DfT Maintenance Challenge Bid 2017

The A4 and A4174 Strategic Routes Scheme, Value for Money Assessment

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1.0 Introduction

1.1 The scheme

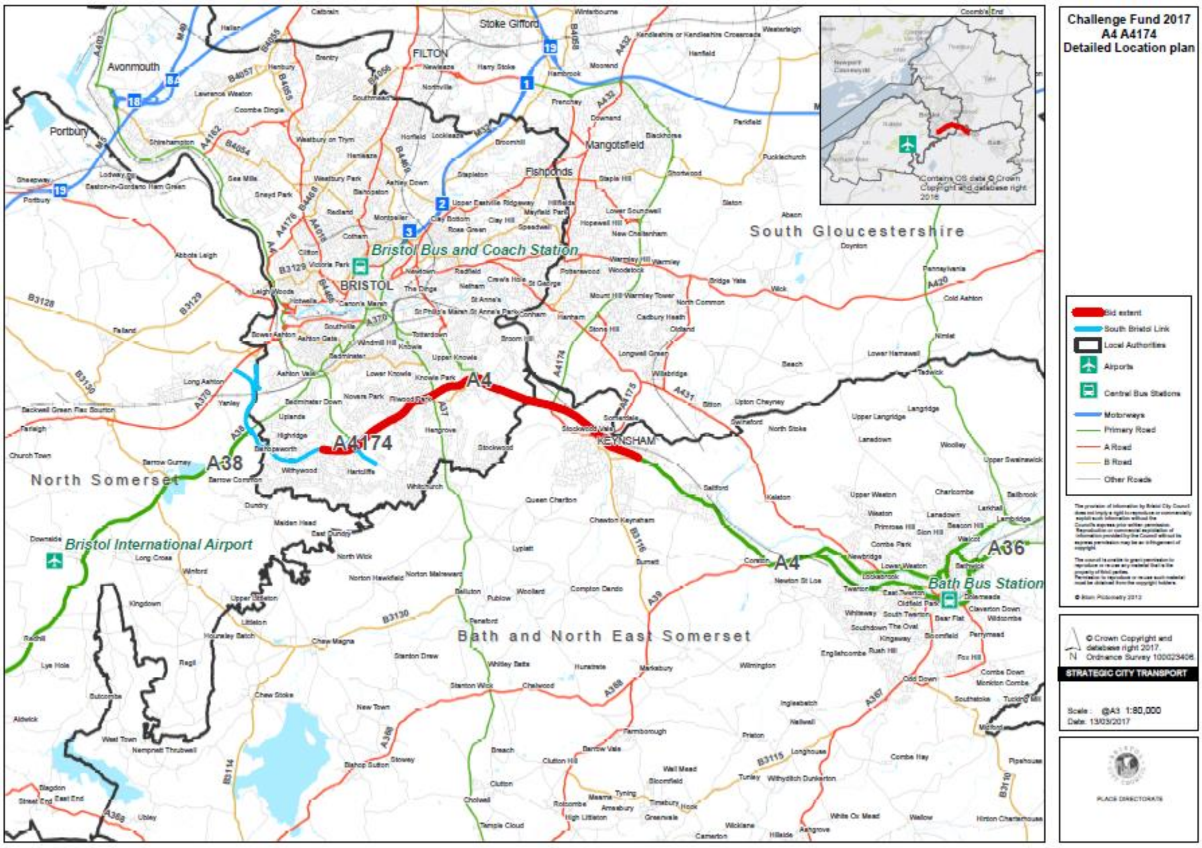
Bristol City Council (BCC) and Bath & North East Somerset Council (B&NES) have submitted an application for funding to the DfT's Maintenance Challenge Fund 2017. The scheme consists of maintenance and enhancements works along the A4 from Keynsham Bypass, Bath Road, A4174 linking to new South Bristol Link Road and Bristol Airport. Figure 1-1 shows the scheme context, location and extents.

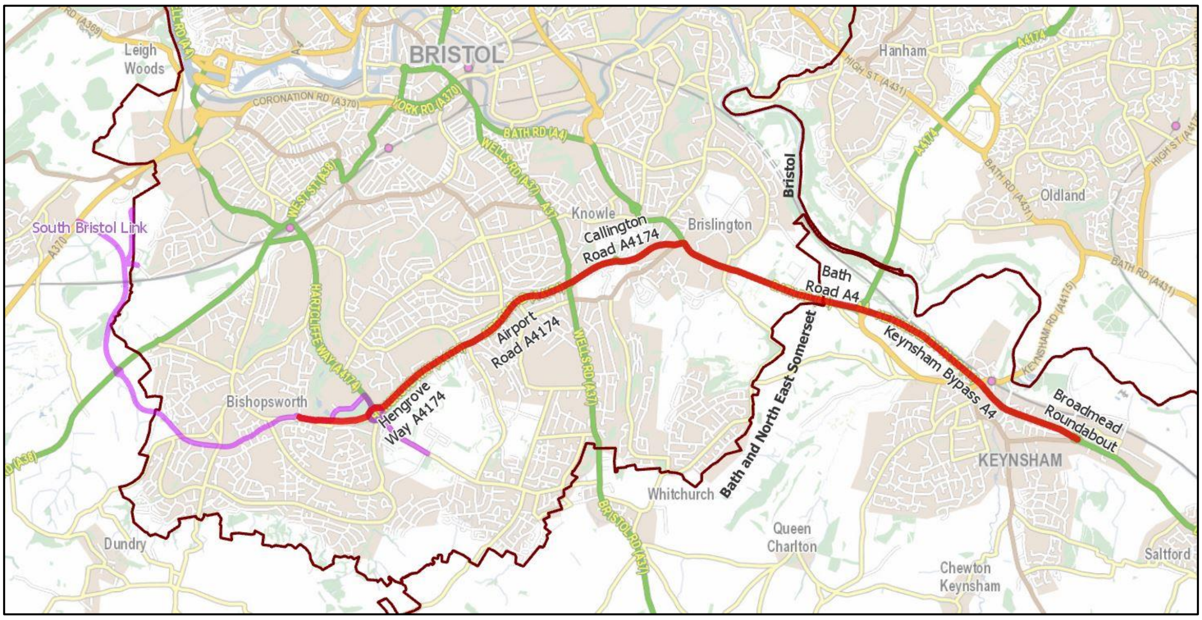
1.2 This technical note

The remainder of this technical note sets out the methodology, assumptions and results of value for money assessments carried out to support the application.

- Section 2 describes the scheme in more detail, including the rationale and costs of the scheme;
- Section 3 goes on to describe the derivation of scheme benefits, including:
  - Pavement condition impacts: vehicle speed and operating cost benefits from improvements to the road surface;
  - Accident benefits: accident savings from improved road surface;
  - Works to structures: reduced travel delays from reducing the likelihood of route closure due to failures of structures along the route;
  - Public Transport: added value to bus users through selected "bus quality" interventions;
  - Cycling: health and related benefits from increased cycling due to walk and cycle measures.
- Section 4 summarises the results.

Figure 1-1 Scheme context, location and extents





2.0 The A4 and A4174 Strategic Routes Scheme

Figures 2-1 and 2-2 illustrate the locations of the works proposed by B&NES and the resurfacing works proposed by BCC along with brief description of the nature of works.

A more detailed description of the works proposed is presented below.

BCC

- Bath Road - From Boundary to Park and Ride:
    - Resurface whole of inbound, reconstructing from kerb a width of 2m wide
    - Reconstruct failed area by Foxcote Manor
    - Surface Belmouth at Ironmould Lane
- Emery Road: Reconstruct Carriageway, including mini-roundabout;
- Bath Road - From Emery Road towards West Town Road: Surface whole area, reconstruct outbound bus lane and reinstate red coloured surfacing;
- West Town Lane / Callington Road Roundabout: Reconstruct outbound side of roundabout.
- Callington Road (Tesco) Roundabout: Surface Roundabout;
- Wells Road (including junction at Airport Road): Part surface / Part reconstruct;
- Airport Road (Wells Road to and including Creswicke Junction): Airport Road crack and seat, 100mm construction including grid, reconstruct Creswicke junction;
- Hengrove Way (towards Creswicke Road): Reconstruct, including McDonalds Junction;
- Hartcliffe Way Roundabout: Surface roundabout, reconstruct part of Hawkfield Road, Reconstruct Whitchurch Lane roundabout and inbound Lane 1;
- Cater Road Roundabout: Reconstruct roundabout;
- Maintenance works on 23 structures that include maintaining subways, footbridges, culverts and overbridges;
- New shelters / raised kerbs at 14 bus stop locations along the corridor;
- Renewal / widening footway to provide an off-road cycleway along the Wootton Park section of the A4174 corridor;
- A pedestrian crossing replacement at Airport Rd / Cadogan Rd.

B&NES

- Resurfacing and road marking renewal of a section of the A4 Keynsham Bypass;
- High PSV surfacing material and road marking renewal of Broadmead and Hicks Gate roundabouts / approaches;
- Chew River Bridge: Deck waterproofing and parapet refurbishment;
- Replacement of the equipment at crossing west of Hicks Gate roundabout;
- Improved safety lining at Broadmead roundabout.

Figure 2-1 Locations of works proposed by BCC

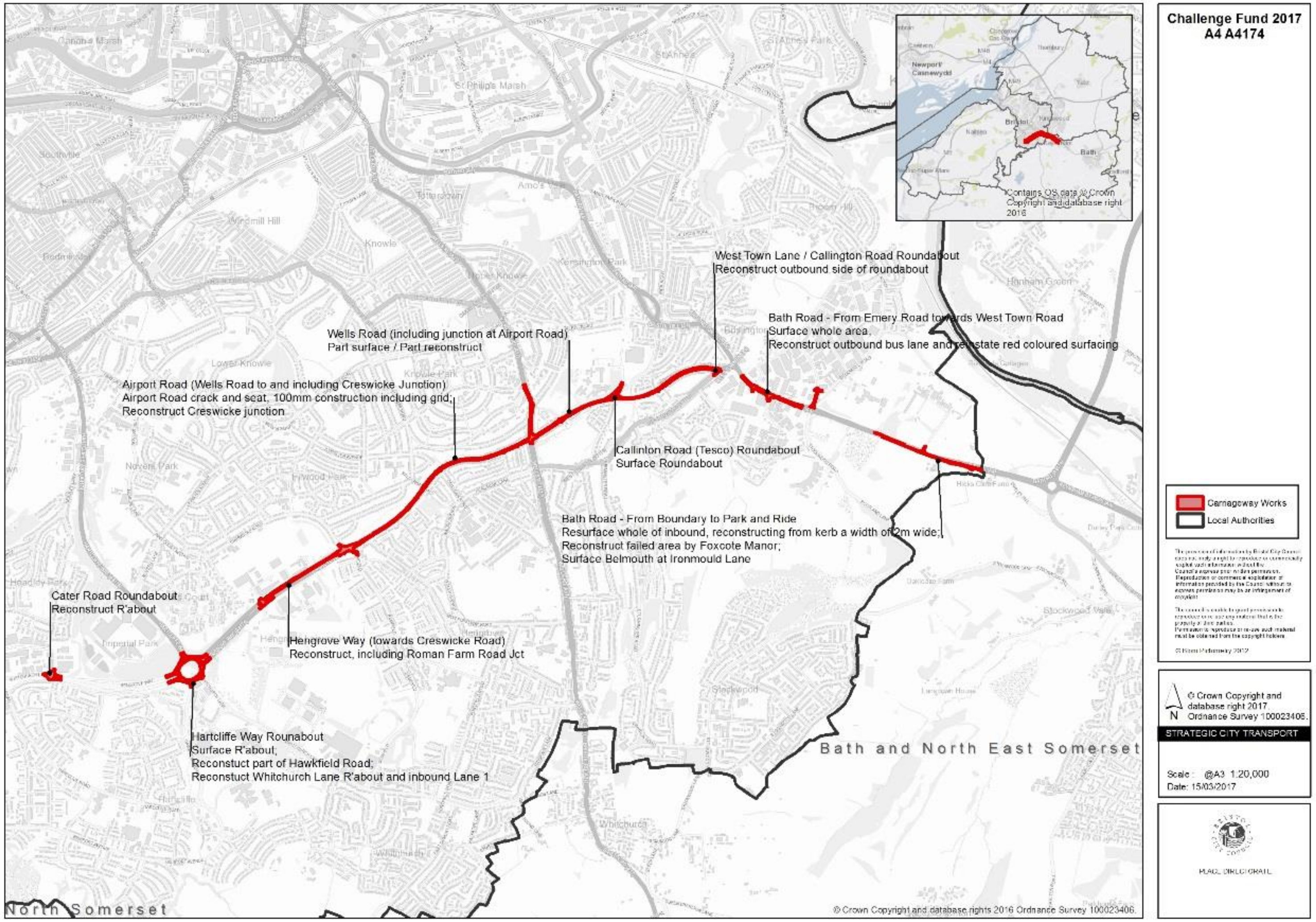
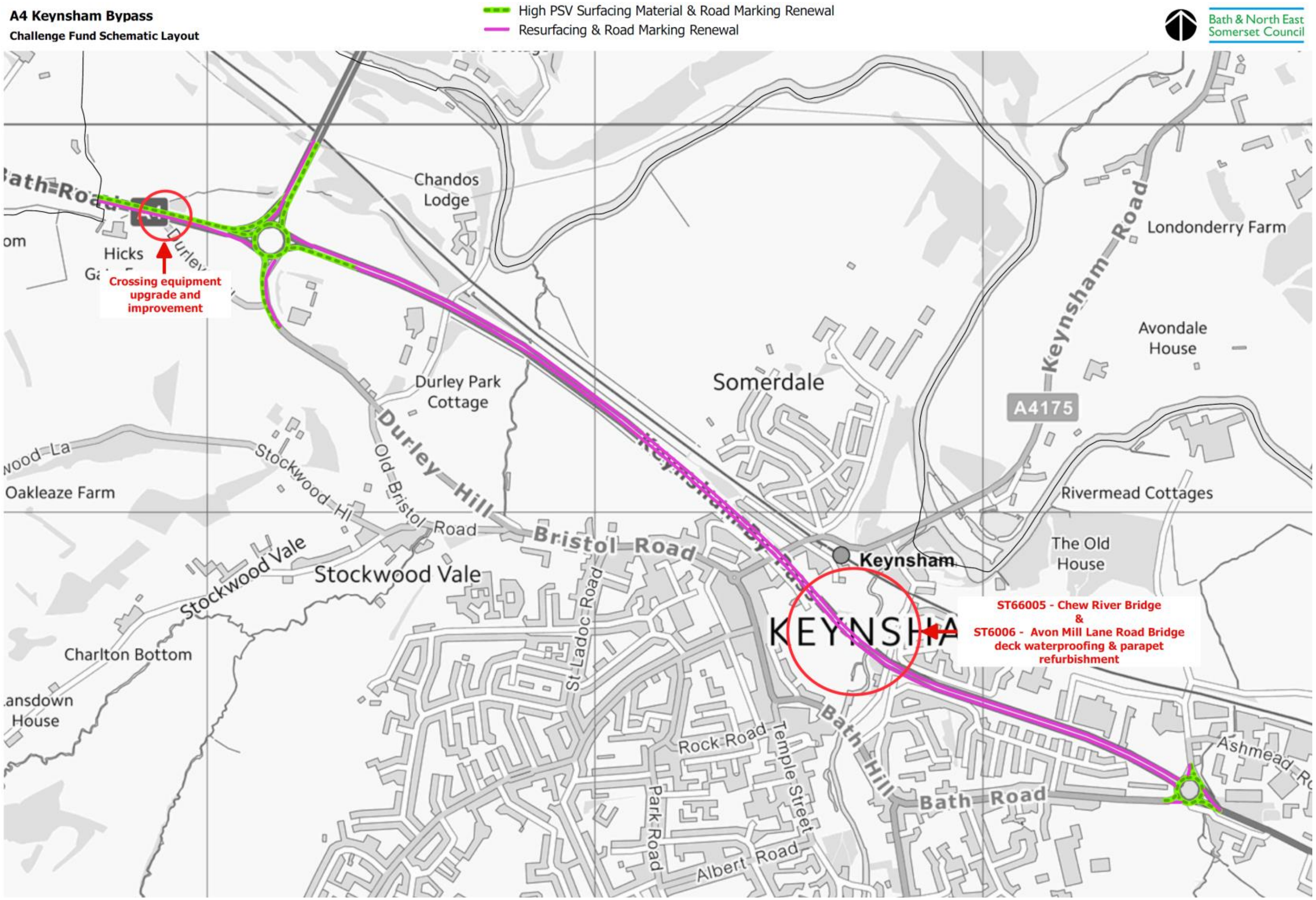


Figure 2-2 Locations of works proposed by B&NES



The posted speed limit along the route is shown below.

Section name	Speed (m/h)
A4 Keynsham Bypass	70
A4174 Keynsham	70
A4 Bath Rd (B&NES)	40
Durley Hill, Keynsham	40
B3116 Bath Rd	30
Broadmead Lane, Keynsham	30
A4174 Hengrove Way	40
A4174 Callington Road	40
A4 Bath Rd (BCC)	30-40

2.1 Rationale

The scheme rationale is presented here for each of the benefits categories:

- Pavement condition: If the required funding is not secured then the current managed decline of the A4 & A4174 will be continued which is a more expensive option in the long term. This would result in a gradual worsening of carriageway condition with impacts of increased vehicle operating costs, journey times and accident rates.
- Accidents: Accident reduction/benefits are expected as a result of improved road surface.
- Works to structures: If funds are not granted for the subways and footbridges the outcome would be to ultimately close them to pedestrians and cyclists resulting in using the existing congested network to provide appropriate diversion routes, which would have cost and safety issues. The do minimum situation for culverts would be partial or total failure and obstruction of the watercourse which would contravene the drainage and waterways acts and may result in flooding onto the Network or surrounding areas. Ultimately, failure of any culvert or bridge would result in the closure of the network with resultant diversion and congestion.
- Cycling: If the equipment is not replaced at the A4 Bath Road pedestrian / cycle crossing, it is likely it would need to be closed due to the increasing occurrence of equipment faults in recent years. In the last 12 months the site has had the following faults:

  All out: 4
  Lamp faults: 8
  Other: 8

  This is high compared to another nearby Toucan crossing of a similar age which had the following faults in the last 12 months:

  All out: 1
  Lamp faults: 1

  The Wootton Park cycleway is to be provided in order to facilitate increased cycling journeys and cycling safety to complement other cycleways in the corridor.
- Public transport user benefits are expected as a result of improved bus stop facilities.

2.2 Costs

Capital cost for the whole of the BCC and B&NES A4 and A4174 Airport Road Scheme is £6.37m (2017 Q1 prices). This is broken down as shown in Table 2-1. 15% optimism bias has been applied to reflect high cost certainty with the scheme ready for implementation in the current year. Capital cost with optimism bias and discounting at 3.5% /yr is £5.19m in 2010 prices. A 15% risk allowance has been included (in addition to optimism bias).

Table 2-1 Capital scheme costs (2017 prices Q1)

Works	Capital costs	
Resurfacing	£	5,098,170
Structures	£	822,500
Bus stops	£	220,950
Ped and cycle	£	227,250
Total	**£**	**6,368,870**

Without scheme funding there would be a need for ongoing reactive maintenance. Do minimum current (2017 prices) and discounted (2010 prices) maintenance costs are presented in Table 2-2.

Table 2-2 Do Min maintenance costs (£'000)

No.	Year	Do Min cost 2017 Prices	Discounted Do Min costs 2010 Prices
1	2017	49.83	35.32
2	2018	49.83	34.12
3	2019	49.83	32.97
4	2020	49.83	31.85
5	2021	49.83	30.78
6	2022	57.33	34.21
7	2023	57.33	33.06
8	2024	57.33	31.94
9	2025	57.33	30.86
10	2026	57.33	29.81
11	2027	64.83	32.57
12	2028	64.83	31.47
13	2029	64.83	30.41
14	2030	64.83	29.38
15	2031	64.83	28.39
16	2032	72.33	30.60
17	2033	72.33	29.56
18	2034	72.33	28.56
19	2035	72.33	27.60
20	2036	72.33	26.67
21	2037	72.33	25.76
22	2038	72.33	24.89
23	2039	72.33	24.05
24	2040	72.33	23.24
25	2041	72.33	22.45
Total		**1,583.31**	**740.53**

A discount rate of 3.5% has been applied.

3.0 Benefits Assessment

3.1 Pavement condition impacts

Pavement condition forecasting

BCC and B&NES provided recent pavement condition data for the scheme. This was taken forward into the future, assuming that pavement condition will deteriorate with time to a greater extent without re-surfacing than with. No specific modelling was carried out for this study, however modelling of pavement condition on the A4174 that was incorporated into the 2015 Tranche 1 Challenge Fund application was used to derive future year profiles of the DM condition.[1]

Forecast traffic

From recent local count data the Annual Average Daily Traffic (AADT) by vehicle type on each section of route was estimated. Table 3-1 shows the resulting two-way 2017 base AADT estimated for each section of the scheme. These volumes were growthed across the assessment period using NTEM (v7.2) growth factors, which yielded an average growth of 16.0% from 2017 to 2036.

Table 3-1 2017 2-way AADT traffic

	CarsTaxisMcycle	Buses Coaches	Light Goods Vehicles	All HGVs	All Motor Vehicles
A4 Keynsham Bypass	20,732	2,078	1,101	148	**24,059**
A4174 Keynsham	29,103	2,917	1,545	208	**33,773**
A4 Bath Rd (B&NES)	28,488	2,855	1,512	203	**33,059**
Durley Hill, Keynsham	14,178	1,421	753	101	**16,453**
B3116 Bath Rd	14,261	1,429	757	102	**16,549**
Broadmead Lane, Keynsham	5,958	597	316	43	**6,914**
A4174 Hengrove Way	15,391	116	3,731	696	**19,934**
A4174 Callington Road	13,882	108	2,177	616	**16,784**
A4 Bath Rd (BCC)	29,102	322	6,016	1,167	**36,608**

Pavement condition and operating costs

The impact of pavement condition on vehicle operating cost (VOC) has been estimated using relationships published in a study by Transport Scotland and TRL ('Economic, Environmental and Social Impacts of Changes in Maintenance Spend on the Scottish Trunk Road Network', 2012). Table 14.9 of that report provides calculated changes in the VOC for various vehicle types (cars, LGV, HGV and PSV) for increasing values of International Roughness Index (IRI) based on output from the HDM-4 model. The relative change calculated from this table is shown in Table 3-2.

Table 3-2 increases in VOC with increases in IRI

[1] The assessment of pavement lifecycles is based on existing pavement condition data and uses information drawn from previous maintenance challenge fund bids that modelled future condition using a deterministic deterioration model to assess the state of the pavement in each year in do minimum and do something maintenance scenarios.

Vehicle Type	IRI = 1	IRI = 4	IRI =7	IRI=9.5
Car	0.00%	3.55%	13.79%	22.36%
LGV	0.00%	4.35%	21.45%	36.99%
HGV	0.00%	6.71%	21.55%	33.09%
PSV	0.00%	9.48%	31.91%	48.33%

The pavement forecast condition considers the proportion of the route falling within three categories: Red (RCI > 100), Amber (RCI 40-100), and Green (RCI < 40). However, to calculate the impact on VOC, a single RCI value was needed. Thus, an RCI value within each category was used, based on the mean calculated for each band from the pavement condition data. Values used were as follows: Red = 122.42, Amber = 61.53 and Green = 6.07. These values were converted initially into 3 metre longitudinal profile variance (LPV3m) value and then into IRI using the following formula taken from the Transport Scotland (2012) study:

(1) $$LPV3m = A \times RCI + B$$

(2) $$IRI = \sqrt[1.8507]{LPV3m/0.2117}$$

where: *A* is a coefficient for single all purpose trunk roads of 0.0397
B is a coefficient for single all purpose trunk roads of 0.3085

Using these formulae, IRI values within each Scanner category were calculated as follows: Red = 5.82, Amber = 4.39 and Green = 2.49. The impact on VOC for each vehicle type (car, LGV, HGV and PSV) was then estimated by interpolating between the values in Table 3-2. Table 3-3 shows the resulting VOC adjustments by vehicle type used to estimate the impact of pavement condition on VOC.

Table 3-3 VOC Adjustments by scanner category by vehicle type

Vehicle Type	Red	Amber	Green
Car	14.73%	6.65%	0.89%
LGV	23.15%	9.53%	1.09%
HGV	22.82%	11.20%	1.68%
PSV	33.71%	16.27%	2.37%

The values of VOC by vehicle type in each forecast year were taken from the Transport Analysis Guidance (TAG) data book (July 2016). TAG provides forecast fuel, both work (Table A1.3.12) and non-work (Table A1.3.13), and non-fuel resource operating costs (Table A1.3.14). The fuel cost element was calculated based on an assumed mean speed of 49 kilometres per hour (weighted average value derived from GBATS4 assignments) and split for cars and LGV between work and non-work time based on weighted average based on the proportion of travel in work and non-work time in data book Table A1.3.4. The non-fuel resource was calculated based on an assumed mean speed of 49 kilometres per hour with the cost assumed to be fixed throughout the assessment period.

The vehicle kilometres for each vehicle type within each Scanner category were calculated by multiplying the forecast two way AADT along each route section by type in each year by the length of the section (in kilometres) within each category for that year from the DM and DS pavement condition forecast. The VOC within each category, by each vehicle type, was then calculated by multiplying the vehicle kilometres by the forecast VOC increased by the relevant VOC adjustment factor for the category. These were then summed to give a value over the assessment period.

Pavement condition and travel time

The impact of pavement condition on travel time is based on a study by TRL ('The Effect on Traffic Speeds of Resurfacing a Road', by Cooper, Jordan and Young, 1980), which showed that average speed increased when a new surface was provided for a road pavement. The Transport Scotland study (2012), by assuming the reverse, namely that speeds reduce as pavement condition deteriorates, provides estimated reductions in speed for various vehicle types based on increasing values of 3mLPV. This is shown in Table 3-4.

The assumed values within each Scanner category were converted to LPV3m using equation (1). This gave LPV3m values within each category as follows: Red = 5.67, Amber = 3.25 and Green = 1.05. The impact on mean speed for each vehicle type (car, LGV, HGV and PSV) was then estimated by interpolating between the values in Table 3-4. Table 3-5 shows the resulting mean speed reduction by vehicle type.

Table 3-4 Reductions in Speed by LPV3m by Vehicle Type

Type	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5
Car	0	0.22	0.44	0.67	0.89	1.11	1.33	1.56	1.78	2
LGV	0	0.26	0.51	0.77	1.02	1.28	1.53	1.79	2.04	2.3
HGV	0	0.26	0.51	0.77	1.03	1.28	1.53	1.79	2.05	2.30
PSV	0	0.22	0.44	0.67	0.89	1.11	1.33	1.56	1.78	2

Table 3-5 Mean Speed Adjustments by Scanner Category by Vehicle Type (kph)

Vehicle Type	Red	Amber	Green
Car	2.0	1.1	0.2
LGV	2.3	1.3	0.2
HGV	2.6	1.4	0.3
PSV	2.0	1.1	0.2

The values in Table 3-5 were used to create an adjusted mean speed within each Scanner category. The total vehicle hours by type were then estimated by dividing the length of the route section within each category (in kilometres) from the DM and DS pavement condition forecast by the adjusted mean speed (in kilometres per hour) to give the travel time in hours for a single vehicle. This was multiplied by the forecast AADT for that vehicle type on each of the scheme locations to give total vehicle hours.

The vehicle hours in each year were then monetised using average type/all-week values of time (VOT) in pounds per hour from TAG (Table A1.3.5) growthed in line with forecast values of time set out in TAG Table A1.3.6. The costs in each year were then summed to give a yearly cost which was totalled over the assessment period to give an overall estimate of daily travel time costs for each maintenance scenario.

Net economic benefit

The methodology set out above was carried out for the DM and DS maintenance scenarios based on the pavement forecast data for each scheme site. The separate VOC and travel time components were separately calculated and summed to give costs within each of the assessment years. The daily benefit was calculated by the net difference between the DM and DS scenarios. A 3.5% discount factor was applied to future benefits and the benefits were annualised using a factor of 365.

The calculations were carried out separately for each of the sections of route within the scheme with the relevant route length and AADT forecast used to estimate the economic impacts of forecast pavement condition.

The monetised pavement condition benefits discounted over 25 years are £16.4 million (2010 prices).

3.2 Accident benefits

Current accident record

Records of recent accidents in the scheme locations have been investigated for a five year period from January 2012 to December 2016. A total of 143 accidents were identified at scheme locations, a majority of 118 accidents are classified as 'slight' in terms of severity, 23 accidents as 'serious' and two as 'fatal' accidents. Table 3-6 presents the number and annual rates of accidents recorded.

Table 3-6 Current accident record

Severity	Total current accidents (5-years)	Total/year DM
Fatal	2	0.4
Serious	23	4.6
Slight	118	23.6
Total	**143**	**28.6**

Assumptions

The BCC and B&NES A4 and A4174 Airport Road Scheme is designed to improve the surfacing of the carriageway which is expected to have a positive impacts the number of accidents.

Accident reduction benefits have been calculated using 2010 base price values abstracted from WebTAG. These unit base year prices are shown in Table 3-7.

Table 3-7 Accidents costs, COBAT1, July 2016

Severity	Insurance £ Admin	Damage to Property £ Urban	Police Cost £ Urban	Casualty Cost £	**Total Rates £**
Fatal	285	7,441	16,755	1,556,245	**1,580,727**
Serious	178	3,988	1,850	174,878	**180,894**
Slight	108	2,353	478	13,481	**16,420**

The change in accident values over time are taken from WebTAG's annual rates of growth of accident values (COBALT2). Accidents reduction benefits have been discounted for 25 years using a discount rate of 3.5%, assuming that accident reduction is principally associated with resurfacing.

The Royal Society of Prevention of Accidents (ROSPA) Road Safety Engineering Manual Report states resurfacing schemes have been observed to reduce accidents generally by 46%, based on a number of established UK sources. As a conservative assumption it has been assumed that resurfacing will result in a general reduction in accidents by 10%. As such, annual accidents savings have been included in the benefit calculations as follows:

- 2.36 slight
- 0.46 serious
- 0.04 fatal.

Table 3-8 Estimated scheme (DS) accidents

Severity	Total DS (5-year)	Total/year DS
Fatal	1.8	0.36
Serious	20.7	4.14
Slight	106.2	21.24
Total	**128.7**	**25.74**

Results

The monetised accident reduction benefits in the opening year (2018) are £181,432, with overall accident reduction benefits discounted over 25 years being £3.8 million (2010 prices).

3.3 Works to Structures

Benefits from works to structures are primarily journey time savings, through avoiding the potential for route closures due to structure failures if they are not maintained. Works are proposed at 24 structures along the A4 / A4174 route as part of the scheme (23 in Bristol and one in B&NES). It has not been possible to tests the impacts of a failure at each of the structure individually and hence the following approach has been undertaken:

- Assess the transport economic efficiency impacts or a route closure at two locations using TUBA in conjunction with the GBATS4 model: one location on each of the A4 and A4174 respectively.
- Estimate the likelihood of a structural failure that would lead to a road closure over specified timeframes in the future. These have been estimated by BCC as follows:

  A4
  0-10 yrs: 20%
  10-25 yrs: 40%

  A4174
  0-10 yrs: 30%
  10-25 yrs: 50%
- Factor the TUBA results by the above percentages to obtain 'likelihood-weighted' impacts due to route closures. This was done by applying Bayesian[2] probability calculations to reflect the fact that once a route has closed due to the failure of a structure it cannot be closed again (to avoid double counting). Due to the inherent uncertainty, the likelihood values were halved to provide conservative estimates.
- Finally, the impacts were adjusted to exclude impacts due to failures at culverts, since flooding impacts will results in temporary rather than permanent route closures. This was done with simple factoring on the basis that nine out of the 23 BCC structures relate to culverts.

The discounted daily impacts of a potential route closure have been calculated as follows (2010 prices):

A4: £34,000

A4174: £7,019

The resulting net 'likelihood-weighted' benefits of works to structures discounted over 25 years are £13.7 million (2010 prices).

[2] Bayes Theorem is an accepted result in probability theory relating to conditional probabilities

3.4 Public transport benefits

Public transport benefits have been calculated for the provision of 14 new and improved bus shelters / raised kerbs along the corridor. Whilst the proposed measures will provide benefit to both boarding and alighting passengers (through the provision of a raised kerb), those boarding services will benefit additionally through the provision of improved bus shelters. The assessment has taken a conservative approach and estimated benefits only for bus boarders.

As no bus stop boarding surveys were available, an estimate of the potential public transport users to benefit from the investment was derived using the GBATS4M public transport model. Locally sourced factors were used to expand the modelled hour flows to a daily total.

Table 3-9. Estimation of potential bus stop boarders

	AM Peak Hour	Average Inter Peak Hour	PM Peak Hour	All day
Public Transport Boardings	116	60	51	850

The estimate of daily patronage was split into three user classes and converted to annualised totals. The user class split was based on local survey data gathered during public transport Origin – Destination surveys for the development of the GBATS4M public transport model. A factor of 252 was used to convert daily to annual boardings. This is conservative in that it excludes expansion to cover weekends and bank holidays.

Table 3-10. User Class Split and Annualisation Factors

Factor	Value
Home based Work	37.7%
Employer Business	2.6%
Other	59.7%
Annualisation Factor (Daily – Annual)	252

WebTAG Unit M3.2.1 provides an estimate for the added value given to bus users through selected “bus quality” interventions. The table provides an estimate for the benefits gained from the provision of new shelters, but does not detail the benefit from a raised kerb. It does however provide an estimate for the benefit gained from “low-floor buses”. For the purpose of this evaluation, and given that the bus stops improvements represent less than 4% of overall capital expenditure, it was considered appropriate and proportionate to assume the benefit of the raised kerb was equivalent to the low floor bus.

Table 3-11. User Class Split and Annualisation Factors

Measure	Value (Generalised Minutes)
New Bus shelter	1.08
New Bus with Low Floor	1.19

Annualised benefits per user class were derived (boarding x benefit) and converted to financial terms using the relevant value of time. Benefits were calculated over a 10 year period only, discounted to 2010 prices and values.

The monetised public transport user benefits are £0.56 million (2010 prices).

3.5 Cycling Benefits

Cycling benefits have been estimated for the two parts of the overall package:

- Wootton Park cycle way;
- The A4 Bath Road pedestrian / cycle crossing.

Wootton Park cycle way

A HEAT assessment was undertaken by BCC for a similar, neighbouring scheme on the A4174 Airport Road section between Wells Road and Creswicke Road. The assessed scheme is around 1.4km in length. The Wootton Park scheme serves the same locality and is 0.54km in length. To be conservative the results from the HEAT assessment for the Airport Road scheme were divided by three to estimate the Wootton Park scheme benefits, due to the difference in scheme length. The key HEAT assumptions were as follows:

- Trip distance. 5.77km (source: Census average cycle to work distance BCC);
- 117 additional individuals regularly cycling, based on other local scheme evaluation;
- % return journeys: 90%;
- Proportion of increase attributable to intervention: 100% (trip increase assumption is based on 1 year intervention increase only with no background growth);
- Time needed to reach full level of cycling: 1 year;
- UK average mortality rates;
- Value of a statistical life: £1,654,000;
- Time period over which benefits are calculated: 30 years;
- Discount rate: 3.5%.

A4 Bath Road pedestrian / cycle crossing

In order to estimate the number of potential cyclists using the crossing (no actual crossing data is available), various data sources have been utilised. These are detailed in Table 2.3

Table 3-12 Estimation of cyclists in crossing vicinity

	Value	Source
Ped/Cycle Crossings catchment area definition (miles)	1.5	National Travel Survey (2015); Table NTS0306
Commuters in catchment area	15,289	ONS, Census 2011
% of Commuters in catchment area who cycle	2.9%	ONS, Census 2011
Baseline cycling commuters	443	Estimate
Current Primary School Population in catchment area	1,496	ONS, Census 2011
Current Secondary School Population in catchment area	2,090	ONS, Census 2011
Proportion of Primary School Population who Cycle	3.4%	DfT Access Fund Submission 2016

Table 3-12 Estimation of cyclists in crossing vicinity

	Value	Source
Proportion of Secondary School Population who Cycle	4.6%	DfT Access Fund Submission 2016
Baseline cycling for Primary Education	51	Estimate
Baseline cycling for Secondary Education	96	Estimate
Baseline cycling education	147	Estimate

The benefits were calculated using the DfT Active Modes Toolkit. Separate analysis was carried out for commuters and school children. The main modelling assumptions are given in Table 3-13. The analysis period was restricted to 10 years with a decay rate of 7.7% in annual benefits, although this is a conservative assumption since the scheme provides physical measures that will yield ongoing benefits.

Table 3-13 Assumptions in DfT Active Mode Toolkit

Attribute	Value	Source
Commuter Journeys	44	5% of baseline potential commuters
Average Trip Length	7.6km	2015 BCC/SGC Travel to Work survey
Average Trip Speed	17.5kph	2015 BCC/SGC Travel to Work survey
Annualisation Factor - Commuters	220	No. work days
School Children journeys	15	5% of baseline potential commuters
Average Trip Length	2.5 Km	2015 BCC/SGC Travel to Work survey
Average Trip Speed	10.5kph	2015 BCC/SGC Travel to Work survey
Annualisation Factor - School Children	190	No. school days

The monetised cycling benefits are £0.59 million (2010 prices).

4.0 Results

4.1 Cost benefit analysis

Costs and benefits associated with the scheme have been used to undertake a cost benefit analysis, bringing together potential benefits from road surface improvements, works to structures, public transport, walk / cycle and accident benefits from improved road surfaces.

‘Do Something’ Capital and ‘Do Minimum’ on-going reactive costs and benefits have been assessed, and discounted to a 2010 price base. The results are summarised below.

Scheme costs are summarised as follows:

Public Accounts	(£’000)
Investment costs	£5,191
Operating costs (reduced maintenance)	-£741
Broad Transport Budget	£4,450

2010 values and prices

The cost benefit analysis is summarised as follows:

Analysis of Monetised Costs and Benefits	(£'000)
Cycling Benefits	£593
Accidents	£3,824
Works to structures	£13,727
Pavement Condition	£16,433
PT user benefits	£560
Broad Transport Budget	£4,450
Present Value of Benefits (PVB)	£35,137
Net Present Value (NPV)	£30,687
Benefit Cost Ratio (BCR)	*7.90*

2010 values and prices

The assessment indicates the scheme represents very high value for money with a BCR of 7.9.

A simple sensitivity assessment has been undertaken to identify the changes in costs / benefits needed to reduce the BCR to 2. This is shown below in Table 4-1.

Table 4-1 Cost / Benefit changes yielding BCR of 2

Change to give BCR of 2	Change
Cost increase	+ 250%
Benefit reduction	- 74%

This shows that it would require very large increases in costs or decreases in benefits to reduce the BCR to a value of 2.

Full Analysis of Monetised Costs and Benefits (AMCB) and Public Accounts (PA) tables are provided in Appendix A.

Appendix A

Appraisal Tables

Analysis of Monetised Costs and Benefits

Noise		*(12)*
Local Air Quality		*(13)*
Greenhouse Gases		*(14)*
Journey Quality		*(15)*
Physical Activity	593,393	*(16)*
Accidents	3,823,861	*(17)*
Economic Efficiency: Consumer Users (Commuting)	21,536,662	*(1a)*
Economic Efficiency: Consumer Users (Other)		*(1b)*
Economic Efficiency: Business Users and Providers	9,541,502	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-358,209	- *(11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	35,137,209	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*
Broad Transport Budget	4,450,391	*(10)*
Present Value of Costs (see notes) (PVC)	4,450,391	*(PVC) = (10)*
OVERALL IMPACTS		
Net Present Value (NPV)	30,686,818	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	7.9	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.

Public Accounts (PA) Table

	ALL MODES TOTAL		ROAD INFRASTRUCTURE	BUS and COACH	RAIL	OTHER
Local Government Funding						
Revenue	0					
Operating Costs	-740,534		-740,534			
Investment Costs	1,115,136		1,115,136			
Developer and Other Contributions	0					
Grant/Subsidy Payments	0					
NET IMPACT	374,602	*(7)*	374,602	0	0	0
Central Government Funding: Transport						
Revenue	0					
Operating costs	0		0			
Investment Costs	4,075,789		4,075,789			
Developer and Other Contributions	0					
Grant/Subsidy Payments	0					
NET IMPACT	4,075,789	*(8)*	4,075,789	0	0	0
Central Government Funding: Non-Transport						
Indirect Tax Revenues	0	*(9)*	0			
TOTALS						
Broad Transport Budget	4,450,391	*(10) = (7) + (8)*				
Wider Public Finances	0	*(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.