Draft: Option Assessment Report for Cambourne to Cambridge Better Bus Journeys

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EXECUTIVE SUMMARY

Glossary

Catchment area	The widest potential area within which any alignment may be created on the corridor
Corridor	The land between Cambourne and Cambridge
Full Outline Business Case	A full appraisal of a single option
High Quality Public Transport (HQPT) (infrastructure)	Primarily segregation providing the highest levels of speed, reliability and capacity – resulting in 'fast frequent and reliable' journeys.
Infrastructure	The physical measures that are used by Services
Off line	Not on highway corridor
On line	On highway corridor
Options	Choices between corridors (north, central or south)
Recommended Option	Catchment Area for option 3A (or if necessary Catchment Area for option 3)
Route	A particular way or direction between places Cambourne and Cambridge
Scheme (1)	The final option to be put forward for approval
Scheme (2)	The entirety of the Steps to achieve the Scheme (1) – the totality of the project
Segregation	Dedicated public transport infrastructure separate from other traffic
Services	The operation of vehicles along infrastructure
Specific route alignment	The proposed line of the infrastructure
Step	A stage of the Scheme
Strategic Case	Section of Strategic Outline Business Case considering the need for a Scheme
Strategic fit	Compliance with policy objectives
Strategic Outline Business Case	The combined output of Step 2 – appraisal of a series of Options

1. This Option Assessment Report (OAR) assesses and summarises a range of technical information for the Cambourne to Cambridge Better Bus Journeys Scheme. The scheme aims to deliver new High Quality Public Transport infrastructure. The objective of the scheme is to achieve improved connectivity and reduced congestion between residential and employment areas while improving the quality of life in Greater Cambridge and ensuring environmental sustainability is central to design criteria.

2. The current Step identifies and recommends an option to meet this objective and is concluded by the production of this report and supporting material. The next Step is to take the Recommended Option forward for further detailed scheme development.

3. This report is subdivided into 2 parts.

4. **Part 1** provides the background to the appraisal work by setting out the overall context of the proposed scheme and describing the previous analysis conducted on a range of options that have been subject to stakeholder engagement including extensive public consultation. This includes the following key headings:
   - Scheme objectives;
   - The Greater Cambridge City Deal - "City Deal" - context;
   - The local context;
   - The methodological approach; and
   - A detailed description of the Options.

5. **Part 2** of the report sets out the main aspects of the option appraisal undertaken to and considers the following outcomes:
   - The 5 Transport Assessment Guidance 'cases' for appraising the investment implications for each Option:
     - Strategic Case (including a wider economic assessment)
     - Economic Case (including an environmental assessment)
     - Financial Case
     - Commercial Case
     - Delivery Case;
   - These 5 cases together form the Strategic Outline Business Case which contain the detail of the appraisal;
   - The overall weighting of the 5 cases in the City Deal context;
   - Identification of a recommended option
   - The key attributes of the Recommended Option ; and
   - The next steps for further assessment and single option development to specific route alignment as part of the overall scheme progression following selection of a Recommended Option.

6. The scheme underwent early option sifting in 2014 which resulted in City Deal Board agreement (in June 2015) for 6 Options to be published for public consultation which was carried out in October 2015. The consultation on the 6 options made clear a number of key issues around the public acceptability of the options as well as a number of potential alternatives. While there was significant support for public transport and cycling improvements along the corridor this was balanced by the possible environmental effects and the cost of off line infrastructure.

7. The public consultation outcomes formed part of the ongoing option appraisal process at Step 2. This has now been concluded and presented in a Strategic Outline Business Case in which 5 Options for different levels of infrastructure interventions between Cambourne and Cambridge were appraised as well as new Park & Ride locations close to Madingley Mulch roundabout.

8. The Strategic Outline Business Case appraisal uses the Department for Transport WEB based Transport Appraisal Guidance (TAG) to develop 5 cases for investment against which the options are assessed. These Cases are based on the Treasury Green Book investment criteria for public investment decisions. The 5 Cases are Strategic, Economic, Management, Commercial and Finance and each focusing on specific aspects of the Strategic Outline Business Case which in total represents the overall appraisal.

9. At this Step of the scheme development process, given that the focus and resources are on ensuring the right strategic decision to select a recommended option for further detailed development, the main due consideration is given to the strategic fit of each option. The more detailed analysis which forms the other 4 cases will be more fully addressed once an option has been selected.

10. In that context the Strategic Outline Business Case has concluded that the option with the highest strategic policy fit is that which best meets the scheme objectives is Option 3 as modified by Option 3a. Option 3 was modelled to represent a segregated bus infrastructure intervention for its whole route between Cambourne and Cambridge, running to the south of the existing road and is the highest performing option against strategic fit. This conclusion is based on the high degree of compliance with local policy objectives including both transport and planning policies and the high economic benefits as expressed through Gross Value Added to the national economy

11. The TAG method also recognises the importance of reflecting the local context and specific concerns that may be of strategic importance to decision makers. As such officers have also identified that Option 3 could be amended to allow for the section west of Madingley Mulch to be routed alongside the old St Neots Road rather than an entirely new route through open countryside

to the south. This option has not been modelled but an outline engineering assessment does point to potential feasibility of this option as retaining high strategic benefits as with Option 3 but with possible lower environmental effects and costs . This Option (3a) is recommended to be explored more fully as part of the next Step of work.

12. Option 3a represents segregated reliable and high speed public transport links to and from key growth sites. Option 3a is a potentially viable variation of Option 3 with potential to optimise costs and benefits through detailed scheme development and as such it would be the option taken forward for further consultation during Step 3, subject to confirmation of viability. Should Option 3a not prove viable, Option 3 is the Recommended Option.

13. The option Catchment Area Maps indicate the area within which a specific alignment would be assessed during the next Step of further detailed scheme development.

14. The Recommended Option best served by the proposed Park & Ride located to the south east of Madingley Mulch roundabout which is therefore the recommended site for that facility. Up to 2000 car parking spaces and significant cycle provision may be provided at this facility.

15. The Economic, Management, Commercial and Finance cases do not significantly differentiate between the options. At this stage of assessment there is no overwhelming evidence in the Economic Case (which captures direct transport/economic and environmental costs and benefits) to strategically differentiate between any options. Given the significant amount of further detailed work necessary to develop these cases as part of Step 3 Full Outline Business Case, the high level assessments for each would be subject to significant refinement.

16. With the Recommended Option approved, Step 3 will produce a Full Outline Business Case for a specific route alignment within the catchment area indicated in the Catchment Area Maps. The Full Outline Business Case will involve further public consultation in Summer 2017 on the basis of the catchment area for the Recommended Option with specific route alignments specified.

17. Environmental and engineering assessment including modelling and transport planning will also form part of the next stage of work in order to refine the Economic Case including a revised Benefit Cost Ratio. Step 3 will conclude in November 2017 when a recommended specific route alignment will be presented to the City Deal Board for agreement to obtain statutory approvals.

18. Public consultation and stakeholder engagement continues to inform the ongoing development of the scheme. Strong support for public transport and

cycling improvements on the corridor has been weighed against the significant concerns regarding the potential environmental effects of new infrastructure on the green belt. As such, in addition to the extensive existing statutory and local policy requirements, the scheme will be guided by design criteria that will applied to option design development.

19. A Local Liaison Forum is now established and will play a key role in further detailed scheme development.

PART 1: BACKGROUND – SETTING THE SCENE

Introduction

1. The Option Assessment Report (OAR) summarises and assesses a range of technical information for the Cambourne to Cambridge Better Bus Journeys Scheme and identifies a Recommended Option. The OAR sets out the key decision making criteria used to determine the Recommended Option as proposed in the City Deal Executive Board Report dated 13th October 2016.

2. The OAR forms part of a set of documents, which together comprise the Strategic Outline Business Case for the selection of a Recommended Option for further detailed scheme development. These documents are as follows:
   - City Deal Board Report dated 13th October 2016– sets out the decision sought from City Deal Executive Board and the overall officer recommendations
   - Appendix to Board Report - Option Assessment Report – this report, which integrates and assesses the key conclusions from the technical work
     - The Background Papers to the Board Report – these contain the details of the technical analysis and include the following: TAG Cases each with an executive summary:
       - Strategic Case including a wider economic assessment
       - Economic Case including an environmental assessment
       - Financial Case
       - Commercial Case
       - Delivery Case
     - Technical Notes and Draft Technical Notes dealing with specific issues and assisting in the broader understanding of issues as highlighted in the OAR are appended to the OAR. These are as follows:
       - **A428 Park & Ride locations TN1**
       - **Contra Flow Bus Lanes on Madingley Hill TN2**
       - **Considerations for Catchment Area Maps TN3**
       - **Local Liaison Forum Resolutions and Project Board response TN4**

3. The OAR considers both the transport appraisal and the wider economic assessment outcomes within an overall City Deal decision framework.

Objectives of the Scheme

4. The Cambridge to Cambourne Better Bus Journeys scheme objective is to deliver new high quality public transport infrastructure to achieve improved connectivity and reduced congestion between residential and employment areas and improving quality of life.

5. This connectivity and reduced congestion is key to delivering growth in Cambridge and South Cambridgeshire in line with the Greater Cambridge City Deal objectives. The western area of the city, and existing and proposed new settlements to the west, contain both housing and employment development areas which will generate increased demand on the transport network. The Local Transport Plan (LTP), the Transport Strategy for Cambridge and South Cambridgeshire (TSCSC), and the Cambridge and South Cambridgeshire Submitted Local Plans envisage enhanced transport infrastructure by non- car modes to provide sustainable transport links to address this increased demand. Without this planned mitigation, this growth will have an adverse effect on highway congestion levels and journey times affecting quality of life and potentially constraining further growth.

6. This scheme therefore seeks to deliver a high quality public transport solution which:

   - Delivers the integrated planning and transport strategy as set out in the local planning and transport policies
   - Achieves modal shift from cars to public transport and active modes, such as walking and cycling
   - Provides segregated congestion free capacity for buses as part of an integrated public transport network;
   - Connects current and potential major employment sites in and on the edge of the city (including Cambridge Science Park, University West Cambridge site, North West Cambridge, the Cambridge Biomedical Campus / Addenbrooke's Hospital); Bourn and Cambourne;
   - Removes or reduces the need for private transport for travelling in and out of the city centre;
   - Intercepts car traffic into Cambridge from the A428 and routes that feeds into it;
   - Provides high quality public transport, defined as frequent, fast and reliable journeys; and

- Is compatible with emerging proposals from the linked Western Orbital scheme, which is being considered as part of a separate study and integrated with other emerging City Deal proposals such as City Centre Access Study incorporating demand management measures
- Improves quality of life and environmental sustainability in Greater Cambridge.

7. Quality is defined as the extent to which infrastructure can deliver 'fast, frequent and reliable' public transport journeys and therefore provide a genuine alternative to the private car. This reflects the LTP policy objectives for transport improvements along the corridor. The LTP also sets out the objective of providing the right infrastructure on corridors to encourage commercial operators to provide high quality services.

   Summary: The scheme must deliver a qualitative step change in public transport to support economic growth and its success should be measured against this primary objective.

The City Deal Context

8. The Greater Cambridge city region[1] is one of the fastest growing parts of the UK and this high rate of growth is expected to continue. The Submitted Cambridge and South Cambridgeshire Local Plans envisage growth between 2011 and 2031 of 33,500 new homes (equating to a 25% rise in population) and 44,000 new jobs.

9. Nationally the significance of the city region is recognised by the National Infrastructure Commission (NIC) which has been tasked with unlocking growth, housing and jobs in the Cambridge – Milton Keynes – Oxford corridor. The NIC has recently undertaken a 'call for evidence' to gain views on how this growth can be best facilitated. The consultation submissions from the Local Enterprise Partnerships covering the corridor emphasised the role of both regional and local transport infrastructure investment to support economic growth.[2]

10. The Greater Cambridge City Deal is a unique opportunity to secure the future of Greater Cambridge as a leading UK and global hub for research and technology, support economic growth and improve quality of life for residents of Cambridge and South Cambridgeshire.

11. The City Deal recognises that the partner authorities have worked closely together on the new local plans and associated transport strategy and have aligned plan-making processes to achieve the benefits of what amounts to a single overarching development, infrastructure and delivery strategy for Cambridge.

[1] The area covered by the districts of Cambridge and South Cambridgeshire.
[2] http://www.semlep.com/news/2016/cambridge-milton-keynes-oxford-growth-corridor/

12. The additional work undertaken by the local planning authorities in 2015 concludes that the Submitted Local Plans represent “a sustainable development strategy for the wider Cambridge area that meets objectively assessed housing needs in a way that supports the successful economy and provides a pattern of development that will give genuine opportunities for residents of new developments to live in a sustainable way. Many will benefit from new settlements that provide a wide range of services and facilities and, with significant new public transport measures on the two corridors involved akin to the successful Guided Busway, the opportunity to move around the area by sustainable modes of transport.

13. The City Deal will through investment in infrastructure, will make it easier to travel in, out and around Cambridge and South Cambridgeshire by public transport, cycle or on foot. For stability in car trips to be seen in the period to 2031 with the population growth envisaged in the Local Plans, the proportion of people driving to work would need to fall to around 47% from the current level of around 60%.

14. The City Deal vision for a comprehensive sub-regional infrastructure network is represented in **Figure 1**, which draws on the key components of the development strategies in the submitted Local Plans and the Transport Strategy for Cambridge and South Cambridgeshire, and reflects the emerging City Deal schemes.

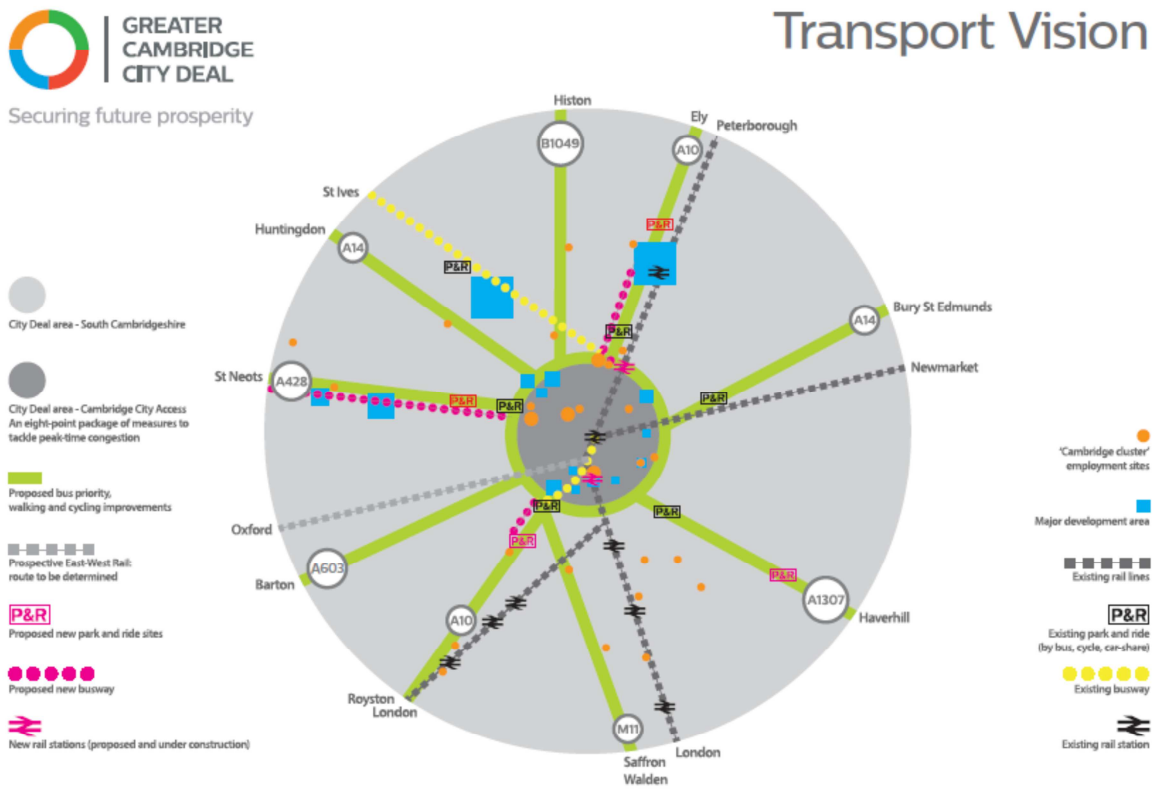


Figure 1: The City Deal Vision for Greater Cambridge

15. The interrelationship between infrastructure and growth as envisaged by the City Deal is summarised in ***Figure 2*** below:

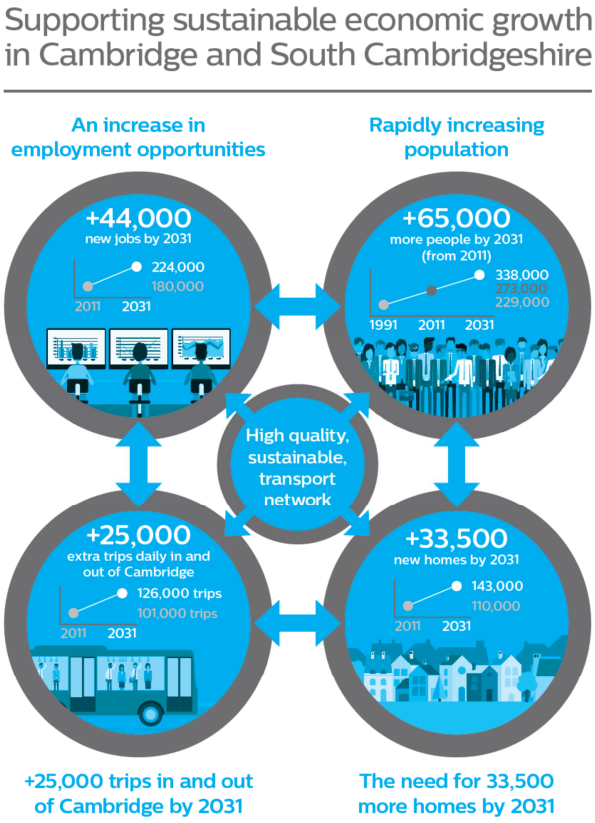


Figure 2: The City Deal supporting sustainable growth

16. The City Deal is subject to a mechanism, whereby £400m of Central Government funding in the 10-15 years after 2019 is dependent on the delivery of significant economic impacts through the prioritised spending of an initial £100m of funding over 2015-19.

17. The City Deal agreement with central government aims to achieve additional economic benefits through devolved funding to a partnership of local authorities and other partners with the following objectives:
    - to nurture the conditions necessary to enable the potential of Greater Cambridge to create and retain the international high-tech businesses of the future;
    - to better target investment to the needs of the Greater Cambridge economy by ensuring those decisions are informed by the needs of businesses and other key stakeholders such as the universities;
    - to markedly improve connectivity and networks between clusters and labour markets so that the right conditions are in place to drive further growth;
    - to attract and retain more skilled people by investing in transport and housing whilst maintaining a good quality of life, in turn allowing a long-term increase in jobs emerging from the internationally competitive clusters and more university spin-outs.

18. These key objectives have been summarised into an option approval criteria as to how options:
    - Support business investment and confidence;
    - Represent targeted investment where business needs it;
    - Link effectively key growth sites;
    - Support the transport infrastructure and quality of life.

19. In order to implement these objectives through investment the City Deal includes a framework which quality assures the decision making process[3]. This framework provides information for the Board's key considerations in prioritising investment decisions. At the highest level schemes will need to demonstrate the following attributes:

    - **Value for money** – value for money measured as a return on investment based upon an adjusted Benefit Cost Ratio (BCR) including Wider Economic Benefits (WEB's) and Gross Value Added (GVA)
    - **Environmental and social distributional impact** – potential benefits and adverse impacts. This means the impact on different demographic groups.
    - **Contribution to objectives** – Transport Strategy objectives Local Plan and LEP objectives
    - **Deliverability** – affordability, practicality, key risks, key milestones and stakeholder/public support

20. At the option assessment stage for prioritised schemes for each Tranche of funding, the assurance framework provides a more detailed set of requirements which is discussed in Part 2 of the OAR.

    Summary: Greater Cambridge is a key sub-region for national growth and the City Deal seeks to harness and support the growth in Cambridge and the surrounding region South Cambridgeshire through delivering sustainable infrastructure. The City Deal is based on long term local decision making within the context of an assurance framework that emphasises the strategic focus of investment for economic return. The City Deal requires that investment decisions are considered against how they contribute to the following issues:

    - **Support business investment and confidence;**
    - **Represent targeted investment where business needs it;**
    - **Link effectively key growth sites;**
    - **Support the transport infrastructure and quality of life.**

[3] Cambridge City Deal Assurance Framework

The Local Context – The need for a scheme

21. The City Deal should be seen in the context of local policies to deliver growth which underpinned the decision to apply to Central Government for City Deal status. The key local policies should be understood as a coherent expression of the overarching aims and objectives of the partner authorities.

22. The City Deal supports delivery of the strategy set out in the Submitted Cambridge and South Cambridgeshire Local Plans through investment in transport infrastructure, housing delivery and skills. Likewise, the Submitted Cambridge and South Cambridgeshire Local Plans will support the City Deal commitments by speeding the delivery of new homes and jobs.

23. The LTP commits to:

- Extend the busway network to serve major new developments and employment sites.
- Develop high quality public transport corridors along key routes with priority at key junctions, helping to reduce journey times.
- Achieving modal shift from cars to public transport and active modes, such as walking and cycling

24. The Transport Strategy for Cambridge and South Cambridgeshire (TSCSC), prepared in parallel with the Submitted Local Plans, was adopted by Cambridgeshire County Council in March 2014. The strategy provides a plan to manage the rising population and increase in demand on the travel network by shifting people from cars to other means of travel including cycling, walking and public transport It envisages a range of infrastructure interventions on the St.Neots and Cambourne to Cambridge corridor as a key part of the integrated land use and transport strategy, responding to the levels of planned growth[4].

25. The TSCSC focus of public transport intervention along the corridor is busway/ High Quality Public Transport Infrastructure[5]. Its requirements are reflected in the Long Term Transport Strategy[6], which forms part of the LTP. Policies in the Submitted South Cambridgeshire Local Plan[7] reflect this, requiring high quality segregated public transport improvements between the A428 /A1303 junction and inner ring road, and measures to

[4] Transport Strategy for Cambridge and South Cambridgeshire Page 5-23 St Neots and Cambourne to Cambridge corridor
[5] Cambridgeshire Long Term Transport Strategy 2015 Figure 4.1, (page 4-9)
[6] Cambridgeshire Long Term Transport Strategy 2015 figure 4.3 (page 4-7)
[7] Submission South Cambridgeshire Local Plan 2014 Policy SS/6 New Village at Bourne Airfield, Policy SS/8 Cambourne West.

ensure bus journeys between Cambourne / Bourn Airfield and the A428 / A1303 junction are direct and unaffected by any congestion suffered by general traffic on the Cambourne to Cambridge corridor, to ensure the sustainability of planned developments.

26. As such there is a strong emphasis in the suite of local transport and planning policies (LTP, the Transport Strategy for Cambridge and South Cambridgeshire, and Submitted Local Plans) on sustainability and connectivity of homes, jobs and services through the provision of high quality public transport.

27. In terms of cycling/pedestrian links, adopted policy recognises that there is great potential in this corridor to enhance multi-modal journeys by enhancing the links between cycling/pedestrian routes and public transport. This would increase mobility choice for people, reduce congestion and negate the need for extensive car parks at stations, as well as reducing the likelihood of residential streets being clogged with commuter cars.

28. In January 2015 the City Deal Executive Board agreed the prioritisation of schemes for Tranche 1 of the City Deal funding. The A428-A1303 corridor from Cambourne to Cambridge was selected as a priority scheme in line with the Greater Cambridge City Deal vision to secure economic growth and quality of life, whilst allowing ease of movement between key employment and residential sites.

29. The City Deal Executive Board determined that the corridor scheme may be delivered in two tranches. Tranche 1 (to 2020) will include the part of the corridor which runs from the A428/A1303 junction at Madingley Mulch roundabout, east to Cambridge city centre. Tranche 2 or 3 (up to 2030) would include the part of the corridor which runs from Caxton Gibbet roundabout east to Madingley Mulch roundabout.

30. This responds to the important role that the A428 corridor plays in the development strategy for Greater Cambridge that is contained in the Submitted Local Plans, and in particular to the proposals for a new settlement at Bourn Airfield and a major extension to Cambourne at Cambourne West.

31. There are a total of 8800 dwellings planned at strategic growth sites in the corridor, including development at St Neots.

32. At the Cambridge end of the corridor, North West Cambridge will provide up to 3000 new homes (1500 homes for its key workers, and 1500 homes for general sale) with accommodation for 2000 students,100,000 square metres of research facilities and a local centre with a primary school,

community centre, health centre, supermarket, and hotel. In addition Darwin Green will provide approximately 1780 homes in Cambridge and 1,000 in South Cambridgeshire. West Cambridge is an existing strategic employment allocation. Further intensification of development on the site is proposed. This could provide up to 15,000 employment places on the site.

33. The A428 corridor links with related orbital corridors in and around Cambridge. 15,000 new jobs are planned for Cambridge Biomedical Campus which will also house the relocated Papworth Hospital. The campus will eventually have a working population of around 30,000, making it one of the largest biomedical sites in the world. Further employment growth is likely to continue in areas such as Cambridge Science Park. There will also be future opportunities at Cambridge Northern Fringe East around the new railway station.

34. During the Local Plan Examinations, the Inspectors wrote to the Councils outlining a number of areas for further work. One of the areas related to the deliverability and feasibility of sustainable transport options to support new settlements[8]. The Councils responded with further evidence of the deliverability and feasibility of transport measures on the corridor. Therefore the Cambourne to Cambridge busway scheme is an important element to ensure new developments planned in the corridor have the infrastructure they require to make them sustainable developments

35. In addition to future growth the prioritisation of the corridor by the City Deal Executive Board also recognises the current congestion issues at peak times. Modelling for the City Centre Access Study has demonstrated that Madingley Road has seen increases in traffic between 2004 and 2014. The key current conditions on the corridor can be summarised as:
    - long delays on the eastbound A1303 up to the Madingley Road Park & Ride (P&R) site;
    - bus delays on Madingley Road in both the AM and PM peak
    - significant journey time variability along the single carriageway sections of the corridor, particularly eastbound in the morning peak and westbound in the evening peak
    - low traffic speeds in both peaks, particularly approaching / at key junctions;
    - during the AM peak 80% of route length from A428 / A1303 junction to M11 J13 is subject to queues;
    - the average delay in AM peak is 18 min between A428 / A1303 junction and Queen's Road / Northampton Street, with the average delay in AM peak being 10 min between St Neots and Caxton Gibbet; and

[8] Cambridge Local Plan and South Cambridgeshire Local Plan Examinations Letter from the Inspectors to the Councils dated 20 May 2015 regarding Preliminary Conclusions

- significant knock on impact of interaction between P&R, M11 and other traffic that exacerbates congestion.

36. The planned growth in the corridor has the potential to add to the already high levels of congestion in and around Cambridge. On the A428 corridor there are a number of areas where increased traffic levels would have significant detrimental effects, particularly Madingley Rise and Madingley Road.

37. Transport modelling forecasts that car trips on the A1303 corridor towards Cambridge will increase by 45% in the morning peak hour; 70% in the inter-peak period; and 50% in the evening peak period between 2011 and 2031.

38. The model also predicts that congestion on Madingley Road would remain relatively unchanged in the morning peak as the road is already at capacity and therefore unable to accommodate additional traffic. This is *without* the predicted impacts of any potential demand management measures in the City Centre as a result of the City Centre Access Study. Additional traffic would result in additional queuing as well as applying additional pressure to other routes into Cambridge.

39. The prioritisation by the City Deal Executive Board of work on a scheme for the whole corridor responds to the current and predicted traffic issues in this area and the significance of delivering a high quality public transport scheme to support the development strategy in the submitted Local Plans. The section of the corridor between the M11and the inner ring road has been identified as requiring urgent intervention and as such has already been identified by the Local Enterprise Partnership for Growth Deal funding of up to £9m subject to an accepted business case.

Summary: The A1303 area of the corridor is close to or at transport capacity. The local and national policy and planning framework supports effective sustainable transport scheme intervention along the corridor to address existing demand and to meet predicted transport challenges arising from growth, and reduce the impact on adjacent corridors thereby supporting future strategic development.

Work done at earlier Steps of the scheme

40. The scheme has been taken forward in 4 technical Steps which reflect the approach to scheme development supported by TAG. The principal objective of this method is to inform and test the options in a methodological step by step basis. A mixture of disciplines is required including transport planning, transport modelling, engineering, planning, property, environmental and economic assessment.

41. TAG states that all new proposals should be subject to comprehensive but proportionate assessment, wherever it is practicable, so as best to promote public interest. There are usually trade-offs to be made between resources invested in data collection and analysis, and the pursuit of more accurate results. **Table 1** summarises the process and the current stage of the scheme development.

Step 1	Identify potentially feasible Options	
Step 2	Identify Options for further single scheme Option development on the basis of an Outline Strategic Business Case	Current stage
Step 3	Present a Full Outline Business Case for a recommended alignment to proceed to statutory approval	
Step 4	Seek formal consent to construct	

Table 1: Project Development Steps

42. At Step 1 during 2014 all the potentially feasible options for public transport infrastructure interventions along the corridor were considered through a comprehensive appraisal which can be summarised as followed
    - an initial brainstorming and package generation process, in which 21 individual elements were combined to generate a long list of 34 potential Options;
    - an initial sifting process involving refining the grouping of the elements into Options followed by further analysis and sifting;
    - a number of workshops during which the Options underwent further evaluation, and three additional Options were subsequently added to the shortlist; and
    - a more detailed Option assessment process using the TAG Early Assessment Sifting Tool (EAST) which ultimately sifted the shortlist down to a proposed new Park and Ride location close to the Madingley Mulch Roundabout , with three Recommended Option for

bus priority measures to the west of the new P&R location, and three to the east.

43. On 5th June 2015 at the commencement of Step 2 the Executive Board agreed to consult on the 6 short listed Options, 3 in each Tranche. The public consultation presented nominal corridor routes as Options, ('North', 'Central' and 'South') in order to engage the public as widely as possible with the issues and link them to the key City Deal transport objectives.

44. The corridor Option routes were divided into east and west of Madingley Mulch roundabout in line with the prioritisation of the eastern section of the scheme in Tranche 1 City Deal funding, with three Options for the eastern section described as Area 1, and three for the western section described as Area 2. In addition, potential Park & Ride locations were proposed close by Madingley Mulch roundabout and included in the consultation. The Options presented at public consultation are set out in **Figure 3** below.

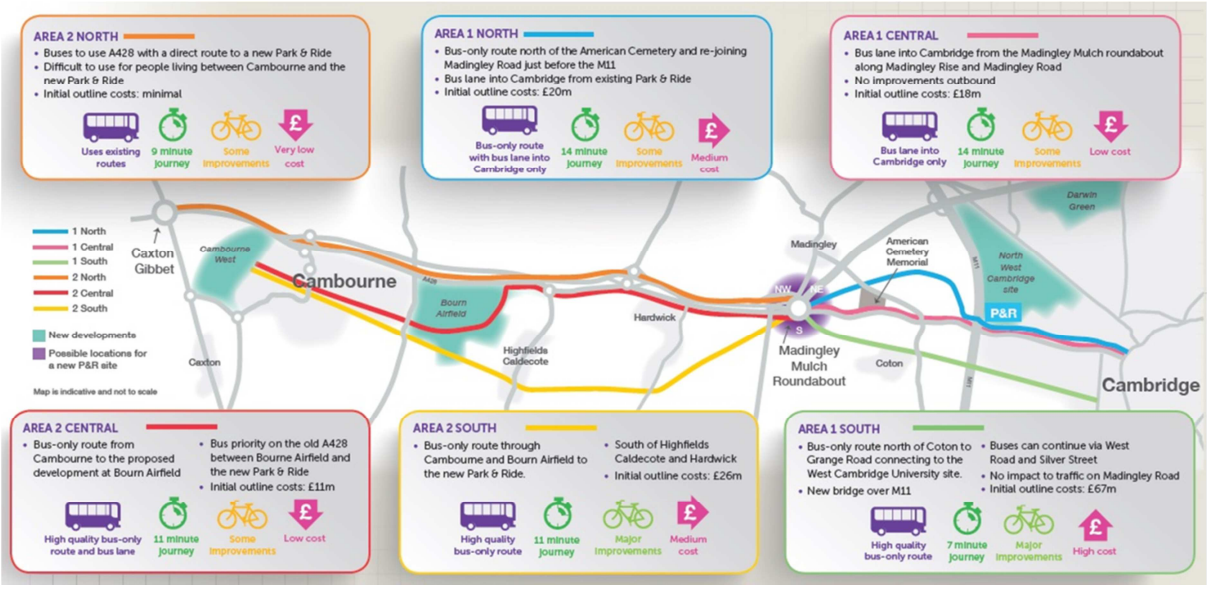


Figure 3: Options Presented for Public Consultation in 2015

45. In October/ November 2015 a public consultation was undertaken on the Options. The public consultation was extensive. 13,000 leaflets containing the survey and 30,000 postcards were produced. Over 8,000 leaflets and 20,000 postcards were delivered to those who lived along the A428 corridor, whilst the others were distributed at a variety of local outlets, as well as through informal exhibitions. Eleven events were held between Tuesday 27th October and Thursday 19th November, gathering a combined attendance of over 300 members of the public. 2,193 surveys responses were received.

46. The results of the public consultation were presented to the Executive Board in March 2016. The headline results of the consultation were as follows:
    - 70.3% of respondents agreed in principle to better bus journeys between Cambourne and Cambridge.
    - Over 50% of respondents indicated that they were often in slow or stationary traffic between the Madingley Road Roundabout and the M11 junction.
    - Just over a quarter (29.5%) indicated that they travelled between Cambourne and Cambridge on a daily basis.
    - 77.2% of respondents indicated their usual mode of travel was by car as a driver
    - 'Factors making bus travel a better alternative to the car:
        - 'Reliable journey times' was cited as being key by 50.7% of respondents.
        - 'faster journey times' was cited by 44.3% respondents, and
        - 'more buses per hour' cited by 43.1% of respondents.
    - When asked about current travel methods between Cambourne and Cambridge 25.5% indicated they used the bus;
    - 66.3% of respondents felt it was important or very important that cycling and pedestrian facilities are improved within this scheme;
    - Options Area 1 Central and Area 2 Central received majority support (66.8% and 58.1% respectively);
    - Options Area 1 South and Area 2 South received majority opposition (65.5% and 58.2% respectively) as did Option Area 1 North (57.8%);
    - From comments and communications sent in separately to the survey, the most opposition was seen for Area 1 South, due to the damaging effect it might have on Coton and the landscape of the area;
    - 176 responses gave direct additional comments to the six Options supplied within the consultation (8.0%);
    - The most frequently commented issue focused on the significance of green spaces and the landscape of the area – and the impact that each proposal might have on existing locations. 270 comments referred to this (12.3% of all survey respondents);
    - 46.1% of respondents approved of a new Park & Ride site near the Madingley Mulch roundabout, with 28.3% against the suggestion. A high proportion had no preference about its specific location (45.8%).

47. In addition to the comments, a number of alternative proposals were submitted during the public consultation offering modifications of the Options or different strategies to achieve similar objectives.

48. In the report to the City Deal Executive Board in March 2016, it was explained that some proposals were out of scope of the project, although some may be considered as part of other City Deal schemes in development.

49. Those proposals considered relevant to the project scope were assessed in order to determine their suitability for inclusion within the detailed analysis necessary to complete Step 2.

50. One alternative proposal – the BOLD initiative ("a bold approach to Cambridge's transport problems") was considered to have potential benefits and was therefore included in the modelling assessment set out in this report as Option 4 (see Table 3). The summary of the response to all relevant proposals received during the public consultation are set out in the **Table 2** below:

Proposal received from public consultation	**Response**
Alternative P&R locations	A number of alternative proposals were received for P&R locations along the corridor. • Scotland Farm; • North of Cambourne; and Transport Hubs at • Cambourne; • Bourn; • Between Highfields and Caldecote. Further assessment concluded that Madingley Mulch is the location best situated at a point on the network where corridor congestion begins, and therefore is well placed to encourage car users to switch travel modes. It is also relatively close to the center of Cambridge, and therefore would likely benefit from reasonable operating costs. Transport hubs are not considered unfeasible on grounds of first principles in addition to main P&R site but the specific location, capacity and access arrangements could only be considered as part of the next Step of assessment on a Recommended Option **Technical Note 1** sets out consideration for a P&R in more detail.
Specific route alignment north of Cambridge Road and new bridge	This proposal was not considered suitable for further assessment. In this case the infrastructure would not directly link into the City Centre without first passing through significant constraints such as the second

across M11north of J13	P&R site at Madingley Road. The overall costs of providing a new bridge across the M11 north of J13 would not be outweighed by possible benefits
Specific route alignments east of J13 M11	These proposals of routes into Cambridge from the M11 will be considered as part of any Recommended Option further scheme development at Step 3. This would include considering connectivity with West Cambridge.
Tidal bus lane for Option 1 Central	This proposal was included in early assessment of the highway Options to explore potential transport opportunities of single lane running. However further analysis indicated that introduction of a tidal bus lane would have significant safety, maintenance and townscape impacts for a limited benefit to journey times during PM periods. A **Technical Note 2** has been provided as an Appendix to this paper.
Option 4: 1 central and 1 north with a route through West Cambridge (known as the BOLD proposal)	This hybrid Option of on and off highway interventions was initially assessed as having the potential to achieve a high level of segregation without the need for a new bridge over the M11, as a result it was included in the assessment as Option 4 set out in Part 2 of this report
Smart Traffic Management at Madingley Rise	This proposal specified providing additional queuing areas at Madingley Hill in conjunction with programmed traffic signals on the highway that would hold back traffic and manage its release in line with conditions in the City Centre. It is considered that this approach does not align with City Deal objectives because it does provide enhanced connectivity nor capacity to accommodate for growth. High quality public transport is best served by providing a P&R and bus infrastructure. This proposal was not taken forward as part of this project.
Closing Madingley Hill to through-traffic	This proposal requires significant modification of the Girton interchange to be feasible. It is outside the scope of this public transport infrastructure scheme. As such this proposal has not been considered as part of this scheme assessment

Table 2: New Proposals raised in 2015 Consultation and response

51. The public consultation on the high level options formed only part of the wider stakeholder engagement and the scheme will continue to be informed by engagement with all stakeholders on an on-going basis. Stakeholders are involved in the study, to help shape decisions in the public benefit.

52. A Local Liaison Forum (LLF) was formed in March 2016 as part of this process. Wide participation and public consultation is a key factor in gaining public support and gauging acceptability for proposals.

53. The LLF has provided Resolutions for consideration by the Project Board and these Resolutions have been responded to as set out in **Technical Note 3.**

Summary: Options were developed methodically and have been subject to public consultation, the results of which have informed the appraisal during this Step of the scheme development. Most support received during the October/ November 2015 public consultation was for on-line Options and most objections was to off-line Options. Over 70% of respondents supported the need for public transport improvements along the corridor and less than 20% considered that nothing needed to be done. From the initial public consultation the following key concerns were raised in relation to off line Options:

- **Highest level of opposition was to the southern off line Options.**
- **Concerns included environmental impact on Coton and the West Fields.**
- **High cost was also mentioned as a consideration**

Officers will use the public consultation process and ongoing stakeholder engagement to ensure that detailed proposals take into account concerns.

Further project development work post public consultation

54. As part of Step 2 and the ongoing technical assessment, the conceptual options presented for public consultation and those received that merited further consideration underwent further appraisal. To achieve this, 5 Options were established for assessment for the complete corridor from Cambourne to Cambridge as set out and illustrated in **Table 3**.

55. Option 3a has also been included in Table 3. Option 3a has been considered on an early engineering basis to potentially offer a viable variation to Option 3. This option would use the established transport corridor adjacent to St Neots Road, and could potentially be designed to provide a similar level segregation and high quality public transport to Option 3 but with a reduction in cost over providing an entirely new corridor between Cambourne and Madingley. This responds to concerns raised during public consultation. At this point Option 3a has not been modelled separately as a standalone Option but in part within Option 3 and 5.

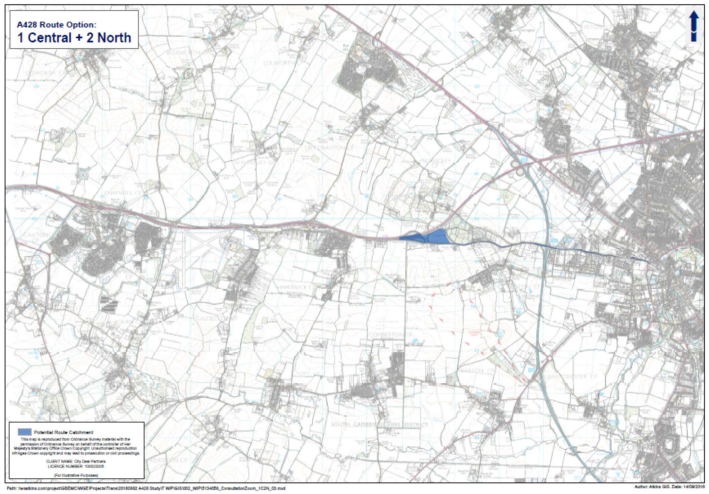
56. Maps have been prepared that show an indicative catchment area for each option that illustrates the area within which potential specific route alignments will be identified and presented at a further public consultation as part of the next Step. These catchment area maps there have the potential for a number of possible alignments during the next Step which need to be assessed against constraints including the following :
    - Planning
    - Policy
    - Environmental
    - Property
    - Engineering
    - Transport
    - Social and Economic

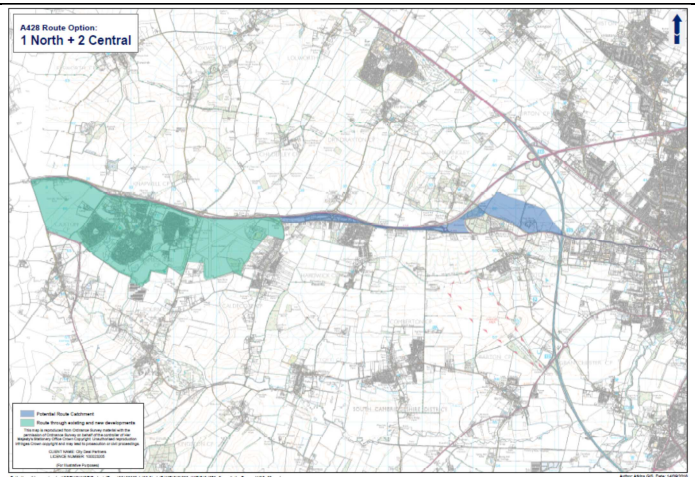
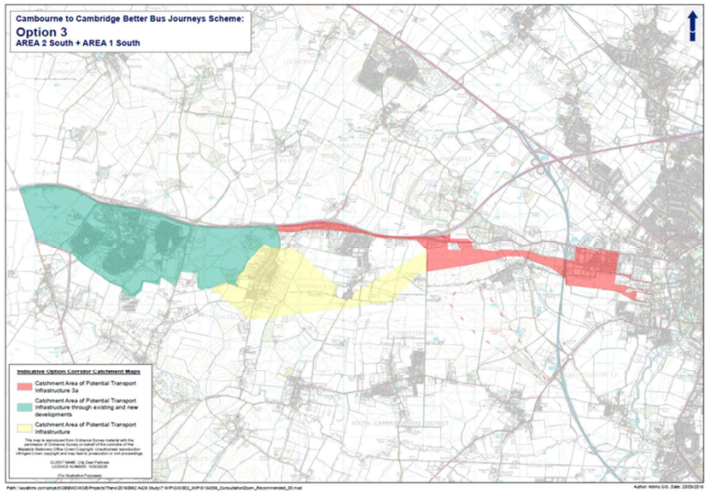
57. At the end of the next Step a specific route alignment within the catchment area and Full Outline Business Case will be presented to the Executive Board

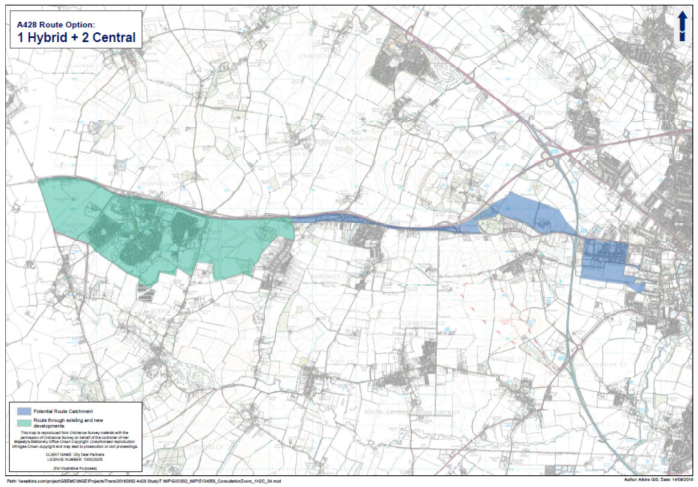
58. A Technical Note describing how the option catchment areas are defined, taking account of the constraints is presented in **TN4**

59. For each option, the level of infrastructure intervention has been classified as:
    a. High – a significant degree of offline segregation for all or the majority of the route with integral cycle improvements
    b. Medium - a hybrid of both on and off highway measures such as a stretch of busway combined with an on road bus lane and
    c. Low - conventional highway improvements such as bus lanes

60. All 5 Options modelled include a new P&R in the vicinity of the Madingley Mulch Roundabout as shown in **Figure 3.** The recommended location for the P&R will be generally determined by selected option.

*All Options were modelled assuming a P&R at Madingley Mulch roundabout (Site 2)			
Scheme	**Level of intervention**	**Option Description (Description used during consultation see Figure 3)**	**Option Catchment Area Maps**
Option 1	Low	AREA 1 Central+ AREA 2 North • Improvement to bus services, which will run along existing roads. • No bus priority is proposed on the existing A428 dual carriageway • Signalisation of Madingley Mulch roundabout will take place, along with provision of a new Park & Ride at this junction. • Includes online eastbound bus lanes from the A1303 / A428 junction along Madingley Rise and Madingley Road to Lady Margaret Road.	

Option 2	Medium	AREA 1 North+ AREA 2 Central • A new offline segregated route linking Cambourne and the proposed Bourn Airfield new settlement. • The route continues along St Neots Road with bus priority measures in place to the A1303 / A428 junction • From here, a new offline dedicated bus route going northeast from the A1303 / A428 junction, connecting to Madingley Road just west of the M11. • A further eastbound bus lane on Madingley Road would be provided as far as Lady Margaret Road.	
Option 3	High	AREA 1 South + AREA 1 South • A new offline segregated dedicated bus route connection between Cambourne and Bourn Airfield • The segregated route then runs south of Hardwick to Madingley Mulch roundabout. • From here direct access to a new segregated dedicated bus route running north of Coton and parallel to Madingley Road and Madingley Rise to new bridge over the M11 • Route continues to Grange Road, with a connection to the West Cambridge University site (the alignment could be south of, or within, West Cambridge)	
Option 3a	*High*	*AREA 2 Central + AREA 1 South* • *A new offline segregated dedicated bus*	*Included as variation of Option 3 indicated between Bourn Airfield and Madingley Mulch*

		route connection between Cambourne and Bourn Airfield • *The segregated route then runs alongside the old A428 to Madingley Mulch roundabout (this is a variation of Option 3 that provides the benefits of a segregated route but uses the existing road corridor).* • *From here, direct access to a new segregated dedicated bus route running north of Coton and parallel to Madingley Road and Madingley Rise to new bridge over the M11.* • *Route continues to Grange Road, with a connection to the West Cambridge University site (the alignment could be south of or within West Cambridge)*	*roundabout using St Neots Road corridor.*
Option 4 (BOLD)	Medium	AREA 1 Hybrid + AREA 2 Central • A new segregated bus route linking Cambourne and the proposed Bourn Airfield new settlement. • The route continues along St Neots Road with bus priority measures in place to the A1303 / A428 junction. • A new Park & Ride site is provided at Madingley Mulch roundabout (Site 2). • From here, a new off line segregated bus route going northeast from the A1303 / A428 junction, connecting in to Madingley Road just west of the M11. • Services would use the existing bridge to cross the M11 and then enter the	

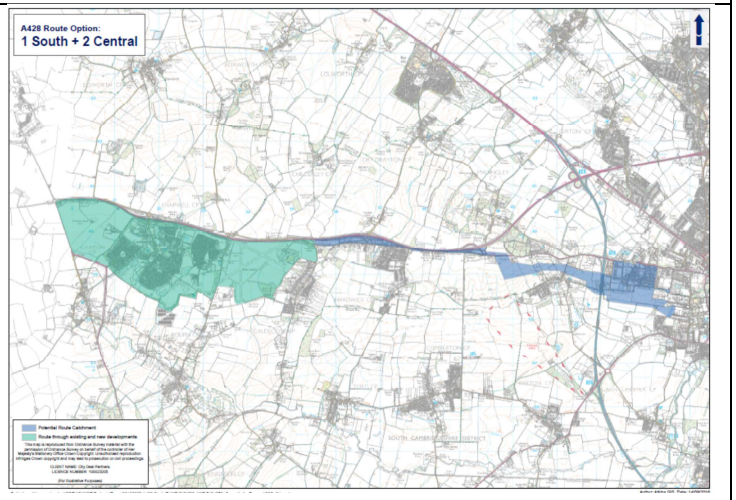
		West Cambridge site, before continuing south and east to Grange Road on a new offline dedicated bus route running parallel to Madingley Road	
Option 5	Medium	AREA 1 South + AREA 2 Central • A new offline segregated bus route linking Cambourne and the proposed Bourn Airfield new settlement. • The route continues along St Neots Road with bus priority measures in place to the A1303 / A428 junction, new Park & Ride provided at Madingley Mulch. • From here a new offline dedicated bus route running north of Coton and parallel to Madingley Road and Madingley Rise to new bridge over the M11 • Route continues to Grange Road, with a connection to the West Cambridge University site (the alignment could be south of, or within, West Cambridge).	

Table 3: Description of Options

61. 3 potential locations for a P&R at Madingley Mulch were also assessed as part of this stage of work. These locations are set out in Figure 4

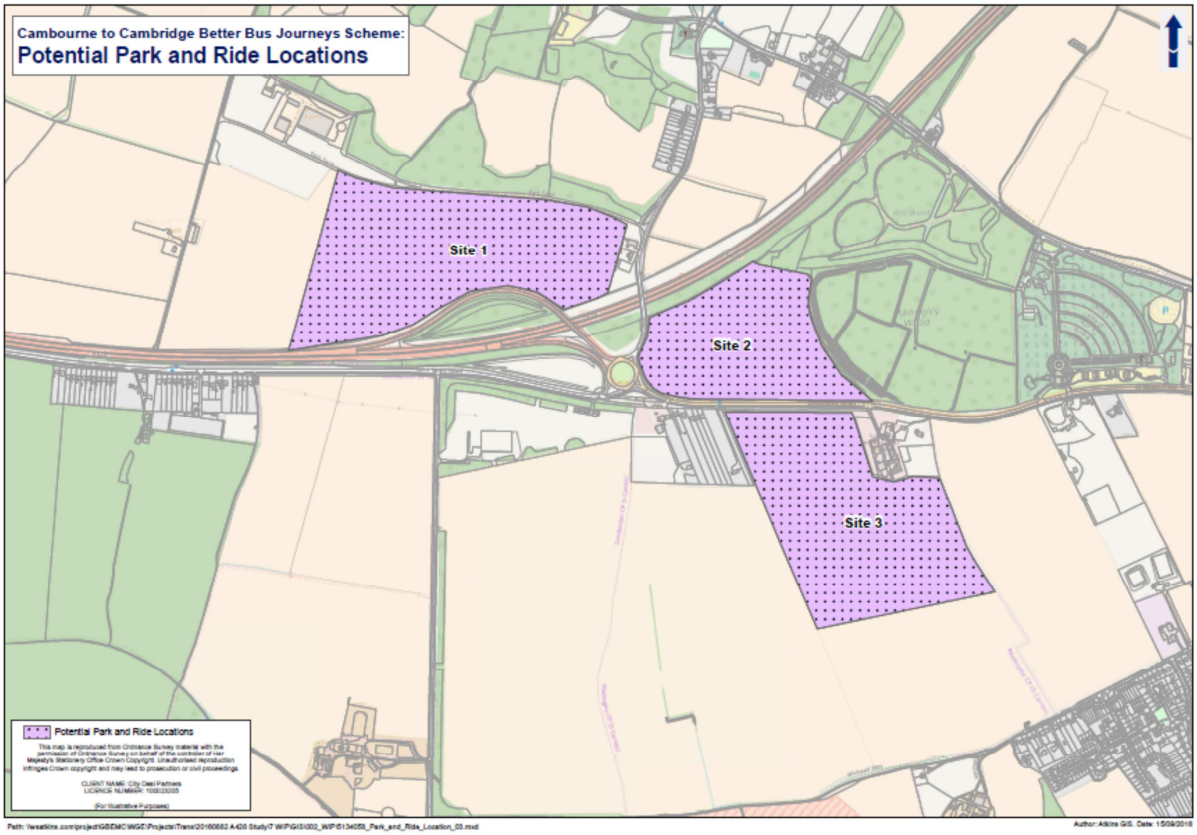


Figure 4: Potential P&R locations assessed

62. For the purposes of strategic modelling a specific location for the proposed P&R near Madingley Mulch roundabout was assigned. It was considered reasonable that a single location with potential capability for any Option would be sufficient for strategic level appraisal as such Site 2 was selected. It was acknowledged that the offline route to the south would require buses to cross over Madingley Road twice), and would provide the easiest access for the majority of vehicles in the AM peak. This site was deemed to be the most flexible and therefore taken forwards for the appraisal

63. The constraints for the location of the Park & Ride are the similar as those for the linear options. The key strategic consideration of the P&R location is the extent to which it operates effectively with each option.

<u>Summary: 5 Options and 3 Park & Ride location in the vicinity of Madingley Mulch Roundabout were taken forward for further assessment.</u>

PART 2: ASSESSMENT – THE TECHNICAL OPTION APPRAISAL

Introduction

1. The City Deal partnership has an assurance framework, specifically agreed with Government, to ensure that overall value for money is secured. All schemes promoted will be assessed to ensure they deliver value for money where the economic benefits of the scheme exceed the costs of investment and maintenance, contribute to City Deal, Local Plans and Local Enterprise Partnership objectives and can be delivered on time and to budget. The approach to assessment is therefore to support the City Deal objectives and complying with its assurance framework.

2. Since the public consultation in 2015, further appraisal undertaken for the 5 options and P&R in the vicinity of Madingley Mulch Roundabout, to inform the determination of a Recommended Option. In summary the approach to the assessment was as follows:

3. TAG assessment which considers direct costs and benefits of transport schemes and organises these under 5 cases for investment, which are:
    - The Strategic Case (including a wider economic assessment)
    - The Economic Case (including a wider environmental assessment)
    - The Commercial Case
    - The Management Case
    - The Financial Case

4. These 5 cases reports together with individual supporting detailed technical documents constitute a Strategic Outline Business Case which is brought together in this OAR.

5. This Strategic Outline Business Case informs an overall assessment against the City Deal objectives in order to arrive at Recommended Option.

6. It is important to emphasise that any selected option would undergo further analysis and refinement at the next Step of work.

Details of the Assessment

7. The January 2015 report the City Deal Executive Board option prioritisation decision was informed by an assessment using the DfT's Early Assessment and Sifting Tool (EAST) methodology. This DfT tool, which is primarily transport focused, was supplemented by a more wide ranging economic prioritisation exercise in which the housing and growth impact of interventions were considered. As such from the earliest stage of consideration of City Deal transport schemes the assessment has been holistic and focused on the core economic rationale of the City Deal programme.

8. TAG is the standard method used by the Department of Transport for the appraisal of transport infrastructure options, principally using strategic modelling and its outputs. This method prioritises transport investment by use of national appraisal criteria.

9. TAG is a toolkit which aims to consider all relevant economic, social and environmental outcomes of an intervention with a value for money and deliverability framework. The toolkit consists of software tools and guidance on transport modelling and appraisal methods, that are applicable for highways and public transport interventions. These facilitate the appraisal and development of transport interventions, enabling analysts to build evidence to support business case development and inform investment funding decisions.

10. It is important to note that TAG is intended to be applied to specific circumstances and to recognise that the application of TAG at a national level may differ in some ways from its application to the local context. TAG itself recognises this within its guidance notes. Paragraph 1.1.5 of Senior Responsible Officer TAG guidance also sets out that the appraisal output can be supplemented for the purposes of decision-making with specific additional wider investment criteria, to better reflect the circumstances of the scheme being considered. This would apply, for example, to investment criteria relevant to the objectives of the City Deal in so far as they may differ from standard national growth assumptions.

11. The Strategic Outline Business Case introduces a way of identifying the overall benefits and costs as a ratio for each Option, known as the Benefit Cost Ratio (BCR) with both the denominator (costs) and numerator (benefits) expressed in monetary terms. The BCR forms only one part of the assessment and is subject to change during each Step of the scheme development. The BCR will have the highest degree of refinement at the Step of the scheme development where most detail is assessed.

12. Business cases are developed in line with HM Treasury's advice on evidence-based decision making set out in the Green Book and use its best practice Five Case model approach. Essentially, analysts are required to

develop a business case giving due consideration, and providing evidence on:

- The Strategic case: demonstrating the case for change and strategic fit delivered by the proposal, providing a clear rationale for the proposed investment. The Strategic Case will also include the wider Gross Value Added (GVA) different levels of intervention may deliver to the local and national economy. This goes beyond the normal technical transport approach, recognising the wider objectives of the City Deal and the economic benefits that will be brought to Greater Cambridge by new housing and jobs and the transformational change that high quality sustainable transport solutions can bring.
- The Economic case: assessing the Value for Money of the proposal. This considers all impacts delivered, and analyses whether the proposal presents good value for tax payers' money; The Economic Case also includes measurement of the environmental costs and benefits of each Option
- The Financial case: analysing the financial profile of the investment, and identify funding and accounting issues;
- The Delivery case: demonstrating that project planning (phasing and delivery of implementation), risk management and stakeholder engagement has been addressed; and
- The Commercial case: demonstrating that financial implications, risks of proposed commercial deal, risk allocation and transfer have been addressed in the proposed procurement strategy

13. The Executive Board as an investment board should consider the evidence in all five cases when making an investment decision in respect of the Recommended Option. The degree of detail contained within the Strategic Outline Business Case may vary depending on the level of investment or risk proposed to ensure that the appraisal process is proportionate.

Outcomes of Assessment

A. Strategic Case

14. The Strategic Case sets out the vision for Cambridgeshire of ambitious growth and high quality of life. The Strategic Case discusses the strategic and policy context in which this vision may be met and provides an assessment of how the options for the Cambourne to Cambridge better bus journeys scheme address the transport and wider policy requirements of Cambridgeshire and the City Deal to achieve this vision.

15. The overarching strategic focus, built from Local Plans and Strategies, is summarised in the City Deal Assurance Framework[9] strategic goals. These are:
    - To nurture the conditions necessary to enable the potential of Greater Cambridge to create and retain the international high-tech businesses of the future;
    - To better target investment to the needs of the Greater Cambridge economy by ensuring those decisions are informed by the needs of businesses and other key stakeholders such as the universities;
    - To markedly improve connectivity and networks between clusters and labour markets so that the right conditions are in place to drive further growth; and
    - To attract and retain more skilled people by investing in transport and housing whilst maintaining a good quality of life, in turn allowing a long-term increase in jobs emerging from the internationally competitive clusters and more University of Cambridge spin-outs.

16. The City Deal have rationalised the transport aspects of these objectives in their Strategic Economic Plan[10] (SEP) into a number of key themes, such as:
    - ensuring that the future transport network is fit for an economically vital high growth area,
    - working with partners to facilitate improvements to key routes;
    - ensuring linkage with national transport investment decisions; and
    - identifying scalable interventions that open up access to significant growth locations.

17. The SEP vision for transport focuses on the transport contribution to sustainable growth and economic prosperity. In terms of public transport, the SEP highlights the need for more sustainable transport options such as increased bus use and active travel, noting that new developments such as those at Bourn Airfield could achieve a high public transport mode share. The focus on public transport provision is a requirement to deliver high quality sustainable transport links that offer an alternative to the private car[11.]

18. The vision set out in the SEP is built from Local Plans and the Transport Strategy for Cambridge and South Cambridgeshire (TSCSC).

19. In the Submitted City of Cambridge Local Plan 2014, 'Policy 5: Strategic transport infrastructure' identifies a need to promote sustainable transport and pedestrian and cycle priority. In terms of public transport, the Policy notes a need to ensure new development in Cambridge is linked through High Quality Public Transport (HQPT) routes, frequent services and cycle

[9] Greater Cambridge City Deal: Cambridge City Council; Greater Cambridge Greater Peterborough Enterprise Partnership; Cambridgeshire County council; South Cambridgeshire District Council; University of Cambridge: Draft document

[10] Greater Cambridge Greater Peterborough Economic Partnership, Strategic Economic Plan

[11] Ibid.

ways to the city centre, railway station and employment centres. ‘Policy 80: Supporting sustainable access to development’ notes that development on the edge of the city and urban extensions are supported by HQPT linking them to the city centre and employment centres. The Policy notes that for a HQPT system to be successful, it needs to be efficient, reliable and attractive and 'free from other traffic, where possible, in order for them to deliver on reliability and speed of journey.’

20. The Submitted South Cambridgeshire Local Plan 2013 is consistent with the Cambridge Local plan in terms of the need for high quality public transport. It makes specific reference to public transport on the A428 with reference to the proposed Bourn Airfield development, noting that significant improvements in public transport would include a segregated bus link between Cambourne to Bourn Airfield and measures to ensure that bus journeys between ‘Caldecote / Highfields and the junction of the A428 and the A1303 is direct and unaffected by any congestion suffered by general traffic.’

21. Taken together the two Submitted Local Plans highlight a requirement for HQPT supported by direct walking and cycling routes and that in order for these new public transport services to offer an attractive alternative to the car, there is a need to ensure that the services are not affected by congestion caused by general traffic.

22. In terms of delivery, the Transport Strategy for Cambridge and South Cambridgeshire (TSCSC) supports the growth and development vision set out in the Local Plans. With reference to the A428, ‘Policy TSCSC 21: Planning obligations for Bourn Airfield and West Cambourne’ indicates a requirement for the following:
    - Segregated bus links between the A428 and the M11;
    - A1303 / A428 outer Park & Ride capacity;
    - Direct, segregated high quality pedestrian/cycle links to west Cambridge, Papworth Everard, Highfields, Hardwick, Caxton, Bourn, Caldecote, Comberton, Bar Hill and Dry Drayton;
    - Any mitigation measures needed at the junctions of the A428 with the A1303 and A1198;
    - Delivery of funding of any measures required to mitigate the traffic impact of the developments on Bourn, Caldecote, Toft, Comberton and Barton; and
    - A smarter choices package including residential school and workplace travel planning for a busway between West Cambourne and the junction of the A1303 and A428.

23. Other key related policies highlight a number of requirements for Public Transport, Walking and Cycling:
    - ‘Policy TSCSC 1: The strategy approach’ notes that ‘The backbone of the strategy will be a high quality passenger transport network of bus, guided bus and rail services, fed and complemented by comprehensive pedestrian and cycle networks. Highways capacity enhancements will

ensure that traffic can move efficiently in appropriate locations without interfering with passenger transport corridors.'

- 'Policy TSCSC 8: Improving bus services' notes that 'The County Council will work with partners and passenger transport operators to develop an improved and integrated network of HQPT.'
- 'Policy TSCSC 9: Access to jobs and service's notes that the transport network needs to be efficient and effective with HQPT and cycle network routes near major employment, education and service centres.
- 'Policy TSCSC 12: Encouraging cycling and walking' makes a number of suggestions to improve capacity and also notes that where feasible, pedestrian and cycle facilities will be provided alongside HQPT and new road infrastructure (citing the Busway facilities as a standard example).
- 'Policy TSCSC 15: Managing travel demand' highlights that measures for managing demand could include reallocation of road space to be used by passenger transport, pedestrians and cyclists.

24. Overall it is clear that there is a consistent and direct relationship between the Submitted Local Plans, Transport Strategies and the City Deal priorities. As well as defining specific corridor objectives related to new developments, they all indicate a need to provide HQPT and walking and cycling improvements in order to offer an alternative to the private car. The Submitted Local Plans indicate that consideration should be given to attempting to ensure that public transport services are not affected by general traffic.

25. The Strategic Case also includes an assessment of the Wider Economic Benefits (WEBs) that can be attributed to an investment in appropriate public transport infrastructure, which are central to the Strategic Outline Business Case for undertaking the City Deal scheme. The City Deal objectives give rise to different considerations to conventional TAG standard metrics, in particular the delivery of additional economic growth over the period to 2031. These wider ranging benefits move beyond the direct user benefits which are captured within the standard Economic Case approach.

26. The City Deal reflects a wider approach to devolution and local control of investment decisions and seeks to promote economic growth building on the Cambridge 'phenomenon'. As such a more holistic concept of 'return on investment' based on wider benefits applies to investment decision.

27. A number of City Deal agreements are underway across the UK and those authorities who are similarly prioritising investment recognising the link between transport infrastructure and wider economic growth. City Deal authorities have therefore used assessment methods to ensure that wide ranging economic benefits are captured when considering investment decisions. This involves capturing the key economic benefits, namely jobs and Gross Value Added (GVA), being enabled directly and indirectly through investment in public transport infrastructure provision.

28. GVA is a measure of economic output (the value of goods and services produced) in a local or regional economy. In terms of wider economic benefits, the standard methodology in the Economic Case for a transport scheme focuses only on the economic benefits directly related to transport user benefits. However, a transport infrastructure intervention that seeks to unlock economic growth would clearly have wider effects as it assists or directly enables new development to take place and new jobs and GVA to be created. These benefits need to be captured in order that the full effects of the intervention can be appraised. Although these benefits cannot be directly reflected in the Economic Case, this approach accords with the HM Treasury Green Book which sets out that all benefits should be captured by the appraisal. It should be noted that the DfT is currently developing new transport assessment guidance on appraisal of these wider benefits.

29. Given the high level of employment and housing growth planned in the submitted Cambridge and South Cambridgeshire Local Plans to 2031 and beyond, which the City Deal is aligned to support, an approach to decision-making which takes into consideration such wider benefits would ensure that the potential contribution of a proposed transport scheme to economic growth and to delivering the key City Deal objectives was fully considered.

30. The Strategic Economic appraisal builds upon the direct benefits captured within the Economic Case assessment by assessing the wider economic benefits of the scheme associated with development along the corridor. In summary the following impacts are assessed for each of the High, Medium and Low intervention levels (as defined in paragraph 55):Option:
    - **Land utilisation benefits** contributing towards bringing forward development along the corridor including new residential development, and the creation of jobs and the associated GVA. These benefits are assessed and considered additional at a Greater Cambridge level and a key part of the strategic case for the scheme.
        - A proportion of these benefits are then considered net additional to the UK economy (i.e. would not be simply accommodated elsewhere in the UK) given the nature of the Greater Cambridge economy that to a significant extent competes on an international stage.
    - **Access to more productive jobs** – the remaining GVA benefits derived from those jobs created in Greater Cambridge which support existing UK residents to access more productive jobs than they may currently hold (that is jobs that generate higher GVA). TAG contains guidance on this in Unit A2.1, and the analysis aims to be consistent with this whilst also brining local data and considerations into the analysis.
    - **Reductions in spatial inequalities and structural unemployment** –the welfare benefits associated with any jobs created in areas with high levels of deprivation and reductions in long term structural unemployment

- **Option and non-use values** - the benefits relating to the value residents place on having access to opportunities due to the schemes (Option values) and that they may place on a public transport service even if they never intend to use it (non-use values). TAG includes recommendations on their quantification, although they are not always a core component of scheme appraisal.

31. The assessment of the WEB's places significant emphasis on the strategic economic context of Greater Cambridge and how the scheme will improve connectivity and networks and thereby contribute towards enabling the new wave of innovation led growth that City Deal investment seeks to deliver. As set out above this accords with the local and national policy framework.

32. The WEBs are based on combining:

- a qualitative appraisal of the intervention levels (High, Medium and Low, as defined in paragraph 59 in Part 1) for the options against the City Deal strategic objectives across a number of key channels via which the scheme is likely to influence economic growth given the identified transport benefits; and,
- Attributing a level of growth from those development sites most likely to be impacted by the scheme and wider city centre development to the highest performing Option (from the qualitative appraisal). This has involved a detailed review of the Local Plans, housing and employment developments planned and the growth targets and the transport benefits under each Option from the transport modelling work.

33. The WEBs assessment has considered the extent to which the different levels of intervention contribute toward achieving these targets along the Cambourne to Cambridge Corridor. The High and Medium scheme Options (Hybrid and Segregated, respectively) are identified as likely to deliver the most benefits in terms of supporting business investment and growth and labour market mobility. However, the High (Segregated) scheme Option is expected to deliver the highest level of economic benefits since it also contributes to the longer term strategic aims of Greater Cambridge in terms of promoting a positive image and perceptions and investment in capacity for post 2031 growth.

34. Based on combining land utilisation analysis and transport demand modelling, the WEBs assessment estimates that the total attributable proportion of remaining B-use (Business/Industrial/ Storage/Distribution) jobs in Greater Cambridge, to the highest performing segregated Option, is in the region of 800 jobs and housing in the region of 900 dwellings between 2016-2031. This is a significant level of attribution but is based on the strong linkages between development sites and the scheme, especially in the case of Bourn Airfield and Cambourne and the strategic objective of the scheme to improve West to East connectivity to Cambridge and other cluster sites. This also reflects the analysis undertaken as part of the Transport Economic Assessment Report earlier prioritisation work informing the 15th January 2015 corridor prioritisation.

35. From this, as detailed in Table 4, wider economic benefits have been calculated for the High (Segregated), Medium (Hybrid) and Low (on highway) intervention levels. A significant level of wider economic benefits have been calculated for the High and Medium Options, compared to the Low (on highway) measure, based on quantitative analysis of the transport benefits against each intervention level and how the maximum level of growth attributed to the scheme is likely to differ.

Benefit	Option		
	Low (On highway)	Medium (Hybrid) Option	High (Segregated)Option
GVA benefits – Greater Cambridge level (£s in discounted 2010 factor prices)			
Direct jobs	189	606	786
Direct GVA per annum	5.2	17.5	22.6
TOTAL GVA	**155.7**	**526.2**	**679.3**
GVA benefits – UK level (£s in discounted 2010 factor prices)			
Land utilisation – net additional jobs to the UK	38.4	129.7	167.5
Move to more productive jobs within the UK	7.0	23.7	30.6
TOTAL GVA	**45.4**	**153.4**	**198.1**
Welfare benefits – UK level (£s in discounted 2010 market prices)			
Reduction in spatial inequalities	0.28	0.93	1.21
Alleviation of unemployment	0.06	0.22	0.28
Option and non-use values	0.00	29.76	29.76
TOTAL WELFARE	**0.33**	**30.92**	**31.25**

Table 4: Wider Economic Benefits (£Ms rounded to 2010 discounted values and prices) over 30 year period

36. The WEBs for the three types of intervention, to align with transport guidance, are presented at three different levels –GVA benefits to Greater Cambridge, GVA benefits net additional to the UK economy and a range of welfare benefits. The benefits identified, at a Greater Cambridge and UK level, although highest for the High interventional level are also significant for the Medium intervention level, when compared to the Low intervention level (on-highway measures). The High and Medium level intervention Options Option represent a longer term investment in the capacity Greater Cambridge to accommodate the growth anticipated up to 2031 and thereby directly support planned development. These indicative figures are considered

conservative since no growth attribution is made to the scheme post 2031 despite considerable development being planned along the corridor.

37. The assessment of wider economic benefits is, similarly to the assessment of all costs and benefits attributed to the Options, carried out at an early stage conceptual level. The figures would be refined during the next Step of further scheme development built upon the well-defined Recommended Option.

Western Orbital Strategic Integration

38. Beyond the Cambourne to Cambridge corridor the options assessment sits within the context of a series of developing City Deal interventions on related corridors/areas. These interventions are being developed through discrete projects towards meeting the overall programme City Deal objectives and clearly have interdependency with the Cambourne to Cambridge corridor particularly in relation to the Eastern section of Option 3/3a..

39. The Western Orbital study involved exploring possible schemes to increase orbital bus capacity along the M11 corridor and to intercept car journeys from the A10 and A603 radial routes into Cambridge. Projected housing and employment growth in this area is likely to result in increased highway congestion unless these additional trips can be accommodated using public transport.

40. Sections of an orbital or circular bus route and Busway are already in operation linking the north of the City (Science Park) to the south east (rail station and Cambridge Biomedical Campus). In addition there is infrastructure connecting with the existing Busway that currently links the Trumpington Park and Ride site to Cambridge Biomedical Campus. The construction of the Darwin Green and North West Cambridge developments has secured further orbital connection linking the north to Madingley Road in the west. The lack of public transport catering for orbital movements in the south west of the City therefore emerges as a missing link which may be limiting public transport around the City.

41. In December 2015, the Executive Board agreed that high level Options for a Western Orbital bus link should be consulted on as part of ongoing development work. Due to its proximity the Western Orbital bus link has close strategic links with the Cambourne to Cambridge Corridor. A report will be presented to City Deal Board for selection of their preferred option (s) in November 2016

42. To support considerations on the Cambourne to Cambridge scheme the following **Table 5** summarises the strategic fit between Cambourne to Cambridge Options and the three Western Orbital Options that were subject to public consultation in 2016.

	A428 High level Intervention – i.e. Option 3	A428 Medium level intervention i.e. Options 2/4/5	A428 Low Level intervention i.e. Option 1
Western Orbital using M11	**Not as attractive due to requirement for buses to loop through West Cambridge** to access the M11 at Junction 13; **Reduced journey time and reliability benefits** of online Options could discourage use.	Opportunity to **connect at Madingley Road P&R** to access the M11 at Junction 13; **Reduced journey time and reliability benefits** of online Options could discourage use	Opportunity to **connect at Madingley Road P&R;** **Reduced journey time benefits and reliability benefits** of online Options could discourage use.
Western Orbital Offline (East of M11)	Opportunity to **connect at Madingley P&R or in West Cambridge;** Potential to create an **offline junction to the east of the M11** to allow the A428 to continue to the City Centre and the Western Orbital to run alongside the M11; Could **reduce the requirement** to run an alternative service from the City Centre to Addenbrooke's.	Opportunity to **connect at Madingley P&R or in West Cambridge;** **Reduced journey time and reliability benefits** of online Options could discourage use; Could **reduce the requirement** to run an alternative service from the City Centre to Addenbrooke's.	Opportunity **to connect at Madingley P&R;** **Reduced journey time and reliability benefits** of online Options could discourage use; Could **reduce the requirement** to run an alternative service from the City Centre to Addenbrooke's.
Western Orbital Offline (West of M11)	Potential to create an **offline junction to the west of the M11** to allow the A428 to continue to West Cambridge and the Western Orbital to run alongside the M11; Could **reduce the requirement** to run an alternative service from the City Centre to Addenbrooke's.	**Reduced journey time and reliability benefits** of online Options could discourage use; **Could reduce the requirement** to run an alternative service from the City Centre to Addenbrooke's.	**Reduced journey time and reliability benefits** of online Options could discourage use; Could **reduce the need** to run an alternative service from the City Centre to Addenbrooke's.

Table 5: Strategic Assessment of Western Orbital and A428 Options

43. The Western Orbital assessment in Table 5 indicates that selection of the A428 offline Option will make it more difficult to ensure the effective integration of the A428 / A1303 scheme with a Western Orbital Option that uses the M11. Conversely, an offline Western Orbital Option to either the east or west of the M11 would have a very good 'strategic fit' with Cambourne to Cambridge.

44. There is a high level of synergy between these two City Deal schemes and the potential positive impact on the BCR by considering both schemes strategically as scheme development for both to move forward.

Cambridge Access and Capacity Study

45. In June 2016, the City Deal Executive Board considered recommendations on the Cambridge Access and Capacity Study. They agreed a policy approach for a congestion reduction package, incorporating:
    - better bus services and expanded usage of Park and Rides;
    - better pedestrian and cycling infrastructure;
    - better streetscape and public realm;
    - peak congestion control points in the weekday morning and evening peak periods;
    - a workplace parking levy;
    - on-street parking controls (including residents' parking)
    - smart technology;
    - travel planning.

46. The Peak-time Congestion Control Points (PCCPs) involve the closure of key routes in the City Centre to general traffic in the morning and evening peak hours, while allowing pedestrians, cyclists and public transport services continued priority access. PCCPs are under consideration on Grange Road and Queens Road to the west of the City Centre.

47. Early traffic modelling for the City Centre Access Study has suggested that PCCP's could result in more congestion at peak times along Madingley Road which would impact public transport reliability and support a separate segregated resilient route for public transport into the City Centre.

48. In terms of maximising benefits for users of new infrastructure along the Cambourne to Cambridge corridor there is a high level of synergy between the infrastructure proposals and the Cambridge Access proposals, which could result in further improvements to bus patronage over and above those that will be seen from the infrastructure proposals on their own. This is because the measures will jointly increase the attractiveness of the bus and reduce the attractiveness of the car for journeys at peak times.

Summary: The Strategic Case sets out the case for implementing the scheme and assesses options at the highest strategic level. The

Strategic Case demonstrates that the higher quality intervention as represented by Option 3 will deliver the highest strategic fit against the core City Deal objectives. The inclusion of wider economic benefits within the Strategic Case strengthens this conclusion. The consideration of the interaction between the City Deal schemes also supports Option 3 as the Option with the greatest coherence to the wider programme. Early engineering assessment considers that Option 3a may potentially be a viable alternative to Option 3 with similar strategic benefits.

B Economic Case

49. The Economic Case documents the assessments of public transport economic efficiency, cost, environmental impact, wider economic benefits and social & distributional impacts. The Economic Case also contains a multi-criteria analysis of the performance of each Option against a range of qualitative and quantitative economic and strategic criteria.

50. A significant tool to derive the Economic Case is strategic transport modelling. Transport modelling is a way of predicting the direct transport impacts (benefits and disbenefits) of proposed schemes/interventions. Therefore to represent the levels of intervention, the five Options were assessed using the Cambridge Sub-Regional Strategic Model (CSRM).

51. The focus of the "initial" BCR is to reflect core transport specific impacts compared to costs. These impacts include:

Transport User Impacts:

I. Journey time impacts to all modes
II. Operating cost changes
III. Fares, tariffs, tolls incurred by users

Transport Provider impacts, public and private sector

I. Infrastructure costs - construction, land/property, maintenance, operation and renewal
II. Service delivery costs – fleet, operating and maintenance costs
III. Revenues – fares/ticket receipts, advertising, retail
IV. Taxes – impact on tax receipts to Government

52. The BCR and associated Net Present Value (NPV) calculation, is often used by central Government to assist in national investment decisions. As such its calculation method is closely constrained at this stage of scheme development. For example at this stage the assessment does not assume any form of mitigation for environmental impacts within the BCR calculation, as that would form part of the next Step of the project.

53. It should be noted that the wider economic impacts defined in the Economic Case do not include GVA impacts. However as described earlier in this report

GVA impacts are captured within the Strategic Case to reflect City Deal objectives.

54. **Table 6** below summarises the monetised impacts of the scheme as defined by the Economic Case

Costs and Benefits	Option 1	Option 2	Option 3	Option 4	Option 5
Net Public Transport Benefits (£000s)	56,886	69,144	57,536	22,052	24,565
Environmental Impacts (£000s)	-6,440	-8,758	-9,968	-11,861	-11,859
Wider public finance (Indirect Tax Revenues)	-6,796	-7,825	-6,252	-3,683	-4,284
Total Present Value Benefit (all monetised benefits, including wider public finance impacts and excluding wider economic impacts) (£000s)	43,694	52,561	41,317	6,509	8,421
Total Present Value Cost (£000s)	42,515	109,185	207,846	149,269	167,423
Initial BCR	1.03	0.48	0.20	0.04	0.05
Wider Economic Impacts (£000s)	8,221	1,481	1,361	-2,613	-2468
Total Present Value Benefits (all monetised benefits plus Wider Economic Impacts) (£000s)	51,870	54,042	42,678	3,896	5,953
Adjusted BCR	1.22	0.49	0.21	0.03	0.04

Table 6 Economic appraisal summary (all values NPV, 2010, £000s)

55. The Benefit to Cost ratios for all Options are poor or low, with initial BCRs ranging from 0.04 for Option 4 to 1.03 for Option 1 (the lowest cost Option). Poor BCR performance is attributed both to low modelled generic transport benefits and to the high estimated costs associated with building new offline infrastructure

56. Low transport benefits reflect the low modelled levels of demand for public transport along the A428 corridor which are due to the relatively faster journey times of private car for local commuting and business trips and to the high levels of car dependency in Cambridgeshire. The mode share for public transport in the A428 corridor is approximately 21% across all user types, patronage is dominated by education and leisure users which have low values of time according to the approach taken in TAG to attributing values of time to different user groups.

57. The modelling suggests that while the options offer journey time improvements for public transport trips, these improvements still do not

enable public transport journey times to compete with car journey times, and the low levels of demand for public transport means these journey time improvements translate into a relatively small level of transport benefits. This emphasis for the need for improvements in high quality public transport infrastructure to combine with congestion reduction proposals with the Cambridge Access Report.

Environmental Assessment

58. Within the BCR calculation is a first stage assessment of the potential environmental effects of each Option. This environmental assessment includes consideration of the following issues:
    - Noise Impacts
    - Air Quality Impacts
    - Greenhouse Gases
    - Impacts on Landscape
    - Impacts on Townscape
    - Impacts on the Historic Environment
    - Impacts on Biodiversity
    - Impacts on the Water Environment

59. The assessment at this Step looks at the range of known environmental constraints on the corridor and takes a high-level desktop view on the extent to which such constraints could avoid, mitigate compensate or enhance within the detailed design of any recommended option (although such mitigation is not included within the BCR). In effect, this assessment identifies any insurmountable constraints which would make an option unfeasible. The details on any specific effects will emerge in detail at the further development of the schemes progresses.

60. All of the options are likely have some effects in different ways on the environment. The aim of ongoing environmental assessment is to ensure that the environmental implications of decisions at each step of the scheme selection process are fully understood and appropriately managed and mitigated. The requirement of environmental appraisal at the early stage of feasibility and option analysis is effectively a desk top study to determine the scope of potential effects associated with each of the options. Consequently the Step 2 appraisal has considered
    - Identification of key constraints along the corridor
    - Mapping of constraints
    - Review of relevant local and national policy
    - Specialist desktop review of site specific environmental information

61. On the basis of the assessment done to date, it is not considered that any of the options has overriding constraints which would cause them to be ruled out at this stage.

62. The environmental assessment at Step 2 has recognised the issue of impact on the Green Belt. This is a planning constraint and as such will be a consideration of the further detailed scheme development. As part of the next Step of scheme development a more detailed assessment of Green Belt issues would be carried out.

63. In general online options involving widening works are unlikely to be considered inappropriate development because the road is already established within the Green Belt and widening works are unlikely to impact on the openness of the Green Belt or conflict with the purposes of including land in the Green Belt.

64. All offline segregated routes would pass through the Green Belt. Whilst inappropriate development in Green Belt is generally restricted, development of local transport infrastructure can be considered as appropriate development under specific circumstances. This would be the case where a requirement for Green Belt location can be demonstrated, it preserves the openness of the Green Belt and it does not conflict with the purpose of including land in Green Belt.

65. Segregated infrastructure proposals would have to undergo these tests to determine whether it constitutes appropriate development, and if not whether there are very special circumstances justifying the development. In either case, impact on the Green Belt would need to be minimised through sensitive engineering design to minimise as far as practicable the degree to which the scheme impacts on the Green Belt's openness and the purposes of including land in the Green Belt, which may for example include: ensuring that any associated buildings and structures are of a suitable size relative to the operational requirements; visual screening and landscaping measures; limiting of lighting etc.

Other considerations to BCR

66. The BCR is, when fully assessed for a recommended option an overall assessment of value for money – in other words the overall benefit the public will receive for an intervention versus the cost of that intervention.

67. The value of a transport scheme is judged by weighing the benefits against the costs to indicate whether it is Value for Money. The Value for Money assessment is, however, not just about money and saving people time; a wide spectrum of impacts is considered in a detailed appraisal, including various impacts on the economy, the environment and social welfare

68. BCR's are categorised by the DfT as follows:

- poor VfM if the BCR is less than 1.0
- low VfM if the BCR is between 1.0 and 1.5
- medium VfM if the BCR is between 1.5 and 2.0
- high VfM if the BCR is between 2.0 and 4.0
- very high VfM if the BCR is greater than 4.0

69. The BCRs generated by the Strategic Outline Business Case assessment for each option are based on early stage design development and proportional analysis of costs and benefits. These costs and benefits are subject to change through more detailed analysis in the following areas that may allow for design and benefits optimisation and thereby increase the ratio of benefits to costs. The following issues will be more fully considered as part of the next Step of further scheme development to test for BCR sensitivities to local and circumstances route catchment area of the selected option:

Land Use Planning assumptions
In terms of land use the modelling is restricted to the minimum growth figures to 2031. For example at Bourn Airfield 1360 houses are predicted to be built by 2031 rather than the full 3500 that have been identified in the Submitted Local Plan. This reflects the land use assumptions in the District Council's Housing Trajectory to 2031[12]. The incorporation of growth after 2031 will provide increased benefits for all options and increase BCRs.

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Third Party funding contributions
The BCR does not take into account financial contributions from the significant developments (S106 funding) along the corridor which will change the effective BCR by reducing the public sector net contribution. These developments contributions are still under negotiation and as such within the BCR constraints it is not possible to account for them until more certainty has been obtained on the level of contribution. Nor does the take account of the source of public sector contributions.

Modelling Methodology
Use of the CSRM modelling supports option selection. However traffic interaction may affect some options more than others and the full impact of this would not be fully understood until detailed modelling is carried out in Step 3. The on line options (e.g. Option 1) are likely to have higher traffic interactions than off line Options (e.g. Option 3). Where such traffic interactions had higher adverse traffic impacts, this could affect or alter the standard BCR calculation.

Madingley Road P&R

[12] South Cambridgeshire Annual Monitoring Report 2014-2015 (January 2016)

The initial modelling assumption was that Madingley Road P&R would remain open for the duration of the modelling period but found it would reach capacity in 2022 In any event the lease expires in 2031. In the context of City Deal planning horizon, there is a likely scenario that the existing P&R site may close and that the benefits of the 5 Options should also take account of a scenario in which the P&R at Madingley Road is closed. Although not a specific scheme objective, significant direct transport benefits for Options 1 and 2 (in so far as they incorporate proposals previously identified as Options 1 North and 1 Central) are attributed to serving the existing Madingley Road P&R site. If the P&R closes benefits attributed to Options 1 North and 1 Central would likely be reduced. Transport benefits which are derived from demand emanating from the M11 rather than Madingley Rise west- bound.

Benefit Optimisation

At the current stage of development only limited assumptions have been made around key factors that may impact demand. For example no account has been taken around specific bus service routes, timetabling, fares, ticketing and passenger information. Similarly the impacts of demand management within the City Centre that may occur as part of the City Centre Access study and other City Deal schemes have not been reflected in the BCR at this stage. These will be a factor in the next Step of further scheme development.

Estimated Scheme Costs

At this stage the overall estimated scheme costs are based on high level assumptions based upon previous schemes and include significant risk and optimism bias allowances. Further detail scheme development will provide greater detail on costs and optimisation as opportunities for efficiencies are realised.

Estimated Environmental Costs

As stated, at this stage environmental assessments are desktop and costs are considered “worst case” and do not accounting for potential mitigation measures, which will result in an overall reduction of these as monetised costs within the Full Outline Business Case.

Summary: The Economic Case at this stage has estimated poor or low BCR’s for all Options. It is expected that refinement of a single Option will result in further changes to the BCR. Environmental considerations form part of the BCR, again at this Step of scheme development focusing on constraints. Again this assessment will be further refined in line with the other aspects of the BCR. Green Belt impacts do not form part of the environmental assessment. At the policy level it is expected that the overall process of

refining the environmental effects will consider the specific issues in the Green Belt.

C Multi Criteria Analysis Framework

70. The Strategic and Economic cases, together allow for an overall performance assessment to be made for each Option at this stage.

The Multi Criteria Assessment Framework (MCAF) is an appraisal tool used to assess the Strategic Fit of the Options has been assessed by the extent to which they align with The scheme aims to deliver new High Quality Public Transport infrastructure and the City Deal objectives to achieve improved connectivity and reduced congestion between residential and employment

71. The MCAF assessed Options based on the following strategic criteria (alongside other standard environmental and economic metrics that have been considered in the business case):
    - The extent to which the Option's infrastructure and services are likely provide High Quality Public Transport (HQPT) in terms of ride quality, HQPT buses and related facilities (for example the ability of an Option to include Wi-Fi, smart ticketing and branding).
    - The level of segregated service (where segregation allows for greater reliability, route control and potentially minimises disruptive utility road works permissions issues);
    - The extent to which the Options provide potential improvement in walking infrastructure (where segregation is likely to enable and encourage more and safer walking);
    - The extent to which the Options provide potential improvement in cycling infrastructure (where segregation is likely to enable and encourage more and safer cycling); and
    - Reliability (where segregation supports greater reliability as it is dedicated infrastructure and there is minimised interaction with other traffic).

72. The Strategic objectives are derived from the City Deal Agreement with Government. To achieve the strategic objectives specific requirements are identified which are considered most relevant considering the TSCSC. In other words although there may be other potential interventions to achieve the strategic objectives these would not be policy compliant.

73. Table 7 represents the MCAF assessment for each option:

MCAF Analysis
Cambourne to Cambridge Better Bus Journeys Scheme Options

Key				
Qualitative scoring		**Quantitative scoring**		
Best performing option	5	Best performing option		5
Worst performing option	1	All other options		Proportion based on the best performing option

Strategic Goals (City Deal Assurance Framework)
To better target investment to the needs of the greater Cambridge economy by enabling those businesses and other key stakeholders such as the universities.
Value for Money, increased transport capacity, improved transport connectivity, improved journey times, High Quality Public Transport

Outcomes

Metric for scoring outcomes	Ranking										Rationale
	Option 1		**Option 2**		**Option 3**		**Option 4**		**Option 5**		
	Assessment	**Score**	**Assessment**	**Score**	**Assessment**	**Score**	**Assessment**	**Score**	**Assessment**	**Score**	
High Quality Public Transport Attributes (vehicle fleet/ride quality/RTPI/branding/ticketing)	Lowest	1	Medium	3	Highest	5	Medium	3	Medium	3	Option 1 has no dedicated infrastructure and therefore the high quality ride expected to be achieved with a HQPT scheme could deteriorate over-time. Options 2, 4 and 5 have some dedicated infrastructure, but lower control overall when compared to option 3 which is offline and can maintain both ride quality and start/stop frequency. Branding is also expected to be lower on an online scheme.
Level of service that segregation provides	No segregation	1	Partially segregated	2	Fully segregated	5	Partially segregated	3	Partially segregated	3	More segregation will be indicative of greater route control and fewer permissions issues e.g. utilities / general highway maintenance works that could be undertaken during operation.
Improvements in walking infrastructure	No segregation	1	Partially segregated	2	Fully segregated	5	Partially segregated	3	Partially segregated	3	Where busway sections are provided, direct walking infrastructure will be included within the scheme.
Improvements in cycling infrastructure	No segregation	1	Partially segregated	2	Fully segregated	5	Partially segregated	3	Partially segregated	3	Where busway sections are provided, direct cycling infrastructure will be included within the scheme.
Disruption to existing traffic during construction	Highest	1	High	2	Lowest	5	Medium	3	Medium	3	No full assessment of construction disruption has been undertaken, however construction impacts will be greatest where infrastructure is proposed on Madingley Road / Madingley Rise. Option 1 has an eastbound bus lane proposed, east of Madingley Mulch roundabout. Option 2 has works on Madingley Road, east of the M11 bridge. Diversion options for traffic using Madingley Road are very limited.
Deliverability risk (planning/consents)	Lowest	5	Medium-high	2	Highest	1	Medium-high	2	Medium-high	2	Deliverability risk (in terms of planning requirements and permissions) is expected to be lowest where schemes are based on upgrades to existing infrastructure. New infrastructure on greenfield sites is expected to have the highest risk. Any relevant environmental / statutory consents would be required.
PVC (Bus Only)	£42,515,000	5.0	£109,185,000	3.4	£207,846,000	1.0	£149,269,000	2.4	£167,423,000	2.0	Results from modelling undertaken.
PT Benefits	£43,648,905	4.2	£52,334,527	5.0	£40,074,353	3.9	£6,195,801	1.0	£8,120,677	1.2	Results from modelling undertaken. Does not include environmental disbenefits (see below)

			GVA benefits - UK Level - (PVB over 30 years, 2010 prices, Source: Mott MacDonald)	£45,400,000	-	Not assessed	-	£198,100,000	-	£153,400,000		Not assessed	-	Mott MacDonald assessment of Wider Economic Benefits. Work assessed Options 1,3 and 4 only and therefore option-specific performance is not scored as part of this MCAF assessment. ***Source:*** *Mott MacDonald (2016) Strategic Economic Appraisal of A428-A1303 Bus Scheme: Wider Economic Benefits.*
	Potential to create connectivity and networks between clusters and local markets so that the right conditions are in place to drive further growth.		**Journey times (2031, Cambourne - Drummer Street, Inbound, AM Peak)**	46	1.0	23	4.5	20	5.0	22	4.7	22	4.8	Results from modelling undertaken.
			Bus frequency (AM Peak, Buses Per Hour, Inbound)	6	1.0	12	5.0	9	3.0	9	3.0	9	3.0	Reported as number of buses per hour. For Option 1 divide by two as it is 12 buses per hour, but not on the full route
			Bus and Park and Ride mode share	21%	1.0	23%	3.0	25%	5.0	22%	2.0	21%	1.0	Results from modelling undertaken.
			Wider Impacts (PVB over 60 years, 2010 prices)	£8,220,538	5.0	£1,480,843	2.5	£1,361,425	2.5	-£2,613,091	1.0	-£2,467,951	1.1	Results from modelling undertaken.
			Constructability risk (complexity of delivery)	Medium	2	Medium	2	Highest	1	Medium	3	Highest	1	Delivery will be most complex where the route options include a new bridge over the M11. In addition, Madingley Road has traffic management restrictions in peak periods, so construction windows are likely to be restricted, increasing the complexity of construction.
			Operability risk	Highest	1	Medium-high	2	Lowest	5	Medium	3	Medium	3	Bus operations are easier where 2-way priority is given to buses. This gives operators more consistent and reliable journey times to enable easier planning for turn-around.
			Reliability	No segregation	1	Partially segregated	2	Fully segregated	5	Partially segregated	4	Partially segregated	4	Expected that offline options will offer a more reliable service than those that run online.
			Sub-total	31		42		57		41		38		
		More Housing	**Accessibility**	Lowest	1	Medium	3	Medium	3	Medium	3	Medium	3	Based on qualitative assessment of accessibility plots, which rely on journey times.
			Sub-total	1		3		3		3		3		
	Potential to create synergies to create and retain the international high-tech businesses of the future.	**Environmental Impacts**	**Total change in air quality over the 60 year appraisal period**	-£98,413	5.0	-£390,560	1.9	-£400,349	1.8	-£476,740	1.0	-£365,105	2.2	These figures are partly based on highway modelling that is not being presented fully due to the model being overly sensitive to changes in network conditions, which don't totally represent changes due to the scheme.
			Change in C02 emissions (£,NPV)	-£6,393,751	5.0	-£7,022,713	3.9	-£8,699,656	1.0	-£8,581,612	1.2	-£8,332,582	1.6	
			Change in noise impacts on households (£,NPV)	£52,070	5.0	-£1,571,200	3.2	-£2,110,641	2.5	-£3,115,847	1.4	-£3,461,636	1.0	
			Impact on the water environment	Neutral	5.0	Slight adverse	4.0	Slight adverse	1.0	Slight adverse	2.0	Slight adverse	3.0	Based on environmental assessment undertaken
			Landscape and visual impact	Slight adverse	5	Slight/Moderate adverse	2	Moderate adverse	1	Slight/Moderate adverse	2	Slight/Moderate adverse	2	Based on environmental assessment undertaken
			Heritage impact	Neutral	5	Slight adverse	4	Moderate adverse	3	Slight adverse	4	Moderate adverse	3	Based on environmental assessment undertaken
			Biodiversity impact	Large adverse	1	Large adverse	1	Large adverse	1	Large adverse	1	Large adverse	1	Based on environmental assessment undertaken, based on the principal of 'most adverse category'. Mitigation options to be explored during design development.
			Reduction in road traffic	Neutral	0	Neutral	0	Neutral	0	Neutral	0	Neutral	0	Minimal change across all options, compared to do-minimum

			accidents										
			Sub-total	31		20		11		13		14	
		Stakeholder support	**From public consultation**	Most support	5	Some support	4	Most opposition	1	Some support	3	Some opposition	2	Based on assessment of consultation responses.
			Sub-total	5		4		1		3		2	
			TOTAL SCORE	68		69		73		60		57	

Table 7: Atkins (2016) with UK-level GVA impacts supplied by Mott MacDonald (2016). Strategic Economic Appraisal of A428-A1303 Bus Scheme: Wider Economic Benefits.

Commentary on MCAF Table Outcomes

Option 1 (on line Option from Cambourne to Cambridge using AA428 and A1303)

74. As outline in the Economic Case, Option 1 is the lowest estimated cost option. The combination of low costs and high levels of strict transport benefits results in a BCR of 1.03 (the highest of the 5 options) but will not offer a step change in connectivity and journey efficiency (i.e. combination of speed and reliability) and unlikely to deliver a HQPT service along the corridor. In increasing public transport capacity this option meets some, but not all, of the strategic criteria. Critically, the TSCSC aspires to deliver a High Quality Passenger Transport (HQPT) service along the corridor, with increasing levels of segregation. As a fully online option with bus priority measures on the existing highway, the option has a limited ability to achieve the key strategic objective to deliver HQPT services. The restrictions of the online alignment on the A1303 also mean that bus priority provision can only be accommodated in an inbound (eastbound) direction, meaning that there is no priority for services travelling away from Cambridge at the same time even with tidal flow arrangements.

75. Option 1 does not provide infrastructure or service improvements west of the Madingley Mulch roundabout. This means that this option is not likely to achieve the requirements (set out in the TSCSC) for providing 'busway / HQPT infrastructure' that connects Cambourne West and Bourn Airfield. In addition, this option does not improve cycling or pedestrian provision as there is little scope along the A1303 to widen the alignment to provide high Quality improvements. Therefore it does not support the requirements of the TSCSC policy, which aims to provide more improved cycling and walking routes.

76. The public transport benefits generated by Option 1 are driven mostly by the specific transport benefits provided to the users of the existing Madingley Park & Ride site, east of the M11 J13 Bridge. This is based upon the modelling assumption that patronage from the south i.e. M11 corridor is an important factor in the scheme.

77. The existing Park & Ride at Madingley Road allows traffic to be intercepted from both the A1303/Madingley Road and from the M11. Whilst journey time improvements related to the existing Park & Ride as a result of this option are relatively low, the volume of trips that have been generated for bus travel combined with the benefits provided to users of the Madingley Road Park & Ride site, result in the large transport benefits.

78. Option 1 is predicted to have the lowest impacts in terms of noise, air quality and emissions as well as wider environmental impacts (such as impacts on the historic environment and biodiversity) and this is primarily because the scheme will run on existing roads. At this stage it does not assume increased

car usage that takes up the freed up capacity due to the modal shift provided for by offline segregated route. It does not consider the implementation of demand manage measures which would reduce this capacity.

79. The MCAF does not consider the impacts of property acquisition and land take which in the case of Option 1 unlike the other options would likely require the acquisition of some residential garden space.

80. In summary, from the MCAF and economic analysis undertaken it is evident that while Option 1 generates high transport benefits due to high volumes of use from P&R passengers at Madingley Road and low costs (and, therefore, demonstrates the best value for money) it also demonstrates a significantly lower strategic fit than options that deliver a highly segregated HQPT route. This is primarily due to the option providing no segregation and as a result not providing the same level of HQPT as routes with offline options

Option 2: Using Old St Neots Road with no significant infrastructure intervention and then routing north of the American Cemetery on Madingley Road before returning to Madingley Road east of M11)

81. Option 2 generates the highest level of public transport benefits of all options, driven in part by servicing both the existing Madingley Road Park & Ride (located east of the M11 J13) as well as the new Madingley Mulch Park & Ride. The BCR is 0.48 which is lower than Option 1 despite the higher benefits, due to much higher costs.. The MCAF assessment identifies that this option addresses some of the strategic goals of the scheme, however it does not align fully with the longer term aspiration and visions of the sub-region to provide corridor-wide segregation for buses, pedestrians and cyclists.

82. The option is offline between Cambourne and Bourn Airfield which directly addresses the objective in the TSCSC to create a HQPT corridor that provides a busway/HQPT infrastructure to serve Bourn Airfield / Cambourne. This segregation does not extend throughout the scheme. This offline busway section increases the cost when compared to Option 1, however due to the option making use of existing infrastructure along St. Neots Road, it provides a compromise between fully offline and fully online options. The restrictions of the online alignment on the A1303 mean that bus priority provision can only be accommodated in an inbound direction, meaning that there is no priority for services travelling away from Cambridge on what is expected to continue to be a congested section of the corridor.

83. The Option is considered to be a compromise between costs, connectivity, accessibility and HQPT to the west of the Madingley Mulch roundabout. The option broadly addresses strategic objectives for the western section of the scheme. In addition this option provides direct walking and cycling

infrastructure along the offline section of the route, addressing walking and cycling objectives for this section of the route, however not along the entire corridor.

84. Based on the modelling and analysis, a significant proportion of the patronage is generated by the existing Madingley Road Park & Ride and not the new housing schemes at Cambourne West and Bourn Airfield. This is upon the modelling that takes account of patronage from the south i.e. M11 corridor.

85. Because this scheme includes new, offline sections, there may be noise impacts to additional households that were previously less exposed to noise, air quality impacts through increased vehicle kilometres and a related increase in GHG emissions. In addition there will be increased landscape, historic environment and biodiversity impacts due to the fact that the option includes a section of offline route through greenbelt land. This option passes closest to Site of Special Scientific Interest (SSSI) at Madingley Wood and the listed American Cemetery and additionally through the newly planted 800 Wood. Further design development could mitigate some of these effects in future stages of the scheme development.

86. This option provides the highest level of public transport benefits and is partially aligned to the strategic objectives and vision for the corridor and Greater Cambridge. Importantly by not providing segregation along the entire corridor, the option does not provide the level of segregation that is envisaged in the policy nor are pedestrians and cyclists catered for on a corridor-wide basis.

Option 3: Fully segregated route from Cambourne to Cambridge

87. Option 3 performs best in terms of strategic fit, mainly because the fully offline route provides the highest level of connectivity, capacity and journey efficiency and therefore is best aligned to the provision of a HQPT service and direct, segregated walking and cycling infrastructure. However, as a result the option is the most costly due to significant conception, design and construction costs (plus other costs, revenue and indirect tax impacts). It has a poor BCR of 0.20.

88. This option does not directly connect with the existing Madingley Road Park & Ride (as services would need to significantly divert from their route to do so), which results in lower transport benefits than Options 1 and 2, which do serve the Madingley Road P&R.

89. Importantly, this option avoids Madingley Road and is segregated, therefore the eastern section of the route does not add to congestion on Madingley road (nor is it impacted by congestion) as it is not online. This indicates a

good strategic fit in this area in that it addresses strategic HQPT objectives whilst also addressing existing congestion issues in this part of the corridor.

90. This option requires further environmental assessment. Noise, Air Quality and Green House Gas emissions are modelled to increase as a result of the new route and additional buses. The assessment to date does not take account of the potential overall reduction of car use due to the provision of segregated HQPT as a sustainable alternative to the care desktop assessment at this stage suggests that the relative effect on the landscape, historic environment and biodiversity may be significant as this scheme includes the most new off line infrastructure. Further scheme development would be required to assesses these impacts and proposed mitigation where required.

Option 4 – Using old St Neots Road with minimal infrastructure intervention, proceeding north of American Cemetery before entering West Cambridge.

91. Option 4 is offline between Cambourne and Bourn Airfield, which partially addresses the strategic objective to create a HQPT service to link Cambourne and Bourn Airfield with central Cambridge, Addenbrooks and the Science Park. However, this option's potential alignment, in the approach to central Cambridge, does not include a bridge over the M11 and instead re-joins the main carriageway where the buses will integrate with general traffic which severely undermines the HQPT offering on this portion of the route. Having utilised the existing bridge, the services would continue on dedicated bus infrastructure.

92. As for all the segregated or partially segregated options (Options 2 through to 5) there may be negative noise and air quality impacts to additional households that were not previously as close to bus routes. These negative impacts may be mitigated. A more detailed environmental assessment as part of further scheme development would identify what the effects are and any mitigation measures required as a consequence. While the exclusion of a new bridge does reduce cost, the cost still remain high compared to the associated benefits currently forecast for the route and as such the initial BCR of this scheme is 0.04.

Option 5 (Using old St Neots Road with minimal infrastructure intervention before proceeding south of the Madingley Hill across a new bridge to the east of the M11)

93. As this option includes new, offline sections, there may be effects to households that were previously not exposed to the levels of noise, air quality impacts and Green House Gas emissions associated with bus services running close-by. Further scheme development would be required to assesses these effects and propose mitigation measures where required.

94. This option does not serve the existing Madingley Road Park & Ride as buses would need to significantly divert from this route to do so, as such this Option has lower transport benefits than Options 1 and 2. Options 4 and 5 have slightly longer journey times than Option 3, and do not stop at Caldecote and Coton which suggest why Option 3 significantly outperforms Options 4 and 5.

95. The estimated costs associated with this scheme, compared with the associated benefits leads to an initial BCR of 0.05.

Summary: **The Multi-Criteria Assessment Framework has been undertaken to provide a broad assessment of each Option against strategic fit, transport economic, environmental, and delivery criteria to indicate the extent to which each demonstrates a compelling case for investment. Option 3 (and 3a) have the highest combined score of all the Options as it aligns most closely with the strategic objectives for the scheme, namely the provision of a segregated and thus reliable high quality public transport that connects the housing developments in Cambourne and Bourn Airfield with employment sites in Cambridge, Addenbrooke's and the Science Park.**

D Financial Case.

96. The Financial Case represents both Capital and Operational total outturn costs estimate and expenditure profiles of each of the Options are presented, along with an assessment of the impact of construction of each Option on the City Deal budgets and accounts.

97. The Financial Case has considered the estimated costs of the scheme, with reference to capital expenditure including estimated construction infrastructure and land costs.

98. As with all Cases at this stage of scheme development further refinement will be provided in the next Step of work.

Capital construction costs

99. Construction cost estimates for each of the options are derived from high level preliminary proof of concept design consideration. For further details on the infrastructure proposed for each option, refer to the option descriptions presented in the Strategic Case. Each option includes an estimated cost for the new Park & Ride site. The base costs exclude allowances for VAT, inflation, risk and optimism bias.

100. The capital cost estimates include the following key assumptions:
- Ground conditions are generally good with no soft spots;
- No piling is required along the length of any guideway (i.e. shallow foundations);
- Stabilising of soils not required over and above risk allowance;
- Services are not generally diverted but protected;

- No major environmental impacts.
- A 12% allowance for construction preparatory costs, including professional fees.

101. The options that include an off-line segregated infrastructure allow for the cost of implementing a guided busway for the off-line sections.

102. Fleet investment has been estimated with reference to the Peak Vehicle Requirement forecasts, derived using the CSRM. For further details on the proposed number of public transport services for each Option refer to the Economic Case.

103. Table 8 provides a summarised breakdown of the out-turn cost estimate (i.e. the costs which will actually be incurred at the time of expenditure, taking into account the full impacts of construction inflation, with no discounting, market price adjustment or removal of background inflation as has been applied in the Economic Case) for each of the options, excluding VAT. The risk allowance is also included within the out-turn cost totals.

Estimated Cost item	Option 1 cost (000's)	Option 2 cost (000's)	Option 3 cost (000's)	Option 4 cost (000's)	Option 5 cost (000's)
Preparatory costs	**£2,238**	**£5,106**	**£10,140**	**£5,945**	**£7,286**
Construction + Land costs	**£25,234**	**£55,517**	**£112 545**	**£64,124**	**£77,749**
Risk	**£5,164**	**£11,703**	**£19,147**	**£13,603**	**£16,679**
Total	**£32,636**	**£72,326**	**£141,833**	**£83,673**	**£101,713**

Table 8 – preparatory, estimated capital construction costs for each option

104. The Financial Case represents a high level assessment of the five options

105. The Financial Case presents an estimated range of between £32 million and £141 million in out-turn costs (including risk) between the options. This variation can be attributed to the proportion of each Option which requires off-line infrastructure, including a new bridge over the M11 and the differences in route alignment (i.e. the resultant land acquisition requirements).

106. Option 1 is shown to be the lowest cost Option, with an out-turn cost of approximately £32 million. The estimated highest-cost option is indicated as Option 3, with an out-turn cost of approximately £142 million.

107. In addition to the estimated scheme costs presented, the whole life costs (maintenance and capital renewal) are considered within the Economic Case. Operational cost estimates are set out in Table 9.

Option	Initial Fleet Investment (000s)	Operating Cost (000s)	Operating Revenue (000s)	Revenue-Cost (000s, excluding fleet investment)
Option 1	£3,600	£38,500	£45,900	£7,400
Option 2	£5,700	£60,500	£52,200	-£8,300
Option 3	£5,300	£55,300	£42,000	-£13,300
Option 4	£5,800	£58,100	£24,300	-£33,900
Option 5	£5,800	£57,700	£28,200	-£29,400

Table 9 – Nominal modelled operational costs

108. In practice it would not be expected to set up a bus scheme that ab initio requires subsidy for the lifetime of the scheme, and would instead seek to optimise the bus service specification as far as possible, however, at this stage of analysis, the TAG assumptions are utilised in the modelling which results in an operational deficit.

109. Further work to reduce operating deficit will explore:
- The optimal number of additional buses per hour assumed on the recommended option and existing routes
- The optimal route of the recommended option to maximise patronage along the alignment or diversion of buses onto more commercial routes
- The optimal fare
- various sources of subsidy, such as developer contribution .
- Part of the subsidy includes paying for concessionary passengers for instance, which may be central government funded

110. The cost estimates will be subject to significant refinement to establish affordability as part of the further business case development

E Management/Delivery Case

111. The purpose of the Delivery Case is to assess if the proposals are deliverable. As such the Delivery Case presents the current view on the management and governance arrangements to be adopted to enable delivery of the scheme. It clearly sets out what needs to be done, why, when and how, with measures in place to identify and manage any risks.

112. The Delivery Case does not relate to any single option but addresses the overall programme and project management structure and seeks assurance that it has sufficient capacity to govern the project.

113. Use is made of evidence from other similar schemes delivered by the County Council such as the Cambridgeshire Guided Busway to demonstrate effective delivery structures.

114. The Delivery Case reviewed the City Deal programme management arrangements, the project management arrangements in place including the Terms of Reference for the Project Board controlling the project, the Project Inception Document and Project Plan.

115. The Delivery Plan concluded that arrangements that will ensure successful delivery of the scheme have been initiated by the promoters, with a number of plans and strategies emerging. The promoters can draw upon the lessons learned and experience of delivery of other major transport infrastructure projects including the Cambridgeshire Guided Busway. While there were difficulties encountered during construction, the system has delivered the required service levels and quality, with large numbers of passengers transferring to bus.

116. Governance arrangements are in place that will enable efficient decision making and change control to take place throughout the phases of the project from feasibility and Optioneering to approval, construction and operation.

117. There are a number of key milestones in the Project Plan where internal and/or external approvals will be required in order for the scheme to progress. The project will pass through a number of gateways to ensure that progress is approved. The role of the Assembly will be to scrutinise Executive Board decisions. Independent local audits will be carried out and these will be reported to the Executive Board, Assembly and the constituent member organisations as appropriate.

118. Effective communication is critical to the success of the project. Key stakeholders have been identified and will be involved in the delivery of the proposed scheme project. All internal and external stakeholders will need to be informed of relevant project information in a timely manner. Stakeholder engagement including public consultation and a LLF is an important means of realising opportunities and informing king decisions. The cooperation of the bus operator(s) will be essential so that high quality, reliable and frequent services can be realised.

119. Risk management processes are employed and recorded throughout the project lifecycle. A risk register is monitored and, as necessary, updated at regular workshops and meetings. Risks to delivery will be identified, assessed avoided mitigated or accepted. A key strategic risk will be the appointment of a contractor. Managing risk will be a key issue within any contractual arrangements.

120. Monitoring and evaluation of potential benefits is required to establish the extent to which the defined scheme meets the objectives. To be fully effective, plans for monitoring and evaluation form part of the early development of - and be a continuous process within – the scheme business case. Measuring performance, understanding scheme impacts and disseminating this to Government and to wider stakeholders to ensure that any potential issues post implementation are identified and addressed is a key activity.

121. The Management or Delivery Case provides a high-level assessment, of whether the proposed scheme is deliverable. The Delivery Case presents the current view on the management and governance arrangements to be adopted to enable delivery of the scheme and concludes that the promoters of the scheme have initiated arrangements to ensure successful delivery of the scheme, whichever Option is taken forward for implementation. The promoters can draw upon the lessons learned and experience of delivery of other major transport infrastructure projects for example The Cambridgeshire Guided Busway (CGB).

122. While there were difficulties encountered during construction, the Busway has delivered high quality public transport and exceed predicted service levels, with large numbers of passengers transferring from car to bus.

F Commercial Case

123. The Commercial Case explores the procurement strategy Options available to engage the market, setting out the financial implications of each potential procurement strategy and the commercial model which drives best value for money. It provides evidence on how the scheme is seeking to implement an innovative approach to deliver the objectives outlined in the Strategic Case.

124. At this stage of Business Case development, the Commercial Case has been prepared at a high level, to provide a strategic overview. Details on construction contract length and management will be finalised and updated subject to approval to proceed with the development of the Full Business Case at Step 4.

125. Five Options have been considered in the preparation of the Commercial Case. In identifying an appropriate procurement strategy for the infrastructure (Capital) outputs for these options procurement strategies have been developed. These will be subject to further specialist review and development during the next Step of scheme development.

126. In terms of infrastructure, all of the options include a new P&R site, bus priority traffic signals and varying amounts of utility diversionary works.

127. Where options require carriageway widening or completely new infrastructure (notably the P&R site and any new segregated busways) the delivery of which can only be secured by the use of additional land ('land assembly'), such land assembly will need to be secured through the possession of powers of compulsory acquisition; and compliance with legislative and regulatory requirements .

128. A high level qualitative risk assessment of the key specific risks to time, cost and delivery arising from the outputs from the 5options is shown in **Table 10** below. The assessment identifies in each case the derived risk of 'occurrence' in terms of High ('H'), Medium ('M') or Low ('L').

Risk	**Assessed Risk Factor ('H', 'M', 'L')**		
	TIME	COST	DELIVERY
Land Acquisition	H	L	L
Utilities works	H	M	L
New Bridge design	M	M	L
New Bridge construction	H	L	L
Contaminated land treatment	M	M	L
Traffic Management ('TM')	H	H	L
Signalised Junctions design	M	L	H
Signalised Junctions construction	M	L	H
Segregated design	M	L	H
Segregated construction	M	L	H
Park & Ride site design	M	L	H
Park & Ride site construction	M	L	H
Maintenance	L	M	M

Table 10: Qualitative Risk Assessment of Output Risks

129. The Commercial Case discusses risk management strategies which are common to all options. These strategies include:

- Establishing a clear capital works procurement strategy based on the specific design/build/operate requirements of the option, This will cover such matters as construction contractual arrangements to balance cost and risk, the appropriate pricing and payments mechanism and the contractor performance management regime.
- Establish a clear approach to contract management. A form of contract that is well understood throughout the supply chain and relies on a pre-defined risk register to allocate and manage anticipated risk is preferred.
- Considering an approach for securing levels of bus service including using market mechanism, CGB style Agreements third party contributions and using various partnership arrangements including potential Enhanced Partnership

arrangements as set out in the Draft Bus Services Bill (2016) currently under parliamentary consideration.

130. The Commercial Case at this stage of assessment considers all Options procurable. As identified in Section 1.11 of the Commercial Case ('Rationale for Preferred Sourcing Option') it is considered at this early stage that the 'Develop and Construct' model of procurement may be appropriate for all the options.

131. The risk mitigation facilities available within the New Engineering Contract (NEC) standard form contracts could be adjusted to suit the specific risk profiles that emerge for the scheme and the outline design developed further before tendering. Specialist support has been appointed to develop procurement and contract strategy to ensure that the City Deal obtains the best balance of efficiency and risk management in constructing a scheme.

Summary: The Financial, Commercial and Delivery Cases do not provide high level strategic differentials between the options. These Cases are dealing with more detailed implementation considerations which will be more fully considered at the next Step of scheme development. However these Cases do demonstrate that, commensurate with the stage of scheme development the overall approach taken thus far by the scheme and wider project management is compliant with TAG and feasible.

Overall Option Recommendation

Policy Compliance

132. As detailed earlier, the LTP, incorporating the Long Term Transport Strategy is the core transport policy document for the area and sets clear objectives for the extension of HQPT networks on the corridor and the extension of busway. These interventions are seeking to achieve modal shift. The approach is reflected in the TSCSC and South Cambridgeshire and the submitted Local Plans, providing what amounts to a single overarching development, infrastructure and delivery strategy for Cambridge.

133. A review of the extent to which options comply with policy goals has been undertaken to support option selection. The policy compliance review assumes that the stated policy goals are to achieve the highest quality outcomes in each area of public transport provision. The key factors which are considered policy compliant and the extent to which each option achieves them is summarised in **Table 11**.

134. In Table 10 the following rating approach has been taken:

- High rating – the Option is considered to contribute fully to the achievement of the policy goals
- Medium rating – the Option will partially contribute toward the achievement of policy goals with omissions
- Low rating – the Option will not achieve the policy goal or have significant omissions

TSCSC corridor goals (policy compliance)	Rating				
	Option 1	Option 2	Option 3	Option 4	Option 5
• Focus on bus and addressing issues that prevent a good service being delivered.	Low	Medium	High	Medium	Medium
• Segregated links or offline alignments on the A428 and M11.	Low	Medium	High	Medium	Medium
• Bus priority measures	Medium	Medium	High	Medium	Medium
• Outer ring of Park & Ride	High	High	High	High	High
• Busway / HQPT infrastructure to serve Bourn Airfield / Cambourne	Low	Medium	High	Medium	Medium
• Walking and cycling improvements, including direct links	Low	Medium	High	Medium	Medium
• Highway capacity improvements	Low	Low	Low	Low	Low

Table 11: Policy Compliance Rating of Options

135. Table 11 indicates that Option 3 with the provision of segregated infrastructure has the highest degree of policy compliance on key considerations.

The Option Selection

136. As set out in TAG guidance there is a key distinction between the transport appraisal process and the decision-making process. The transport appraisal process is about options generation, development and evaluation of intervention impacts. In contrast, the decision-making process involves a separate governance process concerned with identifying and implementing interventions that deliver the needs of the sponsoring organisation and fits best with its investment funding objectives

Overall Weighting

137. At this stage of scheme development the key requirement is to establish the strategic case for investment, to demonstrate how this investment will further City Deal's aims and objectives and to secure approval

to proceed with development a Full Outline Business Case for a specific route alignment with an recommended option catchment area.[13]. The following **Table 12** summarises the overall performance of each option against the weighted 5 cases:

[13] Ref: DfT (2013). The Transport Business Cases

	Strategic	Economic	Financial	Delivery	Commercial
Key Factors	• **Segregation improves reliability** • **provides better connectivity, journey time speed direct connection between houses and employment –** • **future proofing for increased long term capacity ,** • **policy compliance** • **Maximising wider economic benefits** • **HIGHEST WEIGHTING**	• **Direct Transport benefits for users of scheme** • **Direct and scheme specific economic benefits** • **Environmental impact** • **HIGH WEIGHTING**	• **Overall cost and affordability** • **LESS HIGH WEIGHTING**	• **Capacity of City Deal to deliver schemes** • **LESS HIGH WEIGHTING**	• **Management of risk factors related to build and operation of scheme** • **LESS HIGH WEIGHTING**
Reason for weighting	*The level of assessment is focused on the strategic considerations and as such they best inform the decision. The strategic decision is key to get right before the more detailed analysis is undertaken in the next stage*	*Direct benefits of any scheme are significant in any strategic decision. However at the Option selection stage the degree of understanding of these benefits is lower, The direct benefits are more fully explored during the next stage*	*The costings are high level and subject to further refinement and as such should be used a 'scale of investment required' consideration rather than a detailed assessment of affordability at this stage*	*At this stage the key objective is to understand overall organisational capacity to deliver a scheme. Unless any clear deficiencies are identified in terms of delivering one specific Option this Case is not likely to be a key strategic decision making criteria*	*At this stage the objective is to ensure that overall risk management processes are understood and either are in place or can be put in place (in relation to capacity highlighted in Delivery Case) Again unless one Option highlights unmanageable risks which the organisation cannot manage, this is not likely to be a key strategic decision making criteria*
Option 1	LOW PERFORMING OPTION This option has low strategic fit. It does not provide the level of segregation, capacity and resilience which would support the ambitious local and national policy objectives. Lowest impact on Gross Value Added which is a key City Deal objective.	LOW PERFORMING OPTION The overall BCR for this Option is low in terms of overall DfT investment criteria so taken in isolation there is no strong case to invest on the basis of this BCR. Moreover this BCR has low potential to improve during the next stage of work due to constraints of using the existing highway network – for example the impact on other road users	HIGH PERFORMING OPTION This is the lowest cost Option	MEDIUM PERFORMING OPTION There is no significant differential between this Option and other Options in terms of the Delivery Case	MEDIUM PERFORMING OPTION There is no significant differential between this Option and other Options in terms of the Commercial Case
Option 2	MEDIUM PEFORMING OPTION This option has medium strategic fit. It does provide segregation in parts of the corridor where these is currently significant congestion by providing an off line alignment to the north of Madingley Hill. However this capacity is then reduced by returning buses to Madingley Road which may impact reliability and journey	LOW PERFORMING OPTION The overall BCR for this Option is poor. There is lower potential to optimise the BCR as the Option is constrained by the Madingley Road corridor. Some of the benefits captured relate to Madingley Road P&R which	MEDIUM PERFORMING OPTION This is medium cost Option	MEDIUM PERFORMING OPTION There is no significant differential between this Option and other Options in terms of the Delivery Case	MEDIUM PERFORMING OPTION There is no significant differential between this Option and other Options in terms of the Commercial Case

	times as well as reducing utility for other road users.	could be attributed to Option 3 with further analysis.			
Option 3	HIGH PERFORMING OPTION This option has high strategic fit as it offers significant whole route segregation addressing both current congestion issues and future growth impacts. It creates significant new capacity from the west into Cambridge supporting the long term economic growth on this corridor. It offers a resilient solution under control of the City Deal authorities.	LOW PERFORMING OPTION The overall BCR is poor at this stage although there is significant potential to improve this BCR. High potential environmental effects and estimated construction costs impact the BCR. Mitigation and cost control and benefit optimisation would be used in the next Step of scheme development to improve the BCR.	LOW PERFORMING OPTION This is the highest estimated cost Option	MEDIUM PERFORMING OPTION There is no significant differential between this option and other options in terms of the Delivery Case	MEDIUM PERFORMING OPTION There is no significant differential between this option and other options in terms of the Commercial Case
Option 4	MEDIUM PEFORMING OPTION This option has medium strategic fit. It does provide segregation in parts of the corridor where these is currently significant congestion by providing an off line alignment to the north of Madingley Hill. However this capacity is then reduced by returning buses to Madingley Road at J13 which may impact reliability and journey times as well as reducing utility for other road users.	LOW PERFORMING OPTION The overall BCR for this Option is poor. There is lower potential to optimise the BCR as the Option is the crossing over the M11 and the bottlenecks around North West Cambridge and Madingley Road P&R. Some of the benefits captured relate to Madingley Road P&R which could be attributed to Option 3 with further analysis.	MEDIUM PERFORMING OPTION This is medium cost Option	MEDIUM PERFORMING OPTION There is no significant differential between this option and other options in terms of the Delivery Case	MEDIUM PERFORMING OPTION There is no significant differential between this option and other options in terms of the Commercial Case
Option 5	MEDIUM PEFORMING OPTION This Option has medium strategic fit. It does provide segregation in parts of the corridor where these is currently significant congestion by providing an off line alignment to the south of the A1303 and a new bridge over the M11. However it does provide for future capacity and resilience at the Bourn end of the corridor as it assumes only limited bus priority along St Neots Road. .	LOW PERFORMING OPTION The overall BCR for this option is poor. It does have high cost elements associated with Option 3 including off line busway and a new M11 crossing. .	MEDIUM PERFORMING OPTION This is medium cost Option	MEDIUM PERFORMING OPTION There is no significant differential between this option and other options in terms of the Delivery Case	MEDIUM PERFORMING OPTION There is no significant differential between this option and other options in terms of the Commercial Case

Table 12 – Option Assessment Summary Outcome Table

138. The assessment in Table 11 concludes that the Recommended Option 3 as the best performing option against the highest weighted strategic objectives. The performance of the other options against the other lower weighted cases does not provide significant differentials which would override the strategic benefit of the Recommended Option.

Park & Ride Option Selection

139. Based on the P&R location transport planning and engineering assessment it is recommended that location 3 as set out in Figure 4 is the best placed to accommodate the facility for the Recommended Option. It would allow the most direct access for public transport services, and remove the conflict of buses with other road traffic. Further assessment of the traffic arrangements and of the P&R location, will be undertaken alongside the development of the Recommend Option alongside the environmental and other assessments as set out in the Next Steps.

Discussion of Recommended Option

140. The main basis for recommending Option 3a as set out in Table 12 is the high strategic fit of this option which is the key criteria for decision making at the conclusion of the opioneering and feasibility Step 2 of scheme development.

141. Selection of a Recommended Option will allow the scheme to progress to a specific route alignment within the catchment area with further detailed assessment leading to the presentation of a Full Outline Business Case including a revised BCR for approval by the Executive Board in November 2017.

142. The key strategic benefits of Recommended Option 3 are as follows

- *Frequency*: High frequency services are particularly attractive to commuters. Segregated infrastructure provides for a high capacity 2 way public transport corridor into Cambridge into the city. Since frequencies on segregated routes can be higher than on routes where the bus conflicts with traffic, the capacity of the system is greater. Segregated infrastructure is therefore more future-proof to allow for increases in service frequency if required. For example the Transportation Research Board has published details on the maximum capacity (passengers per hour per direction) achievable for different bus infrastructure systems which are as follows.
    - 1,200 – 1600 for kerbside bus lanes (30-40 buses per hour)
    - 1,600 – 2400 for Busway and Guided Bus (40-60 buses per hour)

  This offers long term resilience for current and future growth potential in an area with regional and national economic importance

- *Reliability*: Segregation improves the reliability of bus services against on line options. For example Real Time Passenger Information (RTPI) systems in Cambridge, for all school term days in November 2015 across a range of different infrastructures, suggest fully segregated busways provide greater reliability than bus lanes. For example, analysis of RTPI data demonstrates that in the AM peak, services in bus lanes exhibit 14% less variation in travel time compared to those not in a bus lane. Urban Busway services have 29% less variability in the AM peak than those running with general traffic. Greater reliability of public transport has potential to support business productivity and investment as set out in the GVA analysis.

- *Journey Times:* Segregation improves journey times by providing dedicated bus infrastructure. Estimated journey times for the options

assessed are as follows in T**able 13.** The current highest operational speed of buses on the Cambridgeshire Guided Busway is 57mph

Option	Cambourne-Queens Rd-Cambourne JTs (Minutes)
DM	75
Option 1	64
Option 2	38
Option 3	28
Option 4	32
Option 5	30

Table 13: Journey Times of options compared

- *Flexibility :* Off line infrastructure would be integrated into online bus priority measures to allow for services to join and leave the infrastructure at different point as required. Service patterns can be changed to complement changes to demand in the area.

- *Coherence with City Deal vision and local policy objectives*: The City Deal vision is dependent on a coherent and high quality public transport network across the Greater Cambridge area. The Recommended Option is a highly segregated scheme and is anticipated to deliver the highest level of economic benefits since it also contributes to the longer term strategic aims of Greater Cambridge in terms of promoting a positive image and perceptions and investment in capacity for post 2031 growth.

- The Recommended Option in line with local policy offers an extension of the quality interventions delivered by the Guided Busway and offers strong synergy with emerging options for the Western Orbital to provide a regional transit across the west of Cambridge. Additionally the provision of reliable high quality public transport will support the strategy for managing car use within the core centre of Cambridge in line with potential demand management measures.

- *Potential for further optimisation:* The segregated bus infrastructure offers further potential for optimisation. Specific opportunities include:
    - Potential for specific service level agreements with operators
    - Higher quality environmental mitigation as compared to non-segregated route

143. The Cambourne to Bourn Airfield section of the Recommended Option is subject to a number of specific considerations:

- The progress related to the live planning application for the Cambourne West development. This planning application proposes development on a larger site with higher housing numbers than specified in the Submission South Cambridgeshire Local Plan (2350 dwellings on land excluding the existing business park)
- The extent to which effective bus priority measures can be achieved through Greater and Upper Cambourne to allow for high quality public transport
- The appropriate location to allow for priority bus access from Upper Cambourne to Bourn Airfield via the Broadway.
- Consideration at an appropriate stage through a Master planning process for Bourn Airfield and the extent to which a segregated bus corridor can be achieved and connection onward to either St Neots Road (option 3a) or to the south (Option 3)

144. Engagement has taken place with the promoters of schemes on these sites but further detailed work will need to be considered as part of the next Step of work.

145. The Cambridge West site is also a key location along the corridor. This site may also significantly intensify use subject to planning permission. A planning application is currently being considered by Cambridge City Council. Early engagement with the land owner has taken place to understand potential opportunities and constraints within this site and would need to continue as part of the ongoing option development.

146. The Cambridge West site will be served by the scheme.

147. The section of route on highway within the City Centre will be subject to further detailed development at the next Step of work. The issues around passenger demand, route optimisation and on street measures will be considered. Coherence with City Centre Access Study proposals for tacking peak time congestion (e.g. locations of Peak Congestion Control Points) will be a key consideration and proposals are being advanced to facilitate more effective bus operation in the city centre. It is envisaged that as part of scheme delivery measure a number of on street measures will be promoted to benefit all public transport and active modes.

148. The Recommended Option development would include strategic integration with the Western Orbital proposals as they emerge. In particular the issues around access to the M11 motorway at J13 or future integration with a segregated alignment alongside the M11 will be part of the detailed consideration in Step 3.

Summary: The Outline Business Case study which comprises the 5 cases for investment support the decision on the selection of the Recommended Option. The key consideration at this stage is strategic fit with the City Deal objectives as demonstrated in the Strategic Case. The more detailed considerations around the economic, commercial, financial and delivery cases have a greater degree of significance once a Recommended Option has been identified. Option 3 or 3a are recommended for detailed development. This detailed development will also include further testing of Option 3a to determine if it can be taken forward as the Recommend Option. Detailed proposals within the City Centre and through development areas as well as coherence with the Western Orbital are subject to further assessment.

Next steps

149. The OAR summarises the output STEP 2 of and recommends an Option for further scheme development.

150. The decision sought from the City Deal Executive Board at the end of STEP 2 on October 13th 20016 informed by the OAR is for the following recommendations:

The Executive Board is asked to:

I. Note the accompanying Option Assessment Report, the further background papers containing the Outline Strategic Business Case, and the Appendices to this Report;

II. Agree – in principle – that a segregated route between Cambourne and Cambridge, with a Park & Ride near the Madingley Mulch roundabout, best meets the strategic objectives of the City Deal and the City Deal Agreement, given the wider economic benefits;

III. Instruct Officers to undertake further appraisal on:

(a) Possible specific route alignments within Catchment Area 3a ,with Catchment Area 3 as an alternative if (but only if) Option 3a proves unviable , noting that both would connect with and potentially through Cambridge West ; and

(b) a new Park & Ride (P&R) at location 3 (see Figure 5 below)

all in accordance with the scheme design criteria set out in Paragraph 12 below, and within established environmental and planning policies;

IV. Delegate to the Executive Director of Economy, Transport and Environment,

acting:

a) with input from the A428/A1303 Local Liaison Forum (LLF); from the Parish Councils and Residents' Associations along Catchment Areas 3a and 3; from interested members of the Assembly; and from interested Councillors from the County, City and District Councils; and:
b) in consultation with the Chair and Vice Chair of the City Deal Executive Board

the responsibility to:

a. identify a specific route alignment(s) within Catchment Area 3a (or, if necessary, Catchment Area 3);

b. identify a footprint for a P&R location at location 3;

c. undertake a public consultation on that specific route alignment and P&R location, targeted for May-July 2017; and

d. subsequent to that public consultation, provide a report to the Assembly and Executive Board, targeted for November 2017, containing a recommendation and Full Outline Business Case for a specific route alignment and one Park & Ride location; that would then subsequently be worked-up in detail, and an application made for Statutory Approval in 2018.

151. This further scheme development will consist of the following elements:

- Production of a more detailed potential alignment within the catchment of the corridor from which to recommend a final alignment
- Further environmental assessment including field surveys
- Additional transport/traffic modelling at both the strategic and local level
- Undertaken further public consultation and ongoing stakeholder engagement
- Refinement of business case to deliver a Final Outline Business Case for a single Option

152. The following section sets out in summary form the main aspects of this work under each element

Production of a detailed proposed alignment within the catchment

153. The next stage of work will require the identification of an optimum alignment for the scheme within the catchment area of the Recommended Option set out in the OAR. This will involve a multi-disciplinary approach included engineering, transport planning, a range of field technical surveys and buildability assessments. Property and planning considerations will also

form part of this analysis. The technical specification for the development of the optimum alignment will be based upon regulation guidance and policy.

Further environmental assessment

154. Identification of the optimum alignment will also require further environmental assessment

155. Environmental impact Assessment (EIA) is the process by which the anticipated or potential effects on the environment of the selected Option are assessed and measured...

156. The appraisal within the Strategic Outline Business Case has been high level desk top assessment using 'worst case scenario' considerations.

157. Having identified a Recommended Option further detailed assessment including site surveys will be undertaken to identify the potential scope of impacts in order to understand the likely environmental effects and to inform the design development and mitigation measures.

158. The Local Planning Authority and relevant bodies such as Natural England play an important role in attaining formal consent for a major transport scheme. This is likely to require an Environmental Impact Assessment to be undertaken and Environmental Statement submitted.

159. The following provides a list of some of the potential assessment areas of that EIA on an environmental topic basis.

- **Planning**
- **Property**
- **Heritage & Archaeology:**
- **Ecology & Biodiversity**
- **Landscape and Visual**
- **Air Quality**
- **Lighting**
- **Sound, Noise and Vibration**
- **Water Quality, Flood Risk and Drainage**
- **Ground Conditions**
- **Waste**
- **Social and Community**
- **Transport**

160. Design measures or other relevant mitigation measures can be taken to reduce or avoid effects. In some instances environmental enhancements may result e.g. the creation of new or better quality ecological habitats. The overall approach to the design measures will be defined by local and national policy and guidance. The effects of the scheme will be addressed in detail and where necessary undertakings for appropriate and mitigation and or compensation measures specified.

161. The City Deal will produce environmental design criteria to guide design through the scheme development and minimise negative environmental impacts. The criteria will be based on the City Deal objectives. The criteria will include design approaches that ensure that new infrastructure integrates into the existing landscape and urban realm and protects the continuity and character of open space and green belt. The Design Criteria will consider the following issues:

I. Location of infrastructure – respecting the urban and rural context for example through assessing proximity to and the relationship with the existing built up areas
II. A specific route alignment assessment to test accessibility from the start to the end of journeys through the centres of employment (e.g. Cambridge West) and housing (e.g. Bourn) and the environmental effects with a view to integrating with existing infrastructure and minimising impacts
III. Siting – positioning of infrastructure to minimise visual intrusion on the existing landscape through considering issues such as ground levels, slopes and other natural features and also minimising impact on important features such as ecological and heritage assets
IV. Design – the materials, features and introduced landscaping that will form the new infrastructure and achieve high quality design, minimising environmental impacts consistent with delivering the scheme's objectives, and integration with existing infrastructure and the ends of the route and along it.

162. These design criteria will reflect and supplement the existing statutory assessments, local and national policy and guidance and will update the Urban and Environmental Design Guidance adopted in June 2016.

Additional transport/traffic modelling at both the strategic and local level

163. Further scheme development will require refinement of the modelling. This will include both strategic and local traffic modelling. Strategic modelling will use updated data to fully consider future travel patterns across the corridor and focus on the optimisation of the performance of the Recommended Option. Local traffic modelling will be used to understand specific issues and highway constraints as they interact with the recommend Option. Examples may be junctions and P&R access/entrance.

Carry out further public consultation and ongoing stakeholder engagement

164. The public consultation approach taken to date is consistent with the TAG major scheme development methodology. Public consultation is undertaken as part of wider stakeholder engagement in advance of any decisions on final options to consider and facilitate necessary input in the development of the scheme. There are two main categories of stakeholders, although some may appear in more than one category, are:

165. Community stakeholders: This includes individuals or organisations that are interested because they live in the community the scheme may affect, for example interested parties, local businesses, bus operators, developers, landowners and local action groups. Local Liaison Forums provide for regular dialogue between the project team and members of the local community during the course of any major transport project, ensuring interested parties are kept informed and can continue to have their say outside of formal consultation processes. The Local Liaison will continue to be the key body engagement with local residents and their representatives and will form an integral part of ongoing scheme development.

166. Statutory consultees: These include bodies which the Greater Cambridge City Deal partnership should consult in order to comply with requirements set out in planning legislation. This includes bodies such as government agencies and local authorities. For example district and parish councils, Environment Agency, Highways England, Historic England and Natural England.

167. The next public consultation before recommendation of a final specific route alignment to the City Deal Board will be held on the proposed alignment(s) within the Recommended Option catchment area. Within the public consultation the range of alignments considered with the benefits and disbenefits of each will be set out alongside the proposed specific route alignment(s).

Refinement of business case to deliver a Final Outline Business Case for a single Option

168. The next key decision Report to the City Deal Board is proposed at the Completion of STEP 3 in November 2017

169. The culmination of STEP 3 is the Full Outline Business Case. The City Deal Board will consider the Full Outline Business Case to decide whether a recommended specific route alignment should proceed to detailed design of a scheme and application for statutory approvals.

170. The Full Outline Business Case will broadly mirror the structure of the Strategic Outline Business Case presented at the end of STEP 2 but will be for one option and will have significant additional detail including. :

- set out the result of the consultation programmed for Early STEP 3 and how this has influenced the scheme proposal
- provides details of the project's overall balance of benefits and costs against objectives and set out plans for monitoring and evaluating these benefits when required;
- confirm the strategic fit and the case for change;
- provide the business and financial rationale for the project;
- detail the proposed contract management resourcing, processes and benefit realisation plans;
- show how the return would justify the overall investment of time and money; and
- continue to be used to align the progress of the project towards achieving City Deal objectives.

171. In line with TAG guidance it will be necessary to continue to develop a lower cost option for comparative purposes to inform further decision that the City Deal Executive Board will be required to consider. As such Option 1 (on line option) will also continue to be assessed.

Programme

172. The Recommended Option may require a Transport and Works Act (TWA) Order or possibly (depending on the nature and scale of the scheme) a suite of consents including Highways Act powers and planning powers to achieve the range of consents necessary to deliver the scheme. Any consents 'package' would be likely to need to include the following:

- Compulsory purchase of land
- Planning permission
- Traffic regulation orders
- Public rights of way orders

  The advantage of a TWA Order is that it could (for the right type of scheme) incorporate all of the above elements.

173. Should a TWA be sought and granted it will be for a scheme for guided transport only.

174. The Cambridgeshire Guided Busway Order 2005 took approximately 3 years to achieve and given the extent of powers which may be required for Option 3 an updated timescale from the generic programme reported to the City Deal Board in March 2016 is now set out in the following **Table 14**:

Stage	Target Completion Date
Report to GCCF Executive Board on outline business case in order to select a Recommended Option **Completion of STEP 2**	October 2016 (this report)
Refinement of Recommended Option (s) detail to ensure sufficient public information available during next consultation	End 2016
Consult on Recommended Option (s)	Summer 2017
Completion of Full Outline Business Case for Recommended Option	October 2017
Report to GCCD Executive Board on a Full Outline Business Case for the Recommended Option and to seek authority to commence statutory processes and procurement **Completion of STEP 3**	November 2017
Substantially complete statutory Approvals	June 2019
Report to GCCD Board on final scheme for authority to construct **Completion STEP 4**	September 2019
Start construction of scheme	February 2020
Substantially complete construction of entire scheme Cambridge to Cambourne	Summer 2023

Table 14 Programme

175. The above timetable does not preclude potential for sectional completion of elements of the scheme with potential joint working with developers along the corridor.

176. A detailed implementation strategy including procurement, contract management and construction timetable would form part of the Step 3 report to be presented to the Board in November 2017.

TECHNICAL NOTES

DRAFT TN 1

Project:	A428 study - Phase 2	**To:**	Adrian Shepherd
Subject:	A428 Park & Ride locations	**From:**	Atkins
Date:	Jun 3, 2016	**cc:**	Ashley Heller

Introduction

Purpose of Technical Note

The purpose of this technical note is to provide a summary of the analysis which underpins recommendations on potential Park and Ride locations along the A428, west of Cambridge. It forms a supporting document for the wider A428 study being undertaken by Atkins, on behalf of the Cambridgeshire County Council, as part of Greater Cambridge City Deal Partnership.

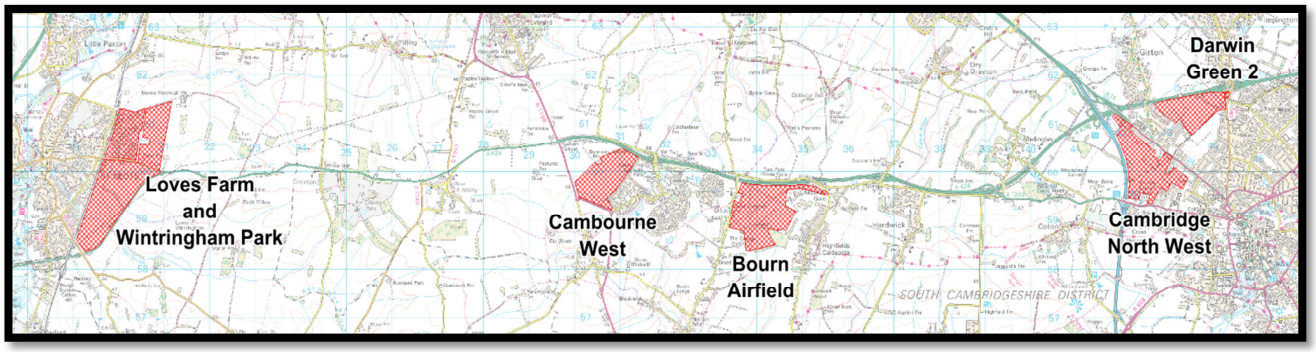
Background

The proposal for a new Park and Ride site along the A428, west of Cambridge, is part of the wider A428 study aiming to develop improvements to public transport infrastructure, and reduce congestion in the Cambridgeshire area. There are significant developments currently under consideration along the A428 corridor, as shown in Figure 1, which will generate a notable increase in travel demand in the area. This highlights the need for greater access to sustainable modes of transport, with improved service frequency, journey times, and reliability for bus routes serving Cambridge. The improvements are intended to facilitate the high levels of population and employment growth occurring within Cambridge and Cambridgeshire.

A Park and Ride facility currently exists at Madingley Road, east of Junction 13 of the M11. The site being proposed as part of the A428 study is intended to be *additional* to the Madingley Road site, and would increase Park and Ride capacity in the area.

The existing facility would continue to serve traffic accessing Cambridge that would not be intercepted by the new site, such as from the M11. The proposed Park and Ride, in combination with proposed bus priority measures, would serve to reduce private car trips along the corridor, reducing congestion going into Cambridge during the AM peak and leaving the city in the PM peak.

Development Hubs Along the A428 Corridor



Park and Ride Locations

Key considerations in identifying potential Park and Ride sites include:

Vehicle access (dedicated infrastructure / priority);
Bus Access (segregated);
Proximity to strategic road network;
Ability to provide direct, fast, and reliable route options;
Capacity;
Associated facilities and staffing; and
Environmental consideration.

With the above in mind, potential locations along the A428 corridor have been identified during a series of workshops with key stakeholders, and within consultation responses given as part of the A428 Phase 1 public consultation exercise. The principle locations identified include:

Madingley Mulch roundabout;
Scotland Farm;
North of Cambourne; and
Transport Hubs at
- Cambourne;
- Bourn;
- Between Highfields and Caldecote.

This technical note outlines the potential benefits of locating the Park and Ride site at the above locations, and provides a high level assessment of the comparative benefits of each of the locations. A qualitative appraisal of the potential Park and Ride sites is presented, which also makes reference to the comparative operating costs of each of the potential sites.

Location Appraisal

Madingley Mulch

Proposal

Rationale

The potential for a Madingley Mulch Park and Ride site was identified within workshops attended by key stakeholders of the A428 project. Three potential sites have been identified at Madingley Mulch which could be utilised as a Park and Ride; the comparative benefits of these sites would require further detailed assessment to determine which is most suitable to support the A428 corridor improvements.

The site at Madingley Mulch is considered suitable based on the nature of the predicted congestion around Cambridge, and the balance between access and operating costs. It is considered that a site at Madingley Mulch would alleviate capacity constraints at the existing Madingley Road Park and Ride site.

A428 corridor congestion towards Cambridge typically begins in the area around the Madingley Mulch roundabout. In addition, this location is also suitable for connecting bus services to Cambridge City Centre and other employment hubs within Cambridge.

While there is some congestion at the roundabout at peak times, the potential for signalisation would assist in regulating traffic flow. It is considered that having visible congestion along the corridor is more likely to encourage Park and Ride usage then having the Park and Ride at an uncongested, free-flowing location.

Potential Capacity

A site at Madingley Mulch could potentially extend over 120,000 m^2 to 370,000 m^2 depending on the specific location of the Park and Ride site. The three sites identified at Madingley Mulch all have sufficient space to provide a larger Park and Ride site than at Madingley Road, which would significantly increase the Park and Ride capacity along the corridor.

Access Arrangements

A site at Madingley Mulch roundabout would require provision of new junctions off the existing carriageway, to accommodate access into the new site. Signalisation of the roundabout, would also be required, which would provide additional benefits to general traffic at the junction, and facilitate any bus priority necessary for the wider A428 Phase 2 scheme.

Qualitative Appraisal

Site suitability

This location offers minimal opportunities for walk-and-ride patronage from neighbouring settlements in comparison with other sites considered in this report.

The site has good accessibility for both trunk road and local road traffic in the area, such as the A428 (eastbound), Church Lane and Long Road.

The Cambridgeshire Sub-Regional Model (CSRM) indicates that congestion into Cambridge begins to build up on the A428/ A1303 corridor east of the Madingley Mulch roundabout, on the approach to the M11 overbridge. Flow data from the model indicates that there could be approximately 600 PCUs/hour travelling eastbound towards Cambridge on the A1303 just east of the Madingley Mulch roundabout during the AM peak. This number could increase to approximately 800 PCUs/hour just east of the M11 on slip. By 2031, in a do-minimum scenario (whereby no interventions or transport improvements are implemented), the A1303 could see a significant rise in traffic, and therefore delay, with up to 800 PCUs/hour just east of the Madingley Mulch Roundabout and approximately 1000 PCUs/hour just east of the M11 on slip during the AM peak. This increase in flow would serve to exacerbate the forecast delays to the east of Madingley Mulch roundabout.

Since congestion towards Cambridge typically begins in the area around the Madingley Mulch roundabout, the site is a good location for a new Park and Ride facility. .

It is also pertinent to note that whilst a Park and Ride at Madingley Mulch has limited accessibility from the east, it could serve as a potential option for traffic from the north of Cambridge.

Environment and transport impacts

The landscape character of the area would need to be considered when assessing the potential locations of a Park and Ride at Madingley Mulch roundabout. Should visual character be affected, mitigation measures such as screening would be considered.

Traffic impacts on the surrounding area from the introduction of a Park and Ride at Madingley Mulch roundabout would be assessed in full as part of the ongoing analysis. Initial considerations suggest that there could be some changes in traffic flows in Church Lane to the north, the north of the villages of Barton and Comberton and the slip from the M11 onto the A1303, as traffic may transfer from the existing Park and Ride to a new site at Madingley Mulch.

If direct access to the site from the A428 is possible, there could be a potential benefit to the Madingley Mulch junction in the AM peak as it would intercept cars upstream from the center of Cambridge congestion. Whilst there could be a localised increase in traffic and delay immediately adjacent to the roundabout, the impact of the Park and Ride on existing flows on the network on the whole would be positive as traffic going into Cambridge and beyond is reduced in the AM peak, and traffic leaving the city is reduced in the PM peak. All proposed A428 Phase 2 options include the signalisation of Madingley Mulch roundabout to ease congestion, and regulate flow on the roundabout itself.

It is acknowledged that any new Park and Ride has the potential to attract vehicle trips from other radial routes, as any new site in this location combined with bus priority measures would provide a strong alternative to the existing site in the corridor. However, it is anticipated that the majority of trips would be undertaken by those already utilising the corridor. Whilst those who may switch to using this corridor over another may cause some localised dis-benefits in the immediate surrounding area, it is likely that there would be consequential improvements elsewhere across the network.

Potential operating costs

The operating costs of a Park and Ride site at Madingley Mulch would perform better than sites further west, due to the reduced distance that buses would be required to operate over. This location is the eastern-most location which effectively balances congestion free access, high capture of patronage, and lower operating costs.

Summary

Madingley Mulch roundabout appears a reasonable location for a Park and Ride site, although the specific siting of the facility would require further consideration. The location is situated at a point on the network where corridor congestion begins, and therefore is well placed to encourage car users to switch travel modes. It is also relatively close to the center of Cambridge, and therefore would likely benefit from reasonable operating costs.

Scotland Farm

Proposal

Rationale

The proposal of a Park & Ride facility at Scotland Farm was put forward by stakeholders as part of the A428 Phase 1 consultation. The proposal involves locating a Park and Ride site at the Hardwick junction of the A428. The site was put forward due to the potential to result in earlier interception of traffic on the A428. It also has potential to have better connectivity with the immediate area in terms of walking and cycling, and provides an option for buses to serve Cambridge by continuing on the A428.

Potential capacity

A site at Scotland Farm, located to the northeast of the Hardwick junction, could potentially extend over 85,000m^2. The site would be constrained to the south and west by the A428 and Scotland Road respectively. Due to other land uses at the Hardwick junction, there is limited scope to explore alternative sites at this location off the Hardwick junction.

Access arrangements

A site at Scotland Farm would likely require the northern roundabout of the Hardwick junction to be reconfigured to accommodate an additional arm, which would serve as a dedicated entry/ exit for the Park and Ride site. It would also be important to consider potential land take of any new access point, which may impact on the overall number of parking spaces provided.

Qualitative Appraisal

Site suitability

The site is located close to local settlements such as Hardwick, and would therefore be accessible for some walking and cycling users. However a proportion of these settlements (e.g. southern part of Hardwick) would be outside of the recommended walk/ cycle catchment, and users would still therefore need the private car to access the site. This would make it less likely that they would switch from their current mode of transport to utilise the Park and Ride site. The overall volume of potential walking/ cycling trips to the site is therefore considered to be relatively small.

Locating the site further west than Madingley Mulch, at a location such as Scotland Farm, reduces the accessibility from the road network compared to a site further east. This is on the basis that users travelling along Long Road and Church Lane to access Cambridge are unlikely to travel away from the center, in order to park and get a bus back. It is more likely that potential Park and Ride users from Long Road and Church Lane would use the existing site at Madingley Road, therefore continuing to exacerbate congestion observed on Madingley Hill.

Whilst a Park and Ride site at Scotland Farm would provide the flexibility to use either the A428 or A1303, in the longer term this may not provide the greatest benefit to the area. An orbital route via the A428 would only allow buses to link housing and employment locations on the fringe of the City. However providing an orbital route east of the M11 (as is being proposed by the separate City Deal

Western Orbital study) would have the advantage of linking developments at West Cambridge, North West Cambridge and Darwin Green, which could not be achieved by using the A428/A14. It is likely that any future bus services would need to serve such developments, and therefore use of the 'fringe' orbital route would not be suitable.

Environmental and transport impacts

The landscape character of the area would need to be considered when assessing the potential locations of a Park and Ride at Scotland Farm. The location of the facility on the edge of the Green Belt may perceptually be more desirable than a site further east, however this will not affect the planning process.

While the location of the proposal further west along the A428 does offer the possibility of reducing congestion through earlier interception of vehicles, taking account driver behavior would suggest fewer vehicles would choose to use the facility if they cannot see a queue or congestion on the A428 corridor. Locating the Park & Ride in a location where the congestion is visible would offer greater incentives for modal switch.

Survey Data from June 2014 and TrafficMaster data, as well as modelled traffic flows indicates that queueing typically starts at or just beyond the Madingley Mulch roundabout. All proposed A428 options include the signalisation of Madingley Mulch roundabout to ease congestion, and regulate flow on the roundabout itself.

The potential of increased patronage of residents from Hardwick could be better achieved by placing local bus stops closer to the village as opposed to a Park & Ride site north of the A428. Users from the southern section of Hardwick would need to cycle or drive to the proposed location and may therefore be less likely to switch from their current mode of transport. Additionally users from Dry Drayton are unlikely to travel by foot as the distance to the site is prohibitive. A facility at Madingley Mulch coupled with local bus services to Hardwick and Dry Dayton could serve more users in the area and be better suited to capture users further east.

In considering a site at Scotland Farm, it is worth considering future development in the area. As shown in Figure 1, there is a large development proposed at the Bourn Airfield. Once this development is complete, there could be an increase in junction specific congestion and delays at the Scotland Farm junction, which buses would need to interact with to access a Park & Ride facility at this location. The CSRM model does not indicate that corridor congestion would extend beyond Madingley Mulch in the future year 2031, and therefore any congestion at Scotland Farm would be specific to the Bourn Airfield development. There would still be a free-flowing corridor beyond Scotland Farm (eastbound) and therefore, with driver behavior in mind, users are unlikely to choose to stop at Scotland Farm is there is no sight of congestion on the A428.

Potential operating costs

The operating cost of bus services serving the site would be increased compared with a location further east. Servicing the proposed location would take buses an additional 10 minutes when compared with the proposed location at Madingley Mulch roundabout (five minutes each way). Assuming buses keep their current frequency of one bus every 10 minutes, this would require at least one additional vehicle. However, the additional time and distance travelled by the bus would also require an increase in layover time, indicating a realistic estimate would be for two additional vehicles required to serve the proposed site at Scotland Farm compared with a site at the Madingley Mulch Roundabout. With an estimated base figure of £170,000 in operating expenditure per bus per year, a Park & Ride facility at Scotland Farm could cost a minimum of £340,000 per year in additional operating expenditure when compared to a facility at the Madingley Mulch roundabout.

The increased operating costs are a significant limitation of a Park and Ride site at Scotland Farm.

Summary

Whilst a Park and Ride site has some benefits in terms of local patronage capture and early interception of traffic, it is not considered the most suitable location for a Park and Ride site in the context of Cambridge. Concerns relating to the nature of network congestion in the area and bus operating costs may limit the feasibility of a Park and Ride site at Scotland Farm.

North of Cambourne

Proposal

Rationale

The proposal of a Park & Ride facility north of Cambourne was put forward by stakeholders as part of the A428 Phase 1 consultation. As part of the proposal, two potential locations have been considered, namely between the two roundabouts south of the A428 access and north of the junction with the A428. The site was put forward due to the potential to result in earlier interception of traffic on the A428, and proximity to the settlement of Cambourne.

Potential capacity

It is assumed that the two sites located north of Cambourne could provide a Park and Ride site extending between 10,300m^2 and 94,000m^2. The smaller of the sites is constrained by the junction itself, and therefore has limited scope for expansion. The larger of the two sites is currently open fields, with room for expansion further north, away from the junction itself.

Access arrangements

No specific access arrangements have been proposed as part of a 'North of Cambourne' Park and Ride, but it is likely that the Cambourne Road junction with the A428 would require reconfiguration to accommodate dedicated accesses. It would be important to consider potential land take of any new access point, which may impact on the overall number of parking spaces provided.

Qualitative Appraisal

Site suitability

Both sites are located close to Camborne, and therefore could be accessible for walking and cycling trips. However a mode shift towards public bus services could also be achieved through better placement of bus stops in Cambourne and other bus priority measures.

Locating the site further west than Madingley Mulch (or Scotland Farm), would further reduce the accessibility from the road network compared to a site further east. This is on the basis that users travelling towards Cambridge from settlements such as Highfields, Hardwick and Dry Drayton are unlikely to travel away from the center, in order to park and get a bus back in. This could potentially put additional strain on the existing Park and Ride site at Madingley.

Environmental and transport impacts

The landscape character of the area would need to be considered when assessing the potential locations of a Park and Ride north of Cambourne.

While the location of the proposal further west along the A428 does offer the possibility of reducing congestion through earlier interception of vehicles, as with Scotland Farm the consideration of driver behavior suggests that fewer vehicles would choose to use the facility if they cannot see a queue or congestion on the A428. Locating the Park & Ride in a location where the congestion is visible would offer greater incentives for modal switch.

Potential operating costs

The operating cost of bus services serving the site would be increased compared with a location further east; it would be greater than that estimated for Scotland Farm. There may be potential demand for additional vehicles, on top of those estimated for Scotland Farm which would greatly increase the operating costs, and could lead to the service being commercially unfeasible if high frequencies needed to be maintained.

Summary

The considerations above indicate that locating a Park and Ride at Cambourne would be less beneficial than locating it further east at locations such as Madingley Mulch or Scotland Farm, where

congestion on the corridor is greater, there is higher potential patronage and where operating costs would be lower.

Transport Hubs at Cambourne, Bourn, and between Highfield and Caldecote

Proposal

Rationale

The proposal is for the creation of transport hubs at Cambourne, Bourn, and between Highfields and Caldecote. The creation of transport hubs was put forward by consultees as part of the A428 Phase 1 consultation. It is understood that the proposals would provide 'facilities similar to a train station'. It has been put forward that a series of smaller Park and Ride sites would provide earlier interception of traffic on the A428, and the additional facilities would provide further incentive for users to switch modes to access the center of Cambridge.

Potential capacity

There have been no specific sites identified for the potential transport hubs. However it is envisaged that some of the sites already discussed within this technical note could provide suitable locations. It is considered that the location constrained by the junction at Cambourne would be too small, and therefore it is estimated that the capacity of the transport hubs could vary between 85,000m^2 and 95,000m^2.

Access arrangements

No specific access arrangements have been proposed as part of 'transport hubs' scheme, but it is likely that there would be a requirement to reconfigure a number of junctions in the area. It would be important to consider potential land take of any new access point, which may impact on the overall number of parking spaces provided, particularly with the requirement for additional facilities on site.

Qualitative Appraisal

Site suitability

The transport hub sites could be could be accessible for walking and cycling trips. However a mode shift towards public bus services could also be achieved through better placement of bus stops in local settlements, accompanied by other bus priority measures.

As has been discussed above, locating the site further west than Madingley Mulch, at locations such as Scotland Farm and Cambourne, would reduce the accessibility from the road network compared to a site further east. This would also be the case with a hub between Caldecote and Highfields, which also has the detrimental factor being situated away from the main A428 corridor.

Environmental and transport impacts

The landscape character of the areas would need to be considered when assessing the potential locations of the transport hubs.

While the locations further west along the A428 do offer the possibility of reducing congestion through earlier interception of vehicles, driver behavior suggests that fewer vehicles would choose to use the facility if they cannot see a queue or congestion on the A428.

In addition to this, it is considered that the impact of the hubs would be further limited due to the requirement for users to use the old A428 (St Neots Road), which would reduce the incentive to divert off the A428 prior to the existing Park and Ride at Madingley.

Potential operating costs

The operating cost of bus services would be higher than that of a site at Madingley Mulch. Depending on the frequency and number of transport hubs, a number of additional dedicated bus services may

be required. The increased operating costs could lead to the provision of a number of transport hubs being commercially unfeasible.

Summary

The considerations above indicate that a number of transport hubs would be less beneficial than locating a larger Park and Ride site further east at locations such as Madingley Mulch. The benefits likely to arise from the provision of transport hubs could more suitably be achieved by providing better placement of bus stops in local settlements and other bus priority measures.

Summary

This Technical Note has summarised the analysis undertaken as part of the A428 Phase 2 study which relates to the provision of a new Park and Ride site along the corridor. It has focused on the following key locations:

Madingley Mulch roundabout;
Scotland Farm;
North of Cambourne; and
Transport Hubs at
- Cambourne;
- Bourn;
- Between Highfields and Caldecote.

The analysis indicates that a Park and Ride site situated close to Madingley Mulch roundabout would be the most suitable location, as it would offer a good balance between congestion free access, high capture of patronage, and lower operating costs.

Whilst sites at Scotland Farm, Cambourne and a series of transport hubs could offer some benefits in terms of local accessibility from walking and cycling, they are unlikely to encourage drivers on the main A428 corridor to switch modes. This is due to the nature of congestion along the corridor, which does not typically begin until after the Madingley Mulch roundabout. If drivers observe the A428 is still uncongested, there is little evidence to suggest that they would switch modes earlier than where there are signs of imminent corridor congestion.

A key limitation of these alternative sites is operating costs of bus service provision. To maintain a regular service frequency a greater number of buses will be required, due to the distance away from Cambridge. The increased operating costs from these sites may mean that they are commercially unviable. Sites west of Madingley Mulch would hence offer fewer benefits and are thus viewed as less feasible.

The principle benefits of a site at Madingley Mulch include:

Being located as far east as possible making it accessible to the greatest number of users;
Having good accessibility from the trunk road and local road network;
Achieving interception of car users at the point where congestion starts;
Having the lowest likely operating costs of bus services compared to sites further west; and
Having the potential for the largest land capacity for the provision of a Park and Ride site.

With the above in mind, it is therefore considered that a site at Madingley Mulch is the most suitable for further consideration as part of the A428 Phase 2 project.

TN2

Project:	A428 Study	**To:**	Cambridgeshire County Council
Subject:	Tidal Bus lane Review	**From:**	Atkins
Date:	24 May 2016	**cc:**	

Introduction

As part of the A428 Corridor Study to improve the bus journey time between St Neots and Cambridge, Atkins put forward a feasibility option which includes the provision of new east-bound bus lane along part of A1303 Madingley Road between Madingley Mulch roundabout and M11 Junction 13 into Cambridge City.

Cambridgeshire County Council is, however, considering the possibility of introducing a tidal bus lane. In order to determine if a tidal bus lane would be feasible along this corridor, this technical note details existing schemes where tidal (or reversible) lanes have been implemented in the UK and other locations worldwide as a reference for further appraisal.

This note reviews the existing constraints along the corridor to determine the practicalities of introducing a bus lane, including its design and safety implications. The note then reviews the potential benefits of a tidal lane on this particular road section and provides recommendations.

Review of existing site constraints for A1303 Corridor

The existing site constraints which may be encountered for the A428 scheme proposals are divided into sections as follows.

Madingley Mulch Roundabout to Crome Lea Business Park

Madingley Road is 7.2m in width and when travelling eastbound the following features could be noted; access to Madingley Mulch Garden Supplies on the south side of Madingley Road along with accesses to residential properties. Following these property accesses there is one access to the north and one access to the south leading to agricultural land adjacent to Madingley Road.

A partially marked right turn area for eastbound traffic along Madingley Road leads to an access road to Crome Lea Business Park on the south side of Madingley Road which is approximately 5.2m in width.

Should a tidal flow lane be implemented at this location the main issue that would need to be considered is how traffic is managed when entering and exiting these side road / residential accesses.

Crome Lea Business Park to American Cemetery

Following the access to the Crome Lea Business Park there is a layby on the southern side of A1303 Madingley Road, the layby is approximately 65m in length and is partially utilised for a bus stop.

Approximately 100m after the layby the bus / coach entrance to the Cambridge American Cemetery is located on the north side of Madingley Road followed 75m later by the combined bus parking exit and the car park exit for all traffic. Directly opposite the Cemetery there are three residential property accesses on the south side of Madingley Road.

Should a tidal flow lane be implemented at this location the issue that would need to be considered is how traffic is managed when entering and exiting these side road / residential accesses, ensuring that the layby remains accessible to all traffic not dependant on the direction of the tidal lane, or whether provision of additional facilities are required on the opposite side of the A1303

Cambridge American Cemetery to Cambridge Road

A further 130m along Madingley Road there are three driveway accesses on the north side of the road, one of which is the exit from the American Cemetery car park, the other two appear to be to residential properties. The carriageway at this location is approximately 7.2m in width.

Along this section of Madingley Road there is a layby on the northern side of Madingley Road, which is approximately 75m in length. Directly after the layby the carriageway widens to approximately 9.5m to provide an additional central right turn lane into a property access road on the southern side of Madingley Road, this turning lane is protected by traffic islands on both sides of the access possibly due to its location on the bend.

Madingley Road Straightens out as it approaches Cambridge Road where the carriageway is approximately 10.5m in width at this location. At the junction of Madingley Road and Cambridge Road right turn lanes are provided for both opposing directions of traffic.

Should a tidal flow lane be implemented at this location the issues that would need to be considered are; how traffic is managed when entering and exiting these side road / residential accesses, ensuring that the layby remains accessible to all traffic not dependant on the direction of the tidal lane, or whether provision of additional facilities are required on the opposite side of the A1303. The need for the hatched and protected right turn storage area on the bend approaching Cambridge Road would need to be assessed to determine its usage and necessity with regards to safety, and the implications of its removal to provide the required space for a tidal lane. Finally, as traffic approaches Cambridge Road the requirement for any bus facilities to be suitably terminated prior to the junction would need to be considered or the possibility that the junction may require signalisation in order to allow bus priority and time improvements.

Cambridge Road to M11 Junction 13

Following on from the Cambridge Road junction the carriageway narrows back to two lanes measuring approximately 7.2m over the length of approximately 120m where the carriageway widens once again to approximately 10.5m to provide a nearside bus lane for eastbound buses, this extends for 350m until the M11 overbridge where the bus lane terminates. At the junction with the off-slip from the M11 at Junction 13 the bus lane bypasses the junction and allows buses to continue eastbound unobstructed until after the junction where buses must then merge with normal traffic due to the width of the overbridge at this location.

For a tidal flow lane to be implemented along this section of the A1303 Madingley Road the main issue for consideration should be how the tidal lane should be terminated. The most feasible option would be to terminate the lane ahead of the M11 Junction to avoid confusion and the requirement to sign warnings of the tidal flow to motorists exiting the M11 at Junction 13. This would also enable to existing eastbound bus lane to be utilised on the approach to the junction.

M11 Junction 13 to Northampton Street

East of Junction 13 of the M11 Madingley Road becomes increasingly residential. The number of private accesses both to residences and educational centres increases. Similarly, the number of pedestrians and cyclists using and crossing the road also increases in this section. These characteristics make the introduction of a tidal bus flow lane along this section of the corridor impractical.

Design Considerations

Appendix A contains a review of tidal flow schemes in the UK and internationally. Of these the majority make use of overhead signals to allow motorists to identify which lane can be used by which type of vehicle and when. They all have a central lane or lanes that switch directions at peak periods to provide increased capacity in one direction.

Schemes in the UK with tidal lanes have a continuous lane along the entire length of the scheme rather than allowing short sections of tidal flow, this enables motorists to identify the tidal flow sections and know when they begin and end.

The main constraint to a scheme of this type is controlling the movement of traffic at accesses along the route where right turn lanes are currently provided to allow the free flow of traffic continuing along the main line. Vehicles waiting in a normal traffic lane to turn right could cause traffic to back up behind them, which although temporary, could happen regularly at peak periods.

In addition to this, overhead lane designation signals would be required to provide all road users with the necessary information with regard to lane use, which could be visually intrusive on the surrounding area. A more modern design for the overhead mounting arrangement could improve the aesthetics of the scheme.

For the effective implementation of a tidal bus lane along the A1303 Madingley Road the following features would most likely be required:

Road space available for a minimum of three continuous lanes;
The provision of overhead signals;
Removal of the provision of right turn lanes;
The junction of Madingley Road / Cambridge Road to be signalised; and
The provision of advanced signage.

Three continuous lanes

Of the three lanes, a central lane could be reversed at peak times. This could be in the form of a central bus lane which swaps directions (Table 1) or in the form of a nearside bus lane eastbound in the AM peak period and a nearside westbound bus lane in the PM peak period (Table 2). The latter would require more management of the lane switch over as this would most likely require an additional stage to the lane changeover.

Tables 1 and 2 show the potential arrangement of lanes along the A1303 and how a tidal lane could be operated.

Table 1 shows the centralised tidal bus lane option and where only buses can use the central lane, this lane switches direction to allow buses to flow freely during peak periods.

Table 2 shows the nearside bus lane option, where during peak periods the nearside lane in the busiest direction is a bus lane with the central lane being used for general traffic in the same direction. This is a more complicated option and requires a two stage changeover period as there would be need to be a period of time where the central lane is unused.

	AM	Changeover Period	PM
Lane 1	All Traffic (Eastbound)	All Traffic (Eastbound)	All Traffic (Eastbound)
Lane 2 (Tidal lane)	Buses (Eastbound)	Unused	Buses (Westbound)
Lane 3	All Traffic (Westbound)	All Traffic (Westbound)	All Traffic (Westbound)

Central tidal flow bus lane option

	AM	Changeover Periods		PM
Lane 1	Buses (Eastbound)	All Traffic (Eastbound)	All Traffic (Eastbound)	All Traffic (Eastbound)
Lane 2 (Tidal lane)	All Traffic (Eastbound)	Unused	All Traffic (Westbound)	All Traffic (Westbound)
Lane 3	All Traffic (Westbound)	All Traffic (Westbound)	Unused	Buses (Westbound)

Nearside bus lane option with tidal central lane

Overhead signals

Overhead signals would be necessary to control the lane usage. These would need to span all three lanes to ensure drivers are informed of the lane designation / direction as it would not be practical to convey the tidal flow message to drivers effectively using only roadside signage.

Overhead signals are required to be between 5.5m and 9m in height, as per the Traffic Signs Regulations and General Directions (TSRGD) (2016). Gantries of this height which span three lanes are also likely to require large foundations.

Removal of right turn lanes

Removing right turn areas / lanes from minor junctions to free up road space for the additional tidal flow lane.

Signalisation of Madingley Road / Cambridge Road Junction

If the junction is not signalised, any bus lanes may need to terminate prior to the junction with enough distance for general traffic to be able to merge into the lane of their choice.

To ensure buses are able to approach the junction and pass through it with relative ease, signalisation may be necessary. This could depend on the method of tidal flow as shown in Tables 1 & 2.

Advance Signage

Providing signage in advance of the tidal flow lanes to ensure drivers are aware of the upcoming restrictions on lane use. Signs would need to inform drivers of the individual lane control in force and that there are restrictions on the type of vehicle that can use each lane. Variable Message Signs could be used in this instance to provide more information of the current status of the tidal flow.

AM and PM Peak Benefits

The sections above have established that subject to design and further investigation a tidal bus lane could be implemented along the 2.5km section of the A1303 Madingley Road from Madingley Mulch Roundabout to the junction with the M11.

However, doing so would require introduction of gantries and advance signage, restriction of right hand turns and could potentially lead to safety incidents. The potential benefits of implementing a tidal bus lane along this section will need to be considered against these issues.

Traffic Delays on Madingley Rise

The Cambridge Sub-Regional Model (CSRM) has been used to generate predictions of traffic delays to car users on this section of Madingley Rise in 2021. The AM peak and PM peak have been considered separately and are shown in Figures 1 and 2 below. It is worth noting that the model predicts traffic on a "typical" day (i.e. it cannot forecast variation due to route unreliability).

Figure 1: Predicted 2021 AM Peak Delays

Figure 2: Predicted 2021 PM Peak Delays

These figures show that in the AM peak period the significant delay is eastbound approaching the M11 junction. The section already has a short section of bus lane on approach to the bridge, although the magnitude of the delay implies that the queue will be quite extensive; a longer section of bus lane to avoid that queue is likely to be beneficial.

The presence of this queue is likely to incentivise car users to park their car and switch to public transport if bus priority which bypasses the queue can be provided along this section. The proposed location of the Park and Ride at Madingley Mulch would facilitate this modal switch. However, it is worth noting that introduction of a Park and Ride and bus priority is unlikely to completely eliminate queues, as car users will likely only switch modes once the road is at capacity.

Westbound the delays are not as significant, and amount to a predicted 8 seconds in the AM peak and 17 seconds in the PM peak. A tidal bus lane which switches to westbound operation in the PM peak is therefore likely to have only minor journey time benefits compared to the benefits obtained in the AM peak period.

Reliability

As explained above, it is not possible to use CSRM to predict the reliability of car or bus journeys in future. However the various infrastructure solutions being considered by the scheme can be ranked in terms of their reliability, as shown in 0.

Greater reliability

Infrastructure	Comments
Uni-directional bus lane	Provides a certain level of reliability, but buses are still subject to obstructions such as stopped cars, or may need to travel slowly whilst waiting to overtake cyclists
Bi-directional bus lane	As above, but would offer greater reliability in the PM peak too
Segregated bus route	Greatest reliability. No interaction with other modes (except for discrete incidents).

Reliability of different infrastructure types

Bi-directional bus lanes would offer reliability benefits both in the eastbound and westbound directions, but the most reliable solution is to provide a completely segregated route for the bus. This infrastructure has the advantage of being bi-directional and eliminates the possibility of interference from other road users (e.g. turning vehicles or cyclists), providing the greatest reliability.

Options 1 North and 1 South, which are being tested as part of the continued assessment of the A428 route options, both offer the possibility of achieving completely segregated routes to bypass queues on Madingley Rise while achieving a high level of reliability.

Conclusion

Following initial assessment of the road characteristics from Madingley Mulch roundabout to Northampton Street, it would be possible to implement a tidal lane along the 2.5km section of A1303 Madingley Road between Madingley Mulch roundabout and the M11. This is providing there is suitable redesign of this section of the route, in particular its junction with Cambridge Road. This would most likely be in the form of overhead signal controlled lanes similar to that of the Lincoln and Sheffield schemes.

However, the road section from the M11 to Northampton Street contains many junctions and residential accesses to be accommodated restricting a tidal bus lane to be practical.

Introduction of a tidal bus lane is likely to have significant safety implications and would require alterations to the road environment. These dis-benefits should be assessed against the potential benefits of providing bi-directional priority along this section.

Examination of predicted traffic flows in 2031 in the AM and PM peak has shown that delays are more severe during the AM peak on Madingley Rise and in the section approaching the M11. Car users would therefore be incentivised to leave the car at a Park and Ride site further upstream, if a scheme

with east-bound priority allowed them to bypass these queues (therefore forcing them to travel back to the Park and Ride by bus in the evening).

Delays during the PM peak are not as severe as those in the AM peak, and therefore the journey time benefits of providing bus priority in the westbound direction are not as significant.

Some reliability benefits could be obtained from the introduction of tidal bus lanes, but these will be less than those provided by a completely segregated bus route, which is being explored by some of the other project options.

Given the engineering considerations and safety implications of a tidal bus scheme and the high-level assessment of journey time benefits likely to be achieved in the eastbound and westbound directions, it is recommended that an east-bound only bus lane is provided on Madingley Rise. Introduction of a tidal bus lane would have significant safety, maintenance and townscape impacts for a limited benefit to journey times during PM periods.

Review of Tidal Flow Schemes

Existing tidal flow schemes in the UK

A38(M) Aston Expressway (Birmingham)

The A38(M) Aston Expressway in Birmingham links the A38 at its junction with A4045 at Dartmouth Circus to the north of Birmingham City Centre to the M6 Motorway at the Gravelly interchange (Junction 6, Spaghetti Junction).

The tidal flow section of the A38(M) is 1.6 miles in length and at its widest is a seven lane carriageway. Of these seven lanes, the central lane highlighted with red surfacing has a prohibition of motorcyclists at all times due to the centrally located drainage system which would be dangerous to motorcyclists. This central lane acts as a “buffer” lane, when 3 lanes of traffic can travel in each direction with a lane between them. During AM and PM peaks this typically changes to four lanes in one direction and two lanes in the opposite direction maintaining the one lane “buffer”.

The lanes are managed with overhead gantries with lane indicator signals to TSRGD Diagrams 5001.1, 5003 & 5005, these are located at regular intervals ranging between 250m and 400m apart. Visually these are similar to gantry lane signage found on a number of motorways and is not out of place in this location.

Figure 1: Northbound view of A38(M) Aston Expressway

A15 Canwick Road (Lincoln)

This tidal flow all traffic lane begins on the A15 Canwick Road at the junction of A15 Canwick Road / A15 South Park Avenue and B1188 Canwick Road. This scheme is approximately 420m in length comprising of three normal traffic lanes using nine Gantry / Cantilever mounted lane indicator signals to TSRGD Diagrams 5001.1, 5003 & 5005 to control the direction of flow at peak periods.

Both approaches have signage to TSRGD Diag. 5011 indicating the use of lane control signals on the road ahead. The central lane on this road section is not highlighted on the carriageway and all lane designation signals are of the same size. The existing lane designation signs without any backing board could have visibility issues under certain light conditions. The overhead gantries reduce footway space on both sides of the carriageway however they are less visually intrusive in this partly industrial area.

Recent improvements at the junction of A15 Canwick Road / A15 South Park Avenue & B1188 Canwick Road have seen new cantilever mounted signal equipment replacing the previous gantry structures. These have only been replaced in locations where the signals span two lanes rather than three, it is unknown if there is a limitation.

Figure 2: Northbound view of A15 Canwick Road

Figure 3: Southbound view of A15 Canwick Road

A61 Queens Road / A61 London Road (Sheffield)

This central tidal flow all traffic lane begins on the A61 Queens Road at the junction of A61 Queens Road / Alderson Road and continues until the junction of A61 London Road / Broadfield Road.

It is approximately 400m in length and varies between three and four traffic lanes with one lane highlighted in red to identify the tidal flow lane. This is controlled using five gantries with lane indicator signals to TSRGD Diagrams 5001.1, 5003 & 5005. This allows the direction of traffic in the tidal flow lane to be controlled at busy periods.

Four signalised junctions are located along the length of this scheme along with one controlled pedestrian crossing, at each location there are opposing stop lines on the central tidal lane to be compliant with regulations. The majority of these junctions have yellow box markings to TSRGD Diagrams 1044. At Cookes pet store and Halfords on A61 Queens Road yellow boxes to TSRGD Diagram 1043 are used to allow right turning traffic into and out of the car park / access road without blocking the tidal flow lane.

The tidal flow lane signage for the central lane at this location is larger than the two normal traffic lanes not having any backing to the lane designation signal could make the signal difficult to see under some light conditions, however the signals have been covered with a hood to reduce the glare from sunlight.

The overhead gantries take up valuable footway space on both sides of the carriageway, however they are less visually intrusive in this largely industrial area

Figure 4: Northbound view of A61 London Road

Existing tidal flow schemes overseas

Coronado Bridge (San Diego – US) – "Road Zipper" moveable barrier system

This tidal "reversible" lane utilises a moveable concrete barrier system extending along the entire length of the 1.6 miles Coronado Bridge. This system uses a specially constructed vehicle which can be driven along the route and reposition the interlocked one metre barriers from one edge of a lane to the opposite edge. This can be easily undertaken whilst all lanes are open providing the traffic in the central lane is moving. This system has been in place for almost 20 years and was installed following a spate of head on collision accidents in the mid 1990's.

This system allows a central traffic lane across the bridge to have its direction of flow altered at any point and provides a clear indication to motorists when the lane is available due to the nature of the barrier. This also means that there is no need for additional signalisation to provide motorists with lane designation information.

Figure 5: Northbound view of CA-75 on the Coronado Bridge

Figure 6: Moveable barrier system in operation

Tidal Busway – (Eugene Oregon - US)

This tidal (or reversible) lane is a partially segregated central busway utilising overhead light rail type signals, at signalised junctions these are integrated into the existing overhead cantilever traffic signal.

The bus services in Eugene utilise central bus stops similar to that of light rail stops. These are located within wider central reservations which can be accessed via the central tidal bus lane from either direction or from either of the normal traffic lanes adjacent when required.

This system utilises a combination of traffic signal controls and strategically located bus lanes to provide buses with the required priority at junctions when not using the tidal bus lane.

The layout of a centralised bus lane which is segregated from the main carriageway works due to the availability of road space between property boundaries; the space for the centralised bus stops is

easily achieved by utilising large central reserve spaces. The space taken up by this scheme would be on par with a light rail system in the UK.

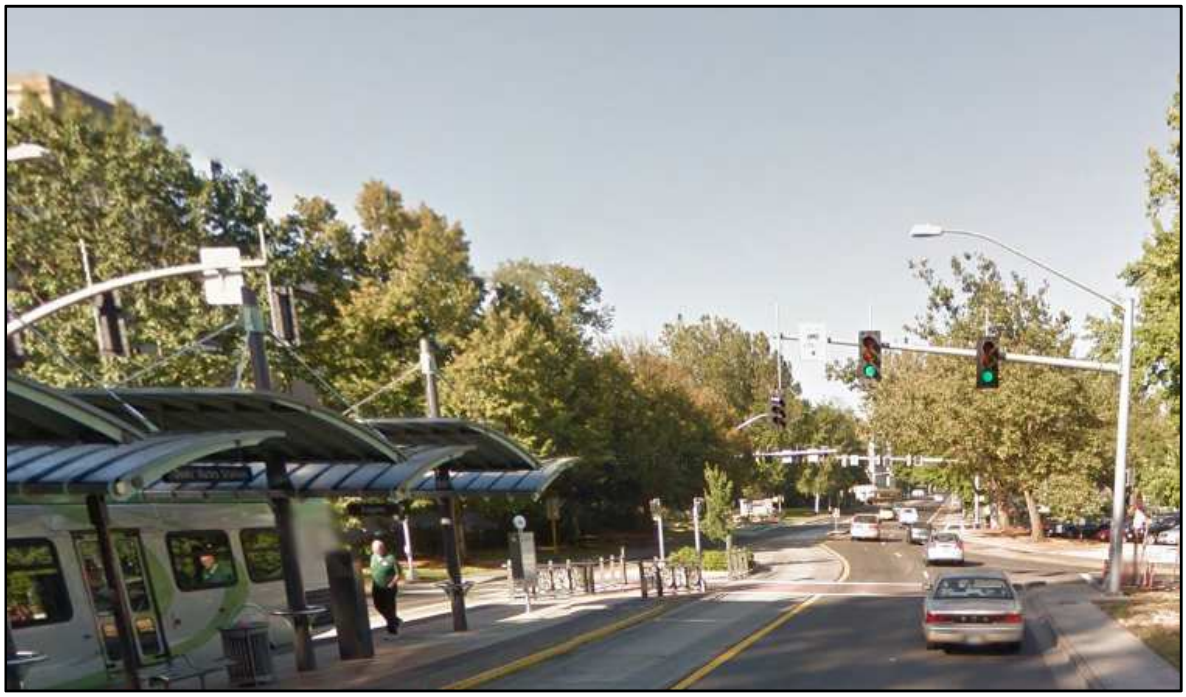


Figure 7: Eastbound on E 11th Ave. at Dad's Gates Station

Proposed tidal flow schemes in the UK

A40 Eynsham to Oxford tidal bus lane proposal (3.8 miles)

A tidal bus lane has been proposed along a stretch of the A40 between Eynsham and Oxford. This part of the A40 is approximately 3.8 miles in length. Along this section of road there are two junctions where traffic can enter and leave the A40.

During the morning peak hour it would allow buses to bypass eastbound traffic between Eynsham and Oxford, switching to the opposite direction in the evening peak hour.

The proposals for this scheme have not been finalised and are still being reviewed with further option appraisals to be undertaken. Potentially, there are two options in which this could be achieved; either by having a single reversible bus lane segregated from normal traffic and controlled by entry signals, or by having three lanes with restrictions on direction of flow and use, which can be adjusted throughout the day.

For the first option, control would be through entry restrictions (which would probably need to be traffic signal controlled) and separation, either physical or through regulation, of the reversible lane from the remaining carriageway.

For the second option, the control of traffic would be via overhead gantries which would restrict traffic from travelling in a particular direction in each lane and prohibit the use of the central lane except to a particular class of vehicle (e.g. buses & coaches). Gantries in this location would increase the visual intrusion on the surrounding landscape.

The majority of discussions on these options suggest that a central tidal bus lane would be the most likely choice, utilising overhead gantries and road markings to show which direction the lane is

running and which type of vehicles are able to use the lane. At locations where the carriageway is narrow for three lanes, bus gates could be provided to give priority to buses.

Implications for the A1303 Madingley Road

The bus rapid transit scheme in Eugene would be the most ideal option for improving public transport as this segregates buses from general traffic as much as possible, whilst still providing fully functioning junctions which cross its path. However the road space required to provide this is significantly more than is available along the A1303 Madingley Road.

The “Road Zipper” system used in San Diego has a proven track record for improving traffic flows at peak periods however this system is best suited to locations where there is no requirement to turn left (right in the UK) across the mainline of the carriageway such as along bridges. This system would not be suitable along the A1303 due to the number of side road / residential accesses and junctions.

The two schemes which have similar constraints to that of the A1303 Madingley Road are the A15 in Lincoln and the A61 in Sheffield. Both of these schemes have property boundaries and pedestrian areas which limit the road space available for the scheme. The signage methods used would also be similar as both schemes are in the UK. In places, side roads along the length of these schemes have been altered to provide safer movement of traffic, i.e. banned / restricted turns.

TECHNICAL NOTE 3

R1: The forum believes that the steps the City Deal has taken in relation to the western bus corridor lack strategic overview. The Forum requests that, before any additional road infrastructure is decided upon, demand management options are explored and their impacts assessed. Such demand management options should include residents' parking, employers' car parking levy, and congestion charging.

R1 addendum: The Forum recommends that there be a public consultation in which specific options are put forward.

Addendum passed:

19F; 0A

R1 with addendum passed:

23F; 0A

Project Board Response

The Project Board is assured that the strategic aspects of the project are well considered. In particular the project is grounded in a clear policy background including the Joint Transport Strategy, Local Plan and other local transport strategies. Additionally the project has been prioritised in accordance with Department for Transport Early Sifting Tool assessment processes which are well focused on strategic overview.

As work being carried out in the parallel City Centre Access study demonstrates, the City Deal is also seeking to understand and potentially deliver demand management measures. These will form part of the overall strategy which needs to be focused both on travel demand but also better public transport.

The A428 and Western Orbital corridor measures will not include demand management measures in isolation. The wider City Centre Access approach will undoubtedly have an impact on the A428 corridor and other corridors. The Project Board agrees that during the ongoing development of detailed proposals for the A428 corridor full understanding of the impact of demand management options must form part of the assessment process.

R2: The Forum asks that proposals for the Cambourne to Cambridge busway and Western Orbital be reviewed to clarify how they will improve the sustainability of Cambourne and the new A428 settlements. No final decision should be taken on either scheme until this has been done and a full business case that includes bus operational impacts and viability is completed.

R2 passed:

19F; 0A

Project Board Response

The Project Board agrees that – in line with the standard project development approach - the sustainability of any recommended option will be fully assessed through the development of a full business case.

R3: In view of widespread criticism of previous consultations run by City Deal, the Forum proposes that planners consult with its members, before any future consultation documents are issued, in order to ensure more positive engagement. In particular, the Forum requests that particular care is taken to ensure the accuracy of all factual information, including maps, in consultation documents.

R3 addendum: A summary of social and environmental impacts should be included in future consultations.

Addendum passed:

23F; 0A

R3 with addendum passed:

19F; 0A

Project Board Response

The Project Board agrees that that a summary of social and environmental impacts should be included in future consultations and will consult with the LLF on the presentation of these issues. It also agrees that the LLF should be consulted on issues such as presentation and structure of material.

R4 amended: The Forum considers that no evidence has been provided on the projected usage and commercial viability of the Western Orbital to justify the expense and environmental damage of an off-road solution. More evidence is requested.

R4 Amended resolution passed:

17F; 0A

Project Board Response

The Project Board agrees that as part of further development work for the Western Orbital assessment of bus operations will be required. This would form part of the wider business case assessment which would also include full considerations of environmental issues along the corridor.

R5 amended: The Forum notes overwhelming public opposition to off-road busway proposals either side of Madingley Hill (Area 1 North & Area 1 South). It also notes it is 'considered potentially possible to implement a tidal bus lane along the stretch of Madingley Road between the Madingley Mulch Roundabout and the M11 bridge' (Atkins, Technical Note, 1/2/16). Should the City Deal Board select one of the off-road options, the Forum would strongly object on the grounds that an on-road dedicated bus lane, on this stretch of the road, amply satisfies the aims of the scheme in terms of speed and reliability. It would therefore consider the expense, environmental damage and negative impact on the neighbouring villages, of that selected off-road alternative, not to be justified. The Forum's support for on-road only extends as far as the M11.

Addendum passed:

17F; 2A

R5 Amended resolution passed:

17; 0A

Project Board Response

The selection of a preferred option will be a matter for the City Deal Executive Board. The Project Board notes the point regarding the adequacy of a bus lane. The Project Board would, prior to the recommendation of any preferred option require the Project Manager to produce a full case for investment in one or other of the options. The case for investment would include both transport and wider economic considerations in line with City Deal objectives. The Project Board would require for any Preferred Option a full business case to be developed which would need to demonstrate that the option has clear strategic benefits. The Project Board would not recommend to the City Deal Board a proposal which could not be justified on the range of assessment criteria.

R6 amended: The Forum understands that discussions have taken place between City Deal planners and the University as regards a route through the West Cambridge site for the Cambourne to Cambridge busway. The Forum requests more information on these discussions, and the routes and technology being considered.

R6 Amended resolution passed.

20F; 0A

Project Board Response

The Project Board agrees that as part of the ongoing project development the LLF is updated as any discussions develop with West Cambridge, while not prejudicing any specific negotiations which may be undertaken with the West Cambridge site developers.

R 7: The Forum notes that considerable work has been undertaken to assess various options for remodelling the M11 bridge at junction 13. It also notes that one proposal for the Cambourne to Cambridge busway requires spending up to £50 million on a new bus-only bridge across the M11. The Forum suggests that, should the City Deal Board select an option using the existing bridge, measures should be included to ensure it better serves all traffic, as well as providing bus priority. This would deliver greater economic benefit, and would thus represent a better use of City Deal funds.

R7 addendum 1: The Forum proposes no further action on this until a range of demand management measures have been investigated.

Addendum passed:

18F; 0A

R7 with addendum passed:

17F; 0A

R7 Addendum 2: The Forum believes that the Girton Interchange needs upgrading to accommodate full movements from the A428 onto the M11. This would be the most beneficial traffic improvement in the area, and would significantly reduce congestion on Madingley Hill.

R7 Addendum 2 passed:

19F; 0A

Project Board Response

The Project Board agrees that any on road option recommended to the City Deal Board for preferred option development should – as part of that development – include further consideration of the J13 bridge and how that would support the corridor scheme objectives. Such an assessment would need to consider the economic and transport benefits of improvement of the bridge and also the environmental impact.

The Project Board considers that it has responded to the issue of demand management as part of its response to R1.

The Project Board considers that the Girton Interchange is not within the scope of the A428-A1303 project nor the Western Orbital. It does however recognise, in line with the County Councils representations to Highways England on this matter, that there could be strategic benefit in further consideration of this issue as part of the Oxford to Cambridge Expressway work currently being undertaken by Highways England. The Project Board understands that the County Council in its role as highway authority continues to engage with Highways England on this matter. The Project Board agrees that the A428-A1303 and Western Orbital Project Managers will provide assistance to Highways England in exploring this matter.

R8 deleted: The Forum supports a new Park and Ride along the A428 corridor. However should the City Deal Board select the Madingley Mulch Roundabout for a Park and Ride location, the Forum would object as it considers Scotland Farm to be a better location.

R8 replacement: The Forum recommends that City Deal Officers to work with Smarter Cambridge Transport to discuss alternative Park & Ride sites and Transport Hubs for the A428 corridor.

R8 passed.

15F; 0A

Project Board Response

As part of the project development work undertaken on the A428 corridor a number of Park & Ride locations were considered. The conclusion of these assessments were that small transport hubs were not precluded by the provision of a strategic Park & Ride but that they could not replace such a Park & Ride. Reasons included the operational and bus service planning benefits of a single Park & Ride and the need to provide capacity for future growth of the corridor. The Project Board agrees that as part of preferred option development smaller hubs in addition to a strategic Park & Ride site can be considered if a positive case for such hubs can be made. The Project Board instructs the Project Manager to engage with Smarter Cambridge to discuss specific proposals for transport hubs as part of the scheme development process for the preferred option.

R9: Should a Park and Cycle site be approved at J12 by the City Deal Board, the Forum considers that the locations proposed by Barton Parish Council to be safer and easier to access.

R9 passed.

XXF; XXA

Project Board Response

The Project Board instructs the Project Manager of the Western Orbital to engage with Barton Parish Council to discuss future Park and Cycle sites at J12 if such a proposal forms part of a preferred option recommendation.

R10: The Forum recognises the peak time traffic problems on the A10 South, and supports Harston and Hauxton Parish Councils in asking officers to investigate siting the new Park and Ride south of Harston instead of at Hauxton. Foxton is suggested with its train station offering a choice of travel.

R10 passed.

15F; 0A

Project Board Response

The development of Park & Ride options at on the A10 south corridor forms part of the Western Orbital scheme development. This included a consultation in early 2016. In this consultation the proposal was made for a Park & Ride at J11 immediately to the west of the junction. The proposal was based on both the existing land option which the County Council has on this site and an assessment of the benefits of a site close to the M11 to intercept traffic both north and eastbound. Consideration of a Park & Ride at Foxton formed part of the assessment process but has been ruled out because it will not capture north bound traffic, has high operational costs due its distance from Cambridge, has no clear suitable available land site and would have limited benefit for bus priority. The Project Board agrees that any proposal for a Park & Ride on the A10 corridor as a preferred option should be subject to a full environmental and traffic assessment and that there should be ongoing engagement with the local Parish councils regarding local impacts.

DRAFT TN4

Project:	Cambourne to Cambridge Better Bus Journeys	**To:**	CCC
Subject:	Considerations for Catchment Area Maps	**From:**	Atkins
Date:	1 Sep 2016	**cc:**	

Introduction

This note summarises considerations undertaken when preparing the Catchment Area Maps for the Cambourne to Cambridge Better Bus Journeys Project.

Considerations

This section of the note identifies initial considerations for the proposed HQPT routes in the A428 corridor, and documents the thought processes involved in determining the areas of land to be shaded in the Catchment Area Maps presented with the reports. Further assessment and consultation regarding the exact alignment of the preferred option will be undertaken in early 2017.

Plans showing the alignments of the routes discussed in this section are presented in Appendix A. Label references [X] are indicated on the plans as appropriate.

Route Option 1 Central

This option involves provision of a bus lane on Madingley Road. It is shown as a single line on the Catchment Area Maps, as it is constrained by the corridor, but there may be a requirement for land take on Madingley Road to achieve the minimum width for a bus lane.

Route Option 1 South

Route option 1 South concerns the link between the A428/A1303 roundabout (referred to as Madingley Mulch) and Grange Road. This link is described in three sections, from East (City) to West (Madingley Mulch)

From Grange Road to West Cambridge

Four possible connections to Grange Road are being considered:

- University Sports Ground/Adams Road [A]
- Herschel Road [B]
- North of Cambridge University Rugby Ground [C]
- North of Cambridge University Rugby Ground/ Cranmer Road [D]

Adams Road

The junction of Wilberforce Road and Adams Road has reduced visibility where the proposed busway would join Adams Road. The proximity to the pond and the constraints on Adams Road, in terms of parked cars, have the potential to make the route unfeasible. It is unlikely that the parking

is by local residents as most properties have generous off road parking available therefore objections to necessary TROs would be unlikely.

The junction of Adams Road and Grange Road is already signalised, and existing signals could be modified to give buses a measure of priority. The Coton footpath and Adams Road form part of the national cycle network, and any infrastructure provided would seek to enhance it where possible.

Herschel Road

To connect to Herschel Road, this route would run to the south of the University sports fields, therefore avoiding the pond. Parked vehicles on Herschel Road could have the potential to slow services along this route. It is unlikely that the parking is by local residents as most properties have generous off road parking available therefore objections to necessary TROs would be unlikely.

Herschel Road currently has a higher level of on-street parking and is narrower than Adams Road, with limited opportunities for vehicles to pass. The junction between Herschel Road and Grange Road is not signalised.

There is a listed building on Herschel Road, but the impacts of the route on it are unknown at present.

The western section of Herschel Road is privately owned.

North of the University Rugby Ground

This route links with Grange Road to the north of the University Rugby Ground. Some level of disruption to the University Rugby ground could be expected due to the narrow nature of the existing access track. The route may avoid the Top Pitch, or this would need to be relocated.

This route minimises conflict with other traffic, as it has less accesses than Herschel Road and Adams Road, but its overall width may limit opportunities to provide a fully segregated bus route.

The junction with Grange Road has limited visibility due to fences and has a skewed layout, which may require significant realignment to accommodate turning vehicles.

South of the University Rugby Ground / Cranmer Road

This route links with Grange Road to the south of the University Rugby Ground, at Cranmer Road. Parked vehicles on Cranmer Road could have the potential to slow services along this route. It is unlikely that the parking is by local residents as most properties have generous off road parking available therefore objections to necessary TROs would be unlikely.

Cranmer Road currently has a higher level of on-street parking and is narrower than Adams Road, with limited opportunities for vehicles to pass.

West Cambridge - M11 Crossing - Junction at Cambridge Road

The West Cambridge University site [E] is a key employment location in this corridor, and consideration should be given as to how best to serve it. A route through the site is likely to capture more patronage than a route to the south of the site. However, interaction with other traffic may generate slower journey times and reliability issues, unless a dedicated bus-only corridor can be secured through the site. The watercourse on the West Cambridge site (which runs parallel to Charles Babbage road to the south [F]) is to be avoided if possible to reduce the engineering complexity of any alignment through the site.

Routing along this section is also somewhat dependent on which road has been used to gain access to Grange Road. Given the range of possible connection points to the West Cambridge site, there is a wide area shown in the Catchment Area Maps to the south of the site which may be used to gain this access (although this does not mean the entirety of the fields would be built over). The existing hedge line which runs approximately 220m south of the West Cambridge site may be used for screening purposes.

The exact location of the new bridge across the M11 will be dependent on the alignment of the route to the east and west of the motorway, and also the cost and complexity of embankment construction. The northernmost point of crossing is likely to be in line with Charles Babbage Road, while the southernmost is likely to be just south of the woodland on the western side of the motorway. Bridges further north have the potential of having the least expensive earthworks for the new structure. There is a level difference between the motorway and the embankments at the crossing point, and subject to ground investigation, this may minimise the extent to which abutments may need to be built up. The motorway at this location is slightly wider than further south, and therefore the bridge deck may need to span further, with a subsequent increase in cost.

West of the M11, the route should travel north of Coton village [G] in order to avoid residential properties. It is envisaged that a signalised junction and a bus stop would be provided at Cambridge Road.

Depending on the exact location of the bridge over the M11, and the alignment towards Cambridge Road, the route would pass, upon an alignment, through Coton Orchard.

From Cambridge Road (north of Coton) to Madingley Mulch P&R

There are a range of viable alignments from Cambridge Road to Madingley Mulch [H].

The northernmost route would run from Cambridge Road to the south of Crome Lea Business Park. This option would pass through a total of five fields, potentially causing severance [I].

The southernmost route option would run north of the reservoirs north of Coton. This route passes through five fields, however is aligned further south, to run along the northern boundary of the reservoirs in order to avoid severance where possible. It has not been determined how close the route can run to the reservoirs at this stage, as no information on the structures and their foundations is readily available, however this route intends to run as close as possible.

All routes would likely involve screening by means of planting for the purposes of landscape mitigation (and potentially generating a cutting) to limit the visibility of the route from the adjacent countryside. There are no known engineering constraints (beyond topography) at this location, so the exact routing would be relatively flexible.

For Option 3 (1 South 2 South), the Park and Ride site could be located south east Madingley Mulch roundabout, between Crome Lea Business Park and the Madingley Mulch business. Access to the Park and Ride for vehicles could be gained from Madingley Road, whereas buses could have dedicated accesses to the east and west of the site.

This Park and Ride would be of a similar size to the Trumpington Road Park and Ride. The shaded area shown on the Catchment Area Maps also includes an area to the south of the Park and Ride which could be used to provide environmental mitigation in the form of landscaping.

Route Option 1North (also applicable to 1Hybrid)

Route option 1North concerns the link between Madingley Mulch P&R, between the roundabout and Madingley Wood, and Madingley Road to the east of Cambridge Road. Madingley Wood, a SSSI (Site of Special Scientific Interest), is a sensitive site that any route from the P&R site would avoid. Also within the vicinity of the link is the American Cemetery.

All route options from the P&R avoid the SSSI [J], and therefore are required to run through the 800 wood [K], towards Cambridge Road. There are known archaeological remains adjacent to the northern boundary of the SSSI site, which should be avoided if possible.

Another alternative is to follow the embankment of the A428, west of the 800 wood. This option may be unfeasible due to the engineering challenges of passing between the A428 bridge and Trinity Cottages. The small distance between the bridge and the cottages means significant modifications to the bridge abutments may be required if the buses were to follow this route.

After crossing Cambridge Road, the route runs to the north of Cambridge Road until it re-joins the A1303 to the west of the existing M11 bridge (junction 13). Several route options are possible for this section, the southernmost one involves running parallel to Cambridge Road, to the south of Moor Barn Farm [L]. Changes in land levels and the proximity to the American Cemetery [M] prevent the route running immediately adjacent to Cambridge Road.

The northernmost alternative passes to the north of Moor Barn Farm. This option was designed to provide a greater distance between the route and Madingley Wood. It allows for the pedestrian footpath to the north to be accommodated via a small diversion rather than a separate crossing point. It also avoids the severance of Moor Barn Farm and maintains access to Madingley Road but leads to more severance of the fields north of Cambridge Road. As land falls away from Cambridge Road, this route has the potential to be screened better to minimise landscape impact.

Route Option 2Central

Route option 2Central concerns the link between Cambourne West and Madingley Mulch, via Cambourne and Bourn. Due to the length of this link, for the purpose of this assessment, it has been broken down into two sections.

From Cambourne West to Bourn Roundabout

Achieving bus rapid transit through Cambourne presents engineering challenges, as this is an established settlement. The project team are working with the local planning authority and with the Cambourne West developers to seek potential solutions.

There is the potential for the installation of a bus link from Sterling Way [N] in Upper Cambourne to Broadway [O]. Correspondence with SCDC has highlighted the potential for this bus link to be secured through the proposals for Cambourne West [P] as there is presently a contribution and requirement to deliver the bus link in the draft Heads of Terms for Cambourne West.

Bourn Airfield [Q] is yet to be developed, hence there is the potential to introduce a rapid bus transit route through this development from its design stage. The project team have discussed with the developer how this may be achieved.

From Bourn Roundabout to Madingley Mulch

From Bourn Roundabout [R], the route would join St Neots Road. Buses will travel on St Neots Road (with minor junction realignments at the Petrol Station roundabout). Two possible interventions are

available to achieve bus priority on St Neots Road. The first involves closing down the eastern arm of the Long Road/St Neots Road junction to general traffic (via rising bollards or similar), which would avoid rat-running through the corridor as an alternative to the A428 main carriageway. The second would involve providing a segregated route adjacent to the existing St Neots Road, which may require the realignment of the existing highway or land take at certain locations to accommodate.

Route Option 2 South

Route option 2 South concerns the link between Cambourne West and Madingley Mulch, via Bourn and Cambourne. Due to the length of this link, for the purpose of this assessment, it has been broken down into three sections.

From Cambourne West to Bourn Roundabout

This section would be similar to that for Option 2 Central above.

Highfields Caldecote

Three options have been considered for bypassing Highfields Caldecote [S]. All options have been shown on the Catchment Area Maps, however it is considered that north of Highfields Caldecote is the most likely option at this stage.

North of Highfields Caldecote

This route option runs north of the existing airfield buildings and across Highfields Road to the north of the village. This route option is considered to be the most direct and fastest given its segregated nature.

Through Highfields Caldecote

This option enters the village, therefore being the shortest of all three routes which have been considered. It has the potential to offer a pick up point in the centre of Highfields, therefore attracting further patronage from this location. However, journey times through the village will likely be slower than on a segregated route, and this increased journey time could reduce attractiveness of the overall route.

South of Highfields Caldecote

This route runs to the south of Highfields Caldecote. Initial study into this route highlighted the location of Hardwick Wood [T] and Caldecote Meadows [U] as SSSI sites; both of which are located to the south of the village. Therefore the route has the potential to run to the north of the Caldecote Meadows, along the residential boundary, to meet Hardwick Road. To the east of Hardwick Road the route runs to the north of Hardwick Wood. In order to avoid the SSSI sites to the south of the village the alignment of this route option runs through the eastern edge of a wildlife site. Without a significant detour to the south, it is not possible to avoid the wildlife site.

From Highfields Caldecote to Madingley Mulch P&R

This section runs from Hardwick to the north of Jaggards farm [V] and across Madingley Road to the P&R site. An alternative is to bypass the farm to the south, but this would increase the length of the route and would involve crossing Bin Brook [W] at an angle, which could prove more costly. As a result, the route to the north of Jaggards farm has been shown on the Catchment Area Maps.

Summary and Conclusions

The note has documented the processes used to determine the area of possible route locations which is shown on the Catchment Area Maps.

The overall aims of Cambourne to Cambridge Better Bus Journeys Study have been taken into consideration when establishing possible routes. Namely, there is a need to provide fast and reliable bus services between Cambourne and Cambridge. The routes chosen are considered to provide a balance between fast and direct access to the City and the potential to absorb trips from the settlements and business hubs adjacent to the route without compromising environmental sustainability.

In addition to the overall study objectives, the routes also take into account environmental constraints (e.g. SSSI sites), and attempt to minimise disruption to private property (where this does not directly conflict with the two other considerations above).