



TECHNICAL MEMORANDUM

# DfT WECA NPIF Economic Case

## Technical Note

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### 1.0 Background

The WECA authorities (BCC, B&NES and SGC) are submitting a National Productivity Investment Fund (NPIF) application to secure finance towards a number of junction improvement schemes across the three authority areas, as follows:

Ref	Road	Junction	Authority	Cost (k)
A	A431	Junction with Kingsway	BCC	390
B	A431	Junction with Whittucks Road	SGC	504
C	A431	Junction with Alder Moor Way	SGC	636
D	A431	Brougham Hayes/Windsor Bridge Rd junctions with A36	B&NES	500
E	Upper Maudlin Street	Lower Maudlin/Upper Maudlin Street/ Marlborough Street	BCC	630
F	Upper Maudlin Street	BRI Entrance/Upper Maudlin Street	BCC	140
G	Upper Maudlin Street	Colston Street/St Michael's Hill/Upper Maudlin Street	BCC	230
H	Upper Maudlin Street	Park Row (B4051) junction with Lower Park Row	BCC	50
I	A38	Ashley Down Road junction to Filton Avenue	BCC	315
J	A4017 (Cleeve Hill)	A432 Badminton Road / Cleeve Road	SGC	684
K	A4017 (Cleeve Hill)	A4017 Bromley Heath Road/ Cleeve Hill	SGC	936
			<b>Total</b>	<b>5,015</b>

This technical note sets out the methodology and related assumptions, along with the outcome of the economic assessment and cost-benefit analysis.

The note sets out details for each of the assessment criteria, as follows:

- New signals equipment (improved legibility) – accident benefits



- New signals equipment (replacing faulty equipment) – travel time savings
- Improved walk / cycle provision – health
- Improved walk / cycle provision – travel time savings
- Economic jobs / GVA benefits

A proportionate approach has been undertaken since the scheme is considered a small project in terms of the NPIF guidance.

## 2.0 Highway resurfacing – travel time savings and vehicle operating costs

Carriageway resurfacing is proposed for all the improvement schemes.

### *Pavement condition forecasting*

pavement condition data was provided for scheme locations, which was taken forward into the future, assuming that pavement will deteriorate with time to a greater extent without re-surfacing than with, based on recent highway pavement condition modelling undertaken for the DfT Maintenance Challenge Fund on behalf of BCC.

### *Forecast traffic*

From available count data the mean two-way 2017 base Annual Average Daily Traffic (AADT) by vehicle type on each section was estimated from counts and GBATS4 strategic traffic model data using appropriate expansion and seasonal adjustment factors. Volumes were factored to a common 2017 base using GBATS4 base year and forecast year flows, and growthed across the assessment period using growth factors derived from GBATS4 model years (2021 and 2036).

### *Pavement condition and operating costs*

The impact of pavement condition on vehicle operating cost (VOC) has been estimated using a 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.

### *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.

### **Forecast benefit**

**£4.60m** (2010 prices)

We have also quantified the expected safety improvements attributable to resurfacing by using observed reductions in collisions contained in the ROSPA Road Safety Engineering Manual. This is set out in the section *New signals equipment (improved legibility) and resurfacing – accident benefits* below.



### 3.0 New signals equipment (better operation) – travel time savings

Upgraded signal control is included in the schemes A431/Kingsway junction and A36 Lower Bristol Road/Windsor Bridge Road junction (from VA to MOVA) and at Perry Road/Park Row/Lower Park Row junction (from FT to SCOOT).

The following reductions in total delay in line with evidence have been assumed:

- FT to SCOOT: 12%
- VA to MOVA: 17%

Results have shown that SCOOT achieves an average saving in delay of about 12% when compared with up-to-date fixed time plans. Research by Bell and Bretherton (1986) suggests that SCOOT is likely to achieve an extra 3% reduction in delay for every year that a fixed-time plan ages. Since SCOOT is designed to adapt automatically to compensate for ageing and incident effects, it is reasonable to expect that, in many practical situations, SCOOT will achieve savings in delay of 20% or more. However, we have assumed the 12% reduction in this assessment.

MOVA will generally provide in the region of 21% reduction in delays. A TRL research project found that an average 13% decrease in delay at 20 junctions running with MOVA compared with standard VA. This is based on the TRL study "RR279 MOVA: The 20-site trial" by J R Peirce and P J Webb. 1990". We have applied the mid-point 17% reduction in delays to this assessment.

These reductions were applied to total forecast AM peak, PM peak junction delays (from GBATS) in 2021 and 2036, which was factored up to calculate an annual delay reduction. Delays at the A36 Lower Bristol Road/Windsor Bridge Road were taken from Highways Analyst and vehicle flows from local data.

The total forecast reduction in annual delays is 14,652 hours in 2021 and 16,028 in 2036.

#### **Forecast benefit**

**£6.10m** (2010 prices)

### 4.0 New signals equipment (improved legibility) and resurfacing – accident benefits

Benefits are forecast to arise from the replacement of signalling equipment where old signals are being replaced, i.e. all junctions except the A38 Ashley Down Road junction to Filton Avenue, and for resurfacing.

The ROSPA Road Safety Engineering Manual Report states that resurfacing and (existing) signal improvements have been observed to reduce accidents generally by 46% and 22% respectively. As a conservative assumption, it has been assumed that each improvement will result in a general reduction in accidents by 10% (compounded), which has been applied to the average annual accident rates at junctions concerned.

These factors have been applied to the average annual accident rates (calculated from local data over the past five years) at all junctions subject to improvements.

The average value of prevention per casualty by severity has been taken from WebTAG data book (Table A 4.1.1) to which COBALT Compound Annual Rates of Growth of Accident Values have been applied.

The improvements are forecast to result in 0.25 serious and 3.2 slight casualties annually.



### ***Forecast benefit***

**£2.04m** (2010 prices)

## 5.0 New signals equipment (replacing faulty equipment) – travel time savings

Benefits are forecast to arise from the replacement of signals that are currently at least 20 years old, since there will be fewer signal failures. Comparing average and maximum travel times (i.e. during signal failures) through the junctions with the recorded number of annual signal failures, the annual delay to the network attributable to signal failures at each junction has been established.

From Highways Analyst, the observed travel time on links approaching each junction (during 0700-1900) has been reviewed to identify the difference between the average travel time and maximum travel time. The assumption is that the maximum travel time occurs during major incidents including signal failures. To be conservative, the 5% lowest and 5% highest of travel times have been excluded from the dataset. This data has been combined with the recorded number of annual signal failures at each location (most recent 12 months of data available) and junction traffic counts (from GBATS or manual classified counts) to calculate the annual delay to the network attributable to signal failures at each junction.

The B4051 Upper Maudlin Street / Bristol Royal Infirmary junction has been excluded from the assessment due to the lack of count data at this location.

Travel time savings were calculated for the AM and PM peak flows only, with total annual savings forecast to be 11,640 hours in 2021 and 12,302 hours in 2036.

This is conservative with respect to the following:

- Delays attributable to signal failures are assumed to remain constant in future (rather than increasing as would reasonably be expected)
- The number of signal failures per year are assumed to remain constant in future
- All failures have been assumed to be rectified within 24 hrs whereas in practice some failures would require longer to resolve.

### ***Forecast benefit***

**£4.72m** (2010 prices)

## 6.0 Improved walk / cycle provision – health

A HEAT assessment has not been undertaken hence the assessment is conservative in this regard.

## 7.0 Improved walk / cycle provision – travel time savings

Highway delay reduction attributable to modal shift has also been calculated. This draws on the BCR of 6.1 set out in the West of England Cycle Transformation Cycle City Ambition Grant (CCAG) Funding Bid, which is based on highway delay benefits due to mode shift from car to walk/cycle. The CCAG methodology applies evidence from investment in six Cycling Demonstration Towns (Sloman et al, 2009). This has been applied to the approximate walking/cycling spend of each element of the scheme, equating to 25% overall (as confirmed with Marc Tite, BCC).



## Forecast benefit

**£2.91m** (2010 prices)

## 8.0 Benefit Cost Summary

A cost-benefit analysis of the scheme has been undertaken over 60 years. 15% optimum bias has been included. An average value of time for all vehicle types of £12.25/hour (2010 prices) was used in all calculations.

The table below presents a summary Analysis of Monetised Costs and Benefits.

Analysis of Monetised Costs and Benefits	Present value (£k)
Accidents	2,043
Economic Efficiency: Consumer Users (Commuting)	6,417
Economic Efficiency: Consumer Users (Other)	6,417
Economic Efficiency: Business Users and Providers	5,500
Present Value of Benefits (PVB)	20,377
Present Value of Costs (PVC)	4,053
Net Present Value (NPV)	16,324
<b>Benefit to Cost Ratio (BCR)</b>	<b>5.0</b>

The benefits associated with each of the assessment criteria discussed above are summarised below.

Scheme component	Present value (£k)
Resurfacing	4,600
New signals equipment (better operation)	6,103
New signals equipment (if 20y+ old)+ resurfacing	2,043
New signals equipment (replacing faulty equipment)	4,721
Improved walk / cycle provision (delays)	2,910
<b>Total</b>	<b>20,377</b>

## 9.0 Economic jobs / GVA benefits

Job creation and GVA impacts have been estimated from delay/journey time savings associated with the scheme improvements.

Based on experience of the relationship between the monetised value of journey time savings and job creation on major transport schemes throughout the West of England (e.g. MetroWest, AVTM), it is assumed that journey time savings valued at £400,000 typically translate to one FTE job. This is primarily due to productivity impacts and labour supply expansion.

Based on this benchmark, a journey time saving of £16.00m translates to creation of **40.1 FTE jobs**.

Using the GVA benchmark of £48k per job for Bristol from ONS sub-regional data, the corresponding GVA benefits are **£1.92m**.