

Summary Position Paper

Cambridge Autonomous Metro and the A428 Corridor

Produced for the Greater Cambridge Partnership Joint Assembly by Arup on behalf of the Cambridgeshire and Peterborough Combined Authority (CPCA) and the Greater Cambridge Partnership (GCP)

15 November 2018

1. Background

1.1. The Cambridgeshire and Peterborough Combined Authority (CPCA) appointed Arup in August 2018 to undertake the role of critical and technical friend over an initial four-month period in connection with the development of the Cambridge Autonomous Metro (CAM) programme. Arup's critical and technical friend role has been focused initially on reviewing existing technical work produced by Steer, Mott Macdonald and others that have been involved in developing the technical and economic analysis to date. The teams have been evaluating different components for the development of the network, in particular:

- Steer have been commissioned by the CPCA to deliver a Strategic Outline Business Case (SOBC) for the CAM network;
- Mott McDonald have been commissioned by the GCP to deliver SOBCs for the GCP corridors; and
- Arup have been commissioned separately by the GCP to produce a City Access Strategy for Cambridge.

1.2. The Arup commission for the CPCA is to be a critical and technical friend of the SOBC being produced by Steer for the end of the year and, to act as a technical advisor to the Mayor and the CPCA on matters relating to the CAM. The SOBC that is being produced will focus on the development of the whole CAM network which includes the central section as well as the branches and corridors that extend beyond the city centre. The SOBC is being produced to support discussions with Government about how the project could be taken forward. It is based on the principles of the Treasury "Five Case Business Case" approach including the strategic case; economic case; financial case; commercial case; and, management case. More detailed updates on the SOBC will be provided on instruction by the client team. It has been agreed that future work on the development of the CAM will be led jointly by both the CPCA and GCP.

2. Purpose of the Paper

2.1. The purpose of this paper is to provide a short overview of the case for the CAM and to provide a specific update on one of the proposed corridors of the future CAM, the A428 corridor. In doing so, this paper provides:

- an overview of the strategic need for the CAM and the contribution the A428 corridor makes to the overall case for the CAM;
- an explanation of the process of review that has been undertaken for the A428 corridor; and
- A recommended way forward for the A428 corridor at West Fields and Coton.

2.2. The paper has been produced by Arup on behalf of the CPCA and is a summary of the review work undertaken to date. It supports the paper that has been produced by the GCP giving an update on progress with developing the business case for the A428 Cambourne to Cambridge (C2C) Better Public Transport project.

Strategic Overview of the case for the CAM

- 2.3. The case for the CAM is focused on a number of specific objectives which are summarised below:
- Unlocking economic growth in and around Cambridge;
 - Providing a mechanism to accelerate the delivery of housing;
 - Addressing city wide congestion and its environmental consequences; and
 - Connecting people with jobs from across the wider Cambridge region.
- 2.4. Cambridge has been identified by central Government as one of the most important drivers for economic growth in the UK, through the expansion of major science and tech research facilities. Termed the '*Silicon Fen*', the area is comparable to major global tech clusters, including MIT and Kendall Square and Silicon Valley in the USA, where industries agglomerate around talent and higher education. Given the positive contribution the Cambridge economy makes to the economic productivity of the UK, it is paramount that Cambridge is able to maintain its poll position in attracting, nurturing and retaining the best talent from around the world.
- 2.5. In support of this, the National Infrastructure Commission recognise the Cambridge – Milton Keynes – Oxford as a national priority. To secure the Arc's long-term economic success, the National Infrastructure Commission in its Partnering for Prosperity report highlight the importance of delivering improved infrastructure and new homes to create places where people will want to live and work. There are several major development sites; both housing and commercial, which are in the pipeline in Cambridge and across the wider region which will support and nurture strong economic growth. Enhanced public transport solutions will be a key factor in facilitating delivery of these schemes.
- 2.6. Whilst there has been a significant attempt to alleviate congestion in the city, it is apparent that without major intervention, productivity and inward investment could be held back from future growth. Cambridge suffers from high levels of road traffic congestion. Figure 1 shows AM peak time congestion in the Cambridge region, with those sections of the road network in red and orange having high levels of congestion.
- 2.7. Congestion has a number of negative impacts including the concentration of harmful emissions caused by standing traffic; longer journey times and delays which affect the economic efficiency of the area and the perception that it is difficult to move around, which can impact on inward investment and future growth. In addition, from a residents perspective, congestion can impact on everyday life and can potentially limit access to new opportunities. Figure 2 illustrates the existing journey times to central Cambridge from a number of surrounding locations. Cambourne for example, can be up to 60 minutes journey time from Cambridge to Duxford at peak times, for a distance of around 11 miles.

2.8. A transport solution, in the form of a Metro, for Cambridge City Centre and its surrounding environs has the ability to tackle ongoing and increasing congestion issues in the city centre. This has the potential to create the capacity for future growth without adding further to congestion levels across the region.

Figure 1: AM Peak time congestion in the Cambridge region

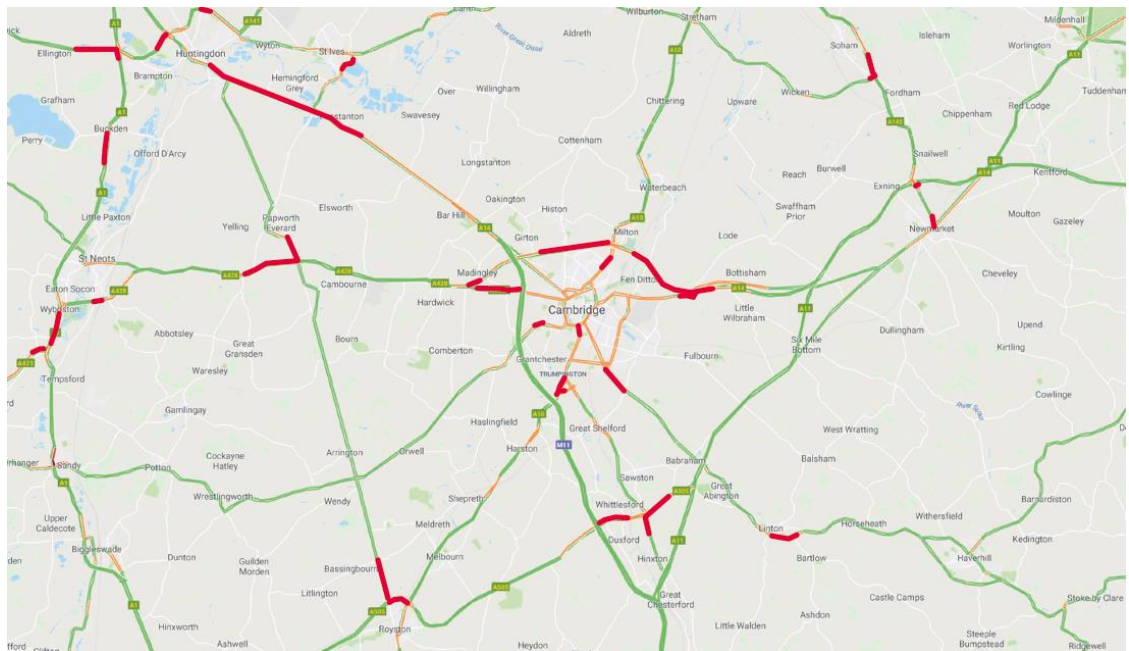
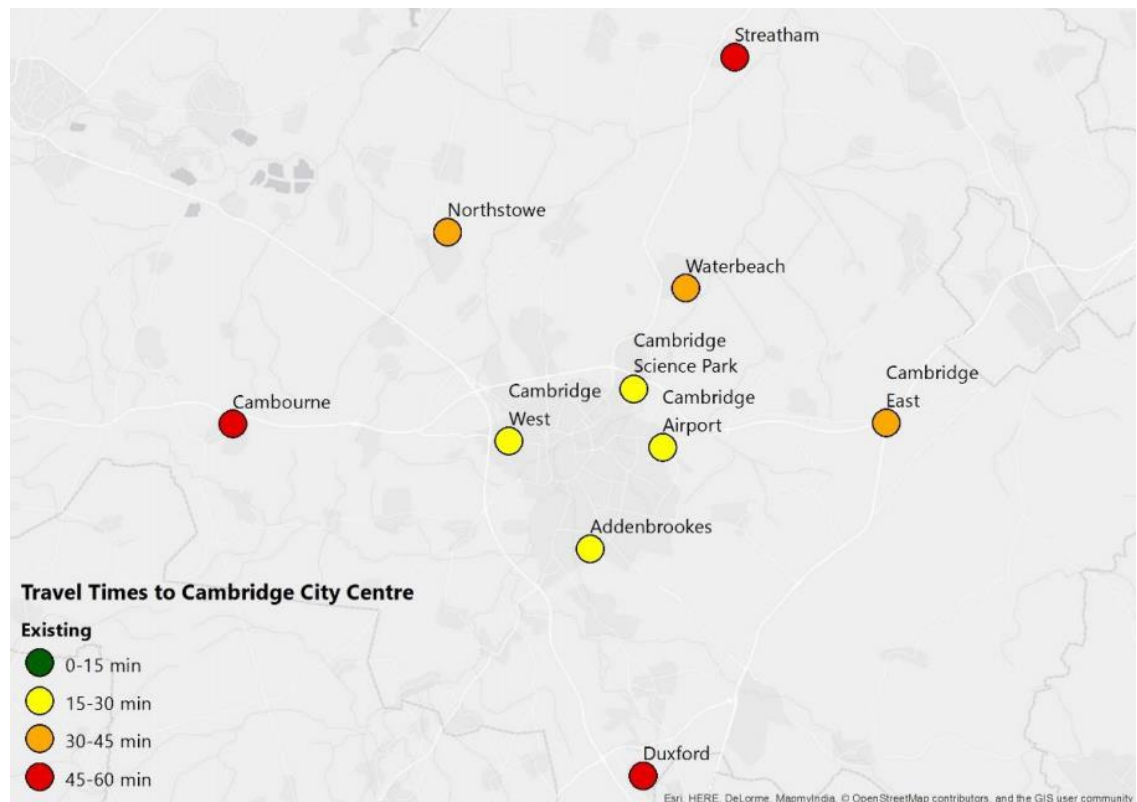
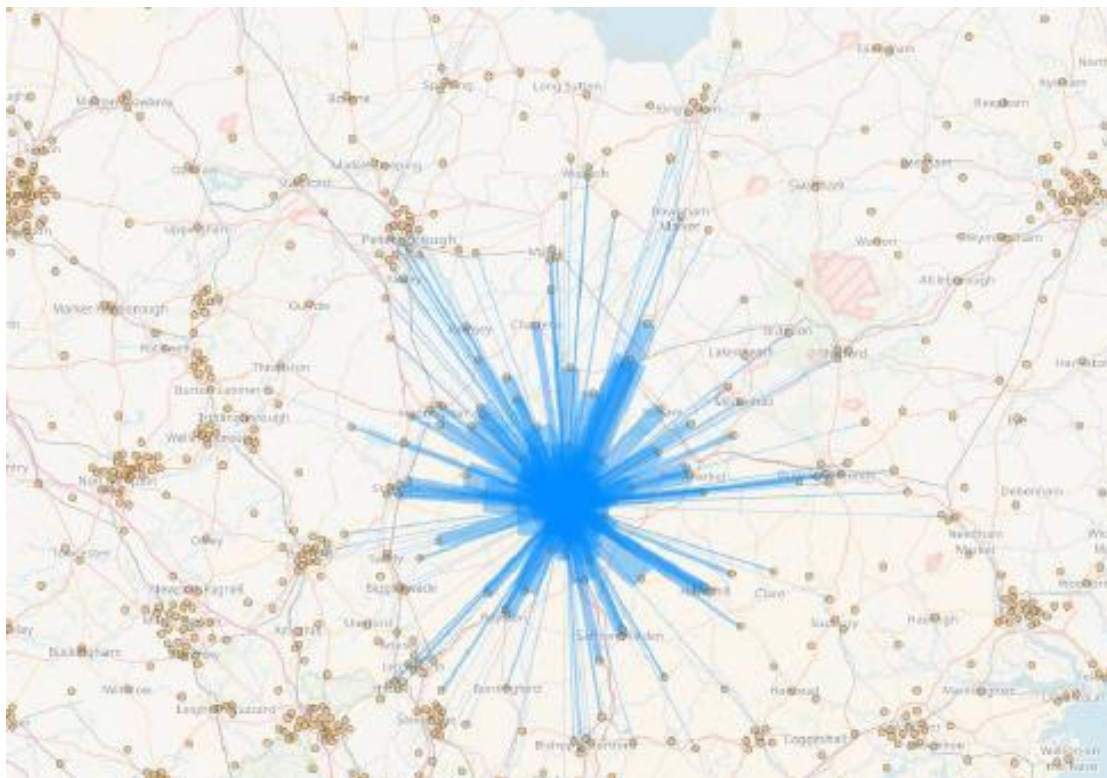


Figure 2: Existing travel times to Cambridge city centre



2.9. Locations where this future economic growth can take place are spread across the city and the wider region and there is a need to ensure these growth areas are well connected to each other, alongside the creation of good links to the city centre and main transport nodes such as the rail station. It is the connectivity between these important economic elements of the city that will help drive economic growth, without adding further to congestion. These growth areas also need to be connected to areas of existing and future housing, allowing people to benefit from the new opportunities that are created. The labour market area for Cambridge spreads across a wide area as shown on Figure 3.

Figure 3: Origins of journeys to work in Cambridge within an hour's journey time



2.10. The availability and affordability of housing is a critical issue in the Cambridge region that has the potential to be a constraint on future growth. There is also a need to ensure the wider region is well connected to Cambridge in order for people to access existing and new job opportunities, helping to spread the economic benefits of Cambridge across a wider area. Using investment in transport solutions to help unlock new housing sites and connect areas of existing housing to Cambridge is a major priority for the future.

2.11. A system like the CAM has the ability to address these challenges by providing connections through the city and beyond, allowing areas of existing jobs and economic activity, to be connected with new growth areas, the city centre, main rail station and residential. There are several major development sites; both housing and commercial, which are in the pipeline in Cambridge and across the wider region that will support and nurture strong economic growth. Enhanced public transport solutions will be a key factor in facilitating delivery of these schemes. The ability for transport to unlock the

maximum growth potential of the Cambridge region is of national significance to the UK economy.

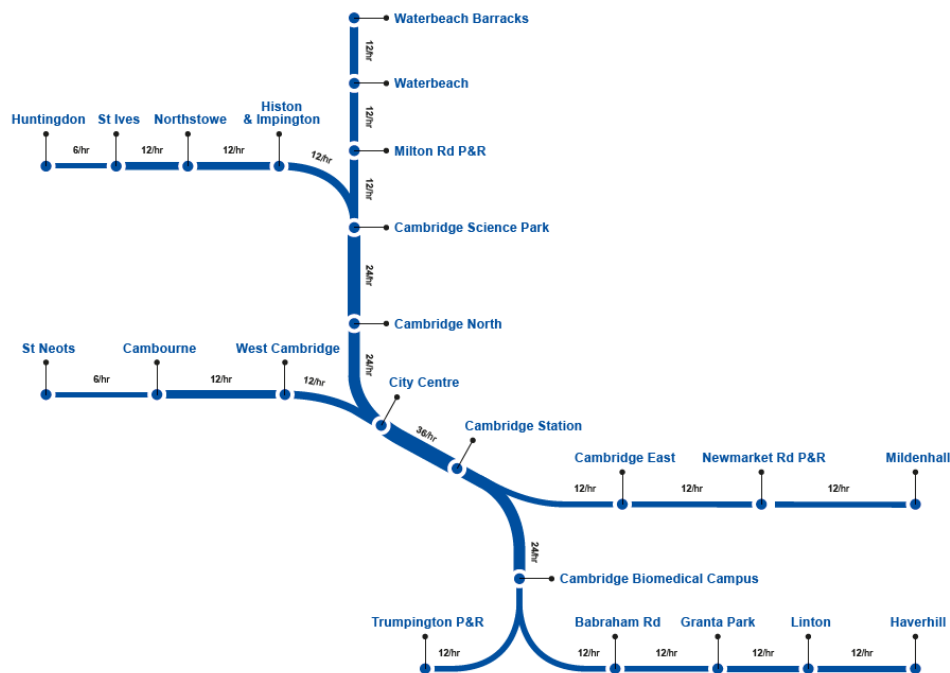
3. Development of a CAM network

3.1. The emerging business case for the CAM is based on the development of a new rapid transit system for the Cambridge region that is capable of responding to the specific challenges of the region that have been described above. Through Arup's review process, the principles for a successful business case for a CAM system have become much clearer, and include:

- i. The need to provide high levels of connectivity to the city centre of Cambridge and the station area, without adding to existing congestion and helping to reduce congestion levels in the city overall. This requires the creation of dedicated routes for the CAM network through the centre of Cambridge, using a network of new small tunnels that would connect with routes on the surface extending beyond Cambridge.
- ii. The need to provide levels of connectivity and journey times on the approaches to Cambridge that encourage significant behaviour change towards greater use of public transport. This relies on dedicated routes for the CAM network that allow for high levels of frequency and journey time reliability operated by a rapid transit type system.
- iii. The creation of a network that has the flexibility to serve a number of different destinations beyond Cambridge, including areas with significant planned or potential housing growth. This requires a network with flexibility to operate on different routes outside of Cambridge and is not limited to serving the city of Cambridge alone. There are a number of different rapid transit technology solutions that could achieve this and which are being investigated through the SOBC process.
- iv. For the network to directly address the transport challenges of major growth areas allowing development to come forward in an acceptable way.
- v. To have the potential for the network to be delivered in phases, with the potential for early phases to operate independently and deliver benefits early whilst having the ability to be connected into a larger network at a later date.
- vi. For the network to operate as a whole, with high levels of frequency and connectivity that allow people to connect through the City and beyond. Operated as a single system with an integrated approach to operations and ticketing, allowing high levels of service reliability and performance to be achieved.
- vii. For the network to be affordable with methods of funding identified that allow the scheme to be delivered in a timescale that addresses the challenges whilst delivering the benefits that are required.

3.2. Figure 4 illustrates the CAM concept, which is subject to ongoing development and refinement as part of the SOBC process.

Figure 4 – Illustrative CAM Concept



4. Review of the potential for CAM west of Cambridge

- 4.1. One of the corridors that has been identified for major improvements in public transport is the corridor to the west of Cambridge which connects Cambridge to Cambourne and is referred to as the A428 corridor.
- 4.2. The objective for this corridor is to improve public transport connectivity between Cambridge and areas to the west that deliver a major reduction in journey times and improvements in reliability that will change travel behaviour. There is also a need to improve accessibility and connectivity to the University of Cambridge western facility, and areas of proposed development at Bourn Airfield, as well as ongoing development at Cambourne and St Neots which could benefit from improved transport connections. In achieving these objectives, there is a need to ensure any impacts on existing local communities are minimised.
- 4.3. The need for public transport improvements along the A428 corridor has been prioritised by the GCP and has already undergone public consultation in 2016 and 2017/18. During these consultations the following issues emerged:
 - The potential for adverse impacts in the existing areas of the West Fields and the village of Coton;
 - Number and location of service stops; and
 - Location of park and ride facilities as not to impact on the surrounding environment
- 4.4. In response to these, Arup was asked by the CPCA to undertake a review of the different proposed routes along the A428, drawing on work undertaken to date and testing assumptions where appropriate. The objective of this work was to review the

current route options that had already been developed by the GCP and their consultants and consider how these could be incorporated into the wider CAM network, without compromising their ability to be delivered as an early phase. This recognises that improvements on the A428 corridor could happen earlier but they need to be planned and designed in a way that they can be incorporated in the CAM at a later date. In parallel with this there was also a need to develop solutions that could address the concerns raised by local residents during the consultation process.

4.5. In undertaking the strategic review of the A428 preferred corridor (based on GCP published materials) Arup considered the following proposals:

- **Route A** – A new dedicated off-road route alignment between Madingley Mulch roundabout and Grange Road
- **Route B** - An on-road bus priority option on Madingley Road running between the Madingley Mulch roundabout and the new entrance to Eddington (High Cross).
- **Route C** – The principle of an additional northern off-road alignment between Madingley Mulch and West Cambridge.

4.6. These route options are illustrated on Figure 1 below.

Figure 1: Indicative routes in the A428 corridor for review



4.7. Arup defined a series of key metrics that enabled a comparison and review of the three primary route options along the A428 corridor. The information to conduct this comparison was derived from various pieces of technical analysis and advice provided by Steer, Mott Macdonald and Arup. The key metrics formed part of a high-level assessment of the route options, allowing their respective merits and risks to be easily assessed. A summary of the results of this analysis is set out in the table below with a red, amber, green status for the three options against each of the metrics.

Summary Assessment of Route Options

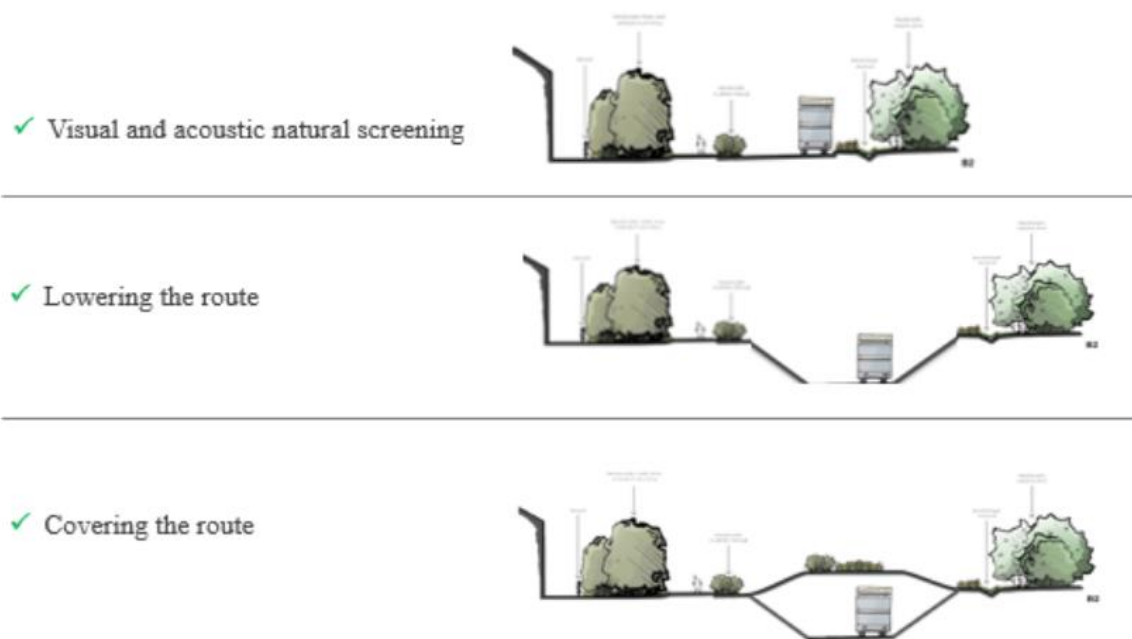
Metric	Option		
	Route A	Route B	Route C
Timeline	Deliverable by 2025 (Business case assessments and public consultation have been undertaken) ●	Deliverable by 2025 (May be delayed due to additional consultation or CPO appeals) ●	Not feasible for delivery by 2025 (Will require additional consultation, assessment and route specification) ●
Local population impacts	Encroaching on Coton (Potential visual and future development opportunities, but also provides direct stop access) ●	Impacts Limited (Some major houses alongside A1303, but the road is existing) ●	Far from Coton (Potential visual and future development opportunities, but also provides no direct stop access) ●
Planning & environmental constraints	Minor Impacts No national designations Some local designations Within Green belt ●	Variable Adjacent to Cambridge American Cemetery and Memorial - Grade I SSSI & Ancient woodland, Grade II* Within Green belt ●	Variable Proximate to Cambridge American Cemetery and Memorial - Grade I SSSI & Ancient woodland, Grade II* Within Green belt ●
Journey time (Madingley RA to Cambridge CC)	Fastest - 7-8min (Entirely segregated with a non-level crossing of the M11) ●	Slowest - 14min (Due to lack of traffic segregation, could be improved with route segregation) ●	Highly Variable - 9-14min (Dependent on interaction with M11) ●
Benefit implications	Highest BCR PV Benefits of ~£20-25m ●	Lowest BCR PV Benefits of ~£2-3m (lower due to lack of segregation) ●	Mid BCR PV Benefits of ~£10-20m (dependent on interaction with M11) ●
Cost implications	High Cost PV Cost £120-150m ●	Low Cost PV Cost £75-100m ●	Highly Variable Cost PV Cost £120-200m ● Tied to how route interacts with M11
Important considerations	Local impact could be reduced by cutting and covering a portion of the alignment that runs proximal to Coton however this could lead to dramatic cost increases	Cost implications of widening Madingley road to create segregated lanes would be very high due to acquisition costs but fully exploring alternative arrangements including digital capacity management shall be ensured May not require major changes to Madingley Road roundabout	Implications for future infill towards a route further away from road and existing development Unclear how route would cross M11.

● - Positive
● - Caution
● - Concern

Development implications	Major development sites are to the west of Madingley roundabout where all three routes considered would converge, therefore development would most likely not impact the three proposed routes differently.
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- 4.8. From this assessment it is clear that the merits of the different options vary significantly across the different metrics. For example, Route B is the slowest in terms of potential journey time because of the interfaces with existing road traffic and Route C performs poorly in terms of timescale for delivery. The currently proposed corridor (Route A) is the most attractive in terms of programme, planning and environmental constraints, as well as journey time. However, with Route A, a number of issues needed to be addressed in terms of mitigation, which are discussed in more detail below.
- 4.9. The route proposed by Cambridge Past Present and Future (CPPF) and other groups', for a route which extends north alongside the M11 to the Girton interchange and then proceeds west on road along the A428 corridor. A high-level review has identified:
- the route would introduce an interface with an already congested road and junction which would require a significant upgrade;
 - the route and journey times would be longer than alternatives; and
 - the option would have a higher cost.
- 4.10. For these reasons, this option was not considered to perform as well as Route Option A.
- 4.11. Two possible areas of mitigation were considered for the West Fields area. The first mitigation would be to position the tunnel portal north of West Fields and avoid the permanent route encroaching onto West Fields. The second option would be to extend the tunnelled section further west, serving West Cambridge through an underground station, which would be a more expensive option. Further work on these options should be undertaken as part of the continued development work of the CAM project.
- 4.12. Three mitigation options have been identified for Coton and are illustrated below. These options focus on the ability to screen the route of the CAM through natural screening, lowering of the route and covering the route. These options are illustrated below on Figure 5. Further work on these design solutions should be undertaken as part of the continued development work of the CAM project.

Figure 5 - Mitigation measures around Coton village



5. Conclusions and Next Steps

5.1. The Strategic Outline Business Case (SOBC) for the CAM, which will follow HMT green book guidance is being produced for the end of the year/beginning of 2019. This is now being produced under the joint guidance and leadership of the CPCA and GCP.

5.2. In relation to the A428 corridor, as requested by the CPCA, Arup has undertaken a high level review of route options and concluded that:

- The process undertaken to date to determine the route is robust and the optimal solution for the corridor is confirmed;
- The route is reclassified as a CAM route to serve the wider network, and not an independent guided busway corridor;
- The vehicle operating along the A428 corridor will comply with the principles of the CAM;
- The route will continue to be designed to align and integrate with the overarching CAM network, comprising one of the phases of the CAM network; and
- Options for mitigating the impact of the scheme at West Fields and Coton will be incorporated into scheme design for the SOBC.