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Subject	**Kepax Bridge Demand and Economics** **Annex 3 to SOBC**
Attention	Worcestershire County Council
From	Victoria Edge
Date	September 2019
Copies to	Worcestershire County Council

1 Introduction

Worcestershire County Council (WCC) is working in partnership with Worcester City Council in the delivery of a new pedestrian and cycle bridge across the River Severn in Worcester from Gheluvelt Park to the Kepax site in St Johns. Improvements to the existing adjoining walking and cycling network will connect residents to leisure, employment and education opportunities via the new bridge and will reduce severance across the river.

A step change in the levels of walking and cycling in north Worcester will be facilitated and opportunities for riverside leisure walks and access to a Green Flag Park will be enhanced. The increased leisure and tourism opportunities will increase visitor spending in the area and increase the number of jobs offered in this sector.

Provision of the bridge and improvement of wider links is hereafter referred to as the scheme.

This note presents the methodology and assumptions that have been adopted to assess the potential demand and economic impacts of Kepax Bridge in Worcester, and wider improvements to pedestrian and cycle links. Through desk-top based analysis and use of Diglis Bridge demand as a benchmark, the economic impacts associated with the scheme will be captured through the following indicators; active mode related impacts and other wider benefits.

The note sets out the following:

- Section 1 – Introduction: This section outlines the purpose and structure of this document.
- Section 2 – The Scheme: This section gives a summary of the scheme, including estimated costs.
- Section 3 – Diglis Demand: Diglis Bridge in the south of Worcester has been used as a benchmark for the scheme.
- Section 4 – Modelling Approach: As part of the proposals, there will be an increase in individuals walking and cycling. This section presents the monetary health benefits associated with an increase in active modes.
- Section 5 – Value for Money Statement: Presenting the BCR for the scheme.

- Section 6 – Wider Economic Impacts: As a result of the scheme, various economic benefits such as increased expenditure, leisure jobs and GVA will materialise. These impacts and their derivations are presented in this chapter.

- Section 7 – Summary of the results.

- Appendix 1 – Sensitivity test: Presents the demand and economics in relation to provision of the bridge and access path only, with no wider improvements to create a riverside loop. Census journey to work information, leisure and education trips have been considered.

2 The Scheme

Kepax Bridge will be provided between Gheluvelt Park on the east side of the river, and the Kepax site to the west of the river. The scheme comprises of a number of improvements to the wider cycling and pedestrian network to connect residents to employment, education and leisure opportunities. The wider improvements will also provide a riverside loop in the north of Worcester.

These improvements include the following:

- A new access path provided over the Kepax site, linking the new bridge to Hallow Road (West Route 3).
- Improve the existing Severn Way path to the south of the bridge location to where it meets the existing paved section by the A443 link (West Route 1).
- Improvements to a route to the east of the river from Gheluvlet Park to the City Centre (East Route 1).
- Providing pedestrian/cycle links from the bridge to NCN45 (East Route 2a.)

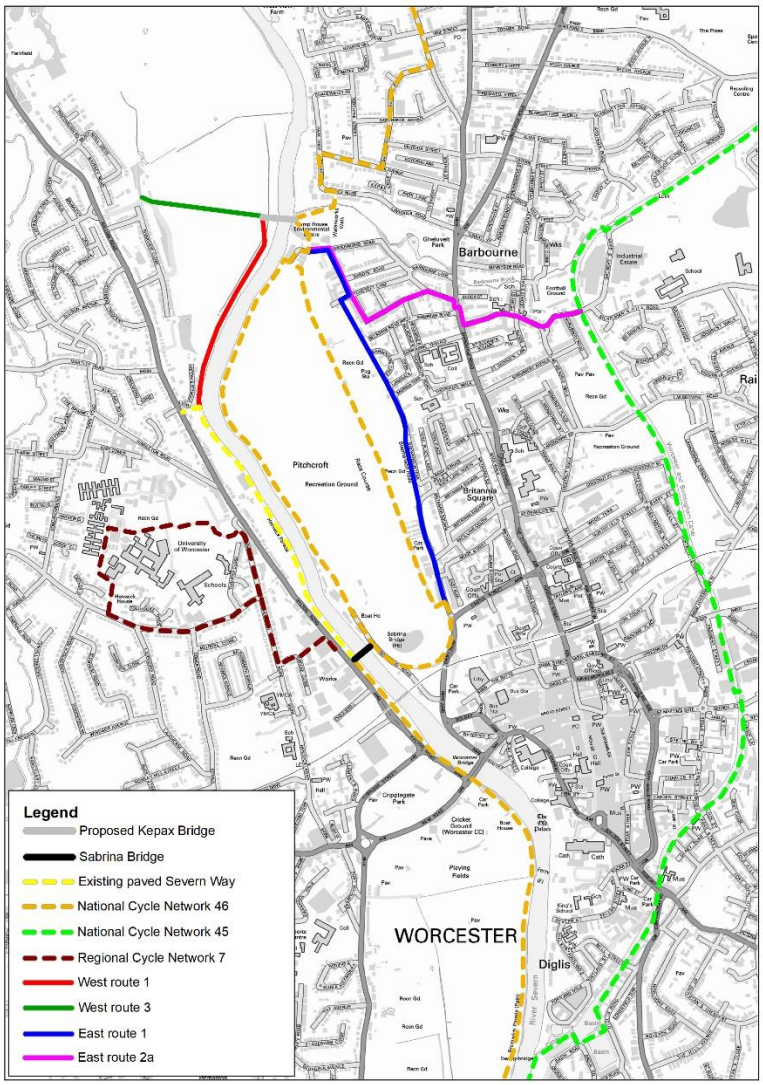

Figure 2.1: Proposed scheme

2.1 LTP4

The LTP4 for Worcestershire covers the period 2018 to 2030 and sets out the issues and priorities for investment in transport infrastructure, technology and services to support travel by all relevant modes of transport.

Strategic Transport Schemes include 'Active Travel Corridors' which involve systemic investment in walking and cycling links along corridors to create a safe, comprehensive, integrated network linking residential areas with key trip attractors.

In South Worcestershire, Strategic Active Travel Corridor Schemes that require Kepax Bridge include:

- SWAT12 - Worcester North East - North West Active Travel Corridor (Lower Broadheath to Worcester Six, via new river bridge); and
- SWAT13 - Worcester River Severn Active Travel Corridor (Sabrina Bridge to Kepax).

The location of Kepax Bridge is presented in LTP4 in relation to the other Strategic Active Travel Corridor Schemes in South Worcestershire.

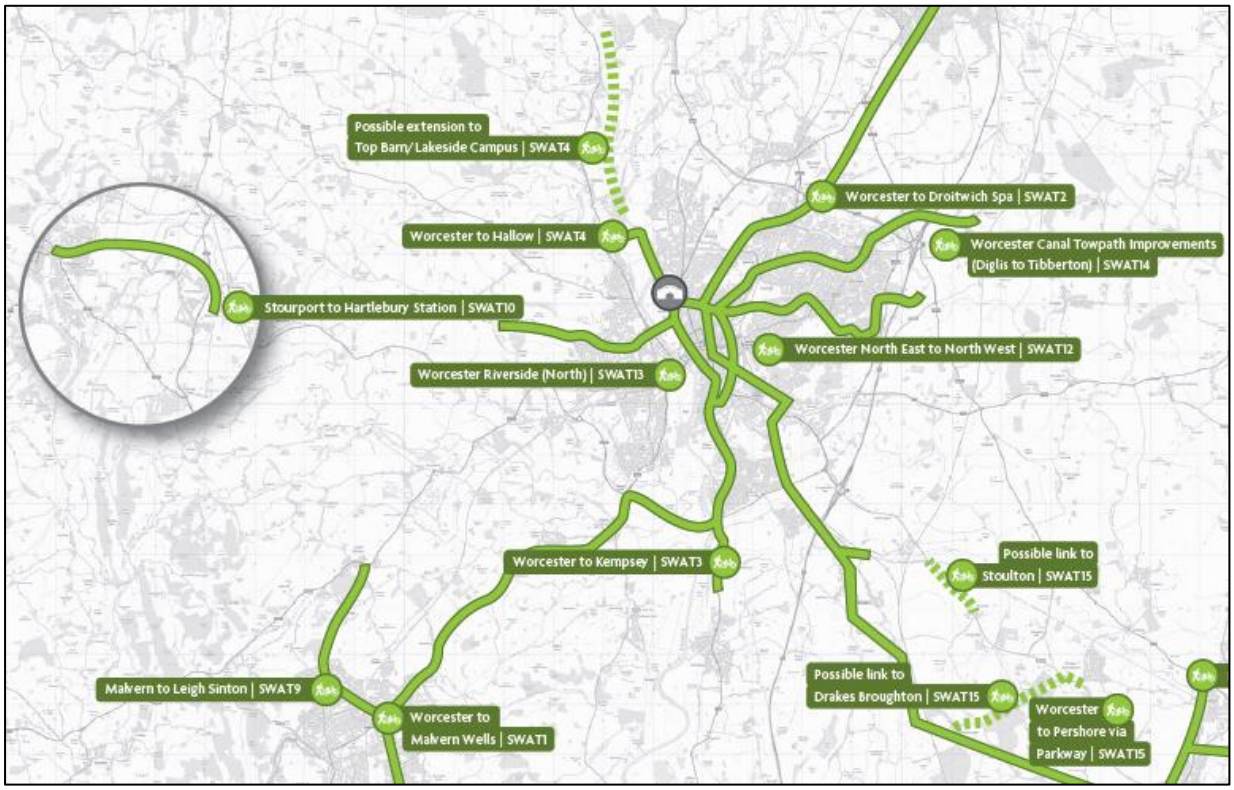

Figure 2.2: Extract from LTP4 (page 44)

2.2 Costs

2.2.1 Construction Costs

Costs of the bridge construction have been developed and are presented below. The costings are based on previous/similar schemes of the same construction and of similar span. The costs are subject to the results of any further investigations required. They are based on desk-based research and more detailed assessment is required to confirm these figures.

Any text on costs for wider links here.

	Cost
Preparation	£296,938
Design	£477,376
Bridge construction	£5,945,495
Access path cost[1]	£569,595
Wider improvements[2]	£1,490,627
Total	**£8,780,031**

Table 2-1: Estimated Costs (2019 prices)

The access path is a path over the Kepax site directly linking the bridge to the local residential area. Wider improvements include improvements to the Severn Way on the west of the river to create a riverside loop and connections to the canal network, NCN45 and NCN46 to the east. Refer to Figure 2.1 for more information.

The costs in Table 2.1 do not include optimum bias. This is applied within the Economic Assessment only.

2.2.2 Maintenance costs

The annual maintenance budget for the structure will depend on the ultimate chosen design of the structure. Potential costs associated with a cable stayed bridge have been included within the economic assessment and are presented in the table below:

Maintenance	Estimated Cost	Frequency	Notes
Principal Inspection	£15,000	6 years	Roped Access Inspection required
General Inspection	£1,000	2 years	
Graffiti Removal	£500	Yearly	Gang to attend site multiple times a year
Steelwork Painting	£400,000	30 years	Dependant on Bridge Type, potentially to have higher painting costs due to larger surface area. Specialist Access Team required, dependant on design substantial scaffolding may be required.

Table 2-2: Estimated Maintenance Costs (2019 prices)

[1] Presented as West Route 3 in Figure 2.1

[2] Includes West Route 1, East Route 1 and East Route 2a in Figure 2.1

3 Diglis Demand

3.1 Diglis as a Benchmark

Diglis Bridge opened in July 2010, having cost £1.8 million to construct[3], (reportedly £3.5 million in total). It is a shared use bridge over the River Severn in Worcester, built to increase connectivity for pedestrians and cycle users in the south of Worcester. It creates a circular cycle path between Worcester's main Sabrina Bridge and the Diglis Locks.

In order to determine demand for the scheme, and economic benefits which may be realised, Diglis Bridge has been used as a benchmark. Diglis Bridge is approximately two kilometres south of Worcester City Centre; Kepax Bridge will be a similar distance from the city centre, but to the north.

Diglis Bridge was developed as part of a wider Sustrans Connect2 programme, funded through the BIG Lottery. Provision of a the Kepax scheme, including a new bridge and improvements to wider links will extend the traffic-free network in the north of the city, linking to employment, leisure and education. Additionally, wider improvements will link to the National and Regional Cycle Networks across the city radiating from Kepax Bridge, and will include including new surfacing, improved crossings, lighting and signing.

3.2 Diglis Bridge Demand

Sustrans was responsible for surveying the area and making demand estimations pre-construction and monitoring post-construction. In 2012 Sustrans released a Route User Intercept Survey which gave the levels of demand in 2009 and 2011. Also, the council performed a pedestrian count during 2018. The pedestrian counts in 2018 provided by the council are based on an average daily demand for each month. The demand figures are summarised in the table below.

Year	Daily average pedestrian	Daily average cyclists	Annual pedestrian	Annual cycle
2018	887	170	323,937	61,692
2011	795	387	290,470	141,397
Average (2011 – 2018)	*841*	*279*	*306,965*	*101,835*
2009 (initial forecast)	56	27	20,696	10,091

Table 3-1: Demand for Diglis Bridge (source: Route Intercept Survey Report – Connect2, 2012)

The reason for the decrease in daily average cyclists between 2011 and 2018 is not known, and therefore an average of the two figures is used for the economic assessment.

Users of Diglis Bridge were interviewed during four 12-hour survey periods (month of October); a school-holiday weekday, a school-holiday weekend day, a term-time weekday and a term-time weekend day. The total number of route users counted over the four-day survey period was 708 with 87 people interviewed in 2009 and 3,051 with 159 people interviewed in 2011.

The trip purpose split derived from the 2011 interception survey is shown in the following table:

Trip purpose	Percentage (2011)
Commuting	13.30%
Education	0.00%

[3] https://www.gov.uk/government/case-studies/new-cyclist-and-pedestrian-bridge-diglis-bridge-worcester

Shopping	8.20%
Personal Business	0.30%
Leisure	70.50%
Other	7.70%

Table 3-2: Trip purpose of users of Diglis Bridge

4 Modelling Approach

The scheme has been assessed as a single package of investment using the DfT's Active Mode Appraisal Toolkit, 2019. The DfTs Active Mode Appraisal Toolkit covers a range of economic, environmental and social impacts. These are summarised in the table below.

Impact	Benefit Estimated
Physical Activity	Yes
Absenteeism	Yes
Accident benefits	Yes
Environmental benefits	Partially included. As study area is defined as 'Other Urban', WebTAG does not allow air quality benefits to be included.
Decongestion and indirect tax	Yes
Journey quality	Yes – WebTAG Data Book values used to define impact on journey quality (Unit A 4.1.6 for cyclists and A 4.1.7 for pedestrians.

Table 4-1: Impacts Assessed for active mode components of the Kepax Bridge scheme

4.1 Key Assumptions

4.1.1 Journey Quality Assumptions

WebTAG Data Book Unit A 4.1.6 has been used to assess the value of journey quality impacts to cyclists. The value for 'off-road segregated cycle lane' has been used as a benchmark for the journey quality impact as the bridge and riverside loop will be off road. This is valued at 7.03 pence per minute, as shown in Table 5.1.

Table 4.1.6: Value of journey ambience benefit of cycle facilities relative to no facilities (2010 prices & 2010 values)		
Scheme type	**Value p/min**	**Source**
Off-road segregated cycle track	7.03	Hopkinson & Wardman (1996)
On-road segregated cycle lane	2.99	Hopkinson & Wardman (1996)
On-road non-segregated cycle lane	2.97	Wardman *et al.* (1997)
Wider lane	1.81	Hopkinson & Wardman (1996)
Shared bus lane	0.77	Hopkinson & Wardman (1996)
	pence	
Secure cycle parking facilities	98.14	Wardman *et al.* (2007)
Changing and shower facilities	20.82	Wardman *et al.* (2007)

Table 4-2: WebTAG Unit A 4.1.6

For pedestrians, WebTAG Data Book Unit A 4.1.7 has been used to assess the value of journey quality impacts. The scheme includes a new river crossing, upgraded segregated paths, dropped kerbs and new bridges. Therefore, the values for 'street lighting', 'kerb level', 'crowding', 'pavement evenness' and 'directional signage' have been added together to give a journey quality value of 9.6 pence per kilometre for pedestrians.

Table 4.1.7: Values of aspects in pedestrian environment (2010 values and 2010 prices)		
Scheme type	**Value p/km**	**Source**
Street lighting	3.7	Heuman (2005)
Kerb level	2.6	Heuman (2005)
Crowding	1.9	Heuman (2005)
Pavement evenness	0.9	Heuman (2005)
Information panels	0.9	Heuman (2005)
Benches	0.5	Heuman (2005)
Directional signage	0.5	Heuman (2005)

Table 4-3: WebTAG Unit A 4.1.7

4.2 Active Mode Toolkit Assumptions

In January 2012, Connect2 produced a Route User Intercept Survey Report as part of the Diglis Bridge scheme. Later on, in 2018 another survey was undertaken to estimate the monthly pedestrian and cycle demand. The Active Mode Toolkit assumptions are largely based these demand figures.

The key assumptions adopted for this assessment are listed in Table 4.4 below. It is also worth noting that a range of benchmark values are built into the DfT's Active Mode Appraisal Toolkit to facilitate the estimation of benefits by different impact categories. These DfT assumptions are visible in the Toolkit.

Table 4.4 outlines a full list of assumptions made for input into the Active Mode Toolkit.

	Modelling criteria	**Value**	**Commentary**
Scheme Details	Opening year	2020	Delivery of the scheme can commence in 2020.
	Last year of initial funding	2021	Assumed the scheme delivery (wider links) will be completed by end of 2021.
	Type of area scheme is located	Other urban	As defined in Table A2 of TAG Unit A5.4: Marginal External Costs.
	Decay rate	10%	Scheme benefits assumed to gradually erode over the appraisal period of 20 years, consistent with the central case example outlined in Table B1 of TAG Unit A5.1: Active Mode Appraisal
	Appraisal period	20 years	Strategic interventions which will achieve long term impacts to walking and cycling. The worked example in the Active Mode TAG Unit taken as the central case.
Do Nothing Scenario	Estimated number of cycle journeys (per day)	27	Based on data from Diglis Bridge, which is used as a benchmark[4]. The nearest bridge to cross the river is currently Sabrina, located 1 mile south of the Kepax site.

[4] *Source: Pedestrian and Cyclist Survey 2018, Worcester City Council*

			Severn Way south of the bridge crossing currently substandard for pedestrians and cyclists. Other routes for improvement are not well maintained or adequately lit. Therefore, the number of baseline cycle journeys is expected to be low.
	Average. cycle journey length (km)	7 km	Based on a circular route around the River Severn, from Diglis Bridge to Kepax Bridge. As a point of reference, the average length of a cycle ride in the National Travel Survey (West Midlands, 2018, Table NTS9910) is 5.6 km.
	Ave. cycle speed (kph)	15	The Analysis for Cycling Potential: Policy Analysis Research Report states average cycle speed is approximately 15 kph.
	Estimated number of pedestrian journeys (per day)	56	Based on data from Diglis Bridge, which is used as a benchmark[5]. The nearest bridge to cross the river is currently Sabrina, located 1 mile south of the Kepax site. Severn Way south of the bridge crossing currently substandard for pedestrians and cyclists. Other routes for improvement are not well maintained or adequately lit. Therefore, the number of baseline cycle journeys is expected to be low.
	Ave. walk journey length	4 km	Based on a circular route around the River Severn, from the City Centre to Kepax Bridge. As a point of reference, the average length of a walk in the National Travel Survey (West Midlands, 2018, Table NTS9910) is 1 km, or 5.6 km for 'walks over a mile'.
	Ave. walk speed (kph)	5 kph	The British Heart Foundation reports that the average walking pace is 5 kph.
	Estimate for the number of return journeys	100%	Assumption from illustrative case study in WebTAG.
Do Something Scenario	Estimated number of cycle journeys (per day)	279	Based on data from Diglis Bridge (average use of bridge in 2011 and 2018), which is used as a benchmark[3]. Kepax and Diglis bridges are comparable due to their distance from the city centre, the nature of the sites and the opportunities for a leisure

[5] *Source: Pedestrian and Cyclist Survey 2018, Worcester City Council*

			riverside 'loop'.
	Estimated number of pedestrian journeys (per day)	841	Based on data from Diglis Bridge (average use of bridge in 2011 and 2018), which is used as a benchmark[6]. Kepax and Diglis bridges are comparable due to their distance from the city centre, the nature of the sites and the opportunities for a leisure riverside 'loop'.
Decongestion Benefit	Proportion of cyclists attracted from car	50%	Census data from the 'north Worcester' area suggests that a significant proportion (around 75%) of travel to work journeys are undertaken by car. WCC believe this accentuates congestion within the city. Leisure users are unlikely to be abstracted from car, however. As such it is assumed that around a third of pedestrians will be abstracted from car.
	Proportion of pedestrians attracted from car	50%	Census data from the 'north Worcester' area suggests that a significant proportion (around 75%) of travel to work journeys are undertaken by car. WCC believe this accentuates congestion within the city. Leisure users are unlikely to be abstracted from car, however. As such it is assumed that around a third of pedestrians will be abstracted from car.
Additional information	Background growth	2%	Assumed that due to the improvements to cycling and pedestrian provision in Worcester, generally (NPIF, Active Travel Corridors, PTP etc) there will be some background growth.
	Period of growth	20 years	Assumed that use will continue to grow over the 20-year appraisal period.
	Number of days in analysis period	365 days	Assumed journeys will be undertaken each day of the year as the trip purpose is predominantly leisure.
	Proportion using the scheme to commute	40%	70% of trips across Diglis Bridge were reported to be leisure trips. Likely to be commuting trips using the wider improvements, such as crossing Barbourne Road to access employment in the east or travelling south along the riverside to the city centre.

Table 4-4: Key Assumptions (Commuters only)

[6] *Source: Pedestrian and Cyclist Survey 2018, Worcester City Council*

5 Value for Money Statement

5.1 VfM of Kepax Bridge with Diglis Bridge demand

The Value for Money from delivering the scheme is estimated using the most up to date costs and the demand figures for Diglis Bridge, as already outlined in previous sections.

The cost presented in section 2.2 (included some nominal maintenance costs) and average Diglis Demand figures presented in Table 3.1 are used to calculate the potential Value for Money of the scheme.

66% Optimism Bias has been applied to the costs of constructing the bridge. 44% Optimism Bias has been applied to all other costs, including improvements to the wider network, preparation and design. These levels of Optimism Bias are recommended in WebTAG Unit A1.2. The resultant BCR for the scheme is presented below:

Scheme	Cost (000's, 2019)	PVC (000's, 2010)	PVB (000's, 2010)	BCR
• Preparation • Design costs • Bridge construction • Wider Network Construction	£8,780	£9,115	£15,506	**1.7**

Table 5-1: Present Value of Costs and Present Value of Benefits in 2010 prices

The BCR for the scheme with current costs and achieving a similar level of demand to Diglis Bridge is 1.7.

5.2 Sensitivity testing

In addition to the main Value for Money Statement, a sensitivity test has been undertaken and is presented as an Appendix to this note. Traditional appraisal techniques are used to determine the demand for Kepax Bridge and the access path, without provision of any wider improvements. This discounts the option of a riverside circular walk, and value for money of the scheme is therefore determined only by east-west movements across the river.

Results of the sensitivity test are summarised in Table 5.1 below.

Scenario	Kepax scheme including:	PVC (2010) (millions)	PVB (2010) (millions)	BCR
	• Kepax Bridge and Kepax site access • Maintenance • Proposed wider improvements • Diglis bridge demand	£9.115	£15.506	1.7
Sensitivity test 1	• Kepax Bridge and Kepax site access • Maintenance • Kepax forecast demand	£7.749	£3.582	0.5
Sensitivity test 2	• Kepax Bridge and Kepax site access • Maintenance • Proposed wider improvements • Kepax forecast demand	£9.115	£3.582	0.4

Table 5-2: Sensitivity test BCR

6 Wider Economic Impacts

6.1 Tourism Expenditure

This section presents an assessment of wider economic impacts which will be created by provision of the scheme. These benefits are in addition to the benefits presented in the previous section: (the active mode travel benefits).

The provision of a new river crossing and wider improvements to walking and cycling links is envisaged to facilitate growth in the visitor economy; an increase in visitor numbers would result in additional visitor expenditure in the local economy. The additional expenditure will facilitate local job creation and additional Gross Value Added as a measure of local economic output.

Analysis is based on data provided in the report "*Strengthening Museums and the Visitors Economy in Worcester*" published by TSE Research in 2014. In order to be robust, only the impacts of the scheme on day domestic visitors is considered. This is a total of 3,650,000 visitors a year. It is assumed that similar to Diglis Bridge, Kepax Bridge will connect different visitor attractors and it will also become an attraction in itself. It is assumed that the scheme could increase the total number of day visitors to Worcester by 1%, resulting in 36,500 additional annual visitors.

The average spends per visitor trip figure suggested in the TSE Research report is of £18.92 (2019 prices). This gives a total additional gross annual visitor expenditure of £690,523.

According to the World Tourism Organisation, there are 20 sub-categories of tourism employment. The average GVA per employee of each of the categories from the ABS Release 2018 results in an average GVA per tourism job of £40,240. From the additional gross annual expenditure and GVA per employee, it can be calculated that the impact of the scheme on the local economy could be the creation of 17 new gross jobs.

The following table summarises the figures and assumptions taken to build the wider economic impacts estimation:

Description	Value
Annual Day Domestic Visitors (2014)	3,650,000
Percentage Increase in visitors after scheme	1.00%
Additional Day Domestic Visitors	36,500
Average expenditure per Day Domestic Visitor (2018 prices)	£18.92
Additional day visitor spends	£690,523
GVA per tourism jobs (2018 prices)	£40,240
New Gross jobs created	17

Table 6-1: Tourism Performance

6.2 Construction Stage Benefits

This section will present the construction stage impacts related to jobs and GVA that could arise as a result of the construction phase of the proposed scheme. Costs presented in this section are in 2019 prices and include: an estimate of design and preparation fees, bridge construction costs and the cost of wider improvements including the access path.

6.2.1 Direct job creation

Job creation resulting directly from the construction phase can be estimated by applying a best practice benchmark of £96,692[7] (2019 prices) per full-time equivalent (FTE) to the construction expenditure of £8,780,031 (2019 prices). Based on the construction expenditure, the project is expected to create 91 FTE jobs during the construction phase.

6.2.2 Direct GVA

Direct GVA can be estimated through the application of best practice turnover to GVA benchmarks (2015). Following a turnover-led approach, a turnover to GVA ratio of 0.5 is applied to professional fees of £774,314 (2019 prices) generating a GVA uplift of £387,157 (2019 prices). Adopting a similar approach, a 0.4 turnover to GVA ratio is applied to the construction expenditure, converting £8,005,717 (2019 prices) in construction turnover to £3,202,286 (2019 prices) in GVA uplift. This results in an overall direct GVA uplift of £3,589,444 (2019 prices) for the construction stage.

6.2.3 Indirect Job Creation

During the construction phase, indirect job creation will occur through a multiplier effect that impacts on the wider economy in two ways:

- Through increase in expenditure by construction firms within their supply chain; and
- Through increased expenditure in the local area by construction workers, leading to a higher demand for goods and services.

This would eventually lead to a multiplier effect in the local economy as local and supply chain businesses expand to cope with the increased demand. To quantify indirect job creation a best practice high end employment multiplier of 1.0[2] is utilised, based on the assumption that most of the expenditure by construction workers will be contained within Worcestershire. The application of the high-end multiplier to the number of direct FTEs jobs created (91) suggests that 91 FTE indirect jobs will be created for the sub-regional economy.

6.2.4 Indirect GVA

The indirect employment effects will also result in an indirect GVA uplift. To assess the extent of the indirect GVA uplift a best practice output multiplier of 0.9[8] is applied to the direct GVA impact of £3,589,444 (2019 prices) resulting in an indirect GVA uplift of £3,230,499 (2019 prices). This multiplier assumes that most of the spending undertaken by construction firms is retained within the Worcestershire construction supply chain.

6.2.5 Aggregate Impacts

The combined impacts of the indirect construction stage and direct construction stage results in an aggregate construction stage impact of 182 FTE jobs and a GVA uplift of £6,819,943 (2019 prices). To express the GVA uplift in 2010 prices and values, GVA uplift has been discounted to 2010 values following best practice guidance set out within WebTag. The GVA uplift when discounted to 2010 prices and present values amounts to £5,179,143.

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[7] WoE LEPs 'Infrastructure Guidance Note for Infrastructure Projects' (2015) inflated to 2018 prices using WebTAG Databook Annual Parameters" (2018)

[8] WoE LEPs 'Infrastructure Guidance Note for Infrastructure Projects' (2015)

7 Summary and Conclusions

Diglis Bridge is believed to provide an appropriate benchmark for the demand which would be attracted at the Kepax Bridge site, and surrounds. Monitoring data for Diglis Bridge has therefore been used to calculate a BCR for the scheme, along with the most up to date costs.

The BCR of the scheme is estimated to be 1.7, representing medium value for money (based on a total scheme cost of £8.8 million (2019 prices)). Sensitivity testing has been undertaken and indicates that provision of the bridge and access path only (no wider improvements) could result in a BCR of 0.5 (based on a cost of £7.3 million (2019 prices)).

The BCR figures presented in this note support implementation of the full scheme including the wider improvements despite the higher cost implications. Delivering the full scheme results in the full benefits being realised. Full benefits include increased leisure spending and jobs and wider GVA uplift. Provision of the bridge and access path in isolation result in more modest benefits being realised.

It is important to note that the benefits derived from the DfT Active Mode Toolkit are sensitive to increased costs and reduced demand. Once scheme design and costs have been refined, the BCR can be refreshed.

Appendix 1 – Sensitivity test

7.1 Introduction

TAG Unit A1.1 outlines that *"since the cost of walking and cycling schemes is often relatively low and the scale of impact relatively small, the cost-benefit analysis is highly sensitive to the quality of these forecasts. Sensitivity tests will be necessary to examine the potential impacts in the face of uncertainty".*

This Appendix uses traditional appraisal techniques to determine the demand for Kepax Bridge and the access path, without provision of any wider improvements. This discounts the option of a riverside circular walk, and value for money of the scheme is therefore determined by east-west movements across the river.

It has been difficult to determine baseline demand using these techniques, particularly in relation to leisure uses. It is then also challenging to forecast an uplift in this demand following the provision of the new infrastructure, although a literature review was undertaken as part of this study to determine relevant benchmarks.

In order to forecast potential demand for Kepax Bridge, a desk-based review of available data has been undertaken. Possible demand from commuters, University students and leisure users has been considered.

7.1.1 Literature Review

A DfT report entitled 'Investing in Cycling & Walking'[9] states that *"In general, the evidence suggests that walking and cycling interventions do increase physical activity levels (rather than acting as substitutes for other activity) but the scale of effect, its duration and its applicability to different groups within the population appears to vary considerably."*

An iConnect study[10] found that new infrastructure (such as a traffic-free bridge in Cardiff, a similar bridge over a trunk road in Kenilworth and an upgraded riverside footpath in Southampton) was more likely to be used by existing cyclists and walkers, and that their travel mode tended to remain consistent before and after the intervention. The same study also found that new routes tended to be used by those who lived nearby.

Evaluation evidence for Sustainable Travel Towns programme and Cycling Demonstration Town programme suggests that 26% is the lowest level of growth in cycling achieved through improvements to existing infrastructure. This value is therefore applied to the existing number of cycle journeys in the Active Mode Toolkit to forecast cycle journeys for the 'do something' scenario.

Evaluation evidence for the Sustainable Travel Towns programme suggests that 10% is the lowest level of growth in pedestrian journeys achieved through improvements to existing infrastructure. This value is therefore applied to the existing number of pedestrian journeys in the Active Mode Toolkit to forecast pedestrian journeys for the 'do something' scenario.

Table 7.1 outlines results from various case studies, which indicates that cycling and walking uplifts from investment can be as high as 1,400%.

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[9] 'Investing in Cycling & Walking': Rapid Evidence Assessment A report for the Department for Transport (October 2016)

[10] Goodman, A., Sahlqvist, S. and Ogilvie, D. (2013) Who uses new walking and cycling infrastructure and how? Longitudinal results from the UK iConnect study. Preventive Medicine 57(5): 518–524.

Location	Intervention	Active Mode Uplift Recorded
Manchester	Protected cycle route provision on Wilmslow road and Manchester Oxford road	An increase off 11% on Oxford road Wilmslow road, 86% increase after 12 months and then 103% after two years
London	Two cycle superhighway routes	200% increase on the east-west route and 124% on the north-south route
Leeds to Bradford	14-mile cycle superhighway route	51% increase in the first year and a further 26% increase in the following year
Cambridge	Provision of two protected cycle routes into the city centre	20-30%
London	Improvement to walking routes	98%
Northampton	Installation of one new bridge and replacement of two existing bridges	195% increase in walking 115% increase in cycling
Newport	Traffic-free cycle route linking education, railway and residential areas	189% increase in active modes
Swansea	Upgrade of disused railway bridge to cycle use	1,000% increase in commuting 400% increase in education trips
Manchester	Segregated NCN Towpath Provision	340%
Scotland	Rural community links	1,023%
Newport to University	Segregated cycle route	251%
Blairgowrie	Ardblair Trail school path	570%
Worcester	Bridge over River Severn at Diglis	1,400%

Table 7-1: Case study uplifts (various, including Sustrans, 'The Real Cycling Revolution')

For the purposes of this study, a 25% increase in walking and a 50% increase in cycling will be applied to baseline demand figures.

7.2 Demand Forecasts

7.2.1 Introduction

Baseline and forecast demand for Kepax Bridge have been sought, as both are required for the DfT Active Mode Toolkit. Partly due to the current lack of infrastructure, and the location of the bridge (currently in relative isolation to other walking and cycling infrastructure), it has been challenging to assess baseline demand and predict future demand. It has been particularly difficult in relation to leisure users, due to a lack of available data.

Where assumptions have been made in relation to demand figures, these have been presented in the relevant section.

7.2.2 2011 Census Journey to Work

Intercept surveys at Diglis Bridge indicated that Journey to Work trips amounted to 13% of all trips over Diglis Bridge in 2011. Although not a significant proportion of trips, a Journey to Work analysis has been undertaken for Kepax Bridge which is based on census data released in 2011.

This analysis is based on the census table *WU03EW: Location of usual residence and place of work by method of travel to work (MSOA level).* The data presents an origin-destination matrix of people who live in MSOA 'A' (area of residence) and work in MSOA 'B' (area of workplace). MSOAs within the catchment area of the Kepax Bridge site were identified and assumptions have been made to identify possible commuting trips across the bridge. A map of the MSOAs used is included as Figure 5.2.

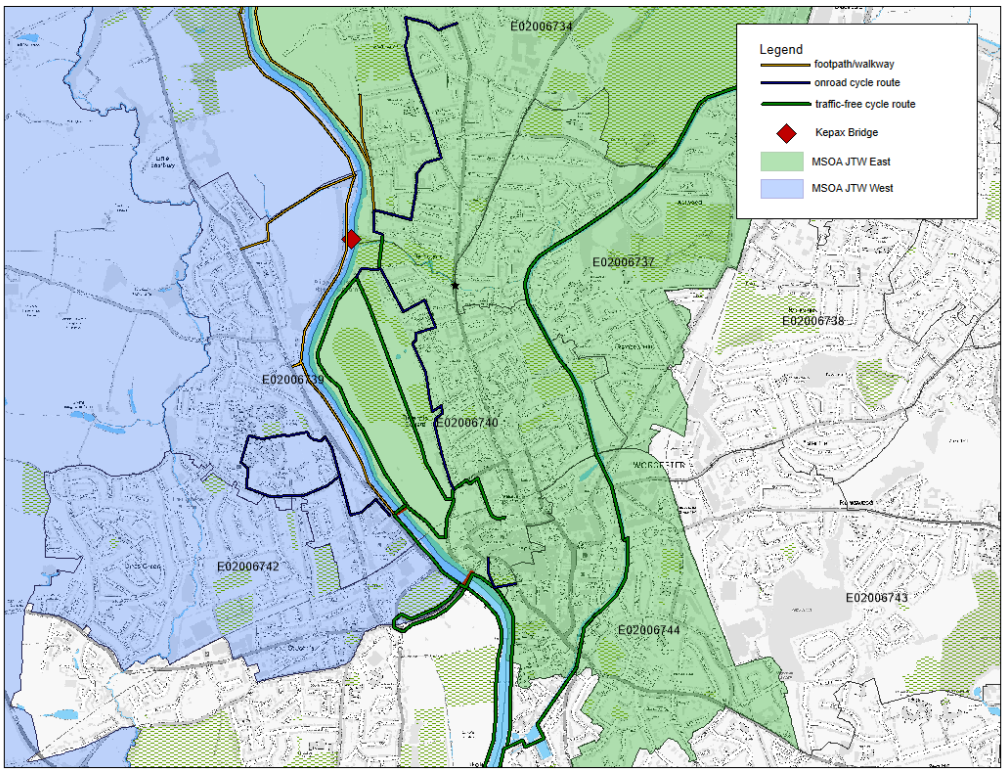

Figure 7-1: MSOAs used in the JtW analysis

The assumptions made in the analysis are as follows:

- Four MSOAs on the west side and 5 MSOAs on the east side of the River Severn were selected.
- Only flows west to east and east to west (crossing the river) have been captured.
- Assumed each person makes an outbound and return trip, 220 days a year.
- The provision of a new cycle and walking link will increase the number of route options available to commuters crossing the river. Analysis has therefore been undertaken to determine the proportion of commuters who would choose Kepax Bridge to cross the river over and above other options (primarily Sabrina and Worcester bridges). The option-preference is presented in a matrix in Table 7.2.

O/D	MH 002	MH 003	WO 006	WO 009	WY 006	WO 001	WO 004	WO 007	WO 011
MH 002					0.00%	0.00%	75.00%	75.00%	75.00%
MH 003					75.00%	75.00%	50.00%	25.00%	25.00%
WO 006					75.00%	75.00%	50.00%	25.00%	0.00%
WO 009					25.00%	25.00%	50.00%	0.00%	0.00%
WY 006	0.00%	25.00%	75.00%	75.00%					
WO 001	0.00%	50.00%	75.00%	50.00%					
WO 004	25.00%	50.00%	75.00%	25.00%					
WO 007	25.00%	25.00%	25.00%	0.00%					
WO 011	0.00%	0.00%	0.00%	25.00%					

Table 7-2: Route assignment matrix showing percentage of baseline trips that would choose the bridge as preferred route to commute between pairs origin-destination.

Tables 7.3 and 7.4 present the baseline demand matrices for walking and cycling following the application of route option selection factors (Table 5.4) and trip rates to the original census data.

O/D	MH 002	MH 003	WO 006	WO 009	WY 006	W 001	WO 004	WO 007	WO 011
MH 002					0	0	2	8	5
MH 003					5	2	1	2	4
WO 006					0	8	1	8	0
WO 009					2	1	1	0	0
WY 006	0	1	2	2					
WO 001	0	1	17	4					
WO 004	1	1	12	3					
WO 007	4	4	4	0					
W 011	0	0	0	2					

Table 7-3: Baseline Origin-Destination matrix for cycling trips over Kepax Bridge

O/D	MH 002	MH 003	WO 006	WO 009	WY 006	WO 001	WO 004	WO 007	WO 011
MH 002					0	0	0	3	3
MH 003					0	0	0	3	2
WO 006					0	2	1	60	0
WO 009					2	3	3	0	0
WY 006	0	0	5	0					
WO 001	0	0	5	4					
WO 004	3	3	18	3					
WO 007	4	3	28	0					
WO 011	0	0	0	4					

Table 7-4: Baseline Origin-Destination matrix for pedestrian trips over Kepax Bridge

Table 7.5 summarises annual flows for the baseline scenario and also annual flows following the demand uplift (see Section 7.1.1, 50% uplift applied to cycling trips and walking trips).

Commuter demand	Baseline	Forecast	Net Figure (Growth)
Daily average of walking trips	157	196	39
Daily average of cycling trips	102	153	51
`Annualisation factor	220		
Annual walking trips	34,540	43,175	8,635
Annual cycle trips	22,300	33,450	11,150

Table 7-5: Summary of commuter demand in the baseline and post-scheme scenario

In relation to journeys to work, the net growth from provision of Kepax bridge is forecast to be 8,635 additional walking trips each year and 11,150 additional cycle trips each year.

7.2.3 Worcester University

The University of Worcester provided homes postcode data for staff and students and their mode of travel to campus. This data has been used to estimate the potential demand for Kepax Bridge amongst Worcester University students. As in the previous section, an uplift is applied to the baseline numbers due to the provision of new infrastructure.

To avoid double counting with the demand numbers, only student trips are estimated in this section as potential staff trips overlaps with the previous section: Journey to Work.

The approach taken to estimate the number of student trips over the bridge for the do-minimum and do-something scenario is based on:

- Undertaking a desk-based GIS analysis to capture the number of surveyed students whose trip length could be reduced by connecting both sides of the river with the Kepax bridge (1).
- Scaling the sample to the total number of students (38). The survey undertaken in 2018 captured a sample of 272 students out of a total of 10,455 currently at University of Worcester.
- Assumed each student makes an outbound and return trip, 220 days a year.
- Assuming an uplift in the demand of 25% for walking and 50% for cycling for the post-scheme scenario based on the literature mentioned in Section 7.1.1.

The resulting figures are summarised in the table below:

Description	Value
Number of students at University of Worcester	10,455
Total number of respondents	272
Ratio of sample	2.60%
Potential new users (trip length reduced by Kepax Bridge)	1
Growth to total number of respondents	38
Percentage walking (from Diglis, 2011)	66%
Percentage cycling (from Diglis, 2011)	33%
Number of trips per person per day	2

Table 7-6: Baseline data and assumption figures for university trips

Student demand	Baseline	Forecast	Net Figure (Growth)
Daily average walking trips	51	64	13

Daily average cycling trips	25	38	13
Annualisation factor	220		
Annual walking demand	11,162	13,953	2,791
Annual cycle demand	5,581	8,372	2,791

Table 7-7: Summary of student demand for the baseline and the forecast scenario

In relation to journeys made by students to the University, the net growth from provision of Kepax Bridge is forecast to be 2,791 additional walking trips each year and 2,791 additional cycle trips each year.

7.2.4 Leisure trips

Two types of leisure users have been considered within this section of the note:

- Local leisure trips which would be undertaken by dog walkers, families visiting Gheluvelt Park etc; and
- Leisure trips undertaken by day visitors, for example visiting the racecourse, undertaking a longer riverside walk.

7.3 Local leisure trips

In order to estimate a baseline number of local leisure trips (leisure trips already being undertaken in the area surrounding Kepax Bridge), an analysis has been undertaken using Census data and the National Travel Survey (NTS). The approach for this calculation is as follows:

- Defining a walking and cycling catchment area around the Kepax Bridge for pedestrians and cyclist and identifying the LSOAs within this area.
- Estimating the total number of residents in the area by using the Census table *"KS102EW: Residents by Age structure"* within the selected LSOAs.
- Obtaining leisure trip rates for walking and cycling trips from the NTS table "*NTS0409 Average number of trips by purpose and mode"*. The survey suggests that in 2018, the total number of walking trips per person for leisure purposes was 40.5 and 5.9 cycling trips.
- Weighting the proportion of trips potentially crossing the River Severn out of the total leisure trips generated. The assumption is based on the JTW travel patterns which suggests that West-to-East and East-to-West movements represent around the 30% of trips produced in the area.

The figures are summarised in Tables 7.8 and 7.9 below.

Description	Value
Walking leisure trip rate (NTS) (person trips/year)	40.5
Cycling leisure trip rate (NTS) (person trips/year)	5.9
Total annual leisure trips within the Kepax catchment (walking)	223,686
Total annual leisure trips within the Kepax catchment (cycling)	32,586
Daily leisure trips within the Kepax catchment (walking)	613
Daily leisure trips within the Kepax catchment (cycling)	89

Table 7-8: Baseline data and assumption figures for leisure trips

It is estimated that there are 613 leisure walking and 89 leisure cycling trips already undertaken in the vicinity of Kepax Bridge (using the above assumptions and NTS statistics). If it is assumed that 30% of leisure trips involve crossing the river (this figure was gauged from the earlier JtW analysis), this results in 184 walking leisure trips and 27 cycling leisure trips crossing the river in a baseline scenario (and this is the figure that can be input as a baseline into the Active Mode Toolkit).

Leisure demand	Baseline
Proportion of trips potentially using the bridge	30%
Annual baseline walking demand	67,106
Annual baseline cycle demand	9,756
Daily average of walking trips	184
Daily average of cycling trips	27

Table 7-9: Summary of leisure demand for baseline scenario

If leisure cycling trips were to increase by 50% and walking trips by 25% as with other uses, it is forecast that there will be an additional 92 local leisure pedestrian trips and 7 cycle trips crossing Kepax Bridge each year.

Leisure demand	Baseline	Forecast	Net Figure (Growth)
Daily average walking trips	184	276	92
Daily average cycling trips	27	34	7
Annualisation factor	365		
Annual walking demand	67,160	83,950	16,790
Annual cycle demand	9,756	12,195	2,439

Table 7-10: Local leisure demand

In relation to journeys made by leisure users, the net growth from provision of Kepax bridge is forecast to be 6,570 additional walking trips each year and 2,537 additional cycle trips each year.

7.4 Day visitor leisure trips

The report "*Strengthening Museums and the Visitors Economy in Worcester*" published by TSE Research in 2014 reviews the tourism landscape in Worcester and gives figures of annual number of tourists visits in the city based on three year rolling averages and GBS data. Three different categories are presented: staying domestic visitors, staying overseas visitors and day domestic visitors. For the purpose of this study only the impacts of Kepax Bridge on day domestic visitors are captured. This is a total of 3,650,000 a year.

It is assumed that Kepax Bridge will provide a new link connecting different tourist attractors and it will become an attraction itself as well. Therefore, it is assumed that the impact of provision could increase in 1% the total number of day visitors in Worcester leading to 36,500 extra annual visitors after the scheme.

Description	Value
Annual Day Domestic Visitors (2014)	3,650,000
Percentage Increase in visitors after scheme	1.00%
Additional Day Domestic Visitors using Kepax Bridge	36,500

Table 7-11: Day visitor leisure demand

Based on the split of pedestrians and cyclists undertaking local leisure trips (86% and 14% respectively), an additional 36,500 visitors would result in the following additional numbers using the bridge.

Leisure demand	Forecast
Daily average walking trips	86
Daily average cycling trips	14
Annualisation factor	365
Annual walking demand	31,284
Annual cycle demand	5,216

Table 7-12: Day visitor leisure demand

The resultant leisure demand from both local users and day visitors is presented in Table 7.13.

Leisure demand	Baseline	Forecast	Net Figure (Growth)
Daily average walking trips	184	362	178
Daily average cycling trips	27	48	21
Annualisation factor	365		
Annual walking demand	67,160	115,234	48,074
Annual cycle demand	9,756	17,411	7,655

Table 7-13*: Summary of total leisure demand*

In relation to journeys made by leisure users, the net growth from provision of Kepax bridge is forecast to be 48,074 additional walking trips each year and 7,655 additional cycle trips each year.

7.5 Summary

Table 7.14 presents the total estimated baseline, forecast and resultant net demand for walking and cycling at the Kepax Bridge site and Table 7.15 compares this to other benchmarks, including Diglis Bridge.

	Commuters			Students			Leisure		
	Baseline	Forecast	Net	Baseline	Forecast	Net	Baseline	Forecast	Net
Annual Walking Trips	34,540	43,175	8,635	11,162	13,953	2,791	67,106	115,234	48,074
Annual Cycling Trips	22,300	33,450	11,150	5,581	8,372	2,791	9,756	17,411	7,655

Table 7-14: Summary of baseline, forecast and net trips demand by trip purpose

Using the data available to us through desk-based research, demand for cycle and walking trips at Kepax Bridge is found to be lower than other benchmarks. The bridge will not be located close to any major employment or education trip generators and calculating the likely number of leisure trips which will be made in the future is difficult.

It is acknowledged that the forecast leisure trips presented in Table 7.15 are likely to be higher. Although without investment in the surrounding network and access paths, demand is unlikely to reach the levels now experienced at Diglis.

	Total Forecast	Diglis Bridge	Sabrina Bridge	Worcester Bridge	Millenium Bridge

	Demand – Kepax Bridge	Demand (2011)	Demand (2018)	Demand (2011)	Demand (2002)
Annual Walking Trips	172,362	290,470	1,172,417	1,571,218	740,000
Annual Cycling Trips	59,233	141,397	179,531	147,636	290,000

Table 7-15: Comparison of walking and cycling demand levels across different bridges

7.6 Active Modes Impact (Benefits)

7.6.1 Summary of impacts

Based on the demand figures from the previous section, value for money of the bridge and access path has been calculated.

In order to capture the benefits of this new link, an assessment has been undertaken using the DfT's Active Mode Toolkit and the DfT's Tag Unit A5.1 Active Mode Appraisal guidance. Assumptions made within the toolkit are presented in Section 4 of the main document.

The benefits are split between commuters, students of the University of Worcester and leisure users. The appraisal period for all three users is **20 years**, which is the typical period that is used to appraise walking and cycling schemes.

It is important to note that the toolkit is sensitive to the number of existing users (baseline) and the increase in future users (forecast) it is the net difference which generates the majority of benefits.

7.6.2 Commuting benefits

The method of travel to work data (Census 2011) analysis performed forecasts that there are 259 commuting trips undertaken over the River Severn that would use bridge if the infrastructure was already in place. Out of these 259 commuting trips in the baseline scenario, 157 are walking trips and 102 are cycling trips.

As outlined previously in the note, it is estimated that the number of individuals cycling to work will increase by 50% whilst the number of individuals walking to work will increase by 25%. This is felt to be robust due to the low existing baseline and the provision of brand-new infrastructure. Post intervention, the number of cycle trips is expected to increase from 102 to 153. Whilst the number of number pedestrian trips post intervention increases from 157 to 196.

The analysis suggests that in relation to commuters walking and cycling the scheme could deliver a present value of benefits (PVB) of **£1.395 million** over an appraisal period of 20 years. The benefits generated are as a result of commuters within the context area switching to an active mode of travel, and also journey ambience benefits for those who already travel by active modes but will switch to using the new bridge. The impacts are summarised in Table 7.16.

Impact Drivers	Estimates (PV, 2010) in £'000s
Baseline demand (average daily trips)	102 cycling trips and 157 walking trips
Forecast demand (average daily trips)	153 cycling trips and 196 walking trips
Congestion benefit	41.16

Accident	11.67
Local Air Quality	0.05
Noise	0.78
Greenhouse Gases	2.08
Reduced risk of premature death	456.99
Absenteeism	409.70
Journey Ambience	480.77
Indirect taxation	-8.03
PVB	**1,395**

Table 7-16: Commuter benefits by category

7.6.3 Education benefits

Survey data provided by the University of Worcester indicates that within a catchment area of 3 km around both university campus, 5% of students travel using a bicycle, whilst over 77% of students walk.

As outlined previously in the note, post-intervention it is estimated that the number of individuals cycling to the University will increase by 50% whilst the number of individuals walking to the University will increase by 25%. The forecast number of cycling trips is expected to be 102 of which 25 were already existing cycling trips using other routes. The forecast number of pedestrians post intervention is expected to be 64 of which 51 were part of the baseline scenario.

It is assumed that all cyclists and pedestrians travelling to the University will undertake a return trip.

The analysis suggests that from a student cyclist/pedestrian perspective the scheme could deliver a present value of benefits (PVB) of **£0.277 million** over an appraisal period of 20 years. The impacts are summarised in Table 7.17.

Impact Drivers	Estimates (PV, 2010) in £'000s
Baseline demand (average daily trips)	25 cycling trips and 51 walking trips
Forecast demand (average daily trips)	38 cycling trips and 64 cycling trips
Congestion benefit	11.47
Accident	3.25
Local Air Quality	0.01
Noise	0.22
Greenhouse Gases	0.58
Reduced risk of premature death	124.96
Absenteeism	0.00
Journey Ambience	138.49
Indirect taxation	-2.24
PVB	**277**

Table 7-17: University student benefits by category

7.6.4 Leisure benefits

An iConnect study[11] found that new infrastructure such as a walking or cycling route was more commonly used for recreation than for transport. This accords with 2011 intercept survey data for Diglis Bridge which reported that 70% of all trips were for leisure purposes.

As part of our desk-based analysis we have considered local leisure users in additional to wider day visitors to the City.

The calculation of the benefits from local leisure trips in this section is based on data from the NTS while day visitor leisure trips is based on a 2014 tourism report. We have calculated that the daily baseline of leisure trips could be 184 pedestrian trips and 27 cycling trips. After the delivery of the scheme the number of trips through Kepax Bridge could reach up to 362 pedestrian trips and 48 cycle trips.

Existing leisure users only get benefits within the Active Mode Toolkit from categories such as journey ambience due to the provision of new infrastructure and enhanced public realm. New trips capture all of the benefit categories.

The analysis suggests that from a leisure cyclist/walker perspective the scheme could deliver a present value of benefits (PVB) of **£1.910 million** over an appraisal period of 20 years. The impacts are summarised in Table 7.18 below. The main driver of the benefits is a reduction in the risk of premature death, with more commuters undertaking physical activity. The increase in the physical activity also reduces absenteeism.

Impact Drivers	Estimates (PV, 2010) in £'000s
Baseline demand (average daily trips)	27 cycling trips and 184 walking trips
Forecast demand (Average daily trips)	48 cycling trips and 362 walking trips
Congestion benefit	114.36
Accident	32.42
Local Air Quality	0.14
Noise	2.16
Greenhouse Gases	5.79
Reduced risk of premature death	1022.25
Absenteeism	0.00
Journey Ambience	754.91
Indirect taxation	-22.31
PVB	**1910**

Table 7-18: Leisure benefits by category

7.7 Value for Money

The Value for Money from delivering Kepax Bridge and the access path has been calculated using traditional appraisal techniques.

[11] Goodman, A., Sahlqvist, S. and Ogilvie, D. (2013) Who uses new walking and cycling infrastructure and how? Longitudinal results from the UK iConnect study. Preventive Medicine 57(5): 518–524.

66% Optimism Bias has been applied to the costs of constructing the bridge. 44% Optimism Bias has been applied to all other costs, including the access path, preparation and design. These levels of Optimism Bias are recommended in WebTAG Unit A1.2. The resultant BCR for the scheme is presented below:

Scheme	Cost (000's, 2019)	PVC (000's, 2010)	PVB (000's, 2010)	BCR
• Preparation • Design costs • Bridge construction • Access path over Kepax site	£7,289	£7,749	£3,582	**0.5**

Table 7-19: Present Value of Costs and Present Value of Benefits in 2010 prices

The BCR based on the parameters presented in this Appendix is calculated to be 0.5.