Technical note

Project:	A428 Study - Phase 2	**To:**	Adrian Shepherd
Subject:	Post-Consultation Activities	**From:**	Elena Martinez
Date:	25 Feb 2016	**cc:**	

1. Introduction

Six conceptual options were presented as part of the A428 public consultation in late 2015. Three of these were located in the area to the east of Madingley Mulch towards the City, and the other three were located west of Madingley Mulch towards Cambourne. The options were presented in this format to align with City Deal investment periods.

Even though the options were presented as six different interventions, for the purposes of undertaking further option assessment the entire corridor route from Cambourne to Cambridge should be considered. This requires that options to the west of the roundabout be combined with options to the east of the roundabout to create a transport project which covers the entire corridor. Since there are three options to the east and three to the west this leads to nine possible combinations.

Some of these combinations are expected to be quite similar in terms of option costs and levels of benefits delivered. In addition, some of the combinations do not represent rational choices for corridor-wide interventions (for example, using an offline busway in the west combined with a bus lane in the east is poor use of investment, as the eastern section is more congested, so buses would be slowed down when they reached this location). For these reasons it is proposed that five options covering a range of benefits and costs are assessed. This note outlines the process followed to select these five option combinations.

2. Background

The A428 Cambourne to Cambridge corridor study aims to investigate possible options to provide congestion free public transport from Cambourne into the City. Early study work identified the problems and challenges of the A428 corridor, and established the objectives that any interventions should achieve before proceeding to option generation and assessment. Six conceptual options were assessed as best achieving these objectives and therefore were shortlisted for consultation in 2015.

Options for the eastern section of the corridor, from Madingley Mulch roundabout towards the City (tranche 1) comprise:

- Option 1Central – Online eastbound bus lanes from the A1303 / A428 junction along Madingley Rise[1] and Madingley Road to Lady Margaret Road;
- Option 1North – A new offline dedicated bus route running north-east from the A1303 / A428 junction, connecting in to Madingley Road just west of the M11. A further eastbound bus lane on Madingley Road would be provided to lady Margaret Road; and
- Option 1South – A new offline dedicated bus route running north of Coton and parallel to Madingley Road and Madingley Rise to Grange Road, with a connection to the West Cambridge University site.

In addition to the three options described above, this note introduces fourth option for the route to the east of Madingley Mulch, which arose during consultation. This option is a combination of Option 1North (from Madingley Mulch to the M11) and Option 1South (from the M11 to the City). The option involves an offline route to the North of the American Cemetery, which re-joins the A1303 west of the M11 J13 bridge. Buses

[1] Throughout the report the term Madingley Rise is used to refer to the section of the A1303 between Madingley Mulch roundabout and the M11.

would use the existing bridge to cross the M11 and would then enter the West Cambridge site. They would travel towards the south through the West Cambridge site, before continuing east towards Grange Road on a segregated offline route.

This hybrid option offers the possibility of achieving a route which is segregated for most of its length (excluding the section across the M11 and through the West Cambridge site) but without the added cost of providing a new bridge across the motorway. Investigating and quantifying whether the dis-benefits of not fully achieving segregation are offset by the lower infrastructure cost (when compared to the fully segregated route) is useful and will provide decision-makers with another option which satisfies the transport objectives of the study.

Options for the western section of the corridor, from the west of Madingley Mulch to the Caxton Gibbet roundabout (tranche 2/3) comprise:

- Option 2North – Improvement to bus services, which will run along the existing roads with no infrastructure improvements to the A1303 / A428 junction;
- Option 2Central – A new route linking Cambourne and the proposed Bourn Airfield new settlement, before services running along St Neots Road with bus priority measures in place to the A1303 / A428 junction; and
- Option 2South – A new offline dedicated bus route connection Cambourne and Bourn Airfield before running south of Hardwick to Madingley Mulch roundabout.

All options assume the existing Madingley Road Park & Ride site continues to operate.

3. Post-consultation options

Modelling the Tranche 1 options individually (with no improvements west of Madingley Mulch) is possible, but modelling Tranche 2 options individually is unfeasible, as the performance of these options will vary depending on the infrastructure available to the east of Madingley Mulch. Ideally, schemes should be modelled as a combination of a Tranche 1 and Tranche 2 intervention, covering the entire study route from Cambourne to Cambridge.

Modelling the full combination of all the Tranche 2 options with each Tranche 1 option would create 12 model runs and outputs for analysis. While this method would provide full coverage of model results, this would generate combinations which are not materially distinct in terms of benefits generated. In addition, some of the combinations do not allow for investment to be targeted at locations with the greatest congestion. Therefore Atkins suggests that a reduced number of combinations are tested to establish the range of benefits that each scheme can be expected to generate.

Atkins recommends that Options 1Central+2North, 1North+2Central, 1South+2Central, 1South+2South and 1Hybrid+2Central are analysed at OBC. These options should be sufficiently diverse as to generate different levels of benefits, which will be compared with the different levels of investment required to deliver them. The table below summarises the options which will be modelled. Further detail on the rationale for this selection can be found in Appendix B.

	1 North	1 Central	1 South	1 Hybrid
2 North	Don't model – very similar to 1North + 2Central	Model	Don't model – very similar to 1South + 2Central	Don't model – very similar to 1Central + 2North
2 Central	Model	Don't model – very similar to 1Central + 2North	Model	Model
2 South	Don't model – does not make best use of investment	Don't model – does not make best use of investment	Model	Don't model – very similar to 1South + 2 South but constrained by bridge

4. Next steps

The next steps of the project involve further definition and assessment of the options, which will inform the production of an Outline Business Case (OBC). The purpose of the OBC will be to compare all options according to the DfT's WebTAG 5-case methodology, which involves the production of a strategic, economic, financial, commercial and management case for the scheme, arriving at a recommended option.

The economic case will involve assessing the options to determine their relative benefits (monetised as per WebTAG standard guidance). Modelling will be used to inform this assessment, considering benefits such as journey time savings for scheme users. The different infrastructure types (on-road, bus lane and off-road/busway) are treated differently in the model, and are therefore expected to deliver different levels of benefits.

5. Conclusion

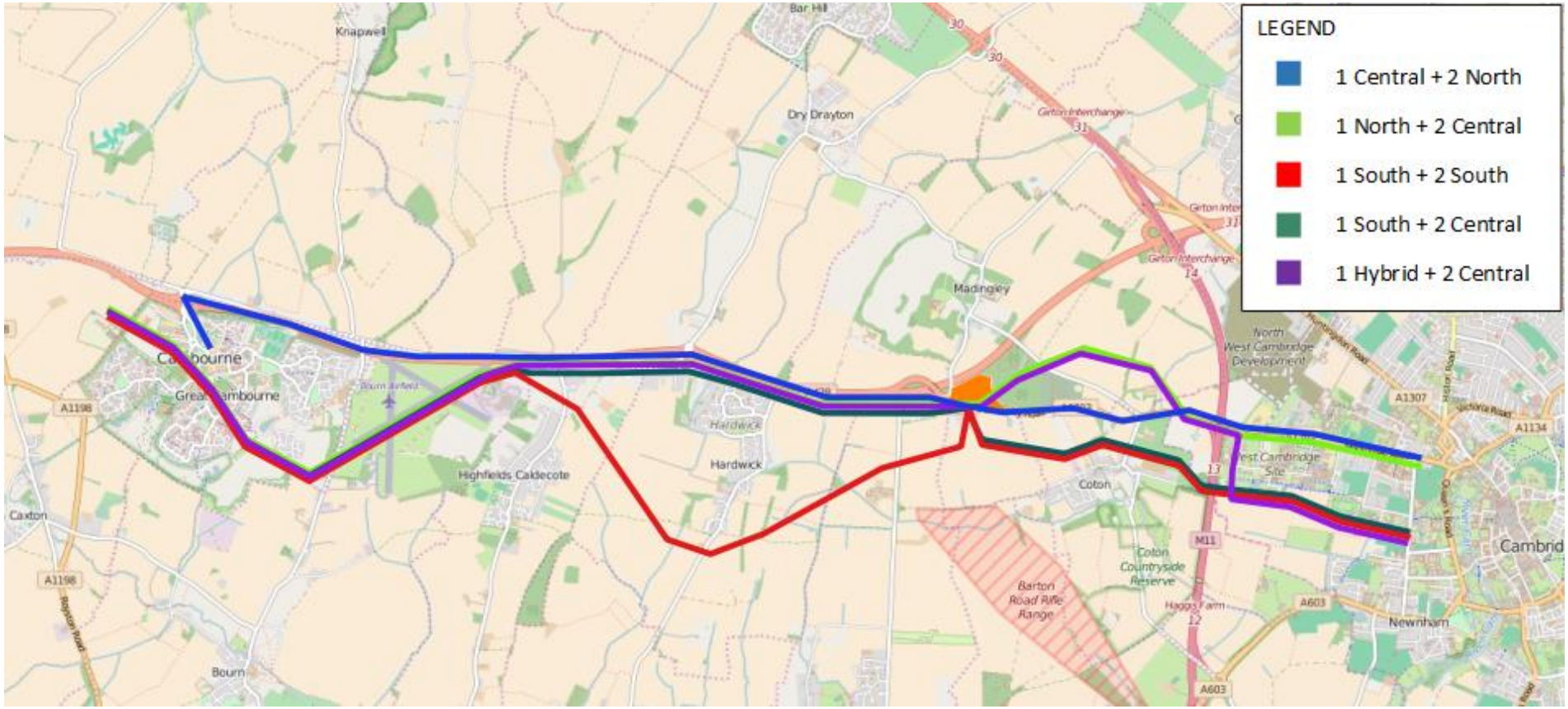
This note has examined the nine possible route-long options arising from combining the six east & west options presented as part of the A428 public consultation. It is recommended that the five combinations outlined above are assessed in further detail, these are:

- 1Central+2North,
- 1North+2Central,
- 1South+2Central,
- 1South+2South, and
- 1Hybrid+2Central

The options above provide a range of benefits and delivery costs, which should allow decision makers to understand the level of benefits available for different levels of infrastructure investment.

The shortlist above excludes options which are very similar in terms of benefits delivered. It also excludes option combinations which do not represent rational investment choices.

Appendix A – Option Map



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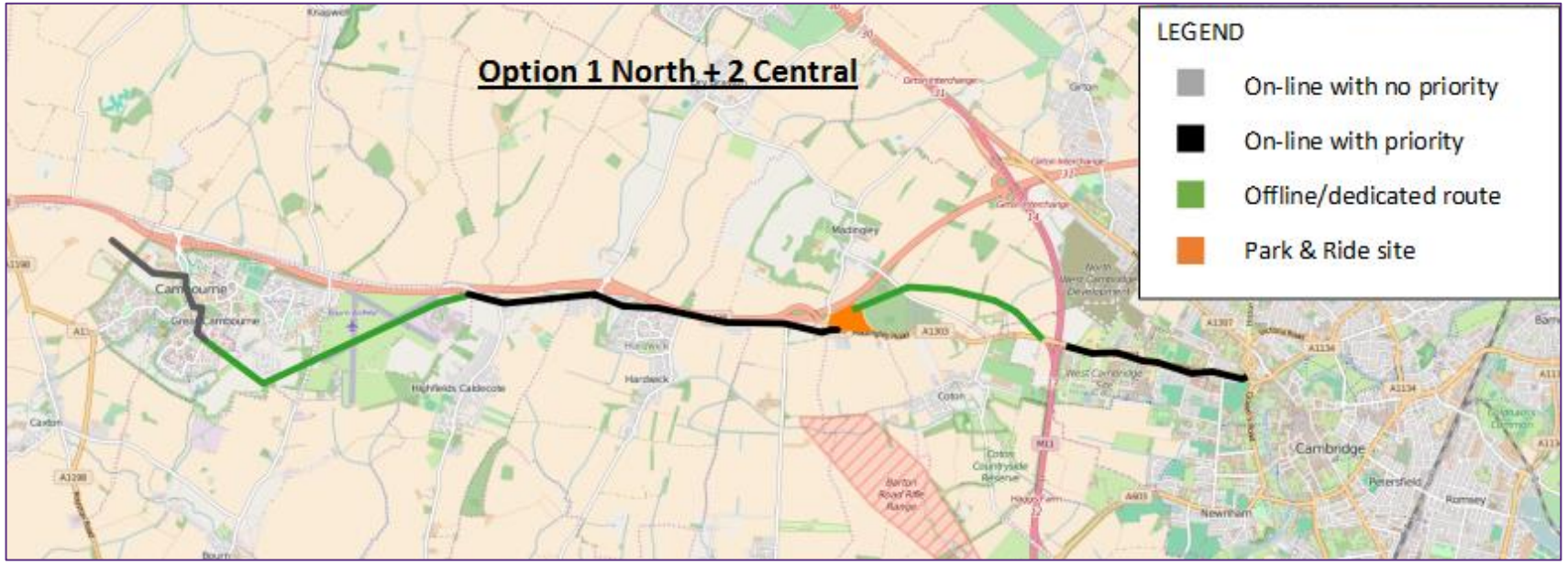

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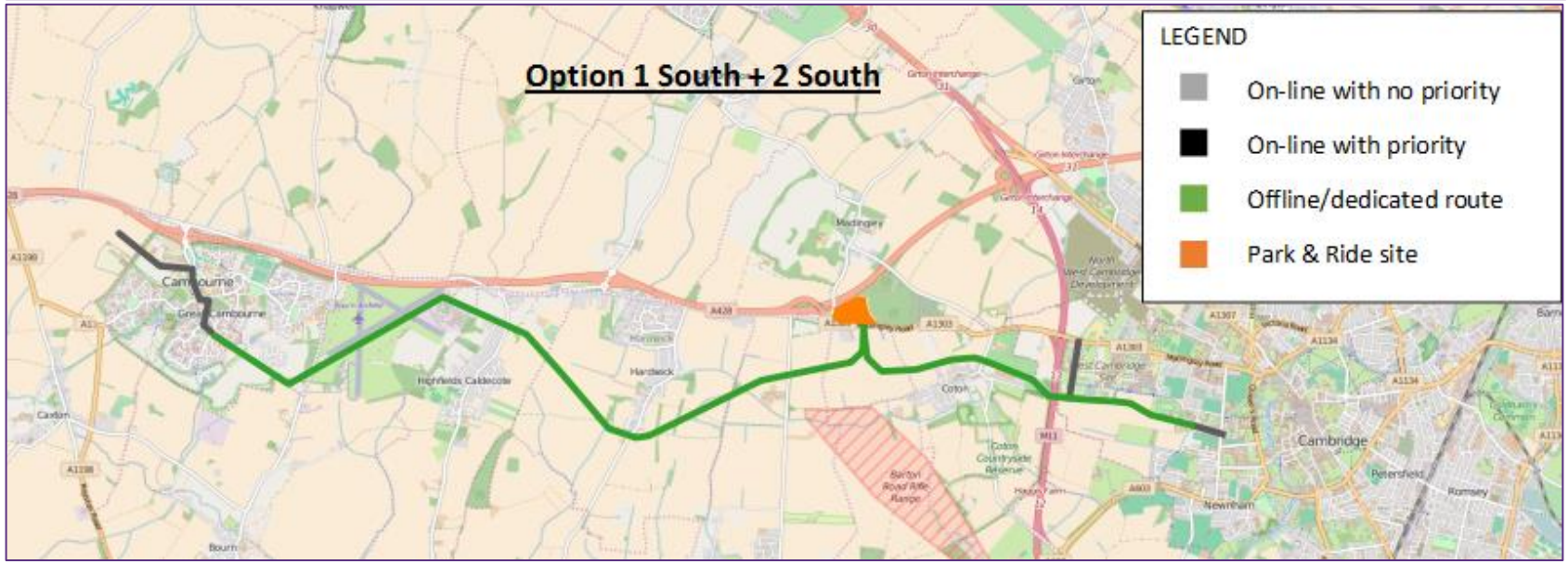

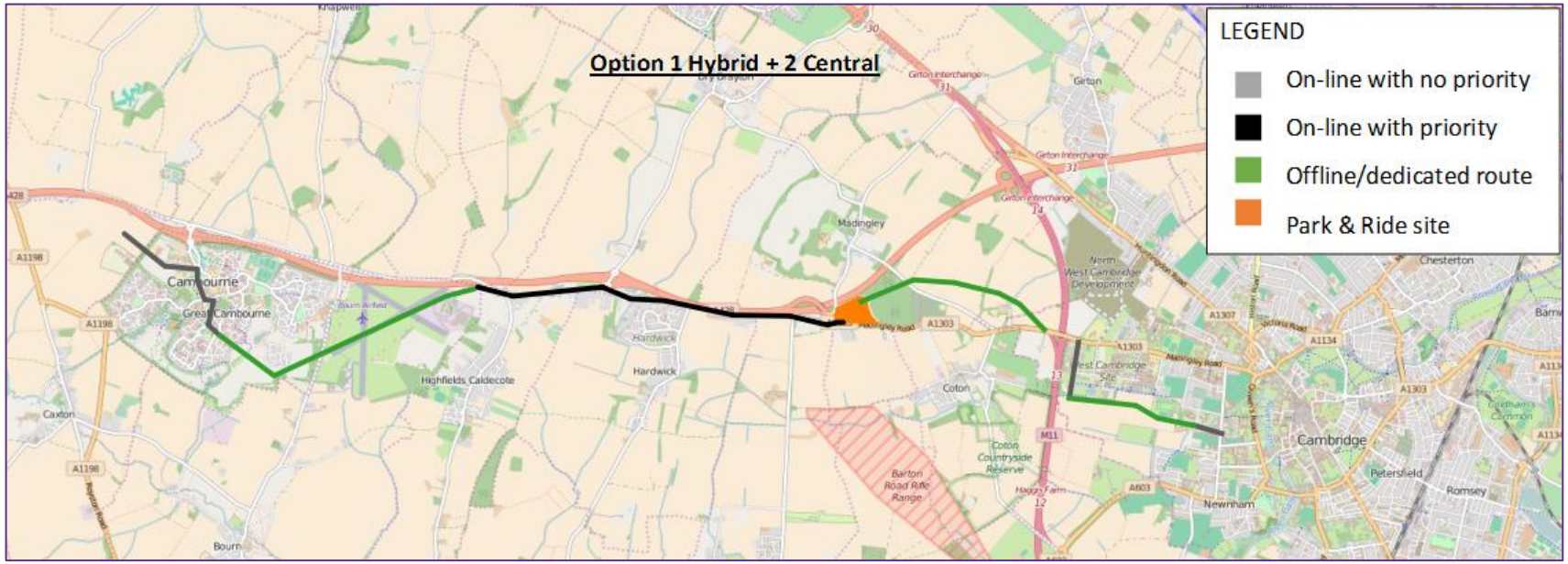
Option 1 Hybrid + 2 Central
LEGEND
On-line with no priority
On-line with priority
Offline/dedicated route
Park & Ride site
Cambourne
Great Cambourne
Highfields Caldecote
Hardwick
Madingley
Coton
Girton
Chesterton
Cambridge
Petersfield
Romsey
Newnham
Caxton
Bourn
A1198
A1303
A1134
A1307
A603
M11

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Appendix B – Option Inclusion Details

The table below explains in further detail the reasoning for inclusion or exclusion of the options.

Option Name	Recommendation	Comments
Option 1Central+2North	Include	Low cost option which intervenes only in congested areas. WebTAG recommends low cost options should be included in the assessment.
Option 1Central+2Central	Exclude	Higher cost than 1Central+2North. The only advantage with respect to 1Central+2North is that this option would offer origin pick up at Cambourne, Bourn and the other settlements along St Neots Road. The additional benefits from offering pick-up at origin are already being tested with option 1North+2Central, hence it is preferable to test 1Central+2North as the low cost alternative, rather than 1Central+2Central.
Option 1Central+2South	Exclude	This option does not make best use of investment. In this option the investment in fast and reliable infrastructure in the form of a busway occurs in the western section, which is the one with the least congestion, whereas a bus lane is provided in the eastern section. This distribution of investment is therefore disproportionate. Greater reliability can be achieved from segregating the entire route (1South+2South) or just the congested section (1South+2North), hence exclude.
Option 1North+2North	Exclude	Very similar to 1North+2Central, but will have a lower cost due to no infrastructure required for 2North. It could potentially be a sensitivity test to 1North+2Central if this is selected as the recommended option. Depending on investment and construction programme, services may be run along the A428 (2North) while infrastructure west of Madingley Mulch is being constructed. However, the transport objectives of the A428 corridor and the growth City Deal is aiming to achieve will be better served by providing a corridor solution which will still offer benefits even if the A428 becomes congested. Therefore, 1North+2Central should be tested instead of 1North+2North as this has the potential of delivering these outcomes.
Option 1North+2Central	Include	Include as this is a hybrid between on & off-line, which may offer a good balance between costs and benefits. It also tests whether origin pick up is beneficial to the scheme.
Option 1North+2South	Exclude	This option does not make best use of investment. In this option the investment in fast and reliable infrastructure in the form of a busway occurs in the western section, which is the one with the least congestion, whereas a bus lane is provided in the

		eastern section. This distribution of investment is therefore disproportionate. Greater reliability can be achieved from segregating the entire route (1South+2South) or just the congested section (1South+2North), hence exclude.
Option 1South+2North	Exclude	Could potentially be a sensitivity test to 1South+2South if this is selected as the recommended option. Depending on investment and construction programme, services may be run along the A428 (2North) while infrastructure west of Madingley Mulch is being constructed. However, the transport objectives of the A428 corridor and the growth City Deal is aiming to achieve will be better served by providing a corridor solution which will still offer benefits even if the A428 becomes congested. Therefore, 1South+2South should be tested instead of 1South+2North as this has the potential of delivering these outcomes.
Option 1South+2Central	Include	This option is similar to 1South+2South, in that it offers origin pick up and uncongested travel east of Madingley Mulch, where most of the congestion is present. Including it will test whether lower levels of investment west of the roundabout would still provide a sufficiently attractive route for users.
Option 1South+2South	Include	Include as this is the only option which tests a route which is completely offline. It also tests whether the benefits of constructing a new bridge over the M11 would outweigh the costs.
Option 1Hybrid+2Central	Include	This option has been suggested by consultees and has the potential of performing well, as it is mostly offline but without the cost of a new bridge.

Options excluded at this stage could still be considered as sensitivity tests to the preferred options if required during subsequent stages of scheme appraisal.

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Appendix C – Using models to calculate scheme benefits

Models are used to calculate scheme benefits because they serve as a way of comparing two hypothetical futures, one in which the scheme gets built (do something) and one in which the scheme does not get built. Assuming that nothing will happen (do nothing) if there is no scheme would not be an accurate representation of the future, so instead the do something case is compared to a do minimum. Examples of do minimum improvements include committed and expected developments, as well as programmed road improvements. The do minimum scenario therefore forms the expected situation without the scheme under investigation.

One of the first steps is to define the do minimum scenario, as the other options will be compared against this. Because trips are generated because of different employment and housing locations, we first define the projected housing and employment across the sub-region. This is built up from Local Plan forecasts and other information obtained from local planning authorities.

We also make assumptions about how the highway and public transport networks will work in this future. In most cases, no changes are made unless there is strong evidence that there will be a change. Programmed transport improvements schemes are included, as are those which the relevant transport authority reasonably expects to make, such as improvements to individual junctions or infrastructure linked to new development. Unfunded or uncertain large schemes, such as new road construction, are often not included. For public transport networks, it is usually assumed that the present services and timetable will continue to run, unless there is a known change planned.

The CSRM model then places trips on the transport networks to represent the journeys that people make. Starting with land use data – information on where people live and where jobs, schools and shops are – the model calculates which people will travel to which destinations. It then determines the most appropriate travel mode for that journey, and finally works out the route that people take. These decisions are based on the journey characteristics for each trip – travel time, distance and convenience (covering interchange and waiting time). Because each decision affects the journey characteristics that influence that decision, the model goes through a series of iterations to ensure that the networks are balanced and the model has allocated trips and routes in the best way possible. When the model was initially created, a series of validation checks were carried out to ensure that this allocation matched the real choices made by travellers, as observed on the networks.

For the do something scenarios, the model transport network is modified to represent the improvements being planned. This might be by including a new road, or it might be changing the capacities or speeds of existing roads. New and altered junctions can be represented in detail, including the number of lanes and priorities for each turn. For changes to public transport networks, the model revisions include the frequency and timing of services, the route they take, and how they connect to developments (i.e. where the bus stops are). When adding in new public transport infrastructure, such as a busway or a railway station, assumptions are made about the services that will use the new infrastructure and these are added to the model.

Model outputs are produced at each stage of the process. The ones most commonly used are the outputs from the final stage – origin-destination matrices by mode, together with travel volumes and time on each link in the network. For the highway network, this means the number of car journeys on each road, together with the travel time, queues and delay time. For public transport, it is the number of people on each service between stops, together with the number of people who get on and off at each stop, and the journey time between those stops. Public transport journey times can also be broken down into travel time and waiting time. For all modes, it is also possible to extract end-to-end journey times for each origin-destination pair.