

## **Appendix C**

### **Histon Road Preliminary Concept Design – Initial Economic Case**

# MEMO

|                |   |                        |               |
|----------------|---|------------------------|---------------|
| <b>TO</b>      | Cambridgeshire County Council   | <b>FROM</b>            | WSP           |
| <b>DATE</b>    | <b>09 February 2018</b>   | <b>CONFIDENTIALITY</b> | <b>Public</b> |
| <b>SUBJECT</b> | <b>Histon Road Preliminary Concept - Initial Economic Case [v1.1]</b> |                        |               |

## 1. INTRODUCTION

WSP has conducted a high level economic appraisal of the benefits that could be realised by the provision of a Histon Road improvement scheme focussing on improving journeys for bus users and cyclists. The latest iteration of the Histon Road scheme is currently under development so this appraisal does not represent a final cost-benefit analysis and is simply intended to provide an initial indication of the scale of benefits that could be achieved, based on the emerging preliminary concept design for Histon Road.

## 2. METHODOLOGY

The Histon Road scheme currently being developed includes improved cycle ways in both directions and a circa 500m section of southbound bus lane, therefore the majority of scheme benefits are likely to relate to the health benefits associated with increased active mode uptake and travel time savings for public transport users. At this stage a DfT Transport Users Benefit Appraisal (TUBA) has not yet been conducted so a comprehensive assessment of travel time impacts is not included. This assessment includes an active mode benefits assessment and an estimate of cycle and bus travel time savings.

To inform the benefit calculations, the Cambridge Sub-Regional Model (CSRM2) has been used to conduct a high level assessment of the amount of mode shift that could be expected from the emerging scheme. The model runs used to inform this assessment assumed that the Histon Road scheme would be implemented alongside the City Access proposals to form a package of measures that jointly discourage car use in the City Centre (City Access) and improve public transport and active-mode options (Histon Road). Where this report refers to *'the scheme'*, this includes both the City Access and Histon Road elements. As the benefits being produced on Histon Road result from both the City Access and Histon Road schemes, the costs being used for this economic appraisal also cover both schemes.

**It is worth noting that the City Access scheme will have a wider impact in terms of benefits than just Histon Road so a large part of the City Access benefits will be excluded from this assessment, despite the full City Access cost being included. This was felt to be the most conservative approach to estimating the benefit-cost ratio at this stage.** An initial cost estimate has been produced for the Histon Road scheme (£6M), but a figure for the City Access measures is yet to be produced so costs for this element are assumed to be in line with the current level of funding allocation (£10M).

A long term projection of the benefits for both a 10 and 20 year appraisal period have been produced for each of the types of benefits calculated in the proceeding sections of this note. As per WebTAG guidance, prices have been based in 2010 pounds (£.2010) and social time preference has been taken into account using the method of discounting detailed in HM Treasury's Green Book<sup>1</sup>.

<sup>1</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/220541/green\\_book\\_complete.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf)

### 3. BENEFIT APPRAISAL

The benefit appraisal presented here is conducted in line with the guidance set out by the Department for Transport (DfT) in their active mode appraisal guidelines (WebTAG unit A5.1) and uses WebTAG Databook v1.9.1 (Dec 2017 release). This TAG unit sets out the various benefit types that should be considered when appraising schemes that impact walk and cycle trips. This includes improved health, journey quality, journey time savings, absenteeism and marginal external costs (congestion, air quality, noise, indirect tax revenue and accident savings). Each of these types of benefit is presented below with a detailed breakdown of the calculations undertaken. In addition to the active mode appraisal, an estimate of the journey time savings for bus users has also been produced.

#### 3.1. Health Benefits

The health benefits of the scheme resulting from a reduction in the number of years of life lost have been assessed using the Department for Transport's Active Mode Health Benefits Worksheet<sup>2</sup>. The key inputs required were as follows:

- Number of new cycle journeys due to scheme: 5,235 (estimated from CSRM2)
- Number of new cyclists due to scheme: 3,379 (estimated from CSRM2)
- Number of new walking trips due to scheme: Assumed to be zero as only minor improvements are proposed for pedestrian facilities.
- Quality Adjusted Life Year (QALY) value, Department of Health: £60,000

The DfT's active mode health benefits worksheet predicts that the addition of 5,235 new cycle journeys due to the provision of the scheme should result in 23.46 fewer years of life lost every year. This equates to a saving of £1 Million during the opening year and gradually lower values over the preceding years due to social time preference which is taken account of in the discounting process.

This annual value has been projected and discounted for a 10-year and 20-year assessment period in the table below.

| <b>Long Term Health Benefits</b>      |                           |                           |
|---------------------------------------|---------------------------|---------------------------|
|                                       | <b>10 year assessment</b> | <b>20 year assessment</b> |
| <b>Total Health Benefits (£.2010)</b> | £ 9.6M                    | £ 17.9M                   |

#### 3.2. Journey Quality Benefits

The quality of a cycle journey, also referred to as journey ambience, is considered to be a perceivable benefit by the Department for Transport. The benefit of improved journey quality is quantified in table 4.1.6 of the WebTAG Databook (v1.9.1), shown below.

| <b>Table 4.1.6: Value of journey ambience benefit of cycle facilities relative to no facilities (2010 prices &amp; 2010 values)</b> |                    |                              |
|---|--------------------|------------------------------|
| <b>Scheme type</b>  | <b>Value p/min</b> | <b>Source</b>                |
| 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 <i>et al.</i> (1997) |
| Wider lane  | 1.81               | Hopkinson & Wardman (1996)   |
| Shared bus lane   | 0.77               | Hopkinson & Wardman (1996)   |
|   | <b>pence</b>       |                              |
| Secure cycle parking facilities   | 98.14              | Wardman <i>et al.</i> (2007) |
| Changing and shower facilities  | 20.82              | Wardman <i>et al.</i> (2007) |

<sup>2</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/639108/active-mode-health-benefits-worksheet.xlsx](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/639108/active-mode-health-benefits-worksheet.xlsx)

This benefit is calculated based on the number of minutes spent using a particular type of cycle facility. In order to calculate the overall journey quality benefit, the proportion of the route spent using each type of facility had to be calculated. This then allowed an average value of journey ambience to be calculated for the existing and proposed layouts, by direction, as shown below.

| Facility type                                  | Value of journey ambience (p/min) | EXISTING LAYOUT |             | PROPOSED SCHEME |             |
|--|-----------------------------------|-----------------|-------------|-----------------|-------------|
|  |                                   | Northbound      | Southbound  | Northbound      | Southbound  |
| Off-road segregated cycle track                | 7.03                              | 12%             | 0%          | 12%             | 0%          |
| On-road segregated cycle lane                  | 2.99                              | 0%              | 0%          | 63%             | 27%         |
| On-road non-segregated cycle lane              | 2.97                              | 44%             | 56%         | 25%             | 73%         |
| No facilities                                  | 0                                 | 44%             | 44%         | 0%              | 0%          |
| <b>Average ambience value of route (p/min)</b> |                                   | <b>2.17</b>     | <b>1.67</b> | <b>3.48</b>     | <b>2.98</b> |

In order to calculate ambience benefits, the number of existing and new cyclists due to the introduction of the scheme have been estimated using the Cambridge Sub-Regional Model (CSRM). As this number varies along the length of Histon Road, an average has been taken over all model links that form Histon Road and an assumption made that this average number all benefit from the full length of the scheme (from the A14 to Victoria Road). Weekend cyclists were then estimated using the ratio of weekend to weekday cyclists recorded in the National Travel Survey (2016)<sup>3</sup>. The average number of cyclists using Histon Road by 2031 is estimated to be as follows:

|  | Weekday    |            | Weekend    |            |
|--|------------|------------|------------|------------|
|  | Northbound | Southbound | Northbound | Southbound |
| Histon Road cycle trips, 2031 (without the scheme) | 1500       | 1162       | 460        | 357        |
| Histon Road cycle trips, 2031 (with the scheme)    | 3355       | 4542       | 1030       | 1394       |
| Difference (increase due to scheme)                | +1855      | +3379      | +569       | +1037      |

The amount of time spent cycling along Histon Road is also required to calculate the ambience benefits of the scheme. To calculate the travel time, an assumption has been made that without the scheme cyclists are likely to travel at 12kph (the default cycle speed assumption used in CSRM2) and with the scheme, an average speed of 20kph has been assumed. The latter is based on findings in Copenhagen which found that cyclists are able to travel at 20kph on well surfaced cycleways in order to take advantage of ‘green waves’ deliberately provided by signal controllers<sup>4</sup>. Cambridge is not dissimilar to Copenhagen in terms of terrain, so reaching average cycle speeds of 20kph on new infrastructure on Histon Road is felt to be a reasonable assumption. The proposed scheme is likely to cause an increase in cycle speeds for the following reasons:

- The re-surfacing of Histon Road will help to provide a smoother, faster running surface.
- Formalising the space available to cyclists by implementing advisory and raised cycle lanes should improve cyclists’ perception of safety and reduce the risk of vehicles passing too closely. This is likely to encourage higher cycling speeds.
- Cycle improvements at the Gilbert Road signalised junction mean cyclists are able to benefit from increased amounts of green time. In addition to receiving green time during the main Histon Road stage, they are also able to continue during the all-red pedestrian stage due to the proposed off-road cycleways bypassing the junction. Advanced cycle stop lines have also been incorporated into the design and will help cyclists to gain priority and minimise delays.

<sup>3</sup> <https://www.gov.uk/government/collections/national-travel-survey-statistics#data-tables> [Table NTS0504 accessed on 24<sup>th</sup> Nov 2017]

<sup>4</sup> <http://www.copenhagenize.com/2014/08/the-green-waves-of-copenhagen.html> [Accessed on 24<sup>th</sup> Nov 2017]

The length of Histon Road from the A14 junction to Victoria Road is 2.3km which translates to an average travel time of 11.1 minutes without the scheme (12kph) or 6.8 minutes with the scheme (20kph).

To calculate the total benefit, the benefit per trip along Histon Road (both northbound and southbound) has been calculated and multiplied by the number of trips. This was done for existing cyclists by calculating the proposed benefit and then subtracting the existing benefit. For new cyclists, all of the proposed benefit was assumed to be received. In accordance with WebTAG guidance, the rule of half has been applied. All values are rounded to the nearest penny.

| <b>Weekday Ambience Benefits</b>                                    |   |   |
|---|---|---|
| Type of cyclist   | Northbound  | Southbound  |
| Existing cyclists<br>(with scheme benefit – without scheme benefit) | <p style="text-align: center;"><b><u>With-scheme benefit:</u></b><br/>1500 cycle trips for 6.8 mins @ 3.48p/min<br/>minus<br/>1500 cycle trips for 11 mins @ 2.17p/min<br/>= <b>£178.56</b></p> <p style="text-align: center;"><b><u>Without-scheme benefit:</u></b><br/>1500 cycle trips for 6.8 mins @ 3.48p/min<br/>= <b>£179.64</b></p> <p style="text-align: center;"><b>Net ambience benefit for existing cyclists =</b><br/>With scheme – without scheme<br/>= <b>-£1.08 per weekday</b></p> | <p style="text-align: center;"><b><u>With-scheme benefit:</u></b><br/>1162 cycle trips for 6.8 mins @ 2.98p/min<br/>minus<br/>1162 cycle trips for 11 mins @ 1.67p/min<br/>= <b>£118.29</b></p> <p style="text-align: center;"><b><u>Without-scheme benefit:</u></b><br/>1162 cycle trips for 6.8 mins @ 2.98p/min<br/>= <b>£107.18</b></p> <p style="text-align: center;"><b>Net ambience benefit for existing cyclists =</b><br/>With scheme – without scheme<br/>= <b>£11.11 per weekday</b></p> |
|   | <p style="text-align: center;"><b><u>With-scheme benefit:</u></b><br/>1855 cycle trips for 6.8 mins @ 3.48p/min<br/>= <b>£220.86 per weekday</b></p>  | <p style="text-align: center;"><b><u>With-scheme benefit:</u></b><br/>3379 cycle trips for 6.8 mins @ 2.98p/min<br/>= <b>£343.90 per weekday</b></p>  |
| <b>Weekend Ambience Benefits</b>                                    |   |   |
| Type of cyclist   | Northbound  | Southbound  |
| Existing cyclists<br>(with scheme benefit – without scheme benefit) | <p style="text-align: center;"><b><u>With scheme benefit:</u></b><br/>460 cycle trips for 6.8 mins @ 3.48p/min<br/>minus<br/>460 cycle trips for 11 mins @ 2.17p/min<br/>= <b>£54.81</b></p> <p style="text-align: center;"><b><u>Without scheme benefit:</u></b><br/>460 cycle trips for 6.8 mins @ 3.48p/min<br/>= <b>£55.14</b></p> <p style="text-align: center;"><b>Net ambience benefit for existing cyclists =</b><br/>With scheme – without scheme<br/>= <b>-£0.33 per weekend day</b></p>  | <p style="text-align: center;"><b><u>With scheme benefit:</u></b><br/>357 cycle trips for 6.8 mins @ 3.48p/min<br/>minus<br/>357 cycle trips for 11 mins @ 2.17p/min<br/>= <b>£36.31</b></p> <p style="text-align: center;"><b><u>Without scheme benefit:</u></b><br/>357 cycle trips for 6.8 mins @ 3.48p/min<br/>= <b>£32.90</b></p> <p style="text-align: center;"><b>Net ambience benefit for existing cyclists =</b><br/>With scheme – without scheme<br/>= <b>£3.41 per weekend day</b></p>   |
|   | <p style="text-align: center;"><b><u>With-scheme benefit:</u></b><br/>569 cycle trips for 6.8 mins @ 3.48p/min<br/>= <b>£67.80 per weekend day</b></p>  | <p style="text-align: center;"><b><u>With-scheme benefit:</u></b><br/>1037 cycle trips for 6.8 mins @ 3.48p/min<br/>= <b>£105.56 per weekend day</b></p>  |

The daily values of journey quality benefits calculated above were then multiplied by weekday and weekend annualisation factors respectively to produce an annual benefit in 2010 prices. It was assumed that 253 average weekdays and 112 average weekend days occur per year.

| <b>Combined Ambience Benefits</b>    |                                       |  |
|--------------------------------------|---------------------------------------|--|
| <b>Type of benefit</b>               | <b>Northbound</b>                     | <b>Southbound</b>                      |
| Weekday benefit                      | £219.77                               | £355.00                                |
| Annual benefit (Weekday)             | =£219.77 * 253<br><b>= £55,602.53</b> | = £355.00 * 253<br><b>= £89,815.82</b> |
| Weekend benefit                      | £67.46                                | £108.97                                |
| Annual benefit (Weekend)             | = £67.46 * 112<br><b>= £7,555.81</b>  | = £108.97 * 112<br><b>= £12,205.05</b> |
| <b>TOTAL ANNUAL BENEFIT (£.2010)</b> | <b>£ 165,179.21</b>                   |  |

In accordance with WebTAG A5.1, benefits have been assumed to accrue over a number of years. A lower bound value, using a 10-year assessment period and an upper bound using a 20-year assessment period have both been produced as it is not clear how long the scheme would continue to realise benefits. The level of benefits presented below have been discounted over time as per WebTAG recommendations.

| <b>Long Term Ambience Benefits</b>      |                           |                           |
|---|---------------------------|---------------------------|
|   | <b>10 year assessment</b> | <b>20 year assessment</b> |
| <b>Total Ambience Benefits (£.2010)</b> | £ 0.7M                    | £ 1.2M                    |

### 3.3. Absenteeism Benefits

WebTAG unit A4-1 recommends using the TfL (2004) method of estimating the benefits to business (increased productivity) that can be achieved by a reduced level of absenteeism due to increased levels of activity, such as cycling. As the Histon Road scheme aims to encourage cycling by providing a higher quality of cycle facility, there is good potential for absenteeism benefits to be realised.

The recommendation in WebTAG (TAG Unit A4.1, paragraph 3.2.17) is to assume a reduction in short term leave (absenteeism) of 25% if physical activity exceeds 30-minutes. The first calculation needed, therefore, is to establish whether the Histon Road scheme is likely to attract an increase in physical activity exceeding 30-minutes.

The 2016 National Travel Survey (NTS0410) indicates that the average cycle commuter trip length in Cambridge is 5.726km. To achieve the required 30-minutes of physical activity, an average cycle speed of 23kph or less would need to be achieved. As previously stated, the average cycle speed in Cambridge has been assumed to be 12kph with more efficient cycle facilities likely to achieve a value in the region of 20kph. Therefore, it is likely that the cyclists using the Histon Road scheme would be meeting the required 30-minutes of activity that have been demonstrated to improve absenteeism.

In order to apply the 25% reduction in absenteeism, we first need to establish the anticipated level of absenteeism without the scheme. On average, employees take 4.3 days<sup>5</sup> of absence annually and 95%<sup>6</sup> of these are classified as short term leave. Therefore, 4.085 days of short-term leave are accrued per worker on average per year. Preventing 25% of this absence due to an increase in physical activity would therefore mean saving 1.02 days per active employee per year.

<sup>5</sup> <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/labourproductivity/articles/sicknessabsenceinthelabourmarket/2016>

<sup>6</sup> <https://bmcpublichealth.biomedcentral.com/articles/10.1186/1471-2458-12-861>

The WebTAG Databook v1.9.1 (table A1.3.1) provides a value of working time per hour, so to apply this value to the 1.02 days saved we first need to establish how many hours are worked per day. According to the Annual Survey of Hours and Earnings, the average time worked per week in Cambridge is 33.2 hours. Assuming the average employee works a 5 day week, the average time worked per day is 6.64 hours. This means a saving of 1.02 days translates to an annual saving of 6.78 hours per active employee.

The value of working time per hour (£.2010, market price, average of all modes) is £19.27 / hr. Applying this to the 6.78 hours saved, we achieve an annual absenteeism benefit to employers of £130.65 per active employee.

CSRM predicts that there will be approximately 1,160 new weekday commuter cyclists that use Histon Road as a result of the scheme, which equates to an annual reduced absenteeism benefit of £151,565.82. This annual value has been projected and discounted for a 10-year and 20-year assessment period in the table below.

| <b>Long Term Reduced Absenteeism Benefits</b>      |                           |                           |
|--|---------------------------|---------------------------|
|  | <b>10 year assessment</b> | <b>20 year assessment</b> |
| <b>Total Reduced Absenteeism Benefits (£.2010)</b> | £ 0.6M                    | £ 1.1M                    |

### 3.4. Gross Cycling Product Benefits

Increased public spending due to an increased uptake of cycling is regarded as an additional source of benefits that can be associated with the introduction of a new cycling scheme. Grous (2011)<sup>7</sup> aims to ‘chart the full extent of cycling’s contribution to the British economy’ in a measure termed the ‘Gross Cycling Product’. Grous states that the average cyclist spends £230 on cycle related shopping annually.

The Histon Road scheme is anticipated to attract 1,160 new cyclists to the corridor who are expected to contribute to cycle spending in the manner described by Grous. In total this results in an additional £101,748.15 per year in 2010 prices. This annual value has been projected and discounted for a 10-year and 20-year assessment period in the table below.

| <b>Long Term Gross Cycling Product Benefits</b>      |                           |                           |
|--|---------------------------|---------------------------|
|  | <b>10 year assessment</b> | <b>20 year assessment</b> |
| <b>Total Gross Cycling Product Benefits (£.2010)</b> | £ 0.4M                    | £ 0.7M                    |

### 3.5. Journey Time Saving Benefits

At this stage, a broad estimate of the level of journey time savings has been produced to help with an initial estimate of the level of value for money that the Histon Road scheme may achieve. Ideally this style of assessment would be conducted using the Department for Transport’s TUBA (Transport User Benefits Appraisal) Tool which is able to take into account a number of modes (car, bus, rail, cycle etc.) and assess the travel time savings that could be achieved by the scheme, taking into account any mode shift. A process is currently being considered to allow a full journey time savings assessment to be undertaken using outputs from CSRM – it is currently pending agreement and review from Cambridgeshire County Council and other consultants appraising other GCP schemes so that a consistent approach can be adopted.

Whilst this approach is under consideration, an alternative method has been used to provide a high level estimate of journey time savings. This method is not felt to be appropriate for use at Strategic Outline Business Case stage but has been included temporarily whilst a more robust method of appraisal is identified and agreed upon.

<sup>7</sup> <http://eprints.lse.ac.uk/38063/1/BritishCyclingEconomy.pdf>

Cycle travel time savings:

As mentioned above, the existing average cycle speed on Histon Road is assumed to be 12kph, whilst the provision of the scheme is estimated to increase this average speed to 20kph. This lead to the assumption that the existing journey time is approximately 11.1 minutes and the travel time anticipated by the scheme is 6.8 minutes. This means a 4.3 minute travel time saving for existing cyclists.

This level of travel time saving has been assumed to apply only to those cyclists that used Histon Road in the do-minimum and continued to use Histon Road in the do-something. This translates to the following daily journey time savings for cyclists on Histon Road.

| <b>Cycle Journey Time Savings (per day)</b> |                     |                   |
|---|---------------------|-------------------|
| <b>Trip time and purpose</b>                | <b>Northbound</b>   | <b>Southbound</b> |
| Weekday commuter                            | £400.36             | £310.30           |
| Weekend commuter                            | £44.50              | £34.39            |
| Weekday business                            | £22.90              | £17.75            |
| Weekend business                            | £2.27               | £1.76             |
| Weekday other                               | £286.08             | £221.73           |
| Weekend other                               | £125.76             | £97.47            |
| <b>TOTAL DAILY BENEFIT (£.2010)</b>         | <b>£99,393.57</b>   | <b>£77,036.07</b> |
| <b>TOTAL ANNUAL BENEFIT (£.2010)</b>        | <b>£ 176,429.64</b> |                   |

This annual value has been projected and discounted for a 10-year and 20-year assessment period in the table below.

| <b>Cycle Journey Time Benefits</b>         |                           |                           |
|--|---------------------------|---------------------------|
|  | <b>10 year assessment</b> | <b>20 year assessment</b> |
| <b>Cycle Journey Time Savings (£.2010)</b> | £ 0.7M                    | £ 1.3M                    |

Public transport travel time savings:

A Paramics microsimulation model has been developed to allow a more detailed assessment of the Histon Road scheme to be undertaken with particular focus on the operational performance of the scheme. This model was used to identify the level of public transport travel time saving that could be expected due to the provision of a southbound section of bus lane on Histon Road. The model estimates the following bus journey times along Histon Road from King's Hedges Road to Huntingdon Road:

| <b>Southbound bus travel time on Histon Road (mins)</b> | <b>Do-minimum</b> | <b>Do-something</b> |
|---|-------------------|---------------------|
| <b>AM Peak</b>  | 14.2              | 11.8                |
| <b>PM Peak</b>  | 11.9              | 9.5                 |

This level of travel time saving has been assumed to apply only to those bus passengers that use Histon Road in the do-minimum and continued to use Histon Road in the do-something. This translates to the following daily journey time savings for bus passengers on Histon Road.



| Bus Journey Time Savings (per day)   |                     |
|--------------------------------------|---------------------|
| <b>TOTAL DAILY BENEFIT (£.2010)</b>  | <b>£ 1,453.17</b>   |
| <b>TOTAL ANNUAL BENEFIT (£.2010)</b> | <b>£ 183,825.89</b> |

This annual value has been projected and discounted for a 10-year and 20-year assessment period in the table below.

| Bus Journey Time Benefits                |                    |                    |
|--|--------------------|--------------------|
|  | 10 year assessment | 20 year assessment |
| <b>Bus Journey Time Savings (£.2010)</b> | £ 0.8M             | £ 1.3M             |

### 3.6. Marginal External Costs

WebTAG unit A5.4 details a way that road decongestion benefits can be quantified if multi-modal model analysis has not been possible. As a full TUBA run has not been conducted, this method has been adopted to take account of elements that have not been included in the assessment elsewhere. WebTAG describes the marginal external cost (MEC) calculation as follows:

*The use of road vehicles incurs both private costs borne by the individual traveller (such as fuel costs and personal travel time) and external costs borne by others. For car use, these external costs include congestion, air pollution, noise, infrastructure and accident costs. The MEC method is based on the change in these external costs arising from an additional (or removed) vehicle (or vehicle km) on the network. These costs have been estimated from the Department's National Transport Model and Surface Transport Costs and Charges: Great Britain 1998.*

The individual elements covered by the MEC calculations are listed in the paragraph above. It should be noted that the accident savings calculated here relate to a reduction in accidents due to fewer cars being present on the roads, whilst a reduction in cycle accidents due to the proposed scheme is covered separately in section 3.7.

The marginal external costs are calculated using factors obtained from WebTAG (table A5.4.2) which are provided in pence per car kilometre. In order to calculate the magnitude of each benefit, an estimate of the reduction in car kilometres due to the scheme was required. CSRM was used to provide an estimate of the level of increase in cycle trips which are all assumed to have materialised as a results of trips shifting from car to bicycle. The National Travel Survey (2016) was used to inform the average distance travelled per cycle trip (5.7km). Using these values, an estimate of the total reduction in vehicle kilometres has been produced.

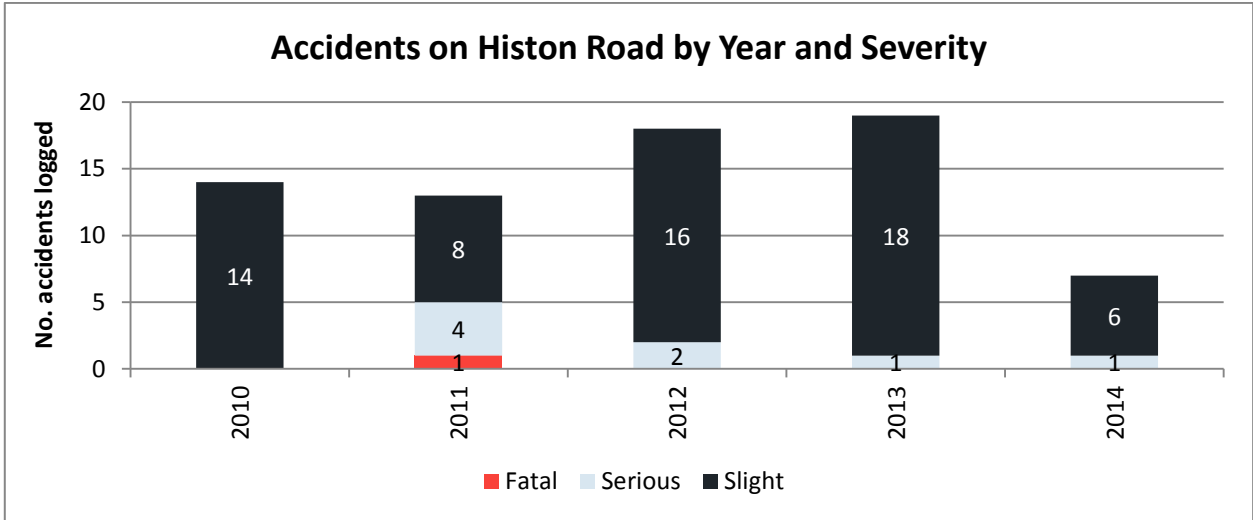
|  | Without scheme      | With scheme |
|--|---------------------|-------------|
| <b>Cyclists on Histon Road (7am-7pm, weekday)</b>  | 1015                | 3011        |
| <b>Increase in cycling on Histon Road (~ reduction in cars) (with scheme – without scheme)</b>   | 1996                |             |
| <b>Reduction in car kilometres</b><br>Assuming average trip distance of 5.7km (7am-7pm, weekday) | -11,430 km          |             |
| <b>Annual reduction in car kilometres</b><br>(assume 253 weekdays per year)                      | -2,891,830 km       |             |
| <b>Annual Marginal External Cost Saving</b>  | <b>£ 239,219.56</b> |             |

This annual value has been projected and discounted for a 10-year and 20-year assessment period in the table below.

| Marginal External Cost Savings                 |                    |                    |
|--|--------------------|--------------------|
|  | 10 year assessment | 20 year assessment |
| <b>Marginal External Cost Savings (£.2010)</b> | £ 3.2M             | £ 5.7M             |

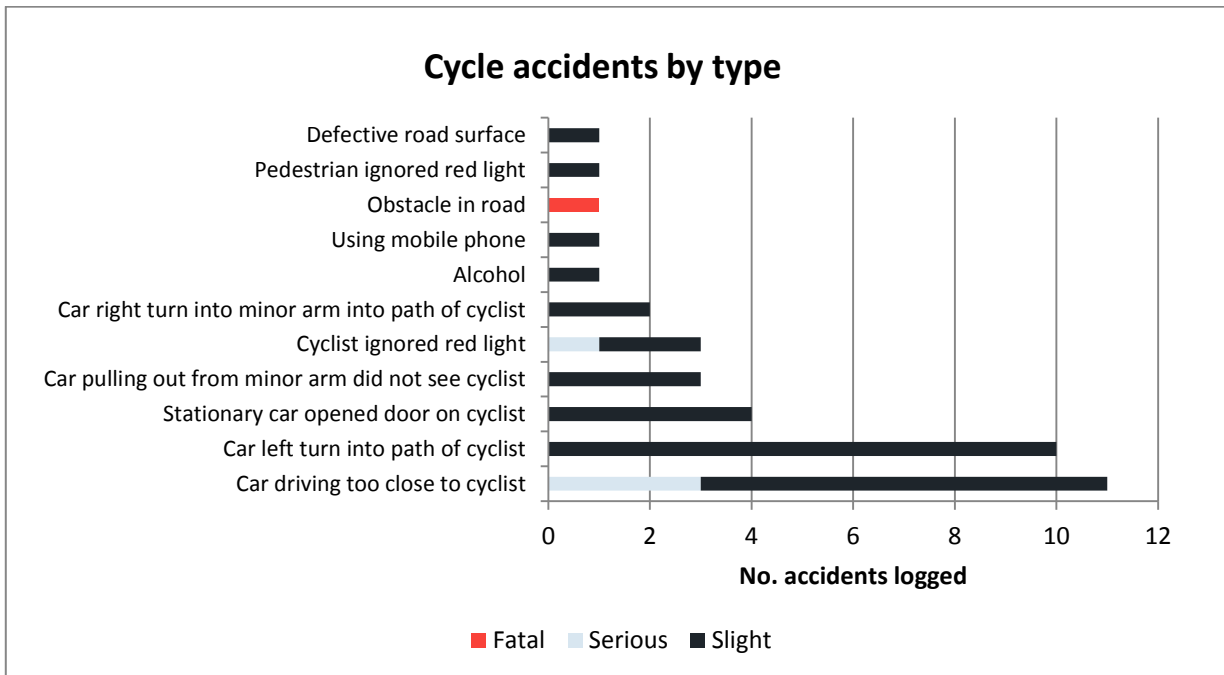
### 3.7. Accident Savings

Accident data was obtained for Histon Road from Victoria Road to the A14 spanning the five year period from 2010 to 2014 inclusive. During this period, 71 accidents were logged, of which there were 62 classed as ‘slight’, 8 classed as ‘serious’ and 1 fatality. Analysis has been conducted on the data set to identify the number of accidents involving cyclists, the reason for the accident and whether or not the proposed Histon Road scheme could have helped to avoid it.



As a key element of the Histon Road scheme is to provide better facilities for cyclists, the main focus of the accident analysis has been to look at accidents involving cyclists in detail. Of the 71 accidents logged, 38 (54%) were found to involve a cyclist. Of the 38 cycle accidents, there was 1 fatality (3%), 4 serious (11%) and 33 slight (87%) accidents.

Further analysis into the cause of each of the cycle accidents revealed that there were 11 broad reasons that could be attributed to causing all cycle accidents, as shown in the chart below.





Of the 11 different reasons found to cause cycle accidents on Histon Road, the following two reasons could be attributed to over half (55%) of the cycle accidents;

- vehicles driving too close to cyclists resulting in the cyclist losing balance (29%); and
- vehicles turning left into the path of a cyclist who is travelling in the same lane but wishing to continue ahead (26%).

The proposed scheme includes the provision of cycle lanes in both directions on Histon Road. The majority of the proposed cycle lanes will help to segregate cyclists and vehicles, either through the provision of a raised cycleway or through the painting of an advisory cycle lane.

It is felt that the provision of a clearly marked cycle lane (segregated by a raised kerb or non-segregated with a white line) is very likely to remove the risk of vehicles driving too close to cyclists. It is therefore felt that the 11 cycle accidents attributed to this problem could have been prevented if the scheme had been in place.

It is also felt that the provision of a segregated cycle lane (and physical kerb) is likely to act as a reminder to motorists that cyclists could be nearby which should encourage drivers to check mirrors and blind spots before making a left turn. It is therefore likely that the 10 cycle accidents attributed to this problem could have been prevented if the scheme had been in place. There is also a chance that other accidents relating to vehicles manoeuvring into the path of cyclists (5 in total) could have been prevented had a cycle lane been in place to remind drivers to check for cyclists before proceeding, although it's difficult to prove this conclusively.

Overall it is felt to be reasonable to conclude that the 11 cycle accidents caused by vehicles driving in close proximity to cyclists (3 serious and 8 slight) could have been prevented had the Histon Road scheme been in place. For the sake of conducting a conservative assessment, it has been assumed that none of the left-turning vehicle collisions would have been saved, although it is likely that some would have been.

|  | Accidents by Severity |              |             |
|--|-----------------------|--------------|-------------|
|  | Fatal                 | Serious      | Slight      |
| Cost of a casualty (£.2010, WebTAG Databook)                                     | £1,556,244.13         | £ 174,878.26 | £ 13,481.34 |
| Number of cycle accidents that could have been prevented by the scheme (5 years) | 0                     | 3            | 8           |
| Number of prevented cycle accidents per annum                                    | 0                     | 0.6          | 1.6         |
| Accident savings per annum (£.2010)  | £ -                   | £ 104,926.96 | £ 21,570.15 |
|  | <b>£ 126,497.11</b>   |              |             |

This annual value of accident savings has been projected and discounted for a 10-year and 20-year assessment period in the table below.

| <b>Long Term Accident Savings</b>      |                           |                           |
|--|---------------------------|---------------------------|
|  | <b>10 year assessment</b> | <b>20 year assessment</b> |
| <b>Total Accident Savings (£.2010)</b> | £ 0.5M                    | £ 0.9M                    |

### 3.8. Benefits Summary

The level of benefits over a 10-year and 20-year appraisal period are summarised below for each type of benefit identified. The total value of benefits (PVB) is presented and has been carried forward into the benefit-cost ratio calculation.

| Benefit Streams                              | 10yr appraisal | 20yr appraisal |
|--|----------------|----------------|
|  | Lower estimate | Upper estimate |
| Health benefits                              | £ 9.6M         | £ 17.9M        |
| Journey Quality                              | £ 0.7M         | £ 1.2M         |
| Absenteeism                                  | £ 0.6M         | £ 1.1M         |
| Gross Cycling Product (GCP)                  | £ 0.4M         | £ 0.7M         |
| Cycle Journey Time Savings                   | £ 0.7M         | £ 1.3M         |
| Bus Journey Time Savings                     | £ 0.8M         | £ 1.3M         |
| Marginal External Costs                      | £ 3.2M         | £ 5.7M         |
| Accident Savings                             | £ 0.5M         | £ 0.9M         |
| <b>Total Present Value of Benefits (PVB)</b> | <b>£ 16.6M</b> | <b>£ 30.2M</b> |

## 4. COSTS

The benefits of the Histon Road scheme have been estimated under the assumption that the Histon Road scheme is implemented alongside the City Access Measures. The costs that are required to implement the scheme should therefore include the cost for the Histon Road and City Access schemes combined.

The City Access measures are yet to be explicitly defined, but they aim to achieve a reduction in vehicle kilometres within Cambridge of 10-15% compared to 2011 levels which has enabled the measures to be mimicked in the transport modelling that has been undertaken using CSRM. As the exact components that make up the City Access measures are not known, it is not possible to produce a cost estimate and therefore the currently allocated level of funding (£10M) has been assumed to be appropriate.

It is estimated that the Histon Road scheme will cost in the region of £6M. This figure represents a current day cost (£.2018) and takes into account facilitation and enabling works, earthworks, minor utility diversions, off-site highway works, verges, minor adaptations for existing laterals and gullies, main contractor preliminaries, traffic management, main contractor overheads and profits and contingency. It does not include any additional cost for relocation of utilities above that already estimated (which will need further consultation with utility companies to more accurately estimate); long term operation, wider scale landscaping (*only making good of existing verges is currently included*), maintenance and professional/technical design and project management fees.

A summary of costs is provided below:

#### **Histon Road Initial Construction Cost Estimate**

|   |             |     |
|---|-------------|-----|
| Utilities                                 | £ 75,000    | 1%  |
| Off-Site Highway Works*                   | £ 3,924,078 | 66% |
| Landscaping                               | £ 5,000     | 0%  |
| Main contractor preliminaries             | £ 680,693   | 11% |
| Allowance for Traffic Management          | £ 320,326   | 5%  |
| Main contractor overheads and profit      | £ 300,306   | 5%  |
| Project contingency on construction costs | £ 660,162   | 11% |

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|                               |                    |
|-------------------------------|--------------------|
| <b>TOTAL CURRENT DAY COST</b> | <b>£ 5,965,565</b> |
|-------------------------------|--------------------|

|   |                    |
|---|--------------------|
| <b>TOTAL CURRENT DAY COST (ROUNDED)</b> | <b>£ 6,000,000</b> |
|---|--------------------|

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Highway works (£ 3.9M) are the main element contributing to the overall cost of the Histon Road scheme. This element is comprised of;

- £1M for works to the Victoria Road / Histon Road junction;
- £0.5M for works to the Gilbert Road / Histon Road junction;
- £0.6M for works on Histon Road between Victoria Road and Gilbert Road; and
- £1.7M for works on Histon Road between Gilbert Road and Darwin Green
- £0.1M for maintenance allowance - 10% Bond Cost for 2 years

This translates to a total of £1.5M for junction alterations. The initial funding estimate for Histon Road estimated that £4M would be required; however this figure was based on the assumption that only minor junction improvements would be required. The addition of the £1.5M for wider junction alterations brings the initial estimate of £4M up to a level in line with the £6M cost estimate that has now been produced.

To take account of the optimistic nature of scheme costing, an optimism bias of 44% has been applied to the £6M Histon Road and circa £10M City Access costs. Inflation is not included so costs have been deflated to 2010 prices in line with the HM Treasury GDP deflator values (December 2017). The total costs are assumed to be incurred in 2030 (1 year before the assumed opening year of 2031) and therefore the costs have also been discounted to take into account social time preference.

| Scheme   | Estimated Cost  |
|--|---|
| City Access Measures   | £10,000,000<br>(currently allocated level of funding, liable to change as measures are developed) |
| Histon Road Scheme   | £6,000,000  |
| Optimism Bias (@ 44%)  | £7,040,000  |
| <b>TOTAL COSTS (£.2017)</b>  | <b>£23,040,000</b>  |
| <b>TOTAL COSTS (£.2010)</b><br>(includes inflation adjustment and discounting) | <b>£10,525,916.14</b>   |

The total 2010 cost associated with the implementation of the City Access and Histon Road schemes is estimated to be **£10.5m**, and it is this figure which is used for the purpose of calculating a Benefit Cost Ratio.

## 5. SUMMARY

The benefit-cost ratio has been calculated based on the benefit and cost calculations presented in this note. Given the level of uncertainty at this stage of the project, a lower and upper value have been presented for a 10 year and 20 year assessment period, in accordance with WebTAG guidance.

| BENEFITS (£M, 2010 values and prices)  | 10 year appraisal | 20 year appraisal |
|--|-------------------|-------------------|
| Health benefits                        | £ 9.6M            | £ 17.9M           |
| Journey Quality                        | £ 0.7M            | £ 1.2M            |
| Absenteeism                            | £ 0.6M            | £ 1.1M            |
| Gross Cycling Product (GCP)            | £ 0.4M            | £ 0.7M            |
| Cycle Journey Time Savings             | £ 0.7M            | £ 1.3M            |
| Bus Journey Time Savings               | £ 0.8M            | £ 1.3M            |
| Marginal External Costs                | £ 3.2M            | £ 5.7M            |
| Accident Savings                       | £ 0.5M            | £ 0.9M            |
| <b>Total present value of benefits</b> | <b>£ 16.6M</b>    | <b>£ 30.2M</b>    |
| COSTS (£M, 2010 values and prices)     | 10 year appraisal | 20 year appraisal |
| <b>Total present value of costs</b>    | <b>£ 10.5M</b>    | <b>£ 10.5M</b>    |

|   | LOWER ESTIMATE | UPPER ESTIMATE |
|---|----------------|----------------|
| <b>NET PRESENT VALUE (benefits – costs)</b> | <b>£ 6.1M</b>  | <b>£ 19.6M</b> |
| <b>BENEFIT - COST RATIO</b>                 | <b>1.6</b>     | <b>2.9</b>     |