagement Plan has been put together to pinpoint the communication channels that should be utilised to ensure all relevant parties are kept informed as the project develops.

Communications will be tailored to meet the needs of each stakeholder and will take into consideration the objectives for the scheme.

The key audiences for the Stakeholder Management and Engagement Plan strategy will be:

- Worcestershire County Council (Councillors/Staff)
- Worcestershire Local Enterprise Partnership
- Herefordshire and Worcestershire Chamber of Commerce/Federation of Small Businesses/Institute of Directors
- Worcester Business Improvement District
- Department for Transport
- Secretary of State for Transport
- Worcester City Council
- Wychavon District Council
- Malvern Hills District Council
- Local Councillors
- Parish and Town Councils
- Herefordshire Council
- The Marches Local Enterprise Partnership
- Highways England
- Environment Agency
- Developers
- Education establishments (e.g. sixth forms, University of Worcester)
- Local Members of Parliament
- Local residents
- Commuters
- Local businesses
- Local media and Trade Press organisations
- Road Haulage Association
- Sustrans and local cycling promotion groups
- Living Streets
- RoSPA
- Ramblers Association
- Campaign for Protection of Rural England
- Open Space Society
- Natural England
- Historic England
- Wildlife Trust
- Canals and Rivers Trust

- Bus/taxi Operators

7.8.2 Engagement undertaken to date

Key stakeholders have been engaged through a range of engagement activities, in particular as part of the development of the second, third and fourth Local Transport Plans (LTP2/3/4), the SWDP, the WTS and the Sustainable Travel Town (“Choose how you move”) research. These documents are publicly available on the WCC website. Stakeholders have also been engaged during the delivery of a number of major schemes.

A summary of the engagement/consultation exercises undertaken is provided below:

- Worcester Transport Strategy (including A4440 Worcester SLR Improvements), 2010. Over 1000 responses were received via workshops, exhibitions, web and focus groups;
- Local Transport Plan 3, 2011. 577 responses received;
- South Worcestershire Joint Core Strategy, 2007-2010. 6505 written responses, 8476 attendees at exhibitions, events and workshops;
- South Worcestershire Development Plan Preferred Options, 2011 to 2016. Total comments 12,939 from 3,286 Consultees;
- Department for Transport, Local MP's and key Stakeholders: Ongoing engagement;
- Local Transport Body Bid, May 2013;
- Land owners have been briefed with regard to the need for CPO and are being actively engaged;
- Public information exhibitions. One month commencing June 2013. Local community and interested parties could express their opinions and gain information about the scheme.
- Engagement with County, District and Parish Councilors, September 2014;
- Public engagement on full dualling of SLR undertaken as part of the SLR Dualling Phase 3;
- Public and key stakeholder engagement on major scheme delivery (Worcester Transport Strategy, Evesham Abbey Bridge and the Hoobrook Link Road);
- Local Transport Plan 4, 2017. 358 questionnaire responses and 130 written responses received;
- Public and key stakeholder engagement ahead of planning submission, June-Sept 2017;
- Southern Link Road Phase 4 Community Liaison Group established in accordance with planning condition.

A summary of responses from the public engagement that took place in the Summer 2017, can be found in Table 7.6. Main comments from statutory and key local stakeholders were:

- The increased use of different transport modes and improvements to paths and cycle routes.
- Equally important was to have historic and environmental research teams involved in the
- planning and completion of the Scheme to ensure important features are retained or enhanced.
- The benefits of reduced congestion and air pollution and increased employment potential.

Comments from local residents and users included:

- Would like to see a sympathetic design, with the design fitting into its setting
 - The new Hams Way Foot and Cycle Bridge has been designed to fit the local area while being aesthetically pleasing
- The concern regarding noise pollution was raised
 - The team have spoken directly the concerned party to resolve the issue.
- A request for lighting the NMU routes

- Lighting will be provided in these areas where appropriate (e.g. due allowance of bat routes).
- A number asked for increased availability and quality of public transport within the area.
- Views should be enhanced not reduced
 - Native trees will be planted along the embankments to help the Scheme blend into its environment
 - There will be improvements to the Ketch Viewpoint
- Comments regarding the foot/cycle way were to incorporate it into the design and create a good quality surface
 - This is being proposed
 - The existing footway will be upgraded to a footway/cycleway
- Flooding risk/worsening was mentioned
 - A detailed Flood Risk Assessment has been carried out for the Scheme and appropriate mitigation agreed with the Environment Agency
- Congestion, most comments regarding the improvements that the Scheme will produce and one with concerns that it may not improve the situation
 - A detailed traffic assessment has been carried out for the Scheme
- There was a concern for the overall funding enabling the Scheme to be completed
- A comment regarding the construction make up
 - This has been designed since the consultation
- Land ownership concern
 - Land owners are known, and negotiations are nearing completion.

More detail on the public information exhibitions can be found within the Planning Statement (October 2017) available on the Worcester County Council Web APAS website¹.

Table 7.6 Summary of responses from June 2017 public engagement

Response	Number of responses
Sympathetic Design	1
Noise Pollution	2
Lighting	1
Public Transport	3
Views	1
Cycle/Footway	2
Flooding	1
Congestion	3
Funding	2
Land Ownership	1
No Issue/Support	5

Engagement about the scheme continues via the Community Liaison Group (CLG) which is a tried and tested mechanism for engagement with local stakeholders that has been employed by the County Council on other major projects. The CLG is chaired by the Chairman of Worcestershire County Council's Planning and Regulatory Committee. Membership of the CLG includes one County Councillor from each of the three County Council electoral divisions that the scheme falls within, one District Councillor from each of the three District Wards, one Parish Councillor from each of the three Parish Councils and key members of the Project Team. The CLG adopted Terms of Reference at its inaugural meeting in September 2018. Its primary role is to ensure that local stakeholders are kept informed about progress with the scheme and to make them aware of forthcoming work that might be of particular interest to the local community. It also provides a

¹ <http://e-planning.worcestershire.gov.uk/swift/apas/run/WPHAPPDETAIL.DisplayUrl?theApnID=17/000036/REG3&backURL=Search Criteria > Search Results>

mechanism for stakeholders to ask questions or make comments via the CLG members in addition to the other channels such as the County Council's dedicated Major Projects email address which is promoted in a variety of places including the County Council's website.

Key Stakeholders Support

Appendix Q contains letters of support from:

- Joint MP letter to the Secretary of State for Transport
- Robin Walker MP
- Harriett Baldwin MP
- Nigel Huddleston MP
- Highways England
- Norton - Juxta – Kempsey Parish Council
- Worcestershire Royal Hospital NHS
- Worcestershire Regulatory Services
- Worcestershire LEP
- Marches LEP
- Herefordshire Council
- Worcester City Council
- Malvern Hills and Wychavon District Councils
- St Peter's Parish Council
- H&W Chamber of Commerce
- Wychavon District Council
- Heart of Worcestershire College

Business Support (in alphabetical order)

- Advised in Worcester
- Alimenti Food Sciences Ltd
- Automated Packaging Systems Ltd
- Bosch Thermotechnology Ltd
- BPI consumer Packaging
- Counterpoint Courses Ltd
- David Middler Brands
- Delta XML
- Deutscheparts
- Dominic Tunnell Opticians
- ECO₂ Solar, Electrical Innovation
- Embrace
- Fortis Living
- Gallery Candles
- Harris Lamb Property Consultant
- Individual Tailoring Ltd
- Industrial and Tractor Ltd
- Joy Global Eurasia
- Malvern Hills Science Park Ltd
- Natwest, Worcestershire Commercial Banking
- Malvern Instruments Ltd
- Microferm Ltd
- QinetiQ
- Quantum Construction Consultants Ltd
- Specsavers Opticians
- Sutcliffe and Co, Insurance Brokers
- Thursfields Solicitors
- "You", Friar Street
- Worcestershire Enterprise Limited

During the project development phase, consultation was undertaken with a number of key stakeholders. These include:

- Discussions with Statutory Undertakers (C3 Estimates) – National Grid (Nov 2016); Severn Trent Water (Dec 2016); CLH (Oil Pipeline) (Nov 2016); BT Openreach (Nov 2016);
- Discussions with Western Power Distribution regarding pylon relocation process – now relocated;
- Environment Agency Consultation regarding Flood Risk Assessment (mitigation approved);
- Environment Agency Consultation regarding Flood Modelling Assessments (mitigation approved);
- Place Partnerships ongoing liaison with main land owner for land affected by scheme and commoners;

- Meeting with WCC Development Control – Re Planning Application requirements in relation to Environmental scoping;
- As part of Environmental Assessment, meetings undertaken with Malvern Hills District Council; County Ecologist, County Archaeologist, Environment Agency, Worcestershire Regulatory Service, Historic England, Natural England, Worcester City Council, Worcestershire Wildlife Trust, the Severn River Trust, the Canals and Rivers Trust.

Further details on the above consultations has been reported within Appendix H – Environmental Assessment Report (Chapter 4).

7.9 Project reporting

For each phase, a Project Initiation Document (PID) is established by WCC and approved by the A4440 Worcester SLR Phase 4 Project Board. This is a ‘working document’ which defines:

- What the project intends to achieve;
- Who is responsible;
- How it will be achieved;
- When it will be delivered.

The PID includes a detailed project plan, which captures the ‘key tasks’ to be achieved prior to the project proceeding to the next stage.

The Project Board’s role is to ensure that the project is developed and managed in accordance with the PID and to provide oversight and advice to the Project Manager to enable progress in a timely fashion.

The Board typically meet every four weeks and its decisions are recorded and communicated to provide appropriate project governance for the project and its development. In advance of the Project Board, the Project Manager, submits a ‘highlight’ report monthly, detailing progress in accordance with the PID. The Project Board occasionally invite a wider audience to attend when deemed beneficial to the current stage of the project. Whilst these bodies will not have responsibility for the project, their attendance and participation is key to successful delivery.

In addition to Project Board, project progress and issues are reported to the Strategic Commissioner / Head of Major Projects and the Director of Economy & Infrastructure via monthly WCC Major Infrastructure Project Review Meetings. Other senior officers are kept abreast of the scheme via the monthly Delivery Programme Board that oversees the full programme of projects currently under delivery within the E&I Directorate. Information is further reported to the Cabinet Member with Responsibility through regular meetings with the Senior Responsible Officer.

From our wider team’s experience of working with DfT, we are aware that for previous large schemes funded by DfT, there is a requirement to complete Quarterly Monitoring Returns to demonstrate progress against key milestones and to record spend against budget. These returns are prepared by the Project Manager and submitted quarterly in line with DfT’s request. From time to time it may be appropriate for a verbal or face-to-face progress meeting with DfT. These will be arranged at a time of mutual convenience, with the Project Team travelling to London if required.

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7.10 Contract management

In line with the commercial case, 3-stage Early Contractor Involvement contracts (NEC3) have been agreed with the preferred supplier, Alun Griffiths. The contracts are staged as follows, with opportunities and options to break or proceed at each stage:

- Stage 1a - Design development and consultation up to planning submission (completed);

- Stage 1b – Statutory processing to prepare scheme for delivery (in progress); and
- Stage 2 – Detailed Design and Construction (Awaiting Final Approval of Full Business Case).

Since the outset of advertising and preparing the 3-stage contract, the project delivery team has been involved in development of the contracts and this has continued throughout the project life as each stage is prepared and executed. The contract management arrangements are outlined in the organograms presented in Figures 7.1 and 7.2.

7.11 Risk management strategy

The accurate evaluation and pro-active mitigation of risk is critical to the success of the project. To ensure that all risks were captured a Quantified Risk Assessment has been undertaken and updated for the scheme. Relevant owners have been allocated for each risk and progress on the management of the key risks is discussed at each Project Board meeting. A copy of the A4440 Worcester SLR Phase 4 Quantified Risk Assessment is included in Appendix P.

The risk register logs the full spectrum of potential risks to the planning and delivery of the scheme.

The risk register ranks each individual risk according to its likely impact and probability of occurring. The management strategy then looks to avoid or reduce the risk. In many cases additional technical work or surveys, or early discussions with partners have already been undertaken in order to reduce or mitigate the risk.

Risk management is embedded into the project delivery. The risk register will continue to be reviewed on a regular basis. Delivery and contractor teams will be responsible for managing their risks and reporting any newly identified risks to the Project Manager. Risks escalated to Medium or High which could impact on the progress or financial position of the project will be referred by the Project Manager to the Project Board.

A Quantitative Risk Assessment (QRA) was undertaken for the A4440 Worcester SLR Phase 4 scheme. The main purpose of QRA is to support the scheme costing by predicting the level of risk contribution, having a defined level of confidence, to cover the construction of the scheme.

For the risk model of this project the following were used as inputs:

- Baseline capital expenditure figures – estimated cost of £62m;
- Risk register – developed by group consensus at various workshops;
- Quantifications of the risks – Cost Impact Estimates and Probability/Likelihood.

The Quantified Risk Assessment process estimated the risk value to be £9,354m (pre-inflation). This was subsequently validated by an @Risk analysis which produced a $P_{(MEAN)}$ value of £9.312m. The top ten risks are shown in Table 7.7.

Table 7.7: Top Ten Risks

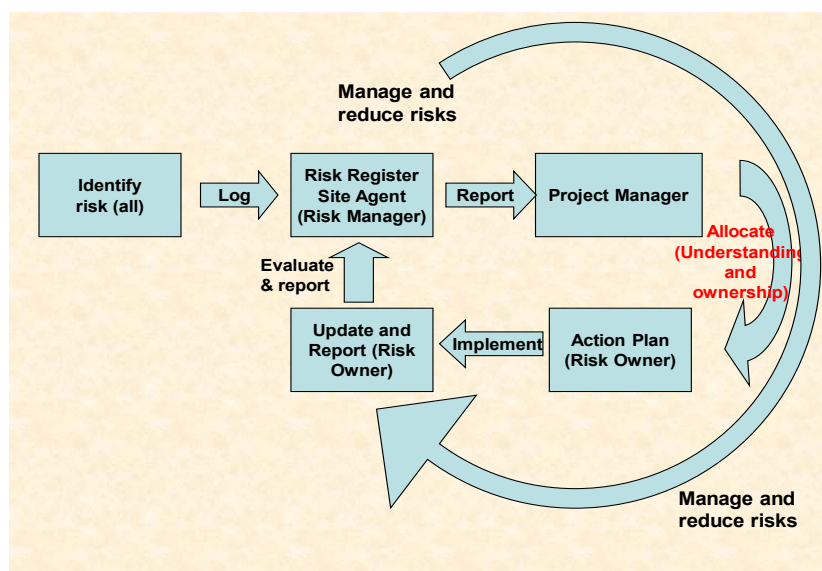
Rank	Risk Ref	Description
1	Risk 025	Scheme costs greater than allocated in Stage 2 Target Price and Proposed Evaluation Events.
2	Risk 065	Resurfacing of existing carriageway (A4440 Temeside Way) with Low-noise surfacing to meet planning condition more costly than anticipated.
3	Risk 028	Slippage of programme so that spending profile not achieved with consequential impact on budget (e.g. inflation) and reputation
4	Risk 052	Major flooding occurs during construction phase, resulting in access restrictions to the site, major impact on programme
5	Risk 037	Adverse Ground conditions affecting scheme costs post GI

6	Risk 026	Scheme cost inflation uncertainty leading to higher than expected out-turn costs resulting in inadequate budget available.
7	Risk 024	Construction costs realised from Risk 003 (Project Sponsor/key stakeholder key decisions affect programme delivery (e.g. amendments to scheme scope).
8	Risk 054	Potential impact from BREXIT leading to increase in material prices/ability to agree costs with sub-contractors/delay to material delivery.
9	Risk 055	Risk of potential adjustment to scope to future proof A4440 Hams Way approach to Powick RB for potential future dualling increasing scheme costs
10	Risk 042	Underestimation of costs associated with the works related with the STW syphon on A38 South and cost to develop design (in additional to generic contingency for SU overspend)

The Council has an overall framework for managing risk. Primary responsibility for managing risk on a day-to-day basis rests with those operational/strategic/project managers who are closest to the service/project and responsible for its delivery. In projects and other specific areas of work, risk registers identifying key risks and mitigating actions are used as a record and tool for monitoring this work. At Head of Service and Directorate level there are aggregated risk registers which identify the top risks at that level, and the actions in place to address these risks. From these is drawn a Corporate level Risk Register which identifies the top risks for the Council and actions in place. These top level risk registers are reviewed on a quarterly basis, and a report on the Corporate Risk Register is taken to Cabinet and the Audit and Governance Committee twice a year.

The contractors, Alun Griffiths, have their own risk management policy which is outlined below. The objective of this policy is to 'ensure that all parties are aware of the potential risks in the project and that sufficient mitigation measures are in place to reduce the impact of any risk.'² As part of this risk management policy, the Site Agent will help to identify and manage project specific risks and arrange a risk control register, as well as holding regular reviews, reviewing objectives against mitigation measures and reporting to the monthly Progress Meeting. Figure 7.6 shows an overview of this Risk Management process.

Figure 7.6 Summary of Alun Griffiths Risk Management Strategy Process



The overall approach to the risk strategy will be discussed between the Site Agent, Project Manager and Designers before works commence. A register will be used to manage all risks, which will be available to all parties to input into, amend and assesses throughout the project. The Site Agent and a Quantity Surveyor will record and manage the risk ownership, mitigation measures and any residual risk. Opportunities will also be recorded in the register.

² Alun Griffiths Risk Management Policy

Mitigation measures will aim to reduce the reduce categorisation of a risk from High to Low based on the matrix in Figure 7.7.

Figure 7.7 Alun Griffiths (Contractors) Ltd Risk Assessment Matrix

	Very unlikely	Possible	Probable	Almost Certain	
	1	2	3	4	5
5	Yellow	Yellow	Red	Red	Red
4	Yellow	Yellow	Yellow	Red	Red
3	Green	Yellow	Yellow	Yellow	Red
2	Green	Green	Yellow	Yellow	Yellow
1	Green	Green	Green	Yellow	Yellow

The risk register is reviewed each fortnight and is a 'live' document, which can be checked at any time by relevant staff. This is to ensure that final out turn cost/value can be predicted and management action triggered at any time should trends become adverse.

The Site Agent will be responsible for reporting progress to the Project Manager at agreed intervals. Other site staff will also be involved in this process so that all parties are aware of new risks that arise and that existing risks are being managed effectively. Where necessary joint action can be taken in order to mitigate risks.

Overall, the process of managing project risk will be overseen and managed by WCC and the risk management approach implemented by Alun Griffiths will be embedded within the council's own risk management policies.

The contractor and their design partners have been actively engaged in this project for 18 months therefore implementation stage risks are not reported separately but rather the QRA has been developed based on a collaborative approach to create a combined comprehensive risk register refined over a series of Risk Workshops as the design developed and risks and potential mitigations became better understood.

7.12 Evaluation and Monitoring Plan

The A4440 Worcester SLR Phase 4 Monitoring and Evaluation Plan, has been prepared to show how the impacts of the scheme deliver the desired benefits and overarching objectives. It incorporates the scale and type of the scheme plus the resources available. Appendix R contains the Monitoring and Evaluation document.

A monitoring plan has been developed to provide details about whether the project is on time and to budget, whether the predicted benefits were achieved and what lessons could be learnt for future WCC transport strategies.

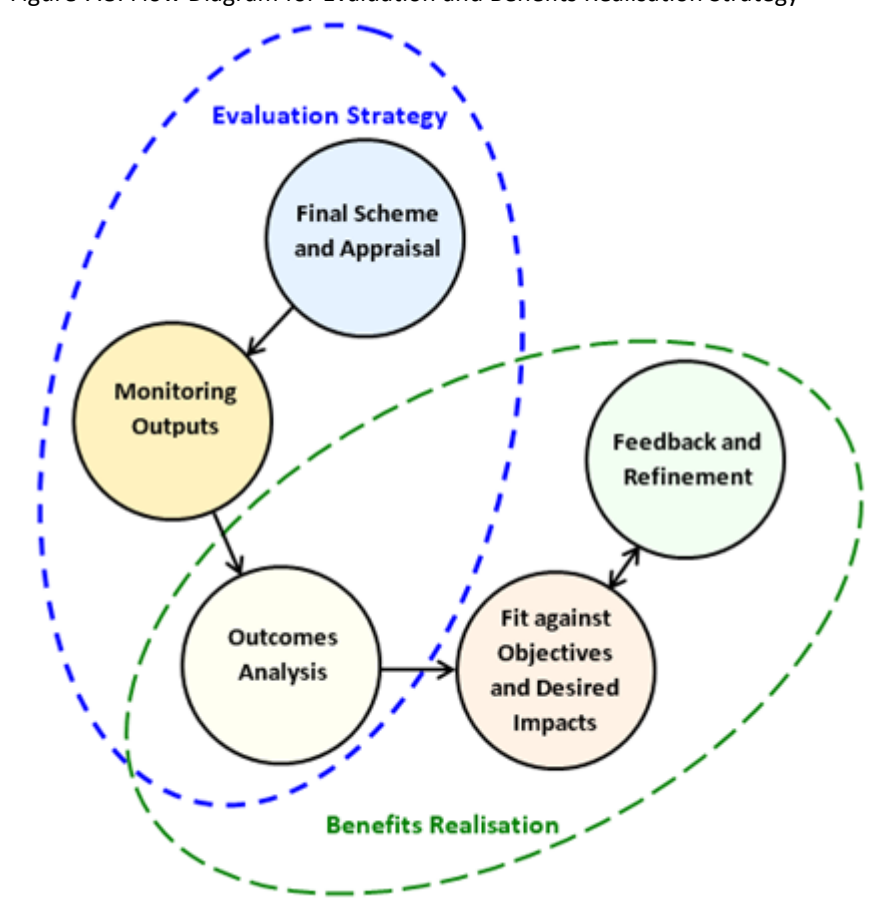
7.13 Benefits Realisation Strategy

The proposed Benefits Realisation approach is designed to assess whether the outputs and impacts of the scheme deliver the desired benefits and overarching objectives. The approach reflects the scale and type of scheme, plus the resources available to complete an evaluation providing a strong evidence base to feed into the benefits realisation assessment.

The approach to assessing scheme outcomes and benefits realisation is defined in terms of the following stages, as shown in Figure 7.8.

- Outputs – defined in the Evaluation Monitoring Plan (labelled M1 to M7);
- Outcomes – defined in the Evaluation outcomes (labelled O1 to O6) and feeding into the Benefits Realisation; and
- Desired Impacts – as defined in the Business Case submission (labelled D1 to D6), to match to actual impacts and to check strategy fit, feedback and refinement to ensure lasting and long term realisation of benefits.

Figure 7.8: Flow Diagram for Evaluation and Benefits Realisation Strategy



Appendix R lists the data collation and collection will be required to provide inputs to the data monitoring outputs, in the format as specified in the September 2012 monitoring guidance. The areas of data collection are as below:

- M1: Traffic Flows
- M2: Junction Operation
- M3: Journey Time Data
- M4: Stakeholder Feedback
- M5: Development Applications
- M6: Accident Data
- M7: Environmental monitoring data

7.13.1.1 Monitoring Outputs and Desired Outcomes

The Outcome Analysis (defined as O1 to O6) to be derived from the data collated and collected as part of the monitoring exercise is summarised below. These outcomes are the main benefits derived in the Business Case:

- O1 - Travel Time Savings – Are there changes to car journey times, including peak and off-peak times and variation in travel times, as a result of the Phase 4 SLR scheme? Comparison will be made between data collected post scheme opening and the predicted outcome stated in the Full Business Case.
- O2 - Traffic Flow – Are there changes to traffic flow on key corridors and SLR as a result of the Phase 4 SLR scheme? - On the key corridors and SLR route traffic count data will be collected, and compared to general traffic growth in Worcester. This will include data collected, as part of standard monitoring, on radial routes not impacted by the scheme to establish levels of traffic growth and act as control sites.
- O3 – Improved Performance – Are there changes to journey time reliability and delay as a result of the Phase 4 SLR scheme? - Journey time reliability and delay (queue length) data will be used to compare to the predicted outcome stated in the Full Business Case.
- O4 – Access to Strategic Network – Is there better access to the Strategic Road Network as a result of the Phase 4 SLR scheme? - Feedback from stakeholders and the attractiveness of neighbouring development will be established to assess how the improvement has improved access to the strategic road network.
- O5 – Access to Key Hubs – Is there better access to Key hubs as a result of the Phase 4 SLR scheme? - Stakeholder feedback and statistics on changes in local employment, retail and office occupancy that link to the wider impacts of the scheme and the local economy will be used.
- O6 – Contribute to Environmental Objectives – Have environmental objectives been met as part of the Phase 4 SLR scheme? - Data collected as standard monitoring consider changes to traffic flows in the City centre will be used.

Table 7.8 shows how the different data monitoring outputs (M1 to M7) will be used to feed the outcome analysis (O1 to O6).

Table 7.8: Mapping of Monitoring Outputs and Outcomes Analysis (showing primary links only)

Monitoring Outputs (M) by Outcome Analysis (O)	O1 – Travel Time Savings	O2 – Traffic Flow	O3 – Improved reliability performance	O4 – Access to Strategic Network	O5 – Access to Key Hubs	O6 – Contribute to Environmental Objectives
M1: Traffic Flows						
M2: Junction Operation						
M3: Journey Times						
M4: Stakeholder Feedback						
M5: Developer Applications						
M6: STATS19 Accidents Data						
M7: Environmental monitoring data						

Table 7.9 shows the linkage between Outcome Analysis (O1 to O6) and the Desired Outcomes (D1 to D15), so completing the loop of the outputs, outcomes and impacts. The loop is iterative and the approach to the monitoring process and analysis allows for refinement to optimise benefits, assess all impacts and ensure the full benefits of the package are realised.

Given the benefits may be limited at 1 year after full package opening, the assessment of outcomes will look at the longer term benefits impacts and any minor remedial measures required to ensure the benefits of the package remain captured over a longer period of time. Such measures may include linkages to other proposed transport schemes and policies for the Worcester area.

Table 7.9: Mapping of Desired Impacts and Outcome Analysis (showing primary links only)

Outcome Analysis (O) by Desired Impacts (D)	Outcome Analysis (O) by Desired Impacts (D)					
	O1 – Travel Time Savings	O2 – Traffic Flow	O3 – Improved reliability	O4 – Access to Strategic Network	O5 – Access to Key Hubs	O6 – Contribute to Environmental
D1: Provide transport improvements which make a positive contribution to local air quality, road safety, accessibility and traffic congestion						
D2: Reduce current congestion issues at the Powick, Ketch, Norton and Whittington Roundabouts						
D3: Improve the resilience of the transport network to extreme weather events and unforeseen disruptions						
D4: Supporting the delivery of the planned growth set out in SWDP up to 2030 and some capacity for post 2030 growth						
D5: Improve the performance and attractiveness to users of the A4440 Worcester SLR as a bypass for Worcester City centre, thereby helping to better manage traffic conditions in the constrained central area						
D6: Improve access to the Strategic Road Network from areas to the west and north west of Worcester, including Malvern Hills District, Herefordshire and parts of the Welsh Marches						
D7: To reduce transport-related emissions of carbon dioxide and other greenhouse gases in Worcester City centre						

7.14 Contingency Plan: Common Land De-Registration

The period for representation for the Section 16 application to deregister the land between Ketch and Powick roundabouts (dualling section of the scheme) has ended and it has been confirmed that there is no need for a Public Inquiry. The period for objections/representations for the Section 16 application for changes to the Common Land to the West of Powick Roundabout is due to conclude shortly and although it is not anticipated that there will be a significant delay to completion of the process, to mitigate any potential for delay, we have reviewed the programme and looked at ways to maintain the programme on sections 2 to 6 (outlined below) without a major delay to the overall delivery of the Scheme. The scheme contingency plan is as follows.

Firstly, the Scheme has been split into 6 sections, working from West to East;

- Section 1 – Powick roundabout, including the Hams Way footbridge
- Section 2 – Powick roundabout to Powick common viaduct
- Section 3 – Powick common viaduct
- Section 4 – Powick common viaduct to Carrington Bridge
- Section 5 – Carrington Bridge
- Section 6 – Ketch roundabout

The current programme shows access to all sections in Spring 2019, with works planned to be completed in Spring 2021. This requires all land negotiations to be completed and the common land to be registered with the change of designation.

For sections 2 to 6 the deadline for representation for the Section 16 application has passed with no Objections and the Planning Inspectorate has confirmed that no Public Inquiry is required.

The process of registering the common land is well underway with the Planning Inspectorate, and we are hopeful to have the issue closed without delay to the project. This would mean that we could carry out site clearance in April 2019 and commence the construction of the foundations in July 2019. The main bridge structure and ramps would then be erected in January 2020.

For Section 1 (west of Powick Roundabout), the S16 application was slightly delayed due to the need to first update the Commons Register to reflect changes from an historical scheme. If there is any delay with the access to section 1, we have looked at scenarios A & B;

- A. Maximum 6 months delay in entering section 1
- B. Over 6 months delay in entering section 1

7.14.1.1 Scenario A – maximum 6 months delay in entering section 1

As this activity in Section 1 (construction of the proposed foot/cycle bridge) isn't critical we have sufficient float in the programme to delay the foundation operations for up to 6 months without causing a delay to the overall scheme. This would allow sufficient time to conclude the registration and progress the construction in line with minimal disruption.

7.14.1.2 Scenario B – over 6 months delay in entering section 1

This scenario is unlikely due to the progress with the Planning Inspectorate, but if we were delayed then we would instigate scenario A up to 6 months, and then start to review the mitigation. Methods of mitigation could include;

- Increase to the construction programme beyond the current end date of Spring 2021 although this would not affect the main dualling of the scheme which would open as planned.
- Provision of a temporary crossing point on the Hams Way link
- Site clearance outside of preferred season.

7.15 Summary of management case

The Management Case demonstrates that WCC has the necessary resources and proven expertise to deliver the A4440 Worcester SLR Phase 4 scheme in accordance with the programme and budget. It shows that the necessary consultation and engagement are being planned. It also shows that WCC has the necessary processes to ensure that decisions are made at the appropriate level and ensure that agreed assurance procedures are followed.

The case shows that WCC has considered the risks, the need for contingency planning, monitoring and evaluation of the scheme.

In summary:

- The Council has a proven track record in the delivery of major transport schemes and has the resource, capability and processes required to deliver A4440 Worcester SLR Phase 4 successfully, to time and budget;
- The project benefits from a strong governance structure and framework;
- There is a robust and effective Risk Management plan which is strengthened by inputs from the contractor;
- There is considerable support from local businesses for the A4440 Worcester SLR scheme for the scheme;
- Significant consultation has been undertaken as part of the development of the project;
- There is a plan in place to ensure benefits set out in the economic case are realised; and
- The latest Gateway Review found that "The project is well run and under control" and "The project should deliver the majority of the benefits sought".