



Cambridge South East Transport Phase 2

Outline Business Case
Appendix D: Public Transport Network Strategy

15 May 2020

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Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
A	07/05/2020	A Coleman	C Harwood	M Payne	Draft for client review
B	15/05/2020	A Coleman	C Harwood	M Payne	Issued for approval

Document reference: 403394-MMD-BCA-00-RP-BC-0370 Rev B

Information class: Standard

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1 Introduction

This report brings together work carried out to assess potential route options and service patterns for the High Quality Public Transport (HQPT) services proposed to run along, or feed into, the Cambridge South East Transport (CSET) Phase 2 infrastructure.

1.1 Purpose of this Report

This report has been prepared to summarise the outputs from the following Technical Notes:

- Technical Note 403394-MMD-TRA-00-TN-TA-0039 which set out the assumptions proposed for use in the strategic modelling of shortlisted options for CSET Phase 2 regarding:
 - The maximum operating speed of vehicles over the proposed segregated rapid transit route between a new Travel Hub site near the A11 in the vicinity of the A11/A1307 junction and the Cambridge Biomedical Campus (CBC) via Sawston, Stapleford and Great Shelford.
 - The frequency of HQPT services from the new Travel Hub site and the routing of these services within Cambridge.
 - Any proposed changes to existing bus services within the CSET study area associated with the shortlisted options.
- Technical Note 403394-MMD-TRA-00-TN-TA-0246 which considered the potential for public transport services, in addition to those assessed in the strategic modelling, that could use the new CSET Phase 2 infrastructure for part of their routes or might feed into it to extend the catchment area.
- Technical Note 403394-MMD-HWA-00-RP-HW-0288-B which considered the potential for the routes serving the proposed Travel Hub to continue on to Granta Park and the Babraham Research Campus, and the infrastructure improvements that might be required to facilitate route extensions.

1.2 Report Format

This report contains the following sections:

- Public transport operational assumptions for strategic modelling; and
- Review of public transport service connectivity beyond the Travel Hub.

2 Public Transport Operational Assumptions for Strategic Modelling

This section of the report presents the assumptions adopted for use in the strategic modelling of shortlisted options for CSET Phase 2 regarding:

- The maximum operating speed of vehicles over a segregated rapid transit route between a new Travel Hub site near the A11 in the vicinity of the A11/A1307 junction and the Cambridge Biomedical Campus (CBC) via Sawston, Stapleford and Great Shelford.
- The frequency of the HQPT services from the new Travel Hub site and the routing of these services within Cambridge.
- Any proposed changes to existing bus services within the CSET study area associated with the shortlisted options.

2.1 Vehicle Operating Speed

The CSET Phase 2 scheme is being developed based on road based non-contact guidance with a nominal design speed of 100 kph where constraints permit. The assumed guidance technology is optical guidance, which is currently speed limited to 70 kph. The adoption of a higher design speed is for future proofing of the alignment to allow for adoption of improved technology that may emerge for higher speed operation.

The technical note “A11 to CBC: Journey Time Analysis” (20 December 2019) presented the results of journey time modelling based on a segregated alignment with a nominal design speed of 100 kph where constraints permit and alternative maximum operating speeds of 50 kph, 70 kph and 90 kph. The analysis was undertaken using Mott MacDonald’s proprietary spreadsheet model for the calculation of rapid transit vehicle run times.

The existing spreadsheet run time model for the Phase 2 segregated alignment was used to generate run times for the modelling team based on maximum operating speeds of 90 kph and 70 kph. Run times were generated for each shortlisted option to reflect the variations in the link distances and other alignment characteristics required to connect to the different Travel Hub site locations.

The 90 kph run times were used for the comparative testing of the shortlisted options.

The maximum operating speed of 90 kph is also consistent with the assumptions made for the modelling of similar segregated rapid transit routes on the A428 Cambourne to Cambridge (C2C) corridor, and by the Cambridgeshire Autonomous Metro (CAM) project, for which electrically powered, rubber-tyred rapid transit vehicles are currently envisaged.

2.2 Service Frequency

2.2.1 Travel Hub

The existing Cambridge Park and Ride (P&R) sites have buses running every 10 minutes to and from the city centre (Monday to Saturday daytime).

The Strategic Outline Business Case for the CAM project refers to a high frequency ‘metro style’ level of service, with a 5-minute frequency (12 departures per hour) assumed to operate during

peak periods on each of the GCP 'inner corridors', one of these being the CSET Phase 2 corridor.

For the comparative testing of the shortlisted options, a service level of eight departures per hour was modelled between the new A11 Travel Hub site and the city centre. This is a logical intermediate step between the current P&R service levels and the CAM objective of providing 12 departures per hour.

For comparison, the C2C bus network proposition is six services per hour from the proposed A428 Travel Hub site to the city centre and a further four services per hour from the proposed Travel Hub site direct to CBC.

The CSET Phase 2 corridor differs from the situation on the C2C corridor in that a single route from a new Travel Hub site can serve both CBC and the city centre. As the geography of the two corridors is not directly comparable, a service level from the proposed A11 Travel Hub site within the range of six to ten services per hour was determined as being broadly consistent with the C2C corridor. The proposed service level modelled was at the midway point in this range.

2.2.2 Granta Park and Haverhill

To test the case for provision of services to Granta Park as part of the CSET Phase 2 scheme, four of the eight services per hour between the A11 Travel Hub site and the city centre were modelled as operating beyond the Travel Hub site to serve Granta Park.

To test the case for enhancement of the existing bus service between Haverhill and Cambridge, as part of the CSET Phase 2 scheme and in recognition of the expected growth in demand for travel between Haverhill and CBC in the short to medium term, two services per hour were modelled as operating beyond Granta Park to serve Linton and Haverhill via the existing X13 bus route.

An increase in the Haverhill-Cambridge service level from the current four departures per hour at peak times to six, with the additional services operating on a limited stop basis and using the CSET segregated rapid transit route to reach CBC, will mitigate the risk of existing bus users from Haverhill and Linton driving to the new A11 Travel Hub site to access a more frequent service.

2.2.3 Routing within Cambridge

There is potential for the new services outlined above to be routed between CBC and Cambridge City Centre either via the southern section of the existing Cambridgeshire Guided Busway and Cambridge Rail Station or via Long Road and Hills Road.

The existing height clearance restrictions on the southern section of the Busway limit the use of this route to single deck vehicles (i.e. no double-deck vehicles). As it was not necessary to specify an exact vehicle type or capacity for modelling purposes, the new services were modelled as operating between CBC and Cambridge City Centre via the Busway and Cambridge Rail Station.

2.3 Existing Bus Services

The main local bus services currently operating on the CSET Phase 2 corridor, both operated by Stagecoach, are:

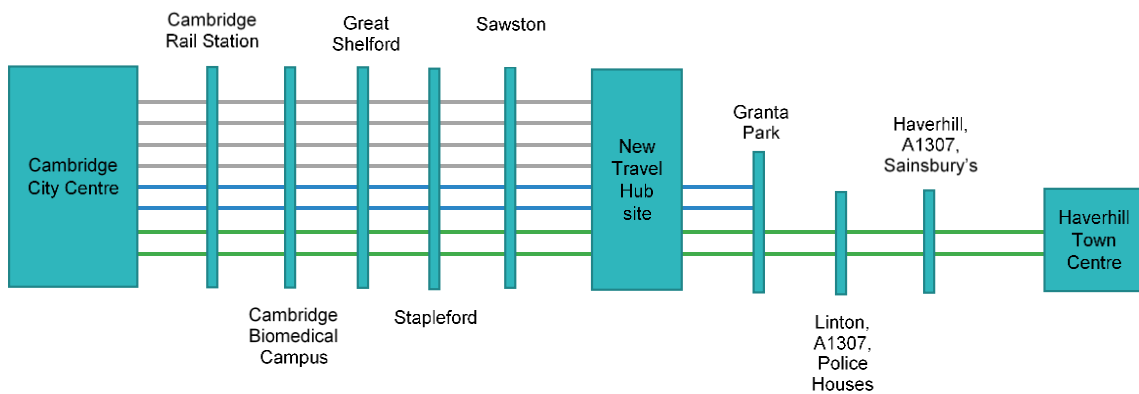
- Citi 7: Duxford / Saffron Walden – Sawston – Addenbrooke's – Cambridge
- 13 / 13A / X13: Haverhill – Horseheath – Linton – Abington – Addenbrooke's – Cambridge

Except for the two additional services per hour between Haverhill, Linton, the new A11 Travel Hub site, CBC and Cambridge City Centre as outlined above, no changes to existing bus services were assumed for the comparative assessment of the shortlisted options.

2.4 Modelled Public Transport Network Proposition

The public transport network proposition developed for testing through the transport modelling for CSET Phase 2 is illustrated in Figure 2.1.

Figure 2.1: CSET Phase 2 Modelled Public Transport Network Proposition



Source: Mott MacDonald

Each line represents 1 HQPT service per hour (sph), giving a total of 8sph between the Travel Hub site, CBC and Cambridge City Centre. It has been assumed that the two services to Granta Park would also serve Babraham Research Campus by leaving the CSET route at Sawston and serving a stop on High Street before continuing to the Travel Hub and Granta Park.

3 Review of Public Transport Service Connectivity Beyond the Travel Hub

This section of the report considers the potential for public transport services, in addition to those assessed in the strategic modelling, that could use the new CSET Phase 2 infrastructure for part of their routes or might feed into it to extend the catchment area.

3.1 Extension of CSET Services to Babraham Research Campus and Granta Park

The potential for services to continue on to Granta Park has already been reflected in the strategic modelling referred to in the previous chapter. This includes the opportunity for some services to leave the CSET route at an earlier point and run via High Street in order to provide a service closer to Babraham Research Campus.

Alternatively, some services could continue on to Babraham Research Campus from the Travel Hub, in a similar way to proposed for Granta Park. The following summarises the potential routing options. All would be subject to further design development and agreements where it is necessary to run over private land. However, the route options considered below could either terminate at the gate of each campus or continue within the campus and circulate internally.

3.1.1 Diversion to Serve Babraham

Services would leave the CSET public transport route prior to the Travel Hub and would continue on High Street. The service would then continue to the Travel Hub via the A1307 eastbound, subject to modifications to the A1307/High Street junction.

This would provide a direct route to Babraham Research Campus using the CSET route but also mean the Travel Hub can continue to be served and avoid the dilution of services that is likely to be required by a route serving the research campus only. An alternative would be an anti-clockwise route with services to travel first to the Travel Hub and then return to Cambridge via High Street. This would however provide a less direct route and increased journey times for those travelling from Cambridge to the BRC.

The above would serve a stop on High Street. However, it could potentially enter the campus and circulate within the site.

3.1.2 Onward Connection from Travel Hub to Babraham Research Campus

From the Travel Hub, public transport services would join the general traffic access on to the A1307, and continue along the A1307 westbound, accessing Babraham Research Campus at the main access. Services would then return to the Travel Hub via the same route and then continue on to Cambridge.

From the point of view of proximity to the campus developments, it would be preferable for the route to continue into the campus and provision for a stop and turning facilities for the public transport vehicles would also be required.

3.1.3 Onward Connection from Travel Hub to Granta Park

In order to serve Granta Park, services would leave the Travel Hub via the general traffic access to join the A1307 and then travel to Granta Park via Newmarket Road and Bourn Bridge.

If public transport vehicles were to continue into Granta Park, circulation and turning within the campus would need to be considered. Alternatively, vehicles could travel as far as the existing roundabout adjacent to the Granta Park access with a stop provided in this location.

3.1.4 Operational Considerations

The route extension options would require additional vehicles to avoid a dilution of services to the Travel Hub.

- One additional vehicle would be expected to be required to allow provision of a 15 minute frequency to Babraham Research Campus as an onward connection from the Travel Hub.
- Rather than providing additional services as above, two of the services to the Travel Hub per hour could run via High Street. However, there would be a journey time penalty and in order to maintain Travel Hub turnaround times, an additional vehicle is likely to be required, compared to a scenario where all services travel directly to the Travel Hub; and
- As noted above, it is already proposed that Granta Park will have a service frequency of four vehicles per hour and this has been included within the modelling. An extension of other journeys terminating at the Travel Hub (e.g. to provide a frequency of six or eight vehicles per hour) is not expected to be necessary and would require additional resource.

3.2 CSET Feeder Services

The following considers services which are not part of the CSET scheme but could be amended to use and benefit from the CSET infrastructure.

3.2.1 Other Bus Services in the CSET Study Area

Section 2.4 sets out the public transport network proposition adopted for the comparative testing of the shortlisted options, along with the assumption of no changes to existing bus services 7 and 13/13A/X13.

Table 1 summarises all the existing bus services in the CSET study area, bounded by the A1307, A505 and the M11:

Table 1: Bus Services in the CSET Study Area

Operator/Service	Route	Comment
Stagecoach Citi 7	Saffron Walden – Duxford -Sawston – Addenbrooke's – Cambridge (hourly) Pampisford – Sawston – Addenbrooke's – Cambridge (hourly) Sawston – Addenbrooke's – Cambridge (hourly)	Core route – every 20 mins from Sawston to Addenbrooke's and Cambridge. Broadly follows the main road through Sawston, Stapleford and Great Shelford.
Stagecoach 13/13A/X13	Haverhill – Linton – Abington – Addenbrooke's – Cambridge (half hourly)	Core route. Follows the A1307 between the A11 junction and Cambridge.
A2B 7A	Trumpington Park & Ride – Sawston – Whittlesford – Duxford (approx. 2 hourly)	Non-core route, provides links to Whittlesford, Hinxton and Duxford (Heathfield) by feeding into Trumpington Park & Ride.

A2B 31	Barley – Fowlmere – Newton – Shelfords – Addenbrooke’s – Cambridge (approx. 2 hourly)	Non-core route, provides links to Fowlmere, Newton, Hauxton, Little Shelford and a back-road route in Great Shelford by feeding into Addenbrooke’s.
A2B 32	Trumpington Park & Ride – Hauxton – Little Shelford circular (peak hours)	Non-core route, provides links to Hauxton, Little Shelford by feeding into Trumpington Park & Ride.

Source: Traveline

Both services 7A and 31 provide some duplication to service 7 through the Shelfords, and the way routes have been extended and altered as the commercial services have changed has resulted in extended journey times (e.g. Fowlmere would be logically linked to Cambridge via Trumpington, rather than via CBC).

3.2.2 Extending the CSET Catchment Area

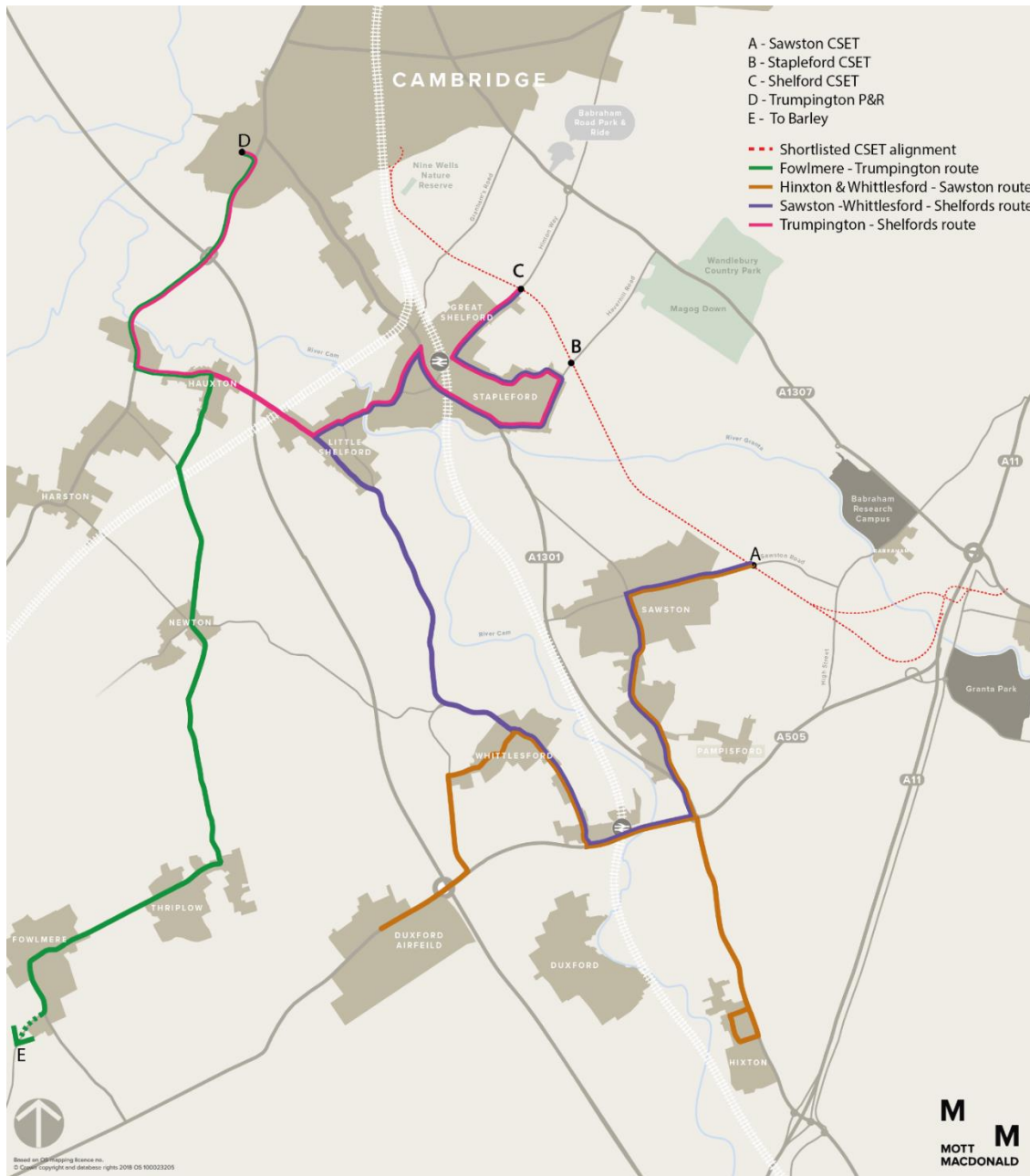
Four scenarios were identified for extending the CSET catchment area:

Scenario 1 – Fixed Route Feeder Services

In this scenario the existing 7A, 31 and 32 (three peak vehicles) could be combined into one or more routes linking the villages both to Trumpington Park & Ride and the CSET corridor at Shelford or Sawston. This would require the provision of suitable infrastructure at the CSET stops.

It would, however, still result in the provision of low frequency conventional bus services in areas where such services have declined over recent years. While the high frequency CSET service would provide an attractive proposition for the onward journey to CBC and central Cambridge, a change of bus/mode is always less attractive than a through journey.

Figure 3.1: Scenario 1 – Fixed Route Feeder Services

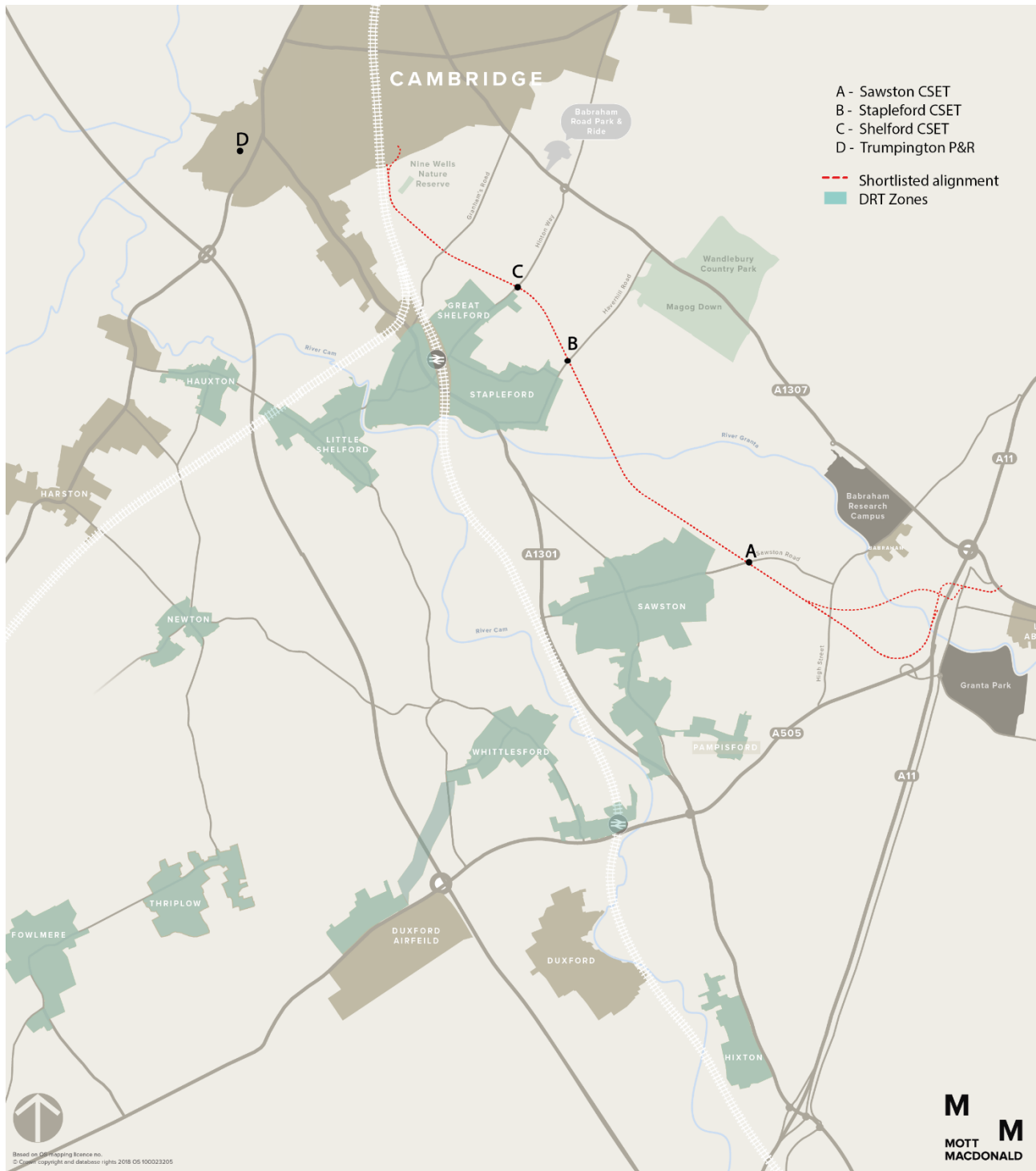


Scenario 2 – Flexible Feeder Services

Demand-responsive feeder services could also be an option, perhaps similar in operation to the Lincolnshire Call Connect services where 33 vehicles provide connections into towns and transport hubs on the core inter-urban bus and rail networks¹. South Cambridgeshire’s population is less dispersed than Lincolnshire’s so in principle the three existing peak vehicles could cover all the villages in the B1386/A505/A1301 triangle plus Hinxton, with links to the CSET stops, the rail stations and the Travel Hubs.

¹ See <https://lincsbus.info/callconnect/> (accessed on 14 May 2020)

Figure 3.2: Scenario 2 – Flexible Feeder Services



Scenario 3 – Revised Core Services plus Feeder Services

In this scenario, the existing Citi 7 service could join the CSET infrastructure at one of the CSET stops.

Great Shelford is the closest CSET stop to Cambridge. It is, however, not possible to avoid the level crossings and still maintain coverage of the village centre at Great Shelford. There are also four pairs of stops along the A1301 between Great Shelford and Addenbrooke's Road that would be left without a bus service.

Diverting the Citi 7 route onto the CSET infrastructure at either Stapleford or Sawston would only be an option for the longer journeys, on the assumption that the existing route coverage of Sawston, Stapleford and Great Shelford villages would still be commercially viable.

It is however possible to envisage a scenario where the entire service to Sawston and beyond to Duxford and Saffron Walden is provided by journeys that join the CSET infrastructure at Sawston with a residual service at the current or lower frequency from Stapleford and the Shelfords. These might include:

- Route A: Saffron Walden via existing route to Sawston then via CSET route to Cambridge (1 bus per hour (bph))
- Route B: Pampisford via existing route to Sawston then via CSET route to Cambridge (1bph)
- Route C: Spicers/Sawston village via CSET route to Cambridge (1 or 2bph)
- Route D: Shelford CSET stop via Hinton Way, Mingle Lane, Gog Magog Way, Haverhill Road, Stapleford, Great Shelford and via existing Citi 7 route to Addenbrooke's and Cambridge (2 or 3bph)

The above options A, B and C would increase coverage of Sawston village and also serve the allocated Local Plan development sites H1a and H1b adjacent to Babraham Road.

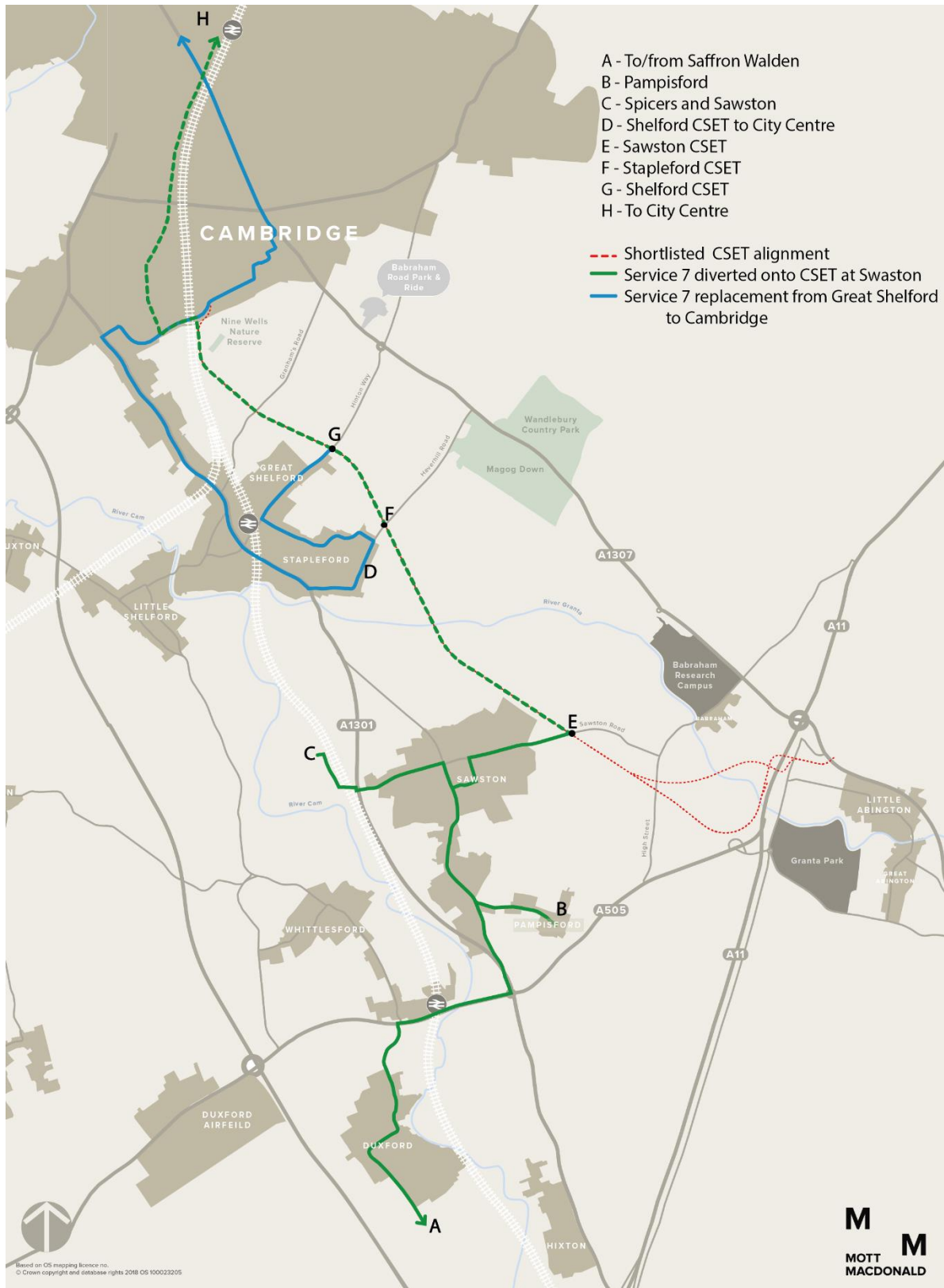
A simpler option for the Citi 7 route would be a double run from the existing route along Babraham Road to and from the CSET stop in Sawston, however, this would disrupt the through journeys from Saffron Walden and Pampisford by adding about 2km to the route and around 4-5 minutes to the journey time.

The existing 13 group of services is not considered in this scenario. Although there might be a small journey time advantage by using the CSET infrastructure, diversion via this route would mean the loss of buses to Babraham Research Campus.

For both the Citi 7 and the 13, using the CSET infrastructure might mean zero-emission vehicles are required, and consideration of the post-CAM scenario is also necessary.

Feeder services could be added as already outlined in Scenarios 1 and 2.

Figure 3.3: Scenario 3 – Revised Core Services



Scenario 4 – Additional CSET Journeys plus Feeder Services

The above three scenarios assume that the base CSET public transport network proposition is delivered as shown in Chapter 2 of this report. It would also be possible to enhance the CSET network by adding journeys that only used the CSET infrastructure for part of their route. In principle, adding journeys like this can only improve the offer, however, this will only be the case if these are in addition to the base network. If these are the result of diluting the base network, by diverting journeys, the overall offering will be diminished as journey times will be extended.

Two potential routes are:

- **Route A:** Journeys leaving the CSET route at Sawston and re-joining it at Stapleford running from the A11/A1307/A505 Travel Hub via CSET route to Sawston, then Babraham Road, Churchfields Avenue, Link Road, Hillside, Cambridge Road, A1301, Stapleford, Bury Road, Haverhill Road to re-join the CSET route.
This adds about 2.5km to the route and approximately 5-7 minutes to the journey time.
- **Route B:** Journeys leaving the CSET route at Stapleford then via Haverhill Road, Gog Magog Way, Mingle Lane, Hinton Way to Shelford Station, then Hinton Way to re-join the CSET route (avoiding the level crossings).
This adds about 1.75km to the route and approximately 4-5 minutes to the journey time.

Using the CSET infrastructure might mean that zero-emission vehicles are required, and consideration of the post-CAM scenario is also required.

Feeder services could be added as already outlined in Scenarios 1 and 2.

Figure 3.4: Scenario 4 – Route A

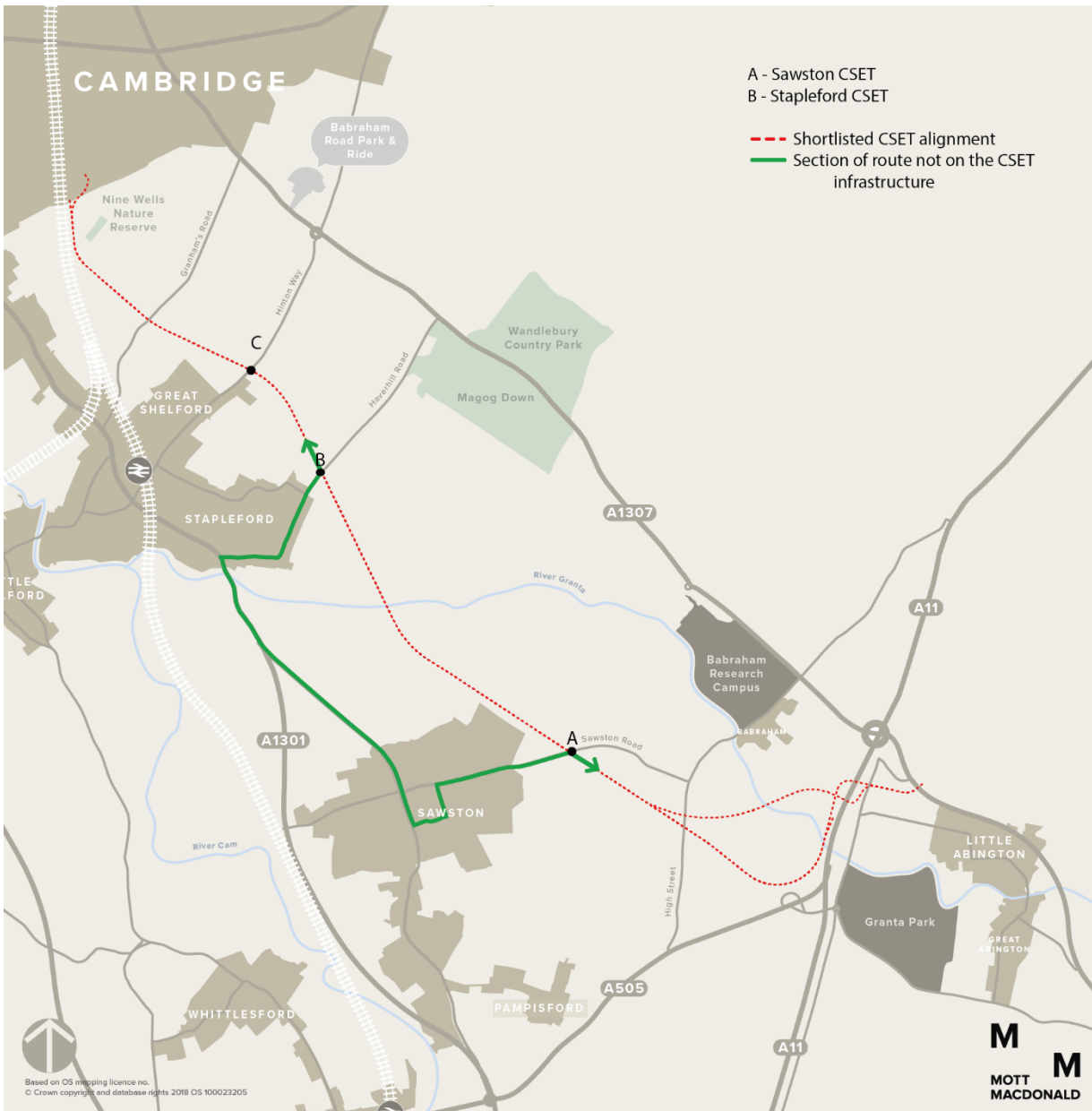
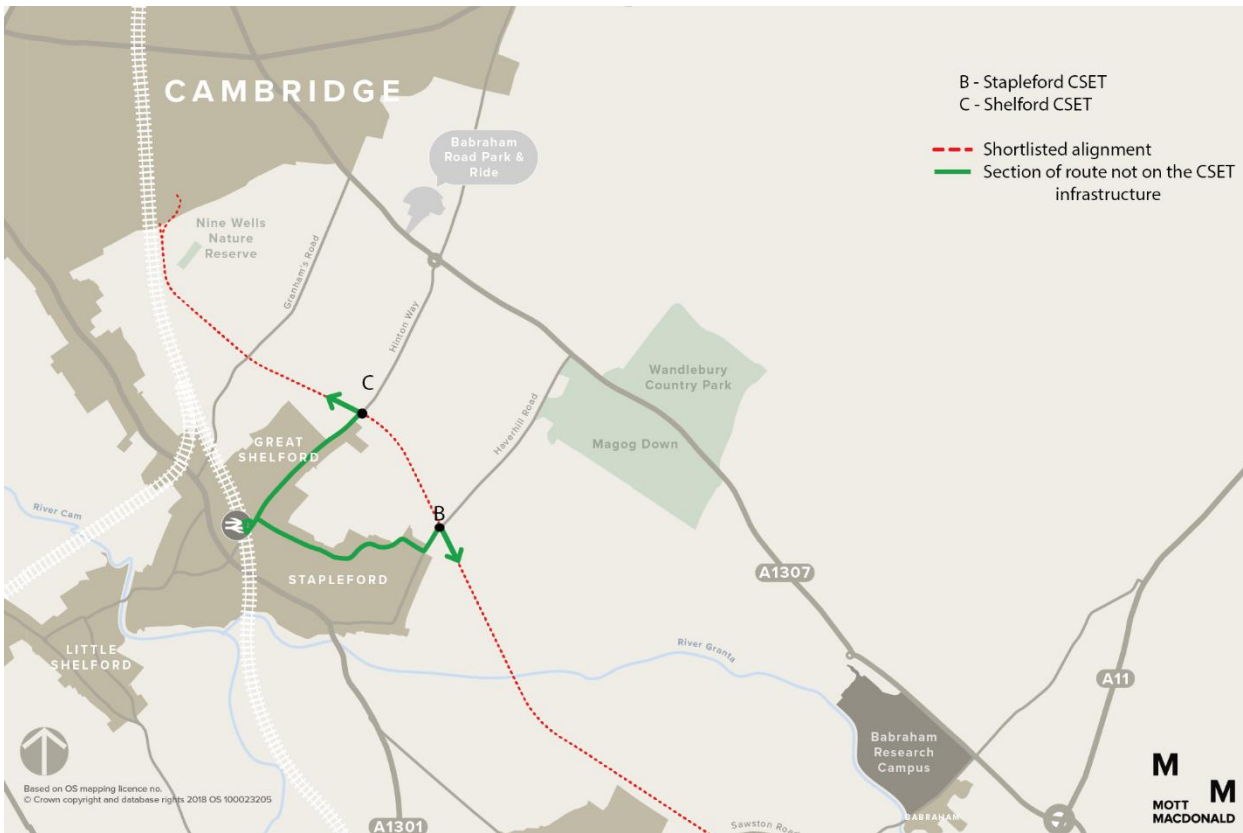


Figure 3.5: Scenario 4 – Route B



3.2.3 Delivery Considerations

Table 2 summarises delivery considerations for the four scenarios and the potential extension to Babraham Research Campus.

Table 2: Routes to extend the CSET catchment area

Scenario	Delivery considerations
1 – Fixed route feeder services	<ul style="list-style-type: none"> • Vehicles do not need access to CSET infrastructure • Additional infrastructure may be required at CSET stops • Could be delivered within existing budgets by revising existing subsidised services
2 – Flexible feeder services	<ul style="list-style-type: none"> • Vehicles do not need access to CSET infrastructure • Additional infrastructure may be required at CSET stops • Could be delivered within existing budgets by replacing existing subsidised services, except for capital and operating costs for booking system and back office
3 – Revised core routes	<ul style="list-style-type: none"> • Vehicles would need access to CSET infrastructure, so consideration needs to be given to the aspiration for zero-emission vehicles, and the interface with CAM when delivered • Access to the CSET infrastructure at Shelford is complicated by the level crossings • Additional infrastructure may be required at CSET stops

4 – Additional CSET journeys	<ul style="list-style-type: none">• Vehicles would need access to CSET infrastructure, so consideration needs to be given to the aspiration for zero-emission vehicles, and the interface with CAM when delivered• It would need to be confirmed whether these services would be in addition to the CSET base network proposition• Funding for the additional routes would need to be confirmed
5 – extension or diversion of journeys to serve BRC	<ul style="list-style-type: none">• Vehicles would need access to CSET infrastructure, so consideration needs to be given to the aspiration for zero-emission vehicles, and the interface with CAM when delivered• It would need to be confirmed whether these services would be in addition to the CSET base network proposition• Funding for the additional routes would need to be confirmed• Would need to consider the impact of additional services on demand for existing Stagecoach services (routes 13/13A/X13)

It would be possible to enhance the CSET network by adding journeys that only used the CSET infrastructure for part of their route. In principle, adding journeys such as those connecting to the employment campuses can only improve the offer; however, this will only be the case if these are in addition to the base network. If these are the result of diluting the planned CSET network, by diverting journeys, the overall offering will be diminished as journey times will be extended.

The options to extend the CSET catchment area as outlined in the scenarios above are opportunities for further consideration as the project is taken forward.

Appendices

A. CSET Route Maps

