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Executive summary

Approach

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.

The Transport Strategy for Cambridge and South Cambridgeshire (TSCSC) and the Cambridge and South Cambridgeshire Submitted Local Plans identify a series of transport proposals to provide for increased travel demand over the period to 2031 including that arising from future development.

Sections of an orbital or circular bus route are already in operation linking the north of the City (Science Park and Busway) to the south east (rail station and Addenbrooke’s). 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 Cambridge North West 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.

The study identified the problems and challenges within the immediate Western Orbital catchment area, and established the planning objectives that any interventions should achieve. This allowed a deep understanding of the characteristics of the area to be obtained before deriving any solutions.

Phase 1 of the Study involved the initial assessment of potential options which fulfilled the criteria outlined in the project brief. Options were generated and assessed against an agreed framework to generate a shortlisted option set for further consideration and assessment in Phase 2. To allow full exploration of solutions which would meet the study objectives, the options considered at this stage have been described as outcomes rather than as prescribed infrastructure interventions (e.g. uncongested bus travel along the M11, rather than prescribing a dedicated bus lane on the M11 to provide this uncongested link).

This report presents the findings from Phase 1 of the study, outlines the methodology of the project and presents the options considered thus far.

Objectives

Improving connectivity between residential and employment sites is key to delivering growth in Cambridge and its surroundings which is consistent with the Greater Cambridge City Deal objectives. The western and southern areas of the city contain both housing and employment development sites which will generate increased demand on the transport network. The TSCSC and the Cambridge and South Cambridgeshire Submitted Local Plans envisage enhanced transport infrastructure to address this increased demand. Without this planned mitigation, this will have an adverse effect on highway congestion levels and journey times. This study therefore seeks to investigate the options for a high quality public transport solution which:

- Provides congestion free orbital bus capacity for buses;
- Links current and potential major employment sites on the edge of the city (Cambridge Science Park, University West Cambridge site, Cambridge North West, the Cambridge Biomedical Campus / Addenbrooke’s Hospital; Bourn and Cambourne;)
- Removes or reduces the need for private transport or for travelling in and out of the city centre;
- Intercepts car traffic into Cambridge from the M11, A10, A603 and B1046 and routes that feed them; and
- Is compatible with emerging proposals for the A428 (Cambourne to Cambridge) scheme, which is being considered as part of a separate study.

In order to ensure the process was thorough and considered a range of factors, options were generated and refined through a series of workshops and assessments which can be summarised as:

- an initial brainstorming and option generation process based on identified problems and challenges within the immediate Western Orbital catchment area;
- two stakeholder workshops during which the options underwent further examination; and
a more detailed option assessment process which ultimately led to recommended options.

Shortlisted options

The shortlisted options described below were produced following an option generation process, and were selected for further assessment as part of a two-stage sifting process.

The option generation process involved an initial workshop to identify broad potential interventions which had the ability to achieve some or all the planning objectives of the study. These were marked on maps together with potential constraints. As mentioned above, at this stage the schemes were described in terms of outcomes, in recognition that different engineering solutions could be used to deliver the same outcome.

The potential schemes were assessed in two stages. The first stage involved assessing how the options aligned with the study’s planning objectives, and resulted in a list of ten options to be examined in further detail. These options were then assessed against a given set of criteria (including feasibility, cost, environmental impacts and journey time estimates). Numerical scores were assigned to each of the assessment criteria, but the option shortlisting process did not merely involve selecting those options with the highest scores. Instead, the assessment facilitated a team discussion where options were selected based on meeting the transport objectives, but also providing sufficient variability and differentiation to allow the team to explore a wide range of solutions during Phase 2 of the study.

The options that are to be taken forwards to Phase 2 are:

- Option A (was Option 9):

![Map of Cambridge area with options marked]

This option would involve construction of a new Park & Ride west of M11 Junction 11. This new P&R will be linked across the M11 with the new busway at Trumpington. The rationale for the new P&R is that it would remove a significant proportion of the traffic from the M11 J11 and the A10 which currently have to cross the M11 to use the existing P&R, thereby removing vehicles from the road before they reach the junction.

In addition to this P&R, a bus link between J11 and J13 of the M11 would be provided. This may be online or offline (further work is required to determine journey time reliability forecasts for the M11), but it will have the aim of providing uncongested bus travel between these two junctions.

A “typical” journey: it is anticipated that buses from Addenbrooke’s will travel using the existing busway to the existing Trumpington P&R, then continue using the new bus link over the M11 to the new P&R at Junction 11. From here, buses would travel north to junction 13. From this point, the route could continue through the developments in the north west and link to the existing services in the north or connect with any of the options being considered as part of the A428 Cambourne to Cambridge scheme.
• Option B (was Option 7):

This option has all the improvements included in Option A.

In addition this option would include a Park & Cycle at Junction 12, together with cycling improvements on Barton Road. Providing a Park and Cycle at J12 may encourage travellers to cycle for the last part of their journey into the City, reducing congestion on Barton Road.

The exact location for the Park and Cycle will require further investigation. Locating it to the east of the M11 would reduce the distance to travel by cycle from the P&C to the city centre, while locating it to the west may abstract traffic from the road earlier, and reduce queues on approach to Junction 12 from Barton.

• Option C (was Option 13):
This option has all the improvements included in Option A.

In addition this option would include a Park and Ride at Junction 12 (which like all P&R sites includes cycle provision). This would allow traffic approaching the City from Barton to be intercepted before adding to the congestion on the approach to J12 and on Barton Road.

Bus services would include a stop at the P&R at J12 (therefore adding some time to journeys compared to Option A), and passengers using this stop would be able to travel to the employment hubs in the north west and south of the City using the bus.

This option is therefore providing radial access to the city centre Public transport, cyclists and pedestrians. Travel to the City Centre could be along Barton Road if services were provided (although no bus improvements are proposed) or alternatively via Addenbrooke’s and then continuing north.

- Option D (was Option 22):

![Image of map showing option D](image)

This option has all the improvements included in Option A and C

In addition this option also involves the provision of cycle improvements along Barton Road. The rationale is that those users which may not find it convenient to travel to the City Centre via an orbital route will have the option of cycling using a more direct, radial, route along Barton Road.

**Next steps (Phase 2)**

The key objective of Phase 2 of the project will be to develop the shortlisted options (including the “do minimum” and low cost alternative) and undertake further appraisal to produce robust evidence which will support the preparation of the outline business case.

Key activities of Phase 2 will include:

- establishing the “do minimum”, “do something” and “do max” scenarios in greater detail;
- carrying out feasibility scheme design and cost estimates;
- testing the shortlisted options using the Cambridge Sub-Regional Model (CSRM), having established an appropriate do minimum scenario in the model;
- assessing in more detail the impacts of the shortlisted options; and
- producing a Strategic Outline Business Case and non-technical summary.

Stakeholder engagement should be part of any option assessment and selection process. During Phase 1 of the project workshops were carried out with representatives from City Deal partners and it is envisaged that public consultation will be undertaken during Phase 2. This will allow stakeholders to express their views on the options being considered and gauge their acceptability before a single option is selected.
In addition, Phase 2 will provide the opportunity to consider recommendations from project workshops and other issues uncovered during Phase 1 of the project which warrant further investigation. These include but are not limited to:

- examining the journey time variability on the M11, and the infrastructure necessary to provide congestion-free public transport along this corridor;
- investigating options for the use of the accommodation overbridge north of J11;
- further investigation on possible locations for P&R sites;
- examining data from Addenbrooke’s/Biomedical campus staff travel survey;
- the environmental impacts of off-line options; and,
- integration of the developing A428/A1303 corridor project into the Western Orbital strategic assessment framework.

At the end of Phase 2 a report will be produced in the form of an Outline Business Case, considering the results of all the workstreams listed above, and producing a recommendation on a preferred option.
1. Introduction

Context

1.1. 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 Cambridge City and South Cambridgeshire Local Plans envisage further growth up to 2031 of 33,000 new homes (equating to a 25% rise in population) and 44,000 new jobs.

1.2. This level of employment growth is fuelled by the ‘Cambridge phenomenon’ – an agglomeration of high-tech and research-based economic activity currently employing over 50,000 people in Cambridge which is expected to continue to grow rapidly. The success of this sector in Cambridge can be attributed to several factors, one being the scale and connectivity of the city.

1.3. The City Deal Transport package, which builds on the Transport Strategy for Cambridge and South Cambridgeshire (TSCSC), sets out an integrated, multi-modal programme to support this growth. The package focuses on improving connectivity from employment sites to residential areas, especially to new residential areas outside the city boundary. Given the desire to continue to improve the quality of life in Greater Cambridge, and that the existing highway network is at or near capacity for much of the day, the package focuses on public transport, cycling and walking solutions. Figure 1 summarises housing and employment sites relevant to the area of this study.

1.4. Figure 1 also evidences how sections of an orbital or circular bus route are already in operation linking the north of the City (Science Park and Busway) to the south east (rail station and Addenbrooke’s), as shown by the purple line. 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 Cambridge North West developments has secured further orbital connection linking the north to Madingley Road in the west (as depicted by the dotted line). 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.

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\(^1\) The area covered by the districts of Cambridge and South Cambridgeshire.
This study

1.5. This report is the first output from a study which will identify and assess options for improved public transport, walking and cycling facilities for a western orbital route connecting the new business and residential developments in the northwest and south of the City, and intercepting car trips from radial routes from the south west. This study is to be treated as a separate piece of work in order to define the ‘best outcome’ for the area, but should also consider its connectivity to other schemes in the City Deal programme, in particular the interaction with the A428 corridor study.

1.6. Without the required mitigation, the planned growth in the City and the district has the potential to add to the, already high levels of congestion in Cambridge. Current traffic conditions show significant congestion in both the AM and PM peaks at key locations, such as the approaches to Junctions 11 and 13, and radial routes into the city centre (mostly within the M11 boundary).

1.7. The key challenge is therefore to identify ways to ensure that the planned growth does not worsen the existing situation but, ideally, how measures can be put in place to improve connectivity and the quality of the environment in Greater Cambridge. Any proposed solution must therefore be able to offer those wishing to make trips (both those already existing and future trips to/from new developments) desirable and high quality alternatives to traditional car-based highway trips. It is worth noting that the study does not seek to improve car journey times on the orbital route and into Cambridge.

1.8. The key aim of the study, as defined in the brief, is therefore:

The interception of car trips from the south / south west of Cambridge into key destinations in the city, including consideration of the potential linkages with orbital capacity including public transport priority between Cambridge North West (Madingley Road) and Cambridge Biomedical Campus (Hauxton Road / Trumpington Park & Ride)

In addition the study includes an initial assessment of the potential usage of and options for a new station at Addenbrooke’s to serve the Cambridge Biomedical Campus and housing development in the south of the city (Trumpington).

Outcomes of this study should also be compatible with the schemes emerging from the A428 Cambourne to Cambridge transport proposals, which are being considered separately.

1.9. Phase 1 of this study was conducted from December 2014 to July 2015.
2. Problems and challenges

Introduction

2.1. This chapter describes existing and future problems and challenges relating to transport between the northwest and south of the city, and on the radial routes. Problems and challenges have been identified and, where possible, quantified, based on available information, data and model runs, including:

- current planning and transport policy documents;
- National Census information from both 2001 and 2011;
- transport data, including traffic flow, public transport provision, road safety and journey time information; and
- forecasts of travel demand from transport data from existing CSRM runs.

2.2. The information below is a summary of the findings. Appendices A.2 to A.5 provide more detail of the analysis.

Weaknesses and threats

Current problems and challenges

Traffic volume, congestion and delays

2.3. TrafficMaster data shows that current conditions on the highway network in the area are variable along each of the main radial routes, A603, A10, and also the M11.

2.4. On the M11 in the morning peak, congestion is particularly prevalent northbound on the approach to the junction 13 off-slip road at Madingley, resulting in high levels of journey time variability. A similar situation emerges southbound on the motorway with queues on the junction 11 slip road impacting on journey time reliability.

2.5. In the evening peak, the southbound M11 to junction 11 performs relatively well in comparison to the congestion experienced in the morning. By comparison, Northbound to junction 13 there are problems at three locations resulting in variable journey times: merging onto the M11 at junction 11, Barton on-slip at junction 12, and the northbound off-slip at junction 13.

2.6. The A10, from the junction with the A505 to the M11 shows relatively stable journey times in the morning peak, with the main cause of variability being the level crossing at Foxton. East of the M11 there is increasing congestion as a result of motorway traffic joining the A10 at M11 junction 11, with increased delays and hence journey time variability.

2.7. The A603 eastbound from its junction with the A1198 is relatively free flowing in the morning peak until it reaches the village of Barton when delays start to impact more on journey time variability. The greatest impact is east of M11 junction 12 southbound off-slip caused by vehicles from the motorway entering the city along Barton Road.

2.8. For both the A10 and the A603, the delays caused by outbound flows in the evening peak are less significant.

2.9. The key aspects of the highway network performance in the area can be summarised as:

- significant journey time variability along radial routes in the morning peak, both east and west of the M11 particularly at:
  - A1309 – Trumpington Road;
  - A10 – Foxton Level Crossing;
  - A603 – Barton Road/Grange Road / Grantchester Street; and
  - M11 – Barton Road Junction.
- congestion on the M11 particularly at the off-slips southbound at junction 11 and northbound at junction 13 in the morning peak;
low traffic speeds in the morning peak, particularly approaching / at junctions of the M11; and
average morning peak delays on the M11 slip roads of 1.5 to 2 minutes northbound, and 1.5
minutes southbound; on the A603 eastbound delays of approximately 13 minutes; and on
the A10 eastbound delays of approximately 16 minutes in excess of free flowing conditions.

2.10. Modelling forecasts that by 2031 the largest increases in trips to Cambridge will be from the A10
and A428 and less so from the A603. The main destinations for trips made by all modes as a
consequence of planned developments in the area are:
- West Cambridge – 88% increase on 2011;
- Science Park – 26% increase on 2011;
- Addenbrooke’s – 23% increase on 2011.

2.11. If the Local Plan were not predicated on addressing this increased demand through an enhanced
transport network this increase would have a detrimental impact on traffic flow at peak times
resulting in an extension of peak periods, with a resultant adverse impact on the local economy.

Road safety

2.12. Analysis of road accident data between January 2010 and April 2015 shows that the accident
rates are lower than national average for both motorway and built-up roads. Results for the M11
(from junction 11 to junction 13), Madingley Road, Barton Road and Trumpington Road are
summarised below.

2.13. The section of the M11 from junction 11 to junction 13 had a total of 61 accidents in the five year
period, comprising 54 slight and 7 serious. No incidents were fatal during this time. 8 accidents
involving pedal cycles were reported at the junctions immediately adjacent to the on-and-off-slip
roads and have been included in this count.

2.14. On Madingley Road, from the M11 Junction to Northampton Street, there were total number of 44
accidents over the five year period, comprising 38 slight and 6 serious. It should be noted that 19
accidents out of 44 involved cyclists, mostly at junctions. This indicates that while there are
segregated cycle paths along Madingley Road, these may not be attractive to all cyclists as they
are not segregated from pedestrians, and accidents still occur at junctions and the mini-
roundabout.

2.15. Barton Road, from the M11 Junction to the Barton Road sports ground, had 19 slight accidents
and 5 serious accidents over the five year period. 7 accidents involved a pedal cycle.

2.16. Trumpington Road (from the M11 junction to the Trumpington P&R entrance) had 5 slight
accidents and 1 serious accidents over the five year period. 1 accidents involved a pedal cycle.

Public transport provision

2.17. Current public transport provision is limited when compared to some other movements from
further afield from Cambridge (e.g. the longer distance Stagecoach services along the A428),
although it is recognised that the Trumpington P&R and Cambridge Guided Bus (CGB) service
do provide good levels of service from within the M11 to Cambridge. The limited services are
partially due to the M11 providing a convenient route for residents of the surrounding areas to
travel to the north or south west of the city. What provision there is available is limited in the most
part by the traffic conditions, providing no real evidential benefit to encourage modal shift. Even
where there is a viable alternative (i.e. CGB links from Trumpington), there are still constrictions
on capacity along some sections of the route, forced by existing infrastructure and other online
conditions; traffic light phasing etc. It is anticipated that there would be limited levels of growth
expected for the study period without any measures to encourage any modal shift.

2.18. Annual Park and Ride patronage figures are provided in Appendix A.3.

2.19. A map of current public transport provision can be accessed from the Cambridgeshire County
Council website:

http://www.cambridgeshire.gov.uk/info/20017/buses/126/bus_route_maps
2.20. Pedestrian and cycling facilities of varying quality and coverage are currently available within the study area. On approach to the M11, both the A10 and A603 have no cycle lanes provided on the main carriageway, although shared pedestrian and cycle paths (of varying and sometimes restricted width) are provided by the side of the road. Alternative car-free routes across the M11 include the bridleway connecting Barton and Grantchester and a proposed route using the existing accommodation overbridge north of the M11 (which is due to be provided as part of the Trumpington Meadows development).

2.21. Within the M11, high-quality segregated facilities exist from the P&R site at Trumpington to Cambridge Rail station and to Addenbrooke’s, following the route of the busway. Routes into the city centre, combining on and off-road facilities are also available.

2.22. No orbital cycle route following the M11 corridor currently exists, and it is likely that cyclists currently travelling between orbital employment sites either use the city centre links or travel through Grantchester.

2.23. A map of current cycling provision in the area can be downloaded from the Cambridgeshire County Council website:


2.24. South Cambridgeshire has high car ownership, with the 2011 Census reporting 89% of households owning a car (compared to the national average of 74%), with 49% owning more than one car. This high car ownership is supported by high levels of employment, with an unemployment figure of 2.3% compared to the national average of 4.4%. Employment is biased towards highly skilled occupations. The city of Cambridge however, has car ownership levels of 66%, a figure probably supported by the high proportion of cycling to work.

2.25. There are a number of key employment areas within Cambridge City Centre including the University of Cambridge as well as those on the outskirts of the City such as the Cambridge Biomedical Campus at Addenbrooke’s and Cambridge Science Park. Journey to work data demonstrates that there is a high tendency towards car as the dominant mode of choice in South Cambridgeshire, with around 50% of journeys to work made by car (driver, passenger or taxi), although this proportion is significantly lower (21%) for the City. Bus usage in both Cambridge City and South Cambridgeshire is typically 4% or lower.

2.26. Land use and environmental constraints

2.27. There are a number of land uses along the project corridor, each of which may have an impact on any proposed public transport scheme in the corridor. There are a number of Sites of Special Scientific Interest as well as other physical constraints such as the Green belt, conservation areas, waterways, and a polo club to the west of the M11 at junction 12 that need to be considered for any proposed schemes.

2.27. Further details are provided in Appendix A.2.
Summary

2.28. The key weaknesses and threats in the area can be summarised as:

- Significant journey time variability along radial routes, particularly east of M11
- Lack of bus services and bus priority along radial routes from south and south west radials
- Uni 4 Bus route has provision for key points (origin and destination) along the routes, but congestion and route layout means that this is a slow option
- No P&R provision on the A603
- Barton Road options are limited due to constraints alongside the existing highway
- A system would have to be put in place to enforce M11 bus only lanes
- High cost associated with provision of structures over the M11 if needed
- Adverse impact on environment for several options
- Interchanges between transport modes can result in higher journey times
- Capacity constraints on CGB and Park & Ride at Trumpington due to both number and height of buses

2.29. Further details are provided in Appendix A.2.

Future problems and challenges

Housing and employment growth

2.30. The submitted Cambridge and South Cambridgeshire Local Plans (currently being examined) envisage significant growth in housing and employment in, and adjacent to, the study area. This growth is likely to have significant impacts on the pattern and level of travel in and through the study area.

2.31. 15,000 new jobs are planned for Cambridge Biomedical Campus, Addenbrooke's 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 the West Cambridge and North West Cambridge sites and the Cambridge Science Park, as the Cambridge phenomenon continues to take hold.

2.32. North West Cambridge (up to 3,000 new homes) and Darwin Green 2 (1,000 new homes) to the north and Clay Farm (2250), Trumpington Meadows Glebe Farm and Bell School (~2,900 new homes combined) will also contribute to residential growth within Cambridge, with the potential to put more strain on the transport system.

Travel demand

2.33. Underlying increases in demand for travel, for example due to economic growth nationally, and local growth in demand due to the developments described above are forecast to lead to substantial growth in the demand for travel in Greater Cambridge.

2.34. At this stage of the study, these forecasts are based on an existing run of CSRM developed for the preferred strategy of the City and South Cambridgeshire Local Plan as it stood at the time of the Examination in Public and therefore reflect the assumptions made in preparing those forecasts. As CSRM is a land use-transport interaction (LUTI) model, the travel demand forecasts it makes are influenced by assumptions about available development land; and the transport networks and services available.

Traffic conditions

2.35. The CSRM runs demonstrated that there is likely to be significant growth in travel demand in this area towards 2031. Current data indicates that by 2031 key destination sites within the study area will see growth of between 5% and 90% in their travel demand in the AM peak trips made by all travel modes, with the West Cambridge site seeing significant growth of 88%.

2.36. These same areas as mentioned above, are also forecast to generate significant additional trips, with a resulting impact on the adjacent infrastructure. Once again, the West Cambridge site is a large contributor to this increase, with around 9,500 additional trips forecast.

2.37. This increase in travel demand is likely to result in traffic levels that will exacerbate the existing high levels of congestion and journey time variability along the key routes within the study area.
2.38. There are a number of other threats that could materialise to a greater or lesser extent over the coming years. The travel patterns into and within Cambridge are likely to become more diverse as the employment areas expand over a wider area, creating less focus for trips into the City. This creates a challenge to provide a high quality public transport service to a greater number of key destinations if these become more disparate.

2.39. The potential impact of the A14 Cambridge to Huntingdon improvement should also be considered. By providing greater capacity on the approach to Cambridge from this corridor, there is the potential to change the existing patterns of movements towards the City.

2.40. Should development to the south of the City (beyond Trumpington) also intensify, these areas are currently not served well by public transport and are limited in their potential to use public transport, due to a lack of routes that can be utilised to provide a high quality service.

**Strengths and opportunities**

**Strengths**

2.41. While there are a number of weaknesses along the route, there are some key strengths that can be taken advantage of for any future scheme:

- The existing Park & Ride sites at Madingley Road and Trumpington Road are well used. For example, the Madingley Road site has a high capture rate of 40% of trips in scope that come from the M11 (according to the 2013 Road Side Interview data), indicating that there is already a strong willingness to utilise Park & Ride services.
- There is existing cycle provision along some sections of the radial routes.
- There is a policy background established in the LTP

**Opportunities**

2.42. The aspiration to improve public transport, walking and cycling measures is fully supported by current policy, including the emerging Cambridge and South Cambridgeshire Local Plans, the TSCSC and Greater Cambridge and Greater Peterborough Strategic Economic Plan.

2.43. While the current high levels of congestion on areas of the highway network is undesirable, this does give an opportunity for a public transport scheme that can bypass these areas of delay and unreliability to provide a real benefit and high quality alternative to car travel.

2.44. Whilst there are some constraints, there is also scope for construction within the highway boundary at a number of locations, and to provide high quality options for walking and cycling facilities in the area. Furthermore, existing public transport provision in the area is limited, which gives the opportunity to attract users to new and high quality services.

2.45. There is also scope for a new Park & Ride site located further west from Cambridge than the existing site on Trumpington Road, accompanied by bus priority measures, but there are capacity constraints at Trumpington to providing an expanded site to cater for additional parking, due to the surrounding (proposed) development. The absence of P&R provision on the A603 allows for options to be considered along this route. However, Barton Road east of the M11 junction 12, has limited available road space to provide bus priority options.

2.46. Options for providing orbital segregated bus operation exist in both on-line and off-line forms and can link to either existing or new P&R facilities.

2.47. The creation of bus lanes or priority bus measures at junctions on motorways has already been trialled at other locations (e.g. on the M4 at the Heathrow Airport Spur). There is an opportunity to introduce good practice from these projects to the scheme should bus priority on the motorway form part of one of the selected options.

2.48. In addition to the above, Highways England announced as part of their Roads Investment Strategy two upcoming schemes in this area. The first scheme will involve technology upgrades on the M11 between junctions 8-14. The second will involve dualling the A428 from St Neots to Caxton Gibbet.
Summary

2.49. The high car ownership and Cambridge-focussed employment in the area means that there is likely to be increasing congestion on the approaches to Cambridge. This high car ownership allied to limited high quality public transport provision within the corridor means that there is a high proportion of journey to work trips made by car, with limited alternatives giving rise to congestion on the approach to Cambridge.

2.50. Current congestion experienced in the area is high, particularly east of the M11, resulting in poor travel conditions for all modes of travel, with highway and bus travel times being highly variable in certain sections, and the lower grade of cycling provision interacting more with the highway than desired. Without mitigation measures, such as those considered in the TSCSC, these conditions are forecast to get worse over time, as new developments and continued growth takes place. These growth areas currently have poor connections by public transport, and therefore there is little realistic alternative to car travel at this time, which would put unacceptable levels of additional traffic and therefore congestion on the highway network. This would not meet the long term vision of Cambridgeshire County Council for a better quality of life within the Sub Region. Therefore, it is not possible to realise the development and growth aspirations of the Local Plans without interventions to facilitate desirable and realistic alternatives to travel by car through the provision of high quality public transport services between key locations.
3. Objectives and outcomes

Introduction

3.1. The previous chapter summarised the problems and challenges in the area and how they will become more acute without intervention. These issues provide a ‘bottom up’ and reactive perspective to identifying potential solutions.

3.2. In this chapter, a set of outcome-focussed ‘planning objectives’ are defined which offer a ‘top down’ perspective to the option identification. Specifically, the planning objectives set out what the proposed interventions are intended to achieve in terms of measurable outcomes. As well as informing the option identification process, the planning objectives also form a key element of the assessment framework used to sift options and identify those for further consideration in Phase 2.

3.3. In this chapter the geographical scope of the potential interventions is defined.

Planning objectives

3.4. The planning objectives for the study were derived based on the high level goals and strategic objectives identified in policy documents, the project brief and the team’s understanding of what the solutions needed to achieve.

3.5. Strategic objectives are set out in a number of policy documents including the submitted Cambridge and South Cambridgeshire Local Plans, the Transport Strategy for Cambridge and South Cambridgeshire, and the National Planning Policy Framework.

3.6. The following high level objectives are specified in the policy documents and represent the transport outcomes required by any option. Some of the objectives are outcomes whilst others relate to potential ways of achieving those outcomes. They are:

- To maximise the potential for journeys to be undertaken by sustainable modes of transport including walking, cycling, bus and train [outcome];
- To provide orbital capacity for buses linking major employment sites in the north, west and south of the city;
- To intercept car journeys to the centre of Cambridge from the M11, A603, B1046 and A10(S) and routes that feed into them;
- To support growth, help create jobs and housing, locate growth in locations that minimise the need to travel and maximise the use of sustainable modes [outcome].

3.7. The planning objectives for this particular study are to provide high quality public transport which:

- PO1: Provides an alternative for car trips from M11, A603, B1046 and A10(S) to key employment hubs
  - PO1a City centre
  - PO1b Cambridge North West
  - PO1c Science Park
  - PO1d Cambridge Northern Fringe
- PO2: Provides an alternative for car trips from A428 corridor to city centre, Science Park, Cambridge NW (see A428 study)
- PO3: Provides an alternative for car trips from A428 corridor to Addenbrooke’s
- PO4: Provides an alternative/capacity for journeys between major peripheral employment hubs

3.8. To achieve the study’s planning objectives, the solution(s) must encourage some existing car journeys to change mode; and attract a high share of new journeys (both from new developments and underlying growth). Additionally, options could seek to:

- reduce demand for motorised travel to / from Cambridge; and
● ‘re-time’ some car trips away from the peak periods.

**Geographic area of interest**

3.9. This study considers the M11 corridor between junction 11 at Trumpington and junction 13 at Madingley Road, a corridor that is currently experiencing considerable growth in employment, particularly in relation to development at Trumpington Clay Farm (housing), Addenbrooke’s Biomedical Campus (employment), Cambridge West (employment and education) and North West Cambridge (housing and employment).

3.10. These developments need connections to facilitate trips between these sites and also for commuters travelling from the west along the A603, B1046, and A10(S) corridors. Furthermore, these developments need connections to the wider area such as housing growth proposals in Cambourne and Bourn, and employment at the Cambridge Science Park and Cambridge Northern Fringe. Trips along the A428 between Cambourne / Bourn and key attractors in the city are addressed in the A428 study.

3.11. The study objective is to identify sustainable transport solution(s) to the expected orbital movements between the north, west, and south of Cambridge that will take place as developments come on line, and reduce the levels of traffic entering the city from the south and southwest. The expectation is that the solutions will need to link into the solution proposed by the A428 work.
4. **Option identification and sifting**

**Introduction**

4.1. This chapter describes the process by which options were identified and assessed, and the outcomes. The different stages of the process, and the number of options present at the different stages, are summarised in Figure 4-1, with the numbers in the arrows indicating the number of options at each stage.

**Figure 4-1** Option process flowchart

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**Long list of options identified**

4.2. An initial workshop was held to generate broad potential interventions, which were marked on maps together with potential constraints, and to discuss current and future challenges in the study area. This workshop was attended by the study team and CCC staff. This approach allowed for initial interventions to be identified and developed and, based on local knowledge, some were discounted because of key constraints that would have a significant impact of deliverability.

4.3. The project team identified a range of elements, A to N, using criteria that broadly overcame the future challenges; as set out in section 2, and supported the policy objectives identified in section 3. This process allowed for the application of both a ‘top-down’ and ‘bottom-up’ approach.

4.4. The 14 elements identified are listed in Table 4-1.

**Table 4-1** List of elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>New P&amp;R M11 junction 11 (Trumpington)</td>
</tr>
<tr>
<td>B</td>
<td>Busway/on line bus service on M11 to junction 12</td>
</tr>
<tr>
<td>C</td>
<td>Busway/on line bus service to junction 13 + Madingley Road</td>
</tr>
<tr>
<td>D</td>
<td>New P&amp;R M11 junction 12 Barton</td>
</tr>
<tr>
<td>E</td>
<td>Barton Road bus improvements</td>
</tr>
<tr>
<td>F</td>
<td>New bus link from New P&amp;R M11 junction 11 to guideway at Trumpington</td>
</tr>
<tr>
<td>G</td>
<td>New bus stop (no P&amp;R) on busway at Barton Road</td>
</tr>
<tr>
<td>H</td>
<td>Cycling improvements on Barton Road</td>
</tr>
<tr>
<td>I</td>
<td>Barton Road Park &amp; Cycle</td>
</tr>
<tr>
<td>J</td>
<td>New Park &amp; Cycle at M11 junction 11 (Trumpington or new site – if latter needs M)</td>
</tr>
<tr>
<td>K</td>
<td>Bus service through Cambridge NW (say, to Chesterton station)</td>
</tr>
<tr>
<td>L</td>
<td>Orbital bus service via M11, Cambridge NW, Science Park, CC, Addenbrooke’s</td>
</tr>
<tr>
<td>M</td>
<td>New cycle link from Park &amp; Cycle at Trumpington across M11</td>
</tr>
<tr>
<td>N</td>
<td>Foxton (Park &amp; Rail) + rail shuttle via Addenbrooke’s station, Cambridge, Chesterton to Waterbeach</td>
</tr>
</tbody>
</table>
4.5. It was intended that these 14 elements would be combined with each other to develop more comprehensive options that could deliver the objectives of the study. The next stage in this process was to combine different elements to generate 30 options (see Appendix B.5) which then were subjected to an initial high-level assessment.

**Assessment**

4.6. The assessment process followed a two stage approach, described in the following sections. The first stage was an initial sift to reduce the long list of 30 options into 10 options that could be assessed in more detail (see Appendix B.3 for the option sifting summary table). Options excluded at this stage were deemed not to meet the objectives of the brief in terms of the demand intercepted, and would be unlikely to reduce car journeys into and around Cambridge.

4.7. This initial sift was followed by a more detailed assessment, using a qualitative and quantitative approach to reduce the 10 options to a shortlist of 4 options which will go forward for detailed appraisal in Phase 2 of the study.

**Initial sift (30 options to 10)**

4.8. Each option was assessed in terms of:

- the Strategic Case: the degree to which the options supported the planning objectives relating to the type and scale of intervention; and
- the Economic Case: the degree to which the options were supportive of the planning objectives relating to the impact on ability to intercept trips from the M11, A603, B1046, and A10(S).

4.9. Each option was scored on its ability to:

- meet each of the planning objectives;
intercept trips from the main routes into Cambridge from the south and south west using a weighted assessment of forecast 2031 demand; and

provide orbital capacity linking the main employment and housing development sites in Cambridge.

4.10. This process included an assessment of the total forecast 2031 demand that each option had the potential to intercept. There was a wide range in the performance of these options with a number performing well in terms of demand intercepted. A further qualitative assessment of the scores was undertaken to eliminate those options which did not meet the criteria of the project brief, or had the potential to result in an adverse impact which went against the objective of reducing car borne journeys into and around Cambridge.

4.11. This outcome of the initial assessment was a list of 10 options that went forward to more detailed assessment. These options are described in Appendix B.4.

Second assessment process (10 options to 4)

4.12. Further assessment of the 10 options was undertaken to give greater quantification of potential benefits of each. The objective of this process was to determine a short list of options that would undergo detailed analysis in Phase 2 of the study. The assessment combined elements of engineering feasibility and costs with transport related benefits for each option (see Appendices D and E for option high-level maps and for the assessment table).

4.13. The assessment process was supported by a series of workshops, which allowed the team to share the options being considered and receive feedback. During the first of these workshops, discussion was based on whether the team had considered all possibilities. Some additional considerations were highlighted to the study team, such as considering the use of the accommodation bridge across the M11 at Trumpington. This and other ideas have been included in the Appendix B.5 as variations to the existing options.

4.14. The approach to option assessment was based on addressing three high level criteria, deliverability, strategic rationale, and benefits / impacts. For each option the team assessed:

- **Deliverability:**
  - Engineering feasibility – including flexibility of option, implementation timetable;
  - Stakeholder acceptability;
  - Environmental impacts – including land take, greenhouse gas emissions;
  - Costs and affordability;
  - Bus service commercial viability; and
  - Key uncertainties.

- **Benefits / impacts:**
  - Social and distributional impacts; and
  - Journey time savings over car – offers peak journey times and journey time reliability that is equivalent to car based journeys, and are preferably better than the equivalent car based journey.

- **Strategic rationale:**
  - Provides orbital bus capacity – connects peripheral employment and housing sites;
  - Intercepts trips from the M11, A603, B1046, and A10(S).

4.15. These criteria were assessed using quantitative measures if these were available (e.g. cost and journey time savings), otherwise the team produced a quantitative assessment. The results of this second assessment process were captured in an Assessment Summary Table (AST), provided in Appendix E.

Recommendations

4.16. The assessment described above was used as the basis for a team discussion where options were selected based on meeting the transport objectives but also providing sufficient variability.
and differentiation to allow a diverse set of solutions to be explored in the next study phase. It is proposed that the following options should be taken forward to Phase 2 of the study:

- **Option A (was Option 9):**
  
  This option would involve construction of a new Park & Ride west of M11 Junction 11. This new P&R will be linked across the M11 with the new busway at Trumpington. The rationale for the new P&R is that it would remove a significant proportion of the traffic from the M11 J11 and the A10 which currently have to cross the M11 to use the existing P&R, thereby removing vehicles from the road before they reach the junction.
  
  In addition to this P&R, a bus link between J11 and J13 of the M11 would be provided. This may be online or offline (further work is required to determine journey time reliability forecasts for the M11), but it will have the aim of providing uncongested bus travel between these two junctions.
  
  A “typical” journey: it is anticipated that buses from Addenbrooke’s will travel using the existing busway to the existing Trumpington P&R, then continue using the new bus link over the M11 to the new P&R at Junction 11. From here, buses would travel north to junction 13. From this point, the route could continue through the developments in the north west and link to the existing services in the north or connect with any of the options being considered as part of the A428 Cambourne to Cambridge scheme.

- **Option B (was Option 7):**
  
  This option has all the improvements included in Option A.
  
  In addition this option would include a Park & Cycle at Junction 12, together with cycling improvements on Barton Road. Providing a Park and Cycle at J12 may encourage travellers to cycle for the last part of their journey into the City, reducing congestion on Barton Road.
  
  The exact location for the Park and Cycle will require further investigation. Locating it to the east of the M11 would reduce the distance to travel by cycle from the P&C to the city centre, while locating it to the west may abstract traffic from the road earlier, and reduce queues on approach to Junction 12 from Barton.

- **Option C (was Option 13):**
  
  This option has all the improvements included in Option A.
  
  In addition this option would include a Park and Ride at Junction 12 (which like all P&R sites includes cycle provision). This would allow traffic approaching the City from Barton to be intercepted before adding to the congestion on the approach to J12 and on Barton Road.
  
  Bus services would include a stop at the P&R at J12 (therefore adding some time to journeys compared to Option A), and passengers using this stop would be able to travel to the employment hubs in the north west and south of the City using the bus.
  
  This option is therefore providing radial access to the city centre Public transport, cyclists and pedestrians. Travel to the City Centre could be along Barton Road if services were provided (although no bus improvements are proposed) or alternatively via Addenbrooke’s and then continuing north.

- **Option D (was Option 22):**
  
  This option has all the improvements included in Option A and C.
  
  In addition this option also involves the provision of cycle improvements along Barton Road. The rationale is that those users which may not find it convenient to travel to the City Centre via an orbital route will have the option of cycling using a more direct, radial, route along Barton Road.

4.17. These options, at a high level:

- Meet the strategic rationale for intervention;
- Are deliverable in engineering terms, could be affordable, and do not have any obvious ‘show stoppers’ that would render them undeliverable on environmental grounds or in terms of stakeholder acceptability; and
- Could deliver significant benefits / impacts in terms of capturing demand, mode share / shift, and journey times.
5. **Next Steps**

5.1. As noted above, the main aims of phase 1 were to consider possible options which would fulfil the study objectives, and to carry out a high-level assessment of these. Further development of these options, and a more detailed appraisal to produce robust evidence for the preparation of the outline business case will be undertaken in phase 2.

5.2. Key activities of phase 2 will include:
   - establishing the “do minimum”, “do something” and “do max” scenarios in greater detail;
   - carrying out feasibility scheme design and cost estimates;
   - producing an Appraisal Specification Report;
   - testing the shortlisted options using CSRM, having established an appropriate do minimum scenario in the model;
   - assessing in detail the impacts of the shortlisted options; and
   - producing an Outline Business Case, non-technical summary and a developer funding technical note.

5.3. Phase 2 of the project will also provide an opportunity to undertake further stakeholder engagement, in the form of a public consultation to allow stakeholders to express their views on the options being considered and gauge their acceptability before a single option is selected.

5.4. At the end of Phase 2 a report will be produced in the form of an Outline Business Case, considering the results of all the workstreams listed above, and producing a recommendation on a preferred option.