



# **Appraisal Specification Report**

Outline Business Case - Appendix D

17 January 2020

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# **Appraisal Specification**

## **Report**

Outline Business Case - Appendix D

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# Glossary of key terms

**Analysis of Monetised Cost and Benefits (AMCB) table:** Summarises the monetised impacts of a scheme that are included in the scheme's Net Present Value and Benefit-Cost Ratio.

**Appraisal Summary Table (AST):** Provides a complete summary of the scheme impacts, including the scheme's monetised impacts, and non-monetised impacts (both quantitative and qualitative).

**Benefit Cost Ratio (BCR):** Benefit Cost Ratio, is an indicator of the overall value for money of a project or proposal.

**Committed Schemes:** Where a scheme has been deemed likely to proceed and is therefore included within the option appraisals.

**Conservation Area:** An area designated under Section 69 of the Planning (Listed Buildings and Conservation Areas) Act 1990 as being of special architectural or historic interest and with a character or appearance which is desirable to preserve or enhance.

**Context:** The setting of a site or area, including factors such as traffic, activities and land uses as well as landscape and built form.

**Countryside:** The rural environment and its associated communities.

**Cumulative Impact:** The summation of effects that result from changes caused by a development in conjunction with other past, present or reasonably foreseeable actions.

**Early Assessment Sifting Tool (EAST):** Early Assessment Sifting Tool is used by DfT, to quickly summarise and present evidence on options. INSET is an enhancement of EAST and follows the same broad principles and approach.

**Effect:** The consequence of the scale of any change to the baseline environment, i.e. impact, on the environmental receptor, taking account of its particular value or sensitivity.

**Element:** A component part of the landscape (for example, roads, hedges, woods).

**Enhancement:** Landscape improvement through restoration, reconstruction or creation.

**Environment:** Our physical surroundings including air, water and land.

**Environmental Impact Assessment (EIA):** A formal, structured process of evaluating the likely environmental impacts of a proposed scheme, considering inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse.

**Full Business Case (FBC):** The culmination of the final phase is the Full Business Case. An investment committee will consider the Full Business Case then make a recommendation to ministers. Ministers will decide whether a proposal should proceed to implementation.

**Form:** The layout (structure and urban grain), density, scale (height and massing), appearance (materials and details) and landscape of development.

**Gross Domestic Product (GDP):** A measure of the total value of goods produced and services provided in an area.

**Gross Value Added (GVA):** A measure of economic output at a sub-national level.

**High Quality Public Transport (HQPT):** High Quality Public Transport, is a transport system that includes a range of features such as high levels of segregation, junction priority, high quality infrastructure (shelters, CCTV, real time, lighting, seating, help points etc), and high quality vehicles to name but a few.

**Heritage Asset:** A building, monument, site, place, area or landscape of historic value.

**Investment Sifting and Evaluation Tool (INSET):** INSET is Mott MacDonald's evaluation tool used in the optioneering process. INSET is an enhancement and expansion of EAST.

**Landform:** Combination of slope and elevation that produce the shape and form of the land.

**Landscape:** The character and appearance of land, including its shape, form, ecology, natural features, colours and elements and the way these components combine. Landscape character can be expressed through landscape appraisal, and maps or plans. In towns 'townscape' describes the same concept.

**Landscape Character:** The distinct and recognisable pattern of elements that occurs consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. It creates the particular sense of place of different areas of the landscape.

**Landscape Feature:** A prominent eye-catching element, for example, wooded hilltop or church spire.

**Landscape Quality:** Based on judgements about the physical state of the landscape, and about its intactness, from visual, functional, and ecological perspectives. It also reflects the state of repair of individual features and elements which make up the character in any one place.

**Landscape Sensitivity:** The extent to which a landscape can accept change of a particular type and scale without unacceptable adverse effects on its character.

**Land Use:** The primary use of the land, including both rural and urban activities.

**Local Liaison Forum (LLF):** The LFF provide a link between a project team and the local community.

**Multi Criteria Assessment Framework (MCAF):** Multi-Criteria Assessment Frameworks are used in the optioneering assessment process and allow options to be assessed against a range of criteria linked to the scheme objectives as well as wider policy and strategy objectives.

**Methodology:** The specific approach and techniques used for a given study.

**Mitigation:** Measures, including any process, activity or design to avoid, reduce, remedy or compensate for adverse landscape and visual effects of a development project.

**Modal Shift:** A shift from one transport type to another e.g. road travel to rail travel.

**Movement:** People and vehicles going to and passing through buildings, places and spaces. The movement network can be shown on plans, by space syntax analysis, by highway designations, by figure and ground diagrams, through data on origins and destinations or pedestrian flows, by desire lines, by details of public transport services, by walk bands or by details of cycle routes.

**Option Appraisal Report (OAR):** The Options Appraisal Report sets out the process undertaken to identify and assesses options, leading to the selection of the preferred option.

**Outline Business Case (OBC):** Is the second phase of the process which reconfirms the conclusions of set out in the Strategic Outline Business Case (SOBC). The OBC focuses on the detailed assessment of the options to find the best solution.

**Public Accounts (PA) table:** Records the investment and operating costs incurred by a public sector in delivering the scheme.

**Receptor:** Something that makes up the environmental baseline e.g. humans or other biological species, elements of the physical environment including water, air, soil, assets that make up the cultural heritage of an area.

**SATURN:** Simulation and Assignment of Traffic in Urban Road Networks, is a computer program that calculates route choices between origin and destination.

**Strategic Outline Business Case (SOBC):** This sets out the need for intervention (the case for change) and how this will meet strategic aims and objectives (the strategic fit). It provides suggested or preferred ways forward and presents the evidence for a decision.

**Strategic View:** The line of sight from a particular point to an important landmark or skyline.

**Sustainability:** The principle that the environment should be protected in such a condition and to such a degree that ensures new development meets the needs of the present without compromising the ability of future generations to meet their own needs.

**Topography:** A description or representation of artificial or natural features on or off the ground.

**Townscape:** Physical and social characteristics of the built and unbuilt urban environment and the way in which those characteristics are perceived. The physical characteristics are expressed by the development form of buildings, structures and space, whilst the social characteristics are determined by how the physical characteristics are used and managed.

**Tranquillity:** A state of calm or quiet.

**Transport Appraisal Guidance (TAG):** The DfT's Transport Appraisal Guidance (often referred to as WebTAG)

**Transport Economic Efficiency (TEE) table:** Summarises the monetised impacts against different user groups.

**Transport User Benefit Appraisal (TUBA):** TUBA is an economic appraisal computer programme developed for the Department for Transport (DfT) for appraising multi modal transport studies.

**Visual Impact:** Change in the appearance of the landscape as a result of development. This can be positive (i.e. beneficial or an improvement) or negative (i.e. adverse or a detraction).

**Wider Economic Benefits (WEB):** improvements in economic benefits that are acknowledged, but which are not typically captured in traditional cost-benefit analysis.



# 1 Introduction

## 1.1 Introduction

This Appraisal Specification Report (ASR) has been prepared to accompany the Outline Business Case (OBC) being developed for the Cambourne to Cambridge Better Public Transport (C2C) project, and sets out the planned approach towards the appraisal of the preferred option and its comparator options i.e. Do Minimum and sensitivity tests.

## 1.2 Purpose of the Appraisal Specification Report

This ASR forms part of the appraisal process as defined by the Department for Transport (DfT) in the Transport Analysis Guidance: The Transport Appraisal Process (May 2018). As part of the options development stage in identifying and appraising options, it is advised that an ASR is produced to clarify the methodology and scope for further appraisal of the better performing options<sup>1</sup>. In line with this guidance, this ASR sets out the:

- Proposed approach to modelling and forecasting;
- Proposed methodology for assessing the sub-impacts as presented in the Appraisal Specification Table (AST); and,
- Proposed specification that will inform the cost estimation.

Included as part of this ASR is the Appraisal Specification Summary Table (ASST) (Appendix A) which summarises the proposed methodology for appraisal against each of the sub-impacts that will be report in the final AST that will be presented within the OBC. The ASSR also identifies where an option is likely to have no likely impact or where the level of impact is assumed only slight, and therefore no further assessment beyond that carried out as part of the earlier stages of multi-criteria assessment is required.

Whilst this ASR sets out the planned approach towards the appraisal of the preferred option and its comparator options, the options assessment process undertaken to identify the preferred route alignment for Phase 1 and 2 of the scheme, and the Park & Ride site location, is set out in Options Assessment Reports 1, 2 and 3<sup>2</sup>, whilst the choice of technology for operating along the route is set out in the Guidance Technology Options Assessment Report<sup>3</sup>. Taken together, these optioneering exercises will conclude with a single preferred option.

## 1.3 Scheme description

The C2C project lies to the west of Cambridge, running between the settlement of Cambourne and Cambridge City Centre along the A428/A1303. The proposed scheme consists of three core elements:

- A **new segregated public transport route**, with junction priority measures between Cambourne and Cambridge where required, that bypasses general traffic congestion;
- A **new Park & Ride** site off the A428/A1303, and;
- **New high-quality cycling and walking facilities** along as much of the route as is feasible.

The C2C project evolved in response to existing issues of congestion on the local road network and the need to provide additional capacity and improve levels of connectivity between the

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<sup>1</sup> DfT – TAG: transport appraisal process, May 2018

<sup>2</sup> At the time of drafting this ASR the optioneering for Phase 2 was still being undertaken.

<sup>3</sup> At the time of drafting this ASR the Guidance Technology Options Assessment was still being undertaken.

growing settlements to the west of Cambridge and key employment locations such as the Biomedical Campus, the science park and the city centre. In particular the project aims to facilitate the growing demand for transport into Cambridge as a result of the planned growth in housing along the A428/A1303 route and the forecast growth in employment within Cambridge.

The C2C project aims to address these issues by providing a new High Quality Public Transport (HQPT) system, to deliver improved, faster and more reliable public transport services, together with high quality cycling and walking facilities and a new Park & Ride site that encourages the use of sustainable modes in favour of private car for people travelling into Cambridge.

Since receiving prioritisation for funding by the Greater Cambridgeshire Partnership (GCP) in 2015, the C2C project has progressed through a series of option generation and assessment exercises, including stakeholder public consultation and engagement. This resulted in the publication of a Strategic Outline Business Case (SOBC) in September 2016.

Since the publication of the SOBC, further development work and consultation has been undertaken to develop the emerging scheme. This will ultimately conclude with a preferred option that will be presented in an OBC towards the end of 2019.

## 1.4 GCP Assurance Framework

There are a number of key milestones in the project programme, where approvals will be required in order for the project to progress.

As part of the approval process at each stage, the project will progress through a number of key decision points where assurance will be carried out to ensure the project meets the required standards to be approved in order to progress to the next phase of work.

The assurance process the C2C project will follow is set out in the GCP Assurance Framework. This sets out the role of the GCP Joint Assembly in making recommendations to, and scrutinising, GCP Executive Board decisions, with the varied membership of the GCP Joint Assembly helping to ensure that it is both independent and sufficiently representative of a variety of viewpoints and stakeholder groups and so provides effective scrutiny.

The assurance process also proposes the involvement of independent advisors who will be appointed to ensure independent scrutiny of the C2C project business case and project as a whole at each key decision point. They will ensure robust and independent scrutiny of the project in line with GCP and DfT requirements. They will be responsible for scrutinising the scheme appraisal and ensuring the scheme represents value for money.

The role of the independent advisor includes providing advice to the scheme promoters, GCP Joint Assembly and GCP Executive Board on whether or not the C2C project should be approved to progress forward and to suggest any conditions that must be met by the scheme promoter. The GCP Executive Board will need to approve the OBC submission before the subsequent stages of work can be commenced.

## 1.5 Document structure

Following this introductory section, the report continues to discuss:

- Section 2: Scheme Background
- Section 3: Options Assessed
- Section 4: Traffic Modelling and Economic Appraisal Approach
- Section 5: Environmental Impacts Appraisal Methodology

- Section 6: Social and Distributional Appraisal Methodology
- Section 7: Reliability Impacts Appraisal Methodology
- Section 8: Wider Economic Impacts Appraisal Methodology
- Section 9: Supplementary Economic Modelling Methodology
- Section 10: Construction and Maintenance Impacts Assessment
- Section 11: Cost Estimation Approach
- Section 12: Appraisal Outputs

## 2 Scheme Background

### 2.1 Scheme background

Cambridge is one of the most successful cities within the UK where economic success, high quality of life and quality of place are inextricably linked. The thriving hi-tech and biotech industries, which have developed since the 1960s, and associated economic growth, have become known as the ‘Cambridge Phenomenon’<sup>4</sup>. As well as its historic success, Cambridge is also one of the fastest growing and most productive cities in the UK, and is viewed as being integral to the UK’s long term economic plan to ensure increasing economic growth, by improving productivity and international competitiveness<sup>5</sup>.

In order to achieve this continued economic growth and support Cambridge’s role in growing the UK economy, the GCP (made up of representatives from Cambridge City Council, Cambridgeshire County Council, South Cambridgeshire District Council and the University of Cambridge) agreed a City Deal with the Government in 2014. The aim of this City Deal is to support economic growth through investment in infrastructure, housing and skills, thereby addressing housing shortages, high congestion levels, and poor levels of connectivity between existing and new settlements and key employment locations.

The City Deal vision is:

**“To unleash a second wave of the ‘Cambridge Phenomenon’, securing sustainable economic growth and quality of life for the people of Cambridge and South Cambridgeshire.”**

A key route within Greater Cambridge is the A428/A1303, which is one of the main radial routes into Cambridge from the West and forms part of the Cambridge-Milton Keynes-Oxford arc. Large scale housing growth is proposed along the route by 2031, with 8,800 new homes planned between Cambridge and St Neots and 3,500 more houses planned to the east of St Neots by 2036<sup>6</sup>.

In order to accommodate this growth in housing, and the associated growth in the demand for travel from the west there is a need to invest in new transport infrastructure to provide effective links to key employment sites and address existing issues of congestion.

The C2C project therefore aims to:

- Achieve improved accessibility to support the economic growth of Greater Cambridge;
- Deliver a sustainable transport network/system that connects areas between Cambourne and Cambridge along the A428/A1303; and,
- Contribute to enhanced quality of life by relieving congestion and improving air quality within the surrounding areas along the A428/A1303 and within Cambridge city centre.

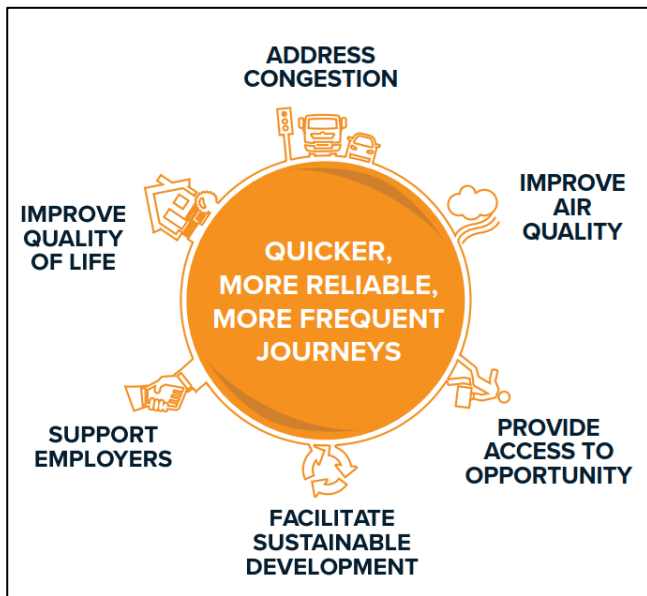
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<sup>4</sup> <http://www.cambridgephenomenon.com/phenomenon/>

<sup>5</sup> Strategic Economic Appraisal of A428-A1303 Bus Scheme, Mott MacDonald, August 2016

<sup>6</sup> South Cambridgeshire Local Plan 2018

Figure 1: C2C Project Aims



Source: Mott MacDonald

## 1.1 The need for intervention

Based on current evidence, and in line with existing policy and strategies, the key underlying drivers for the need for change along the A428/A1303 route and for investment in the C2C project can be summarised as follows<sup>7</sup>:

- The A428 is a nationally important route and forms part of the nationally strategically important Oxford-Milton Keynes-Cambridge arc - highlighted by the National Infrastructure Committee as a priority for growth<sup>8</sup>.
- Large population growth will require the delivery of significant additional housing, much of which is planned to be located to the West of Cambridge along the A428/A1303 route.
- Employment is growing rapidly within Greater Cambridge, including in destinations on the edge of the city such as West Cambridge and the Biomedical Campus to the South, with a need to provide effective transport connections from existing and future settlements.
- The demand generated by the growth in housing and employment will generate ever greater levels of demand for travel in and around Greater Cambridge and will thereby exacerbate current congestion issues.
- Car ownership in Greater Cambridge is high, with 85% of households having access to a car compared to the national average of 74%<sup>9</sup>.
- The rail network does not serve movements along the A428/A1303 route.
- The existing A428/A1303 is inadequate for walking and cycling as a mode of transport into Cambridge.
- Congestion on the route means that current public transport services are unable to offer an attractive alternative to private car.

<sup>7</sup> Further detail on the need for intervention can be obtained from the SOBC and existing OARs published on the GCP project website - <https://www.greatercambridge.org.uk/transport/transport-projects/cambourne-to-cambridge/cambourne-to-cambridge-background/>

<sup>8</sup> The National Infrastructure Commission - Cambridge, Milton Keynes and Oxford Future Planning Options Project Final Report November 2017 - [www.nic.org.uk/wp-content/uploads/5thStudio-FinalReport.pdf](http://www.nic.org.uk/wp-content/uploads/5thStudio-FinalReport.pdf)

<sup>9</sup> 2011 Census

- Without intervention, those living and working in the new developments could become locked into a cycle of car dependency and low use of other modes exacerbating capacity issues along the route.

## 1.2 Scheme vision

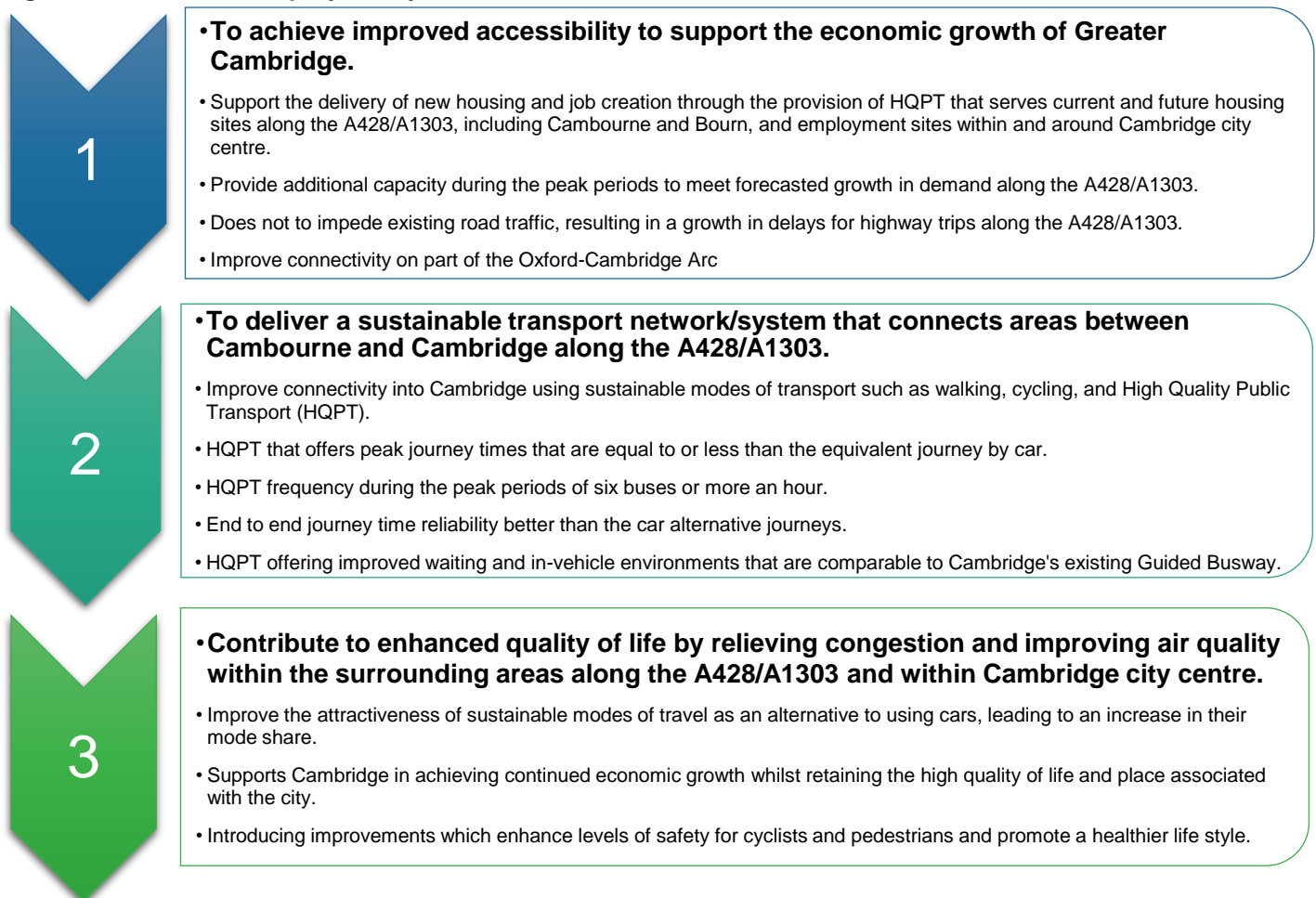
Based on the existing and future issues identified in Cambridge, the proposed overall vision for the C2C project is as follows:

*“To connect existing and new communities along the A428/A1303 to places of employment, study and key services to enable the sustainable growth for Greater Cambridge. We will deliver this through improved, faster and more reliable High Quality Public Transport (HQPT) services, together with high quality cycling and walking facilities serving a new Park & Ride site to the west of Cambridge.”*

## 1.3 Scheme objectives

A set of strategic objectives has been identified for the C2C project in order to achieve the aim of the project. These objectives provide the overarching direction for the project, with each objective having a set of more specific sub-objectives that are more specific and measurable.

Figure 2: C2C scheme – project objectives

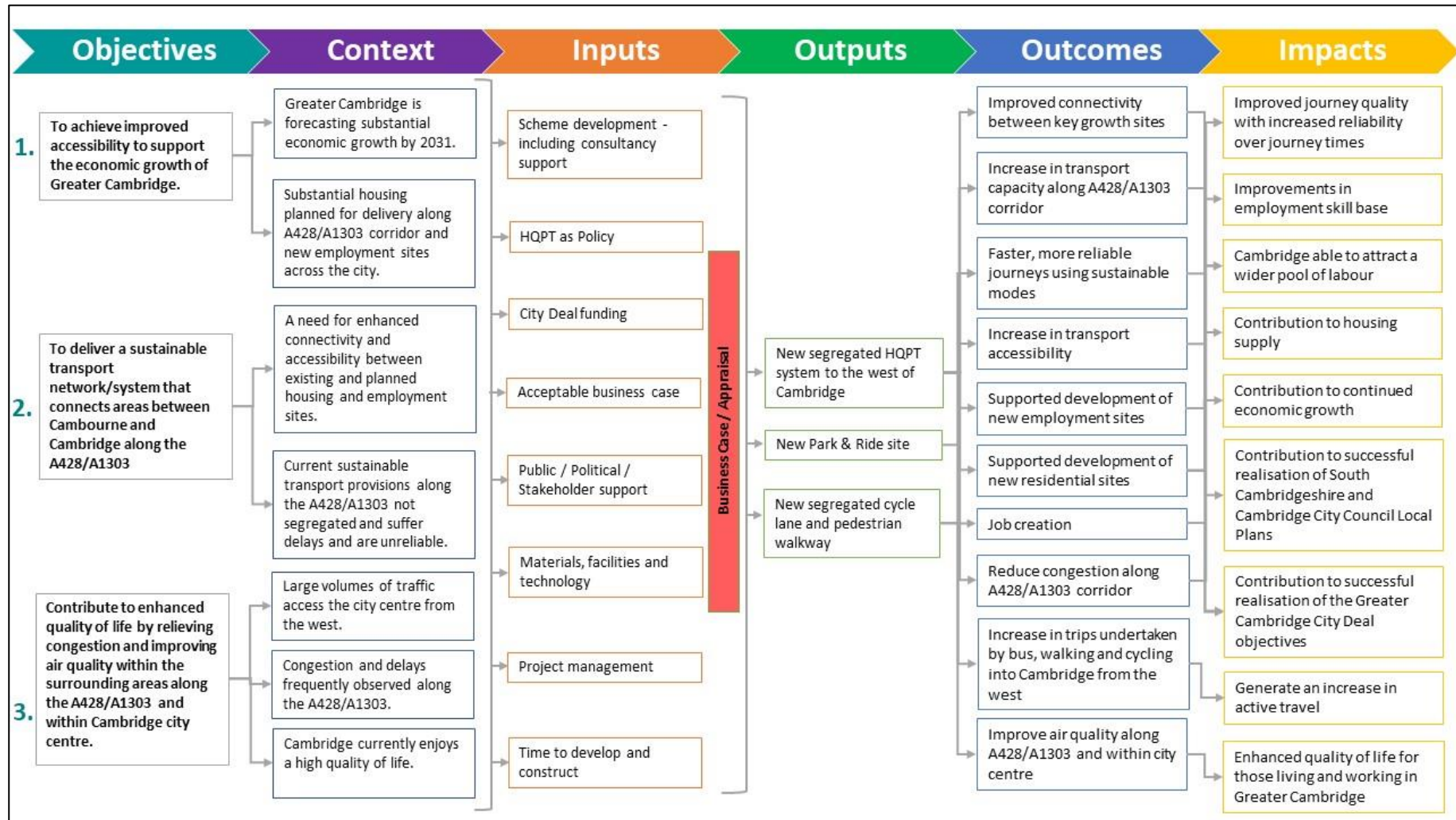


### 1.3.1 Logic map

The delivery and expected benefits of the C2C project is demonstrated in a logic process map in Figure 3. Here, the causal pathway between the objectives of the project, the inputs required to deliver tangible outputs and expected outcomes as a result of the investment are shown.



Figure 3: C2C scheme logic map



Source: Mott MacDonald



## 3 Options Assessed

### 3.1 Background to optioneering

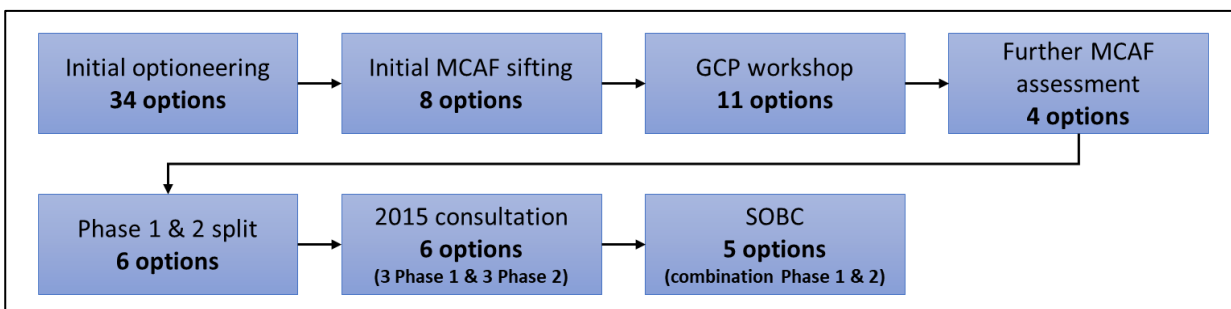
Work on developing plans for the C2C project began in 2014, with the project being prioritised for funding from the City Deal by the GCP in 2015.

Since being prioritised for funding, the scheme has undergone significant development to generate options that would address the issues of congestion and reliability along the A428/A1303 and to develop opportunities to connect local communities to employment opportunities in Greater Cambridge. The options have progressed through a series of assessments and refinement, including public consultation. The short-listed options were presented in a Strategic Outline Business Case (SOBC) in September 2016, with work having now been undertaken since to progress towards the selection of a preferred scheme and the development of an Outline Business Case (OBC).

### 3.2 Options development and assessment through to SOBC

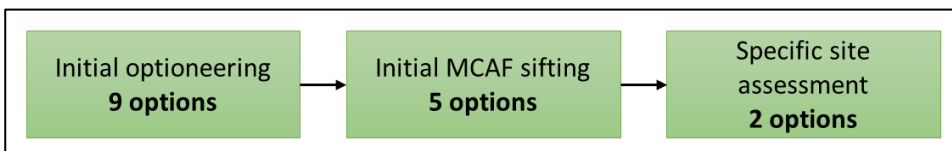
In developing the SOBC the options for the route alignment and location of the Park & Ride site were developed in parallel. This process took place between 2014 and 2016. Figure 4 illustrates the route alignment options development process leading up to the publication of the SOBC, whilst Figure 5 illustrates the optioneering process for identifying the new Park & Ride site.

**Figure 4: C2C SOBC Options Development Process**



Source: Mott MacDonald

**Figure 5: C2C SOBC Park & Ride Options Development Process**



Source: Mott MacDonald

All route alignment optioneering carried out to inform the SOBC is summarised within the Madingley Road/A428 Corridor Study (June 2014), the Madingley Road/A428 Corridor Study Interim Report (June 2015) and the C2C SOBC (September 2016). The Park & Ride optioneering is summarised in the Cambourne to Cambridge Better Public Transport Park & Ride Study. These reports are published on the GCP project website<sup>10</sup>.

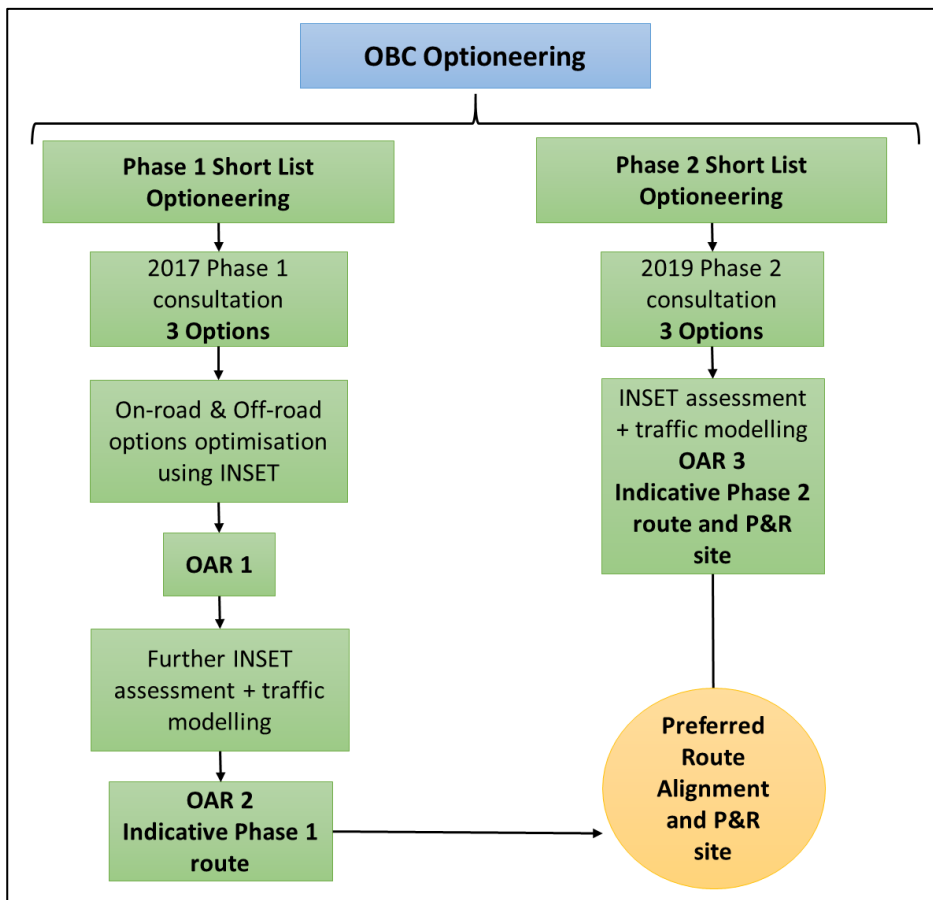
<sup>10</sup> <https://www.greatercambridge.org.uk/transport/transport-projects/cambourne-to-cambridge/cambourne-to-cambridge-background/>

### 3.3 Options development and assessment through to OBC

Following the approval of the SOBC in September 2016, further work has been undertaken to identify a preferred route alignment and Park & Ride site. This has been carried out through a series of steps, including further public consultation. The steps undertaken are summarised in Figure 6. At the point of drafting this ASR, route alignment optioneering for Phase 1 has been completed, whilst the options assessment for Phase 2 route alignments is in the process of being carried out.

The methodology used to assess the options was the same for each Phase. This is summarised in section 3.3.1.

**Figure 6: C2C OBC Optioneering**



Source: Mott MacDonald

#### 3.3.1 Phase 1 and 2 options assessment methodology

The options assessment methodology for Phase 1 and 2 route alignments involved the use of Mott MacDonald's in-house Investment Sifting and Evaluation Tool (INSET) to assess options against 37 criteria developed to establish how well each option aligned with the criteria derived from the scheme objectives. Scoring was based on a combination of qualitative and quantitative assessment undertaken by the appropriate teams and was informed by feedback from stakeholder and public consultation. This facilitated a comparison and ranking of the options.

In addition to the use of INSET, initial and adjusted Benefit Cost Ratios (BCR) for the options were calculated to compare the level of Value for Money of each option.

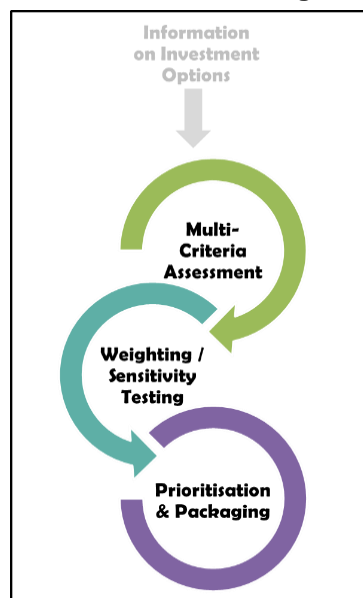
The user benefits were derived from journey time savings and calculated using the strategic Cambridge Sub Regional Model (CSRM2). Further detail on CSRM2 and its application in the economic appraisal of the C2C project is set out in section 4.

The results of the Phase 1 options assessment are presented in OAR1 and OAR2 and the Interim Report (2018), whilst the results of Phase 2 options assessment will be presented in OAR3.

### 3.3.2 INSET

Investment Sifting and Evaluation Tool (INSET) is a Multi Criteria Assessment Framework (MCAF) decision support toolkit developed in-house by Mott MacDonald which is used through the development of this scheme to carry out the initial sift. INSET is designed to be simple, flexible, replicable and transparent. It is based on Green Book compliant Multi-Criteria Decision Analysis (MCDA) and is an enhancement of the DfT's EAST (Early Assessment and Sifting Tool) process. It takes the previous MCAF assessments undertaken at earlier stages of the scheme and has developed and amended the criteria as required for the level of assessment being undertaken.

**Figure 7: Mott MacDonald's Investment Sifting and Evaluation Tool (INSET)**



Source: Mott MacDonald

INSET draws upon standard tools for comparing scheme options, and adds additional functionality to these existing tools. Mott MacDonald has developed INSET as an enhancement of EAST to support the evaluation of different options for large-scale investments and investment programmes. Crucially it enables:

- 'Active' sifting of options in real-time, supporting meetings, workshops and face-to-face engagement with a tool that can be used to facilitate discussions;
- The consideration of multiple economic scenarios as sifting and evaluation progresses, through manipulation of criteria weighting, to enable project teams to discuss 'what if' issues as options are developed, and;
- The assessment of potential scheme packaging. INSET can assess one option against another and can also explore the merits of options being developed in isolation or as part of a package.

### 3.3.3 Assessment criteria

The assessment criteria for the options were generated from the scheme vision and objectives. These were grouped into the following themes that have been selected to reflect the scheme objectives:

- Policy fit
- Contribution to economic growth
- Contribution to improved transport network
- Contribution to quality of life
- Scheme deliverability
- Stakeholder support

The list of criteria used for assessing both Phase 1 and Phase 2 route alignments is shown in Table 1. A detailed description of each assessment criterion can be found in OARs 1, 2 and 3.

**Error! Reference source not found. Table 1: INSET Assessment Criteria**

Theme	Assessment criteria
<b>Policy fit</b>	Cambridgeshire Local Transport Plan 3 <sup>11</sup>
	Highways England Road Investment Strategy
	Greater Cambridge and Greater Peterborough Strategic Economic Plan
	Greater Cambridge City Deal
	South Cambridgeshire Local Plan <sup>12</sup>
	Cambridge City Local Plan <sup>13</sup>
<b>Contribution to economic growth</b>	Labour Market and Activity
	Business investment and Growth
	Cambridge Positive Image
	Future potential growth post 2031
	Capacity
<b>Contribution to improved transport network</b>	Reliability of journey
	Route flexibility Links into existing public transport routes
	Walking and cycle connectivity
	Impact on existing traffic
	Journey times
	Service frequency
	Mode share
	Connectivity to Park & Ride
<b>Contribution to quality of life</b>	Environmental impacts - Landscape Impact
	Environmental impacts – Noise
	Environmental impacts - Air Quality
	Environmental impacts - CO <sub>2</sub> emissions
	Environmental impacts – Biodiversity

<sup>11</sup> Note - The Mayor's Interim Transport Strategy (MITSS) was published in May 2018 and the Combined Authority (CA) are currently in the process of developing a revised LTP which is not yet available. However, the criteria adopted in the INSET process were adopted before the publication of the MITSS and already cover the key issues identified in the MITSS and it is therefore considered to be compliant with emerging CA policy at this stage.

<sup>12</sup> At the time of carrying out Phase 1 options assessment, the South Cambridgeshire Local Plan was still draft. This was formally adopted in September 2018.

<sup>13</sup> At the time of carrying out Phase 1 options assessment, the Cambridge City Local Plan was still draft. This was formally adopted in October 2018.

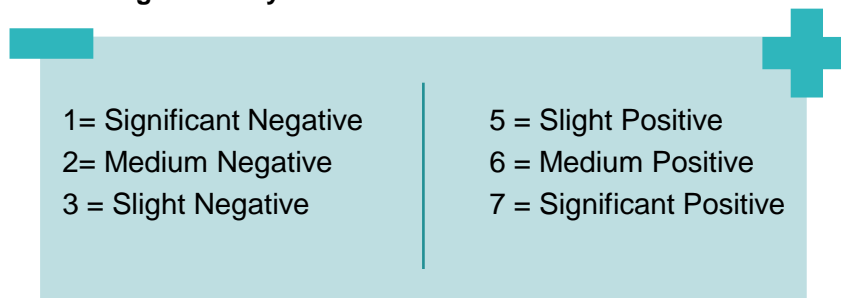
	Environmental impacts – Heritage
	Environmental impacts – Green Belt
	Safety
	Accessibility
<b>Scheme deliverability</b>	Scheme Cost
	Engineering feasibility - construction method
	Land acquisition required
	Impact on local road network during construction
	Future proofing
	Legislative Powers
	Scheme Maintenance and Renewals
<b>Stakeholder support</b>	Public acceptability

Source: Mott Macdonald

### 3.3.4 Assessment criteria scoring

For the basis of the evaluation it was decided to assess all route options on a 7-point scoring system, with 1 - 3 being a negative impact, 4 being no impact, neutral impact or as existing, and 5 - 7 being positive impacts.

**Figure 8: INSET Scoring Summary**



Source: Mott MacDonald

Figure 8 shows an overview of how the scoring range is decided but for each specific metric there is an individual scale for each criterion. Along with the INSET scoring a justification table was completed which details the reasoning and underlying principles behind each score. A summary of this can be found for Phase 1 and 2 route options assessment in OARs 1, 2 and 3.

Within the INSET table there is an option to weight the scores. It was decided that all the criteria will have a weighting of 1 so all criteria have the same weighting.

### 3.4 Short listed options

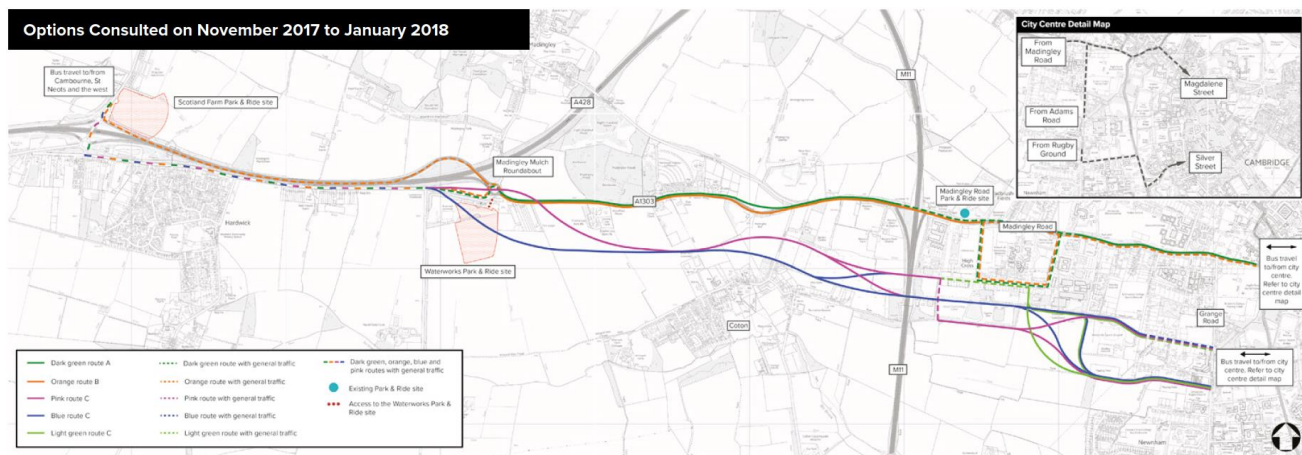
#### 3.4.1 Phase 1 route options

Option development and appraisal for Phase 1 route alignment was undertaken in 2 stages.

The first stage involved consultation on three options. The definition of the three options consulted on in 2017 was as follows:

- **Option A:** An on-road option which includes the introduction of an inbound bus lane on Madingley Road between Madingley Mulch roundabout and Lady Margaret Road;
- **Option B:** An on-road tidal bus lane on Madingley Road running between Madingley Mulch roundabout and the new entrance to Eddington (High Cross); and
- **Option C:** An off-road public transport route running between Madingley Mulch roundabout and Grange Road, Cambridge.

**Figure 9: Phase 1 Options**



Source: Consultation leaflet, 2017-2018. (© Crown Copyright. All Rights Reserved. OS License Number 100023205.2018)

Source: November 2017 to January 2018 consultation leaflet

The options were also assessed against each other to generate an '*optimised*' on-road option that reflected Option A and some of the Option B suggested improvements to outbound traffic, and a single specific off-road route alignment from Option C in order to refine the number of variations within each option down.

Stage 2 of the options assessment process for the Phase 1 route alignment involved the assessment of these '*optimised*' options, with the incorporation of each of the proposed Park & Ride sites, against both a Do Minimum scenario and an Illustrative Comparator.

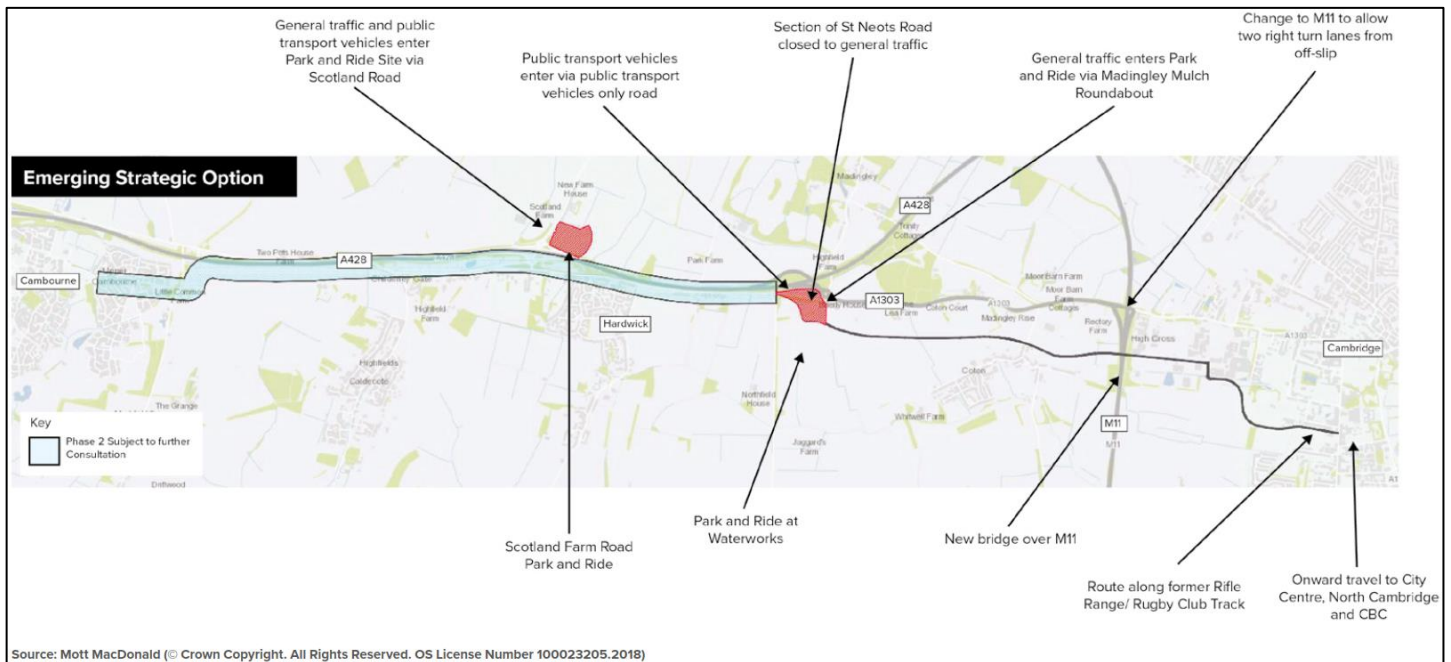
The definitions of the options as part of Stage 2 were as follows:

- **Do Minimum** – Committed Schemes
- **Low Cost a** – Recommended optimised on-road Phase 1 + Park & Ride at Waterworks
- **Low Cost b** – Recommended optimised on-road Phase 1 + Park & Ride at Scotland Farm
- **Do Something 1a** – Recommended off-road Phase 1 Madingley Mulch Roundabout to Grange Road + Park & Ride at Waterworks
- **Do Something 1b** – Recommended off-road Phase 1 Madingley Mulch Roundabout to Grange Road + Park & Ride at Scotland Farm
- **Illustrative Comparator** – Recommended off-road Phase 1 and Phase 2 Cambourne to Grange Road Park & Ride at Waterworks for comparative purposes



The results of the options assessment for Phase 1 concluded with an Emerging Strategic Option, which is illustrated in Figure 10. This is an off-road route alignment. The detailed assessment of the options, the options assessment process and results for Phase 1 are set out in OAR 1 and 2 and in the Cambourne to Cambridge Better Public Transport Project Interim Report (November 2018)<sup>14</sup>.

**Figure 10: Emerging Strategic Option – Phase 1 route alignment**



Source: Mott MacDonald

### 3.4.2 Phase 2 Route Options

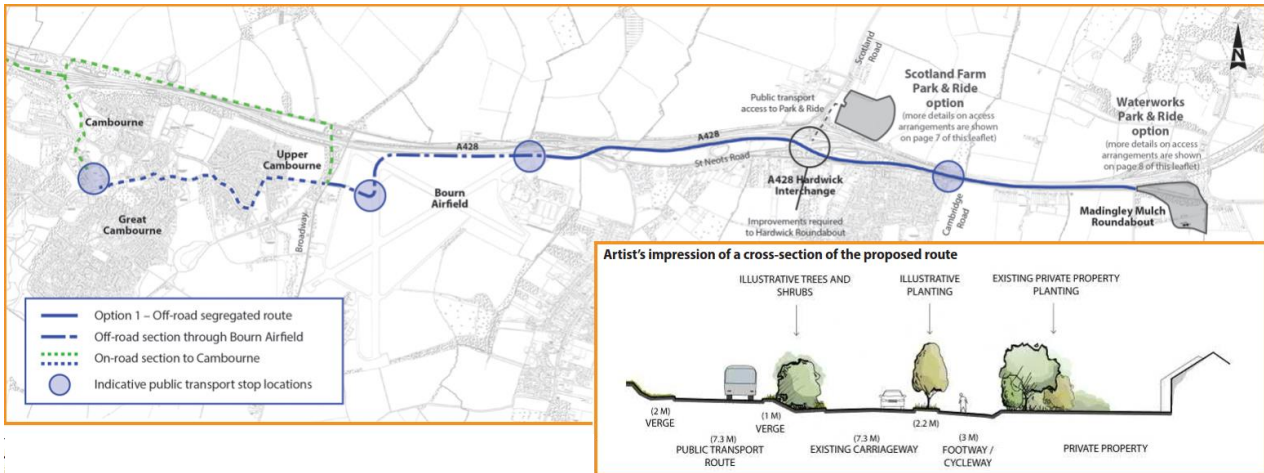
Phase 2 route alignment options include three options. At the time of writing this ASR they are still to be assessed and consulted on.

The definition of the three options presented as part of the public consultation (February to March 2019) for Phase 2 is as follows:

- **Option 1:** Off-road segregated route. A new public transport route adjacent to the A428 and St Neots Road. The route would be entirely off-road with minimal interaction with general traffic, except at junctions.
- **Option 2:** On-road with junction improvements. Public transport vehicles would run on-road along St Neots Road with general traffic east of the Bourn roundabout. There would be basic junction improvements.
- **Option 3:** On-road with public transport priority lanes. Public transport vehicles would run on-road along St Neots Road in priority lanes running in both directions.

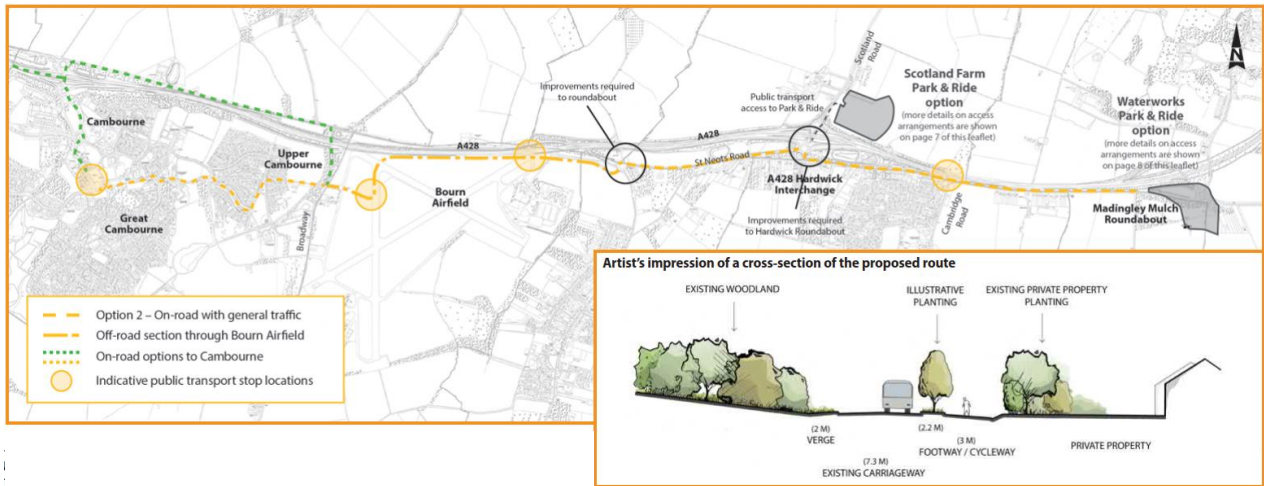
<sup>14</sup> <https://www.greatercambridge.org.uk/transport/transport-projects/cambourne-to-cambridge/cambourne-to-cambridge-background/>

**Figure 11: Phase 2 – Option 1: Off-road segregated route**



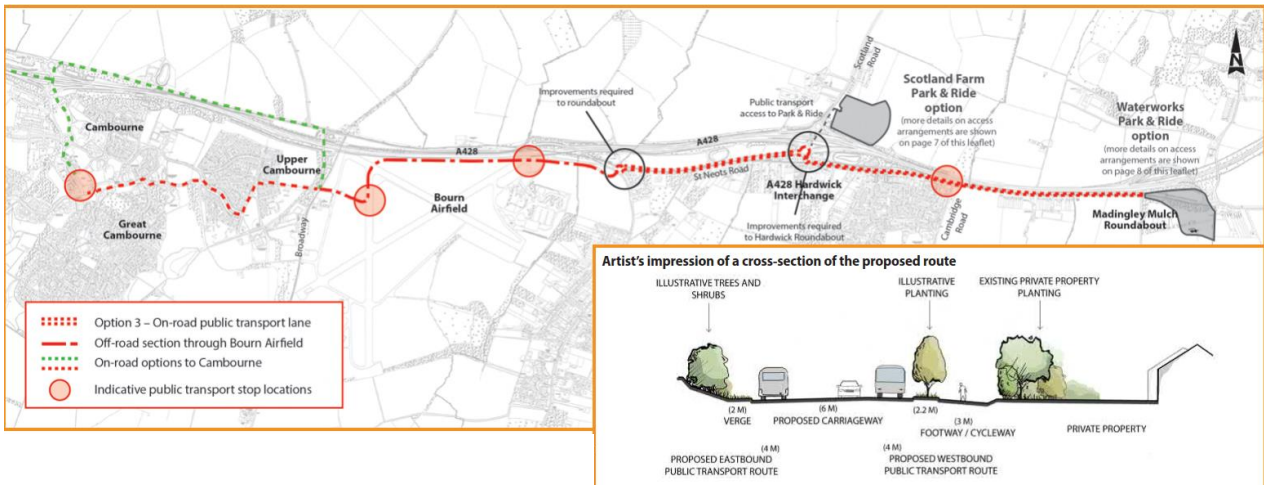
Source: February to March 2019 consultation leaflet

**Figure 12: Phase 2 - Option 2: On-road junction improvements**



Source: February to March 2019 consultation leaflet

**Figure 13: Phase 2 – Option 3: On-road with public transport priority lanes**



Source: February to March 2019 consultation leaflet



### 3.4.3 Guidance technology choice options

In addition to the work on-going to assess route alignment options, a parallel exercise is being undertaken examining the technology options for the system that will operate along the route.

The base assumption for this assessment is that the technology option will be bus based and that it will use some form of guidance technology.

In assessing these options, consideration will be given to how they fit within existing delivery frameworks i.e. Transport Works Act Order (TWAO), Development Consent Order (DCO) etc, and the level of *'proof'* of operation to provide confidence that the preferred guidance technology can be delivered.

### 3.5 Preferred option

Following the conclusion of the options assessment process for Phase 1 and 2, a preferred route alignment will be identified. This will also incorporate a preferred location for a Park & Ride site, and reflect the outcome of the Guidance Technology Options Assessment.

The preferred option will be assessed against a range of impacts, and where proportionate/appropriate, these impacts will be monetised. This includes economic, environmental, social and safety impacts. There will also be an updated assessment of the project's wider economic benefits.

The results of this further appraisal of the preferred option's impacts will allow for a full understanding of the impacts of the project, and, taken with the project's costs, will inform the project's overall Value for Money (VfM) assessment. This will enable a robust VfM assessment to be presented to support the case for the C2C project.

This stage of additional appraisal will focus on the following options:

- **Do Minimum** – included as a benchmark against which the Do Something options are compared
- **Do Something 1a** – without Bourne Airfield and Cambourne West developments
- **Do Something 1b** – with Bourne Airfield and Cambourne West developments

### 3.6 Sensitivity testing

The agreed sensitivity tests at the time of drafting this ASR include:

- **Sensitivity test A - Higher costs** – this will examine the implication that an increase in project costs would have on the overall project VfM.

## 4 Traffic Modelling & Economic Appraisal Approach

This section sets out the traffic modelling approach that has been adopted for the C2C project in order to calculate the user benefits for the preferred option and comparator tests. The results of this will be used in the economic appraisal of the scheme.

### 4.1 Approach to traffic modelling & economic appraisal

In addition to allowing the calculation of user benefits, the results from the traffic modelling will also be used in the assessment of other impacts and will help to determine the level of quantification of other impacts such as air quality and noise.

Those benefits referred to under this section will inform the Level 1 benefits/disbenefits associated with the C2C project (as set out in TAG Unit 2.1).

**Table 2: Level 1 benefits**

Benefit	Description
<b>Transport user benefits</b> (TAG A1)	<ul style="list-style-type: none"> <li>Transport economic appraisal will be undertaken in accordance with published DfT guidance and using the same principles as TUBA.</li> <li>This will be based on trip and cost matrices from the CSRM2 SATURN highway traffic and public transport models and travel cost changes implied by the proposed project.</li> </ul>
<b>Accidents</b> (TAG A4-1)	<ul style="list-style-type: none"> <li>An analysis of the impacts of accidents and their costs as part of the economic appraisal will be carried out using COBA-LT (Cost and Benefit to Accidents – Light Touch), developed by the DfT in 2013 (version 2013.02).</li> <li>Used to undertake the economic appraisal of accidents by assessing the safety aspects of the road projects using detailed inputs.</li> <li>Assessment based on a comparison of accidents by severity and associated costs across the network in the with and without project forecasts, using details of link and junction characteristics, relevant accident data, and forecast traffic volumes.</li> </ul>
<b>Air Quality</b> (TAG Unit A3)	<ul style="list-style-type: none"> <li>Air quality appraisal will be undertaken in accordance with TAG Unit A3 Chapter 3 using the 'Local Air Quality Workbook' and 'Air Quality Valuation Workbook' provided.</li> </ul>
<b>Noise</b> (TAG Unit A3)	<ul style="list-style-type: none"> <li>An appraisal of the noise impact of the route will be undertaken in accordance with TAG Unit A3 (December 2015).</li> <li>This will consider impacts from road traffic in terms of annoyance, sleep disturbance and health impacts, in turn based upon Defra guidance, for which there are dose-response relationships.</li> </ul>
<b>Greenhouse gases</b> (TAG Unit A3)	<ul style="list-style-type: none"> <li>An appraisal of the change in greenhouse gas emissions is carried out using DMRB worksheet.</li> </ul>

Source: DfT - WebTAG

### 4.2 Strategic model – CSRM2

The D Series Cambridge Sub-Regional Model 2 (CSRM2) traffic model will be used as the basis of the assessment of the highway and public transport impacts of the options, with the changes between the CSRM2 base year and CSRM2 future year scenarios fed into updated base and forecast year highway and public transport models.

The D Series CSRM2 is the preferred model for use in assessing City Deal funded schemes within Greater Cambridge.

## 4.3 Transport impacts appraisal methodology

### 4.3.1 Highway user impacts

The D Series base year highway model was reviewed in late 2018/early 2019, with some amendments made to improve the calibration of the model in the vicinity of the C2C scheme, as well as the M11 Junction 11 Park & Ride and A1307 Cambridge South East Transport Study schemes. This has allowed for one consistent base year model to be used for all of these schemes.

A base year public transport model has been prepared using CUBE software. A synthetic matrix based on a previous public transport model has been prepared as well as a matrix based on surveys carried out. These two sets of matrices have been combined, and the model calibrated/validated in line with guidance.

The following items will be provided as inputs to the CSRM2 D Series Demand Model:

- Highway network coding for each of the '*with scheme*' options
- Existing bus routes
- Public transport routes and frequencies serving the new Park & Ride site
- Confirmation of any scheme-dependent development

The following core assumptions are being used in running CSRM2:

- Preferred public transport mode will be able to run at 60mph along the route<sup>15</sup>
- The current Madingley Road Park & Ride site remains open

Assessments will be undertaken for two forecast years:

- 2026
- 2036

And three time periods:

- Morning peak (08:00-09:00)
- Interpeak (10:00-16:00)
- Afternoon peak (17:00-18:00)

To allow for appraisal in line with WebTAG for both economic and environmental impacts, CSRM2 runs with and without scheme-dependent development at Bourn Airfield and Cambourne West will have been undertaken for all the Do Minimum and the Do Something scheme options as part of the route alignment optioneering. These assessments will use the Foundation Case CSRM2 runs, assuming growth levels in line with the adopted Local Plans.

Additional CSRM2 runs for the preferred option, with and without scheme-dependent development, will be undertaken assuming high growth based on potential growth levels as set out in the Cambridgeshire & Peterborough Independent Economic Review (CPIER)<sup>16</sup>.

The resulting CSRM2 highway and public transport matrices, following application of the demand model, will provide the inputs to the scheme assessments.

The differences between the CSRM2 forecast matrices output from the demand model and the D Series base year model will be calculated and applied to the updated base year highway and

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<sup>15</sup> This is based on the assumption that C2C project will be a road based non-contact guidance system with a nominal design speed of 100kph where constraints permit.

<sup>16</sup> Cambridgeshire & Peterborough Independent Economic Review Final Report – September 2018

public transport matrices to ensure any zone changes or flow adjustments undertaken as part of the base model calibration are reflected.

These revised forecast matrices will then be assigned to the forecast highway and public transport networks to provide the final assignments for the options.

Time, distance, and trip/passenger matrices will be output from the final highway and public transport models and feed into the economic assessment.

Highway decongestion benefits will be calculated using TUBA<sup>17</sup> program (Transport Users Benefit Appraisal) where possible. However, experience from the Phase 1 options assessment stage suggests there may not be any noticeable decongestion benefits due to model noise. It should be noted that it is common for model noise to occur in models of this scale and complexity and that assessing its impact is an important part of the modelling process. Therefore, initial TUBA runs will be prepared including the highway and public transport matrices, with the outputs from these being reviewed to determine if model noise is still outweighing any highway decongestion benefits.

If highway decongestion benefits cannot be robustly calculated due to the effects of model noise, then the marginal external costs method from TAG Unit A5-4 may be investigated as an alternative.

#### 4.3.2 Accidents

Accident impacts appraisal will be undertaken in accordance with **TAG Unit A4-1**.

If robust highway decongestion results can be calculated using TUBA then the traffic model flows will be used to undertake a Cost and Benefit to Accidents – Light Touch (COBA-LT) assessment to provide accident benefits/disbenefits in monetised terms.

COBA-LT is used to undertake the economic appraisal of accidents by assessing the safety aspects of road projects using detailed inputs. The assessment undertaken is based on a comparison of accidents by severity and associated costs across the network with and without project forecasts, using details of link and junction characteristics, relevant accident data, and forecast traffic volumes.

If a COBA-LT assessment is not possible due to the lack of robust highway decongestion results, then historic accident data will be reviewed to provide a qualitative assessment of the impacts of the scheme. In this case accidents impacts will not form part of the overall BCR calculations.

#### 4.3.3 Air Quality

Air quality appraisal will be undertaken in accordance with **TAG Unit A3 Chapter 3**.

An initial assessment of the preferred option will be undertaken based on the methodology set out in TAG Unit A3, where the outputs from the Do Minimum and Preferred Options modelled runs will be used to quantify the changes in air quality levels.

A qualitative comment will then be provided that will identify the significance of changes in air quality levels and indicate whether there is merit in carrying out further analysis and

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<sup>17</sup> TUBA is an economic appraisal computer programme developed for the Department for Transport (DfT) for appraising multi modal transport studies.

quantification of the air quality impacts in order to monetise them for their inclusion as part of the preferred options final economic appraisal.

Only where changes are deemed significant, will this second stage of more detailed assessment be carried out. If additional analysis is undertaken, this will be done using the '*Local Air Quality Workbook*' and '*Air Quality Valuation Workbook*' provided as part of TAG Unit A3. These will provide Net Present Values (NPVs) for changes in emissions (NO<sub>x</sub>) and particulate concentrations (PM<sub>10</sub>) that will be used in the calculation of the scheme BCR.

#### 4.3.4 Noise

Noise impact appraisal will be undertaken in accordance with **TAG Unit A3 Chapter 2**.

An appraisal of the noise impact of the route will be undertaken in accordance with TAG Unit A3 and will consider impacts from road traffic in terms of annoyance, sleep disturbance and health impacts, in turn based upon Defra guidance, for which there are dose-response relationships.

The first step in assessing noise impacts will be a qualitative commentary examining whether there is a significant change in noise levels between the Do Minimum and Preferred Option. This will be based on examining the changes in noise levels taken from the modelling outputs.

Only where changes are deemed significant, will a second stage of more detailed assessment be carried out, where a more detailed monetary valuation of changes in noise will be calculated. This will be done using the '*Noise Assessment Workbook*' provided as part of TAG Unit A3. This will provide Net Present Values (NPVs) for changes in noise that will be used in the calculation of the scheme BCR.

#### 4.3.5 Greenhouse gases

An appraisal of the change in greenhouse gas emissions will be carried out using DMRB worksheet and in accordance with **TAG Unit A3 Chapter 4**.

The first step in assessing greenhouse gases impacts will be a qualitative commentary examining whether there is a significant change in greenhouse gas levels between the Do Minimum and Preferred Option. This will be based on examining the changes taken from the modelling outputs.

Only where changes are deemed significant, will a second stage of more detailed assessment be carried out, where a more detailed monetary valuation of changes in greenhouse gases will be calculated. This will be done using the '*Greenhouse Gases Workbook*' provided as part of TAG Unit A3. This will provide Net Present Values (NPVs) of carbon dioxide equivalent emissions for the scheme and will be used in the calculation of the scheme BCR.

#### 4.3.6 Walking and cycling

As the C2C project will include the provision of dedicated cycling routes alongside the provision of the new public transport route, the benefits associated with any changes to walking and cycling will be important to take account of.

The adopted approach for calculating any benefits associated with walking and cycling will be undertaken using the latest version of the DfT's Active Mode Appraisal Toolkit (AMAT) and following guidance set out in TAG Unit 5.1.

AMAT enables for the following benefits to be quantified:

- User benefits - estimated journey time savings and journey ambience uplift;
- Business benefits - reduction in absenteeism;
- Health benefits - economic benefits of preventing early mortality through cycle exercise; and,
- Marginal external cost savings – reduction in the number of car trips of 5km due to mode switch to cycling;

The appraisal will look to use the outputs from CSRM2 and the origin/destination matrix totals for walking and cycling with and without the scheme to estimate the impact the scheme will have on walking and cycling numbers. The changes in numbers will be used to populate AMAT in order to estimate the walking and cycling benefits.

The economic benefits of the walking and cycling improvements will be appraised over a 20-year period, in line with latest guidance.

These results will be incorporated into the AST and the overall AMCB and TEE tables, informing the BCR calculations and final Value for Money assessment for the preferred option and its comparator options.

# 5 Environmental Impacts Appraisal Methodology

## 5.1 Environmental impacts appraisal

This section sets out the approach that will be adopted in assessing the non-monetised aspects of the environmental impact appraisal for the preferred scheme option and its comparator options. This includes:

- Landscape impacts
- Townscape
- Historic environment
- Biodiversity
- Water environment

The assessment for the main topics listed above will generally follow **TAG Unit A3** and the TAG environmental impacts worksheets, with the approach adopted for assessing these environmental impacts for the preferred options mirroring the approach taken in assessing the route alignment options for Phase 1 and 2 as part of the INSET assessment. This assessment will reflect the Assessment Criteria used in the assessment of those options that fall under the Environmental Impacts theme.

## 5.2 Reporting

The results from this assessment will be reported qualitatively, with the level of impact summarised using a standard seven-point scale and reported in the AST of the OBC.

The results will be used to inform the scheme's overall VfM position but will not be part of the core BCR calculations.

## 6 Social and Distributional Appraisal Methodology

This section sets out the approach that will be adopted in assessing the social and distributional impacts for the preferred scheme option.

### 6.1 Social impact appraisal

The social impact appraisal will be carried out in accordance with **TAG Unit 4.1**.

Social impact appraisal covers the human experience of the transport project and its impact on social factors. The impacts considered include:

- Accidents
- Physical activity
- Security
- Severance
- Journey quality
- Option and non-use values
- Accessibility
- Personal affordability

### 6.2 Distributional impact appraisal

The distributional impact appraisal will be carried out in accordance with **TAG Unit 4.2**.

Following TAG Unit 4.2 guidance, a distributional impacts proforma will initially be completed to assess whether a distributional impact assessment is required as part of the scheme appraisal.

If a distributional impact appraisal is deemed appropriate and required, one will be carried out. Any distributional impact appraisal will build on the social impact appraisal and transport modelling outputs to assess the variance of the project's impact across different social groups. Both beneficial and/or adverse distributional impacts of the preferred option will be considered, along with the identification of social groups likely to be affected.

The impacts considered include:

- User benefits
- Noise
- Air quality
- Accidents
- Security
- Severance
- Accessibility
- Personal affordability

### 6.3 Reporting

Results, in the form of mapping and evidence, from the social and distributional impact appraisal will be reported and included in the business case and in the AST.



## 7 Reliability Impacts Appraisal Methodology

The assessment of public transport reliability will be undertaken following the methodology set out in section 6 of **TAG Unit A1.3**.

### 7.1 Reliability impacts appraisal

The calculation of reliability benefits for public transport users (in the case of this scheme, the focus will be bus users), will involve the comparison of the Standard Deviation (SD) of lateness for observed buses currently operating along the A428/A1303, against the expected SD of lateness for buses using the new segregated public transport route.

The SD for current bus lateness will be derived from service timetables compared against Automatic Vehicle Location (AVL) data along the A428/A1303 between Cambourne and Grange Road.

As only one bus route operates between these locations, the focus of timetable and AVL data will be for the number 4 service.

It should be noted that any future worsening of reliability of bus services along the A428/A1303 has not been calculated, as it is considered too difficult to accurately forecast future changes in the SD. However, predicted growth in trips along the A428/A1303 would suggest that, without intervention, reliability would get worse as congestion increases. Therefore, the approach of only using the SD of lateness for current buses at present day is deemed conservative,

Using the observed AVL data, the SD of lateness will be compared to the predicted SD of lateness along the new segregated public transport route.

The formula (shown in Figure 14) for the calculation of benefits to be applied will use the change in the SD of lateness, multiplied by the change in demand switching from current buses to new services operating along the new scheme, multiplied by the value of reliability. The rule of a half will also be applied to the total.

**Figure 14: Reliability benefits formula**

$$Benefit = -\frac{1}{2} \sum_{ij} \Delta \sigma_{ij} * (T_{ij}^0 + T_{ij}^1) * VOR$$

Source: WebTAG Unit A1.3

The value of reliability (VOR) is obtained by multiplying the value of time (VoT) for bus users by the reliability ratio. The reliability ratio will be defined as 1.4, in line with DfT WebTAG guidance.

T<sub>ij</sub><sup>0</sup> and T<sub>ij</sub><sup>1</sup> are the number of trips before and after the introduction of the scheme.

Δσ<sub>ij</sub> is the change in standard deviation of journey time along the route (in seconds).

### 7.2 Reporting

The monetised benefits from this assessment are considered Level 2 benefits; therefore, they will be included in the adjusted BCR and not in the initial BCR or recorded in the AMCB table. They will be recorded in the AST and be used in informing the overall VfM position of the scheme.

## 8 Wider Economic Impacts Appraisal Methodology

This section examines the wider economic impacts for the preferred option that are additional to the transport user benefits. These benefits are calculated following **TAG Unit A2.1** guidance.

TAG Unit A2.1 defines wider economic impacts as the impacts of transport interventions on welfare at a national level that are not captured by a conventional appraisal of transport user benefits. These impacts have traditionally been omitted because the conventional appraisal assumes theoretical '*perfectly competitive*' transport-using markets whereas, in reality, markets are imperfect, leading to the potential for additional benefits (or disbenefits).

TAG defines these Level 2 wider economic impacts as relating to implicit land use changes i.e. any change in land use as a result of the scheme is implicit rather than explicit. Impacts related to explicit land use changes are captured as part of Level 3 benefits/disbenefits (the approach to calculating these benefits, including their definitions, are set out in detail in section 9).

Those impacts that will inform the Level 2 benefits/disbenefits associated with the C2C project and will be included in an '*adjusted BCR*'. The definitions of these impacts are set out in Table 3.

**Table 3: Level 2 benefits**

Benefits	Definition
<b>Agglomeration (TAG Unit A2.4)</b>	<ul style="list-style-type: none"> <li>• Agglomeration refers to the concentration of economic activity over an area. Transport can increase the accessibility of an area for businesses and workers, therefore impacting on the level of agglomeration, through the reduction of generalised costs for business and commuting trips.</li> <li>• The level of agglomeration reflects the productivity benefits experienced by businesses as a result of improved connections to other businesses and to potential employees thus improving interaction, knowledge exchange and access to markets, including labour markets.</li> </ul>
<b>Labour supply impacts (TAG Unit A2.3)</b>	<ul style="list-style-type: none"> <li>• Transport can have an impact on labour supply by affecting the overall costs and benefits to individual workers. An individual will weigh the cost of travel against the wages of a job travelled to.</li> <li>• Changes in transport costs is likely to have an impact on the incentives of individuals to work and hence have an impact on the overall level of labour supplied in the economy.</li> <li>• This can have a positive impact on the economic at a national level with an increase in potential workers employed affecting the level of UK Gross Domestic Product (GDP) through increases in tax revenues.</li> </ul>
<b>Output change in imperfectly competitive markets (TAG Unit A2.2)</b>	<ul style="list-style-type: none"> <li>• Markets are generally considered not to be perfectly competitive, thus leading to lower production and higher prices than would exist in a perfectly competitive market.</li> <li>• This is seen as being detrimental to consumers and the economy as a whole.</li> <li>• Reductions in transport costs allows for an increase in production in the goods and services that use transport, reducing costs so that businesses can make more profit or pass on the saving to customers, so they can be more competitive.</li> </ul>

Source: WebTAG Unit A2.1

## 8.1 Agglomeration and labour supply impacts appraisal

These will be calculated following **TAG Unit A2.3** and **TAG Unit A2.4**, and using DfT's WITA (Wider Impacts in Transport Appraisal) software.

WITA takes input data from the highway and public transport models, similar to TUBA (see section 4.3), and supplements it with additional information from DfT's wider impacts data set<sup>18</sup>.

It is important that the WITA set-up includes highway and public transport data. However, as noted in section 4.3, it is no unusual for model convergence noise in complex highway assignment models to mask any genuine changes in, for example, travel times between the Do Minimum and preferred option Do Something scenarios. In this case the preferred option Do Something travel times would be set equal to the Do Minimum travel times in WITA, to avoid the potentially distorting effect of convergence noise should this occur.

TAG Unit A2.4 recommends that walking and cycling modes are also included in the calculation of agglomeration impacts. We will review whether CSRM2 can provide suitable data to support these calculations.

The current version (at the point when work starts on setting up WITA inputs) of DfT's wider impacts data set will be used. At the time of writing this ASR it is v2.5, dating from July 2013, but a new version is believed to be imminent.

The current version of WITA is v1.2. At time of writing this ASR, the new version, v2.0, is still to be released. We will decide whether to use v2.0 depending on (a) whether it is available at the time of doing the work, and (b) our assessment of the risks of using what will, in effect, be a completely new software product<sup>19</sup>.

## 8.2 Output change in imperfectly competitive markets appraisal

These will be calculated following the method set out in **TAG Unit A2.2**, i.e. the increase in GDP is simply 10% of the business user benefits, calculated as per section 4.3.

## 8.3 Reporting

WITA calculates all of the above impacts in terms of the change in GDP. However, some of the change in GDP from labour supply impacts is already included in the standard calculation of the Level 1 user benefits for commuters. WITA therefore also calculates the 'tax wedge' resulting from the change in labour supply. This is additional to the Level 1 user benefits and can be included in the calculation of an 'Adjusted BCR' without double counting benefits already included in the 'Initial BCR'. This is summarised in the following table:

**Table 4: Reporting of Level 2 benefits**

Impact	Reporting of total GDP impact (with source)	Inclusion in Level 2 benefits for adjusted BCR
Agglomeration	GDP (WITA)	GDP
Labour supply impacts	GDP (WITA)	'Tax wedge' only = 40% of GDP impact
Output change in imperfectly competitive markets	GDP (10% of business user benefits)	GDP

<sup>18</sup> <https://www.gov.uk/government/publications/webtag-economic-impacts-worksheets>

<sup>19</sup> V2.0 represents a complete rewrite of WITA, rather than just an incremental update. Our understanding is that the underlying methodology is unchanged.

Source: Mott MacDonald

## 9 Supplementary Economic Modelling Methodology

This section builds on section 8, and examines the additional wider economic benefits for the C2C project relating to Level 3 benefits as defined within DfT's WebTAG Unit A2.1 guidance. TAG defines these Level 3 wider economic benefits as relating to explicit land use changes. These are assessed through supplementary economic modelling.

A key purpose of the C2C project is to support the continued economic growth of Greater Cambridge by providing new transport infrastructure that will provide effective links to key development sites, supporting housing and employment growth. Therefore, it is critical that the business case, whilst adhering to DfT's WebTAG Unit A2.1 guidance, looks more widely from an economic development perspective at how the scheme supports economic growth in Greater Cambridge.

This section of the ASR focuses on the additional wider economic benefits that could therefore emerge from land use changes via the C2C project supporting the spatial growth planned for Greater Cambridge. From a DfT TAG perspective the approach will focus on considering the impacts from induced investment (TAG Unit A2.2) and TAG Unit M5.3 supplementary economic modelling.

A key consideration for the assessment of these additional wider economic benefits will be understanding the differences between net impacts at the regional level, i.e. Greater Cambridge, and national levels, which relies on assessing the level of displacement of economic activity between Greater Cambridge and the UK. As such the results from the supplementary economic modelling will be used to inform both the strategic case and economic case.

Within the economic case the outputs of the supplementary economic modelling will be used to inform both a '*Total BCR*' incorporating Level 1, 2 and 3 benefits that are net additional at a national level, and a '*BCR sensitivity test*' that will examine the total wider economic benefits arising from explicit land use changes at a Greater Cambridge regional level. This will take into consideration the gross value of Level 3 benefits, rather than just the national net value of Level 3 benefits used in the '*Total BCR*'.

The approach that will be adopted in assessing the Level 3 benefits will be informed by the approach applied within the Strategic Economic Appraisal report produced as part of the SOBC in August 2016<sup>20</sup> but updated in light of the changes in DfT's TAG Unit A2.1 and TAG Unit M5.3. This analysis will also be carried out in conjunction with the appraisal of those wider economic impacts set out in section 8 to ensure consistency.

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<sup>20</sup> Strategic Economic Appraisal of A428-A1303 Bus Scheme, Mott MacDonald, August 2016

## 9.1 Supplementary economic appraisal

Table 5 below provides an overview of the key tasks and areas of analysis which will form a number of wider economic benefits that can then be considered and will inform both the strategic and economic cases.

**Table 5: Level 3 wider economic benefits assessment – key tasks**

Key task	Description
<b>Land use analysis</b>	<ul style="list-style-type: none"> <li>• The status of the Local Plan, growth targets and future local plan reviews.</li> <li>• The latest status of the key developments along the corridor – namely Cambourne West, Bourn Airfield and West Cambridge. This is in terms of planning status, outputs (housing and employment space) and timescales.</li> <li>• More research with regards to the type of jobs that will come forward on the sites, both B-use and non B-use (to capture research and education type activities).</li> <li>• The level of dependency with the C2C scheme – including any critical planning dependencies including workshop with the Planning team at both councils.</li> <li>• Consultation with the key developers / property agencies involved in the schemes themselves.</li> </ul>
<b>Wider business and economic growth consultation</b>	<ul style="list-style-type: none"> <li>• Consultation with key stakeholders who can provide further evidence that the scheme will support them via supporting travel to work and business journeys.</li> <li>• Intermediaries / council representatives working on economic strategy including in the area and wider growth agenda (e.g. Oxford Cambridge growth corridor).</li> <li>• List to be determined.</li> </ul>
<b>Data collection and analysis</b>	<ul style="list-style-type: none"> <li>• Strategic economic growth context – updating all known growth targets and forecasts (e.g. East of England Forecasting Model).</li> <li>• Data indicators including GVA per worker and house prices</li> <li>• Evidence relating to Cambridge’s unique position in the UK economy – to assist with displacement assumptions.</li> </ul>

Source: Mott MacDonald

The final stage, undertaken in conjunction with the transport modelling, will be to update the wider economic benefits identified in the Strategic Economic Appraisal study (August 2016) in line with the updated research but also updated DfT guidance in this area.

The analysis will be undertaken at both a Greater Cambridge and UK level to provide updated estimates of the strategic economic benefits at a Greater Cambridge level and the net UK welfare benefits. Given the difficulties with assessing additionality, and the assumption within DfT guidance that there is 100% displacement, it will be critical to evidence why jobs supported in Greater Cambridge are net additional at a UK level. All benefits will be transformed into 2010 prices and values and discounted over a 60-year time frame, for the Do Nothing versus the Do Something (preferred option), so as to be included in a Level 3 monetised and non-monetised impacts assessment.

These will be clearly set out to demonstrate which benefits feed into:

- The strategic case – Greater Cambridge (referred to as GC in Table 6) level
- The economic case and Level 3 indicative monetised impacts – net welfare UK benefits
- The VfM assessment – net benefits that can be added onto the Level 1 and 2 benefits and presented as a ‘*Total BCR*’, and Greater Cambridge level benefits that can be used in a ‘*BCR sensitivity test*’ to demonstrate the VfM of the scheme at a regional level.

Table 6 below provides an overview of the key wider economic benefits that are anticipated to be identified and quantified and how these cross over with the conventional Level 2 benefits identified in section 8.

**Table 6: Wider economic benefits assessment – key benefits**

Benefits - GC and UK	Description	Crossover with Level 2 benefits	Economic case implications – UK level
Land utilisation benefits (supplementary economic modelling (SEM))	<ul style="list-style-type: none"> <li>• Employment benefits from bringing forward development associated with the scheme, and the associated jobs and GVA.</li> <li>• Assessed for additionality – including a number of displacement scenarios.</li> <li>• Will include a figure that is net additional to the UK and net additional to Greater Cambridge.</li> </ul>	<ul style="list-style-type: none"> <li>• Yes crossover, incorporates a SEM approach using land use changes.</li> </ul>	<ul style="list-style-type: none"> <li>• Additional tax take associated with the labour supply impact at UK level can be added to the economic case.</li> </ul>
Access to more productive jobs (SEM)	<ul style="list-style-type: none"> <li>• The remaining GVA benefits derived from those jobs created in Greater Cambridge which support existing UK residents to access more productive jobs than they may currently hold (i.e. ones generating a higher GVA).</li> </ul>	<ul style="list-style-type: none"> <li>• The tax take associated with this is additional GDP and considered net additional at the UK level.</li> </ul>	<ul style="list-style-type: none"> <li>• Additional tax take can be considered in the economic case.</li> </ul>
Reductions in spatial inequalities and structural unemployment (SEM)	<ul style="list-style-type: none"> <li>• Welfare benefits / government cost savings associated with any jobs created in areas with high levels of deprivation and reductions in long term structural unemployment.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• These benefits are net additional at the UK level and can be considered in the economic case, but should be clearly identified as '<i>indicative</i>' in nature.</li> </ul>
Land Value Uplift (LVU) assessment (primarily from housing development) / Dependent Development analysis	<ul style="list-style-type: none"> <li>• Assessment of the LVU associated with the housing development that will come forward on the sites directly dependent on the scheme.</li> <li>• This will depend on the evidence gathered pertaining to planning conditions and the transport dependency test.</li> <li>• Once assessed will also require estimating the net additional impacts at a national level with a number of displacement scenarios.</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Net additional impact than can be considered in the economic case.</li> <li>• Can be reported in the VfM assessment using DfT switching values approach but not explicitly reported as benefits.</li> </ul>
Transport External Costs	<ul style="list-style-type: none"> <li>• Assessment of the costs imposed by dependent transport users on all other users, using outputs from the traffic modelling</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• Net additional impact that can be considered in the economic case.</li> </ul>
Option and non-use values	<ul style="list-style-type: none"> <li>• Option and non-use values are only relevant in the context of services that provide a new viable commuting alternative to important centres of employment (e.g. a new public transport sub-mode option), which is likely to be a key feature of the A428 where fixed infrastructure alternatives to the car do not currently exist. The provision of 'fixed infrastructure' is a critical consideration for option and non-use values as they are predicated on the consumer being able to make life choices in the knowledge that an alternative will be available for a substantial time into the future.</li> <li>• The calculation of the option and non-use value is based on the assumption that they provide a 'step change' in bus service provision for access to employment</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>	<ul style="list-style-type: none"> <li>• These are no longer monetarised in DfT guidance and are therefore only qualitatively assessed.</li> </ul>

Source: Mott MacDonald

# 10 Construction and Maintenance Impacts Assessment

At this stage in the scheme development i.e. OBC stage, the full extent and duration of construction impacts is not yet known, including any detailed traffic management arrangements. These will not be confirmed until later stages of scheme development when detailed design is underway, and a contractor is appointed.

However, a simple qualitative assessment of construction impacts will be undertaken as part of the OBC development to inform the overall impacts assessment of the scheme. As additional detail is provided as part of the development of the scheme during the next stage (OBC to FBC), the assessment of these impacts is to be refined.

Additionally, any benefits that may be associated with a reduction in maintenance, for example brought about due to any new highway infrastructure introduced as part of the scheme, will also be assessed qualitatively for the purposes of the OBC. If the benefits are deemed significant, additional refinement of the maintenance impacts assessment may be carried out for to inform the FBC.



# 11 Cost Estimation Methodology

This section sets out the approach to the cost estimations that will be captured in the appraisal of the C2C project, explains the costs that will be included, and how they will be manipulated following WebTAG guidance (Unit A1.2) to provide Present Values of Costs (PVC).

## 1.4 Baseline capital costs

The baseline capital costs will cover:

- **Construction costs** consisting of:
  - Main works contract (preliminaries, structures, road works, general works, earthworks)
  - Ancillary work contracts (maintenance compounds, lighting, communications, landscaping, noise insulation)
- **Testing and Commissioning:** This accounts for on-site supervision and testing of scheme elements prior to scheme opening.
- **Preparation costs:** This consists of all project management, consulting engineers and agent authority fees to cover the elements of survey requirements, preliminary design, public consultation, public inquiry, and the costs of obtaining statutory orders.
- **Statutory Undertakings:** Costs to divert or protect existing Statutory Undertakers' equipment affected by the works.
- **Land costs:** This includes the acquisition and legal transaction costs for all the required private and commercial land, and additionally accounts for property management costs and compensation.

## 1.5 Whole life cost estimates

The whole life cost estimates will include the operation and maintenance costs associated with the scheme over a 60-year period from the opening year (currently assumed opening year is 2024). This will cover:

- General inspection of the proposed infrastructure and regular maintenance / replacement
- Replacement of asphalt to footways, maintenance tracks and new highway works
- General street cleaning
- Landscaping maintenance
- Gully cleaning
- Replacement of street lighting fittings
- Maintenance of bus stop fittings
- Maintenance of traffic signals
- Maintenance of welfare building at Park & Ride site.

For the basis of calculating the PVC it is also being assumed that bus purchase and operating costs will be borne by the public sector and not by private sector operators.

## 11.1 Risk allowance

A risk allowance will be applied separately to the baseline capital costs, based on a Quantified Risk Assessment (QRA). The QRA value will be generated through the use of appropriate software, such as a Monte Carlo simulation.

## 1.6 Inflation and optimism bias

All project costs will be calculated to increase in line with inflation over the lifecycle of the project's development and delivery.

Optimism bias will also be applied to reflect the current level of design detail for the project. In line with WebTAG guidance, optimism bias will be applied at 40% for the OBC stage (TAG Unit A1.2 - Table 8 - recommends optimism bias uplift of 40% for light rail schemes, that include guided buses at Stage 2 in development i.e. OBC).

No optimism bias will be applied to the operational and maintenance costs, as in line with guidance.

## 11.2 Assumptions and adjustments

The following assumptions and adjustments will be made to the scheme costs in order to arrive at a PVC:

- Costs will be discounted to 2010 prices using Green Book Discount Factors
- GDP deflator adjustment will be applied, taken from the most recent WebTAG data book
- Market price adjustment factor will be applied at 19%
- Opening year is 2024
- Optimism bias will be applied at 40%

## 11.3 Reporting

All cost estimates used in the economic appraisal of the scheme will be reported in millions of pounds in real prices and net present values to the DfT's base year.

The investment and operating costs incurred by GCP will be recorded in a Public Accounts (PA) table. This summarises the financial impact of the scheme on the public sector.

## 12 Appraisal Outputs

This section discusses the appraisal outputs of the impacts set out in this ASR and how they will be used in reporting the cost-benefit analysis and value for money of the C2C project.

### 12.1 Appraisal Summary Table

The results of the preferred option appraisal will be presented in an Appraisal Summary Table (AST) that will be appended to the main OBC.

### 12.2 Cost benefit analysis

All benefits that will inform the cost benefit analysis will be forecasted over a 60-year period, with all benefit monetary values presented in 2010 real prices and discounted to 2010.

To support the cost benefit analysis and BCR results, including the initial BCR (reflecting the Level 1 benefits) and adjusted BCR (incorporating the additional Level 2 benefits), the following supporting tables will be produced and appended to the main OBC:

- Transport Economic Efficiency (TEE) table
- Public Accounts (PA) table<sup>21</sup>
- Analysis of Monetised Cost and Benefits (AMCB) table

### 12.3 Value for money statement

The Value for Money (VfM) statement for the C2C project will take into consideration all appraisal and assessment work undertaken to present the best VfM case for the scheme. This will take into account the monetised impacts versus the project costs presented as a Benefit to Cost Ratio (BCR), as well as the findings from any qualitative and non-monetised assessments that support the strategic case for investing in the scheme.

The approach to the assessment of VfM of City Deal schemes, as set out in the City Deal Assurance Framework, reflects this by stating that projects scoring a BCR less than 2:1 may still be considered for funding if they can demonstrate a compelling case for investment based on meeting the objectives of the City Deal. These might include, for example, unlocking barriers to growth, delivering wider economic benefits, environmental and social benefits. As long as the project provides a robust evidence base with a proportionate level of quantitative and qualitative analysis to demonstrate that the project represents good value for money and can meet the policy objectives of the City Deal, these do not need to be included in the central benefit-cost analysis.<sup>22</sup>

In the case of the C2C project a number of factors justify looking beyond the standard BCR to determine the scheme's VfM, in particular the importance of the strategic role the scheme will play in unlocking and supporting future housing and economic growth.

The final VfM assessment and statement that will be presented in the economic case will therefore present the build-up of benefits as set out in TAG Unit 2.1 across all the three levels of benefit. Figure 15 sets out the three levels of benefits and the relationship between them.

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<sup>21</sup> The Public Accounts table will capture the investment and operating costs incurred by a public sector in funding the C2C project. These will be recorded as positive values in the appropriate rows of the Public Accounts (PA) table.

<sup>22</sup> City Deal Assurance Framework

The three levels can be summarised as:

- **Level 1** - impacts which assume fixed land use excluding wider economic impacts.
- **Level 2** - selected wider economic impacts which assume fixed land use (connectivity impacts) or do not require land use change to be explicitly quantified.
- **Level 3** - analysis in which either land use change is explicitly quantified (structural impacts) or supplementary economic modelling has been conducted.

**Figure 15: Wider Economic Impacts and Levels of Analysis**

Table 2 - Relationships between Wider Economic Impacts, Levels of Analysis and Land Use assumptions			
	Level 1 (Initial BCR)	Level 2 (Adjusted BCR)	Level 3 (Indicative Monetised Impacts or Non-Monetised Impacts)
Fixed Land Use	User benefits	→	
		Static Clustering	→
Implicit Land Use Change		Output Change in Imperfectly Competitive Markets	→
		Labour Supply Impacts	→
Explicit Land Use Change			Dependent Development
			Move to More/Less Productive Jobs
			Dynamic Clustering
			Supplementary Economic Modelling

\*Note that the arrows signify the previous levels of analysis are required

Source: DfT - TAG UNIT A2.1, Wider Economic Impacts Appraisal, May 2018

As such the OBC will present three core BCRs, including an:

- **'Initial BCR'** – reflecting Level 1 benefits
- **'Adjusted BCR'** – incorporating Level 2 benefits
- **'Total BCR'** – incorporating Level 3 benefits that are net additional at the UK level

In addition, a **'BCR sensitivity test'** will be carried out to demonstrate the total wider economic benefits arising from explicit land use changes at a Greater Cambridge regional level. This will take into consideration the gross value of Level 3 benefits, rather than just the UK net additional value of Level 3 benefits used in the *'Total BCR'*.

# Appendices

A. Appraisal Summary Specification Table

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## A. Appraisal Summary Specification Table

Table 7: Appraisal Summary Specification Table (ASST)

Impacts	Sub-impacts	Estimated impact	Level of uncertainty	Proposed proportionate appraisal methodology	Reference to evidence and rationale in support of proposed methodology	Type of Assessment Output (Quantitative/Qualitative/Monetary)
Economy	Business users & transport providers	Positive	Low	Journey time savings appraisal using time, distance, and trip/passenger matrices outputs from highway and public transport models. Highway decongestion benefits will be calculated using TUBA.	TAG Unit A1.3	Monetary
	Reliability impact on Business users	Positive	Medium	Comparison of the lateness for observed buses currently operating along the A428/A1303, against the expected lateness for services using the new segregated public transport route.	TAG Unit A1.3	Monetary
	Regeneration	Slight positive	Medium	WebTAG guidance	TAG Unit A2.2	Qualitative
	Wider Impacts	Positive	Low	WITA software and supplementary economic modelling	TAG Unit A2.1	Monetary, quantitative and qualitative
Environmental	Noise	Slight negative	Medium	Initial qualitative assessment to determine significance of changes, followed by monetisation of impacts where deemed significant using outputs from CSRM2 and using DfT's <i>Noise Assessment Workbook</i>	TAG Unit A3 Section 2	Qualitative and possibly monetary
	Air Quality	Neutral	Medium	Initial qualitative assessment to determine significance of changes, followed by monetisation of impacts where deemed significant using outputs from CSRM2 and using DfT's <i>Local Air Quality Workbook</i> and <i>Air Quality Valuation Workbook</i>	TAG Unit A3 Section 3	Qualitative and possibly monetary
	Greenhouse gases	Neutral	Medium	Initial qualitative assessment to determine significance of changes, followed by monetisation of impacts where deemed significant using outputs from CSRM2 and using DfT's <i>Greenhouse Gases Workbook</i>	TAG Unit A3 Section 4	Qualitative and possibly monetary
	Landscape	Slight negative	Low	TAG environmental impacts worksheets	TAG Unit A3 Section 7	Qualitative
	Townscape	Neutral	Low	TAG environmental impacts worksheets	TAG Unit A3 Section 7	Qualitative

	Historic Environment	Neutral	Low	TAG environmental impacts worksheets	TAG Unit A3 Section 8	Qualitative
	Biodiversity	Neutral	Low	TAG environmental impacts worksheets	TAG Unit A3 Section 9	Qualitative
	Water Environment	Neutral	Low	TAG environmental impacts worksheets	TAG Unit A3 Section 10	Qualitative
<b>Social</b>	Commuting and Other users	Positive	Medium	Journey time savings appraisal using outputs from CSR2	TAG Unit A1.3	Monetary
	Reliability impact on commuting and other users	Positive	Medium	Comparison of the lateness for observed buses currently operating along the A428/A1303, against the expected lateness for services using the new segregated public transport route.	TAG Unit A1.3	
	Physical activity	Positive	Medium	Following WebTAG guidance and using CSR2 outputs and mapping analysis. AMAT	TAG Unit A4.1, Section 3	Monetary, quantitative and qualitative
	Journey quality	Positive	Medium	Following WebTAG guidance	TAG Unit A4.1, Section 6	Qualitative
	Accidents	Slight positive	Medium	Following WebTAG guidance and using CSR2 outputs and mapping analysis. COBA-LT	TAG Unit A4.1, Section 2	Qualitative and monetary
	Security	Neutral	Medium	Following WebTAG guidance and using CSR2 outputs and mapping analysis.	TAG Unit A4.1, Section 4	Qualitative
	Access to services	Positive	Medium	Following WebTAG guidance and using CSR2 outputs and mapping analysis.	TAG Unit A4.1, Section 8	Qualitative
	Affordability	Neutral	Medium	Following WebTAG guidance and using CSR2 outputs and mapping analysis.	TAG Unit A4.1, Section 9	Qualitative
	Severance	Neutral	Medium	Following WebTAG guidance and using CSR2 outputs and mapping analysis.	TAG Unit A4.1, Section 5	Qualitative
	Option and non-use values	Positive	Low	Supplementary economic modelling	TAG Unit A4.1, Section 5	Qualitative
<b>Public Accounts</b>	Cost to Broad Transport Budget	Negative	Low	Scheme costings	TAG Unit A1.3	Monetary
	Indirect Tax Revenues	Neutral	Medium	TUBA	TAG Unit A1.3	Monetary

Source: Mott MacDonald

