MOTT MACDONALD

Options Assessment Report (Part 3)

Outline Business Case
Appendix C

November 2019

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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.

Cambridge Autonomous Metro (CAM): CAM is the proposed metro style system for Greater Cambridge.

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 value of goods and services produced in the UK.

Gross Value Added (GVA): A measure of the value of goods and services produced at a sub-national or industry level. GVA is used to calculate GDP for national accounting purposes. GDP is a broad aggregate measure of economic activity and cannot be calculated at the level of the individual business, which renders it an infeasible metric for measuring economic activity at the sub-national or industry 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.

Land Value Uplift (LVU): The change in value from developing the land which Is the value of the land in its new use (e.g. commercial or residential) minus the value of the land in its existing use. Any increase in land value as a result of a change in its use reflects the economic benefits of conversion to a more productive use.

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 Assessment Report (OAR): The Options Assessment 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.

Supplementary Economic Modelling (SEM): Non-standard methods to estimate the economic impact of transport schemes, further outlined in TAG Unit M5.3 on Supplementary Economic Modelling.

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 Assessment 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.

Value for Money (VfM): Using public resources in a way that creates and maximise public value.

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 Impacts (WEI): improvements in economic benefits that are acknowledged, but which are not typically captured in traditional cost-benefit analysis.

Executive summary

Scheme Background

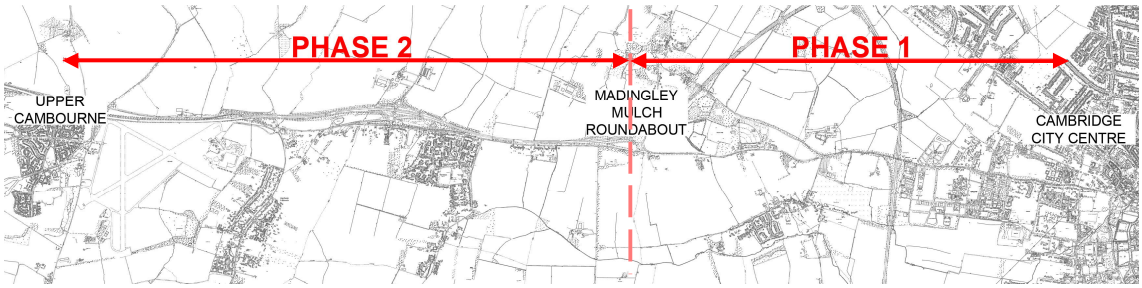
In 2015 the proposed Cambourne to Cambridge Better Public Transport Project (C2C) project was prioritised for funding by the Greater Cambridge Partnership (GCP) from the City Deal. This was in response to existing issues of congestion and poor journey time reliability along the A428/A1303 during peak periods, as well as the need to improve the levels of connectivity between the growing settlements to the west of Cambridge and key employment centres within Cambridge to support continued economic growth.

C2C is considered phase 1 of the Cambridgeshire Autonomous Metro (CAM) scheme being developed by the Cambridgeshire and Peterborough Combined Authority (CPCA). As such, the C2C project has been sympathetic to the wider transport aspirations of the region the CAM scheme, making sure consideration is taken in the design and assessment process.

Since the scheme's inception, it has progressed through a series of optioneering steps to identify and assess options that address these issues. The option development and assessment process undertaken as part of the production of the scheme's Outline Business Case (OBC) has been carried out and presented in three parts. This was due to the scheme being split into two phases:

- Phase 1 - from Madingley Mulch Roundabout to Grange Road
- Phase 2 - Cambourne to Madingley Mulch Roundabout

Figure 1: Phase 1 and Phase 2



Source: Mott MacDonald

This Options Assessment Report (OAR) forms Part 3 of the assessment process, covering the options assessment process for options covering Phase 2 of the scheme.

Position at the end of OAR Part 1

OAR Part 1 provides a summary of all options development and assessment work that has been carried out since the scheme's inception, up to the formal consultation period on the initial shortlisted options that ran between November 2017 and January 2018. OAR Part 1 also included further assessment of the shortlisted options to develop and refine them and arrive at an optimised list of options that include a single recommended on-road option and a single recommended off-road option for Phase 1 of the C2C project.

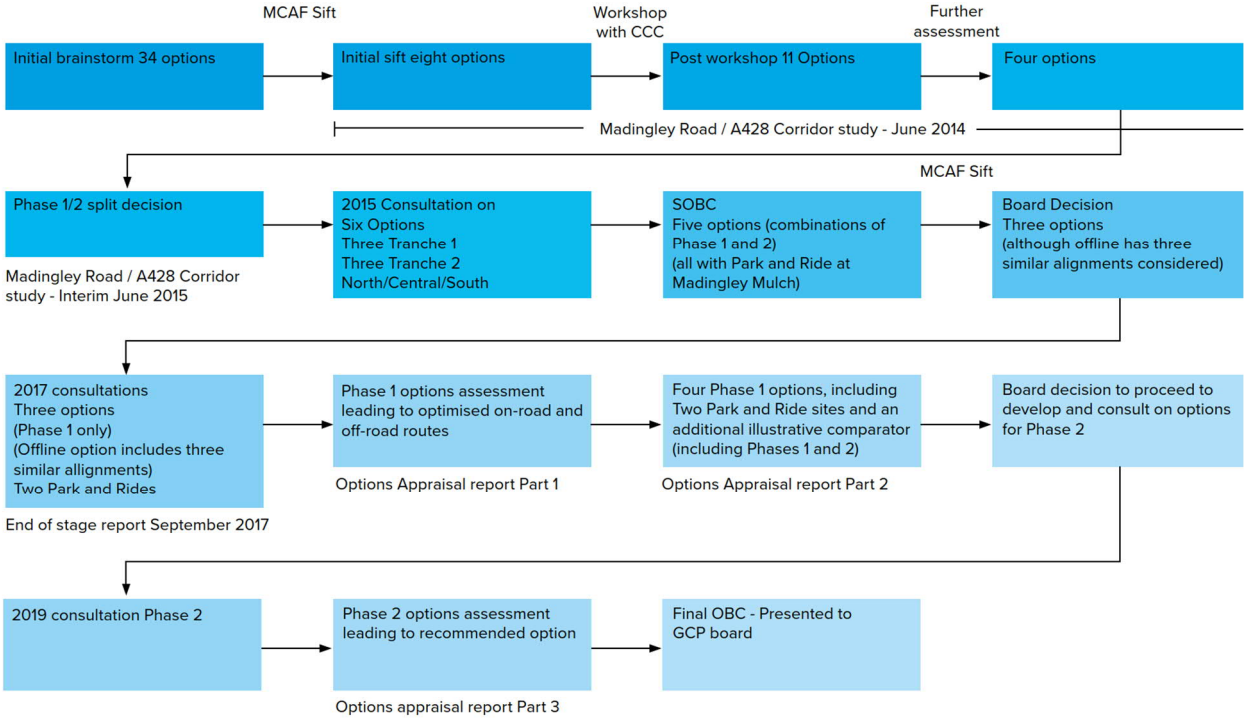
Position at the end of OAR Part 2

OAR Part 2 provides an assessment of the refined shortlisted options from OAR Part 1 using Mott MacDonald's Investment Sifting and Evaluation Tool (INSET) against a series of assessment criteria, and incorporating an initial assessment of the scheme's value for money using traffic modelling output to provide initial Benefit Cost Ratios (BCRs) for each option. This assessment also incorporates the findings and feedback from consultation to arrive at a recommended option for Phase 1 of the C2C project.

Position at the end of OAR Part 3

OAR Part 3 provides an assessment of the Phase 2 options using the same approach as the assessment of Phase 1 options, including the assessment of the options against the same assessment criteria using INSET, and further assessment of the scheme's value for money using traffic modelling outputs to provide updated initial Benefit Cost Ratios (BCRs) for each option. This assessment also incorporates the findings and feedback from consultation to arrive at a recommended preferred option for Phase 1 and 2 for the full C2C project.

Figure 2: Options Appraisal Steps



Source: Mott MacDonald

Phase 2 Route Alignment Assessment

Following the completion of optioneering for Phase 1 route alignment, as summarised in OAR Part 1 and 2, further optioneering has been carried out to identify the preferred route alignment for Phase 2. The results of which are presented in this report. The optioneering for Phase 2 covered 3 route alignments, with a variation for each that included 2 locations for the Park & Ride. As with the selection of the preferred route alignment for Phase 1, public consultation was carried out on the Phase 2 options to inform the optioneering process.

The list of Phase 2 options includes:

- Option 1a – Off-road segregated with Waterworks Park and Ride
- Option 1b – Off-road segregated with Scotland Farm Park and Ride
- Option 2a – On-road junction improvements with Waterworks Park and Ride
- Option 2b – On-road junction improvements with Scotland Farm Park and Ride
- Option 3a – On-road public transport priority with Waterworks Park and Ride
- Option 3b – On-road public transport priority with Scotland Farm Park and Ride

OAR Part 3 evaluates the options against a series of assessment criteria that were grouped by the following themes:

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

In addition to the options assessment against the identified criteria, traffic demand modelling was carried out to further inform the optioneering process. For each option tested, the recommended preferred alignment from Phase 1 was incorporated into each Phase 2 option. This allowed for the full scheme to be assessed. The outputs from this assessment allowed for an understanding of the differences in demand levels and journey times between the options, as well as an appraisal of the options value for money. The results from the public consultation were also used to inform the final selection of the preferred route alignment for Phase 2 as well as the preferred location for the Park & Ride.

OAR Part 3 Assessment Results

The assessment results from the multi criteria assessment showed that the best performing option against the full range of criteria aligned to the scheme objectives was Option 1b – Segregated off-road option with Park & Ride at Scotland Farm.

Table 1: INSET results

Option	INSET Scoring Summary Ranks	INSET Score
Option 1a	Ranked 2nd	181
Option 1b	Ranked 1st	182
Option 2a	Ranked 6th	160
Option 2b	Ranked 5th	163
Option 3a	Ranked 4th	175
Option 3b	Ranked 3rd	176

Source: Mott MacDonald

The result of the consultation questionnaire also showed that 48% of the respondents preferred Option 1, 39% preferred Option 2 and 20% preferred Option 3. As well as the route options the Park and Ride site location was consulted on and the results showed that 63% of the respondents preferred Scotland Farm with only 17% preferring Waterworks.

The initial BCR values showed that the best performing option was Option 2a - On-road junction improvements with Waterworks Park and Ride. However, all options BCRs were close to each other and are not considered significantly different to suggest a clear preference.

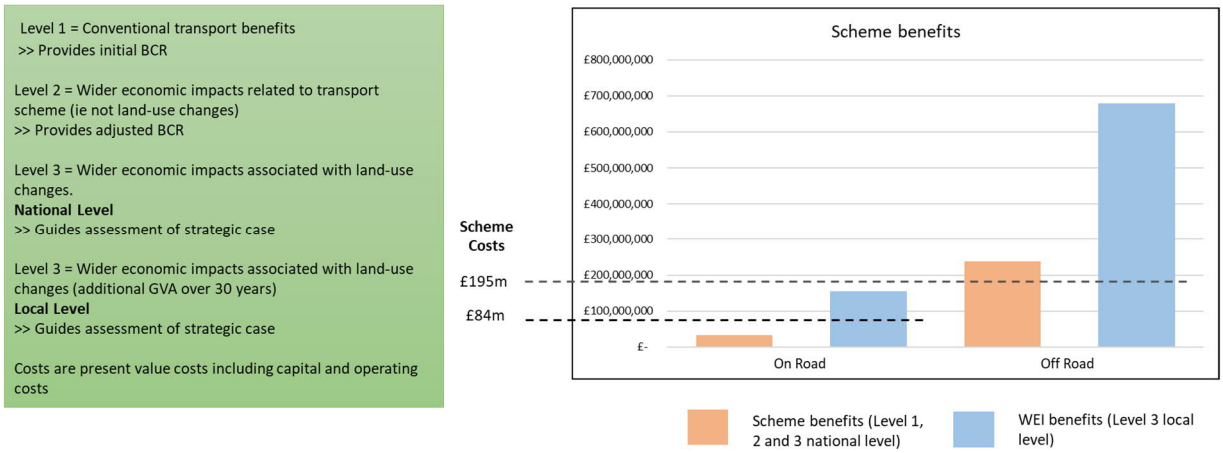
Table 2: C2C BCRs – Phase 2 options[1]

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Benefit Cost Ratio	0.31	0.32	0.35	0.33	0.31	0.34

Source: Mott MacDonald

In order to fully consider the value for money the options would potentially deliver and to inform the optioneering exercise, and to support the final decision of the best performing option, the incorporation of Wider Economic Impacts (WEI) assessment was done to compare an off-road to on-road option. The WEI appraisal confirms that there were substantial benefits to an off-road segregated route. Figure 3 illustrates how an off-road option compares to an on-road option in delivering WEI at both a national and local level.

Figure 3: C2C on-road vs off-road WEI comparison



Source: Mott MacDonald

Taking into account the results of the multi criteria assessment, consultation feedback and comparison of an off-road versus on-road solution with regards to WEI, **Option 1b – Off-road segregated with Scotland Farm Park and Ride** is the best performing option and therefore is recommended to be taken forward as the preferred option.

[1] Note – each option for the value for money assessment included the recommended preferred option for Phase 1, which was an off-road route alignment.

1 Introduction

1.1 Purpose of this report

In 2015 the proposed Cambourne to Cambridge Better Public transport (C2C) project was prioritised for funding by the Greater Cambridge Partnership (GCP) from the City Deal. This was in response to existing issues of congestion and poor journey time reliability along the A428/A1303 corridor during peak periods, as well as the need to improve the levels of connectivity between the growing settlements to the west of Cambridge and key employment centres within Cambridge to support continued economic growth.

Following the approval of the Strategic Outline Business Case (SOBC) for the Cambourne to Cambridge Better Public Transport (C2C) project in October 2016, by the Executive Board of the GCP, and completion of an End of Stage Report in September 2017 which informed subsequent public consultation, the GCP commissioned the development of an Outline Business Case (OBC) as part of the next phase of the scheme's development. An integral component of the business case process and that of producing an OBC is the development of options and their assessment, which is reported in an Options Assessment Report (OAR).

This OAR is produced in line with the Department for Transport's (DfT) Transport Appraisal Guidance (TAG) and, follows the Transport Appraisal Process and methodology. The OAR summarises all work previously undertaken to identify the need for the intervention, to identify options for addressing the identified issues and opportunities, and how those options have been assessed and refined to arrive at a recommended option.

The OAR for the C2C project at the OBC stage is formed in three parts:

- **OAR Part 1** – outlines all work done to date to identify the need for the intervention, and the options development process and assessment process carried out in order to arrive at a short list of options for Phase 1 of the C2C project. OAR Part 1 also includes the assessment of the shortlisted options in order to refine and optimise them and arrive at on and off-road options to be taken forward for further assessment.
- **OAR Part 2** – outlines the assessment of the shortlisted options as presented at the conclusion of OAR Part 1 and takes the reader through the assessment of the Phase 1 on-road and off-road options defined in OAR Part 1 using multi criteria assessment and initial Benefit Cost Ratios (BCRs) based on user benefits and scheme costings to present an emerging strategic option.
- **OAR Part 3** – outlines the assessment of the Phase 2 options. OAR Part 3 takes the reader through the assessment using the consultation information, multi criteria assessment and BCRs based on user benefits and scheme costings to present a final recommend option.

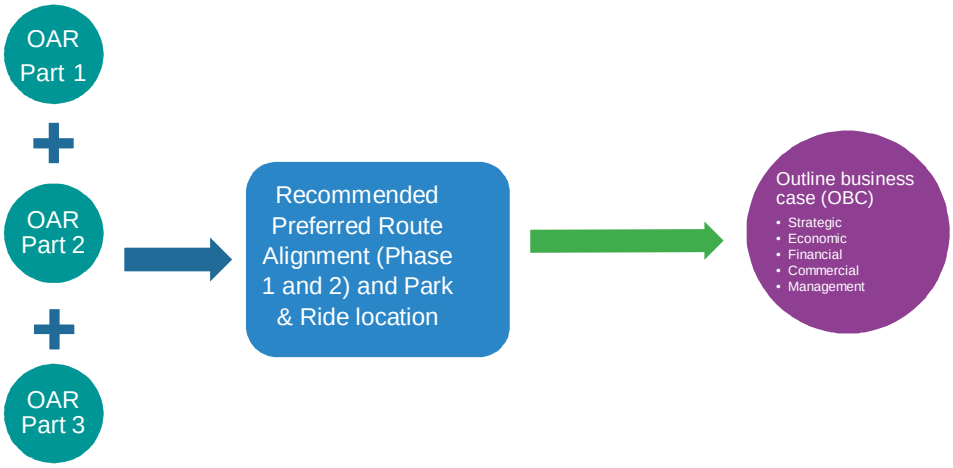
This document is OAR Part 3. To fully understand this document, it is advised that OAR Part 1[2] and OAR Part 2[3] is read prior to reading OAR Part 3.

[2] Cambourne – Cambridge Better Bus Journey Options Assessment Report (Part 1), 392438-MMD-BCA-XX-RP-BC-0002, Mott MacDonald

[3] Cambourne – Cambridge Better Bus Journey Options Assessment Report (Part 2), 392438-MMD-BCA-XX-RP-BC-0004, Mott MacDonald

The results of OAR Part 1, 2 and 3, a recommended preferred Park & Ride location and a route option (Phase 1 and 2), will directly inform the OBC that presents the optioneering process alongside the wider strategic context for investment and information on the transport economic benefits of the recommended option. The OBC also sets out each of the five cases for the recommended option in line with DfT's 'five cases' model[4], covering the Strategic, Economic, Financial, Commercial and Management cases for the C2C project.

Figure 4: Process following the completion of OAR Part 3



Source: Mott MacDonald

1.2 Structure of this report

OAR Part 3 for the C2C project is to be read in conjunction with OAR Part 1 and OAR Part 2, with all parts structured to align with the DfT's Transport Appraisal Process. Table 4 sets out how OAR Part 3 aligns with this process.

Table 4: OAR Part 3 Report Structure

Report and Section	Contents	Description	Alignment with WebTAG option appraisal development stages and steps
OAR (Part 3) – 2	Methodology	Reviews the steps in the DfT's transport appraisal process and outlines the proportionate including and options assessment methodology for the C2C project.	N/A
OAR (Part 3) - 3	Option Development	Highlights any changes to the route alignment between the production of OAR Part 2 and OAR Part 3.	N/A
OAR (Part 3) – 4	Summary of Consultation	Review the results from the public consultations and stakeholder meetings, and the changes that have been undertaken in the design due to the comments and responses.	Stage 1 Step 7
OAR (Part 3) – 5	Final Option Assessment	This section sets out the Phase 2 route alignments and the	Stage 1 Step 8

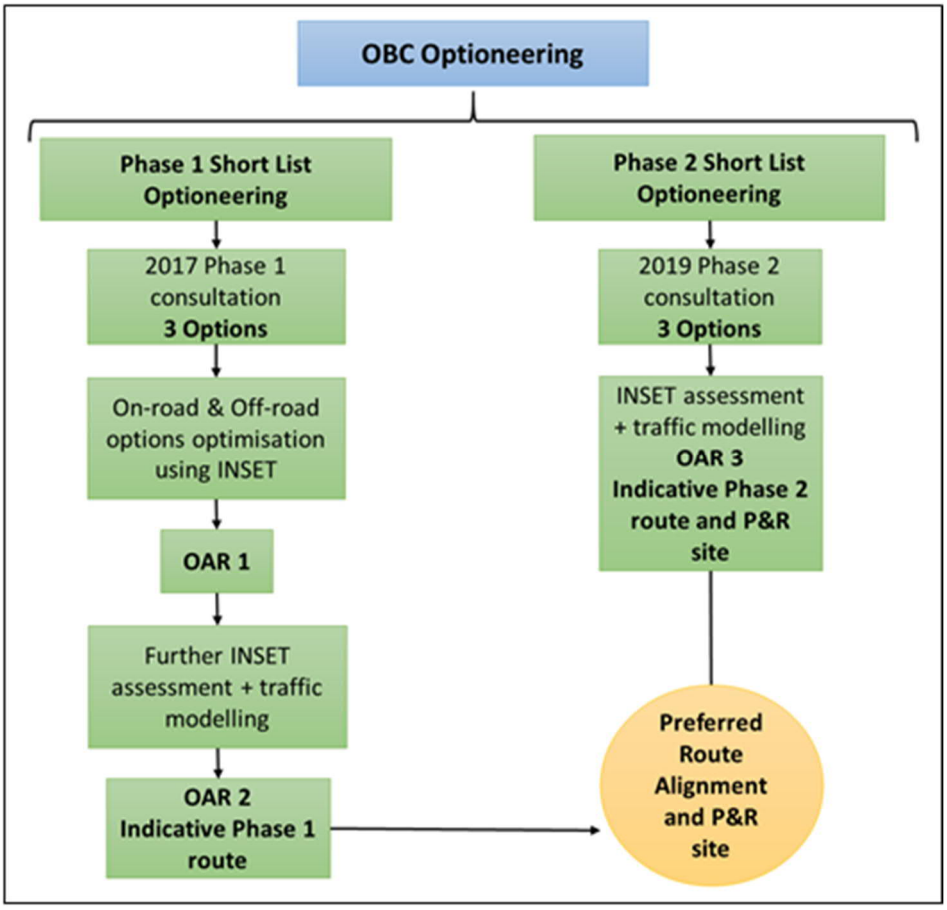
[4] This is based on HM Treasury's Green Book appraisal guidance.

Report and Section	Contents	Description	Alignment with WebTAG option appraisal development stages and steps
		methodology used to assess the shortlisted options and arrive at a single preferred option.	
OAR (Part 3) – 6	Options Assessment Results	This section assessed the recommended on-road and off-road options using the Mott MacDonald in-house Investment Sifting and Evaluation Tool (INSET)	Stage 1 Step 8
OAR (Part 3) – 7	Benefit Cost Ratios	Assess the benefits gained from the scheme against the cost of the scheme.	Stage 1 Step 8

Source: Mott MacDonald

This is identical to the steps taken as part of OAR Part 2 as both reports produce a preferred route alignment for Phase 1 and Phase 2 respectively. This is shown in Figure 5.

Figure 5: OBC Optioneering (OAR Part 2 and Part 3)



Source: Mott MacDonald

1.3 Position of options at conclusion of OAR Part 2

OAR Part 2 provides an assessment of the refined shortlisted options from OAR Part 1 using Mott MacDonald's Investment Sifting and Evaluation Tool (INSET) against a series of assessment criteria, and traffic modelling to provide initial Benefit Cost Ratios (BCRs) for each option. This assessment also incorporates the findings and feedback from the consultation phase to arrive at a recommended option for Phase 1 of the C2C project.

The assessment concluded that the off-road option "Do Something 1" was preferred. However, using the illustrative comparator which proposed an offline route from Cambourne to Grange Road, the assessment demonstrated that additional benefits could be gained from a "Phase 2" route. The assessment of alignment options for Phase 2 have been taken forward to OAR Part 3.

Note that OAR Part 2 did not include the assessment of the two shortlisted options for the Park and Ride sites. Therefore, both sites were carried forward into the further assessment of the Phase 2 options as summarised in OAR Part 3.

2 Options Development Between OAR Part 2 and Part 3

2.1 Introduction

Since the submission of OAR Part 2 there have been developments which have resulted in changes to the Phase 1 route alignment.

2.2 On road enhancements

Following further traffic modelling of the optimised route and the consultation responses, it was demonstrated that the public transport route from High Cross Junction and Lady Margaret Road brought no additional benefits. However, there was a desire for improved cycling facilities. Whilst the on-road route alignment for Phase 1 is not proposed for taking forward as part of the preferred option, elements of this option around cycling enhancements are being considered for further development. The implementation of these enhancements is considered outside the scope of the C2C project.

2.3 Grange Road access

The initial assessment for the Off-Road route alignment to the east of Phase 1 showed that Rifle Range was the best option according to the assessment based on criteria derived from the scheme objectives. However, as the scheme has progressed results from consultation with key stakeholders and members of the public have been received, raising a number of questions concerning the impact on the West Fields, access and land ownership. Also, further studies were completed such as the 2019 addendum to the 2017 LDA report on the impact of various Phase 1 alignments on the Green Belt, including various routes through the West Fields. This has prompted a review of the original INSET assessment which is shown in Table 5.

Table 5: INSET assessment

Criteria	Adams Road	Adams Road Updated	Rifle Range	Rifle Range Updated	Justification
Reliability of journey	2	2	7	3	Further engagement with stakeholders has identified a range of additional users of the Rifle Range track which would impact the segregated nature of the track and therefore impact negatively on journey time
Route flexibility	1	1	1	1	Not Impacted
Walking and cycle connectivity	3	3	7	7	Not Impacted
Impact on existing traffic	1	1	3	3	Not Impacted
Environmental impact – Visual Impact	4	4	2	2	Not Impacted
Environmental Impacts – Noise	3	3	3	3	Not Impacted
Environmental Impacts – Air quality	4	4	4	4	Not Impacted
Environmental Impacts – CO2 emissions	5	5	4	4	Not Impacted

Environmental impacts – Biodiversity	2	2	1	1	Not Impacted
Environmental Impacts – Heritage	3	3	3	3	Not Impacted
Environmental Impacts – Green Belt	4	3	4	2	A detailed review has confirmed Rifle Range would result in low to medium harm A detailed review has confirmed that Adams Road would result in a low level of harm
Safety	3	3	4	3	Further engagement with stakeholders have identified a range of additional users of the Rifle Range track which would increase potential conflict with C2C
Public acceptability	3	3	5	1	The public acceptability has decreased as there have been concerns raised about access and land ownership around the rifle range track. Jesus College wish to retain agricultural access. The Rugby Club uses the Rifle Range track for parking and requires occasional access for special events only.
Scheme Cost	3	3	3	1	The score for scheme cost has been decreased to account for the additional cost of this option due to the complexity of access issues on rifle range
Land Acquisition Required	4	4	3	2	The score has been decreased as there are a number of stakeholders which require the access provided by the rifle range road which will increase the stakeholder engagement required for this option.
Impact on Local road network during construction	2	2	4	4	Not Impacted
Future proofing	3	6	6	3	The score for Rifle Range has been decreased as further development on CAM has indicated that any future scheme would have a tunnel prior to this section of C2C therefore neither option is future proofed. And this option would result in redundant infrastructure. The score for Adams Road has been increased as further development on CAM has indicated that any future scheme would have a tunnel prior to this section of C2C therefore neither option is future proofed.
Average Score	3.06	3.18	4.18	2.94	

Source: Mott MacDonald

The Rifle Range option is more costly and has a greater impact on the West Fields and Green Belt as shown in the 2019 addendum to the 2017 LDA report. However, the Rifle Range route delivers the long-term requirements of C2C more effectively in provision of a segregated route. Adams Road does not provide the function required for C2C and it would not be possible to maintain the commitment to a segregated 3m cycleway throughout alongside the 7.3m highway and an adequate walkway to serve properties on the other side of Adams Road. If Adams Road is selected, then it is likely that the Comberton Greenway would need to provide a cycle route down to the Rifle Range although many cyclists would potentially choose to use to use Adams Road which would carry a relatively low volume of traffic.

On other issues such as ecology and parking and access there are pros and cons of both options but further development of the Rifle Range track has established a number of factors which undermine its potential.

In the light of the potential CAM scheme, there has been a suggestion from stakeholders that the need for a dedicated route to the east of West Cambridge is not justified as it will become redundant in due course. C2C is to be promoted in advance of CAM, and there is no guarantee that CAM will proceed to construction. C2C will be assessed on its own merits and a business case which assumes an end to end scheme. Therefore, from a future-proofing perspective this is a significant argument, but the selection of a solution should be based on the full range of criteria.

Taking into account the reassessment, it was recommended at this stage in the scheme development that Adams Road, as the slightly better performing option with the reduction in harm to the Green Belt, would be the better route alignment for this segment of Phase 1.

2.4 West Cambridge

Since the confirmation of Phase 1 alignment, engagement with the West Cambridge Site has continued, including the provision of indicative drawings of the potential layout along Charles Babbage Road. During this engagement concerns about having two bi directional roads running parallel to one another have been raised, as the new segregated route would run directly south of Charles Babbage Road. Further engagement with UoC has indicated a desire to remove the segregated route and have vehicles running on Charles Babbage Road itself. Measures are being considered by the University to reduce traffic on Charles Babbage Road to ensure reliability for the public transport vehicles. Plans currently retain the segregated route but it is recognised that work should continue to develop this route alongside the developing West Cambridge plans.

2.5 Technological guidance

C2C has aspirations to utilise future technology where possible, to ensure it delivers the greatest level of benefits in relation to meeting its strategic objectives, and to ensure alignment to the future CAM network, for which C2C is considered to be Phase 1.

Mott MacDonald, on behalf of the GCP undertook a market sounding exercise in October 2018 to determine market interest and the availability of technological guidance solutions for deployment on the Cambridgeshire Rapid Transit schemes (this is included in Appendix E to the main OBC).

The report concluded that both kerb guidance and optical guidance achieve most or all of the guidance requirements for the C2C project and should be developed/investigated further.

Previous cost estimates have been based on kerb guidance. As the option for kerb guidance is still being considered it has been used for the cost estimate as it is believed to be a higher cost option compared to an alternative guidance systems such as optical guidance.

2.6 Bus Strategy

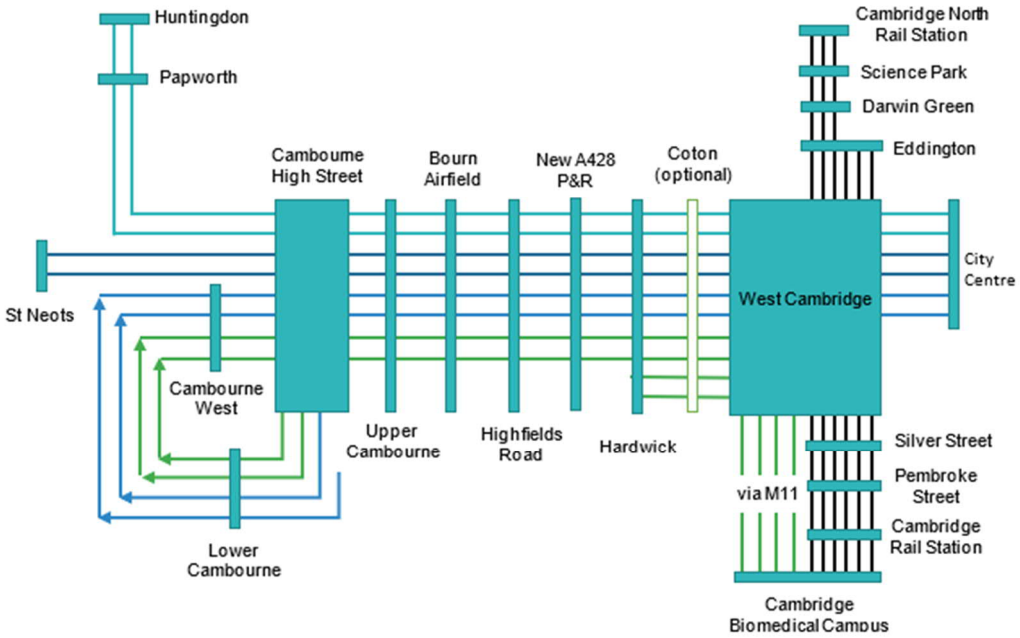
Following engagement with stakeholders it was identified that there was interest in where the proposed C2C route would go within Cambridge, this along with GCP's ongoing intention to demonstrate connectivity resulted in the creation of a bus strategy report (this is included in Appendix F to the main OBC). The purpose of the report was to explore an "end to end" bus strategy, developing express services reaching key destinations. The strategy will be used to inform traffic modelling, which will be used to generate journey times.

The current bus strategy proposes three direct express services to:

- Cambourne to Cambridge City Centre at 10-minute interval service (six buses per hour)
- Cambourne to Biomedical Campus at 30-minute interval service (two buses per hour)
- A428 Park and Ride site to Biomedical Campus at 30-minute interval service (two buses per hour during peak periods)

The routes are based on realistic service numbers and anticipated demand. Although it should be noted that the routes are proposed routes only and have not been agreed with the route operators. Existing bus services would have the option of using the new public transport route, providing they comply with clean vehicle standards. For example, the X5 would be likely to use the new route. The Citi 4 has been assumed to continue to serve existing stops on the A1303.

Figure 6: Proposed Bus Strategy Schematic



Source: Mott MacDonald

3 Options Assessment Methodology

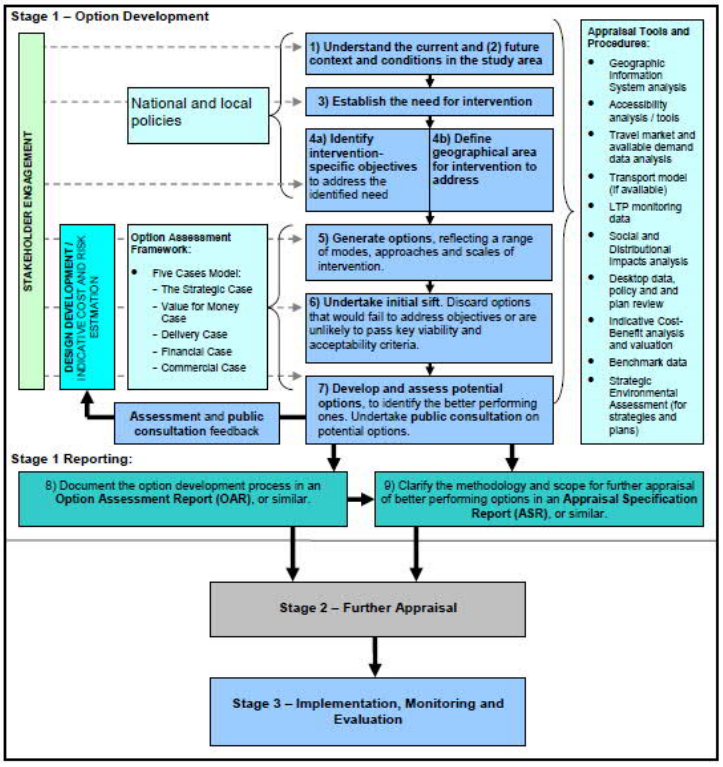
3.1 WebTAG guidance on the Transport Appraisal Process

OAR Parts 1, 2 and 3 follow the Department for Transport's (DfT) guidance 'The Transport Appraisal Process' which provides detailed guidance on appraisal and the requirements needed for transport intervention. A structured approach sets out the necessary steps from initial intervention through to the detailed appraisal that supports preparation of business or investment cases to subsequent approval stages and post implementation evaluation (see **Error! Reference source not found.** and 8 which illustrate the DfT process).

The three stages in the DfT's transport appraisal process are shown below:

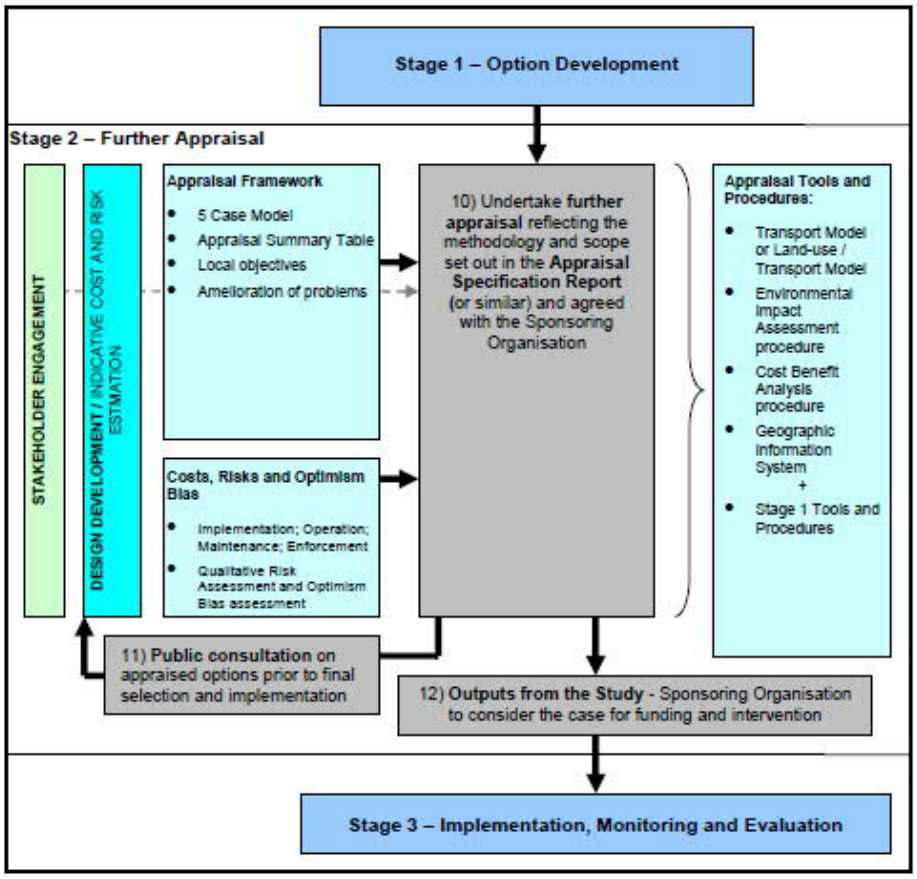
- **Stage 1** – Option Development. This involves identifying the need for intervention and developing options to address a clear set of locally developed objectives which express desired outcomes. These are then sifted for the better performing options to be taken on to further detailed appraisal in Stage 2.
- **Stage 2** – Further Appraisal of a small number of better performing options in order to obtain sufficient information to enable decision-makers to make a rational and auditable decision about whether or not to proceed with intervention. The focus of analysis is on estimating the likely performance and impact of intervention(s) in sufficient detail.
- **Stage 3** – Implementation, Monitoring and Evaluation.

Figure 7: Stage 1 of the Transport Appraisal Process ('Option Development')



Source: Department for Transport (2014), Transport Analysis Guidance: The Transport Appraisal Process

Figure 8: Stage 2 of the Transport Appraisal Process ('Further Appraisal')



Source: Department for Transport (2014), Transport Analysis Guidance: The Transport Appraisal Process

3.2 Methodology summary

The options appraisal process and this report for the C2C project has been structured to align with Stages 1 of the DfT's transport appraisal model outlined in Section 3.1.

Stage 1 included identifying the need for intervention and developing options to address a set of locally developed objectives derived from evidence based issues and opportunities (see OAR Part 1). These options were then sifted to arrive at a shortlist. Further appraisal of the shortlisted options from stage 1 where undertaken to arrive at a recommended route alignment for Phase 1 and Phase 2 and Park and Ride location (see OAR Part 2 and this OAR Part 3). The technological solution for the transport mode is discussed in Section 2.5.

3.2.1 Stage 1 – Options generation and assessment

Stage 1 forms the basis of all previous options development and appraisal carried out for the SOBC published in 2016, and for subsequent further options appraisal work carried out post SOBC and documented in the End of Stage Report in advance of public consultation in September 2017. For further details of the processes undertaken see OAR Part 1.

The initial sift which was undertaken as part of OAR Part 2 led to further assessment of the best performing routes for Phase 1 and Phase 2 and the two recommended Park and Ride sites.

The Phase 1 route alignment (OAR Part 2) and the Phase 2 route alignment (OAR Part 3) use an multi criteria assessment to arrive at the best preforming route between Madingley Mulch Roundabout and Cambridge City Centre (Phase 1) and Cambourne to Madingley Mulch Roundabout (Phase 2).

Also included in this assessment is the results of public consultation and economic appraisal of each option using traffic modelling outputs; specifically highway and public transport modelling to assess demand changes, and the use of marginal external costs assessment which examines changes in vehicle kms.

The single preferred route alignment is subject to additional appraisal as per what is set out in the Appraisal Specification Report (ASR), with the overall appraisal presented in the Economic Case for the OBC.

4 Public Consultation (Phase 2)

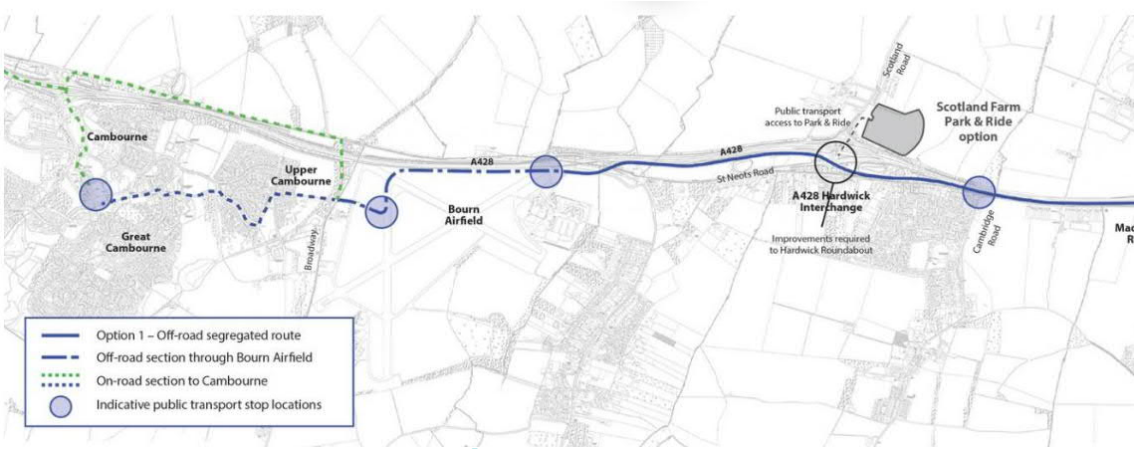
4.1 Options as presented in the consultation

Three alignment options were presented during the consultation period for Phase 2, they are shown in the following sections.

4.1.1 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.

Figure 9: Phase 2 - Option 1

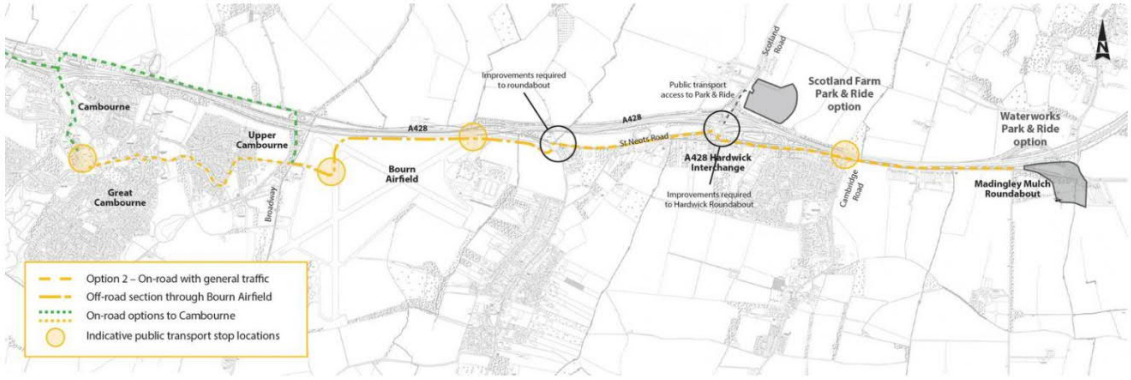


Source: Greater Cambridge Partnership Website[5]

4.1.2 Option 2 - On-road with junction improvements - low-cost alternative

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.

Figure 10: Phase 2 – Option 2



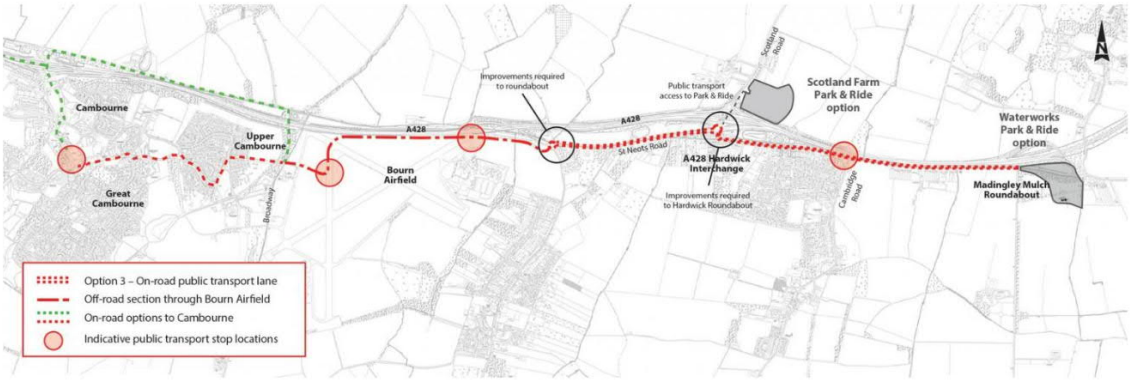
Source: Greater Cambridge Partnership Website[6]

[5] https://www.greatercambridge.org.uk/transport/transport-projects/cambourne-to-cambridge/cambourne-to-cambridge-phase-2/
[6] https://www.greatercambridge.org.uk/transport/transport-projects/cambourne-to-cambridge/cambourne-to-cambridge-phase-2/

4.1.3 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.

Figure 11: Phase 2 – Option 3



Source: Greater Cambridge Partnership Website

4.2 Consultation details

Between 04 February and 31 March 2019, the GCP held consultation on C2C route alignment options between Cambourne and Madingley Mulch Roundabout.

The consultation adopted a multi-channel approach to promote and seek feedback including through traditional and online paid-for, owned and earned media, community engagement events in key or high footfall locations along the route and through the wide-spread distribution of around 15,000 consultation leaflets.

15 drop-in events were held across the area to enable people to have their say in person and the opportunity to question transport officers and consultants.

Quantitative data was recorded through a formal consultation questionnaire (online and hard-copy) with 968 complete responses in total recorded. A significant amount of qualitative feedback was gathered via the questionnaire, at events, via email and social media and at other meetings.

4.3 Results from the consultation

A full summary of all the consultation responses for each route and Park and Ride option can be found in the 2019 Cambridgeshire Research Group report “Cambourne to Cambridge Phase 2: Summary Report of Consultation Findings”[7]

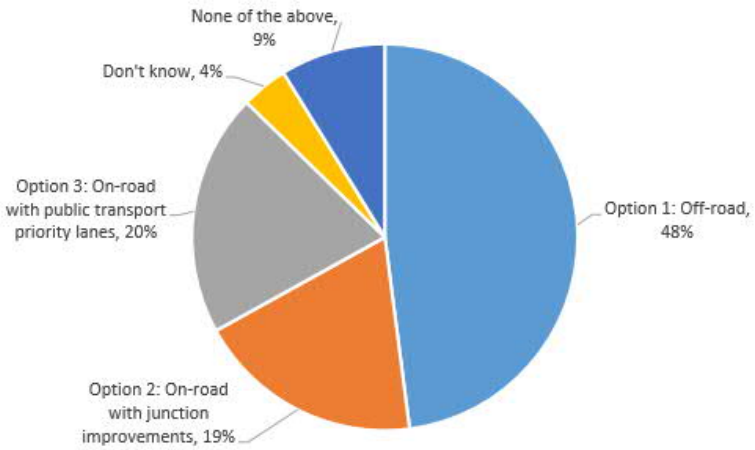
4.3.1 Route option results

The results of the consultation on the routes showed nearly half of respondents preferred ‘Option 1: off-road’ (48%). Two fifths preferred an ‘on-road’ option (39%), with over a fifth preferring ‘Option 3: on-road with public transport priority lanes’ (20%) and under a fifth

[7] Cambourne to Cambridge Phase: Summary Report of Consultation Findings, Cambridgeshire County Council, 2019

preferring 'Option 2: on-road with junction improvements' (19%). One in ten (9%) answered 'none of the above'.[8]

Figure 12: Preferred route alignment for Phase 2 between Madingley Mulch roundabout and Bourn Airfield



Source: Cambourne to Cambridge Phase: Summary Report of Consultation Findings, Cambridgeshire County Council, 2019

4.3.2 Key themes – alignment

A full summary of all the consultation responses for each route option can be found in the 2019 Cambridgeshire Research Group report "Cambourne to Cambridge Phase 2: Summary Report of Consultation Findings"[9]. However, the key themes from the preferred Phase 2 option "Option 1 – Off Road" have been captured in Table 6.

Table 6: Public Consultation Phase 2 Responses: Option 1

Comment Themes	Consultation Responses
Congestion	• Respondents who discussed this theme indicated they chose Option 1 as they felt the off-road route would avoid congestion, which was felt to be a current issue in the area particularly around Madingley Mulch Roundabout. Respondents felt this would help maintain journey times for the route even with the planned developments and ensure timings were reliable.
Journey speed	• Respondents who discussed this theme indicated they chose Option 1 as they felt this route offered the fastest journey speeds, which was felt to encourage usage. – A few of these respondents felt the Option 2 would be slowed down by the same congestion as private vehicles.
Future proof	• Respondents who discussed this theme indicated they chose Option 1 as they felt it would be the most future proofed, ensuring reliable journey times with developments in the area and creation of a route suitable for the CAM service.
Route Option 3: On-road with public transport priority lanes	• Most of the respondents who discussed this theme felt that Option 3 would not offer any beneficial improvements to journeys, as they felt it would still result in public transport being delayed by congestion.

[8] Cambourne to Cambridge Phase: Summary Report of Consultation Findings, Cambridgeshire County Council, 2019
[9] Cambourne to Cambridge Phase: Summary Report of Consultation Findings, Cambridgeshire County Council, 2019

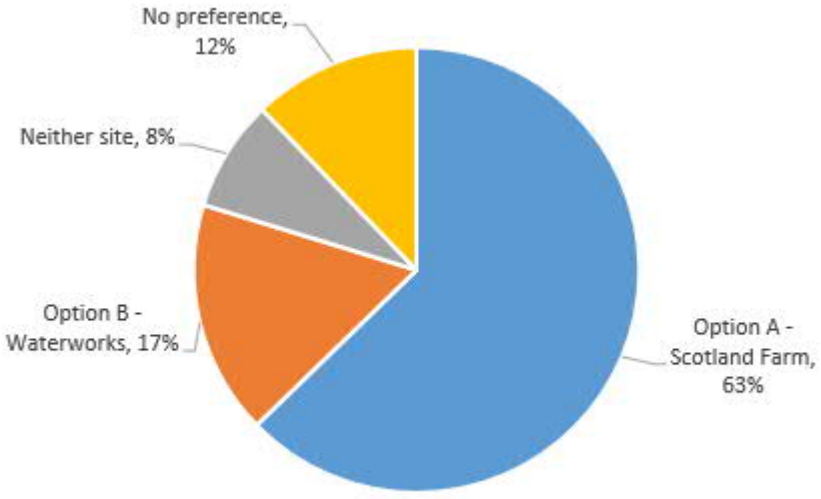
Comment Themes	Consultation Responses
	– Some of these respondents felt that the cost difference between this option and Option 1 were negligible for the added benefit from Option 1. • A few of the respondents who discussed this theme felt that Option 3 could also be beneficial. – Most of these respondents queried what the cycling and footpath provision would look like with this option.
Cycling	• Respondents who discussed this theme indicated they chose Option 1 as they felt it offered the best provision for commuting by cycle safely.
Route Option 2: On-road with junction improvements	• Respondents who discussed this theme felt that Option 2 had a poor cost to benefit ratio, as public transport would be caught in congestion.
Growth	• Respondents who discussed this theme felt that Option 1 offered the best improvements when taking the increase in growth in the Cambourne/Bourn area into consideration.
Cost of development	• Some of the respondents who discussed this theme felt that the added cost of Option 1 when compared to the other options was negligible with the increased benefits of Option 1. • Some of the respondents who discussed this theme felt that Option 1 was expensive but felt it offered the best solution to improving public transport and congestion.
CAM	• Respondents who discussed this theme indicated they chose Option 1 as they felt it would offer the best route for the CAM proposals.
Construction disruption	• Respondents who discussed this theme indicated they chose Option 1 as they felt it would cause the least disruption to existing roads during construction.

Source: Cambourne to Cambridge Phase: Summary Report of Consultation Findings, Cambridgeshire County Council, 2019

4.3.3 Park and Ride results

For the choice of Park and Ride site the majority of respondents (63%) preferred 'Option A – Scotland Farm'

Figure 13: Park & Ride location preference



Source: Cambourne to Cambridge Phase: Summary Report of Consultation Findings, Cambridgeshire County Council, 2019

4.3.4 Key themes – Park and Ride

A full summary of all the consultation responses for each Park and Ride site can be found in the 2019 Cambridgeshire Research Group report "Cambourne to Cambridge Phase 2: Summary Report of Consultation Findings"[10] . From the summary report of the consultation findings we have highlighted the key themes regarding to the preference for Scotland Farm Park & Ride site

Table 7: Public Consultation Phase 2 R Park and Ride Key Themes

Comment Themes	Consultant Responses
Issues with the Scotland Farm Park & Ride site	• Respondents who discussed this theme left comments about the issues they had with the Scotland Farm site. These included: – The sites distance from Cambridge. Some respondents felt this would make the site less attractive due to an increased time on public transport for users. Some respondents felt that this made the site less attractive for users wishing to walk or cycle into Cambridge. – The site's location on the opposite side of the A428 to the proposed public transport links, complicating access to the site and increasing journey times. – The site's proximity to Dry Drayton. Respondents felt it would increase traffic in the area and have a negative impact on residents in Dry Drayton and nearby villages. – Feeling that less users would be attracted to the site with the availability of the Madingley Road Park & Ride site.
Proximity to Cambridge	Respondents who discussed this theme indicated they preferred the Waterworks site due to its proximity to Cambridge. Respondents felt that users would prefer a shorter journey time on public transport or would like to walk/cycle into Cambridge.
Proximity to proposed routes	• Respondents who discussed this theme indicated they preferred the Waterworks site as it was located closer to the proposed routes, resulting in a more direct route. – A few of these respondents felt the Waterworks site had a better alignment with the off-road route than Scotland Farm. – A few of these respondents felt that the Waterworks site made the best use of existing road infrastructure.
Site access	Respondents who discussed this theme indicated they preferred the Waterworks site as they felt it had better access for traffic exiting/entering the M11 and A428.

Source: Cambourne to Cambridge Phase: Summary Report of Consultation Findings, Cambridgeshire County Council, 2019

4.3.5 What we did

From the key themes of the consultation on Phase 2 of the C2C project the following actions will be taken

1. It was noted that congestion and journey times were a key consideration for the people consulted. All routes will be modelled for journey time which will form part of the INSET assessment.
2. It was noted that CAM was an important issue and future proofing the route. All options will be assessed on how well they are future proofed, this will be part of the INSET assessment criteria.
3. It was noted that there were some concerns that a Park and Ride location at Scotland Farm would cause rat running through Dry Drayton. Traffic modelling will be used to model impact on Dry Drayton, with the potential for traffic calming measures to be implemented if a problem is indicated.

[10] Cambourne to Cambridge Phase: Summary Report of Consultation Findings, Cambridgeshire County Council, 2019

4.4 Working groups

As part of the ongoing public consultation events GCP have organised Working Groups for ecology and environment and non-motorised users, a full list of participants can be found in the Statement of Community Involvement in appendix G. The sessions undertaken by these working groups have resulted in a number of suggestions for the C2C project including;

- Additional screening along St. Neots Road
- A transport hub at Cambourne.

These options will be developed at the next stage of the project.

5 Phase 2 Options Assessment

5.1 Introduction

The Phase 2 options assessed reflect the consultation feedback and consequential option refinement. These form the basis for what was assessed using INSET and the traffic model, and which is reported in this OAR Part 3. The results are set out in this section.

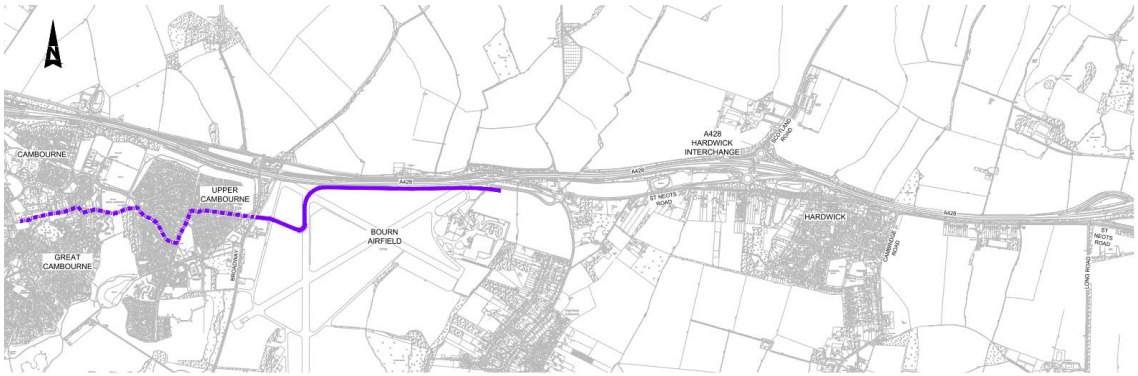
5.2 Final options to be assessed

The final list of the options to be assessed in OAR Part 3 are:

- Option 1a – Off-road segregated with Waterworks Park and Ride
- Option 1b – Off-road segregated with Scotland Farm Park and Ride
- Option 2a – On-road junction improvements with Waterworks Park and Ride
- Option 2b – On-road junction improvements with Scotland Farm Park and Ride
- Option 3a – On-road public transport priority with Waterworks Park and Ride
- Option 3b – On-road public transport priority with Scotland Farm Park and Ride

It should be noted that all three options have an off-road segregated route from Cambourne to Bourn Roundabout see Figure 14. This section of the route is included in the planning application for the Bourn Airfield Development. Therefore, the assessment will only be based on the rest of the route from Bourn Roundabout to the Madingley Mulch Roundabout.

Figure 34: Route from Cambourne to Bourn Roundabout for all options



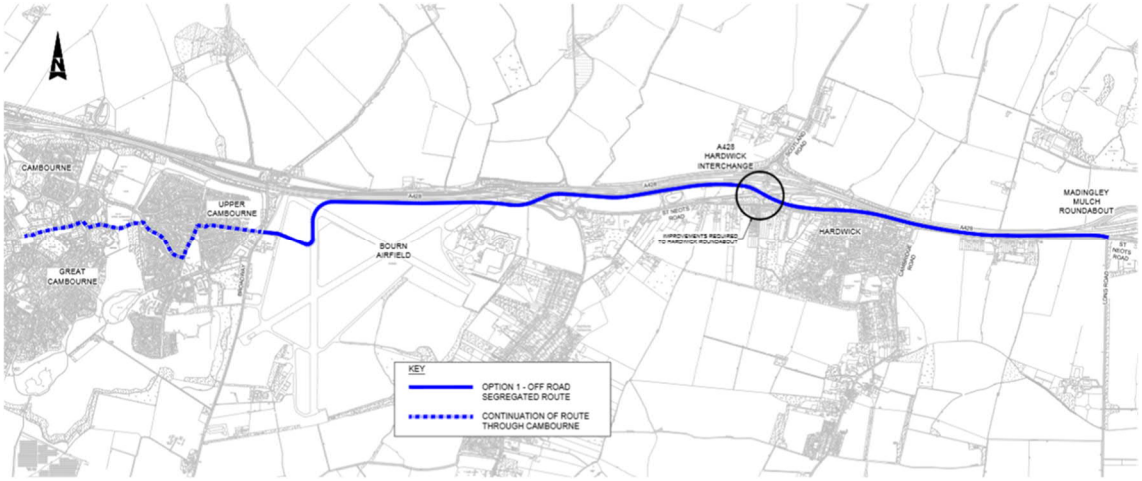
Source: Mott MacDonald

The following sections outline the three main options with schematic diagrams shown in Figure 15 to Figure 16.

5.3 Option 1 – Off-road segregated

The off-road segregated option comprises of a new build public transport route adjacent to the existing A428 and St Neots road. The entire route will be off-road with minimal interaction with existing on-road traffic, except at junctions.

Figure 45: Off-road segregated



Source: Mott MacDonald

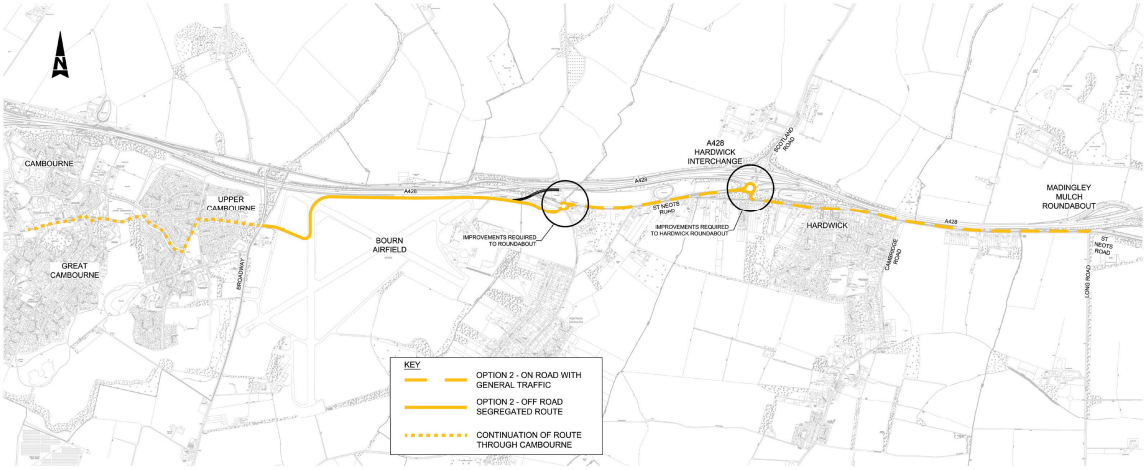
Key design features include;

- Off road section through Bourn Airfield
- New junction with St Neots road to the west of Bourn roundabout
- New segregated route from new junction to Hardwick roundabout
- New priority crossing at Hardwick Roundabout
- New segregated route to the north of St Neots Road to Madingley Mulch roundabout

5.4 Option 2 – On-road with junction improvements

The on-road option locates the public transport vehicles on the existing highway to run with existing traffic after the Bourn Roundabout.

Figure 16: On-road with Junction Improvement



Source: Mott MacDonald

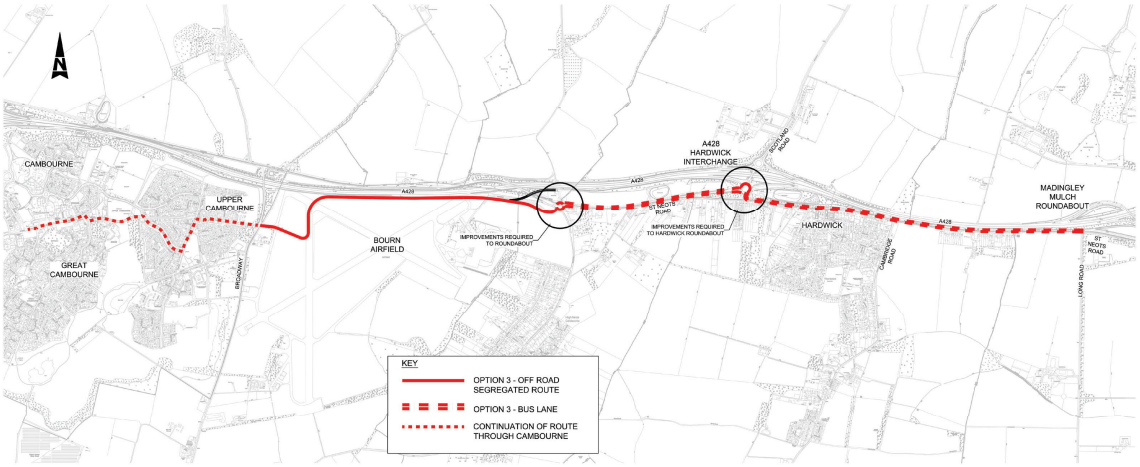
Key design features include;

- Improvements to Bourn roundabout
- On road along St Neots road to Hardwick roundabout
- Improvements to Hardwick roundabout
- On road along St Neots road to Madingley Mulch Roundabout

5.5 Option 3 – On-road public transport priority

This option allows both outbound and inbound public transport priority lanes between Bourn Roundabout and Madingley Mulch Roundabout by widening the existing road.

Figure 17: On-road public transport priority



Source: Mott MacDonald

Key design features include;

- Improvements to Bourn roundabout
- On road public transport lane along St Neots road to Hardwick roundabout
- Improvements to Hardwick roundabout
- On road public transport lane along St Neots road to Madingley Mulch Roundabout

5.6 Summary of options

The final composition of the short-listed of the options assessed are set out in Table 8.

Table 8: Summary of Short-listed Options for Phase 2

		Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Park and Ride	Waterworks	✓		✓		✓	
	Scotland Farm		✓		✓		✓
Cambourne and Bourn	Existing Roads through Cambourne	✓	✓	✓	✓	✓	✓
	New route through Bourne Airfield	✓	✓	✓	✓	✓	✓
Bourn Roundabout	New Junction to North West	✓	✓				
	Improvements to the roundabout			✓	✓	✓	✓
St Neots Road	Segregated to the North	✓	✓				
	Bus Lane					✓	✓
	On road			✓	✓		
Hardwick Roundabout	Create Hamburger island with bus priority through the roundabout	✓	✓				
	Improvements to the roundabout			✓	✓	✓	✓
St Neots Road	Segregated to the North	✓	✓				
	Bus Lane					✓	✓
	On road			✓	✓		

Source: Mott MacDonald

6 Options Assessment: INSET Assessment Process and Results

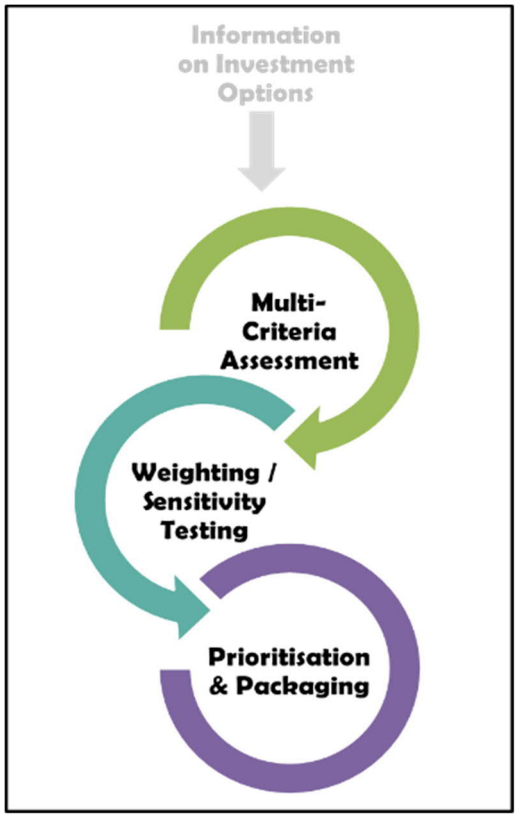
6.1 Our methodology

For the Stage 2, Step 2 options assessment, we applied 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 qualitive and quantitative assessment undertaken by the appropriate teams. This facilitated a comparison and ranking of the options.

6.2 INSET

INSET is a 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 58: 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.

6.3 Assessment criteria

The assessment criteria for the options were generated from the scheme vision and objectives (these are set out in OAR Part 1). These are 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

These themes were then broken down into 37 selection criteria which will be used to assess the different route options. The list of criteria used for Stage 2, Step 1 (as set out in OAR Part 1) are shown in Table 9 below.

Table 9: Assessment criteria as of OAR Part 1

Theme	Assessment criteria
Policy Fit	Cambridgeshire LTP3
	Highways England Road Investment Strategy (RIS)
	Greater Cambridge and Peterborough SEP
	Greater Cambridge City Deal
	South Cambridgeshire Draft Local Plan
	Cambridge City Draft Local Plan
Contribution to Economic Growth	Access to existing homes and jobs
	Supporting house construction
	Supporting job creation
	Increase in GVA
	Capacity
Contribution to improved transport network	Reliability of journey
	Route flexibility - Links into existing public transport routes
	Walking and cycle connectivity
	Impact on existing traffic
	Journey times

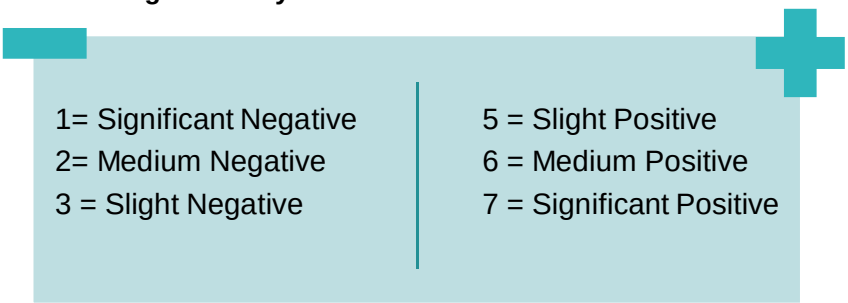
Theme	Assessment criteria
	Service frequency
	Mode share
	Connectivity to Park and Ride
Contribution to quality of life	Environmental impacts - Visual Impact
	Environmental impacts – Noise
	Environmental impacts - Air Quality
	Environmental impacts - CO_2 emissions
	Environmental impacts – Biodiversity
	Environmental impacts – Heritage
	Environmental impacts – Green Belt
	Safety
	Accessibility
Scheme Deliverability	Scheme Cost
	Engineering feasibility - construction method
	Land acquisition required
	Impact on local road network during construction
	Future proofing
	Legislative Powers
	Scheme Maintenance and Renewals
Stakeholder support	Public acceptability

Source: Mott Macdonald

6.3.1 Assessment criteria scoring

For the basis of the evaluation it was decided to assess all options were 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 69: INSET Scoring Summary



Source: Mott MacDonald

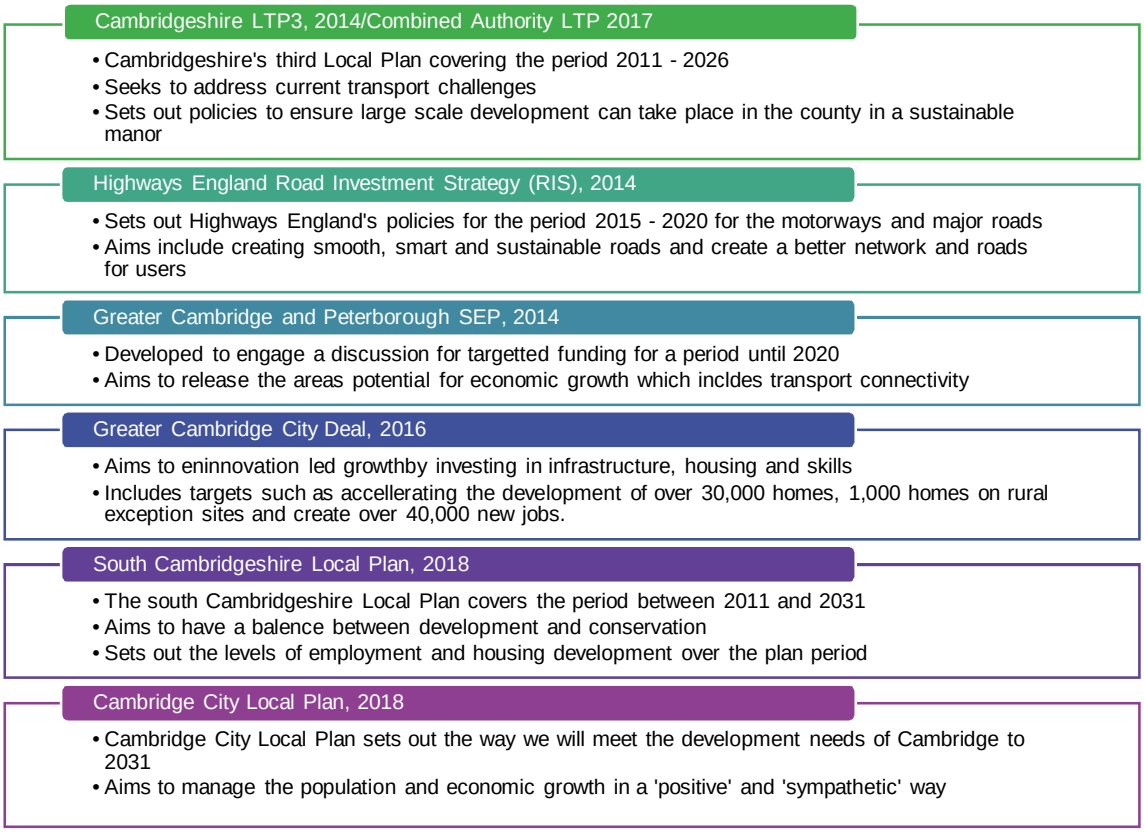
Figure 69 shows an overview of how the scoring range is decided but for each specific metric there is an individual scale for each criterion. Along with the INSET scoring a justification table has been completed which details the reasoning and underlying principles behind each score. A summary of which can be found under each theme in Section 6.4 to 6.9.

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.

6.4 Theme 1 - Policy Fit

The following policies shown in Figure 20 were used to assess each option on how well the options comply and fulfils each policy.

Figure 20: Theme 1 – Policy Fit Assessment Criteria Summary Descriptions



Source: Mott MacDonald

6.4.1 Assessment methodology

To assess the scheme options against the different policies, each policy has been read individually and each scheme has been analysed as to how well they achieve, align and support the policies. The assessment considers the transport and economic growth policies of the documents which the aim of the C2C project aims to achieve.

6.4.2 Assessment results

Table 10: Theme 1 – Policy Fit

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Cambridgeshire LTP3	7	7	5	5	7	7
Highways England Road Investment Strategy (RIS)	7	7	6	6	7	7
Greater Cambridge and Peterborough SEP	7	7	5	5	7	7
Greater Cambridge City Deal	7	7	6	6	7	7
South Cambridgeshire Draft Local Plan	7	7	3	3	7	7
Cambridge City Draft Local Plan	7	7	3	3	7	7
Average	**7.0**	**7.0**	**4.7**	**4.7**	**7.0**	**7.0**
Theme 1 Result Rank	**1st**	**1st**	**5th**	**5th**	**1st**	**1st**

Source: Mott MacDonald

Cambridge LTP3, 2014

Options 1a, Option 1b, Option 3a and Option 3b fully align with LTP3 policies as they provide full length segregation (either through an off-road solution or through the use of public transport lanes). Therefore, they would have a large impact on improving reliability of journey times, managing demand for road space and maximising capacity and efficiency of the existing network. Both options would also result in a greater reduction in the need to travel by private car by making sustainable modes of travel a more viable and attractive alternative to private car use.

Options 2a and Option 2b are less aligned with LTP3 policies as it only provide a small level of segregation through the new housing development at Bourne Airfield, and in fact slightly contradict the policy by running on highway with general traffic for a long section between Bourne Airfield and Madingley Mulch Roundabout, therefore not addressing the issues of needing to provide reliable journey times, making sustainable modes more attractive and viable options to private car use and maximising the possible capacity on the highway network.

Highways England Road Investment Strategy, 2014

Options 1a, Option 1b, Option 3a and Option 3b fully align to Highways England RIS by providing new segregated infrastructure that would contribute to connectivity targets, enabling construction, encouraging economic growth and supporting the smooth flow of traffic as part of the Oxford-Cambridge Arc.

Options 2a and 2b still partially align to the RIS as they provide some level of segregation that would contribute to connectivity targets and encourage economic growth across the Oxford-Cambridge Arc. However, as they include segments of on-road running with general traffic, they do not support RIS objectives to the same degree as the options that include full segregation (either achieved through off-road solution or public transport lanes).

Greater Cambridge and Peterborough SEP, 2014

Options 1a, Option 1b, Option 3a and Option 3b align to the SEP by providing a fully segregated route that provides the greatest level of HQPT (High Quality Public Transport) and has the greatest chance of encouraging those undertaking new trips along the A428/A1303 to choose to use the public transport and therefore contribute to sustainable economic growth.

Options 2a and 2b slightly contradicts the SEP as it does not provide full length segregation or a significant distance of segregation to be truly offering a HQPT solution to attract maximum new users from future trip growth.

Greater Cambridge City Deal, 2016

Options 1a, Option 1b, Option 3a and Option 3b fully aligns with the City Deal, especially with regards to connecting new developments to employment and education opportunities in the city centre through sustainable travel means.

Options 2a and 2b partially aligns with the City Deal, as it provides some direct connectivity between new developments to employment and education opportunities in the city centre.

South Cambridgeshire Local Plan, 2018

Options 1a, Option 1b, Option 3a and Option 3b fully align with the SCDC Local Plan. The Local Plan states there needs to be a segregated HQPT route from new developments and along transport corridors as well as segregated high-quality walking and cycling routes which this option provides.

Options 2a and2b do not align with the SCDC Local Plan as it does not provide full segregation or HQPT from new developments all the way to employment opportunities.

Cambridge City Local Plan, 2018

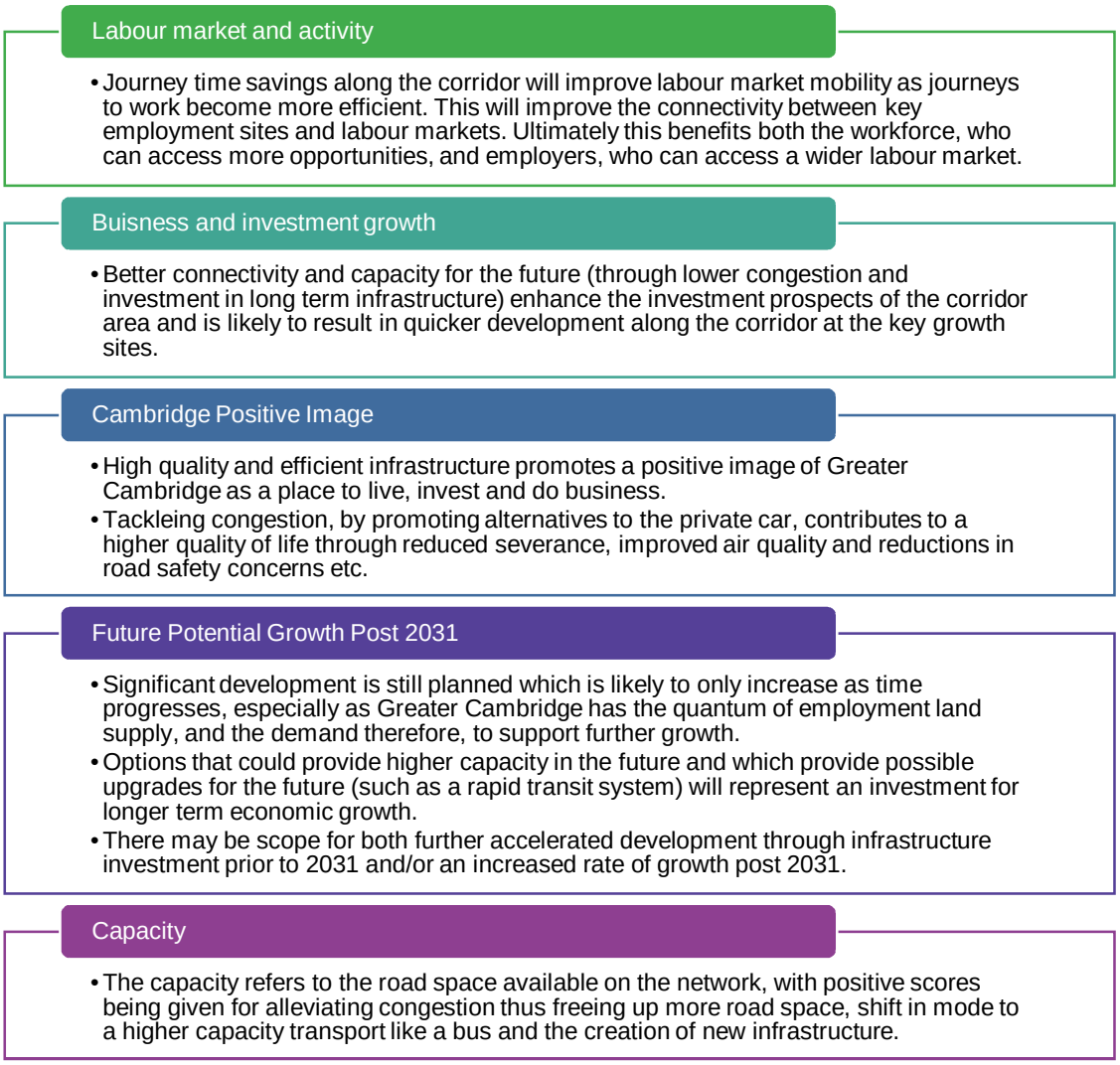
Options 1a, Option 1b, Option 3a and Option 3b fully align with the CaCC Local Plan. The Local Plan states there needs to be a segregated HQPT route from new developments and along transport corridors as well as segregated high-quality walking and cycling routes which this option provides. These options support the development of Bourn Airfield and Cambourne West and increase public transport opportunities.

Options 2a and 2b do not align with the CaCC Local Plan as they do not provide full segregation or HQPT from new developments all the way to employment opportunities.

6.5 Theme 2 - Contribution to Economic Growth

The following criteria has been grouped to cover contribution to economic growth, a more detailed description of each criteria is shown in Figure 21.

Figure 21: Theme 2 – Contribution to Economic Growth Assessment Criteria Summary Descriptions



Source: Mott MacDonald

6.5.1 Assessment methodology

The assessment for the criteria under this theme has been based on the previous assessment of high level options taken from the Strategic Economic Appraisal Report (2016)[11]. This was deemed appropriate as the assessment of an off-road and on-road options contained within this report was of a high-level nature and therefore could still be applied to the current options list.

[11] Greater Cambridge city deal - Strategic Economic Appraisal Report – 2016 Mott Macdonald

6.5.2 Assessment results

Table 11: Theme 2 - INSET Result Ranks

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Labour market and activity	7	7	6	6	7	7
Supporting house construction	7	7	6	6	7	7
Business investment and growth	7	7	6	6	7	7
Cambridge positive image	7	7	6	6	7	7
Future potential growth post 2031	7	7	6	6	7	7
Capacity	7	7	5	5	7	7
Average	**7.0**	**7.0**	**5.8**	**5.8**	**7.0**	**7.0**
Theme 2 Result Rank	**1st**	**1st**	**5th**	**5th**	**1st**	**1st**

Source: Mott Macdonald

Labour market and activity

Options 1a, Option 1b, Option 3a and Option 3b would have a high impact on labour market and activity as a fully segregated option would mean journeys to work will be most efficient. Fully segregated options will provide the quickest access from major housing growth areas (Bourn Airfield and Cambourne) into Cambridge City Centre, surrounding fringe sites and ongoing journeys, linking housing and cluster sites.

These options promote the greatest efficiencies in journeys to work through reductions in existing travel times and costs, whilst also permitting the largest gains in access to opportunities for residents and labour markets for businesses.

These options create the highest level of demand and decongestion enable the greatest gains in quality of life and accessibility, promoting Greater Cambridge as a hub to live and work.

Options 2a and 2b are judged to have a low impact on labour market and activity, as journeys to work will be less efficient than under fully segregated options with lower reductions in travel times and costs.

Whilst the options still connect several cluster sites, the increased travel times and costs relative to fully segregated options, and lack of dedicated infrastructure will not 'unlock' investment to the same extent.

The lowest efficiencies in travel times and costs, producing lower gains than fully segregated options in connectivity between clusters and labour markets.

Scheme demand and decongestion would also be significantly lower than full segregated options, so whilst there are benefits from some mode shift to more sustainable modes, these are correspondingly lower.

Buisness and investment growth

Options 1a, Option 1b, Option 3a and Option 3b are judged to have a high impact on business investment and growth in Cambridge. It is anticipated that scheme demand, congestion savings and connectivity impacts will be the highest for these options. In particular, these options will improve connectivity to the City Centre, and will provide the support to the developments in and around the university. By attracting highest scheme demand, and helping to reduce congestion for other travellers, these fully segregated options therefore do the most to improve connectivity between growth clusters and labour markets.

Options 2a and 2b are anticipated to have the lowest level of scheme demand, congestion savings and connectivity impacts of the options, diminishing the potential connectivity gains relative to fully segregated options. Therefore, they will have a low impact on business investment and growth.

Cambridge Positive Image

Options 1a, Option 1b, Option 3a and Option 3b are judged to have a high impact on Cambridge's image as they provide a high-quality route that are fully segregated with new fixed infrastructure, resulting in the most positive image of the transport network. High quality transport investment which promotes positive image of the area has a greater ability to attract companies / individuals who might go outside of the UK otherwise. Fixed, segregated, infrastructure also gives residents and businesses the confidence to make long-term decisions and remain in Cambridge.

Options 2a and 2b are judged to have a low impact as they are unlikely to promote a positive image of a modern and vibrant city investing for the future. They are judged to be unlikely to promote a positive image of the area and therefore less likely to attract companies and individuals who could go outside of the UK. These options do not represent a 'step change' in provision as there is a lack of tangible dedicated infrastructure, giving businesses and residents less confidence than they can base future decisions around the scheme.

Future Potential Growth Post 2031

Options 1a, Option 1b, Option 3a and Option 3b are judged to have a high impact on future growth as fully segregated options will provide the biggest increase in future capacity for further housing and development planned in settlements and fringe sites. Their segregated nature means they could more easily be upgraded to a mass transit system in the future which will help future proof the corridor for any further unplanned development. Directly supporting needs of key stakeholders who have long term growth plans via investment that can be more readily upgraded to provide additional capacity. Fully segregated options provide the readiest means of adding further capacity for further post-2031 growth, supporting more sustainable travel patterns and growth.

Options 2a and 2b are judged to have a low impact on future growth as existing highway measures which will not provide new infrastructure that could be readily upgraded to provide further capacity. Provides least scope to upgrade in the future, with little scope for expanding capacity. Most difficult to upgrade for future growth, with limited scope for adding significant further capacity through on-highway service

Capacity

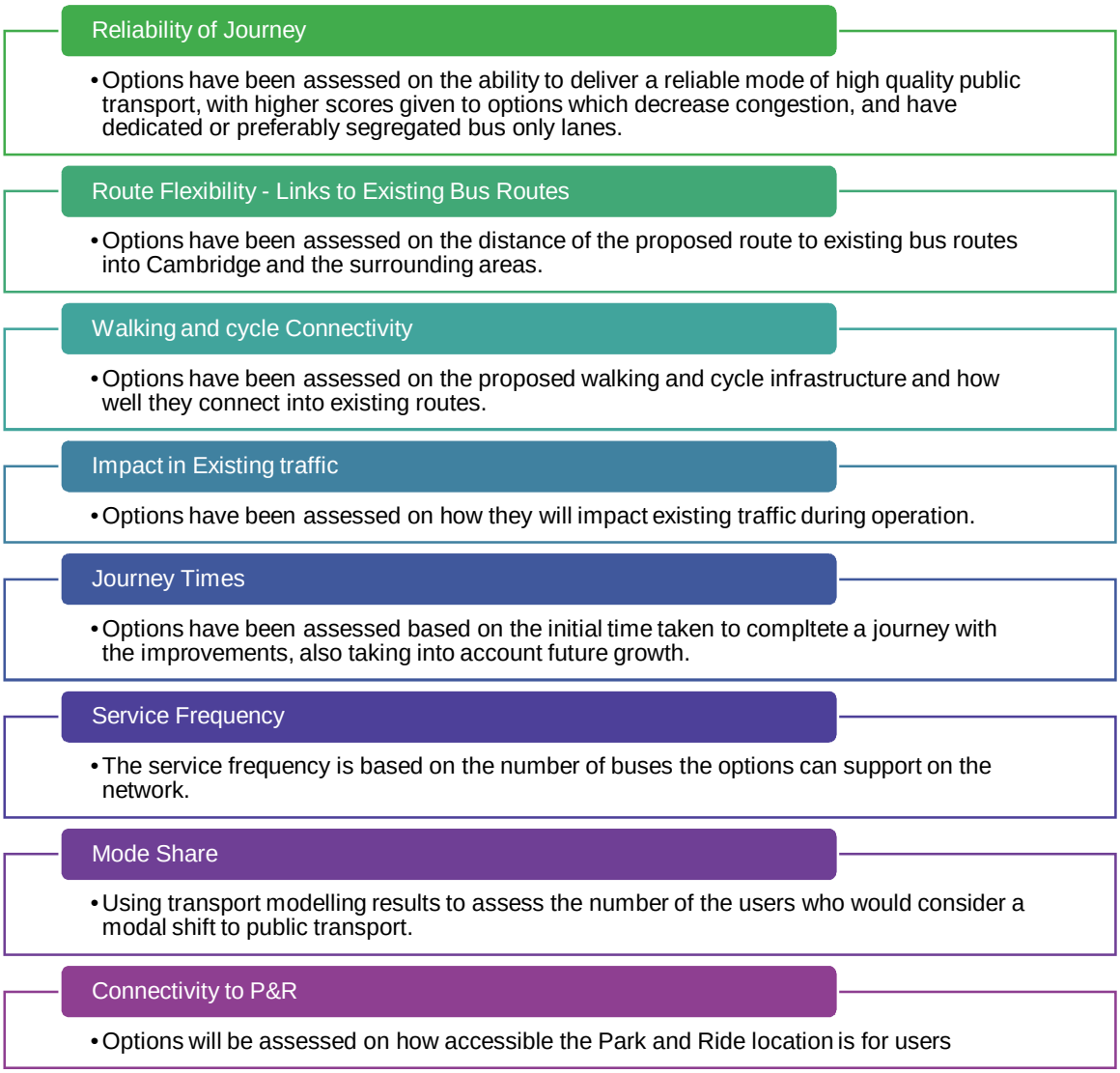
Options 1a, Option 1b, Option 3a and Option 3b are judged to have a significant impact on capacity. Fully segregated route will increase capacity by directly creating new infrastructure for a HQPT service, enabling new services to operate alongside existing or other future local services operating on the existing highway.

Options 2a and 2b will result in a light increase capacity, with new services operating as part of the C2C project running on the existing highway and sharing the highway with current local services and traffic. However, there would still be an increase in capacity directly serving new housing sites at Bourne Airfield and Cambourne West.

6.6 Theme 3 - Contribution to Improved Transport Network

The following criteria has been grouped to cover the contribution to improving the transport network, a more detailed description of each criteria, the majority of which are public transport focused, is shown in **Error! Reference source not found.**.

Figure 22: Theme 3 – Contribution to Improved Transport Network Assessment Criteria Description Summaries



Source: Mott MacDonald

6.6.1 Assessment methodology

The assessment of the options against the Theme 3 assessment criteria was based on the option designs and location of nearby users.

6.6.2 Assessment results

Table 12: Theme 3 - INSET Result Ranks

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Reliability of journey	7	6	4	4	5	5
Route flexibility - Links into existing public transport routes	5	5	5	5	5	5
Walking and cycle connectivity	7	7	6	6	6	6
Impact on existing traffic	2	2	4	4	3	3
Journey times	7	6	6	5	6	5
Service frequency	6	6	6	6	6	6
Mode share	4	4	4	4	4	4
Connectivity to Park and Ride	6	7	6	7	6	7
Average	**5.5**	**5.4**	**5.1**	**5.1**	**5.1**	**5.1**
Theme 3 Result Rank	**1st**	**2nd**	**3rd**	**3rd**	**3rd**	**3rd**

Source: Mott Macdonald

Reliability of Journey

The assessment of reliability of journey considered what improvements would be made to each option using the drawings produced by Skanska shown in Annex A.

For **Option 1a and Option 1b** the route would be fully segregated with junction priority. However, **Option 1b** would have to be on-road for a small section to access the Scotland Farm Park and Ride site.

There will be no impact for **Option 2a and Option 2b** as they will be using the existing roads and modelling has showed that they would be using existing roads from Bourn airfield to Madingley Mulch Roundabout.

For **Option 3a and Option 3b** there will be dedicated public transport lanes and junction priority however there could still be potential interactions with traffic which could impact reliability.

Route Flexibility - Links into existing bus routes

All options have similar links to the existing network with stops along St Neots Road.

Walking and Cycle connectivity

Option 1a and Option 1b will have new cycle footway running parallel to the segregated route.

Option 2a, Option 2b, Option 3a and Option 3b will have improvements to the existing footway to create a shared cycle pedestrian route.

Impact on existing Traffic

Option 1a and Option 1b will have a medium impact on existing traffic due to the buses having priority at a number of junctions and roundabouts which would mean road vehicles would be held at the junctions.

Option 2a and Option 2b will have no impact on existing traffic as the buses use the existing road infrastructure.

Option 3a and Option 3b will have a slight impact on the existing traffic as the route would also have junction priority but at a lesser extent than **Option 1a and Option 1b**.

Journey Times

The tables below show the public transport inbound journey times from Cambourne to the city centre (Parker Street) against an existing or “do minimum” option. This was done for years 2026 and 2036 in the AM and PM peaks.

Option 1a and Option 1b have substantial journey time savings in the AM time period, when buses are travelling in the peak direction. With the highest journey time benefits been achieved in 2036 traffic model.

Option 2a, Option 2b, Option 3a and Option 3b also have journey time savings in the AM time period, when buses are travelling in the peak direction but **Option 1a and Option 1b** perform the best.

There is a slight increase for the Scotland Farm Park and Ride options, compared to the Waterworks Park and Ride options as the buses have to route off the busway into the new Park and Ride site before re-joining the busway.

Table 13: 2026 inbound Journey Times (mins:secs)

Option	AM	Interpeak	PM
Do Minimum	49:57	26:28	33:26
Option 1a	29:12	25:48	28:56
Option 1b	31:13	27:42	31:05
Option 2a	30:17	26:18	29:37
Option 2b	35:16	29:48	33:53
Option 3a	30:46	26:48	30:04
Option 3b	34:38	30:24	35:32

Source: Mott MacDonald

Table 1: 2036 inbound Journey Times (mins:secs)

Option	AM	Interpeak	PM
Do Minimum	52:57	27:44	38:06
Option 1a	29:33	26:24	29:46
Option 1b	31:41	28:30	32:27
Option 2a	30:49	27:00	30:32
Option 2b	34:55	30:42	34:41
Option 3a	31:10	27:36	30:59

Option	AM	Interpeak	PM
Option 3b	34:44	31:18	35:17

Source: Mott MacDonald

Service Frequency

It has been assumed all routes will have 9 express services an hour during peak travel times.

Mode Share

The modelling methodology at this stage assumes no significant difference in mode share for all options.

Connectivity to Park and Ride

The assessment of the options was based on the consultation results and reviews of the locations of the proposed Park and Ride. It was concluded that both Park and Rides are easily accessible by car, although there were concerns with some stakeholders that the AM and PM congestion would mean accessing the Park and Ride at Waterworks would be more difficult. However, based on its location near Cambourne, Hardwick and the proposed Bourn Airfield development allowing people to cycle to the Park and Ride Scotland Farm was deemed to be preferable.

6.7 Theme 4 - Contribution to Quality of Life

The following criteria have been grouped together to cover contribution to improved transport network, a more detailed description of each criteria is shown in **Figure 24**.

Figure 7: Theme 4 – Contribution to Quality of Life Assessment Criteria Summary Descriptions

Source: Mott MacDonald

6.7.1 Assessment methodology

6.7.1.1 Environmental Impact criteria

For the Environmental Impact criteria, the options assessment followed the principals for environmental appraisal as described in the Department for Transport's WebTAG Unit A3 Environmental Impact Appraisal guidance. The appraisal has largely been based on:

- Assessments carried out to date and reported on the GCP website;
- Updated desk studies;
- Site walk overs/drive overs between December 2017 and September 2019
- Winter ecological surveys over the 2017/2018 season, and;
- Preliminary results from geophysical surveys for archaeology west of the M11.

6.7.1.2 Accessibility criteria

The scoring for the Accessibility criteria has been based on public consultation results for the Park and Ride options.

6.7.2 Assessment results

Table 15: Theme 4 - INSET Result Ranks

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Environment impacts - Landscape Impact	2	2	2	3	2	2
Environment impacts - Noise	3	3	3	3	3	3
Environment impacts - Air Quality	4	4	4	4	4	4
Environmental impacts - CO2 emissions	3	3	3	3	3	3
Environmental impacts – Biodiversity	2	2	2	2	2	3
Environmental impacts – Heritage	2	2	2	2	2	2
Environmental impacts – Green Belt	4	4	4	4	4	4
Safety	4	4	4	4	3	3
Accessibility	7	7	7	7	7	7
Average	**3.4**	**3.4**	**3.4**	**3.7**	**3.3**	**3.3**
Theme 4 Result Rank	**2nd**	**2nd**	**2nd**	**1st**	**6th**	**2nd**

Source: Mott Macdonald

Environment Impacts - Landscape Impact

Landscape impacts were assessed against impacts on landscape pattern, landscape tranquillity, cultural receptors and landcover features.

The two Park and ride sites both have landscape impacts with the Waterworks Travel Hub being clearly visible from the open landscape to the south of the waterworks site and the Scotland Farm Travel Hub would be visible in oblique views from dwellings on Scotland Road. Mitigation planting would be incorporated into the scheme proposals to reinstate existing screening vegetation and to integrate the public transport route and car park into the landscape. Tranquillity would be reduced with the addition of public transport vehicles on the route and noise, activity and additional lighting in either of the car parks.

Option 1 and Option 3 would result in a loss of farmland, trees and screening vegetation as a result of the construction of the Proposed Scheme. The impacts of the new public transport route will be most noticeable where it passes along the A428 and St Neots Road, due to the loss of existing vegetation, which will open up views of the A428. The public transport route would be clearly visible from much of the St Neots Road, but it would be separated from the road by a landscape strip and the road itself would not be widened.

Option 2 would only have impact from the Park and Ride site as the scheme uses existing roads.

Taking this into account **Option 1a, Option 1b, Option 2a, Option 3a and Option 3b** are all moderate adverse with **Option 2b** being minor adverse due to Scotland Farm Park and Ride having less of a landscape impact compared to Waterworks.

Environment Impacts - Noise

The assessment of noise has considered the proximity of receptors (residential properties, commercial properties and educational facilities) in the appraisal.

The two Park and Ride sites both have residential properties near to the sites which will represent new noise receptors. With proper design to minimise noise effects the traffic noise impacts are considered negligible from either site although there will be occasional disturbances such as slamming doors, horns and car alarms which cannot be mitigated. There is no preference between sites on noise considerations.

All options are unlikely to result in significant changes in traffic (and therefore noise) on the existing road network. Where the route is adjacent to an existing road such as A428, noise from the latter is likely to predominate and significant impacts are unlikely to result.

Where the route is adjacent to, or on more lightly-trafficked roads, such as those on its route within Upper Camborne and Great Camborne, noise from public transport is likely to be audible at nearest properties.

Taking this into account all options are deemed to be minor adverse in terms of noise impact.

Environment Impacts - Air Quality

A semi-quantitative air quality assessment of the six options has been undertaken. The assessment has been undertaken considering the following key aspects:

- Existing baseline conditions – risk of exceedances of air quality objectives and EU limit values;
- Number of properties affected;
- Potential changes in traffic data, and;
- Potential effects on the Cambridge City Air Quality Management Area (AQMA).

The choice of Scotland Farm Park and Ride slightly increases the number of receptors affected compared to the Waterworks Park and Ride for each of the route options and these receptors would likely receive a small deterioration in air quality as a result of the increased traffic accessed the site which is within 200m of the receptors along Scotland Road. Nevertheless, the changes at these properties would be small, would not result in significant effects and would not have a material benefit on the net present value.

All scheme options follow the same route west of Wellington Way, this is the section of the scheme that is in closest proximity to the highest number of receptors in Cambourne. Traffic changes for each of the scheme options are likely to be similar, and therefore changes in air quality at these receptors would consistent. The changes in traffic would likely lead to a small

deterioration in air quality in this area as there would the additional emissions from the transport vehicles. However, considering the number of public transport vehicles using the route and the distances to the receptors any air quality deteriorations may be off-set by an overall reduction in traffic due to a model shift. Any of these changes would be de minimis and not create a significant change in air quality.

Taking this into account all options are deemed to have a neutral or negligible effect on Air Quality.

Environment Impacts - CO_2 Emissions

Within WebTAG, at OBC stage, CO2 emissions are assessed as an input to the Net Present Value (NPV) of a scheme.

To inform this OAR report a qualitative appraisal of each option considered the potential change in CO_2 emissions for the operational phase only.

Operational carbon is assumed to be a minor benefit as the move to improved public transport is intended to reduce traffic generally. There is potential for car traffic to increase to offset any modal shift to public transport, but if congestion did not improve in the city this would deter car users and so overall it is anticipated there should be a moderate decrease in car travel into the city, with a reduction in CO_2 emissions. Due to this uncertainty the effect is deemed neutral for each scheme until detailed modelling is carried out for the Environmental Assessment Report.

Taking this into account all options are deemed to be minor adverse in terms of CO_2 emissions.

Environment Impacts - Biodiversity

Waterworks Park and Ride site would cause the loss of tall ruderal, grassland, plantation which has high invertebrate interest, trees with high bat potential and reptile likely present. Scotland Farm site for the Park and Ride site is on an arable site, which has not been accessed to survey. The proposed works, without appropriate mitigation, have the potential to adversely affect bats, reptiles, badgers, great crested newts, invertebrates and nesting birds through the loss, fragmentation and isolation of habitats.

There would be an overall moderate adverse effect on biodiversity as a result of **Option 1** and **Option 3**. No effects are anticipated for statutory or non-statutory sites. **Option 2** is largely on-road, but would result in habitat loss of areas of grassland, arable and hedgerow.

Environment Impacts - Heritage

The heritage appraisal considered the following features along each option:

- Built Heritage covering
  - Listed buildings (Grade I, Grade II and Grade II*)
  - Registered Park and Gardens (Grade I and Grade II)
  - Conservation Area
- Buried Archaeological Remains

Information on HER assets were obtained from CCC. Policy information for the appraisal were the SCDC Development Control Policies (2007), City of Cambridge local plan (2006) and the emerging SCDC and City of Cambridge local plans. A geophysical survey was carried out on accessible land that was suitable for such surveys and preliminary results have been used in this appraisal. The scope of the surveys was agreed with the County Archaeologist.

Archaeology

The options for developing the Waterworks Park and Ride site have a potential effect on buried archaeology (identified as to be in the area from aerial photographs and geophysical surveys). It is noted that the options with a Park and Ride at Scotland Farm still have the route traversing the Waterworks Park and Ride site, so there is potential for impacts on buried archaeology at this site from the Scotland Farm Park and Ride options.

The Scotland Farm Park and Ride is located close to a number of buried archaeological sites. So there is potential for archaeological remains to be found on the site.

Outside of the P&R sites, the options largely cover areas already disturbed by existing development. However, there are some fields which are not yet disturbed, and these are considered to have moderate to high potential for low to moderate importance assets to be encountered (ranging from Iron Age/Roman to World War II (linked to Bourne Airfield).

In summary a moderate adverse impact is predicted to unknown archaeological remains within the proposed option area through the construction of the option. Where remains are present they will be removed by necessary excavations. Although the form, nature and extent of potential remains is unknown there is regionally significant archaeology within the vicinity of the proposed option and the area is considered to have a moderate to high archaeological potential in areas outside of the existing road corridor and the A428 construction corridor. This assessment is subject to change following a more detailed assessment and investigation of archaeological potential and finalisation of construction methodology.

Environment Impacts - Green Belt

The Green Belt has strong protection at both National and Local Level. When considering the acceptability of the principle of a public transport route development within the Green Belt, the key policy criteria states that development is not inappropriate if it preserves the openness of the Green Belt and does not conflict with the purposes of including land in the Green Belt. Local transport infrastructure is a specific type of development which is deemed suitable if it can demonstrate a requirement for a Green Belt location.

The Park and Ride site at the Waterworks is in the Green Belt.

Approximately 1.2km of the first part of the route is in the Green Belt and comes out of the Green Belt after the Scotland Farm roundabout. As the route is in an existing highway corridor the impact is not considered to be significant.

Further studies have been commissioned by GCP to understand the impact on the Green Belt. However, at this time all options are deemed to have a neutral or negligible effect on the Green Belt.

Safety

Option 1a, Option 1b, Option 2a and Option 2b have standard highway layouts which is not expected to cause any safety issues. However, **Option 3a and Option 3b** have proposed public transport lanes which means at junctions of Hardwick, traffic will have to cross public transport lane and one lane of highway to turn right. This is assumed to have a greater risk.

The option taken to OBC will be subject to a full safety assessment and appropriate mitigation measures will be taken to address safety issues during design development.

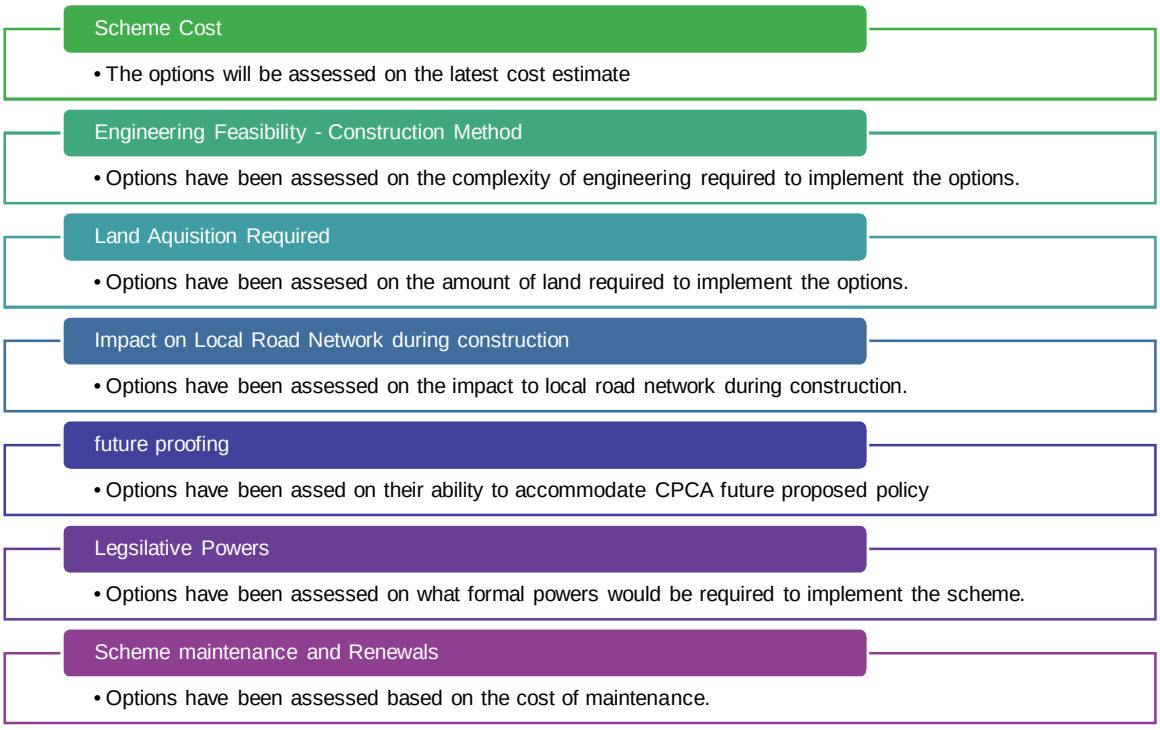
Accessibility

All options create a new Park and Ride site which will provide an interchange enabling motorists, cyclists and pedestrians to access the public transport network and destinations around Cambridge.

6.8 Theme 5 - Scheme Deliverability

The following criteria has been grouped to cover scheme deliverability, a more detailed description of each criteria is shown in Figure 24.

Figure 24: Theme 5 – Scheme Deliverability Assessment Criteria Summary Descriptions



Source: Mott MacDonald

6.8.1 Assessment methodology

The options have been assessed based on the drawings shown in Annex A.

For the purposes of the option cost, and the scheme maintenance and renewals criteria a high-level cost estimate and whole life cost summary was undertaken that provided the scoring for these respectively. Life cycle costing is a modelling method which considers both the up-front costs of installation or renewing highway assets and the various through-life costs such as maintenance, compensation for delays and so on. Process involves identifying activities during the life cycle (60 years), when the activity occurs and associated cost for the activity.

The future proofing criteria was based on an understanding of other regional transport proposals such as CAM and how based on these the designs tie in.

The review of the Legislative Powers is based on our experience bringing transport schemes through the required application routes.

6.8.2 Assessment results

Table 16: Theme 5 - INSET Result Ranks

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Scheme Cost	2	2	3	3	2	2
Engineering feasibility - construction method	4	4	4	4	4	4
Land acquisition required	2	2	3	3	2	2
Impact on local road network during construction	2	2	3	3	1	1
Future-proofing	7	7	5	5	6	6
Legislative Powers	2	2	4	4	4	4
Scheme Maintenance and Renewals	2	2	2	2	1	1
Average	**3.0**	**3.0**	**3.4**	**3.4**	**2.9**	**2.9**
Theme 5 Result Rank	**3rd**	**3rd**	**1st**	**1st**	**5th**	**5th**

Source: Mott Macdonald

Scheme Cost

The cost was based on the high-level cost analysis undertaken by the Mott MacDonald estimating team. The results showed that the lowest cost was for **Option 2a and Option 2b**, with **Option 3a and Option 3b** being the next highest cost, and the most expensive is **Option1a and Option 1b.**

It should also be noted that the having the Park and Ride located at Waterworks rather than Scotland Farm has an overall slightly lower capital cost.

Engineering Feasibility - Construction Method

Normal methods of construction will be used for all options.

Land Aquisition Required

All options will require land for the Park and Ride locations. However due to the off-road running and public transport priority lanes of **Option 1a, Option 1b, Option 3a and Option 3b** will require greater areas of land. **Option 2a and Option 2b** will require minimal land as the option uses existing highway land.

Impact in Local Road Network during Construction

Option 1a and Option 1b will have a medium impact on the local road network as there will be some improvements to junctions along the route.

Option 2a and Option 2b will have slight impact as there will be some pavement improvements for cyclist and pedestrians and some junction improvements.

Option 3a and Option 3b will have significant impact on the local network to add two public transport priority lanes eastbound and westbound.

Future Proofing

During the drafting of OAR Part 3, the emerging CPCA policy for transport within Cambridge began to emerge. This included the Mayoral vision for the Cambridgeshire Autonomous Metro (CAM). However, C2C is to be promoted in advance of CAM, and there is no guarantee that CAM will proceed to construction.

Future proofing is therefore assessed based on the routes ability to provide a sustainable and long-lasting improvement to journey times and reliability, and their ability to be adapted to any future projects.

Option 2a and 2b will have no impact on future proofing as they focus on on-road improvements.

With **Option 1a, Option 1b, Option 3a and Option 3b** options being either fully off-road or public transport priority lanes, this allows for them to support future schemes and can be easily adapted. Although **Option 1a and 1b** would require less alterations.

It was also noted that the Waterworks Park and Ride location better aligns with potential future projects as it will provide easier access for vehicles without needing to use the existing highway network or construct new structures in order to access the Scotland Farm P&R site.

Legislative Powers

All options will require some form of legislative power for implementation, **Option 2a, Option 2b, Option 3a and Option 3b** require a planning application, whereas **Options 1a and Option 1b** could be delivered by means of a Transport and Works Act Order.

Scheme Maintenance and Renewals

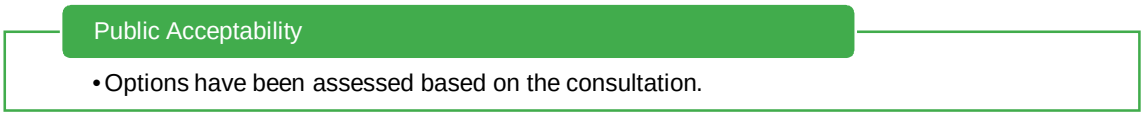
A whole life cost analysis was undertaken by Mott MacDonald, with **Option 1a and Option 1b** having the lowest annual cost. **Option 2a and Option 2b** had a slightly higher cost than

Option1a and Option 1b. However, the highest cost was **Option 3a and Option 3b** which was significantly more than Option 1a, Option 1b, Option 2a and Option 2b.

6.9 Theme 6 - Stakeholder Support

The following criteria covers stakeholder support from the public consultation and other stakeholder activities. A more detailed description of these can be found in Appendix F to the main OBC.

Figure 25: Theme 6 – Stakeholder Support Assessment Criteria Summary Description



6.9.1 Assessment methodology

The options scores were based on the results from the consultation held between February 2019 and March 2019.

6.9.2 Assessment results

Table 17: Theme 6 - INSET Result Ranks

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Public Acceptability	6	7	5	6	4	5
Theme 6 Result Rank	2nd	1st	4th	2nd	6th	4th

Source: Mott Macdonald

The result of the consultation questionnaire showed 48% of the respondents preferred **Option 1,** 39% preferred **Option 2** and 20% preferred **Option 3.** As well as the route options the Park and Ride site location was consulted on and the results showed that 63% of the respondents preferred Scotland Farm with only 17% preferring Waterworks. These results were combined to get the scores.

6.10 Results

All the results from each theme were combined with the results been shown in Table 28.

Table 28: Phase 2 INSET Results

Option	INSET Scoring Summary Ranks	INSET Score
Option 1a	Ranked 2nd	5.00
Option 1b	Ranked 1st	5.03
Option 2a	Ranked 6th	4.43
Option 2b	Ranked 5th	4.51
Option 3a	Ranked 4th	4.84
Option 3b	Ranked 3rd	4.86

Source: Mott Macdonald

7 Traffic Modelling and Economic Assessment Approach and Results

Following on from the INSET option assessment, traffic modelling and the economic appraisal of the options has been undertaken to produce initial BCRs for each option to provide a comparison of the value for money (VfM). Each of the options assessed includes the preferred Phase 1 route alignment.

The previous traffic modelling and economic assessment of Phase 1 used the CSRM C Series highway model for the single forecast year of 2031.

CSRM D Series has been used as the basis of the assessment of the different Phase 2 options. This has been enhanced with additional local refinements to its highway model and the creation of a new public transport model to provide a more accurate assessment of the public transport impacts of the options being considered. Two forecast years are available from CSRM D Series, namely 2026 and 2036.

7.1 Base year modelling

7.1.1 2015 Base year highway model

The base year CSRM2 SATURN highway model structure was initially reviewed along the A428/A1303 corridor, A10/A1309 and A1307 corridors. Additional local road links and new development zones were added to the network to ensure that the forecast schemes could be assessed accurately. In particular for this scheme, additional local roads were included in Cambourne close to the of the proposed off-road public transport link.

The modelled flows at various points along the A428/A1303 corridor were compared to the observed data available to ensure the model was accurately reflecting current base year (2015) flows. In addition to the observed data used as part of the CSRM2 calibration and validation, additional A428 November 2015 data taken from WebTRIS was used together with observed vehicles entering and exiting Madingley Park and Ride site.

In the AM peak, the modelled flow on the M11 J13 southbound on-slip was lower than observed and there was some inconsistency between A428 data available from WebTRIS, but at all the locations modelled flows met the WebTAG validation criteria.

In the interpeak, the A428 westbound modelled flow just west of the A1303 junction was higher than the observed data from the CSRM2 validation but did match an equivalent WebTRIS site. At all other locations modelled flows met the WebTAG validation criteria.

In the PM peak, there is insufficient modelled flow westbound on the A1303 and A428 west of the M11 but the right levels of modelled flow east of the M11. All eastbound modelled flows and all locations east of the M11 meet the WebTAG validation criteria.

Detailed tables showing the comparison of observed and modelled base year flows are contained within Annex D.

The modelled journey times along the A1303 were also compared to observed travel times. The CSRM2 journey time route along the A1303 and then out along the A10 was subdivided to concentrate on the A1303 section between the A428 and Grange Road in more detail.

In the AM peak the observed eastbound travel times between the A428 and M11 of over 20 minutes could not be replicated by the model. Similarly, the observed travel time of 7 minutes in the westbound direction west of the M11 in the PM peak could not be replicated by the model. Contra-peak direction and interpeak travel times were all replicated well by the model.

Investigation into these large observed peak direction travel times revealed that roadworks had been in place along the A1303 during the time that the observed travel times were recorded. Comparisons of observed flow and travel time data between the model base year of 2015 and the subsequent year, 2016 when the roadworks was no longer in place were undertaken. These showed that peak direction flows were reduced with the roadworks and journey times were significantly slower.

Detailed tables showing the comparison of observed and modelled base year and 2016 journey times are contained within Annex D.

The comparison of modelled PM peak outbound journey times against the 2016 observed data shows that the model travel times compare well with the observed data. The AM peak inbound modelled travel times are still quicker than the 2016 observed data but this is to be expected as the 2015 traffic flow levels are lower than those observed in 2016.

7.1.2 2015 Base year public transport model

Public transport supply data was sourced from CSRM2 and converted from MEPLAN to build a standalone model in CUBE. During this conversion process, the hierarchical network of connections between modes as coded in MEPLAN was simplified such that transfers within a transit node did not require additional walk connections. The physical transit network was developed based on links describing the stopping sequences of transit lines. Thus, intermediate nodes such as junctions are not represented.

Journey times for transit services are based on the congested times modelled in the CSRM2 highway module, which are added to the timetabled running times in the MEPLAN model. Where transit lines were coded with varying headways along the route in MEPLAN, this was converted into additional variant transit lines such that link vehicle frequencies matched those in CSRM2.

The zoning system was retained as per CSRM2 and additional connectors added where zones were not directly connected to constituent transit nodes served by transit lines. Direct zone connectors were added where excessively long public transport routings were being made between adjacent zones.

Rail demand matrices were sourced directly from CSRM2. New bus matrices were developed using a combination of onboard bus origin-destination surveys and ticket sales data from November 2015. Ticket sales data controlled the magnitude of the demand matrices with the OD survey data providing trip end distributions. Separate matrices were developed for conventional bus, Guided Bus and Park and Ride bus based on observed usage of each sub mode in the survey data.

For Park and Ride demand, the highway element of these trips is not modelled explicitly in the public transport model. Trips in the rail and bus Park and Ride matrices were aggregated to the zones representing either the bus Park and Ride site or the relevant rail station, using a gravity function to distribute zonal trip ends to up to three competing Park and Ride locations. This was based on the principle that AM Peak trips predominantly drive to the Park and Ride site and thus trip origins are aggregated to the site, and likewise trip destinations in the PM Peak. The

Interpeak was aggregated to provide an overall balance of trips to and from Park and Ride sites across the day.

The aggregation process resulted in demand at most bus Park and Ride sites being up to 85% of car parking capacity, with only Madingley Road and Newmarket Road having over 100%. However, these proportions do not take account of the proportion of Park and Ride bus service usage by non-drivers (e.g. car passengers, kiss & ride, walk/Public Transport access).

For rail, any excess in Park and Ride demand allocated to stations in excess of parking availability was not aggregated to the site but retained as full Origin/Destinations and assumed to access the station by public transport. Most station car parks are effectively filled in the morning peak, and so no aggregation of interpeak rail Park and Ride demand was undertaken.

The modelled flows across the Cambridge Radial Cordon were compared to the observed data available to ensure the model was accurately reflecting current base year (2015) flows. The observed data used as part of the CSRM2 calibration and validation was sued, with additional data cleaning to remove Monday and Friday data to be consistent with the data used to build the bus matrices, and improve matching of fare stage data to model sectors.

In all cases except Interpeak Inbound, all modelled bus flows across the cordon were higher than observed; however, all flows were within WebTag acceptance criteria except for AM Peak Outbound. Modelled guided bus flows alone were mostly lower than observed, though in most cases meeting WebTag criteria. In many cases hourly flows were lower than the minimum threshold of 150 passengers per hour required to satisfy WebTag criteria. Further analysis of average vehicle loadings across the cordon demonstrated no excessive loadings with average loadings in the main peak flow directions varying between 20 and 50 passengers per vehicle.

7.2 Forecast years modelling

Foundation Case CSRM demand model runs for the Do Minimum scenario and the six different scheme options were produced for the AM peak period (0700-1000), interpeak period (1000-1600) and PM peak period (1600-1900) for the forecast years of 2026 and 2036.

The Foundation Case represents a scenario which is consistent with the currently proposed Local Plans for the four LADs represented in CSRM2 (Cambridge City, South Cambridgeshire, Huntingdonshire and East Cambridgeshire). This includes local assumptions on housing, employment and other developments, along with transport schemes which are either committed or expected to be required to support development.

Development at Cambourne West and Bourn Airfield was assumed to be dependent on the scheme and has therefore been excluded from the core model runs used for the economic assessment.

The changes made to the base year highway networks were similarly applied to the forecast year highway networks. Separate networks were then created for the Do Minimum and the six Do Something options. In addition to the network changes, new public transport services were included in line with the bus strategy described in Section 2.6.

The change between the CSRM base year output highway and public transport matrices and those output for the two forecast years were applied to the enhanced highway model and the new public transport model to provide the final highway and public transport assignments with and without the scheme options.

For forecast year scenarios, separate park and ride matrices for each site were provided from CSRM2. These splits were used in forecasting and aggregating the bus and rail Park and Ride

demand, removing the need to estimate Park and Ride site choice as undertaken for the base year.

The CSRM demand model had more highway trips entering than leaving both the existing Madingley Park and Ride site and the proposed new Park and Ride sites over a 12 hour period. This was due to non-home based other trips being generated by direction and therefore able to choose a different mode of travel for each direction of their journey.

A process to adjust the model outputs to balance highway trips entering and leaving the Park and Ride sites over a 12 hour day was derived. This retained the CSRM AM peak period results and then applied the observed profiles of arrivals and departures across the day from the existing Madingley Park and Ride site to provide interpeak and pm peak period highway trips to and from the Park and Ride sites.

It was also noted that the CSRM outputs did not include any trips in the pre-peak hour highway matrices to or from the new Park and Ride sites proposed. These were additionally added in based on the peak hour trips to and from the new Park and Ride sites to ensure the operation of the junctions close to the sites proposed were modelled as accurately as possible.

7.3 Key modelling results

The following tables provide bus passenger numbers across all services along the A428/A1303 corridor at four locations with and without the scheme for each option assessed.

In the AM and PM peak periods in both forecast years there is an increase in bus passengers with the scheme at each location.

In the interpeak periods, there is an increase in bus passengers with the scheme west of Cambourne and then similar numbers with and without the scheme east of there.

Table 19: 2026 AM Peak average hourly bus passengers 2-way

Option	West of Cambourne	East of Bourn Airport	East of Scotland Farm	East of Madingley Mulch
Do Minimum	121	350	353	346
Option 1a	187	937	947	928
Option 1b	152	885	903	884
Option 2a	178	909	905	933
Option 2b	149	866	869	896
Option 3a	181	910	906	935
Option 3b	150	866	869	896

Source: Mott MacDonald

Table 20: 2026 Interpeak average hourly bus passengers 2-way

Option	West of Cambourne	East of Bourn Airport	East of Scotland Farm	East of Madingley Mulch
Do Minimum	143	232	233	241
Option 1a	212	257	250	251

Option	West of Cambourne	East of Bourn Airport	East of Scotland Farm	East of Madingley Mulch
Option 1b	197	216	228	228
Option 2a	203	246	232	237
Option 2b	198	213	218	223
Option 3a	210	255	240	245
Option 3b	198	212	218	222

Source: Mott MacDonald

Table 3: 2026 PM Peak average hourly bus passengers 2-way

Option	West of Cambourne	East of Bourn Airport	East of Scotland Farm	East of Madingley Mulch
Do Minimum	99	199	206	211
Option 1a	261	288	319	319
Option 1b	250	278	297	298
Option 2a	256	281	305	311
Option 2b	249	277	285	292
Option 3a	262	287	312	319
Option 3b	245	272	281	288

Source: Mott MacDonald

Table 224: 2036 AM Peak average hourly bus passengers 2-way

Option	West of Cambourne	East of Bourn Airport	East of Scotland Farm	East of Madingley Mulch
Do Minimum	141	373	376	370
Option 1a	186	925	934	916
Option 1b	152	863	881	863
Option 2a	183	900	896	923
Option 2b	152	850	852	878
Option 3a	183	899	894	921
Option 3b	152	857	860	886

Source: Mott MacDonald

Table 23: 2036 Interpeak average hourly bus passengers 2-way

Option	West of Cambourne	East of Bourn Airport	East of Scotland Farm	East of Madingley Mulch
Do Minimum	153	240	241	248
Option 1a	219	264	256	256
Option 1b	204	221	232	233
Option 2a	209	254	241	245
Option 2b	204	218	223	227
Option 3a	214	260	246	250
Option 3b	204	221	226	230

Source: Mott MacDonald

Table 24: 2036 PM peak average hourly bus passengers 2-way

Option	West of Cambourne	East of Bourn Airport	East of Scotland Farm	East of Madingley Mulch
Do Minimum	110	219	226	231

Option	West of Cambourne	East of Bourn Airport	East of Scotland Farm	East of Madingley Mulch
Option 1a	285	308	339	340
Option 1b	273	302	320	320
Option 2a	279	304	327	334
Option 2b	265	291	298	306
Option 3a	283	307	330	337
Option 3b	265	291	299	307

Source: Mott MacDonald

Section 6.6.2 provides a comparison of public transport journey times between Cambourne and the city centre along the A428/A1303 corridor with and without the scheme. This shows that in the peak direction, i.e. inbound to Cambridge city centre, there are substantial journey time savings with the scheme.

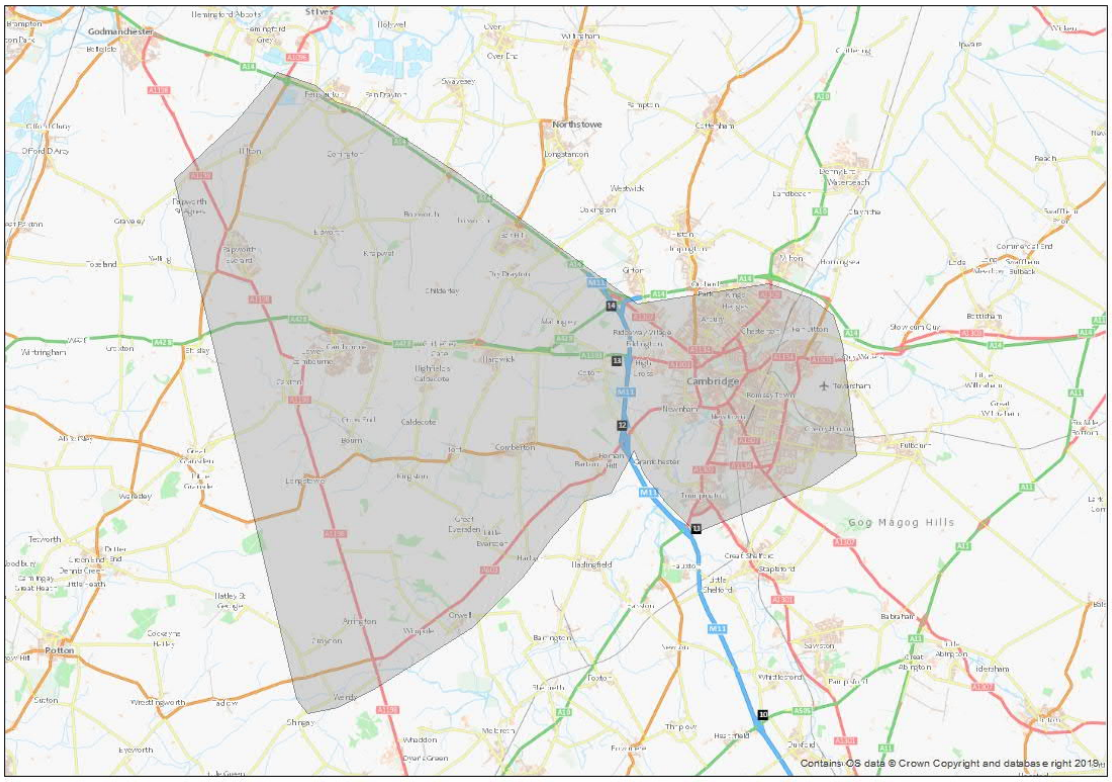
7.4 Economic appraisal methodology

It was originally proposed to use TUBA to undertake the economic assessment of user benefits of the scheme, with vehicle and passenger trip, time and distance matrices extracted from the highway and public transport models for use in the assessments. However, the initial TUBA assessments undertaken for each option using the highway model inputs only showed that model noise at locations well away from the scheme corridor was producing changes in benefits that outweighed the impacts due to the scheme. The A428 scheme has a relatively small impact on highway trips within the larger CSRM network.

To ensure consistent and comparable benefit results across the options, the marginal external cost (MEC) has been applied instead. This alternative method focuses on the estimation of decongestion benefits. WebTAG unit 5.4 suggests that this can be applied in the absence of a suitable multi-modal model. This external cost calculation includes congestion, air pollution, noise, infrastructure and accident costs. The benefits calculated are based on the reduction of vehicle kilometres on the network due to the scheme, while also considering different road types, areas types and congestion levels. Only congestion benefits have been used for the comparison between options.

In order to avoid the model noise affecting the results from the wider model area, the MEC process has been based only on the model area immediately affected by the scheme. Figure 26 below shows the area included from the SATURN model to compare Do Minimum and Do Something vehicle kilometres. This includes the A428 corridor as well as an alternative route to the north, the A14, and an alternative route to the south, the A603.

Figure 26: MEC assessment area



Source: Mott MacDonald

The following steps were carried out to calculate the benefits.

- *Calculating the vehicle kilometres for the scheme area for the Do Minimum and the Do Something*. The actual flow values by user class and time period were extracted from the model assignments and multiplied by the distance of each link.
- *Identifying the characteristics of each vehicle journey by identifying link capacities*. These were calculated based on suggested average capacities described in TAG unit 5.4 tables A5 and A6 multiplied by the number of lanes. The Cambridge area falls into area type 8 for urban medium. However, as this area type does not provide capacities for motorways the motorway capacities were taken from the rural roads section.
- *Calculating the marginal external costs.* TAG Databook May 2019 marginal external costs and indirect tax values from table A.5.4.2 are available for 2025 and 2030 as well as 2035. Thus, interpolated factors assuming linear growth were calculated for the forecast years. The databook factors are provided for cars, LGV's, artic and rigid HGV's and buses for all costs described above for AM, IP and PM peak. The SATURN model provides forecast traffic flows for cars, LGVs, HGVs and bus. The split between artic and rigid HGV's was based on a selection of DfT counts along the A428, A10 and A1307 to ensure consistent split factors across all current Cambridge schemes assessed by Mott MacDonald. The marginal cost application achieved daily values for an average 2026 and 2036 weekday. These were annualised based on WebTRIS local count data covering all Mott MacDonald project areas.
- *Converting to Present Value Benefits* Standard TAG databook discount factors were applied over a 60 year appraisal period with benefits assumed to remain consistent from the last forecast year onwards prior to discounting.

During the review of the method it was noticeable that some comparability issues between the options remained. Analysis showed that this was due to the high impact of the congestion band 5 costs on a differing number of links between options. Section 2.4.5 of TAG unit 5.4 warns about the impact of using congestion band 5 and thus links with type 5 values were changed to a link type 4 in each options including the Do Minimum. The following table list the number of link type 5's in each option converted to link type 4's.

Table 25: Adjusted links

Option	No of links adjusted to link type 4
Do Minimum	411
Option 1a	406
Option 1b	409
Option 2a	386
Option 2b	393
Option 3a	409
Option 3b	401

Source: Mott MacDonald

8 Option Costs

Table 26 below details the capital costs associated with each option divided into construction, design, testing and commissioning, and management costs.

Table 26: Scheme Capital Costs (£'000s, Q4 2018 prices)

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Construction	99,211	103,101	83,562	87,453	95,794	99,684
Design	15,874	16,496	13,370	13,992	15,327	15,949
Client costs (Management)	11,676	12,134	9,834	10,293	11,274	11,732
Environmental Mitigation	1,673	1,743	1,412	1,482	1,616	1,686
Land	11,038	11,114	6,842	6,962	10,034	10,155
Statutory Undertakers	1,100	1,100	1,100	1,100	1,100	1,100
TOTAL	**140,571**	**145,688**	**116,120**	**121,282**	**135,144**	**140,306**

Source: Mott MacDonald

In each case, a Park and Ride site at Waterworks (option a) is cheaper than a site at Scotland Farm (option b), with the fully offline option, Option 1, the most expensive.

Table 27 below summarises the operation and maintenance costs associated with each option. This includes annual maintenance and renewals of new infrastructure as well as public transport vehicle purchase and operating costs.

Table 27: Scheme Operational and Maintenance Costs (£000's over 60 year appraisal period)

	Price Basis	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Infrastructure maintenance	2018 prices	62,986	66,042	60,977	64,032	70,093	73,148
Bus purchase costs	2019 prices	16,493	17,361	16,493	18,229	16,493	17,361
Bus operating costs	2019 prices	193,216	205,292	193,216	217,368	193,216	205,292

Source: Mott MacDonald

For infrastructure maintenance, a Park and Ride site at Waterworks (option a) is cheaper than a site at Scotland Farm (option b), with the fully offline option, Option 1, the most expensive. More buses are required for Scotland Farm options resulting in higher bus costs

In line with WebTAG guidance, inflation has not been taken included in the costs. A 15% optimism bias has been applied in line with WebTAG guidance to the capital costs as the scheme is at outline business case stage No optimism bias has been applied to the operational and maintenance costs in line with guidance.

9 Option Assessment: Value for Money results

9.1 Present Value Benefits

The results from the marginal external costs method described in the chapter 7 for each option are shown in the table below, providing the core level of congestion only benefits for each option. The benefits have been split between journey purpose using the default average week split for cars in the May 2019 TAG databook.

Each of the options has a similar level of congestion benefit.

Table 28: Core Present Value Congestion Benefits (£000's, 2010 prices discounted to 2010)

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Consumer User Congestion Benefits	14,521	16,061	15,083	15,281	14,723	16,968
Employers Business Congestion Benefits	6,870	7,599	7,136	7,230	6,966	8,028
Other Congestion Benefits	35,580	39,354	36,956	37,441	36,075	41,575
TOTAL present Value Congestion Benefits	**56,972**	**63,014**	**59,175**	**59,951**	**57,764**	**66,572**

Source: Mott MacDonald

The benefits arising from the output change in imperfectly competitive markets has been calculated in line with TAG unit A2.1 as 10% of the employers' benefits in the table above. This has been added to the core BCRs to provide adjusted PVBs for each option.

9.2 Present Value Costs

The costs outlined in the previous chapter have been converted to present value costs, using default discount factors from the May 2019 TAG databook. The table below shows the resulting PVC's.

Table 29: Present Value Costs (£000's, 2010 prices discounted to 2010)

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Present Value Costs	186,648	195,141	168,629	180,848	184,899	193,484

Source: Mott MacDonald

9.3 Benefit Cost Ratios

Combining the Present Value Benefits and Present Value Costs above provides the Net Present Value and Benefit Cost ratios for each of the options and these are detailed in the tables below.

Table 30: Core Benefit Cost Ratios

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Present Value Benefits	56,972	63,014	59,175	59,951	57,764	66,572
Present Value Costs	186,648	195,141	168,629	180,848	184,899	193,484
Net Present Value	-129,676	-132,127	-109,454	-120,897	-127,135	-126,912
Initial BCR	**0.31**	**0.32**	**0.35**	**0.33**	**0.31**	**0.34**

Source: Mott MacDonald

Table 31: Adjusted Benefit Cost Ratios

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Present Value Benefits	57,659	63,774	59,889	60,674	58,461	67,375
Present Value Costs	186,648	195,141	168,629	180,848	184,899	193,484
Net Present Value	-128,989	-131,367	-108,740	-120,174	-126,438	-126,109
Adjusted BCR	**0.31**	**0.33**	**0.36**	**0.34**	**0.32**	**0.35**

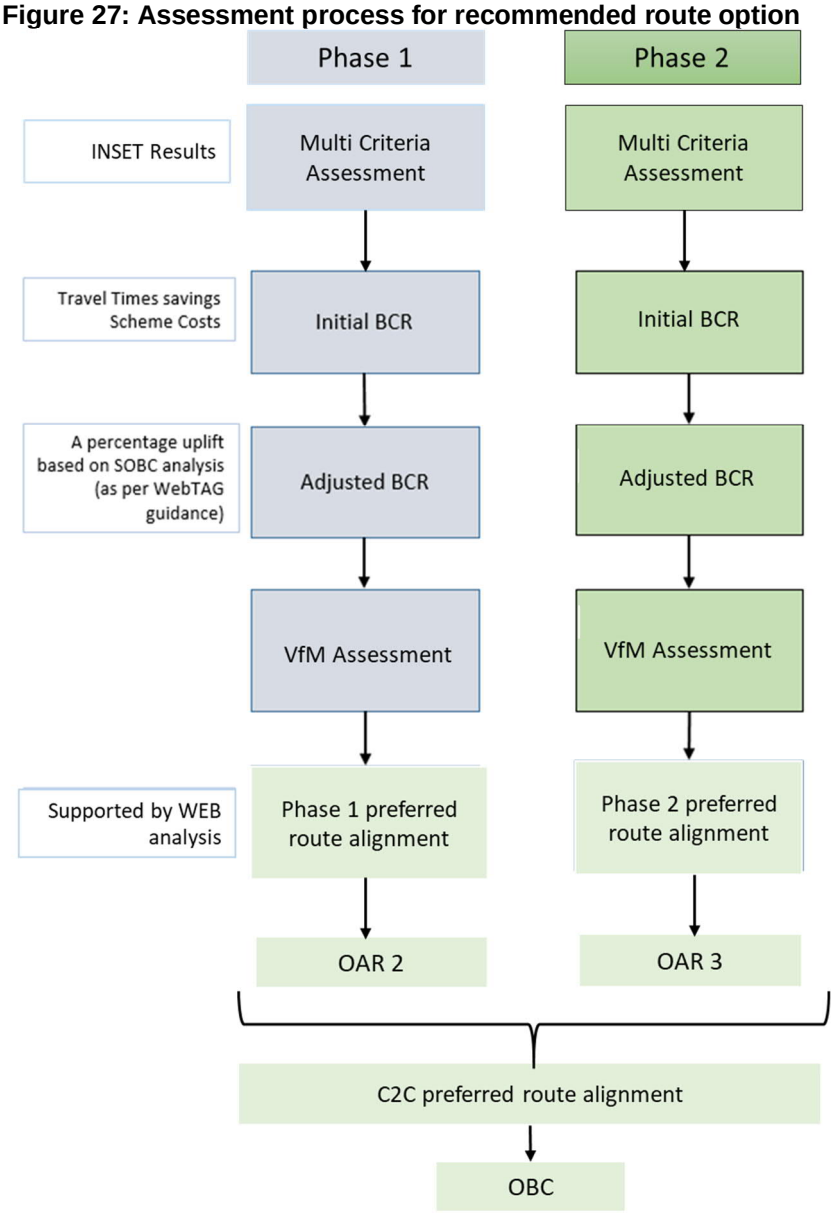
Source: Mott MacDonald

10 Recommended Preferred Option

10.1 Process to arrive at Preferred Option

The process to arrive at the emerging recommended option is shown in Figure 27.

Figure 27: Assessment process for recommended route option



Source: Mott MacDonald

10.2 INSET results

The assessment results from the multi criteria assessment showed that the best performing option against the full range of criteria aligned to the scheme objectives was Option 1b – Segregated off-road option with Park & Ride at Scotland Farm.

Table 32: INSET results

Option	INSET Scoring Summary Ranks	INSET Score
Option 1a	Ranked 2nd	5.00
Option 1b	Ranked 1st	5.03
Option 2a	Ranked 6th	4.43
Option 2b	Ranked 5th	4.51
Option 3a	Ranked 4th	4.84
Option 3b	Ranked 3rd	4.86

Source: Mott MacDonald

The result of the consultation questionnaire also showed that 48% of the respondents preferred Option 1, 39% preferred Option 2 and 20% preferred Option 3. As well as the route options the Park and Ride site location was consulted on and the results showed that 63% of the respondents preferred Scotland Farm with only 17% preferring Waterworks.

10.3 Initial BCR

The initial BCR values showed that the best performing option was Option 2a - On-road junction improvements with Waterworks Park and Ride. However, all options BCRs were close to each other and are not considered significantly different to suggest a clear preference.

Table 33: C2C BCRs – Phase 2 options[13]

	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Benefit Cost Ratio	0.31	0.32	0.35	0.33	0.31	0.34

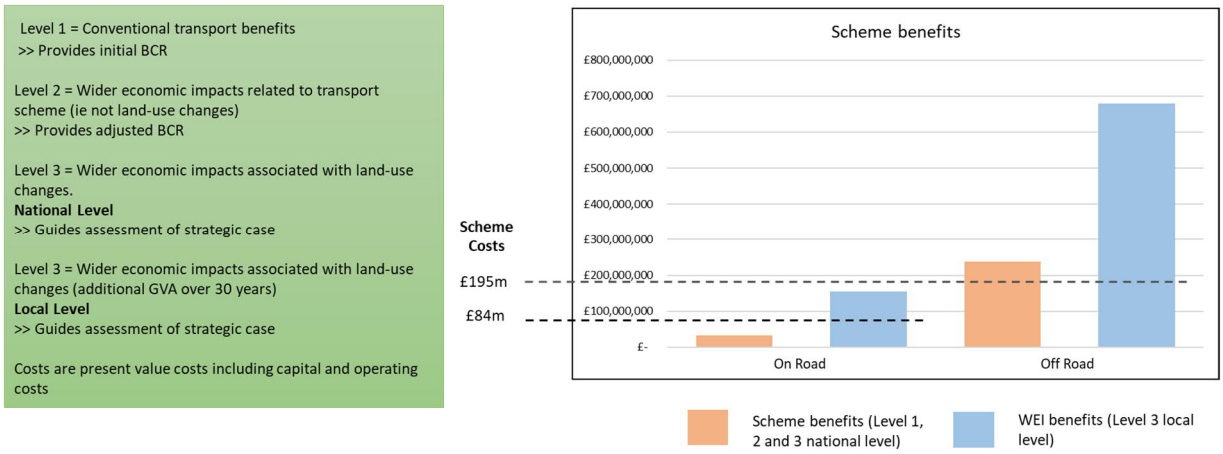
Source: Mott MacDonald

10.4 Wider Economic Impacts

In order to fully consider the value for money the options would potentially deliver and to inform the optioneering exercise, and to support the final decision of the best performing option, the incorporation of Wider Economic Impacts (WEI) assessment was done to compare an off-road to on-road option. The WEI appraisal confirms that there were substantial benefits to an off-road segregated route. Figure 28 illustrates how an off-road option compares to an on-road option in delivering WEI at both a national and local level.

[13] Note – each option for the value for money assessment included the recommended preferred option for Phase 1, which was an off-road route alignment.

Figure 28: C2C on-road vs off-road WEI comparison



Source: Mott MacDonald

10.5 Recommended preferred option

Taking into account the results of the multi criteria assessment, consultation feedback and comparison of an off-road versus on-road solution with regards to WEI, **Option 1b – Off-road segregated with Scotland Farm Park and Ride** is the best performing option and therefore is recommended to be taken forward as the preferred option.

10.6 Next steps

The next steps will be to present these findings to the GCP Executive Board, along with an Outline Business Case presenting further detail appraisal of the recommended preferred option. Following approval by the board, the recommended preferred option will go forward for further design development and full Environmental Impact Assessment in advance of applying for planning powers.

Figure 89: Recommended Option

Source: Mott MacDonald

Annex

A. Option Drawings

Rev B

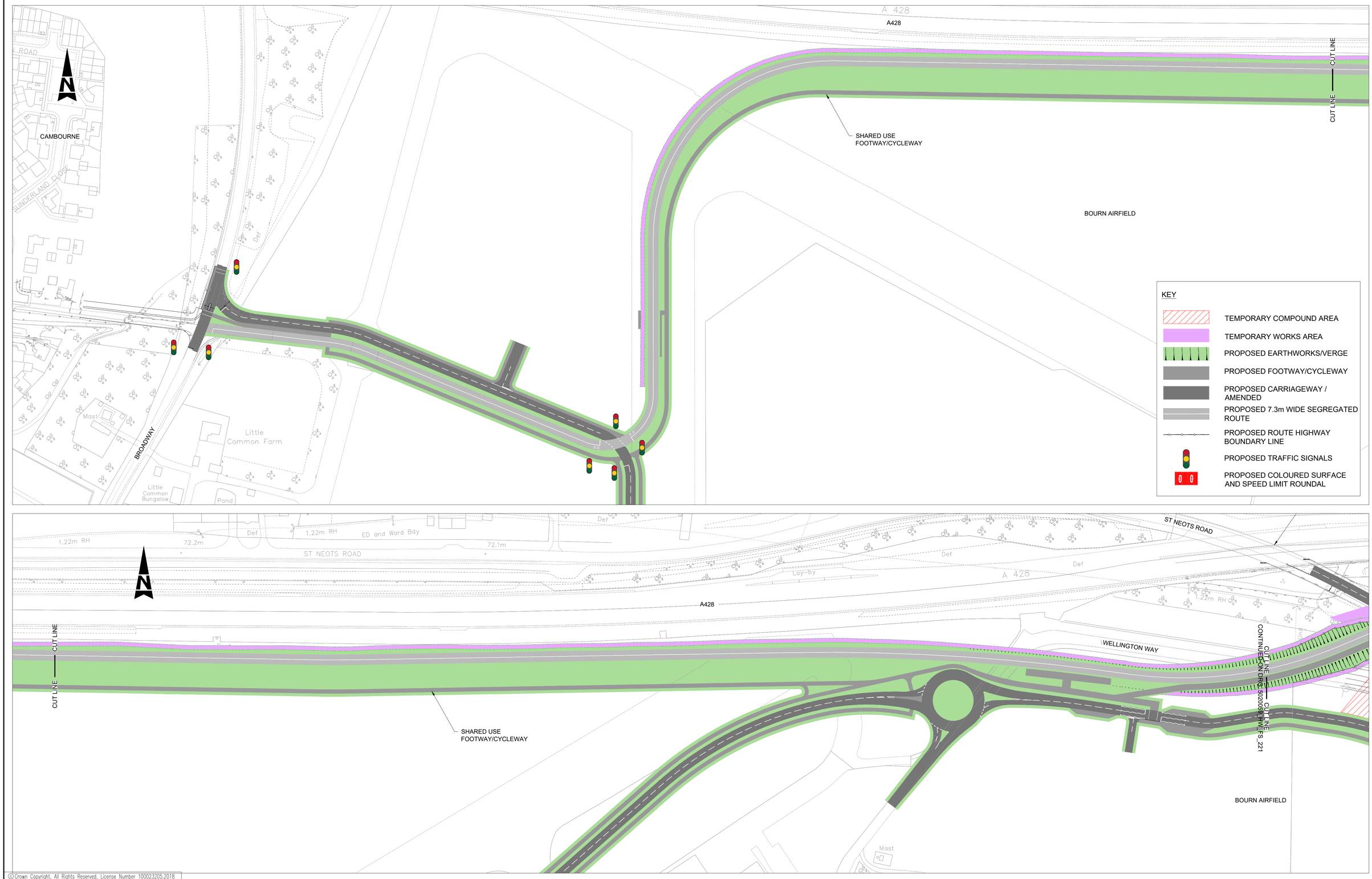
Status I

Drawing Number 5020059_HW_FS_220

DO NOT SCALE

A1

0 10 100



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS
CONSTRUCTION
(ENTER 'NONE' IF APPLICABLE)
MAINTENANCE/CLEANING
(ENTER 'NONE' IF APPLICABLE)
USE
(ENTER 'NONE' IF APPLICABLE)
DECOMMISSIONING/DEMOLITION
(ENTER 'NONE' IF APPLICABLE)

Rev	Description	By	Date	Chk'd	Auth
B	FOOTWAY/ CYCLEWAY AMENDED		3.1.19	SPW	ADB
A	ORIGINAL	–	–	–	–

Stat	Purpose of Issue	Date	Auth
I	–		
I	OPTIONS APPRAISAL REPORT	1.19	ADB

Client

GREATER CAMBRIDGE PARTNERSHIP
Growing and sharing prosperity
Delivering our City Deal

Cambridgeshire Highways ©
Unit 1A, Vantage House
Washingley Road
Huntingdon
PE29 6SR
Tel: (01223) 785165
cambridgeshirehighways@skanska.co.uk

Project

CAMBRIDGE TO CAMBOURNE
BETTER PUBLIC TRANSPORT PROJECT

Title

PHASE 2 OPTION 1
DO SOMETHING FULL OFF ROAD OPTION
SHEET 1 OF 3

Original Scale	Designed/Drawn	Checked	Authorised
1:1250	DMB	SPW	ADB
	Date 16/8/18	Date 16/8/18	Date 16/8/18

Status	Drawing Number	Rev
I	5020059_HW_FS_220	B

File Location: P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_220-222 – Phase 2 – Option 1 Off Road Asphalt CWay RevB.dwg Date: Jan 03, 2019 – 4:05pm Plotted by: Peter Wilson

P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_220-222 – Phase 2 – Option 1 Off Road Asphalt CWay RevB.dwg

Rev B | Drawing Number 5020059_HW_FS_221 | Status I

DO NOT SCALE

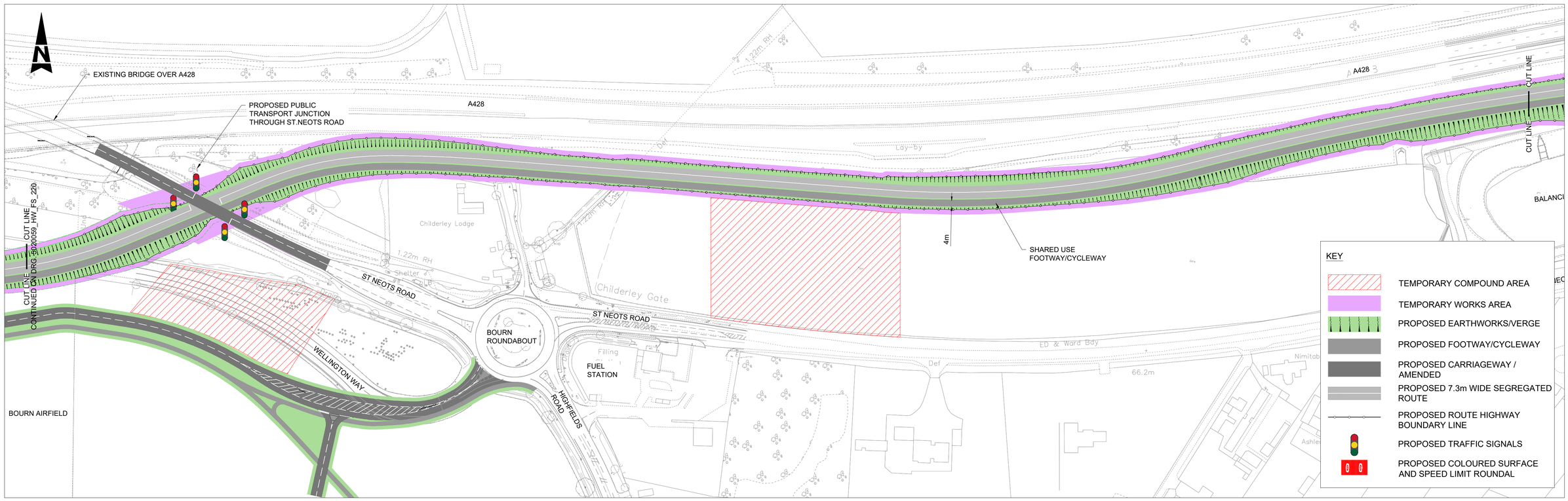
A1 0 10 100

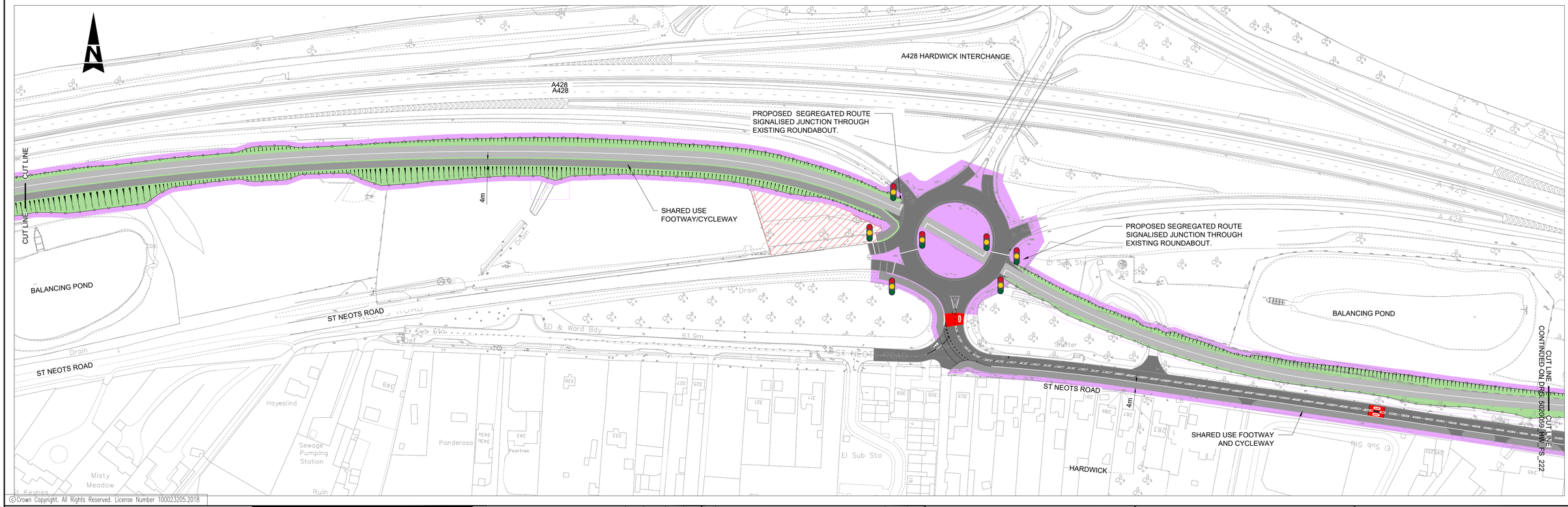
Plotted by: DMB 16/8/18

Date: Jan 03, 2019 - 4:07pm

File Location: P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways - A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_220-222 - Phase 2 - Option 1 Off Road Asphalt CWay RevB.dwg

Drawing Name: 5020059_HW_GA_220-222 - Phase 2 - Option 1 Off Road Asphalt CWay RevB.dwg





SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING SIGNIFICANT RESIDUAL RISKS
CONSTRUCTION
(ENTER 'NONE' IF APPLICABLE)
MAINTENANCE/CLEANING
(ENTER 'NONE' IF APPLICABLE)
USE
(ENTER 'NONE' IF APPLICABLE)
DECOMMISSIONING/DEMOLITION
(ENTER 'NONE' IF APPLICABLE)

Rev	Description	By	Date	Chk'd	Auth
B	FOOTWAY/ CYCLEWAY AMMENDED	–	3.1.19	SPW	ADB
A	ORIGINAL	–	–	–	–

Stat	Purpose of Issue	Date	Auth
I	OPTIONS APPRAISAL REPORT	1.19	ADB

Client

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cambridgeshirehighways@skanska.co.uk

Project

CAMBRIDGE TO CAMBOURNE BETTER PUBLIC TRANSPORT PROJECT

Title

PHASE 2 OPTION 1
DO SOMETHING FULL OFF ROAD OPTION
SHEET 2 OF 3

Original Scale	Designed/Drawn	Checked	Authorised
1:1250	DMB Date 16/8/18	SPW Date 16/8/18	ADB Date 16/8/18

Status	Drawing Number	Rev
I	5020059_HW_FS_221	B

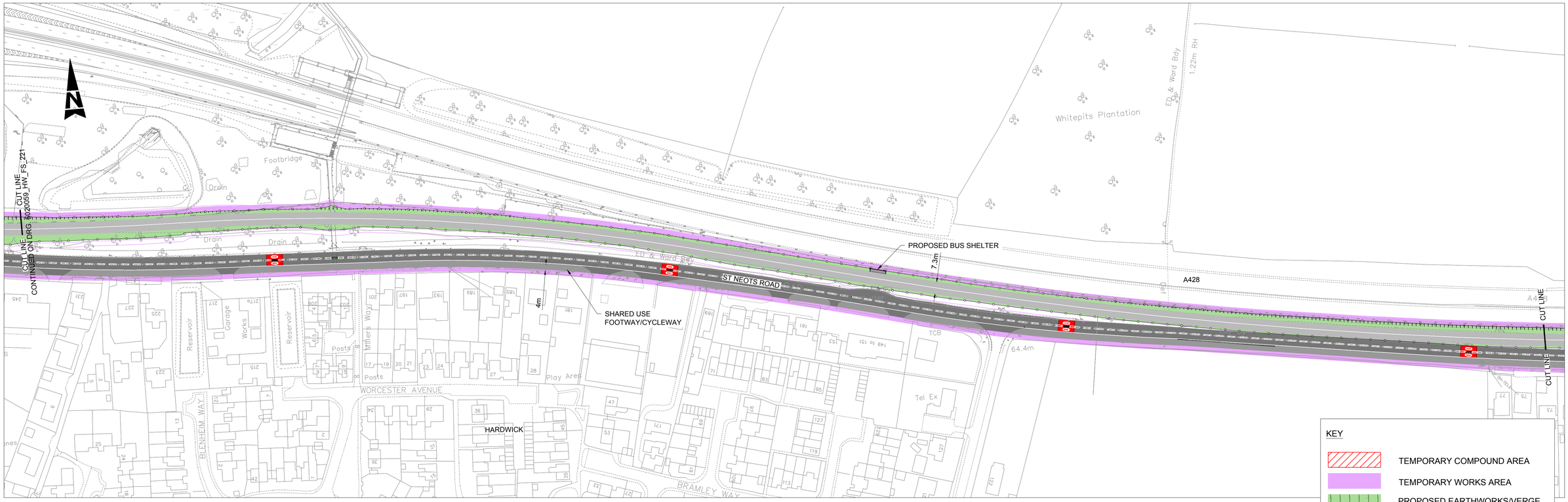
P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways - A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_220-222 - Phase 2 - Option 1 Off Road Asphalt CWay RevB.dwg

Rev B

Drawing Number 5020059_HW_FS_222

Status I

DO NOT SCALE



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DECOMMISSIONING/DEMOLITION
(ENTER "NONE" IF APPLICABLE)

Rev	Description	By	Date	Chk'd	Auth
B	FOOTWAY/ CYCLEWAY AMENDED	MH	3.1.19	SPW	ADB
A	ORIGINAL	–	–	–	–

Stat	Purpose of Issue	Date	Auth
I	OPTIONS APPRAISAL REPORT	1.19	ADB

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Project

CAMBRIDGE TO CAMBOURNE
BETTER PUBLIC TRANSPORT PROJECT

Title

PHASE 2 OPTION 1
DO SOMETHING FULL OFF ROAD OPTION
SHEET 3 OF 3

Original Scale	Designed/Drawn	Checked	Authorised
1:1250	DMB Date 16/8/18	SPW Date 16/8/18	ADB Date 16/8/18

Status	Drawing Number	Rev
I	5020059_HW_FS_222	B

File Location: P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_220-222 – Phase 2 – Option 1 Off Road Asphalt CWay RevB.dwg Date: Jan 03, 2019 – 5:51pm Plotted By: Peter Mc

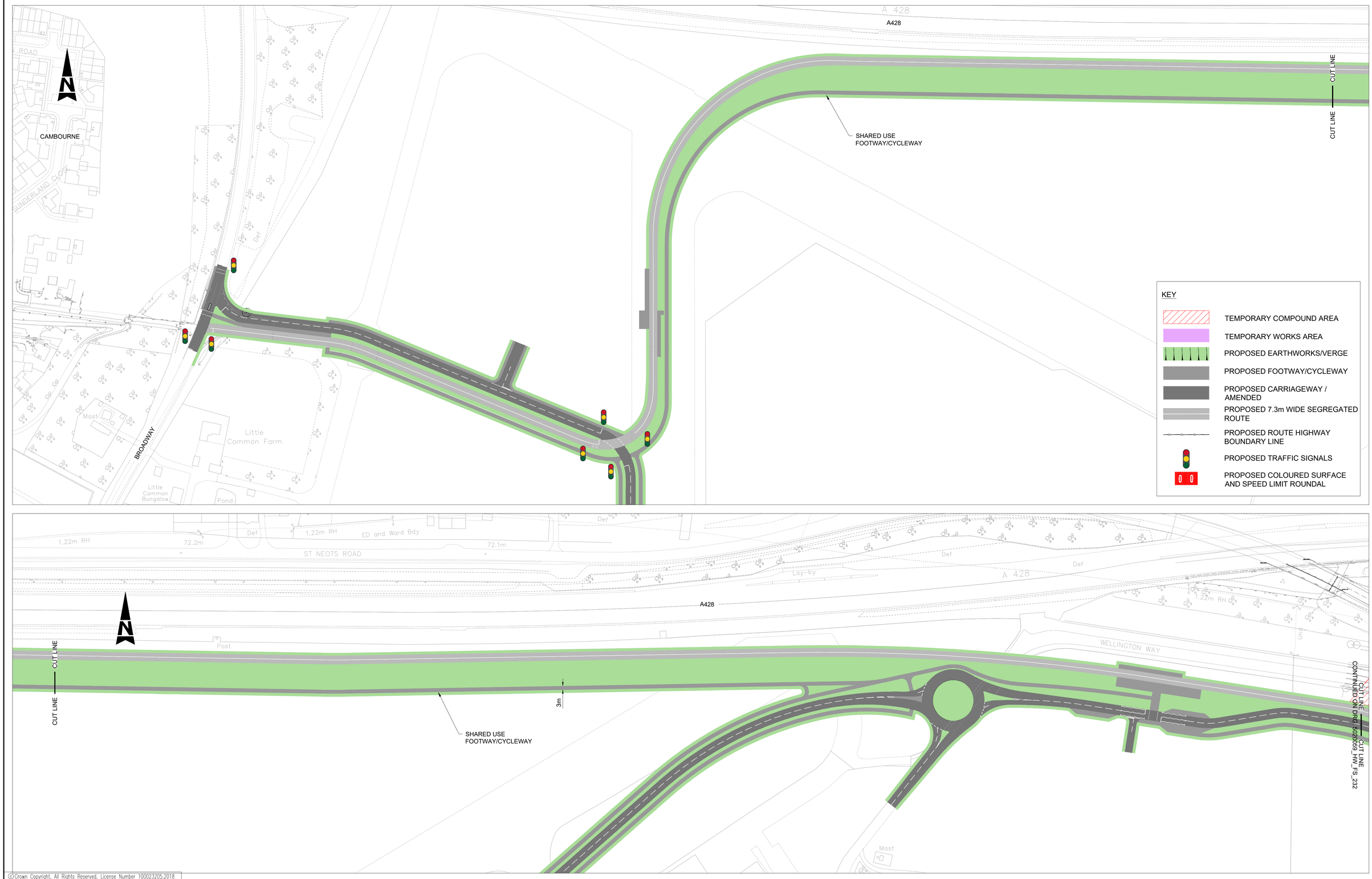
Drawing Name: 5020059_HW_GA_220-222 – Phase 2 – Option 1 Off Road Asphalt CWay RevB.dwg

A1 0 10 100

P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_220-222 – Phase 2 – Option 1 Off Road Asphalt CWay RevB.dwg

Rev B | Status I | Drawing Number 5020059_HW_FS_231

DO NOT SCALE



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
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USE
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DECOMMISSIONING/DEMOLITION
(ENTER 'NONE' IF APPLICABLE)

Rev	Description	By	Date	Chk'd	Auth
B	OPTION RENUMBERED	MH	3.1.19	SPW	ADB
A	ORIGINAL	–	–	–	–

Stat	Purpose of Issue	Date	Auth
I	OPTIONS APPRAISAL REPORT	1.19	ADB

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Project
CAMBRIDGE TO CAMBOURNE
BETTER PUBLIC TRANSPORT PROJECT

Title
PHASE 2 OPTION 2
DO MINIMUM ON ROAD
SHEET 1 OF 3

Original Scale	Designed/Drawn	Checked	Authorised
1:1250	DMB Date 16.08.18	SPW Date 16.08.18	ADB Date 16.08.18

Status	Drawing Number	Rev
I	5020059_HW_FS_231	B

File Location: P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_231-233 – Phase 2 – Option 2 On Road REV B.dwg Date: Jan 03, 2019 – 4:15pm Plotted by: bc971136

Drawing Name: 5020059_HW_GA_231-233 – Phase 2 – Option 2 On Road REV B.dwg

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A1

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Rev B

Drawing Number 5020059_HW_FS_232

Status I

DO NOT SCALE

0 10 100

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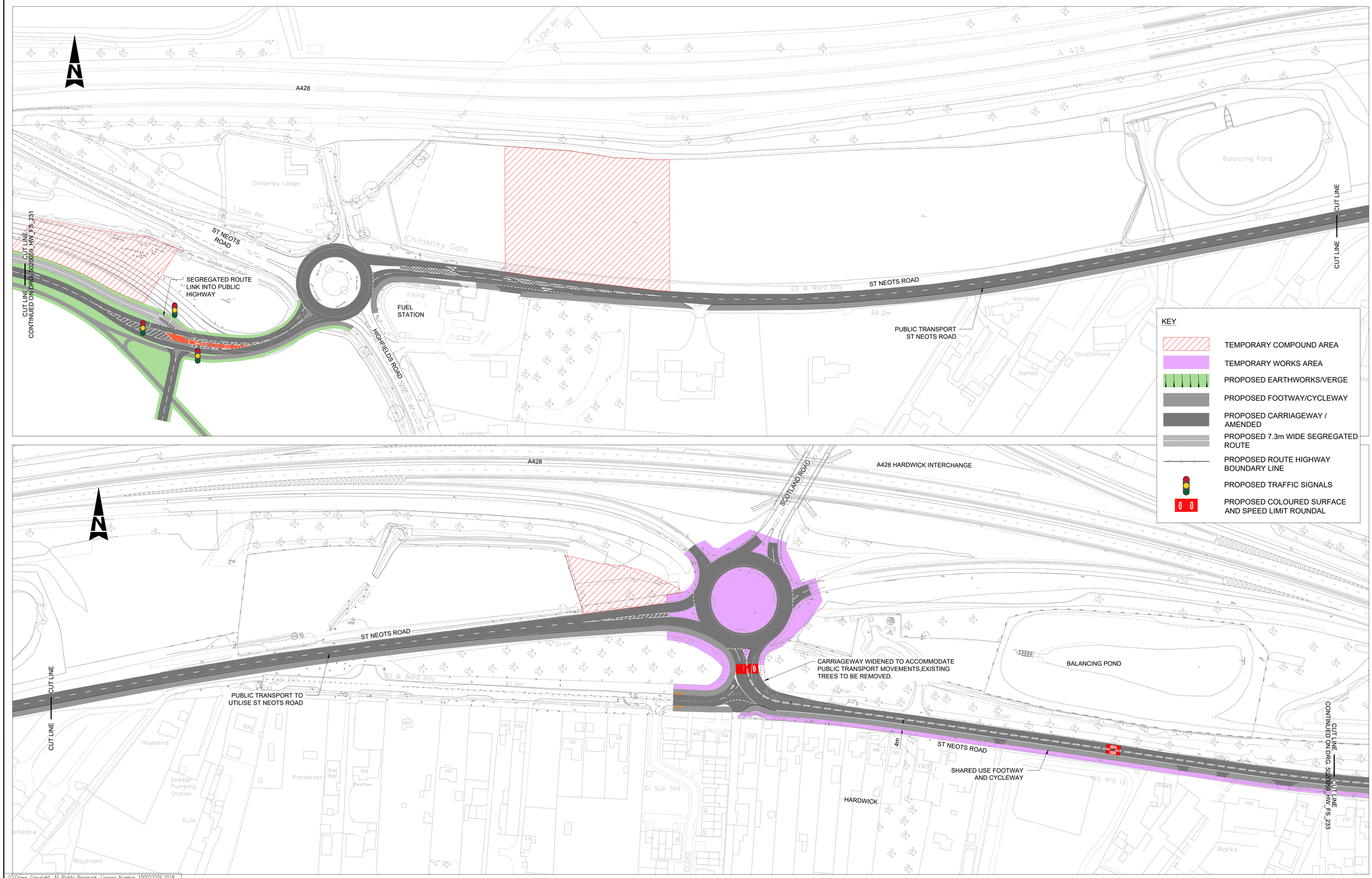
Drawing Name: 5020059_HW_GA_231-233 – Phase 2 – Option 2 On Road REV B.dwg



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DECOMMISSIONING/DEMOLITION
(ENTER 'NONE' IF APPLICABLE)

Rev	Description	By	Date	Chk'd	Auth
B	OPTION RENUMBERED	MH	3.1.19	SPW	ADB
A	ORIGINAL	–	–	–	–

Stat	Purpose of Issue	Date	Auth
I	OPTIONS APPRAISAL REPORT	1.19	ADB

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Project

CAMBRIDGE TO CAMBOURNE BETTER PUBLIC TRANSPORT PROJECT

Title

PHASE 2 OPTION 2
DO MINIMUM ON ROAD
SHEET 2 OF 3

Original Scale	Designed/Drawn	Checked	Authorised
1:1250	DMB Date 16.08.18	SPW Date 16.08.18	ADB Date 16.08.18

Status	Drawing Number	Rev
I	5020059_HW_FS_232	B

P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_231-233 – Phase 2 – Option 2 On Road REV B.dwg

Rev B

Status I

Drawing Number 5020059_HW_FS_233

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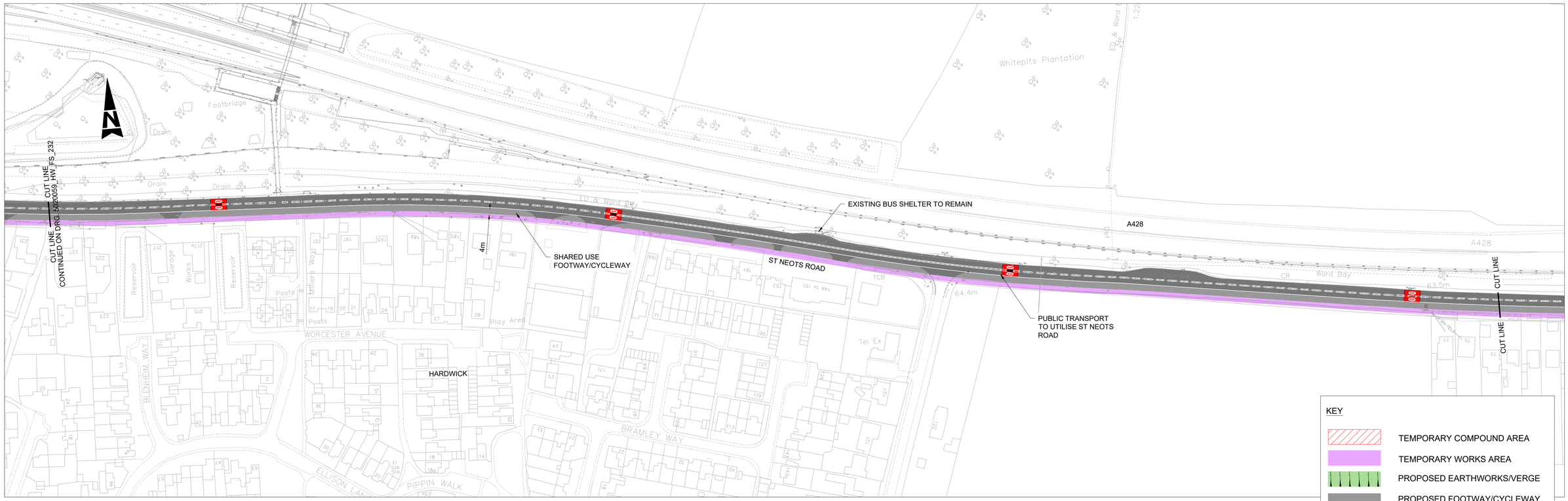

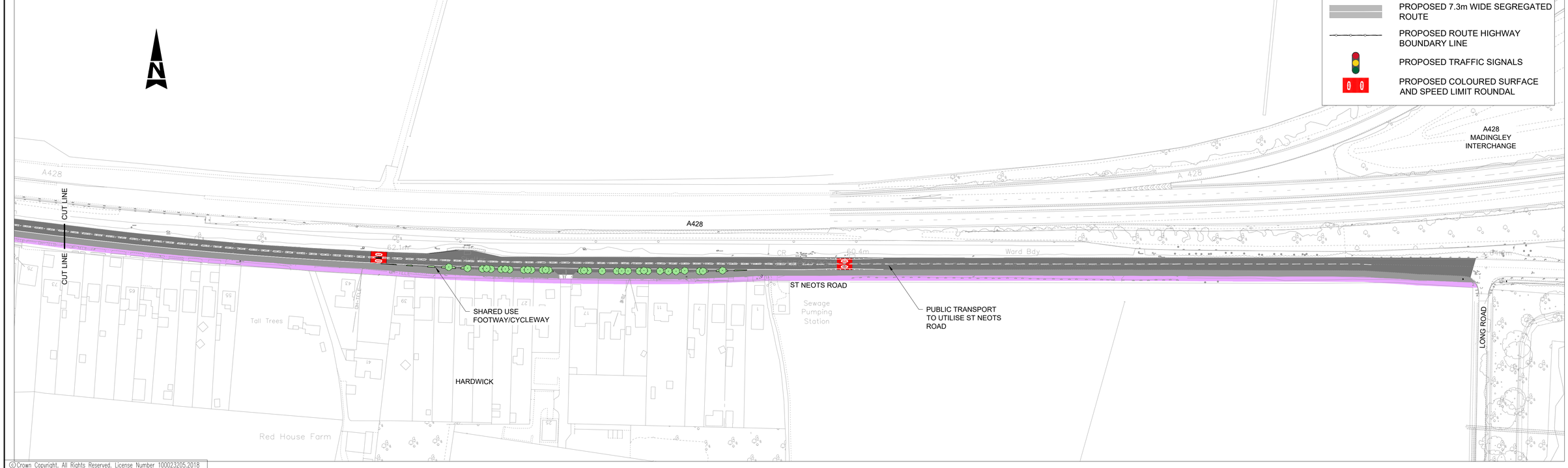

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B	OPTION RENUMBERED	MH	3.1.19	SPW	ADB
A	ORIGINAL	–	–	–	–

Stat	Purpose of Issue	Date	Auth
I	OPTIONS APPRAISAL REPORT	1.19	ADB

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CAMBRIDGE TO CAMBOURNE
BETTER PUBLIC TRANSPORT PROJECT

Title

PHASE 2 OPTION 2
DO MINIMUM ON ROAD
SHEET 3 OF 3

Original Scale	Designed/Drawn	Checked	Authorised
1:1250	DMB	SPW	ADB
	Date 16.08.18	Date 16.08.18	Date 16.08.18

Status	Drawing Number	Rev
I	5020059_HW_FS_233	B

File Location: P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_231–233 – Phase 2 – Option 2 On Road REV B.dwg Date: Jan 03, 2019 – 4:18pm Plotted by: bc971136

Drawing Name: 5020059_HW_GA_231–233 – Phase 2 – Option 2 On Road REV B.dwg

Rev B

Drawing Number 5020059_HW_FS_290

Status I

DO NOT SCALE

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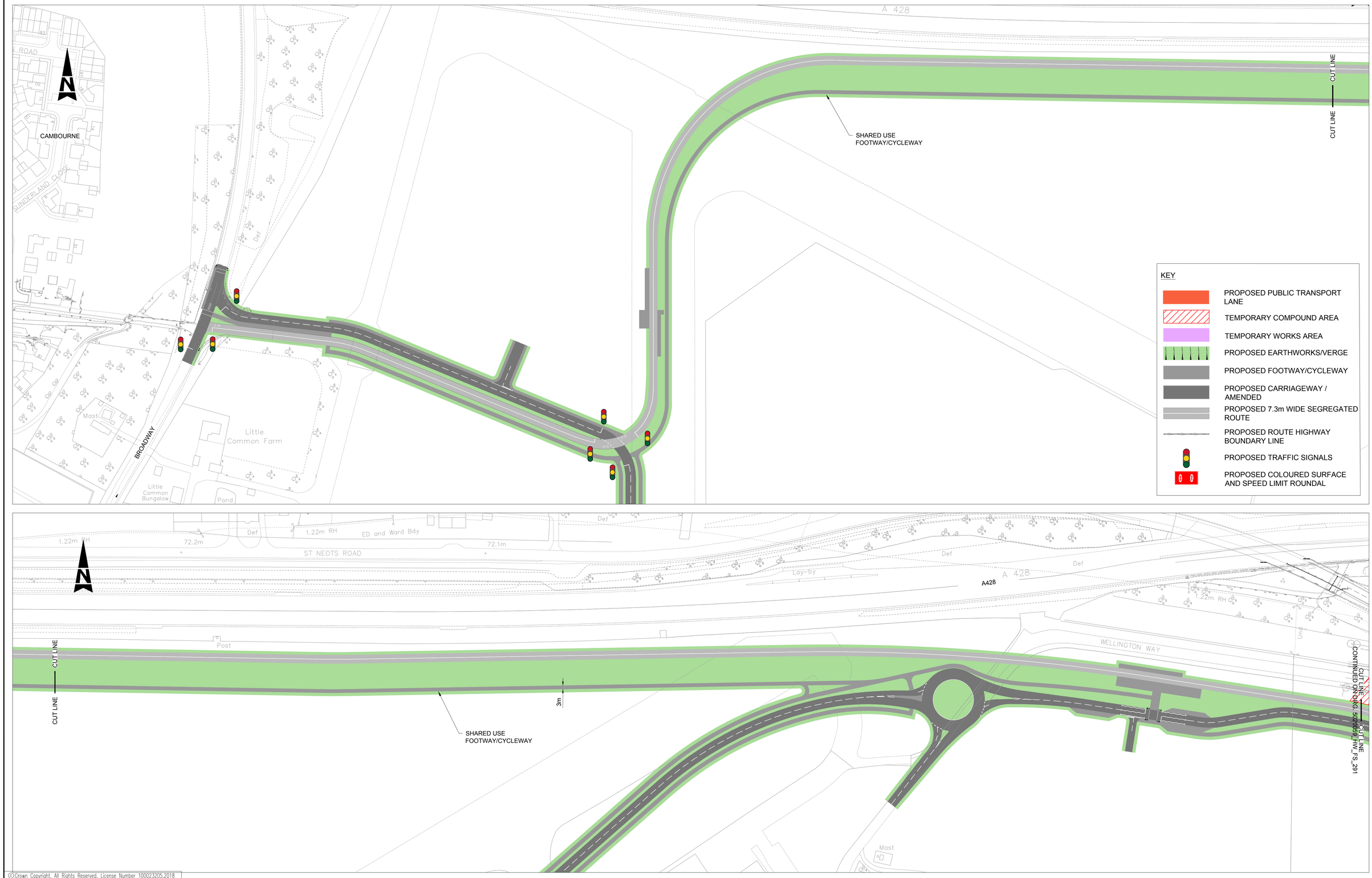

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DECOMMISSIONING/DEMOLITION
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Rev	Description	By	Date	Chk'd	Auth
B	OPTION RENUMBERED	MH	3.1.19	SPW	ADB
A	ORIGINAL	–	–	–	–

Stat	Purpose of Issue	Date	Auth
I	OPTIONS APPRAISAL REPORT	1.19	ADB

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Project

CAMBRIDGE TO CAMBOURNE
BETTER PUBLIC TRANSPORT PROJECT

Title

PHASE 2 OPTION 3
DO MINIMUM WITH BUS LANES
SHEET 1 OF 3

Original Scale	Designed/Drawn	Checked	Authorised
1:1250	DMB	SPW	ADB
	Date 16.08.18	Date 16.08.18	Date 16.08.18

Status	Drawing Number	Rev
I	5020059_HW_FS_290	B

File Location: P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_290–292 – Phase 2 – Option 3 Off Road + Bus Lane REV B.dwg Date: Jan 03, 2019 – 6.23pm Plotted by:

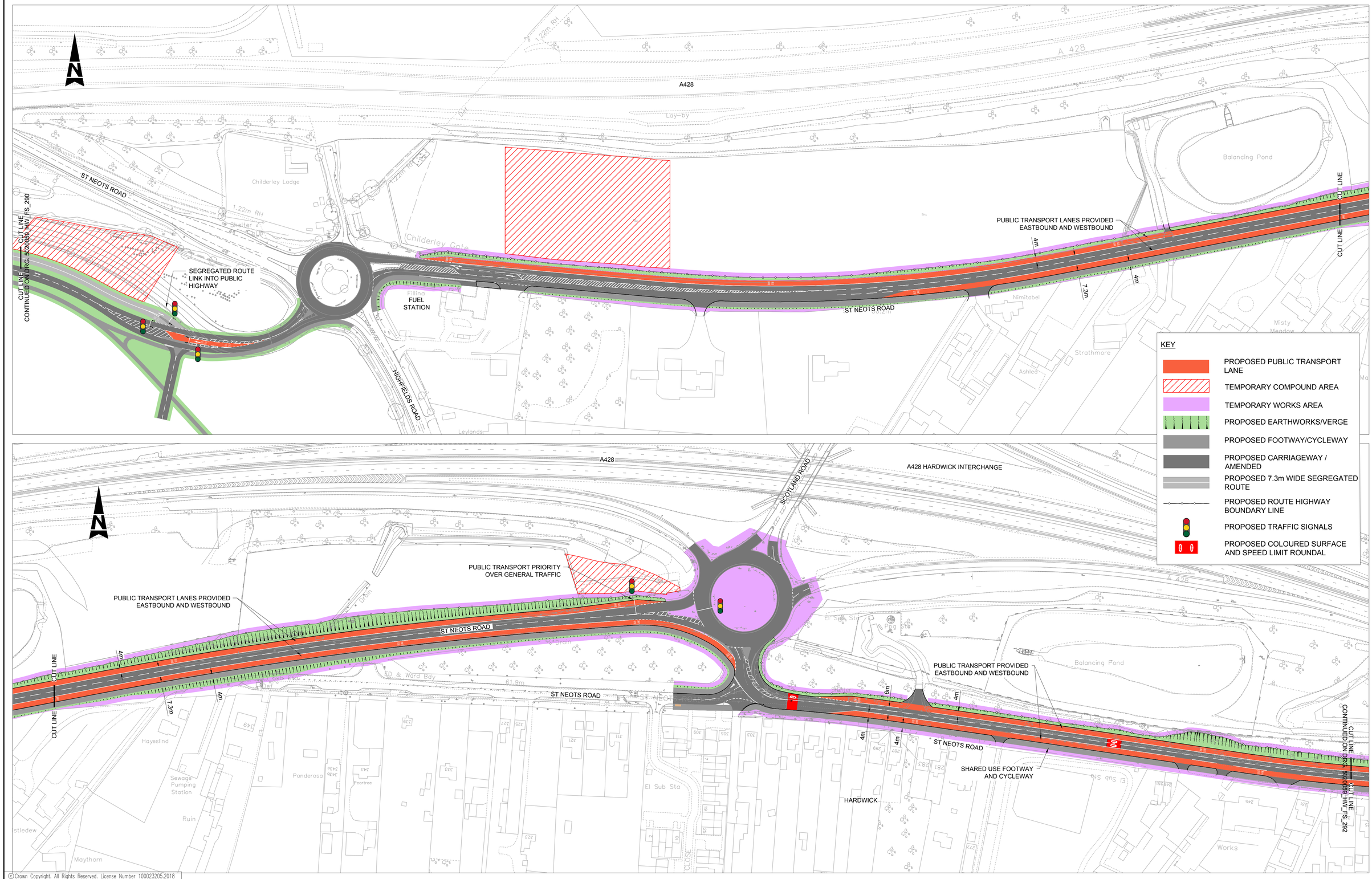
Drawing Name: 5020059_HW_GA_290–292 – Phase 2 – Option 3 Off Road + Bus Lane REV B.dwg

P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_290–292 – Phase 2 – Option 3 Off Road + Bus Lane REV B.dwg

Rev B | Drawing Number 5020059_HW_FS_291 | Status I

DO NOT SCALE

A1



KEY

- PROPOSED PUBLIC TRANSPORT LANE
- TEMPORARY COMPOUND AREA
- TEMPORARY WORKS AREA
- PROPOSED EARTHWORKS/VERGE
- PROPOSED FOOTWAY/CYCLEWAY
- PROPOSED CARRIAGEWAY / AMENDED
- PROPOSED 7.3m WIDE SEGREGATED ROUTE
- PROPOSED ROUTE HIGHWAY BOUNDARY LINE
- PROPOSED TRAFFIC SIGNALS
- PROPOSED COLOURED SURFACE AND SPEED LIMIT ROUNDAL

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
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MAINTENANCE/CLEANING
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DECOMMISSIONING/DEMOLITION
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Rev	Description	By	Date	Chk'd	Auth
B	OPTION RENUMBERED	MH	3.1.19	SPW	ADB
A	ORIGINAL	–	–	–	–

Stat	Purpose of Issue	Date	Auth
I	OPTIONS APPRAISAL REPORT	1.19	ADB

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Project: CAMBRIDGE TO CAMBOURNE BETTER PUBLIC TRANSPORT PROJECT

Title: PHASE 2 OPTION 3
DO MINIMUM WITH BUS LANES
SHEET 2 OF 3

Original Scale	Designed/Drawn	Checked	Authorised
1:1250	DMB Date 16.08.18	SPW Date 16.08.18	ADB Date 16.08.18

Status	Drawing Number	Rev
I	5020059_HW_FS_291	B

File Location: P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_290-292 – Phase 2 – Option 3 Off Road + Bus Lane REV B.dwg | Date: Jan 03, 2019 - 6:34pm | Plotted by: [illegible]

Drawing Name: 5020059_HW_GA_290-292 – Phase 2 – Option 3 Off Road + Bus Lane REV B.dwg

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Rev B
Drawing Number 5020059_HW_FS_292
Status I

DO NOT SCALE

A1

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Stat	Purpose of Issue	Date	Auth
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Title
PHASE 2 OPTION 3
DO MINIMUM WITH BUS LANES
SHEET 3 OF 3

Original Scale	Designed/Drawn	Checked	Authorised
1:1250	DMB Date 16.08.18	SPW Date 16.08.18	ADB Date 16.08.18

Status	Drawing Number	Rev
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File Location: P:\GBIPD\ESol\05 Cambridgeshire Highways\Cambridge Busways – A428 & Western Orbit\900 CAD & BIM\910 Drawings\A428 Cambridge to Cambourne\5020059_HW_GA_290-292 – Phase 2 – Option 3 Off Road + Bus Lane REV B.dwg
Date: Jan 03, 2019 – 6:28pm

B. INSET Tables

CAMBOURNE TO CAMBRIDGE BETTER BUS JOUREYS - P&R SITE SHORTLIST SELECTION
INVESTMENT SIFTING AND EVALUATION TOOL (INSET)

		1		2		3		4		5		6	
Cambourne to Cambridge													
No.	**Name**	**1. Policy Fit**											
		Cambridgeshire LTP3		**Highways England Road Investment Strategy (RIS)**		**Greater Cambridge and Peterborough SEP**		**Greater Cambridge City Deal**		**South Cambridgeshire Local Plan**		**Cambridge City Local Plan**	
		Select from list:											
1	**Option 1a**	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7
2	**Option 1b**	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7
3	**Option 2a**	5: Aligns with Policy	5	6: Aligns and partially fulfils policy	6	5: Aligns with Policy	5	6: Aligns and partially fulfils policy	6	3: Slightly Contradicts the Policy	3	3: Slightly Contradicts the Policy	3
4	**Option 2b**	5: Aligns with Policy	5	6: Aligns and partially fulfils policy	6	5: Aligns with Policy	5	6: Aligns and partially fulfils policy	6	3: Slightly Contradicts the Policy	3	3: Slightly Contradicts the Policy	3
5	**Option 3a**	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7
6	**Option 3b**	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7	7: Aligns and Fulfils policy in Full	7

CAMBOURNE TO CAMBRIDGE BETTER BUS JOUREYS - P&R SITE SHORTLIST SELECTION
INVESTMENT SIFTING AND EVALUATION TOOL (INSET)

		7		8		9		10		11		12	
Cambourne to Cambridge													
		2. Contribution to Economic Growth											
No.	**Name**	**Labour market and activity**		**Supporting house construction**		**Business investment and growth**		**Cambridge positive image**		**Future potential growth post 2031**		**Capacity**	
1	**Option 1a**	7: High impact in Labour market mobility	7	7: High number of new houses supported for construction	7	7: High impact on business investment and growth	7	7: High promotion of positive image	7	7: High support for future growth	7	7: Significant Increase	7
2	**Option 1b**	7: High impact in Labour market mobility	7	7: High number of new houses supported for construction	7	7: High impact on business investment and growth	7	7: High promotion of positive image	7	7: High support for future growth	7	7: Significant Increase	7
3	**Option 2a**	6: Medium impact in Labour market mobility	6	6: Medium number of new houses supported for construction	6	6: Medium impact on business investment and growth	6	6: Medium promotion of positive image	6	6: Medium support for future growth	6	5: Slight increase	5
4	**Option 2b**	6: Medium impact in Labour market mobility	6	6: Medium number of new houses supported for construction	6	6: Medium impact on business investment and growth	6	6: Medium promotion of positive image	6	6: Medium support for future growth	6	5: Slight increase	5
5	**Option 3a**	7: High impact in Labour market mobility	7	7: High number of new houses supported for construction	7	7: High impact on business investment and growth	7	7: High promotion of positive image	7	7: High support for future growth	7	7: Significant Increase	7
6	**Option 3b**	7: High impact in Labour market mobility	7	7: High number of new houses supported for construction	7	7: High impact on business investment and growth	7	7: High promotion of positive image	7	7: High support for future growth	7	7: Significant Increase	7

CAMBOURNE TO CAMBRIDGE BETTER BUS JOUREYS - P&R SITE SHORTLIST SELECTION
INVESTMENT SIFTING AND EVALUATION TOOL (INSET)

13 14 15 16 17 18 19 20

Cambourne to Cambridge

No.	Name	3. Contribution to Improved Transport Network															
		Reliability of journey		**Route flexibility - Links into existing bus routes**		**Walking and cycle connectivity**		**Impact on existing traffic**		**Journey times**		**Service frequency**		**Mode share**		**Connectivity to Park and Ride**	
														Select from list:			
1	**Option 1a**	7: Fully segregated with junction priority	7	5: Links (short distance)	5	7: Improved cycle infrastructure and connectivity	7	2: Offline with major junctions with existing roads	2	7: Major Improvements	7	6: Medium Increase in Service	6	4: No Change	4	6: Good access by Car	6
2	**Option 1b**	6: Partially Segregated with junction priority	6	5: Links (short distance)	5	7: Improved cycle infrastructure and connectivity	7	2: Offline with major junctions with existing roads	2	6: Some Improvements	6	6: Medium Increase in Service	6	4: No Change	4	7: Good access to park and ride by foot or car	7
3	**Option 2a**	4: No Impact	4	5: Links (short distance)	5	6: Improved cycle infrastructure	6	4: No Impact	4	6: Some Improvements	6	6: Medium Increase in Service	6	4: No Change	4	6: Good access by Car	6
4	**Option 2b**	4: No Impact	4	5: Links (short distance)	5	6: Improved cycle infrastructure	6	4: No Impact	4	5: Minor Improvements	5	6: Medium Increase in Service	6	4: No Change	4	7: Good access to park and ride by foot or car	7
5	**Option 3a**	5: Junction Priority	5	5: Links (short distance)	5	6: Improved cycle infrastructure	6	3: Offline but minor Junctions with existing roads	3	6: Some Improvements	6	6: Medium Increase in Service	6	4: No Change	4	6: Good access by Car	6
6	**Option 3b**	5: Junction Priority	5	5: Links (short distance)	5	6: Improved cycle infrastructure	6	3: Offline but minor Junctions with existing roads	3	5: Minor Improvements	5	6: Medium Increase in Service	6	4: No Change	4	7: Good access to park and ride by foot or car	7

CAMBOURNE TO CAMBRIDGE BETTER BUS JOUREYS - P&R SITE SHORTLIST SELECTION
INVESTMENT SIFTING AND EVALUATION TOOL (INSET)

		21		22		23		24		25		26		27		28		29	
Cambourne to Cambridge																			
No.	**Name**	**4. Contribution to Quality of Life**																	
		Environment impacts - Landscape Impact		**Environment impacts - Noise**		**Environment impacts - Air Quality**		**Environmental impacts - CO2 emissions**		**Environmental impacts – Biodiversity**		**Environmental impacts – Heritage**		**Environmental impacts – Green Belt**		**Safety**		**Accessibility**	
						Select from list:													
1	**Option 1a**	2: Moderate Adverse Effect	2	3: Minor Adverse Effect	3	4: Neutral / Negligible Effect	4	3: Minor Adverse Effect	3	2: Moderate Adverse Effect	2	2: Moderate Adverse Effect	2	4: Neutral / Negligible Effect	4	4: No Impact or as existing	4	7: Accessibility provided to all opportunities	7
2	**Option 1b**	2: Moderate Adverse Effect	2	3: Minor Adverse Effect	3	4: Neutral / Negligible Effect	4	3: Minor Adverse Effect	3	2: Moderate Adverse Effect	2	2: Moderate Adverse Effect	2	4: Neutral / Negligible Effect	4	4: No Impact or as existing	4	7: Accessibility provided to all opportunities	7
3	**Option 2a**	2: Moderate Adverse Effect	2	3: Minor Adverse Effect	3	4: Neutral / Negligible Effect	4	3: Minor Adverse Effect	3	2: Moderate Adverse Effect	2	2: Moderate Adverse Effect	2	4: Neutral / Negligible Effect	4	4: No Impact or as existing	4	7: Accessibility provided to all opportunities	7
4	**Option 2b**	3: Minor Adverse Effect	3	3: Minor Adverse Effect	3	4: Neutral / Negligible Effect	4	3: Minor Adverse Effect	3	3: Minor Adverse Effect	3	2: Moderate Adverse Effect	2	4: Neutral / Negligible Effect	4	4: No Impact or as existing	4	7: Accessibility provided to all opportunities	7
5	**Option 3a**	2: Moderate Adverse Effect	2	3: Minor Adverse Effect	3	4: Neutral / Negligible Effect	4	3: Minor Adverse Effect	3	2: Moderate Adverse Effect	2	2: Moderate Adverse Effect	2	4: Neutral / Negligible Effect	4	3: Slight interactions with other road users	3	7: Accessibility provided to all opportunities	7
6	**Option 3b**	2: Moderate Adverse Effect	2	3: Minor Adverse Effect	3	4: Neutral / Negligible Effect	4	3: Minor Adverse Effect	3	2: Moderate Adverse Effect	2	2: Moderate Adverse Effect	2	4: Neutral / Negligible Effect	4	3: Slight interactions with other road users	3	7: Accessibility provided to all opportunities	7

CAMBOURNE TO CAMBRIDGE BETTER BUS JOUREYS - P&R SITE SHORTLIST SELECTION
INVESTMENT SIFTING AND EVALUATION TOOL (INSET)

30 31 32 33 34 35 36 37

Cambourne to Cambridge

No.	Name	5. Scheme Deliverability																6. Stakeholder Support				WEIGHTED AVERAGE	WEIGHTED SCORE FOR THEME
		Scheme Cost		Engineering feasibility - construction method		Land acquisition required		Impact on local road network during construction		Future-proofing		Legislative Powers		Scheme Maintenance and Renewals				Public acceptability					
1	Option 1a	2: New highway infrastructure and complex junctions	2	4: Normal Construction Methods	4	2: Land required (greater area)	2	2: Medium Impact	2	7: Route supports future schemes	7	2: Amendment of a secondary legislation required	2	2: Medium Cost 1M to 2M	2			5: Some stakeholder support	5			**5.00**	**5.00**
2	Option 1b	2: New highway infrastructure and complex junctions	2	4: Normal Construction Methods	4	2: Land required (greater area)	2	2: Medium Impact	2	7: Route supports future schemes	7	2: Amendment of a secondary legislation required	2	2: Medium Cost 1M to 2M	2			7: Significant Stakeholder support	7			**5.03**	**5.03**
3	Option 2a	3: New highway infrastructure	3	4: Normal Construction Methods	4	3: Land required	3	3: Slight Impact	3	5: Route supports future schemes with major alignment changes	5	4: No Powers Required	4	2: Medium Cost 1M to 2M	2			5: Some stakeholder support	5			**4.43**	**4.43**
4	Option 2b	3: New highway infrastructure	3	4: Normal Construction Methods	4	3: Land required	3	3: Slight Impact	3	5: Route supports future schemes with major alignment changes	5	4: No Powers Required	4	2: Medium Cost 1M to 2M	2			6: Medium Stakeholder support	6			**4.51**	**4.51**
5	Option 3a	2: New highway infrastructure and complex junctions	2	4: Normal Construction Methods	4	2: Land required (greater area)	2	1: Significant Impact	1	6: Route supports future schemes with minor alignment changes	6	4: No Powers Required	4	1: High Cost >2M	1			4: No Preference overall	4			**4.84**	**4.84**
6	Option 3b	2: New highway infrastructure and complex junctions	2	4: Normal Construction Methods	4	2: Land required (greater area)	2	1: Significant Impact	1	6: Route supports future schemes with minor alignment changes	6	4: No Powers Required	4	1: High Cost >2M	1			5: Some stakeholder support	5			**4.86**	**4.86**

C. Justification Table

	Criteria	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Policy Fit	Cambridgeshire LTP3	**Fully aligns** with LTP3 policies as by being fully segregated this option would have a large impact on improving reliability of journey times, managing demand for road space and maximising capacity and efficiency of the existing network. This option would also result in a greater reduction in the need to travel by private car by making sustainable modes of travel a more viable and attractive alternative to private car use.	**Fully aligns** with LTP3 policies as by being fully segregated this option would have a large impact on improving reliability of journey times, managing demand for road space and maximising capacity and efficiency of the existing network. This option would also result in a greater reduction in the need to travel by private car by making sustainable modes of travel a more viable and attractive alternative to private car use.	**Close alignment** with LTP3 policies as it provides some segregation. Whilst not to the same extent as a full segregated options, this option would still have an impact on improving reliability of journey times, managing demand for road space and maximising capacity and efficiency of the existing network. This option would also result in a greater reduction in the need to travel by private car by making sustainable modes of travel a more viable and attractive alternative to private car use, but not to the same extent as a fully segregated option.	**Close alignment** with LTP3 policies as it provides some segregation. Whilst not to the same extent as a full segregated options, this option would still have an impact on improving reliability of journey times, managing demand for road space and maximising capacity and efficiency of the existing network. This option would also result in a greater reduction in the need to travel by private car by making sustainable modes of travel a more viable and attractive alternative to private car use, but not to the same extent as a fully segregated option.	**Fully aligns** with LTP3 policies as by being fully segregated this option would have a large impact on improving reliability of journey times, managing demand for road space and maximising capacity and efficiency of the existing network. This option would also result in a greater reduction in the need to travel by private car by making sustainable modes of travel a more viable and attractive alternative to private car use.	**Fully aligns** with LTP3 policies as by being fully segregated this option would have a large impact on improving reliability of journey times, managing demand for road space and maximising capacity and efficiency of the existing network. This option would also result in a greater reduction in the need to travel by private car by making sustainable modes of travel a more viable and attractive alternative to private car use.
	Highways England Road Investment Strategy (RIS)	Option **fully aligns** to the strategy by contributing to connectivity targets, enabling construction, encouraging economic growth and supporting the smooth flow of traffic.	Option **fully aligns** to the strategy by contributing to connectivity targets, enabling construction, encouraging economic growth and supporting the smooth flow of traffic.	Option **partially aligns** to the strategy by providing new segregated infrastructure that would contribute to connectivity targets, enabling construction, encouraging economic growth and supporting the smooth flow of traffic.	Option **partially aligns** to the strategy by providing new segregated infrastructure that would contribute to connectivity targets, enabling construction, encouraging economic growth and supporting the smooth flow of traffic.	Option **fully aligns** to the strategy by contributing to connectivity targets, enabling construction, encouraging economic growth and supporting the smooth flow of traffic.	Option **fully aligns** to the strategy by contributing to connectivity targets, enabling construction, encouraging economic growth and supporting the smooth flow of traffic.
	Greater Cambridge and Peterborough SEP	Option **fully aligns** to the SEP by providing a fully segregated route that provides the greatest level of HQPT.	Option **fully aligns** to the SEP by providing a fully segregated route that provides the greatest level of HQPT.	Option **partially aligns** to the SEP by providing a some segregation, but the on road part reduces the level of HQPT being provided that would attract users.	Option **partially aligns** to the SEP by providing a some segregation, but the on road part reduces the level of HQPT being provided that would attract users.	Option **fully aligns** to the SEP by providing a fully segregated route that provides the greatest level of HQPT.	Option **fully aligns** to the SEP by providing a fully segregated route that provides the greatest level of HQPT.
	Greater Cambridge City Deal	Option **fully aligns** with the City Deal, especially with regards to connecting new developments to employment and education opportunities in the city centre.	Option **fully aligns** with the City Deal, especially with regards to connecting new developments to employment and education opportunities in the city centre.	Option **partially aligns** with the City Deal, as it provides some direct connectivity between new developments to employment and education opportunities in the city centre.	Option **partially aligns** with the City Deal, as it provides some direct connectivity between new developments to employment and education opportunities in the city centre.	Option **fully aligns** with the City Deal, especially with regards to connecting new developments to employment and education opportunities in the city centre.	Option **fully aligns** with the City Deal, especially with regards to connecting new developments to employment and education opportunities in the city centre.
	South Cambridgeshire Local Plan (adopted 2018)	This option **fully aligns** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes.	This option **fully aligns** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes.	This option **does not align** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes. This options does not provide full segregation or HQPT from new developments all the way to employment opportunities.	This option **does not align** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes. This options does not provide full segregation or HQPT from new developments all the way to employment opportunities.	This option **fully aligns** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes.	This option **fully aligns** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes.
	Cambridge City Local Plan (adopted 2018)	This option **fully aligns** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes.	This option **fully aligns** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes.	This option **does not align** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes. This options does not provide full segregation or HQPT from new developments all the way to employment opportunities.	This option **does not align** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes. This options does not provide full segregation or HQPT from new developments all the way to employment opportunities.	This option **fully aligns** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes.	This option **fully aligns** with the policy. The policy states there needs to be a segregated high quality public transport route from new developments and along transport corridors as well as segregated high quality walking and cycling routes.
Contribution to Economic Growth	Labour market and activity	**High Impact** - Journeys to work will be most efficient. It will provide the quickest access from major housing growth areas (Bourn Airfield and Cambourne) into Cambridge City Centre, surrounding fringe sites and ongoing journeys. Will link housing and cluster sites. Promotes greatest efficiencies in journeys to work through reductions in existing travel times and costs, whilst also permitting the largest gains in access to opportunities for residents and labour markets for businesses. Highest scheme demand and decongestion enable the greatest gains in quality of life and accessibility, promoting Greater Cambridge as a hub to live and work.	**High Impact** - Journeys to work will be most efficient. It will provide the quickest access from major housing growth areas (Bourn Airfield and Cambourne) into Cambridge City Centre, surrounding fringe sites and ongoing journeys. Will link housing and cluster sites. Promotes greatest efficiencies in journeys to work through reductions in existing travel times and costs, whilst also permitting the largest gains in access to opportunities for residents and labour markets for businesses. Highest scheme demand and decongestion enable the greatest gains in quality of life and accessibility, promoting Greater Cambridge as a hub to live and work.	**High Impact** - Journeys to work will be most efficient. It will provide the quickest access from major housing growth areas (Bourn Airfield and Cambourne) into Cambridge City Centre, surrounding fringe sites and ongoing journeys. Will link housing and cluster sites. Promotes greatest efficiencies in journeys to work through reductions in existing travel times and costs, whilst also permitting the largest gains in access to opportunities for residents and labour markets for businesses. Highest scheme demand and decongestion enable the greatest gains in quality of life and accessibility, promoting Greater Cambridge as a hub to live and work.	**High Impact** - Journeys to work will be most efficient. It will provide the quickest access from major housing growth areas (Bourn Airfield and Cambourne) into Cambridge City Centre, surrounding fringe sites and ongoing journeys. Will link housing and cluster sites. Promotes greatest efficiencies in journeys to work through reductions in existing travel times and costs, whilst also permitting the largest gains in access to opportunities for residents and labour markets for businesses. Highest scheme demand and decongestion enable the greatest gains in quality of life and accessibility, promoting Greater Cambridge as a hub to live and work.	**High Impact** - Journeys to work will be most efficient. It will provide the quickest access from major housing growth areas (Bourn Airfield and Cambourne) into Cambridge City Centre, surrounding fringe sites and ongoing journeys. Will link housing and cluster sites. Promotes greatest efficiencies in journeys to work through reductions in existing travel times and costs, whilst also permitting the largest gains in access to opportunities for residents and labour markets for businesses. Highest scheme demand and decongestion enable the greatest gains in quality of life and accessibility, promoting Greater Cambridge as a hub to live and work.	**High Impact** - Journeys to work will be most efficient. It will provide the quickest access from major housing growth areas (Bourn Airfield and Cambourne) into Cambridge City Centre, surrounding fringe sites and ongoing journeys. Will link housing and cluster sites. Promotes greatest efficiencies in journeys to work through reductions in existing travel times and costs, whilst also permitting the largest gains in access to opportunities for residents and labour markets for businesses. Highest scheme demand and decongestion enable the greatest gains in quality of life and accessibility, promoting Greater Cambridge as a hub to live and work.
	Supporting house construction	**High -** Fully 'Segregated' and 'Hybrid' options are most likely to deliver the most benefits in terms of supporting housing development.	**High -** Fully 'Segregated' and 'Hybrid' options are most likely to deliver the most benefits in terms of supporting housing development.	**High -** Fully 'Segregated' and 'Hybrid' options are most likely to deliver the most benefits in terms of supporting housing development.	**High -** Fully 'Segregated' and 'Hybrid' options are most likely to deliver the most benefits in terms of supporting housing development.	**High -** Fully 'Segregated' and 'Hybrid' options are most likely to deliver the most benefits in terms of supporting housing development.	**High -** Fully 'Segregated' and 'Hybrid' options are most likely to deliver the most benefits in terms of supporting housing development.
	Business investment and growth	**High Impact** - Scheme demand, congestion savings and connectivity impacts are the highest of the options. In particular it, improves connectivity to the City Centre. Will provide the support to the developments in and around the university but the 'cluster' will only be truly supported by enhanced linkages to other routes providing the enhanced connectivity across key sites. By attracting highest scheme demand, and helping to reduce congestion for other travellers, fully segregated options do most to improve connectivity between growth clusters and labour markets.	**High Impact** - Scheme demand, congestion savings and connectivity impacts are the highest of the options. In particular it, improves connectivity to the City Centre. Will provide the support to the developments in and around the university but the 'cluster' will only be truly supported by enhanced linkages to other routes providing the enhanced connectivity across key sites. By attracting highest scheme demand, and helping to reduce congestion for other travellers, fully segregated options do most to improve connectivity between growth clusters and labour markets.	**High Impact** - Scheme demand, congestion savings and connectivity impacts are the highest of the options. In particular it, improves connectivity to the City Centre. Will provide the support to the developments in and around the university but the 'cluster' will only be truly supported by enhanced linkages to other routes providing the enhanced connectivity across key sites. By attracting highest scheme demand, and helping to reduce congestion for other travellers, fully segregated options do most to improve connectivity between growth clusters and labour markets.	**High Impact** - Scheme demand, congestion savings and connectivity impacts are the highest of the options. In particular it, improves connectivity to the City Centre. Will provide the support to the developments in and around the university but the 'cluster' will only be truly supported by enhanced linkages to other routes providing the enhanced connectivity across key sites. By attracting highest scheme demand, and helping to reduce congestion for other travellers, fully segregated options do most to improve connectivity between growth clusters and labour markets.	**High Impact** - Scheme demand, congestion savings and connectivity impacts are the highest of the options. In particular it, improves connectivity to the City Centre. Will provide the support to the developments in and around the university but the 'cluster' will only be truly supported by enhanced linkages to other routes providing the enhanced connectivity across key sites. By attracting highest scheme demand, and helping to reduce congestion for other travellers, fully segregated options do most to improve connectivity between growth clusters and labour markets.	**High Impact** - Scheme demand, congestion savings and connectivity impacts are the highest of the options. In particular it, improves connectivity to the City Centre. Will provide the support to the developments in and around the university but the 'cluster' will only be truly supported by enhanced linkages to other routes providing the enhanced connectivity across key sites. By attracting highest scheme demand, and helping to reduce congestion for other travellers, fully segregated options do most to improve connectivity between growth clusters and labour markets.

	Criteria	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Economic Growth	Cambridge positive image	**High Impact** - High quality bus route that is fully segregated with new fixed infrastructure will promote the most positive image of the transport network. High quality transport investment which promotes positive image of the area and attracts companies / individuals who might go outside of the UK otherwise. Fixed, segregated, infrastructure gives residents and businesses the confidence to make long-term decisions.	**High Impact** - High quality bus route that is fully segregated with new fixed infrastructure will promote the most positive image of the transport network. High quality transport investment which promotes positive image of the area and attracts companies / individuals who might go outside of the UK otherwise. Fixed, segregated, infrastructure gives residents and businesses the confidence to make long-term decisions.	**High Impact** - High quality bus route that is fully segregated with new fixed infrastructure will promote the most positive image of the transport network. High quality transport investment which promotes positive image of the area and attracts companies / individuals who might go outside of the UK otherwise. Fixed, segregated, infrastructure gives residents and businesses the confidence to make long-term decisions.	**High Impact** - High quality bus route that is fully segregated with new fixed infrastructure will promote the most positive image of the transport network. High quality transport investment which promotes positive image of the area and attracts companies / individuals who might go outside of the UK otherwise. Fixed, segregated, infrastructure gives residents and businesses the confidence to make long-term decisions.	**High Impact** - High quality bus route that is fully segregated with new fixed infrastructure will promote the most positive image of the transport network. High quality transport investment which promotes positive image of the area and attracts companies / individuals who might go outside of the UK otherwise. Fixed, segregated, infrastructure gives residents and businesses the confidence to make long-term decisions.	**High Impact** - High quality bus route that is fully segregated with new fixed infrastructure will promote the most positive image of the transport network. High quality transport investment which promotes positive image of the area and attracts companies / individuals who might go outside of the UK otherwise. Fixed, segregated, infrastructure gives residents and businesses the confidence to make long-term decisions.
	Future potential growth post 2031	**High Impact** - fully segregated options will provide the biggest increase in future capacity for further housing and development planned in settlements and fringe sites. Its segregated nature means it could more easily be upgraded to a rapid transit system in the future which will help future proof the corridor for any further unplanned development. Directly supporting needs of key stakeholders who have long term growth plans via investment that can be more readily upgraded to provide additional capacity. Fully segregated options provide the most ready means of adding further capacity for further post-2031 growth, supporting more sustainable travel patterns and growth.	**High Impact** - fully segregated options will provide the biggest increase in future capacity for further housing and development planned in settlements and fringe sites. Its segregated nature means it could more easily be upgraded to a rapid transit system in the future which will help future proof the corridor for any further unplanned development. Directly supporting needs of key stakeholders who have long term growth plans via investment that can be more readily upgraded to provide additional capacity. Fully segregated options provide the most ready means of adding further capacity for further post-2031 growth, supporting more sustainable travel patterns and growth.	**High Impact** - fully segregated options will provide the biggest increase in future capacity for further housing and development planned in settlements and fringe sites. Its segregated nature means it could more easily be upgraded to a rapid transit system in the future which will help future proof the corridor for any further unplanned development. Directly supporting needs of key stakeholders who have long term growth plans via investment that can be more readily upgraded to provide additional capacity. Fully segregated options provide the most ready means of adding further capacity for further post-2031 growth, supporting more sustainable travel patterns and growth.	**High Impact** - fully segregated options will provide the biggest increase in future capacity for further housing and development planned in settlements and fringe sites. Its segregated nature means it could more easily be upgraded to a rapid transit system in the future which will help future proof the corridor for any further unplanned development. Directly supporting needs of key stakeholders who have long term growth plans via investment that can be more readily upgraded to provide additional capacity. Fully segregated options provide the most ready means of adding further capacity for further post-2031 growth, supporting more sustainable travel patterns and growth.	**High Impact** - fully segregated options will provide the biggest increase in future capacity for further housing and development planned in settlements and fringe sites. Its segregated nature means it could more easily be upgraded to a rapid transit system in the future which will help future proof the corridor for any further unplanned development. Directly supporting needs of key stakeholders who have long term growth plans via investment that can be more readily upgraded to provide additional capacity. Fully segregated options provide the most ready means of adding further capacity for further post-2031 growth, supporting more sustainable travel patterns and growth.	**High Impact** - fully segregated options will provide the biggest increase in future capacity for further housing and development planned in settlements and fringe sites. Its segregated nature means it could more easily be upgraded to a rapid transit system in the future which will help future proof the corridor for any further unplanned development. Directly supporting needs of key stakeholders who have long term growth plans via investment that can be more readily upgraded to provide additional capacity. Fully segregated options provide the most ready means of adding further capacity for further post-2031 growth, supporting more sustainable travel patterns and growth.
	Capacity	There will be a significant increase in capacity as the whole route is segregated from the existing roads.	There will be a significant increase in capacity as the whole route is segregated from the existing roads.	There will be no change from existing	There will be no change from existing	There will be a medium increase in capacity due to additional outbound and inbound bus lanes, segregated from the existing traffic and potentially reducing congestion.	There will be a medium increase in capacity additional outbound and inbound bus lanes, segregated from the existing traffic and potentially reducing congestion.
Contribution to Improved Transport Network	Reliability of journey	Option will provide a very significant increase to journey reliability as the bus route is fully segregated and existing road traffic on the A428 will not be an issue	Option will provide a significant increase to journey reliability as the bus route is fully segregated and existing road traffic on the A428 will not be an issue. However the bus will come on road to access Scotland Farm Park and Ride, resulting in an impact to the reliability at this location.	Option will provide no change from existing reliability	Option will provide no change from existing reliability	Option will provide a medium increase in journey reliability as route is fully segregated with the additional outbound and inbound bus priority lanes.	Option will provide a medium increase in journey reliability as route is fully segregated with the additional outbound and inbound bus priority lanes.
	Route flexibility - Links into existing bus routes	The location of bus stops have not been decided but the route is aligned at key interchange locations.	The location of bus stops have not been decided but the route is aligned at key interchange locations.	The location of bus stops have not been decided but the route is aligned at key interchange locations.	The location of bus stops have not been decided but the route is aligned at key interchange locations.	The location of bus stops have not been decided but the route is aligned at key interchange locations.	The location of bus stops have not been decided but the route is aligned at key interchange locations.
	Walking and cycle connectivity	The proposed option has dedicated pedestrian and cycling facilities spanning from the beginning to the end of the route for westbound which provides much improved connectivity in both areas.	The proposed option has dedicated pedestrian and cycling facilities spanning from the beginning to the end of the route for westbound which provides much improved connectivity in both areas.	The proposed option would have improvements to existing cycle and pedestrian routes	The proposed option would have improvements to existing cycle and pedestrian routes	The proposed option would have improvements to existing cycle and pedestrian routes	The proposed option would have improvements to existing cycle and pedestrian routes
	Impact on existing traffic	There will be slight improved capacity for traffic due to the potential modal shift to bus or bike travel through the fully segregated bus route.	There will be slight improved capacity for traffic due to the potential modal shift to bus or bike travel through the fully segregated bus route.	No Impact	No Impact	There will be slight improved capacity for traffic due to the potential modal shift to bus or bike travel through the bus priority route.	There will be slight improved capacity for traffic due to the potential modal shift to bus or bike travel through the bus priority route.
	Journey times						
	Service frequency	It is proposed to have 9 express services an hour during peak travel times. Although the responsibility for bus timetabling is at the discretion of the bus operators.	It is proposed to have 9 express services an hour during peak travel times. Although the responsibility for bus timetabling is at the discretion of the bus operators.	It is proposed to have 9 express services an hour during peak travel times. Although the responsibility for bus timetabling is at the discretion of the bus operators.	It is proposed to have 9 express services an hour during peak travel times. Although the responsibility for bus timetabling is at the discretion of the bus operators.	It is proposed to have 9 express services an hour during peak travel times. Although the responsibility for bus timetabling is at the discretion of the bus operators.	It is proposed to have 9 express services an hour during peak travel times. Although the responsibility for bus timetabling is at the discretion of the bus operators.
	Mode share						
	Connectivity to Park and Ride	There is good access by car to the Water Works P&R site. Although, some of the people consulted are concerned that the congestion during AM and PM peaks will make access more difficult.	There is good access by car to Scotland Farm P&R. However, additionally it can be more easily accessed by foot or bike from Cambourne, Hardwick and the proposed Bourn Airfield development.	There is good access by car to the Water Works P&R site. Although, some of the people consulted are concerned that the congestion during AM and PM peaks will make access more difficult.	There is good access by car to Scotland Farm P&R. However, additionally it can be more easily accessed by foot or bike from Cambourne, Hardwick and the proposed Bourn Airfield development.	There is good access by car to the Water Works P&R site. Although, some of the people consulted are concerned that the congestion during AM and PM peaks will make access more difficult.	There is good access by car to Scotland Farm P&R. However, additionally it can be more easily accessed by foot or bike from Cambourne, Hardwick and the proposed Bourn Airfield development.
	Environment impacts - Landscape Impact	There would be a loss of farmland, trees and screening vegetation as a result of the construction of the Proposed Scheme. The impacts of the new busway will be most noticeable where it passes along the A428 and St Neots Road, due to the loss of existing vegetation, which will open up views of the A428. The busway would be clearly visible from much of the St Neots Road, but it would be separated from the road by a landscape strip and the road itself would not be widened. TheWaterworks Travel Hub would be clearly visible from the open landscape to the south of the waterworks site. Mitigation planting would be incorporated into the scheme proposals to restore the existing screening vegetation and to integrate the busway and car park into the landscape. Tranquillity would be reduced with the addition of buses on the busway and noise, activity and additional lighting in the car park. The overall magnitude of impact would be moderate adverse due to impacts on St Neots Road and the Waterworks site.	There would be a loss of farmland, trees and screening vegetation as a result of the construction of the Proposed Scheme. The impacts of the new busway would be most noticeable where it passes along the A428 and St Neots Road, due to the removal of existing vegetation, which would open up views of the A428. The busway would be clearly visible from much of the St Neots Road, but it would be separated from the road by a landscape strip and the road itself would not be widened. The Scotland Farm Travel Hub would be visible in oblique views from dwellings on Scotland Road. Mitigation planting would be incorporated into the scheme proposals to reinstate existing screening vegetation and to integrate the busway and car park into the landscape. Tranquillity would be reduced with the addition of buses on the busway and noise, activity and additional lighting in the car park. The overall magnitude of impact would be moderate adverse due to impacts along St Neots Road.	There would be a loss of farmland, trees and screening vegetation as a result of the construction of the Proposed Scheme. Mature trees would be removed to construct the car park at the waterworks site.TheWaterworks Travel Hub would be clearly visible from the open landscape to the south of the waterworks site. Mitigation planting would be incorporated into the scheme proposals to restore the existing screening vegetation and to integrate the busway and car park into the landscape. Tranquillity would be reduced with the addition of buses on the busway and noise, activity and additional lighting in the car park. Mitigation planting would be incorporated to restore the existing screening vegetation and to integrate the busway and car park into the landscape. The overall magnitude of impact would be moderate adverse due to impacts from the Waterworks site.	There would be a loss of farmland and vegetation as a result of the construction of the Proposed Scheme. Tranquillity would be reduced with the additional buses on St Neots Road and noise, activity and additional lighting in the car park. The Scotland Farm Travel Hub would be visible in oblique views from dwellings on Scotland Road, but would not have widespread landscape effects. Mitigation planting would be incorporated into the scheme proposals to reinstate existing screening vegetation and to integrate the car park into the landscape. The overall magnitude and nature impact would be minor adverse.	There would be a loss of farmland, trees and screening vegetation as a result of the construction of the Poposed Scheme. The impacts of the new busway would be most noticeable where it passes along the A428 and St Neots Road, due to the removal of existing vegetation, which would open up views of the A428, and the loss of the rural character of St Neots Road. Mature trees would be removed to construct the car park at the waterworks site and the car park would be clearly visible from the open landscape to the south of the site. Mitigation planting would restore the existing screening vegetation and integrate the busway and car park into the landscape. Tranquillity would be reduced with the addition of buses on the busway and noise, activity and additional lighting in the car park. The overall magnitude of impact would be moderate adverse due to impacts from the Waterworks site.	There would be a loss of farmland, trees and screening vegetation as a result of the construction of the Poposed Scheme. The impacts of the new busway would be most noticeable where it passes along the A428 and St Neots Road, due to the removal of existing vegetation, which would open up views of the A428, and the loss of the rural character of St Neots Road. The car park would be visible in oblique views from dwellings on Scotland Road. Mitigation planting would reinstate existing screening vegetation and integrate the busway and car park into the landscape. Tranquillity would be reduced with the addition of buses on the busway and noise, activity and additional lighting in the car park. The overall magnitude of impact would be minor adverse.

	Criteria	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
Contribution to Quality of Life	Environment impacts - Noise	Traffic noise at source is a function of gradient, road surface, traffic volume, speed and percentage HGVs. In order to achieve an increase in traffic noise of 1dB, in broad terms, a traffic increase of 25% would be necessary. Similarly, in order to achieve an increase of 3dB, existing traffic would have to be doubled. Alternatively, noise changes could also occur as a result of significant changes in flow parameters such as speed and percentage HGV etc. This Option is unlikely to result in significant changes in traffic (and therefore noise) on the existing road network. Where this Option is adjacent to an existing road such as A428, noise from the latter is likely to predominate and significant impacts are unlikely to result. Where this Option is adjacent to, or on more lightly-trafficked roads, such as those on its route within Upper Camborne and Great Camborne, noise from public transport is likely to be audible at nearest properties. Noise from traffic within the Waterworks Park and Ride has the potential to be audible at the rear of nearest properties, although it is likely to be of minor adverse effect and can be reduced with mitigation.	Traffic noise at source is a function of gradient, road surface, traffic volume, speed and percentage HGVs. In order to achieve an increase in traffic noise of 1dB, in broad terms, a traffic increase of 25% would be necessary. Similarly, in order to achieve an increase of 3dB, existing traffic would have to be doubled. Alternatively, noise changes could also occur as a result of significant changes in flow parameters such as speed and percentage HGV etc. This Option is unlikely to result in significant changes in traffic (and therefore noise) on the existing road network. Where this Option is adjacent to an existing road such as A428, noise from the latter is likely to predominate and significant impacts are unlikely to result. Where this Option is adjacent to, or on more lightly-trafficked roads, such as those on its route within Upper Camborne and Great Camborne, noise from public transport is likely to be audible at nearest properties. Noise from traffic within the Scotland Farm Park and Ride has the potential to be audible at the rear of nearest properties fronting Scotland Road, although it is likely to be of minor adverse effect and can be reduced with mitigation.	The impact is not different to Option 1a.	The impact is not different to Option 1b.	The impact is not different to Option 1a.	The impact is not different to Option 1b.
	Environment impacts - Air Quality	All scheme options follow the same route west of Wellington Way, this is the section of the scheme that is in closest proximity to the highest number of receptors in Cambourne. Traffic changes for each of the scheme options are likely to be similar, and therefore changes in air quality at these receptors would consistent. The changes in traffic would likely lead to a small deterioration in air quality in this area as there would the additional emissions from the buses. However, due to the frequency of the bus movements any changes are expected to be de minimis, would not cause significant changes in concentrations, and would not significantly alter the net present value of the scheme. Option one, the off-road segregated route affects slightly fewer receptors than the on-road options due to the section that would be located north of St Neots Road, and therefore fewer receptors are affected in the Hardwick and Highfields Court areas. Receptors to the south of St Neots Road may experience a slight reduction in air quality with options two and three in comparison to option one, due to the buses operating in closer proximity to them on St Neots Road, rather than north of St Neotts Road as in option one. However, considering the number of buses using the busway and the distances to the receptors any air quality deteriorations may be off-set by an overall reduction in traffic due to a model shift. Any of these	The impact is not different to Option 1a.	The impact is not different to Option 1a.	The impact is not different to Option 1a.	The impact is not different to Option 1a.	The impact is not different to Option 1a.
	Environmental impacts - CO2 emissions	Without a full assessment of modelled traffic data, it is not possible to determine the direction of change or the magnitude of change due to some of the scheme elements. As such it is not possible to state which options are expected to result in the highest or lowest operational emissions - this will be assessed within the Environmental Assessment Report when a full WebTAG assessment is undertaken (if this scheme option is taken forward)	Without a full assessment of modelled traffic data, it is not possible to determine the direction of change or the magnitude of change due to some of the scheme elements. As such it is not possible to state which options are expected to result in the highest or lowest operational emissions - this will be assessed within the Environmental Assessment Report when a full WebTAG assessment is undertaken (if this scheme option is taken forward)	Without a full assessment of modelled traffic data, it is not possible to determine the direction of change or the magnitude of change due to some of the scheme elements. As such it is not possible to state which options are expected to result in the highest or lowest operational emissions - this will be assessed within the Environmental Assessment Report when a full WebTAG assessment is undertaken (if this scheme option is taken forward)	Without a full assessment of modelled traffic data, it is not possible to determine the direction of change or the magnitude of change due to some of the scheme elements. As such it is not possible to state which options are expected to result in the highest or lowest operational emissions - this will be assessed within the Environmental Assessment Report when a full WebTAG assessment is undertaken (if this scheme option is taken forward)	Without a full assessment of modelled traffic data, it is not possible to determine the direction of change or the magnitude of change due to some of the scheme elements. As such it is not possible to state which options are expected to result in the highest or lowest operational emissions - this will be assessed within the Environmental Assessment Report when a full WebTAG assessment is undertaken (if this scheme option is taken forward)	Without a full assessment of modelled traffic data, it is not possible to determine the direction of change or the magnitude of change due to some of the scheme elements. As such it is not possible to state which options are expected to result in the highest or lowest operational emissions - this will be assessed within the Environmental Assessment Report when a full WebTAG assessment is undertaken (if this scheme option is taken forward)
	Environmental impacts – Biodiversity	There would be a loss of farmland, trees and screening vegetation as a result of the construction of the Proposed Scheme. The impacts of the busway will be most noticeable where it passes along St Neots Road, due to the loss of existing vegetation (opening up views of the A428) and the widening of the road corridor. The busway would be clearly visible from much of the St Neots Road, but it would be separated from the road by a landscape strip and St Neots Road would not be widened. Mature trees would be lost to construct the car park and it would be clearly visible from the open landscape to the south of the waterworks site. Mitigation planting would be incorporated into the scheme proposals to restore the existing screening vegetation and to integrate the busway and car park into the landscape. Tranquillity would be reduced with the addition of buses on the busway and noise, activity and additional lighting in the car park. The overall magnitude of impact would be moderate adverse.	There would be a loss of farmland, trees and screening vegetation as a result of the construction of the Proposed Scheme. The impacts of the new busway would be most noticeable where it passes along the A428 and St Neots Road, due to the removal of existing vegetation which would open up views of the A428. The busway would be clearly visible from much of the St Neots Road, but it would be separated from the road by a landscape strip and the road itself would not be widened. The car park would be visible in oblique views from dwellings on Scotland Road. Mitigation planting would be incorporated into the scheme proposals to reinstate existing screening vegetation and to integrate the busway and car park into the landscape. Tranquillity would be reduced with the addition of buses on the busway and noise, activity and additional lighting in the car park. The overall magnitude of impact would be minor adverse.	There would be an overall moderate adverse effect on biodiversity as a result of Option 2a. No effects are anticipated for statutory or non-statutory sites. Option 2a is largely on-road, but would result in habitat loss of areas of grassland, arable and hedgerow. Waterworks park and ride site would cause the loss of tall ruderal, grassland, plantation which has high invertebrate interest, trees with high bat potential and reptile likely present. No effects on statutory or non-statutory sites are expected. The proposed works, without appropriate mitigation, have the potential to adversely affect bats, reptiles, badgers, great crested newts, invertebrates and nesting birds through the loss, fragmentation and isolation of habitats.	There would be an overall moderate adverse effect on biodiversity as a result of Option 2. No effects are anticipated for statutory or non-statutory sites. Option 2 is largely on-road, but would result in habitat loss of areas of grassland, arable and hedgerow. Scotland Farm site for the park and ride site is on an arable site, which has not been accessed to survey. The proposed works, without appropriate mitigation, have the potential to adversely affect bats, reptiles, badgers, great crested newts, invertebrates and nesting birds through the loss, fragmentation and isolation of habitats.	There would be an overall moderate adverse effect on biodiversity as a result of Option 3a. No effects are anticipated for statutory or non-statutory sites. Option 3a will in habitat loss of plantation woodland, arable, grassland and hedgerows. Waterworks park and ride site would cause the loss of tall ruderal, grassland, plantation which has high invertebrate interest, trees with high bat potential and reptile likely present. The proposed works, without appropriate mitigation, have the potential to adversely affect bats, reptiles, badgers, great crested newts, invertebrates and nesting birds through the loss, fragmentation and isolation of habitats.	There would be an overall minor adverse effect on biodiversity as a result of Option 3b. No effects are anticipated for statutory or non-statutory sites. Option 3b will in habitat loss of plantation woodland, arable, grassland and hedgerows. Scotland Farm site for the park and ride site is on an arable site, which has not been accessed to survey. The proposed works, without appropriate mitigation, have the potential to adversely affect bats, reptiles, badgers, great crested newts, invertebrates and nesting birds through the loss, fragmentation and isolation of habitats.

	Criteria	Option 1a	Option 1b	Option 2a	Option 2b	Option 3a	Option 3b
	Environmental impacts – Heritage	In summary a moderate adverse impact is predicted to unknown archaeological remains within the proposed option area through the construction of the option. Where remains are present they will be removed by necessary excavations. Although the form, nature and extent of potential remains is unknown there is regionally significant archaeology within the vicinity of the proposed option and the area is considered to have a moderate to high archaeological potential in areas outside of the existing road corridor and the A428	The impact is not different to Option 1a.	The impact is not different to Option 1a.	The impact is not different to Option 1a.	The impact is not different to Option 1a.	The impact is not different to Option 1a.
	Environmental impacts – Green Belt	The Park and Ride site at the Waterworks is in the Green Belt. Approximately 1.2km of the first part of the route is in the Green Belt and comes out of the Green Belt after the Scotland Farm roundabout. As the route is in an existing highway	The impact is not different to Option 1a.	The impact is not different to Option 1a.	The impact is not different to Option 1a.	The impact is not different to Option 1a.	The impact is not different to Option 1a.
	Safety	Although a safety audit has not been completed, it is assumed that there is no safety impact on the route. All constructions are expected highway features.	Although a safety audit has not been completed, it is assumed that there is no safety impact of the route. All constructions are expected highway features.	Although a safety audit has not been completed, it is assumed that there is no safety impact of the route. All constructions are expected highway features.	Although a safety audit has not been completed, it is assumed that there is no safety impact of the route. All constructions are expected highway features.	At junctions of Hardwick, traffic will have to cross bus lane and one lane of highway to turn right. This is assumed to have a greater risk.	At junctions of Hardwick, traffic will have to cross bus lane and one lane of highway to turn right. This is assumed to have a greater risk.
	Accessibility	By connecting the route to existing and proposed housing in Hardwick, Bourn Airfield and Cambourne this option provides links from users to key employment locations.	By connecting the route to existing and proposed housing in Hardwick, Bourn Airfield and Cambourne this option provides links from users to key employment locations.	By connecting the route to existing and proposed housing in Hardwick, Bourn Airfield and Cambourne this option provides links from users to key employment locations.	By connecting the route to existing and proposed housing in Hardwick, Bourn Airfield and Cambourne this option provides links from users to key employment locations.	By connecting the route to existing and proposed housing in Hardwick, Bourn Airfield and Cambourne this option provides links from users to key employment locations.	By connecting the route to existing and proposed housing in Hardwick, Bourn Airfield and Cambourne this option provides links from users to key employment locations.
Scheme Deliverability	Scheme Cost	Option 1 is 1.7X the lowest cost option (2a and b)	Option 1 is 1.7X the lowest cost option (2a and b)	Option 2 is the lowest cost option	Option 2 is the lowest cost option	Option 3 is 1.5x the lowest cost option	Option 3 is 1.5x the lowest cost option
	Engineering feasibility - construction method	Normal construction methods will be used.	Normal construction methods will be used.	Normal construction methods will be used.	Normal construction methods will be used.	Normal construction methods will be used.	Normal construction methods will be used.
	Land acquisition required	Land required for Waterworks P&R and longer offline route	Land required for Scotland Farm P&R and longer offline route	Land required for Waterworks P&R, offline and widening route	Land required for Scotland Farm P&R, offline and widening route	Land required for Waterworks P&R, offline and widening route	Land required for Scotland Farm P&R, offline and widening route
	Impact on local road network during construction	There will be a medium impact on the local road network due to the bus receiving priority at junctions.	There will be a medium impact on the local road network due to the bus receiving priority at junctions.	There will be a slight impact from additional busses on the road network	There will be a slight impact from additional busses on the road network	There will be a significant impact on the local road network due to the busses receiving priority at junctions. This is expected to be a bigger impact compared to option 1 due to the number and type of junction design.	There will be a significant impact on the local road network due to the busses receiving priority at junctions. This is expected to be a bigger impact compared to option 1 due to the number and type of junction design.
	Future-proofing	As the route is fully off-road it will support future schemes.	As the route is fully off-road it will support future schemes.	This option provide no support to future schemes.	This option provide no support to future schemes.	This option provide support to future schemes with minor junction changes required.	This option provide support to future schemes with minor junction changes required.
	Legislative Powers	Route would require an amendment of a secondary legislation to implement	Route would require an amendment of a secondary legislation to implement	Work would be with the highway boundary	Work would be with the highway boundary	Work would be with the highway boundary	Work would be with the highway boundary
	Scheme Maintenance and Renewals	Lowest maintenance and renewal cost	Lowest maintenance and renewal cost	10% higher maintenance cost in comparison with Option 1	10% higher maintenance cost in comparison with Option 2	50% higher maintenance cost in comparison with Option 1	50% higher maintenance cost in comparison with Option 2
Stakeholder Support	Public acceptability	48% of the respondents preferred Option 1. However only 17% said they preferred Water Works P&R	48% of the respondents preferred Option 1, with 63% preferring Scotland Farm P&R	39% of the respondents preferred Option 2. However only 17% said they preferred Water Works P&R	39% of the respondents preferred Option 2, with 63% preferring Scotland Farm P&R	20% of the respondents preferred Option 3. However only 17% said they preferred Water Works P&R	20% of the respondents preferred Option 3, with 63% preferring Scotland Farm P&R

D. Base Year Traffic Model Validation

MOTT MACDONALD

Cambridge D-Series Base Model Review

11 November 2019

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Cambridge D-Series Base Model Review

11 November 2019

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	11 November 2019	M Rose	G Goble	H M Clarke	Issue for Approval

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Information class: Standard

Contents

1 Introduction

In October 2018, the Cambridge Sub-Regional Model 2 D-Series Highway Local Model Validation Report was received from Atkins in conjunction with base year SATURN networks, matrices and a summary validation/calibration spreadsheet.

This report provides an overview of the model set up and analyses the D-Series base year traffic model performance against calibration/validation criteria in three areas around Cambridge for which further assessments are anticipated. These include:

- A428/A1303 Cambourne to Cambridge corridor,
- A10/A1309: Foxton to Cambridge corridor and
- A1307: Linton to Cambridge corridor.

The model is well validated at a strategic level but for looking at local schemes it was considered sensible to see if any further minor improvements were possible at the local level.

In chapter 4 the report describes which improvements and adjustments were made to the AM, interpeak and PM models to create the best base model for a consistent forecasting approach.

Changes to the A428/A1303 and A10/A1309 corridors were consistent with previous changes made to the C-series base model, previously documented in two separate technical notes.

2 SATURN Highway Model

2.1 Model Setup

The CSRM2 D-series base model represents an average November 2015 weekday. The time periods include AM peak 08:00-09:00, interpeak average 10:00-16:00 and PM peak 17:00-18:00.

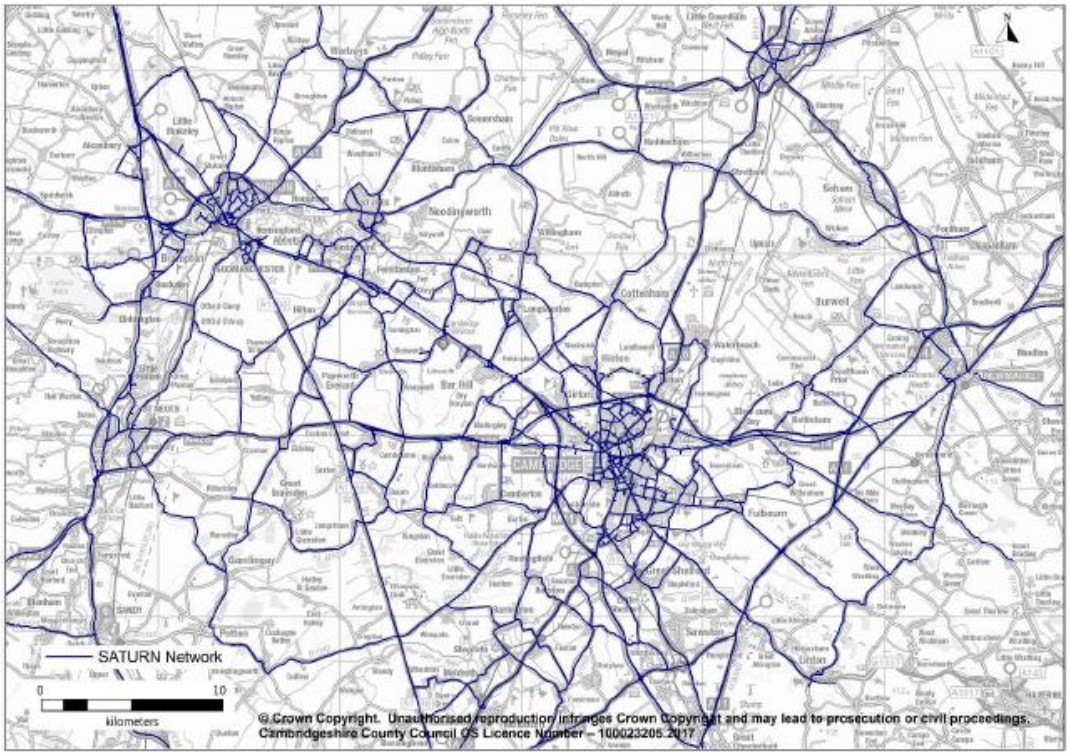
The SATURN model includes 12 user classes taking account of vehicle types, travel purpose and income category. SATURN version 11.4.07H was used.

Seven Park & Ride (P&R) sites were included in the model. Demand for these sites was based on surveys carried out at each site. This data was considered more accurate and replaced mobile phone data for these zones. In addition, bus routes are coded in the model in line with the P&R bus routes.

2.2 Network

Figure 2.1 illustrates the area covered by the simulation network.

Figure 2.1: Network Structure - Simulation Area



Source: Figure 4-13, October 2018 Cambridge Sub-Regional Model 2 D-Series Highway Local Model Validation Report

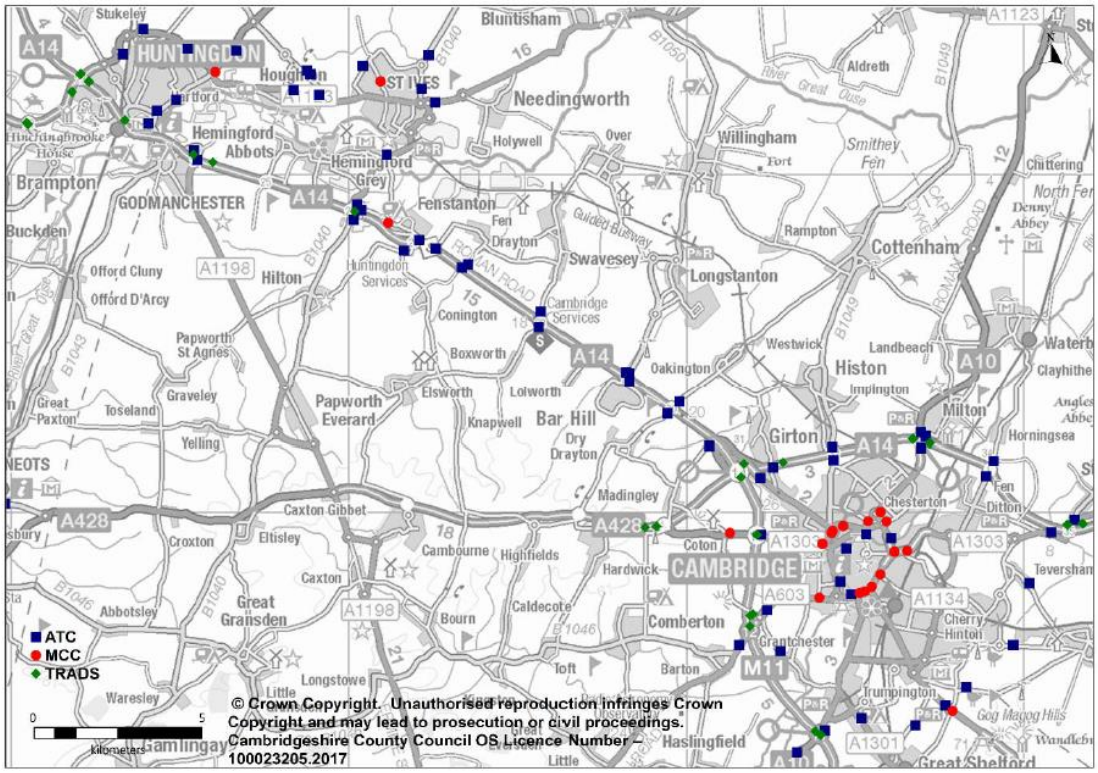
2.3 Zone System

The model zoning system includes 456 zones with smaller detailed zones within Cambridge and zones covering larger areas in the rural surrounding areas.

2.4 Traffic Data

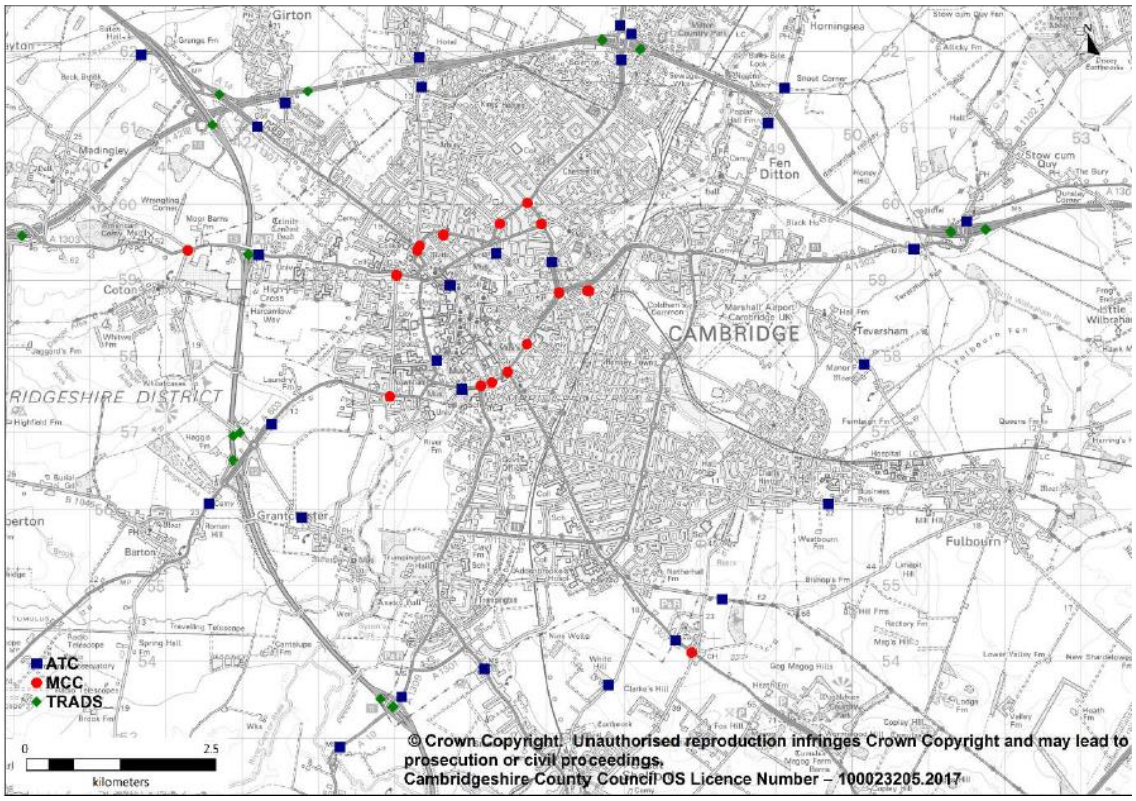
The following figures from the D-Series Local Model Validation Report (LMVR) show the location of the count data used in the model building. Count data was converted to an average November weekday if collected during an alternative time-frame.

Figure 2.2: Calibration Count Sites – Cambridge, Huntingdon & A14



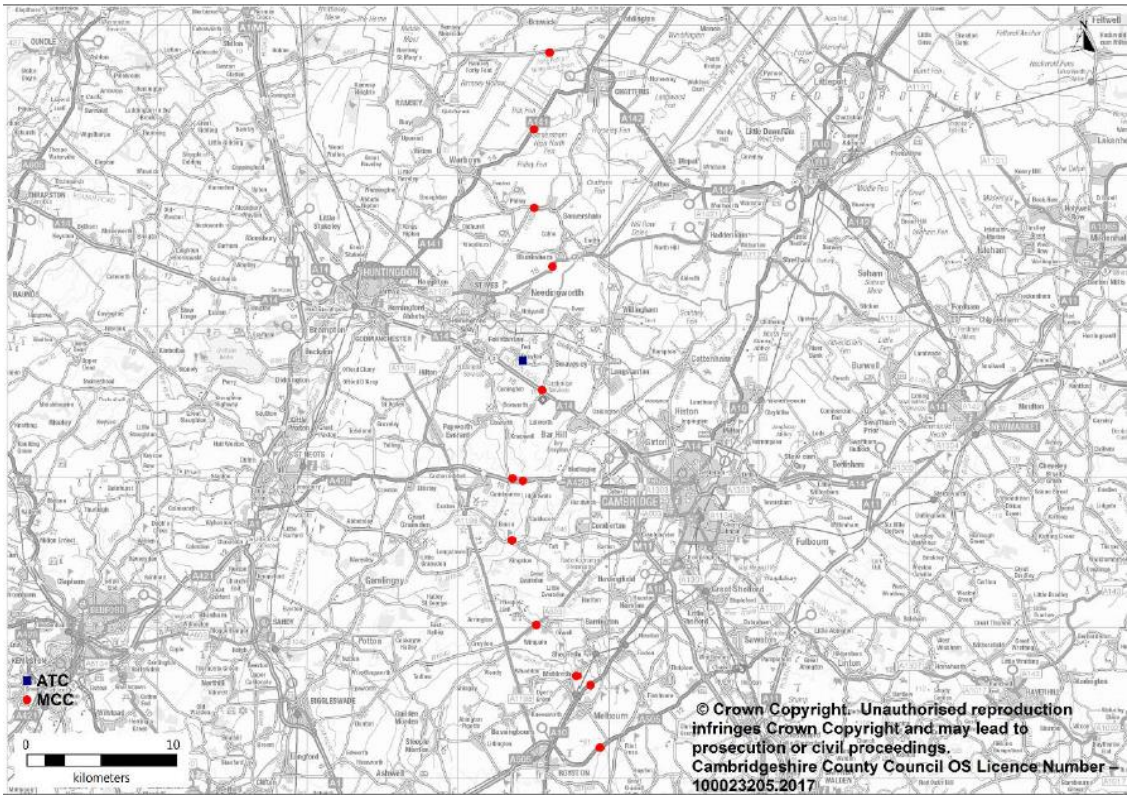
Source: Figure 5-2, October 2018 Cambridge Sub-Regional Model 2 D-Series Highway Local Model Validation Report

Figure 2.3: Calibration Count Sites – Cambridge



Source: Figure 5-3, October 2018 Cambridge Sub-Regional Model 2 D-Series Highway Local Model Validation Report

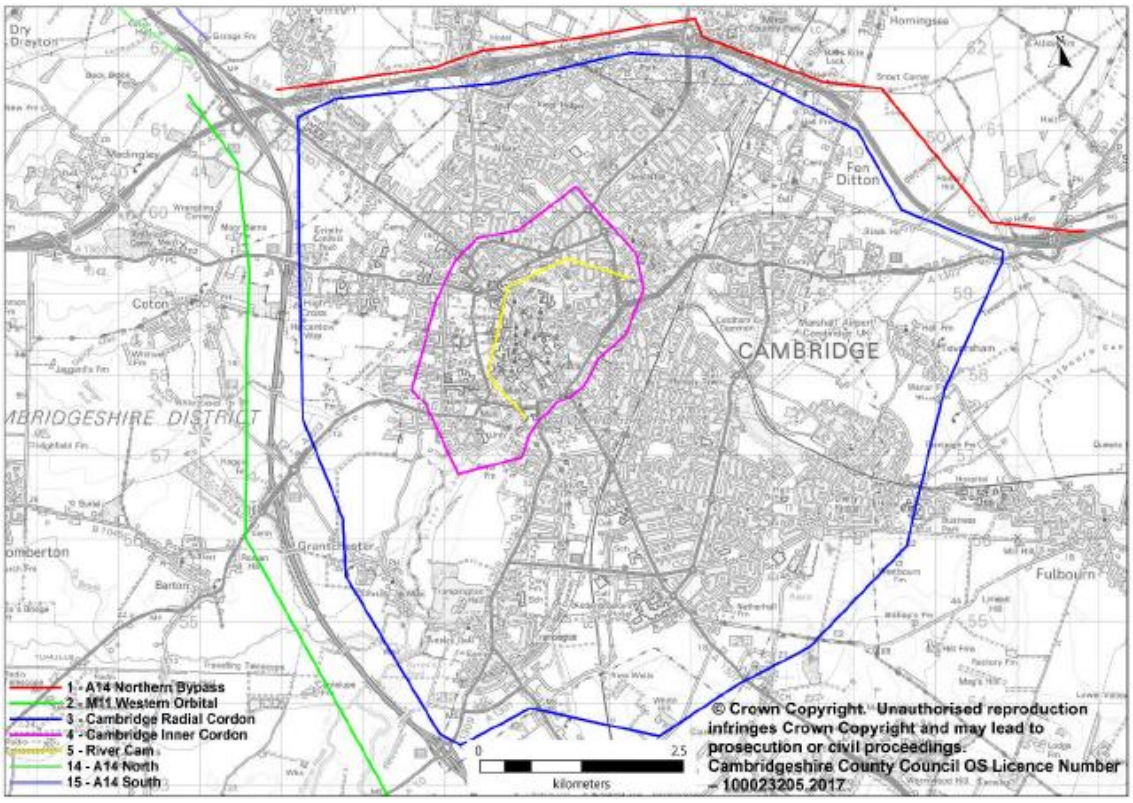
Figure 2.4: Validation Count Sites



Source: Figure 5-4, October 2018 Cambridge Sub-Regional Model 2 D-Series Highway Local Model Validation Report

The count data above was organised into several screenlines and cordons, as shown in Figure 2.5.

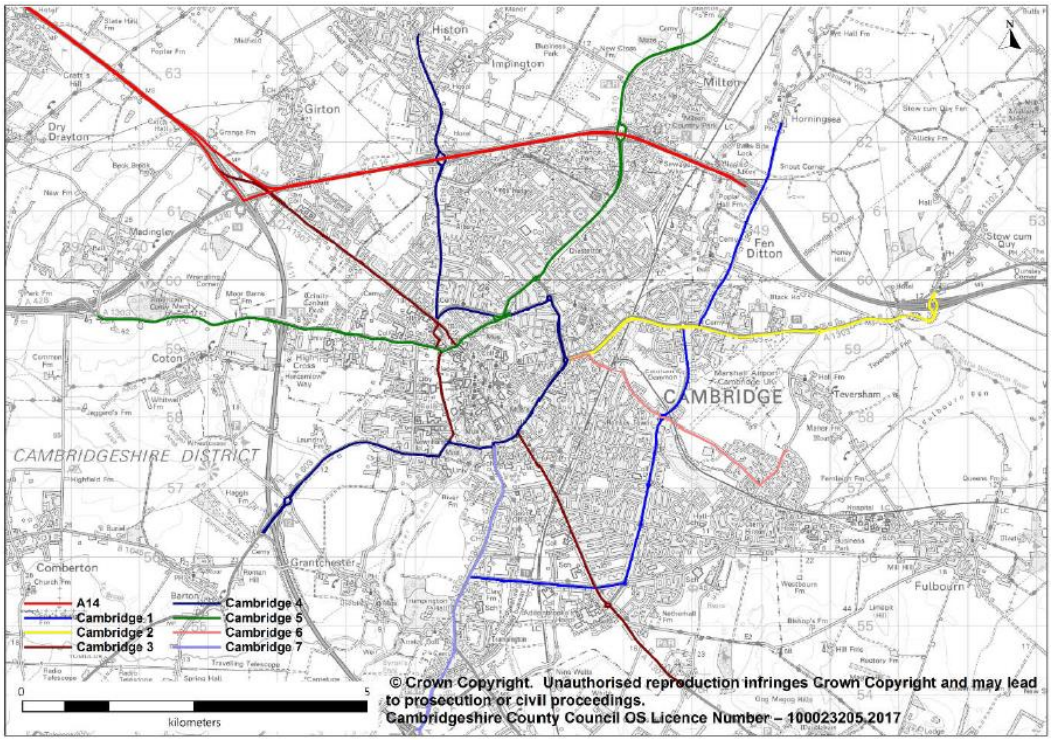
Figure 2.5: Flow Calibration Screenline and Cordon Locations



Source: Figure 8-4, October 2018 Cambridge Sub-Regional Model 2 D-Series Highway Local Model Validation Report

In addition to the count data, 2015 Traffic Master data was used to provide observed journey times along specific routes in the model area. Figure 2.6 shows the journey time routes in Cambridge.

Figure 2.6: Journey Time Validation Routes – Cambridge



Source: Figure 5-6, October 2018 Cambridge Sub-Regional Model 2 D-Series Highway Local Model Validation Report

3 D-Series received Model

3.1 Overall calibration/validation

This section details the calibration levels for the model as received.

Table 3.1 to Table 3.3 show the overall calibration and validation statistics for the whole D-series model for each time period separately.

Table 3.1: Screenline Criteria

Screenline Criteria	AM	IP	PM
Links - GEH* <5	77%	81%	72%
Links - GEH <7	84%	88%	83%
Links - WebTAG Flow Criteria	82%	87%	77%
Calibration Screenline - Flow Difference <5%	68%	68%	57%
Validation Screenline - Flow Difference <5%	50%	100%	50%

Source: M:\A1307 Cambridge\SATURN\Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2.xls

*The GEH statistic is a measure of 'goodness of fit' of a traffic model. A value less than 5.0 is considered to represent a good fit.

Table 3.2: Calibration screenlines

Calibration	AM		IP		PM	
	Total	%	Total	%	Total	%
Total number of screenlines	28	-	28	-	28	-
Total flow difference across all screenlines	-5,750	-6%	-2,983	-4%	-6,214	-6%
Screenlines with flow difference <5%	18	64%	19	68%	15	54%
Screenlines with flow difference < 7.5%	21	75%	21	75%	22	79%
Screenlines with GEH <5	21	75%	26	93%	21	75%

Source: M:\A1307 Cambridge\SATURN\Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2.xls

Table 3.3: Validation screenlines

Validation	AM		IP		PM	
	Total	%	Total	%	Total	%
Total number of screenlines	2	-	2	-	2	-
Total flow difference across all screenlines	-749	-5%	-95	-1%	840	5%
Screenlines with flow difference <5%	1	50%	2	100%	1	50%
Screenlines with flow difference < 7.5%	2	100%	2	100%	1	50%
Screenlines with GEH <5	1	50%	2	100%	1	50%

Source: M:\A1307 Cambridge\SATURN\Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2.xls

3.2 Traffic Flow calibration/validation

Count locations for all three areas of interest are located across three of the calibration screenlines/cordons shown in Figure 2.5, namely the Cambridge Radial Cordon, the Cambridge Inner Cordon and the M11 western orbital screenline and the North-South validation screenline shown in Figure 2.4.

The following tables indicates how well these four screenlines/cordons perform overall in each modelled time period for all vehicles. In the AM peak, total flows across each of the screenlines/cordons meet the criteria in both directions apart from eastbound flow across the north-south screenline which is too low.

In the interpeak, total flows across each of the screenlines/cordons meet the criteria in both directions except for outbound flows on the radial cordon where modelled flows are too high.

In the PM peak, inbound flows on the radial cordon and westbound flows on the M11 screenline are too low. Eastbound flows on the M11 screenline and the North-South screenline are too high.

Table 3.4: AM Peak Screenline/Cordon Validation

Screenline/Cordon	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
Cambridge Radial Cordon	Inbound	14,295	13,847	-448	-3%	√	√	√
	Outbound	7,256	7,647	391	5%	√	x	√
Cambridge Inner Cordon	Inbound	7,789	7,412	-378	-5%	√	x	√
	Outbound	5,459	5,494	35	1%	√	√	√
M11 western orbital screenline	Eastbound	4,487	4,615	129	3%	√	√	√
	Westbound	2,895	2,923	28	1%	√	√	√
North-South Screenline	Eastbound	8,520	7,918	-602	-7%	x	x	x
	Westbound	7,606	7,460	-147	-2%	√	√	√

Source: D-series_Base_HAM_Validation_Summary_v1.0_ForIssue.xls

Table 3.5: Interpeak Screenline/Cordon Validation

Screenline/Cordon	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
Cambridge Radial Cordon	Inbound	6,759	6,810	51	0%	√	x	√
	Outbound	6,460	6,841	381	6%	x	x	x
Cambridge Inner Cordon	Inbound	4,792	4,692	-101	-2%	√	√	√
	Outbound	4,491	4,485	-5	0%	√	√	√
M11 western orbital screenline	Eastbound	1,686	1,756	70	4%	√	√	√
	Westbound	1,657	1,693	36	2%	√	√	√
North-South Screenline	Eastbound	5,450	5,420	-31	-1%	√	√	√
	Westbound	5,702	5,639	-64	-1%	√	√	√

Source: D-series_Base_HAM_Validation_Summary_v1.0_ForIssue.xls

Table 3.6: PM Peak Screenline/Cordon Validation

Screenline/Cordon	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
Cambridge Radial Cordon	Inbound	8,463	7,988	-475	-6%	x	x	x
	Outbound	13,771	13,540	-231	-2%	√	√	√
Cambridge Inner Cordon	Inbound	6,313	6,159	-154	-2%	√	√	√
	Outbound	7,412	7,142	-269	-4%	√	√	√
M11 western orbital screenline	Eastbound	2,726	3,109	383	14%	x	x	x
	Westbound	4,872	4,571	-301	-6%	x	x	x
North-South Screenline	Eastbound	7,666	8,354	688	9%	x	x	x
	Westbound	8,880	9,031	151	2%	√	√	√

Source: D-series_Base_HAM_Validation_Summary_v1.0_ForIssue.xls

The tables below contain a comparison of the modelled and observed flows at the individual count sites along the 3 corridors.

The majority of counts meet the WebTAG validation criteria well. Modelled flows at Coton Road in both directions, eastbound at Grantchester and outbound at Cherry Hinton road are too high in the AM peak.

In the interpeak there are several locations with no count data available. Modelled flows at Hauxton inbound and Coton inbound as well as Cherry Hinton outbound and Bourne Airfield westbound are too high

In the PM peak modelled flows at Babraham inbound, Granham outbound and Coton in both directions are too high while Hauxton Road modelled flows are too low in both directions.

Table 3.7: AM Peak Corridor Count Validation

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
A428 corridor								
St Neots Road	EB	226	280	54	24%	√	√	√
	WB	186	121	-66	-35%	√	x	√
A428 Bourne Airfield - east of Cambourne	EB	1,981	1,791	-190	-10%	√	√	√
	WB	1,155	1,274	119	10%	√	√	√
A428, between A1303 and M11-A14	EB	1,616	1,531	-85	-5%	√	√	√
	WB	787	795	9	1%	√	√	√
A1303 Madingley Road west of M11	EB	596	652	56	9%	√	√	√
	WB	481	499	18	4%	√	√	√
A1303 east of M11	WB	385	387	2	1%	√	√	√
	EB	1,105	1,109	4	0%	√	√	√
A1303 Madingley Road - west of Grange Rd	WB	607	623	16	3%	√	√	√
	EB	773	737	-36	-5%	√	√	√
A10/A1309 corridor								
A10 (just south of M11), Hauxton	EB	894	975	81	9%	√	√	√
	WB	985	969	-16	-2%	√	√	√
Hauxton Rd	OUT	960	905	-55	-6%	√	√	√
	IN	1,704	1,639	-65	-4%	√	√	√
Grantchester Road	EB	108	279	171	159%	x	x	x
	WB	106	106	0	0%	√	√	√
Coton Rd	IN	436	291	-145	-33%	x	x	x
	OUT	71	235	164	231%	x	x	x
A1307 corridor								
Babraham Rd	OUT	588	579	-9	-1%	√	√	√
	IN	518	613	95	18%	√	√	√
Granhams Rd	IN	278	283	5	2%	√	√	√
	OUT	94	129	35	37%	√	√	√
Cherry Hinton Road (N)	IN	611	623	12	2%	√	√	√
	OUT	337	468	131	39%	x	x	x
Worts' Causeway	OUT	78	84	6	8%	√	√	√
	IN	142	243	101	71%	x	x	x

Source: D-series_Base_HAM_Validation_Summary_v1.0_ForIssue.xls

Table 3.8: Interpeak Corridor Count Validation

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
A428 corridor								
St Neots Road	EB	121	125	5	4%	√	√	√
	WB	121	81	-40	-33%	√	√	√
A428 Bourne Airfield - east of Cambourne	EB	825	966	141	17%	x	√	√
	WB	853	1078	224	26%	x	x	x
A428, between A1303 and M11-A14	EB	568	590	22	4%	√	√	√
	WB	600	617	17	3%	√	√	√
A1303 Madingley Road west of M11	EB	No data available						
	WB	No data available						
A1303 Madingley Road, east of M11	WB	438	445	7	2%	√	√	√
	EB	478	486	8	2%	√	√	√
A1303 Madingley Road - west of Grange Rd	WB	No data available						
	EB	No data available						
A10/A1309 corridor								
A10 (just south of M11), Hauxton	EB	640	645	6	1%	√	√	√
	WB	606	613	7	1%	√	√	√
Hauxton Rd	OUT	897	852	-45	-5%	√	√	√
	IN	994	668	-326	-33%	x	x	x
Grantchester Road	EB	No data available						
	WB	No data available						
Coton Rd	IN	96	243	147	153%	x	x	x
	OUT	80	141	61	77%	√	x	√
A1307 corridor								

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
Babraham Rd	OUT	439	418	-21	-5%	√	√	√
	IN	453	425	-28	-6%	√	√	√
Granhams Rd	IN	113	163	50	44%	√	√	√
	OUT	113	154	41	36%	√	√	√
Cherry Hinton Road (N)	IN	46	257	211	462%	x	x	x
	OUT	46	314	269	589%	x	x	x
Worts' Causeway	OUT	62	66	4	6%	√	√	√
	IN	64	62	-3	-4%	√	√	√

Source: D-series_Base_HAM_Validation_Summary_v1.0_ForIssue.xls

Table 3.9: PM Peak Corridor Count Validation

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
A428 corridor								
A428 Cambridge Road - St Neots Road	EB	175	189	15	8%	√	√	√
	WB	203	179	-24	-12%	√	√	√
A428 Bourne Airfield - east of Cambourne	EB	1253	1417	164	13%	√	√	√
	WB	2301	2049	-252	-11%	√	x	√
A428, between A1303 and M11-A14	EB	815	945	130	16%	x	√	√
	WB	1357	1276	-81	-6%	√	√	√
A1303 Madingley Road west of M11	EB	508	514	6	1%	√	√	√
	WB	1185	871	-314	-26%	x	x	x
A1303 Madingley Road, east of M11	WB	960	1057	97	10%	√	√	√
	EB	409	423	14	3%	√	√	√
A1303 Madingley Road - west of Grange Rd	WB	575	639	64	11%	√	√	√
	EB	536	564	28	5%	√	√	√
A10/A1309 corridor								
A10 (just south of M11), Hauxton	EB	742	778	35	5%	√	√	√
	WB	952	964	12	1%	√	√	√
Hauxton Rd	OUT	1759	1311	-448	-25%	x	x	x
	IN	1081	677	-404	-37%	x	x	x
Grantchester Road	EB	75	118	43	57%	√	√	√

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
	WB	130	198	68	52%	√	x	√
Coton Rd	IN	88	214	126	143%	x	x	x
	OUT	238	594	356	150%	x	x	x
A1307 corridor								
Babraham Rd	OUT	878	691	-187	-21%	x	x	x
	IN	611	625	14	2%	√	√	√
Granhams Rd	IN	115	260	145	126%	x	x	x
	OUT	231	230	-1	0%	√	√	√
Cherry Hinton Road (N)	IN	366	391	25	7%	√	√	√
	OUT	632	646	14	2%	√	√	√
Worts' Causeway	OUT	195	199	5	2%	√	√	√
	IN	62	61	-1	-2%	√	√	√

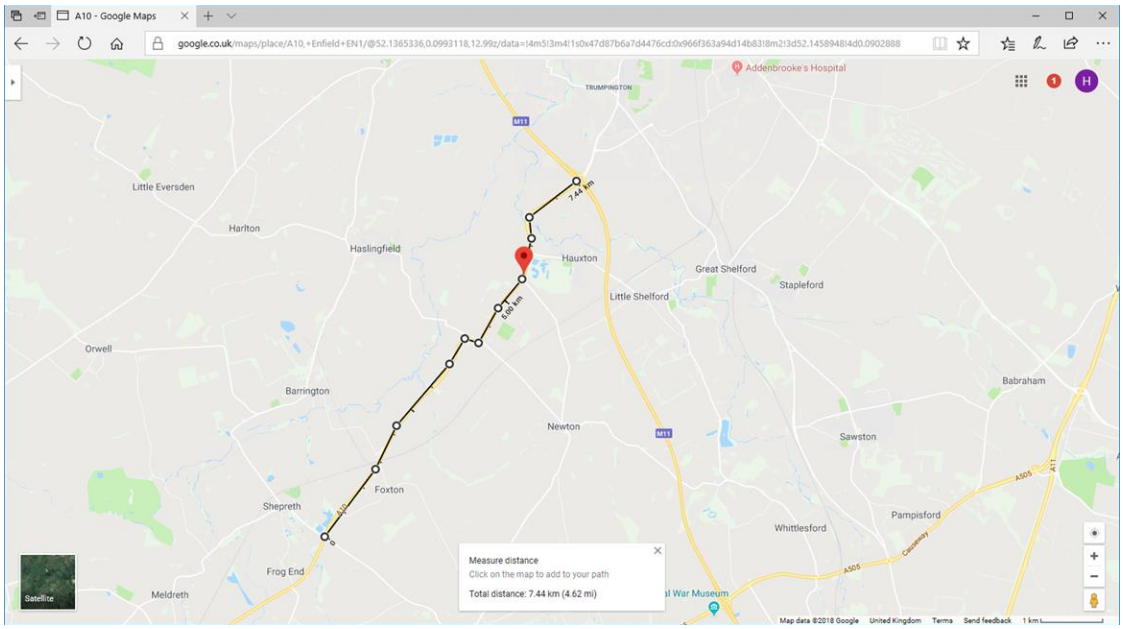
Source: D-series_Base_HAM_Validation_Summary_v1.0_ForIssue.xls

3.3 Journey Time validation

The journey time routes reviewed as part of the D-series model development cover the main routes of interest along the A428, A1303 and A1307 as shown in Figure 2.6. However, for the strategic model the routes are longer than is necessary when concentrating on specific local areas. In the case of the A428 the Cambridge 5 route continues all the way to Milton. Similarly, Cambridge 3 route extends from Oakington to Babraham P&R.

The Cambridge 7 route runs from M11J11 along the A1309 into Cambridge. However proposed schemes along this corridor extend out along the A10 to Foxton Therefore an additional route along the A10 through Foxton to M11 J11 was set up as shown in Figure 3.1.

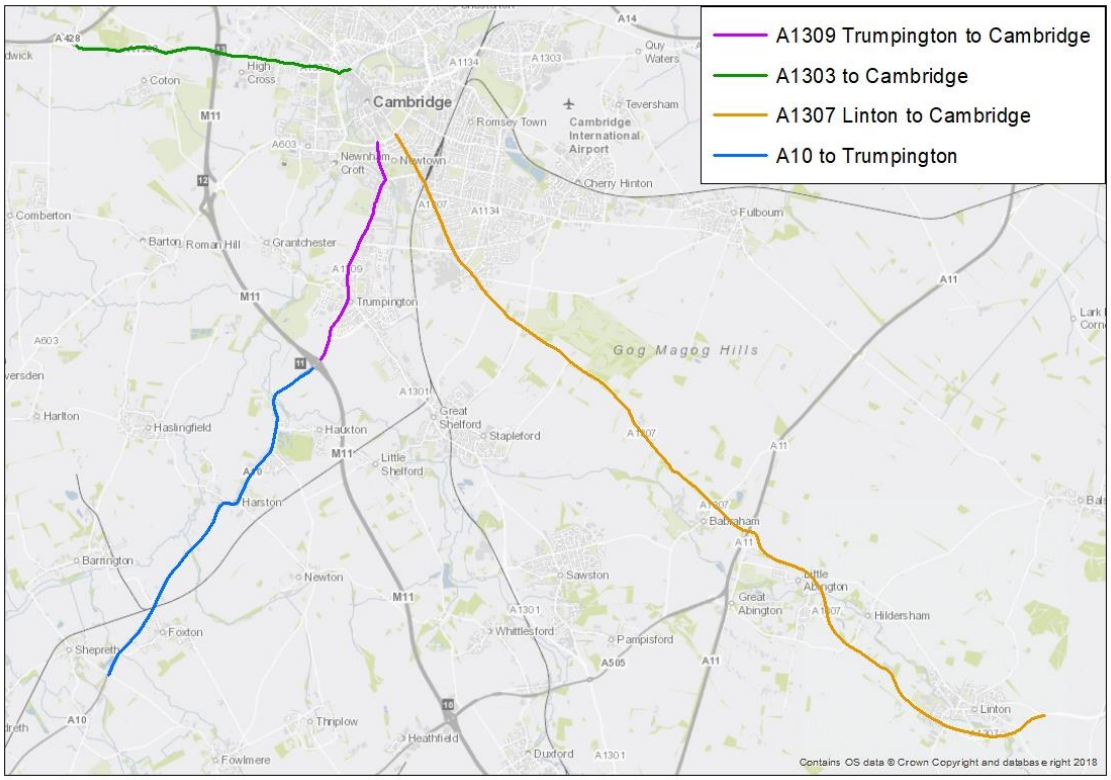
Figure 3.1: A10 journey time route



Source: Google Maps

In order to achieve a better understanding of how well journey times perform in the areas of interest the provided routes were adjusted. The A1303 route was shortened to stop at Cambridge centre, while the A1307 route was extended to just east of Linton.

Figure 3.2: Revised Journey Time routes



Source: Mott MacDonald

Assessing these routes some of the observed journey times appeared counter-intuitive but, on investigation, it appeared that there was roadworks in place during 2015. Therefore, the observed Traffic Master journey time data was replaced with November 2016 data for all adjusted routes.

Table 3.10 to Table 3.12 show that several of the routes do not meet the required criteria of a maximum 15% difference between modelled and observed journey times. In particular the route from Trumpington along the A10 southbound is modelled too slow due to long delays at the M11 Junction 11 in the model. While the A1307 AM inbound route is modelled too fast the PM outbound direction is modelled too slow.

Graphs for each of the routes and time periods are shown in **Appendix A**. These were used to identify exactly where along each route changes were required in the received models.

Table 3.10: AM Peak Journey Time Route Validation

Route	Observed Year	Modelled (mins:secs)	Observed (mins:secs)	Difference (mins:secs)	% difference	Within 15% (or 60 secs if higher)
A10 to Trumpington NB	2016	18:36	14:05	04:31	32%	x
A10 to Trumpington SB	2016	16:04	10:07	05:57	59%	x
Trumpington to Cambridge - NB	2016	14:57	14:07	00:50	6%	√
Cambridge to Trumpington SB	2016	10:58	11:15	-00:17	-3%	√
A428 - to Cambridge	2016	19:27	20:09	-00:42	-4%	√
Cambridge to A428	2016	10:23	10:51	-00:28	-4%	√
Linton to Cambridge (Via A1307)	2016	32:06	43:22	-11:16	-26%	x
Cambridge to Linton (via A1307)	2016	25:31	27:35	-02:04	-8%	√

Source: JT validation_v2_DseriesOrg.xls

Table 3.11: Interpeak Journey Time Route Validation

Route	Observed Year	Modelled (mins:secs)	Observed (mins:secs)	Difference (mins:secs)	% difference	Within 15% (or 60 secs if higher)
A10 to Trumpington NB	2016	12:54	11:16	01:38	15%	√
A10 to Trumpington SB	2016	12:37	10:22	02:15	22%	x
Trumpington to Cambridge - NB	2016	09:58	10:11	-00:13	-6%	√
Cambridge to Trumpington SB	2016	10:15	10:34	-00:19	-3%	√
A428 - to Cambridge	2016	10:33	08:51	01:42	19%	x
Cambridge to A428	2016	08:02	09:06	-01:04	-12%	√
Linton to Cambridge (Via A1307)	2016	26:21	23:34	02:47	12%	√
Cambridge to Linton (via A1307)	2016	24:59	22:18	02:41	12%	√

Source: JT validation_v2_DseriesOrg.xls

Table 3.12: PM peak Journey Time Route Validation

Route	Observed Year	Modelled (mins:secs)	Observed (mins:secs)	Difference (mins:secs)	% difference	Within 15% (or 60 secs if higher)
A10 to Trumpington NB	2016	13:09	09:54	03:15	33%	x
A10 to Trumpington SB	2016	24:08	10:36	13:32	128%	x
Trumpington to Cambridge - NB	2016	10:54	11:07	-00:13	-2%	√
Cambridge to Trumpington SB	2016	12:16	11:59	00:17	2%	√
A428 - to Cambridge	2016	16:33	13:17	03:16	25%	x
Cambridge to A428	2016	09:20	10:25	-01:05	-10%	√
Linton to Cambridge (Via A1307)	2016	28:16	29:16	01:00	-3%	√
Cambridge to Linton (via A1307)	2016	34:59	27:45	07:14	26%	x

Source: JT validation_v2_DseriesOrg.xls

4 D-Series Amended Model

4.1 Network edits

Several network changes were made to achieve a better and consistent base model for all three areas of Cambridge. This included additional road links in the A428 area, adjusting junction layouts such as number of lanes, amending speed flow curves to match journey times more accurately and signal timing adjustments. The following section provides an overview of added links, but a full list of amendments made can be found in Appendix B.

The network structure included in the A428/A3103 corridor contains most of the relevant roads required to assess an improved bus service between Cambourne and Cambridge. Additional network links were added to ensure all proposed options could be assessed effectively, namely:

- Charles Babbage Road / JJ Thompson Avenue
- Network around Cambourne
- South of A1303 and west of Grange Road
- St Neots Road
- Missing rat-runs such as Dry Drayton Road

In order to represent these areas adequately 2 model zones were split.

Further, a separate zone was set up for the John Lewis collection point accessible via the Trumpington P&R. This is to ensure P&R trips can be separated from the collection point trips and forecasted separately. Using the ANPR data all in/out trips lasting less than 1 hour were defined as collection point trips, while all others were defined P&R users.

Also, a new zone was added to represent Babraham Research Centre off the A1307 as turning movements at the roundabout are anticipated to become more important during forecasting

The final amended model zone numbers therefore increased to 460.

4.2 Overall calibration/validation

The tables below show the final statistics achieved for calibration and validation.

The screenline criteria have improved for calibration flow differences below 5% and link GEH statistics. Total flow difference across all calibration screenlines has reduced for all time periods.

Table 4.1: Screenline Criteria

Screenline Criteria	AM	IP	PM
Links – GEH* <5	79%	84%	76%
Links – GEH <7	86%	90%	85%
Links – WebTAG Flow Criteria	85%	89%	81%
Calibration Screenline – Flow Difference <5%	71%	75%	64%
Validation Screenline – Flow Difference <5%	50%	100%	50%

Source: M:\A1307 Cambridge\SATURN\D_series_update\AM\ Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2_Wov1_AM (011).xls

*The GEH statistic is a measure of 'goodness of fit' of a traffic model. A value less than 5.0 is considered to represent a good fit.

Table 4.2: Calibration screenlines

Calibration	AM		IP		PM	
	Total	%	Total	%	Total	%
Total number of screenlines	28	-	28	-	28	-
Total flow difference across all screenlines	-2,626	-2%	-1,535	-2%	-2,905	-3%
Screenlines with flow difference <5%	18	64%	20	71%	16	57%
Screenlines with flow difference < 7.5%	23	82%	23	82%	23	82%
Screenlines with GEH <5	22	79%	27	96%	23	82%

Source: M:\A1307 Cambridge\SATURN\D_series_update\AM\ Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2_Wov1_AM (011).xls

Table 4.3: Validation screenlines

Validation	AM		IP		PM	
	Total	%	Total	%	Total	%
Total number of screenlines	2	-	2	-	2	-
Total flow difference across all screenlines	-740	-5%	-279	-3%	981	6%
Screenlines with flow difference <5%	1	50%	2	100%	1	50%
Screenlines with flow difference < 7.5%	2	100%	2	100%	1	50%
Screenlines with GEH <5	1	50%	2	100%	1	50%

Source: M:\A1307 Cambridge\SATURN\D_series_update\AM\ Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2_Wov1_AM (011).xls

4.3 Traffic Flow calibration/validation

Table 4.4 to Table 4.6 show the cordon and screenline results for the same screenlines as in chapter 3.2 above. Although in the AM the Cambridge Radial Cordon does now quite meet the GEH statistic in the inbound direction any more as total modelled flows are slightly lower, in the Interpeak and PM models all criteria are now met in both directions for this cordon. In the AM peak the flows for Cambridge Inner Cordon inbound are also lower than before failing the flow criteria.

Table 4.4: AM Peak Screenline/Cordon Validation

Screenline/Cordon	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
Cambridge Radial Cordon	Inbound	14,295	13,804	-491	-3%	√	x	√
	Outbound	7,256	7,646	390	5%	√	x	√
Cambridge Inner Cordon	Inbound	7,789	7,292	-497	-6%	x	x	x
	Outbound	5,459	5,412	-47	-1%	√	√	√
M11 western orbital screenline	Eastbound	4,487	4,335	152	3%	√	√	√
	Westbound	2,895	2,757	138	2%	√	√	√
North-South Screenline	Eastbound	8,520	7,922	-598	-7%	x	x	x
	Westbound	7,606	7,464	-142	-2%	√	√	√

Source: M:\A1307 Cambridge\SATURN\D_series_update\AM\ Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2_Wov1_AM (011).xls

Table 4.5: Interpeak Screenline/Cordon Validation

Screenline/Cordon	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
Cambridge Radial Cordon	Inbound	6,759	6,833	74	1%	√	√	√
	Outbound	6,460	6,437	-23	0%	√	√	√
Cambridge Inner Cordon	Inbound	4,792	4,640	-153	-3%	√	√	√
	Outbound	4,491	4,456	-35	-1%	√	√	√
M11 western orbital screenline	Eastbound	1,686	1,760	74	4%	√	√	√
	Westbound	1,657	1,740	83	5%	√	√	√
North-South Screenline	Eastbound	5,450	5,410	-40	-1%	√	√	√
	Westbound	5,702	5,464	-239	-4%	√	√	√

Source: Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2_Wov1_Ipv8.xls

Table 4.6: PM Peak Screenline/Cordon Validation

Screenline/Cordon	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
Cambridge Radial Cordon	Inbound	8,463	8,622	159	2%	√	√	√
	Outbound	13,771	13,752	-19	0%	√	√	√
Cambridge Inner Cordon	Inbound	6,313	6,265	-48	-1%	√	√	√
	Outbound	7,412	7,035	-376	-5%	√	x	√
M11 western orbital screenline	Eastbound	2,726	3,120	394	14%	x	x	x
	Westbound	4,872	4,551	-322	-7%	x	x	x
North-South Screenline	Eastbound	7,666	8,343	677	9%	x	x	x
	Westbound	8,880	9,184	304	3%	√	√	√

Source: Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2_Wov1_PMv9.xls

The comparison of the flow on individual links along the three corridors of interest are shown below.

For all three time periods significant improvements can be seen across the count locations. Improvements were particularly focused on the locations near the park and ride sites and immediately adjacent to the spinal roads of interest.

In the AM peak improvements have been made to match counts better at Worts' Causeway and Cherry Hinton Road.

Table 4.7: AM Peak Corridor Count Validation

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	%Diff	Flow Criteria	GEH	Overall
A428 corridor								
St Neots Road	EB	2266	2662	396	16%	√	√	√
	WB	1866	944	-922	-50%	√	x	√
A428 near Bourne Airfield	EB	1,981	1,778	-203	-10%	√	√	√
	WB	1,155	1,255	100	9%	√	√	√
A428, between A1303 and M11-A14	EB	1,616	1,500	-115	-7%	√	√	√
	WB	787	782	-4	-1%	√	√	√
A1303 Madingley Road west of M11	EB	5966	6244	278	5%	√	√	√
	WB	4811	4945	134	3%	√	√	√
A1303 Madingley Road east of M11	WB	3855	4088	233	6%	√	√	√
	EB	1,1	1,1	44	0%	√	√	√

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	%Diff	Flow Criteria	GEH	Overall
		105	109					
A1303 Madingley Road – west of Grange Rd	WB	607	603	-4	-1%	√	√	√
	EB	773	713	-60	-8%	√	√	√
A10/A1309 corridor								
A10 (just south of M11), Hauxton	EB	894	1,017	123	14%	√	√	√
	WB	985	1,082	87	10%	√	√	√
Hauxton Rd	OUT	960	994	34	4%	√	√	√
	IN	1,704	1,646	-58	-3%	√	√	√
Grantchester Road	EB	108	266	158	146%	x	x	x
	WB	106	106	0	0%	√	√	√
Coton Rd	IN	436	304	-132	-30%	x	x	x

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	%Diff	Flow Criteria	GEH	Overall
	OUT	71	165	94	132%	√	x	√
A1307 corridor								
Babraham Rd	OUT	588	631	43	7%	√	√	√
	IN	518	617	99	19%	√	√	√
GranhamsRd	IN	278	283	5	2%	√	√	√
	OUT	94	104	10	10%	√	√	√
Cherry Hinton Road (N)	IN	611	606	-5	-1%	√	√	√
	OUT	337	419	82	24%	√	√	√
Worts' Causeway	OUT	78	78	0	0%	√	√	√
	IN	142	204	62	44%	√	√	√

Source: Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2_Wov1_AM(011).xls

There are improvements to the flow at Hauxton Road, Cherry Hinton Road and A428 at Bourn Airfield in the Interpeak.

Table 4.8: Interpeak Corridor Count Validation

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
A428 Corridor								
St Neots Road	EB	121	117	-4	-3%	√	√	√
	WB	121	72	-49	-41%	√	√	√
A428 near Bourne Airfield	EB	825	969	144	18%	x	√	√
	WB	853	912	59	7%	√	√	√
A428, between A1303 and M11-A14	EB	568	579	10	2%	√	√	√
	WB	600	620	20	3%	√	√	√
A1303 Madingley Road west of M11	EB	No data available						
	WB	No data available						
A1303 Madingley Road, east of M11	WB	438	405	-33	-7%	√	√	√
	EB	478	523	45	9%	√	√	√
A1303 Madingley Road – west of Grange Rd	WB	No data available						
	EB	No data available						
A10/A1309 corridor								
A10 (just south of M11), Hauxton	EB	640	709	69	11%	√	√	√
	WB	606	700	94	16%	√	√	√
Hauxton Rd	OUT	897	889	-8	-1%	√	√	√
	IN	994	887	-107	-11%	√	√	√
Grantchester Road	EB	No data available						
	WB	No data available						
Coton Rd	IN	96	242	146	152%	x	x	x
	OUT	80	107	27	34%	√	√	√
A1307 corridor								
Babraham Rd	OUT	439	362	-77	-18%	√	√	√
	IN	453	429	-24	-5%	√	√	√
Granhams Rd	IN	113	147	34	30%	√	√	√
	OUT	113	128	15	14%	√	√	√
Cherry Hinton Road (N)	IN	46	81	36	78%	√	√	√
	OUT	46	134	88	193%	√	x	√
Worts' Causeway	OUT	62	51	-11	-18%	√	√	√
	IN	64	46	-19	-29%	√	√	√

Source: Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2_Wov1_Ipv8.xls

Table 4.9: PM Peak Corridor Count Validation

Count Location	Direction	Total Observed Flow (vehs)	Total Modelled Flow (vehs)	Diff	% Diff	Flow Criteria	GEH	Overall
A428 corridor								
St Neots Road	EB	175	168	-6	-4%	√	√	√
	WB	203	169	-34	-17%	√	√	√
A428 near Bourne Airfield	EB	1,253	1,404	151	12%	√	√	√
	WB	2,301	1,984	-317	-14%	√	x	√
A428, between A1303 and M11-A14	EB	815	921	107	13%	√	√	√
	WB	1,357	1,217	-140	-10%	√	√	√
A1303 Madingley Raod west of M11	EB	508	511	3	1%	√	√	√
	WB	1,185	816	-369	-31%	x	x	x
A1303 Madingley Road, east of M11	WB	960	952	-8	-1%	√	√	√
	EB	409	431	22	5%	√	√	√
A1303 Madingley Road – west of Grange Rd	WB	575	519	-56	-10%	√	√	√
	EB	536	555	19	4%	√	√	√
A10/A1309 corridor								
A10 (just south of M11), Hauxton	EB	742	880	138	19%	x	√	√
	WB	952	1,073	121	13%	√	√	√
Hauxton Rd	OUT	1,759	1,797	38	2%	√	√	√
	IN	1,081	982	-99	-9%	√	√	√
Grantchester Road	EB	75	139	64	86%	√	x	√
	WB	130	225	95	73%	√	x	√
Coton Rd	IN	88	259	171	194%	x	x	x
	OUT	238	396	158	66%	x	x	x
A1307 corridor								
Babraham Rd	OUT	878	799	-79	-9%	√	√	√
	IN	611	693	82	13%	√	√	√
Granhams Rd	IN	115	223	108	94%	x	x	x
	OUT	231	229	-2	-1%	√	√	√
Cherry Hinton Road (N)	IN	366	412	46	13%	√	√	√
	OUT	632	658	26	4%	√	√	√
Worts' Causeway	OUT	195	175	-20	-10%	√	√	√
	IN	62	54	-8	-13%	√	√	√

Source: Assignment_Flow_v4.3_MM_Import_Macro_cor_forDSeries_v2_Wov1_PMv9.xls

In the PM peak the model amendments have achieved improvements at the A10, Babraham Road and Hauxton Road.

4.4 Motorway flows

We also compared the updated modelled flows to the turning count carried out at M11 J11 in April 2018. This was to make sure that the modelled flows were reasonable, although the date of the count is several years later than the modelled base year. The comparison showed that the modelled turning movements at the junction were mostly in proportion with observed data.

Table 4.10: M11/J11 turning count comparison

M11 junction count		Arm A – A1309		Arm B – M11 SE		Arm C – A10		Arm D – M11 NW		Total	
		entry	exit	NB off-slip	SB on-slip	entry	exit	SB off-slip	NB on-slip	entry	exit
0800-0900	observed	868	1,524	428	108	916	850	1,129	859	3,341	3,341
	modelled	990	1,638	283	117	1,014	1,079	1,445	890	3,732	3,724
		14%	7%	-34%	8%	11%	27%	28%	4%	12%	11%
average 1000-1600	observed	987	909	163	201	558	550	639	687	2,347	2,347
	modelled	879	868	365	194	706	697	593	785	2,543	2,544
		-11%	-4%	124%	-4%	26%	27%	-7%	14%	8%	8%
1700-1800	observed	1,814	1,152	216	349	707	924	917	1,229	3,654	3,654
	modelled	1,790	972	303	542	877	1,068	677	1,068	3,647	3,650
		-1%	-16%	40%	55%	24%	16%	-26%	-13%	0%	0%

Source: M:\A1307 Cambridge\Calculations\01 CalibrationChecks\MR Updates M11_WebTRIS_Nov15_plusMCC.xlsx

4.5 Journey Time validation

Most improvements for the amended D-series model have made a visible difference to the journey time validation. The criteria of less than 15% difference between total observed and modelled journey time is met for all routes in the Interpeak. The AM and PM have significant improvements for the A10 route although the southbound direction is still modelled slightly slow,

the amended model matches the observed much better. The PM A428 to city centre route and Cambridge to Linton route are now also within the criteria.

The Linton to Cambridge route has not been validated within the criteria in the AM peak. This is due to an observed travel time that appears unusually high with long delays between Babraham Rd/Cherry Hinton Rd roundabout and the Addenbrooke's Hospital roundabout. This delay only occurs during the AM peak despite observed traffic flow being higher in this direction in the PM peak. This indicates that delays are unlikely to be caused by road works. It is possible that cyclists joining the road just after the P&R or longer stopping buses during the AM peak cause these delays.

However, as traffic levels in the AM peak are modelled within the criteria and journey times are modelled consistently compared to other time periods and directions, the delay has not been replicated artificially by increasing delays at signals or lowering saturation flow inconsistently to the other time periods. Using the models for forecasting and calculating option benefits it is crucial that flows are not overestimated leading to higher benefits and all models are consistent. Underestimating delays would mean an underestimation of benefits and is something that should be considered during benefit analysis.

Table 4.11: AM Peak Journey Time Route Validation

Route	Observed Year	Modelled (mins:secs)	Observed (mins:secs)	Difference (mins:secs)	% difference	Within 15% (or 60 secs if higher)
A10 to Trumpington NB	2016	14:11	14:05	00:06	1%	√
A10 to Trumpington SB	2016	12:09	10:07	02:02	20%	x
Trumpington to Cambridge – NB	2016	15:23	14:07	01:16	9%	√
Cambridge to Trumpington SB	2016	11:50	11:15	00:35	5%	√
A428 to Cambridge	2016	18:25	20:09	-01:44	-9%	√
Cambridge to A428	2016	10:06	10:51	-00:45	-7%	√
Linton to Cambridge (Via A1307)	2016	32:19	43:22	-11:03	-26%	x
Cambridge to Linton (via A1307)	2016	25:42	27:35	-01:53	-7%	√

Source: JT validation_v4.xls

Table 4.12: Interpeak Journey Time Route Validation

Route	Observed Year	Modelled (mins:secs)	Observed (mins:secs)	Difference (mins:secs)	% difference	Within 15% (or 60 secs if higher)
A10 to Trumpington NB	2016	09:51	11:16	-01:25	-13%	√
A10 to Trumpington SB	2016	09:38	10:22	-00:44	-7%	√
Trumpington to Cambridge – NB	2016	09:58	10:11	-00:13	-6%	√
Cambridge to Trumpington SB	2016	10:09	10:34	-00:25	-4%	√
A428 to Cambridge	2016	09:56	08:51	01:05	12%	√
Cambridge to A428	2016	08:04	09:06	-01:02	-11%	√
Linton to Cambridge (Via A1307)	2016	24:30	23:34	00:56	4%	√
Cambridge to Linton (via A1307)	2016	24:08	22:18	01:50	8%	√

Source: JT validation_v4.xls

Table 4.13: Interpeak Journey Time Route Validation

Route	Observed Year	Modelled (mins:secs)	Observed (mins:secs)	Difference (mins:secs)	% difference	Within 15% (or 60 secs if higher)
A10 to Trumpington NB	2016	10:24	09:54	00:30	5%	√
A10 to Trumpington SB	2016	14:23	10:36	03:47	36%	x
Trumpington to Cambridge – NB	2016	10:24	11:07	-00:43	-6%	√
Cambridge to Trumpington SB	2016	13:08	11:59	01:09	10%	√
A428 to Cambridge	2016	15:14	13:17	01:57	15%	√
Cambridge to A428	2016	08:59	10:25	-01:26	-14%	√
Linton to Cambridge (Via A1307)	2016	25:38	29:16	-03:38	-12%	√
Cambridge to Linton (via A1307)	2016	31:35	27:45	03:50	14%	√

Source: JT validation_v4.xls

5 Conclusion

The D-series CSRM SATURN base year models received are well calibrated across the whole Cambridge area. However, the model is anticipated to be used for forecasting and option testing with schemes along the A428/A1303, A10/A1309 Trumpington and A1307 corridors. Small amendments have therefore been made to the model to improve validation of journey times and counts in these areas.

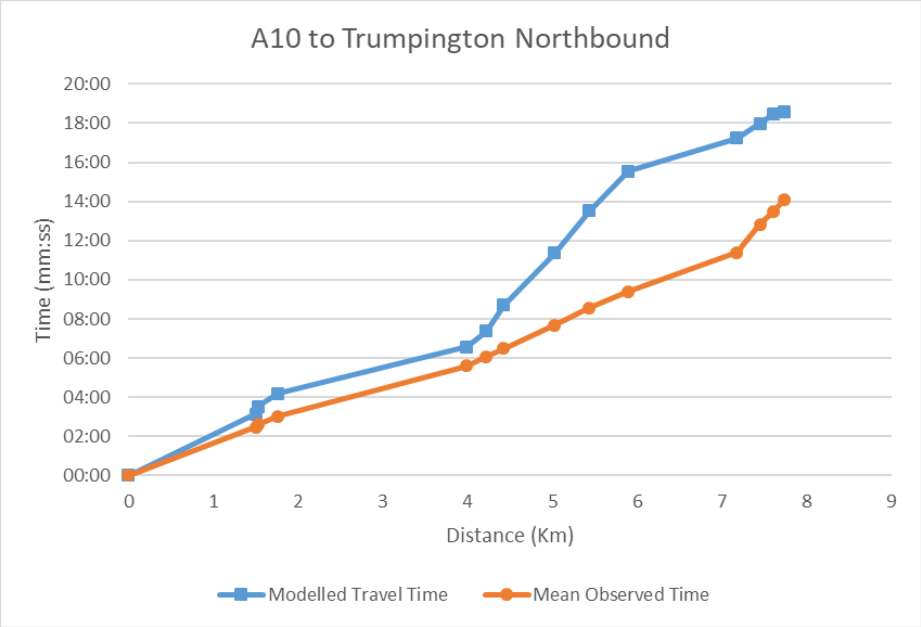
These changes included additional road links in the A428 area, an additional zone to represent the John Lewis collection point at the same location at Trumpington P&R and junction layout adjustments, speed flow curve corrections as well as signal timing changes. Also, a new zone was added to represent Babraham Research Centre off the A1307 as turning movements at the roundabout are anticipated to become more important during forecasting.

The final model represents a more accurate and consistent starting point for forecasting and option testing for the three Cambridge corridors mentioned above.

Appendices

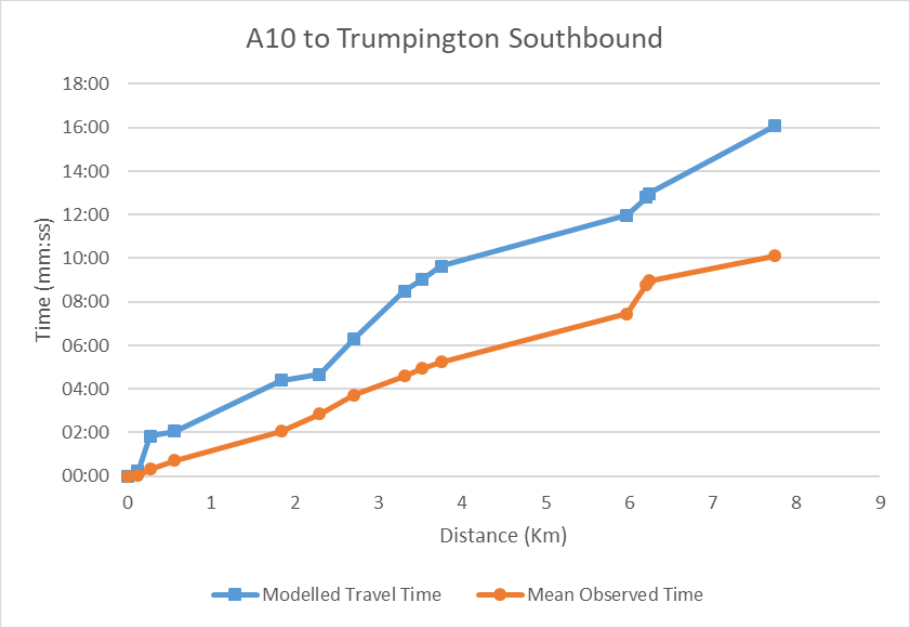
A. Received model journey time graphs

Figure 3: A10 Trumpington Northbound AM



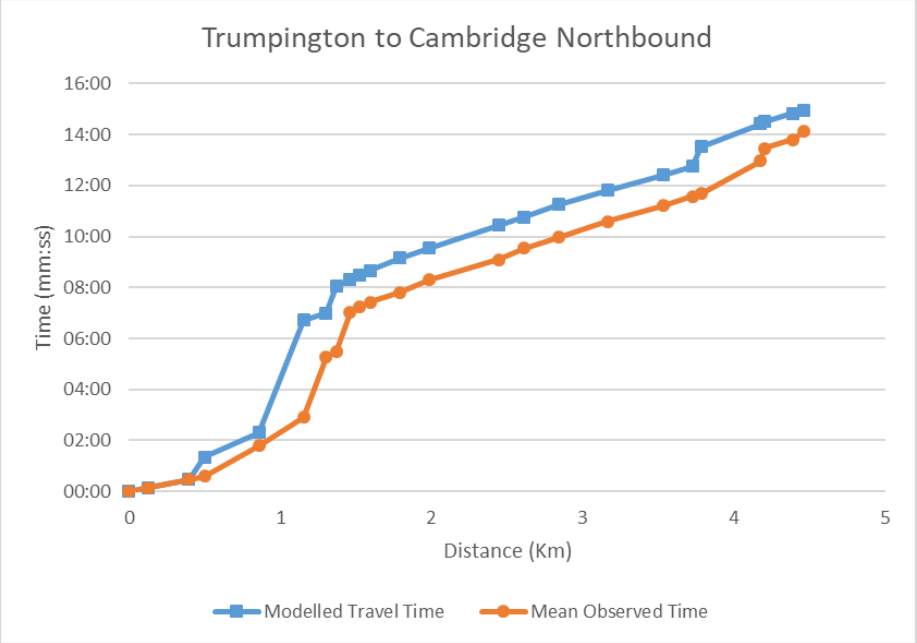
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO – V6_DseriesOrg.xls

Figure 4: A10 to Trumpington SB AM



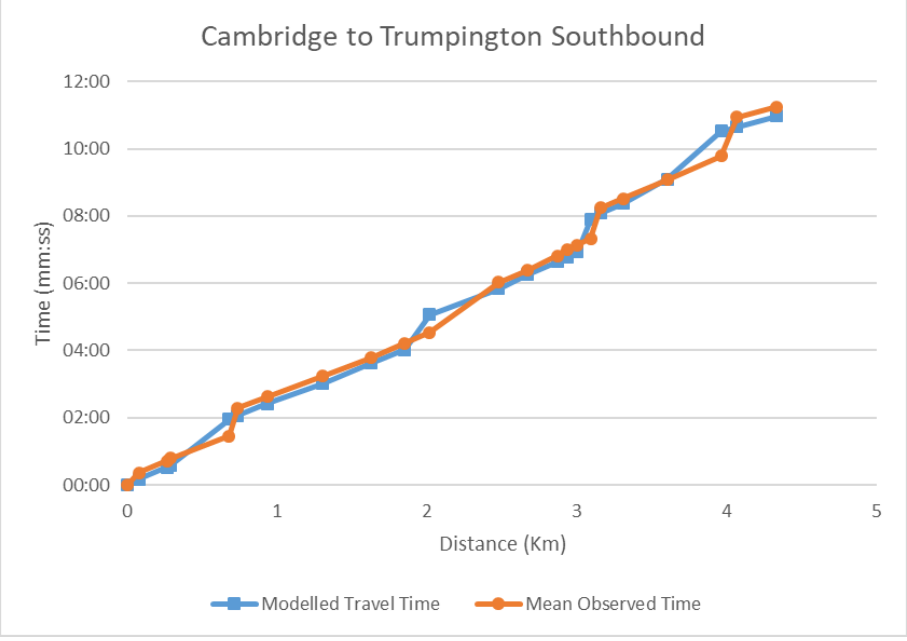
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO – V6_DseriesOrg.xls

Figure 5:Trumpington to Cambridge Northbound AM



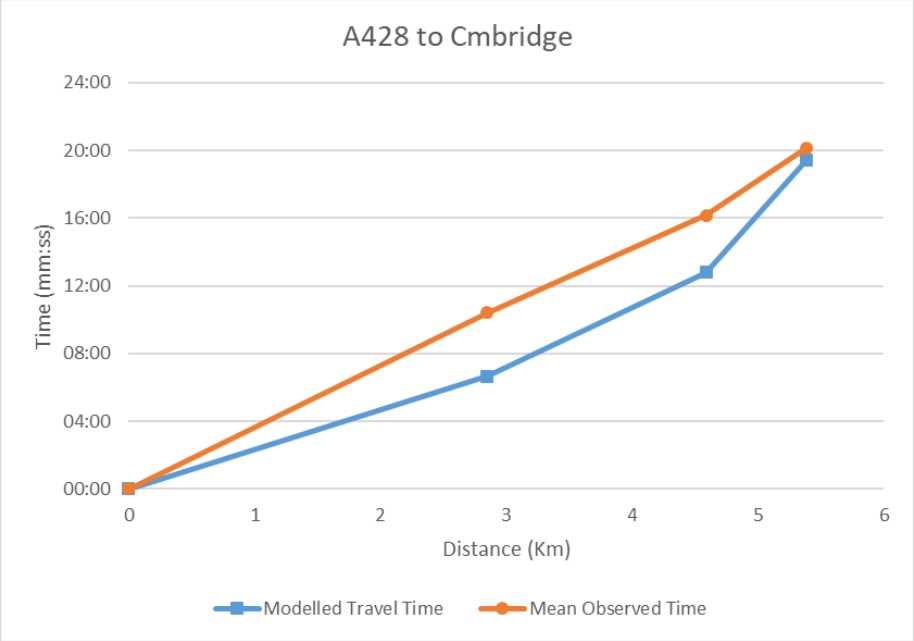
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO – V6_DseriesOrg.xls

Figure 6: Cambridge to Trumpington Southbound AM



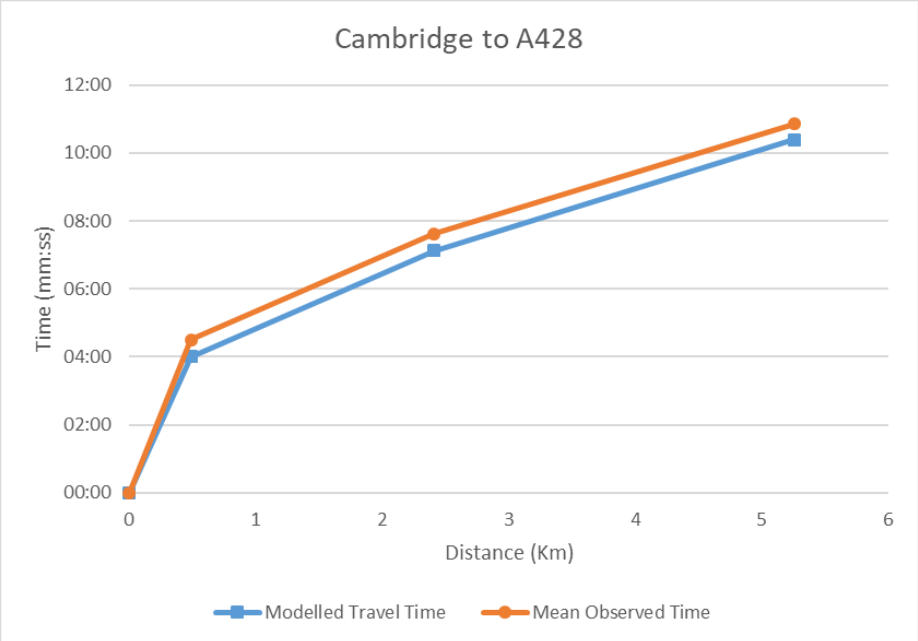
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO – V6_DseriesOrg.xls

Figure 7: A428 to Cambridge AM



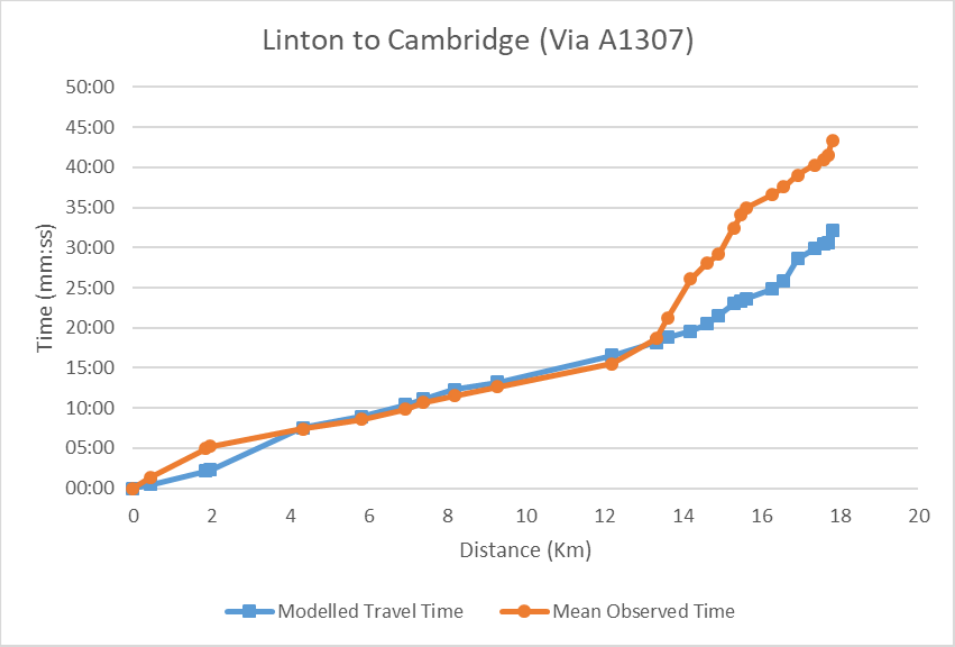
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO – V6_DseriesOrg.xls

Figure 8: Cambridge to A428 AM



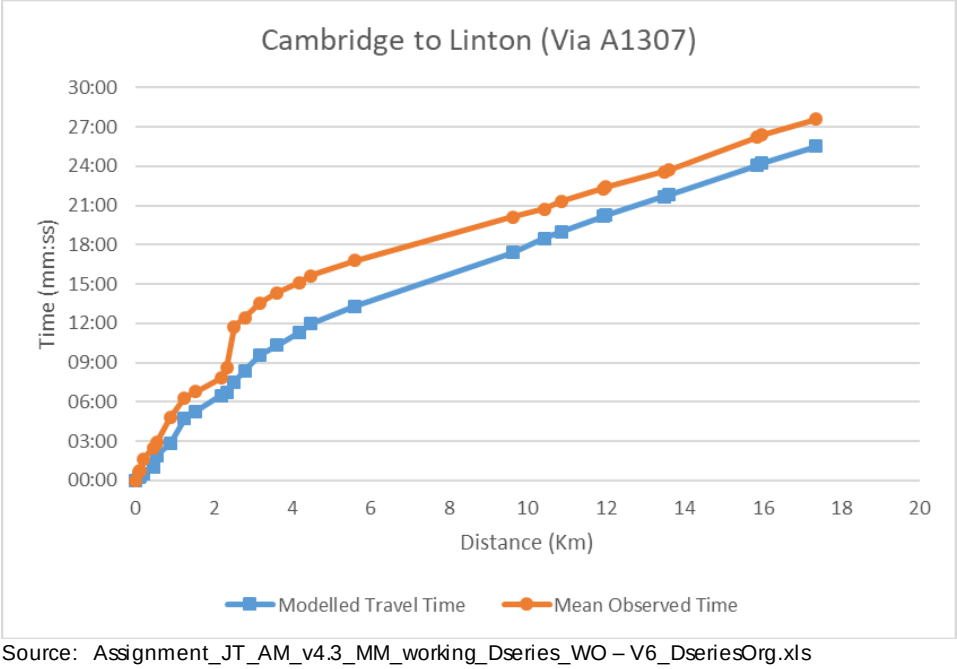
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO – V6_DseriesOrg.xls

Figure 9: Linton to Cambridge (Via A1307) AM



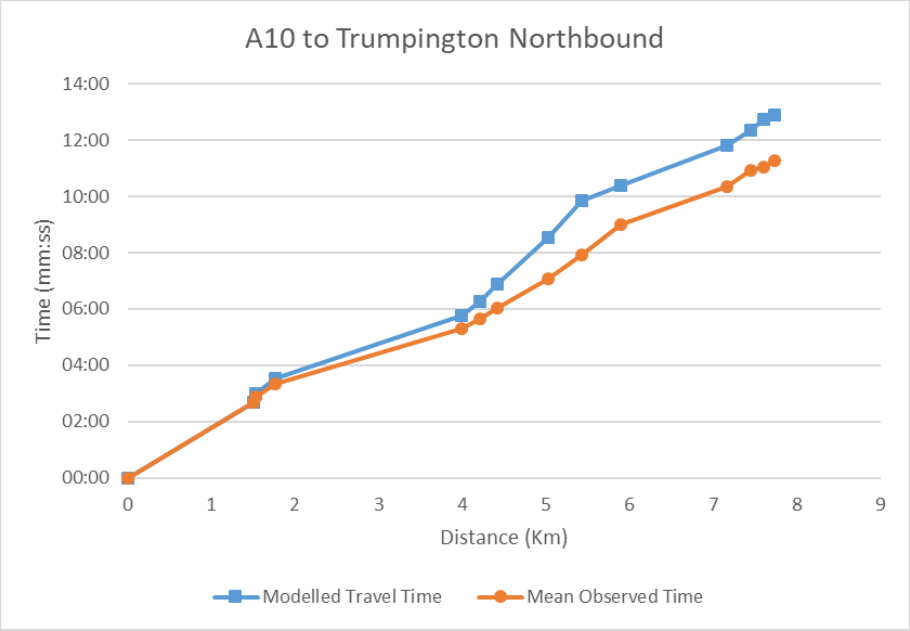
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO – V6_DseriesOrg.xls

Figure 10: Cambridge to Linton (Via A1307) AM



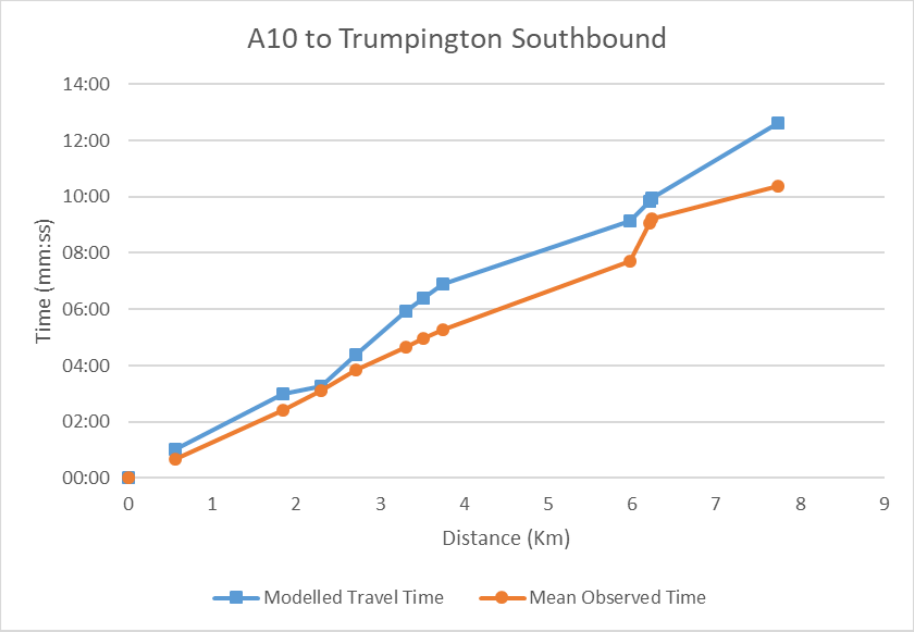
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO – V6_DseriesOrg.xls

Figure 11: A10 Trumpington Northbound IP



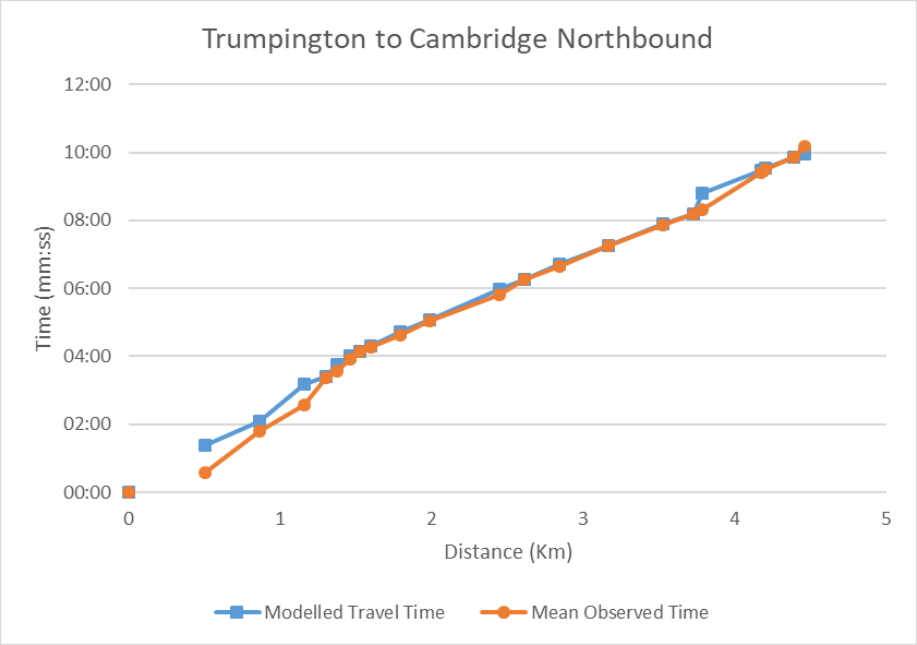
Source: Assignment_JT_IP_v4.3_MM_Wov1_IP_v4_DseriesOrg.xls

Figure 12: A10 to Trumpington SB IP



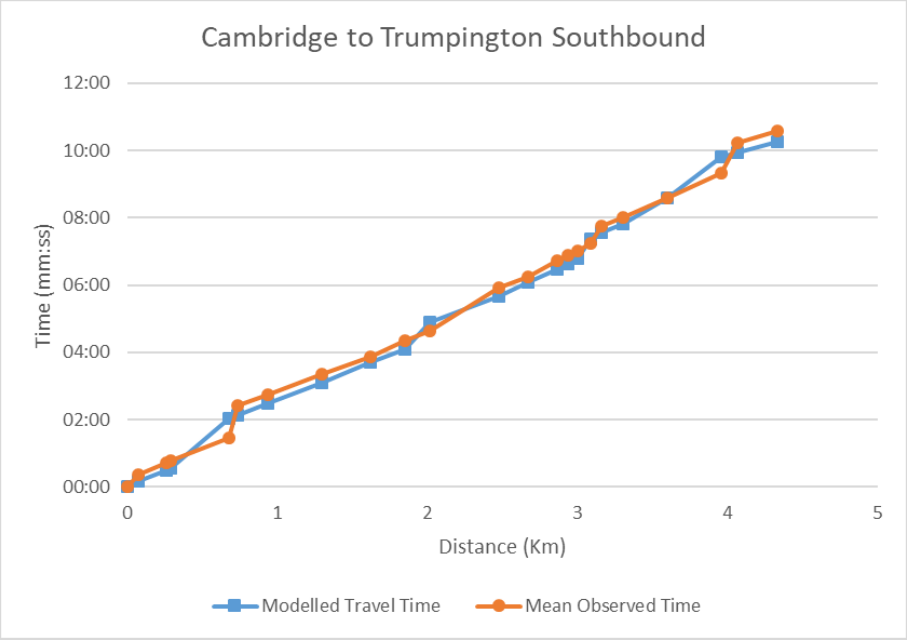
Source: Assignment_JT_IP_v4.3_MM_Wov1_IP_v4_DseriesOrg.xls

Figure 13:Trumpington to Cambridge Northbound IP



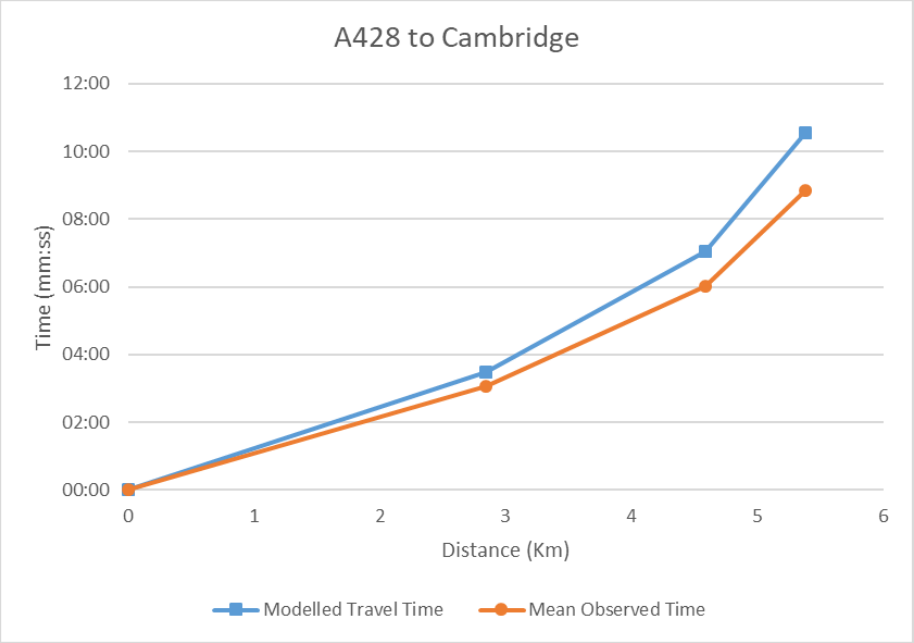
Source: Assignment_JT_IP_v4.3_MM_Wov1_IP_v4_DseriesOrg.xls

Figure 14: Cambridge to Trumpington Southbound IP



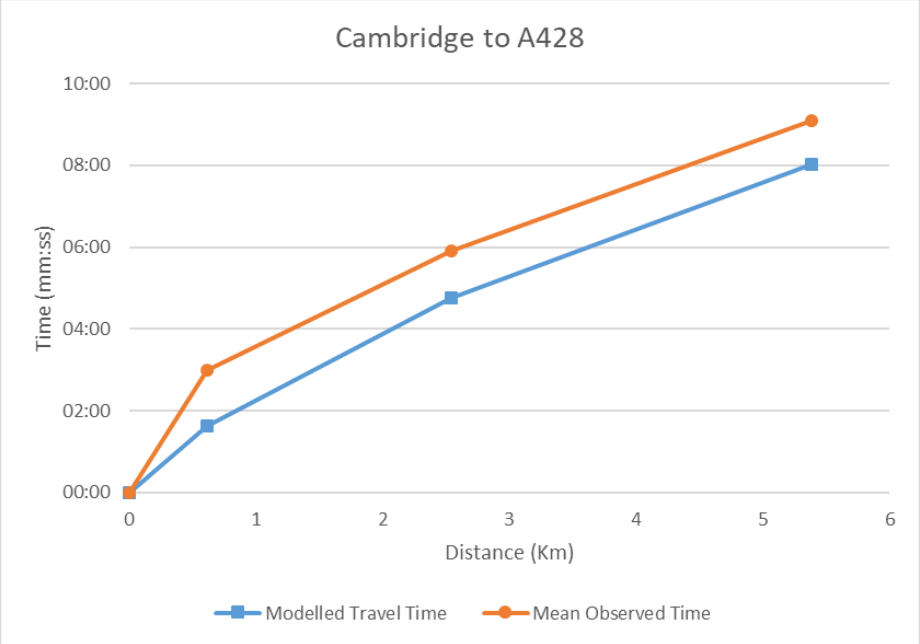
Source: Assignment_JT_IP_v4.3_MM_Wov1_IP_v4_DseriesOrg.xls

Figure 15: A428 to Cambridge IP



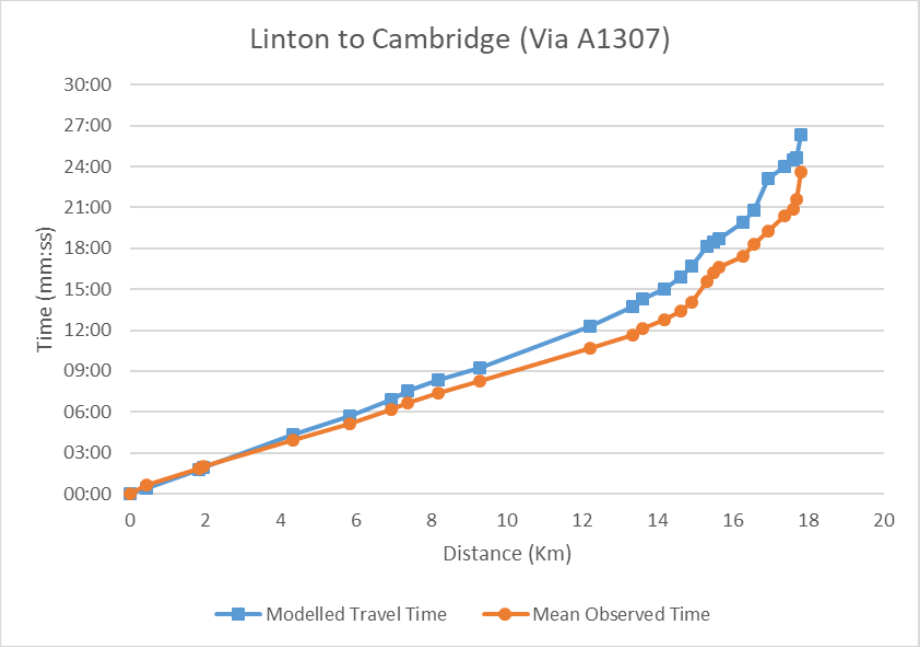
Source: Assignment_JT_IP_v4.3_MM_Wov1_IP_v4_DseriesOrg.xls

Figure 16: Cambridge to A428 IP



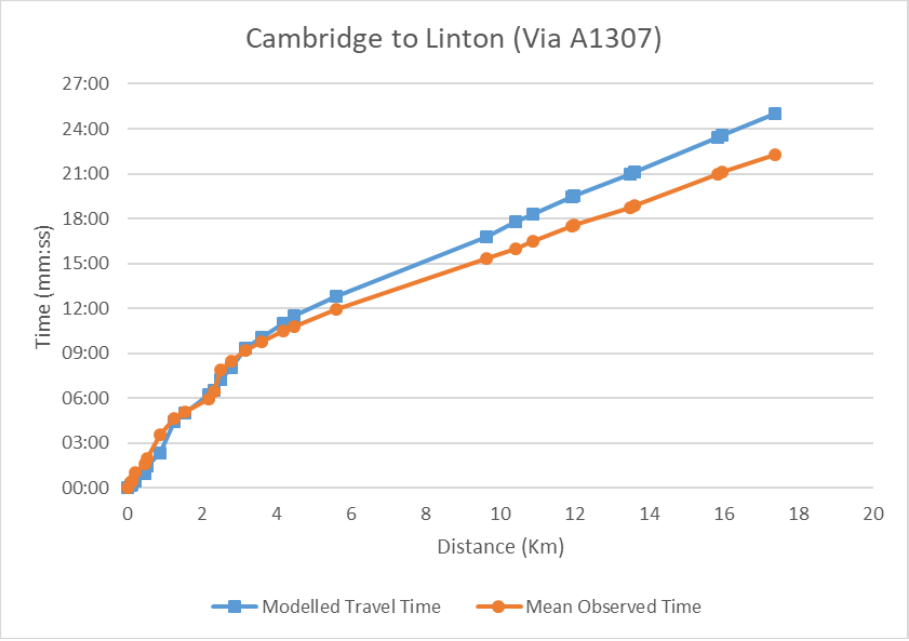
Source: Assignment_JT_IP_v4.3_MM_Wov1_IP_v4_DseriesOrg.xls

Figure 17: Linton to Cambridge (Via A1307) IP



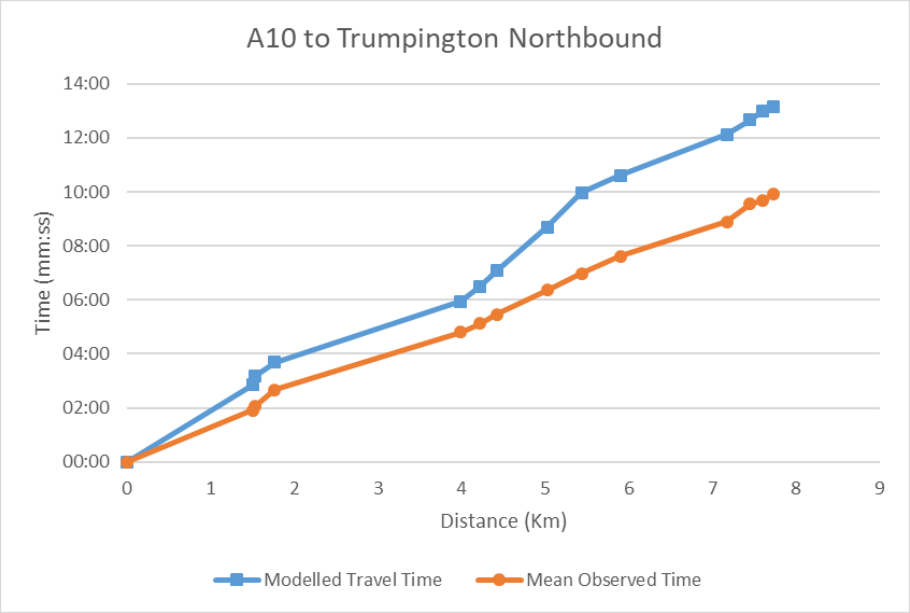
Source: Assignment_JT_IP_v4.3_MM_Wov1_IP_v4_DseriesOrg.xls

Figure 18: Cambridge to Linton (Via A1307) IP



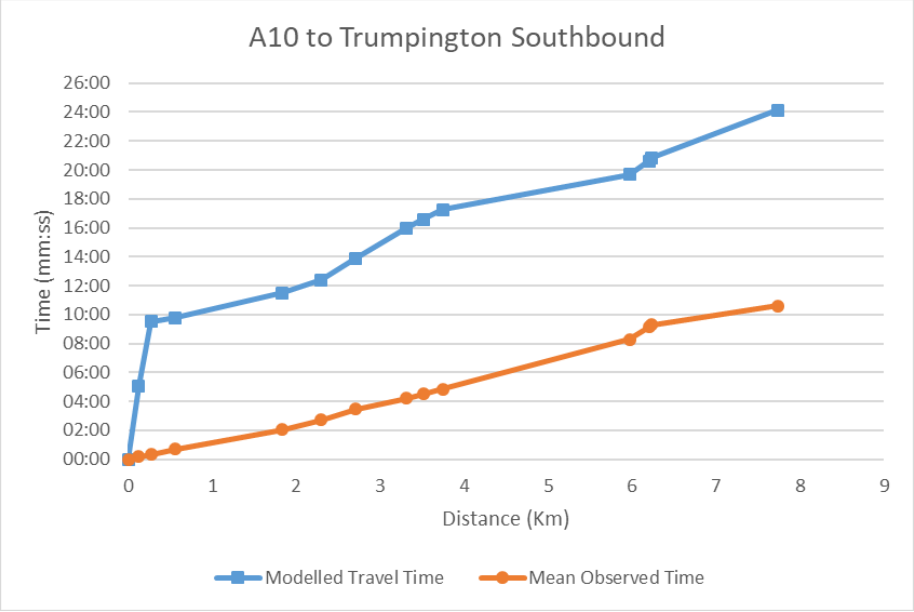
Source: Assignment_JT_IP_v4.3_MM_Wov1_IP_v4_DseriesOrg.xls

Figure 19: A10 Trumpington Northbound PM



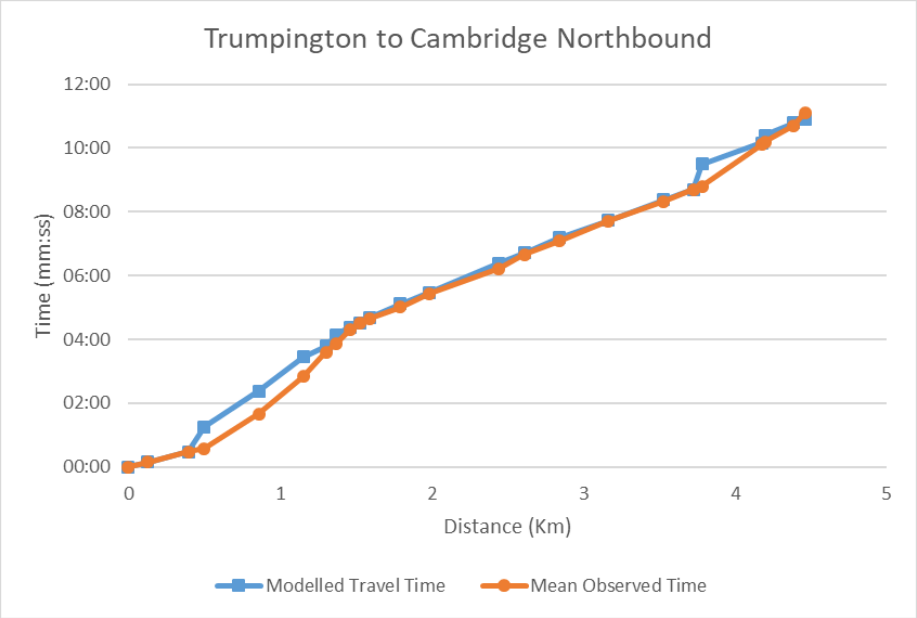
Source: Assignment_JT_PM_v4.3_MM_Wov1_PM_v6_DseriesOrg.xls

Figure 20: A10 to Trumpington SB PM



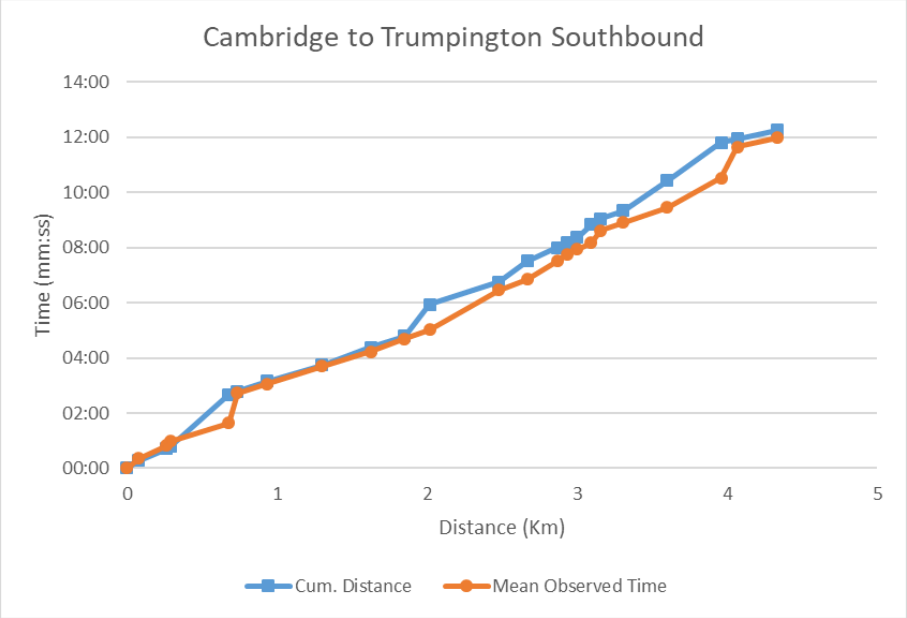
Source: Assignment_JT_PM_v4.3_MM_Wov1_PM_v6_DseriesOrg.xls

Figure 21:Trumpington to Cambridge Northbound PM



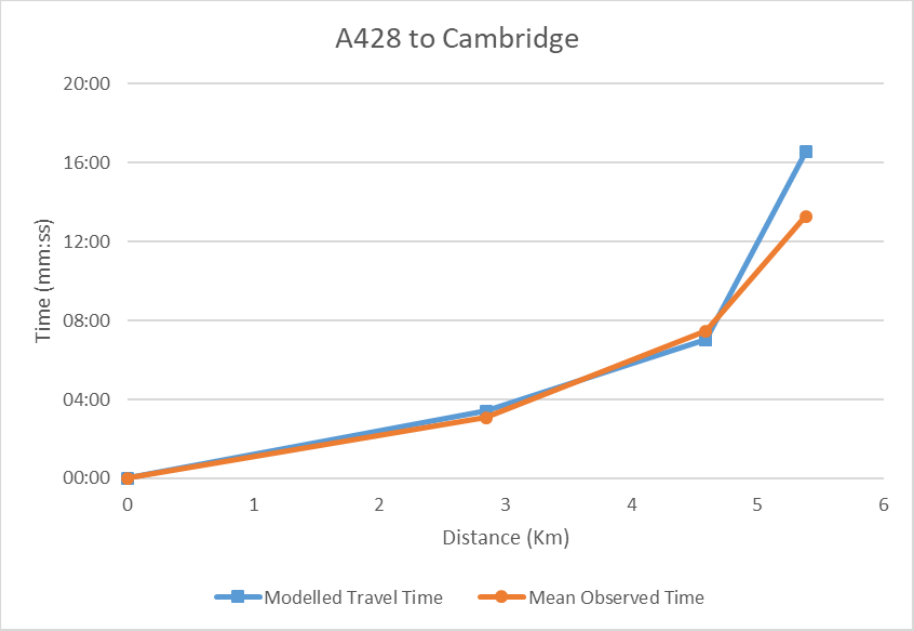
Source: Assignment_JT_PM_v4.3_MM_Wov1_PM_v6_DseriesOrg.xls

Figure 22: Cambridge to Trumpington Southbound PM



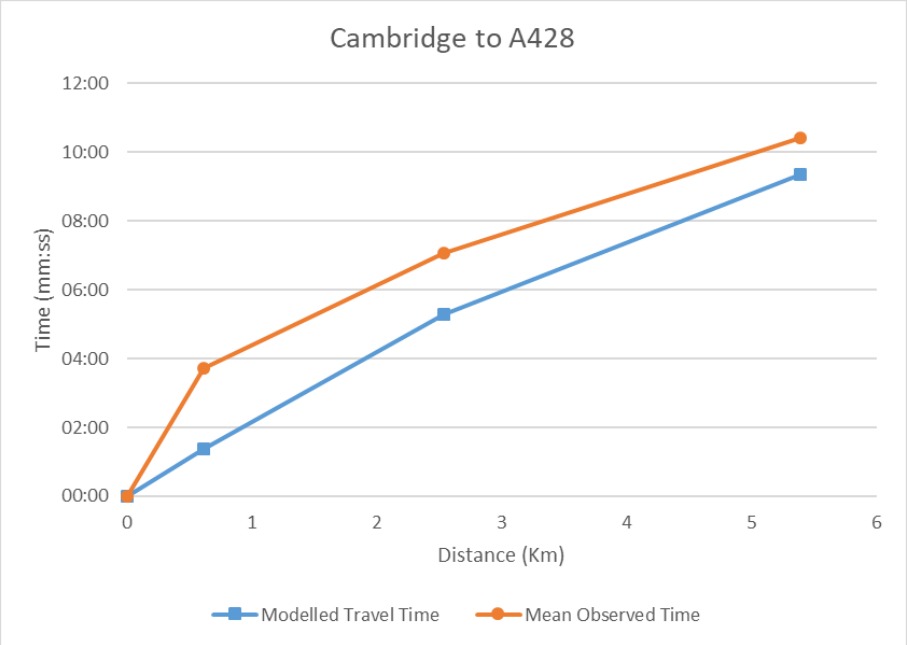
Source: Assignment_JT_PM_v4.3_MM_Wov1_PM_v6_DseriesOrg.xls

Figure 23: A428 to Cambridge PM



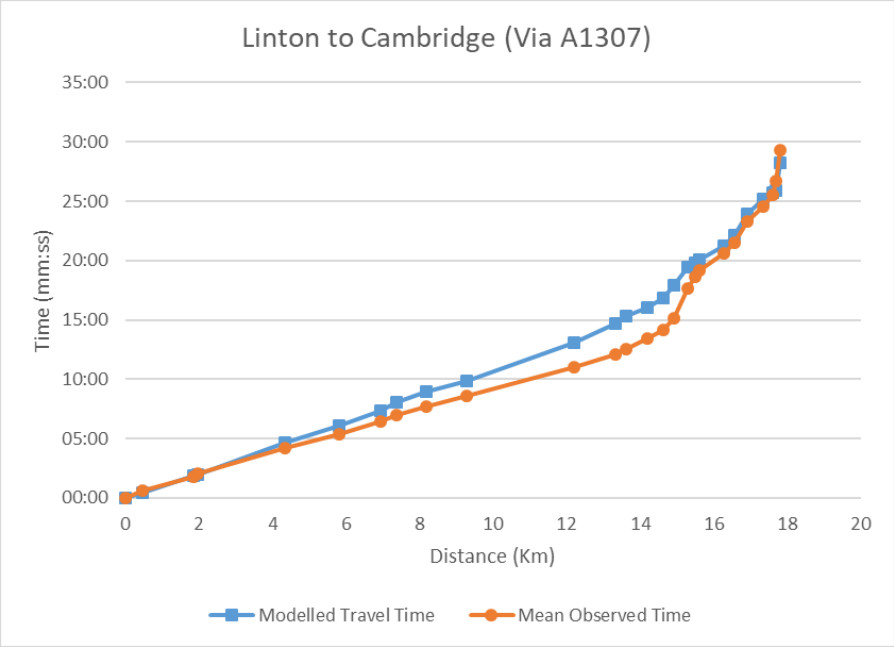
Source: Assignment_JT_PM_v4.3_MM_Wov1_PM_v6_DseriesOrg.xls

Figure 24: Cambridge to A428 PM



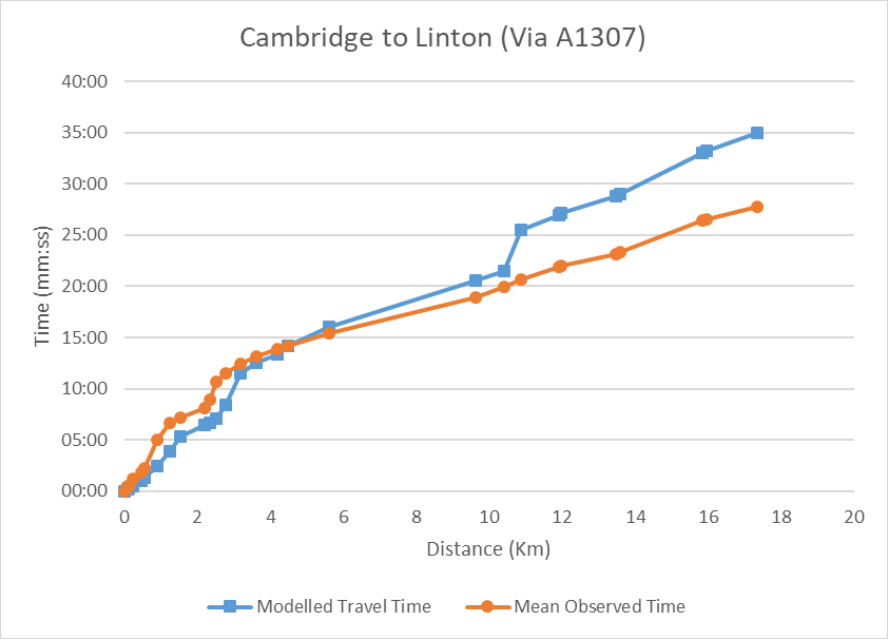
Source: Assignment_JT_PM_v4.3_MM_Wov1_PM_v6_DseriesOrg.xls

Figure 25: Linton to Cambridge (Via A1307) PM



Source: Assignment_JT_PM_v4.3_MM_Wov1_PM_v6_DseriesOrg.xls

Figure 26: Cambridge to Linton (Via A1307) PM



Source: Assignment_JT_PM_v4.3_MM_Wov1_PM_v6_DseriesOrg.xls

B. Amendments to D-series models

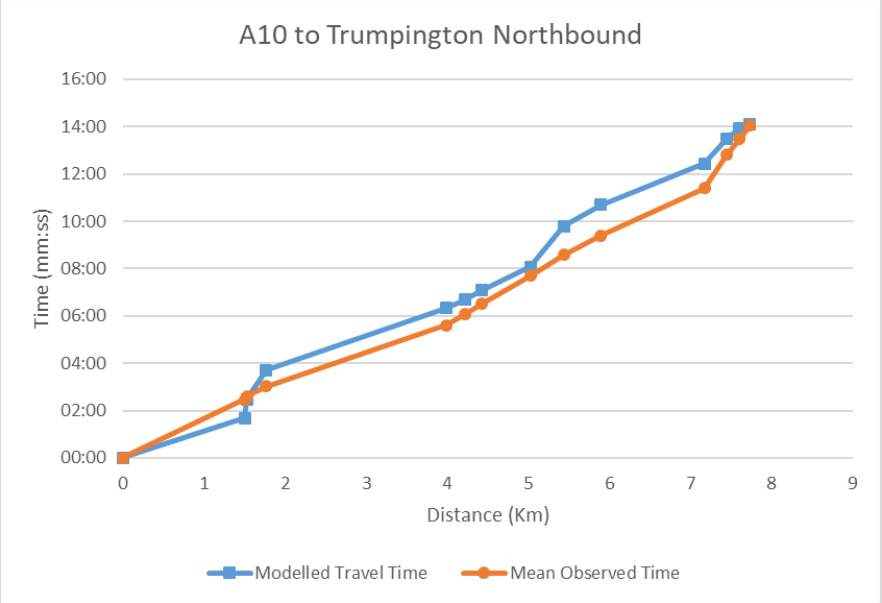
Table 14: Network Changes to D-series Model

Zone	Node	Location	Change
1371 and 1372		Separating Cranmer Rd/Pinehurst Road from Selwyn Gardens into 2 separate zones	Zone Splitting
1391 and 1392		Splitting Adams Rd and Herschel Rd from West Road into 2 separate zones either side of Grange Road	Zone Splitting
221	22110-22115	Cambourne and Lower Cambourne	Adding additional road network
140	18013-18014	Madingley Rise	Adding junctions and adjacent roads for access to A1303
	18000-18020	Junction between Wilberforce Road and Clarkson Road (Central Cambridge) – Adding Clarkson Road	Adding coding for Clarkson Road, Adams Road, Herschel Road, Crammer Road
	15907	Junction between Hauxton Road and Consort Avenue (Central Cambridge)	Signal timing adjustment
	14001	Slipway on to A1303 from Junction 13 of M11	Adjusted saturation flow for consistency
	16306	Cross roads of Arbury Road, Milton Road and Union Lane (Central 46etween46e)	Signal timing adjustment
	15910	Junction between Church Lane and A130 (Central Cambridge)	Signal timing adjustment
	11205	Junction between A1303 and JJ Thomson Avenue	Add flare for right turn into additional coded link
	14001	Slipway on to A1303 from Junction 13 of M11	Signal timing adjustment
	14003	Road connecting A1303 to Madingley Road Park and Ride	Signal timing adjustment
	11102	Junction between Grange Road and A1303 (Central Cambridge)	Signal timing adjustment
	15914	Junction between Hauxton Road, Shelford Road and High Street	Signal timing adjustment
	97403	Junction between A10 and Slip Road to Milton Road Park and Ride	Signal timing adjustment
	92010	Junction between Brampton Road and Edison Bell Way	Signal timing adjustment
	56705	Cross roads between Cambridge Street, High Street and B1043	Signal timing adjustment
	25502 – 23501	Along Fowlmere Road eastbound	Speed flow curve adjustment
	25301-25502	Along Fowlmere Road westbound	Speed flow curve adjustment
	24203-24202	Along Harston High Street up to Orchard Close northbound	Speed flow curve adjustment
	24203-24204	Along Harston High Street up to Manor Close northbound	Speed flow curve adjustment
	24204-24203	Along Harston High Street up to Manor Close soutbound	Speed flow curve adjustment
	24204-24205	Along Harston High Street from Manor Close Junction to London Road junction northbound	Speed flow curve adjustment
	24205-24204	Along Harston High Street from Manor Close Junction to London Road junction southbound	Speed flow curve adjustment

Zone	Node	Location	Change
	24202-24203	Along Harston High Street up to Orchard Close southbound	Speed flow curve adjustment
	24205	Junction between A10 and Church Road	Signal timing adjustment
	15501	Junction between A10 and junction 11 roundabout	Lane allocation change
	15501	Junction between A10 and junction 11 roundabout	Lane allocation change
	15503	Junction between A10 and junction 11 roundabout	Signal timing adjustment
	15701	Junction between M11 junction 11 wesbound offlsip and junction 11 roundabout	Signal timing adjustment
	16006	Crossroads between Trumpington Road, Newton Road and Latham Road	Signal timing adjustment
	15915	Crossroads between High Street, Winchmore Drive and Alpha Terrace	Signal timing adjustment
	15802	Junction 47etween Long Road and Trumpington Road	Signal timing adjustment
	15602	Junction between A1134, Brooklands Avenue and Chaucer Road	Signal timing adjustment
	15907	Junction between Consort Avenue and hauxton Road	Signal timing adjustment
	15509	Junction between Hauxton Road nad Addenbrooke's Road	Signal timing adjustment
	25502 – 23501	Along Fowlmere Road eastbound	Speed flow curve adjustment
	25301-25502	Along Fowlmere Road westbound	Speed flow curve adjustment
	24203-24202	Along Harston High Street up to Orchard Close northbound	Speed flow curve adjustment
	24203-24204	Along Harston High Street up to Manor Close northbound	Speed flow curve adjustment
	14714	Junction between A1307 (Babraham Road) and Babraham Road Park and Ride	Signal timing adjustment
970		John Lewis Collection/Trumpington Meadow Primary School within Trumptingon P&R	Zone added
	10104	Junction at Nightingale Avenue and A1307	Signal timing adjustment
	95013	Roundabout connecting the A1307 (Cambridge Road) and the A11	Capacity adjustment
	24802	Junction at A1307 (Cambridge Road) and Linton Village College Adult Learning	Signal timing adjustment
	27615-27307	Along Babraham Road	Speed flow curve adjustment
	11103	Junction between Madingly Road and Lady Margaret Road	Signal timing adjustment
	10106	Junction between Mount Pleasant and Castle Street	Signal timing adjustment
	15911-15910	Along High Street	Fixed speed adjustment
	21507	Junction between Coton Road, Broadway and High Street	Capacity adjustment
	11002	Junction between Northampton Street, Castle Street, Chesterton Lane and Magdalene Street	Signal timing adjustment
800		Babraham Research Centre added as third arm to the roundabout	Zone added

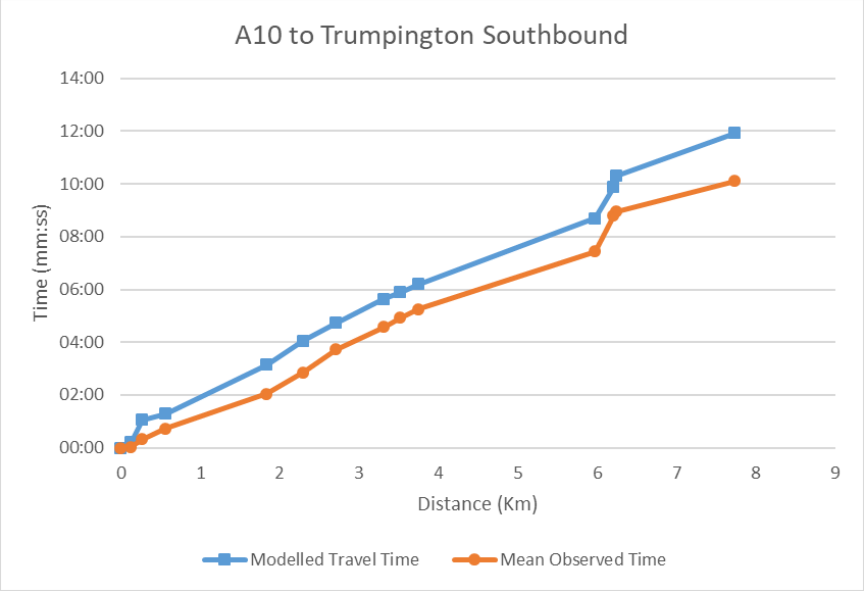
C. Amended model journey times

Figure 27: A10 Trumpington Northbound AM



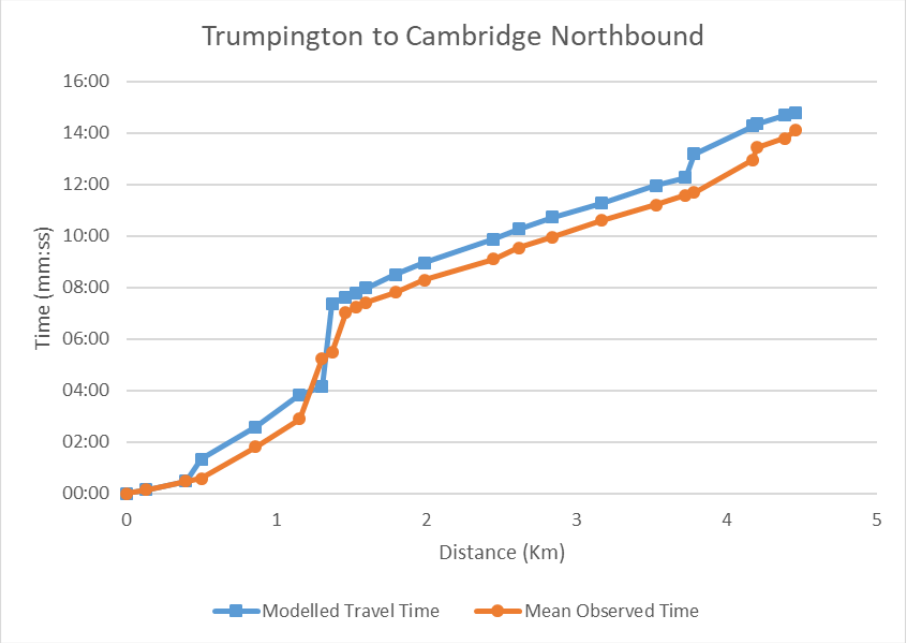
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO - V6.xls

Figure 28: A10 to Trumpington SB AM



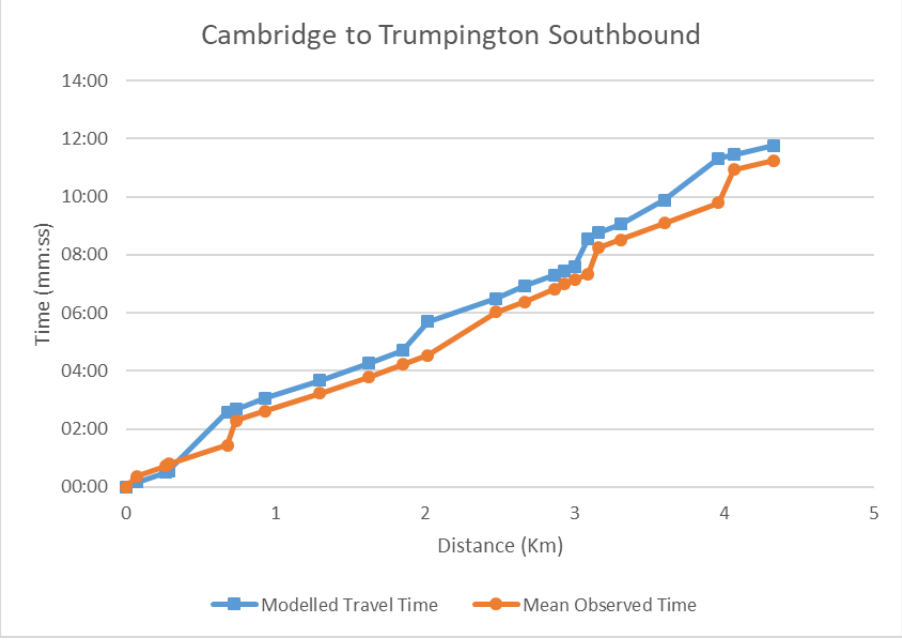
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO - V6.xls

Figure 29:Trumpington to Cambridge Northbound AM



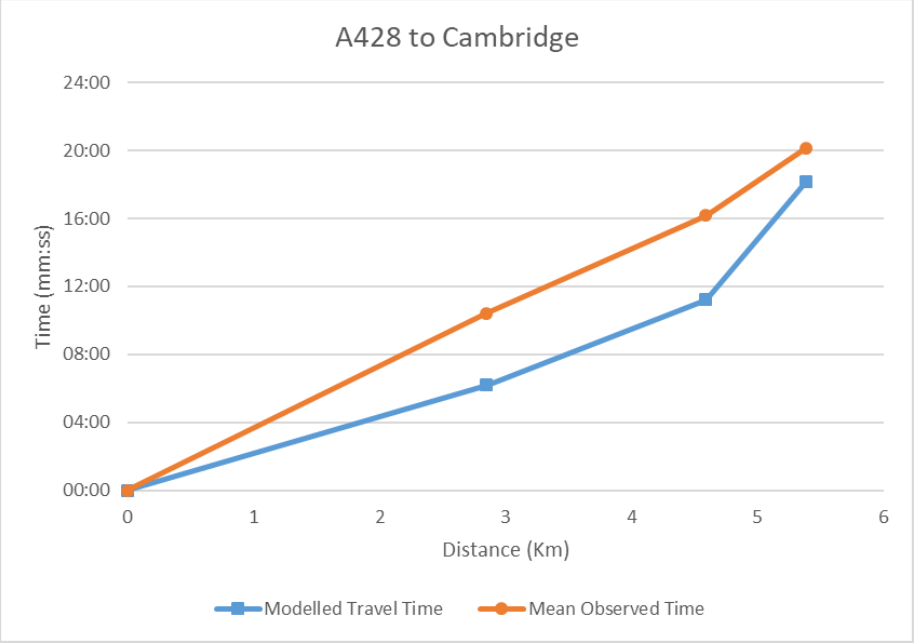
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO - V6.xls

Figure 30: Cambridge to Trumpington Southbound AM



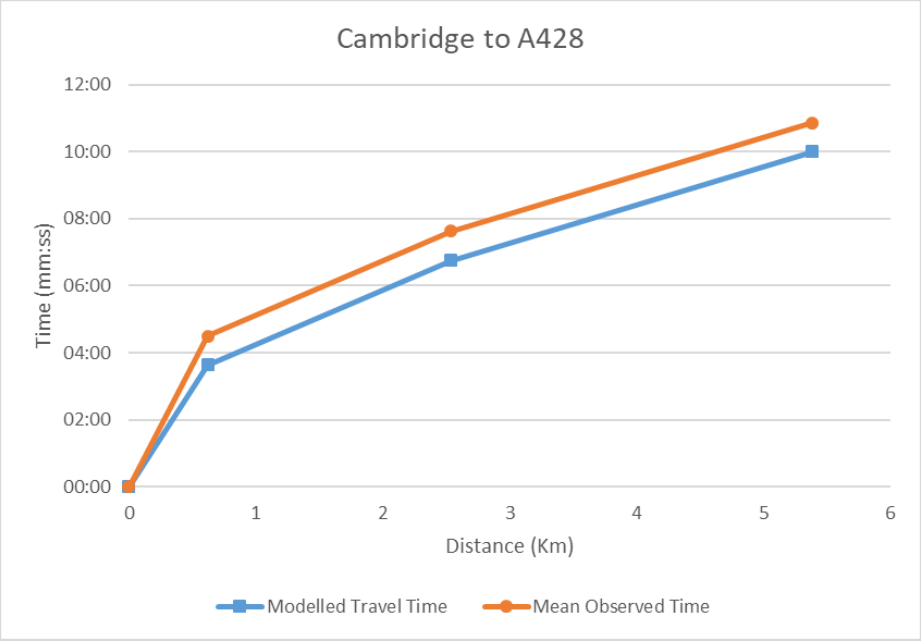
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO - V6.xls

Figure 31: A428 to Cambridge AM



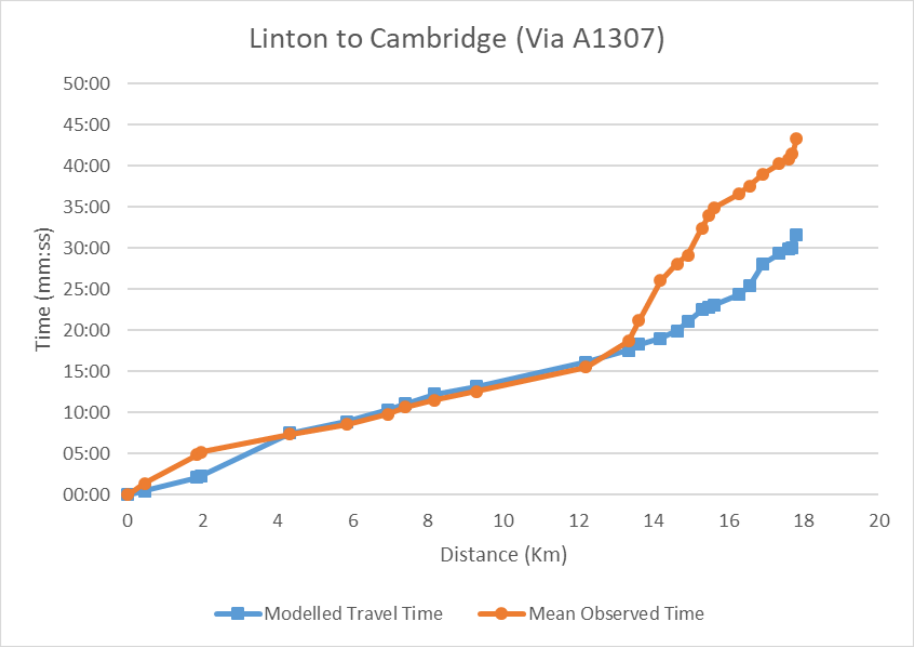
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO - V6.xls

Figure 32: Cambridge to A428 AM



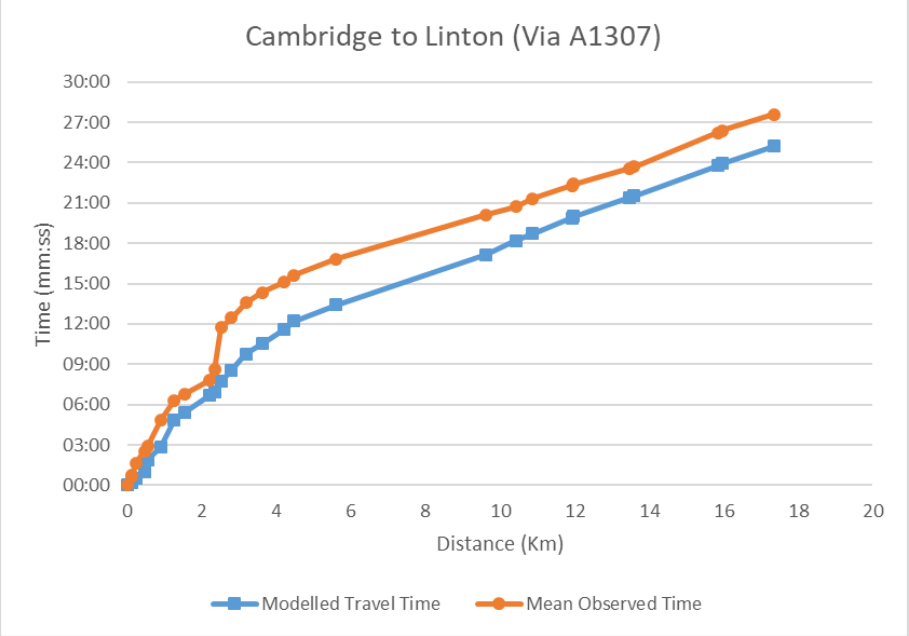
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO - V6.xls

Figure 33: Linton to Cambridge (Via A1307) AM



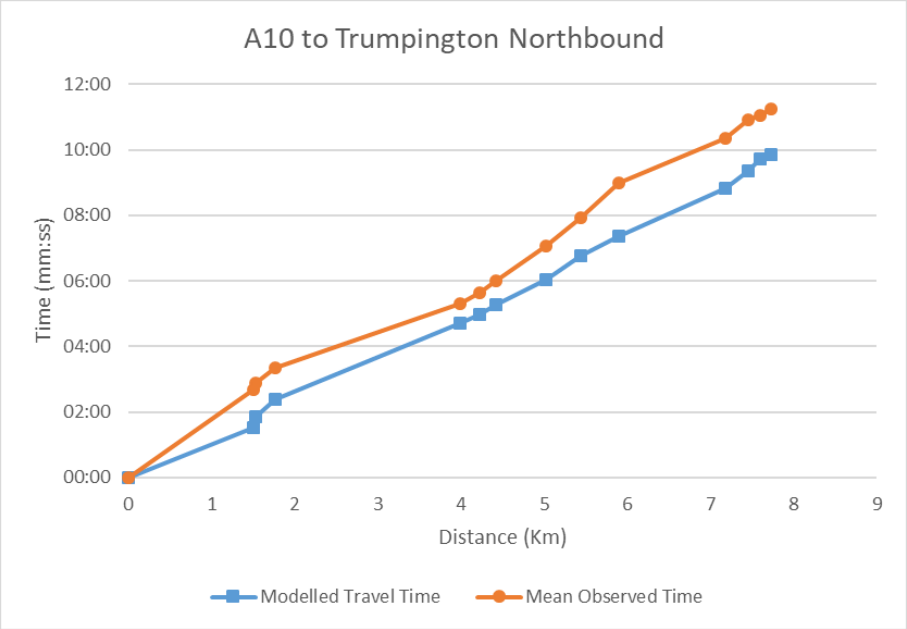
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO - V6.xls

Figure 34: Cambridge to Linton (Via A1307) AM



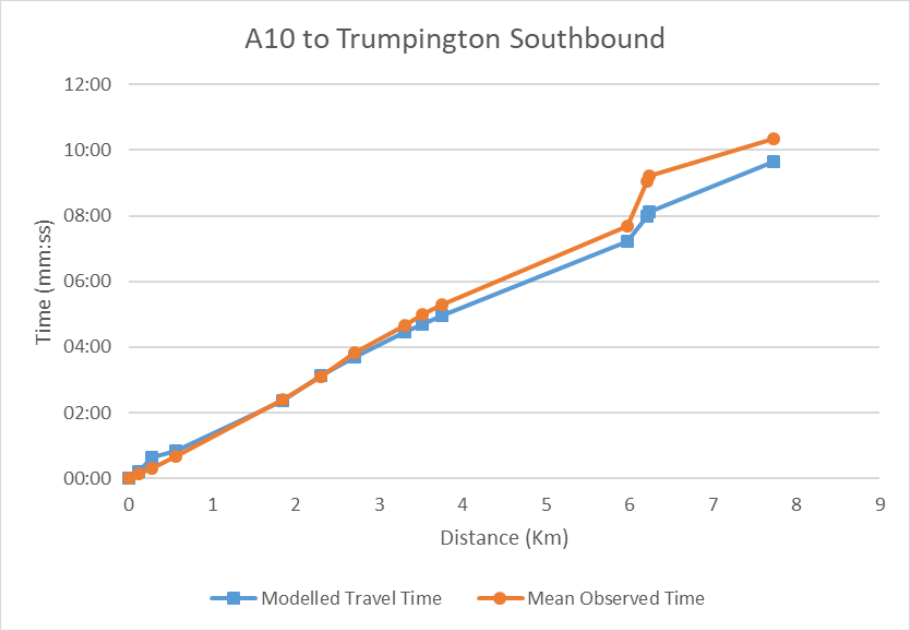
Source: Assignment_JT_AM_v4.3_MM_working_Dseries_WO - V6.xls

Figure 35: A10 Trumpington Northbound IP



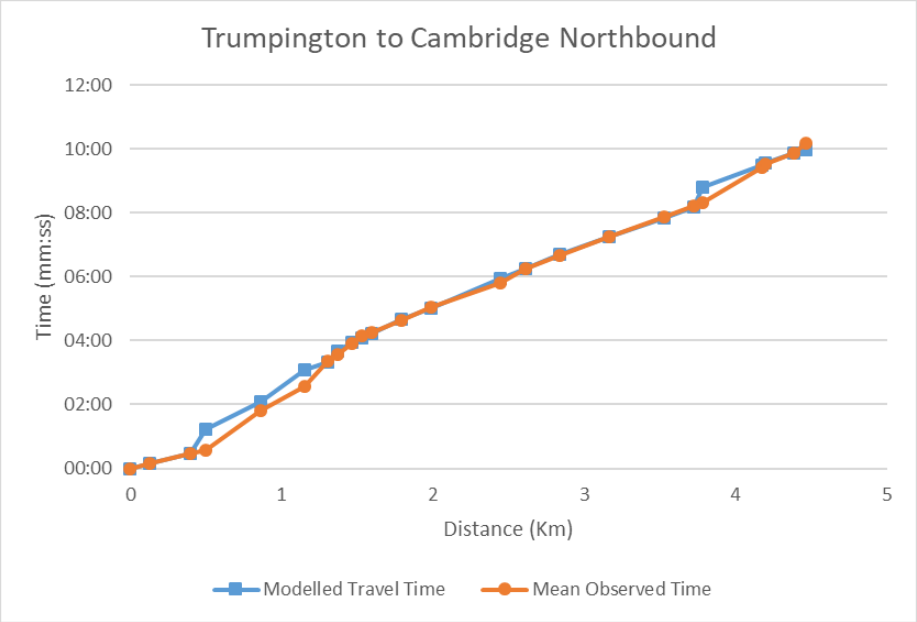
Source: Assignment_JT_IP_v4.3_MM_WOv1_IP_v4.xls

Figure 36: A10 to Trumpington SB IP



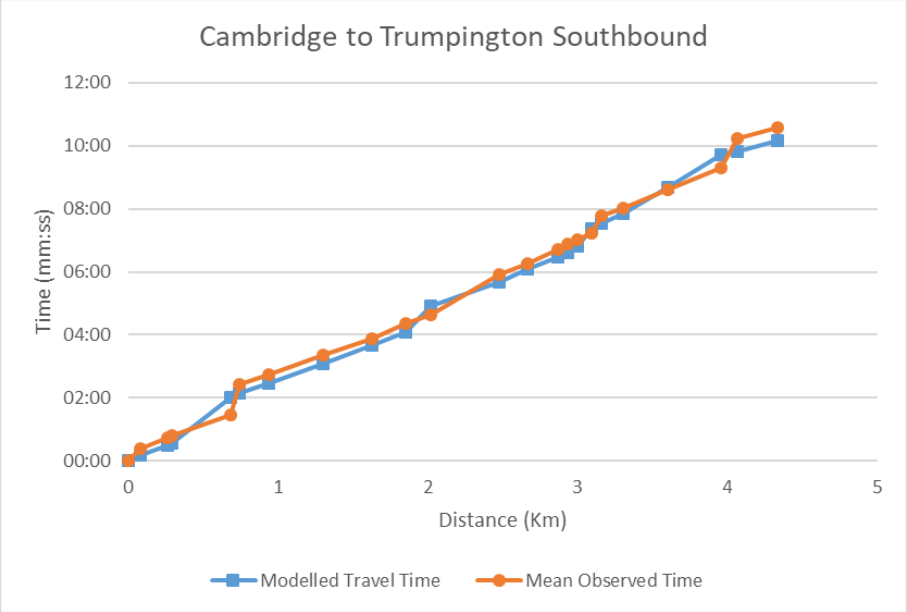
Source: Assignment_JT_IP_v4.3_MM_WOv1_IP_v4.xls

Figure 37:Trumpington to Cambridge Northbound IP



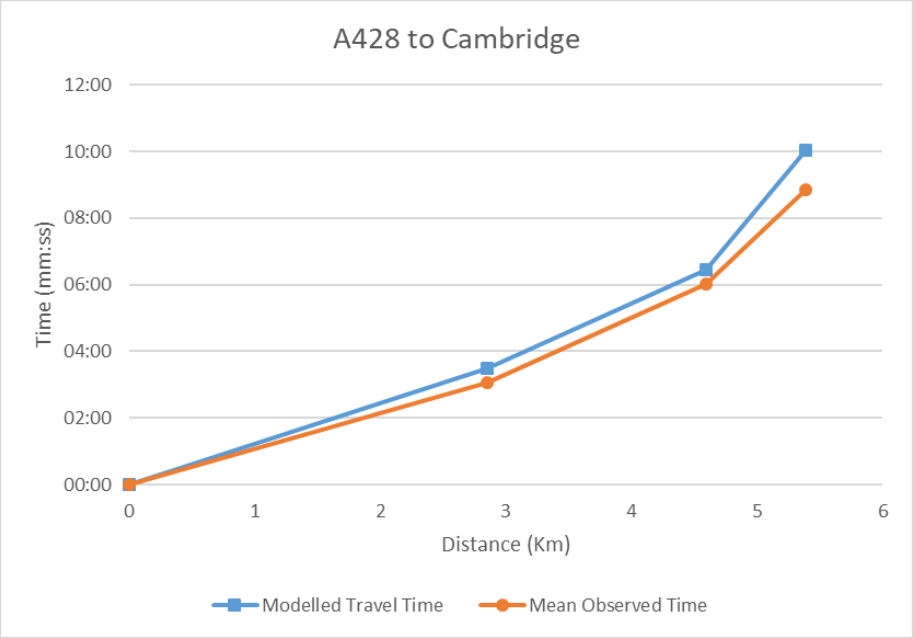
Source: Assignment_JT_IP_v4.3_MM_WOv1_IP_v4.xls

Figure 38: Cambridge to Trumpington Southbound IP



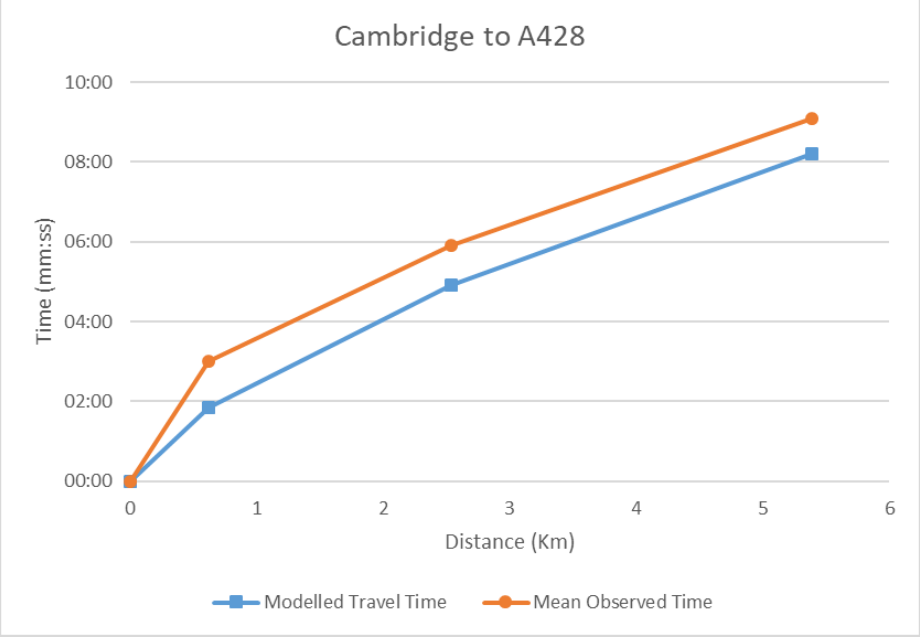
Source: Assignment_JT_IP_v4.3_MM_WOv1_IP_v4.xls

Figure 39: A428 to Cambridge IP



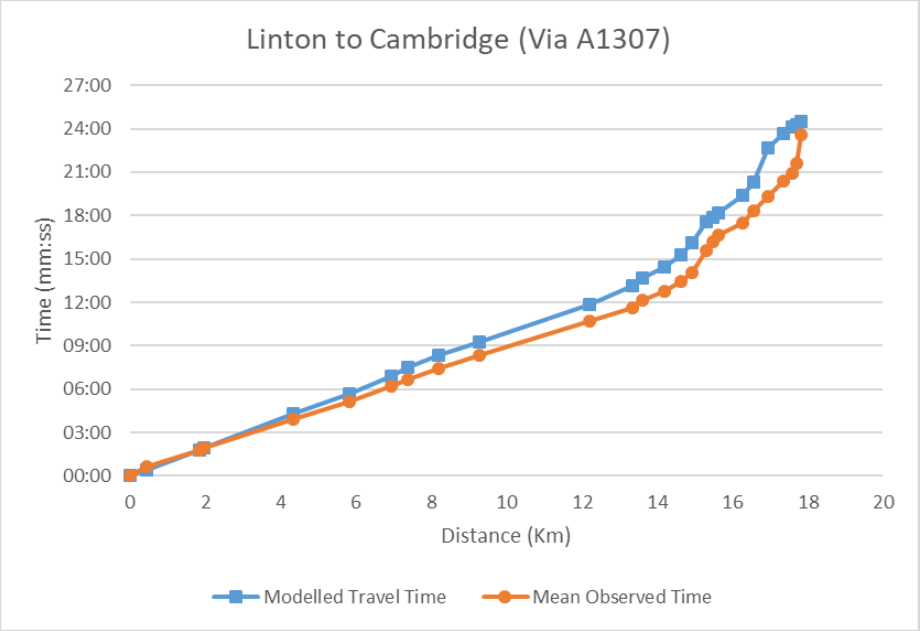
Source: Assignment_JT_IP_v4.3_MM_WOv1_IP_v4.xls

Figure 40: Cambridge to A428 IP



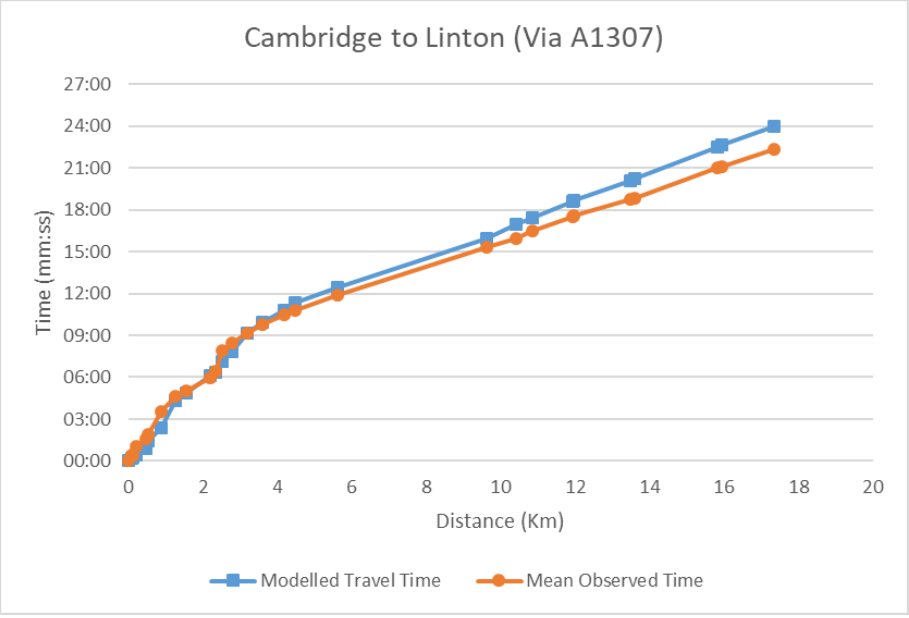
Source: Assignment_JT_IP_v4.3_MM_WOv1_IP_v4.xls

Figure 41: Linton to Cambridge (Via A1307) IP



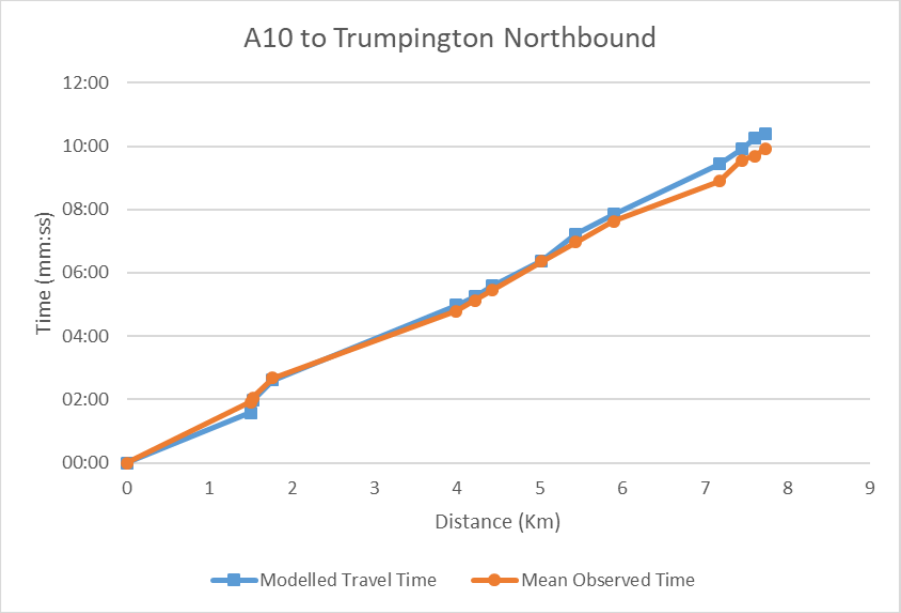
Source: Assignment_JT_IP_v4.3_MM_WOv1_IP_v4.xls

Figure 42: Cambridge to Linton (Via A1307) IP



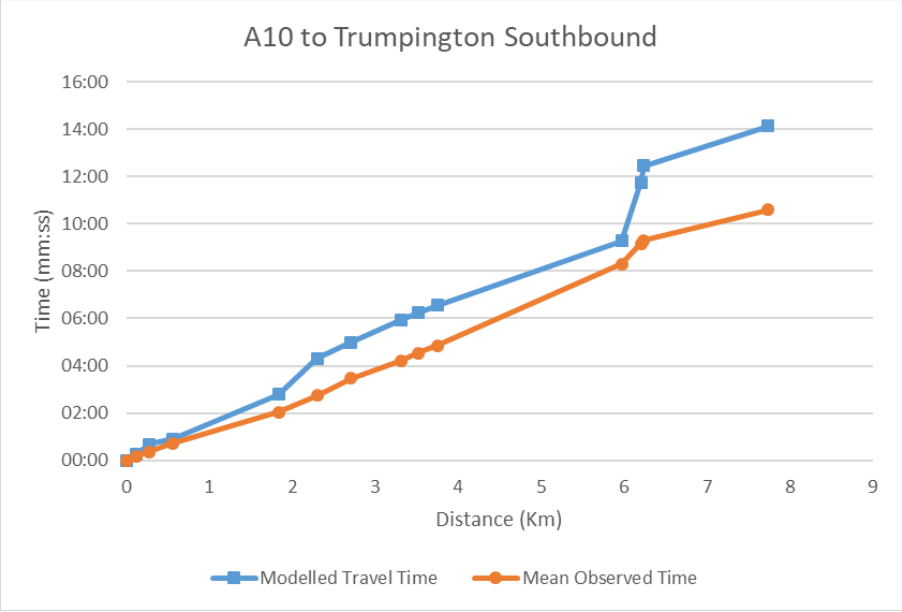
Source: Assignment_JT_IP_v4.3_MM_WOv1_IP_v4.xls

Figure 43: A10 Trumpington Northbound PM



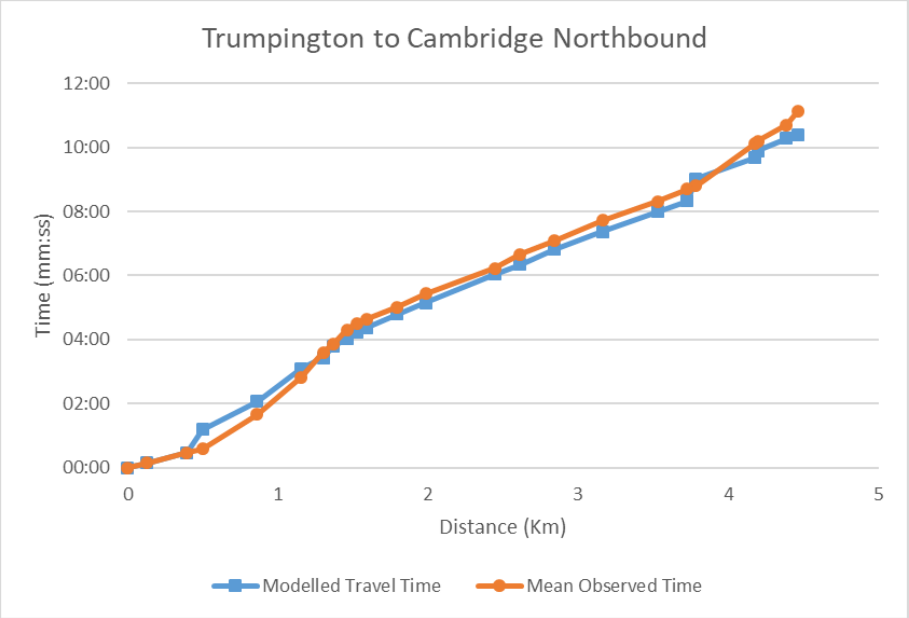
Source: Assignment_JT_PM_v4.3_MM_WOv1_PM_v6.xls

Figure 44: A10 to Trumpington SB PM



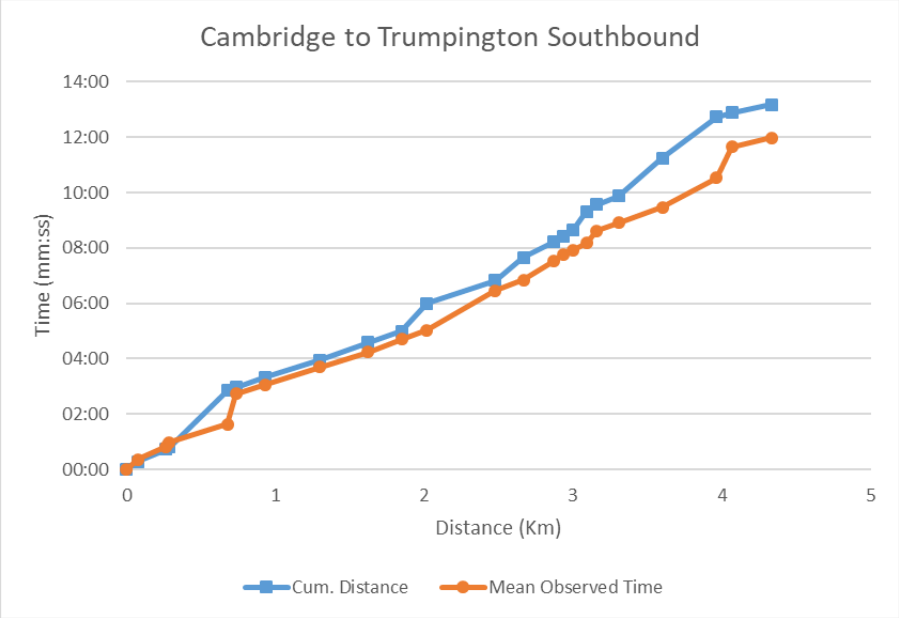
Source: Assignment_JT_PM_v4.3_MM_WOv1_PM_v6.xls

Figure 45:Trumpington to Cambridge Northbound PM



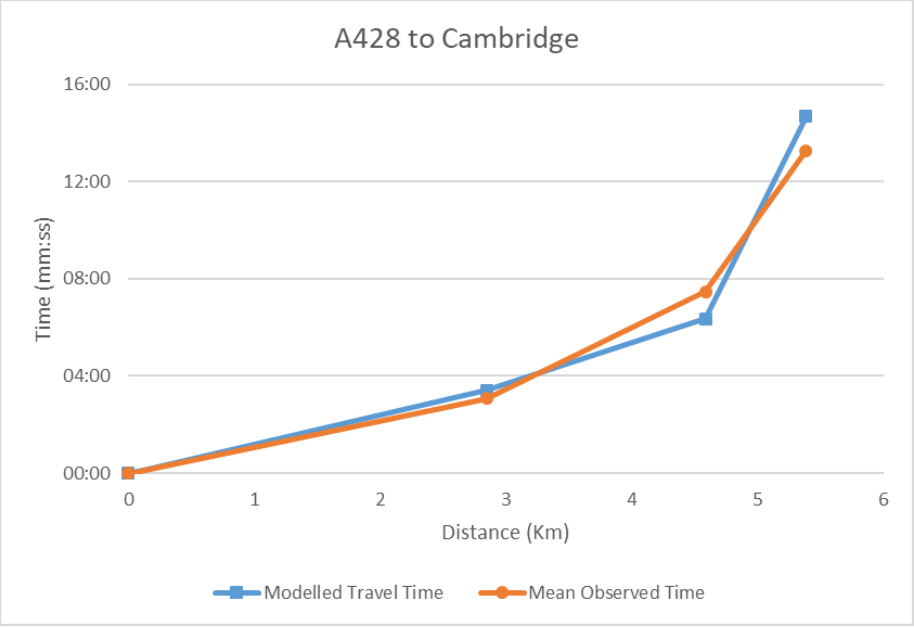
Source: Assignment_JT_PM_v4.3_MM_WOv1_PM_v6.xls

Figure 46: Cambridge to Trumpington Southbound PM



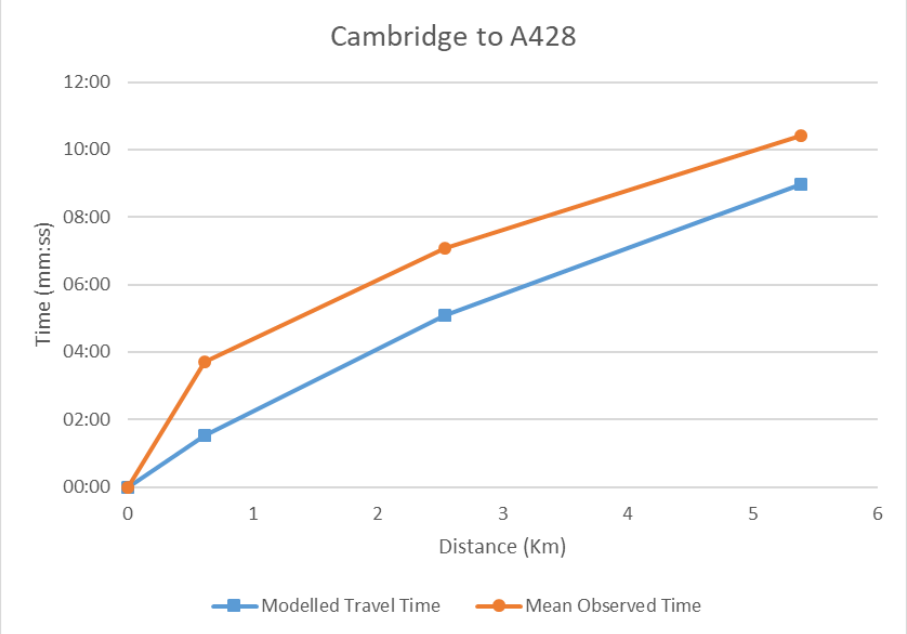
Source: Assignment_JT_PM_v4.3_MM_WOv1_PM_v6.xls

Figure 47: A428 to Cambridge PM



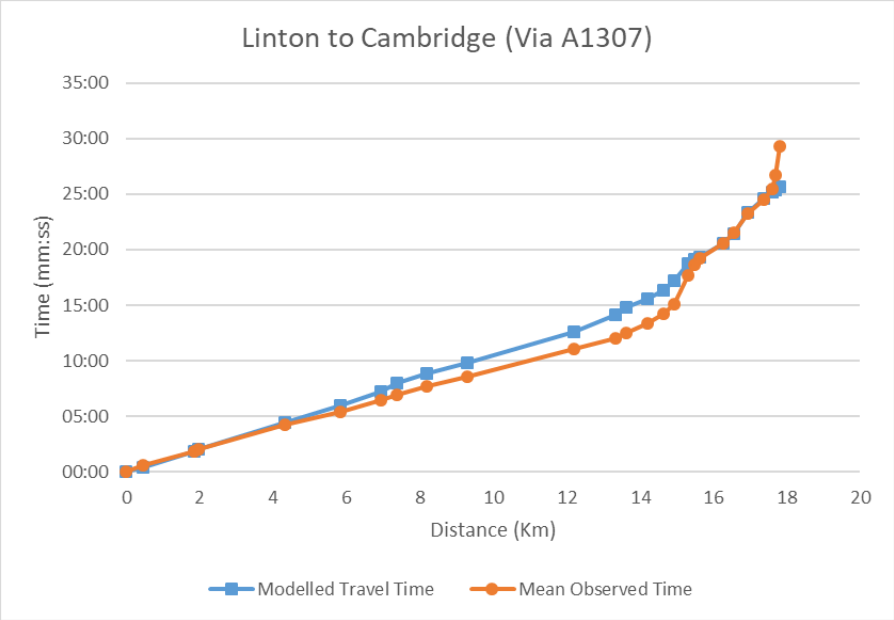
Source: Assignment_JT_PM_v4.3_MM_WOv1_PM_v6.xls

Figure 48: Cambridge to A428 PM



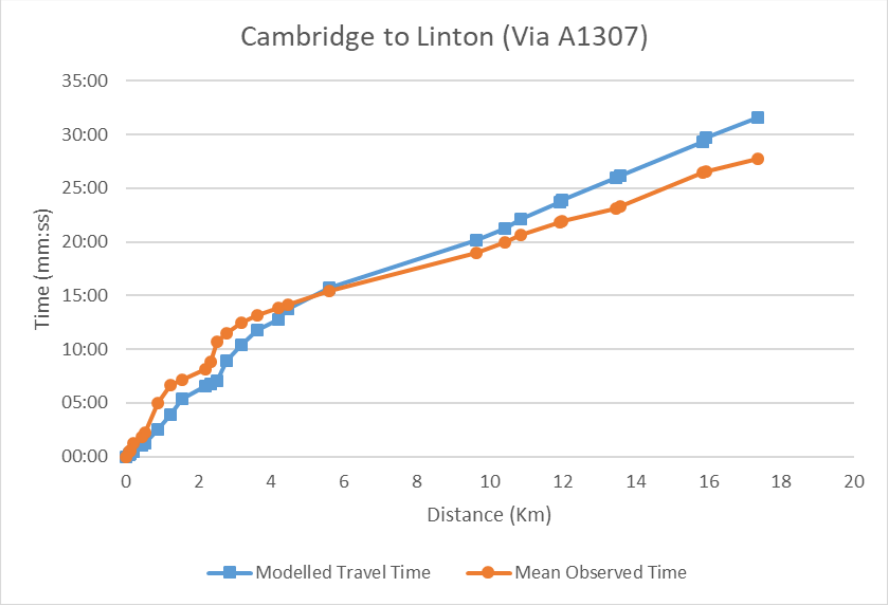
Source: Assignment_JT_PM_v4.3_MM_WOv1_PM_v6.xls

Figure 49: Linton to Cambridge (Via A1307) PM



Source: Assignment_JT_PM_v4.3_MM_WOv1_PM_v6.xls

Figure 50: Cambridge to Linton (Via A1307) PM



Source: Assignment_JT_PM_v4.3_MM_WOv1_PM_v6.xls