

Cambourne to Cambridge Better Bus Journeys Scheme: Strategic Outline Business Case

Strategic Case
City Deal Partners

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1. Purpose of Document

1.1. Purpose of the Strategic Case

The Strategic Case sets out the evidence that demonstrates the need for a transport scheme.

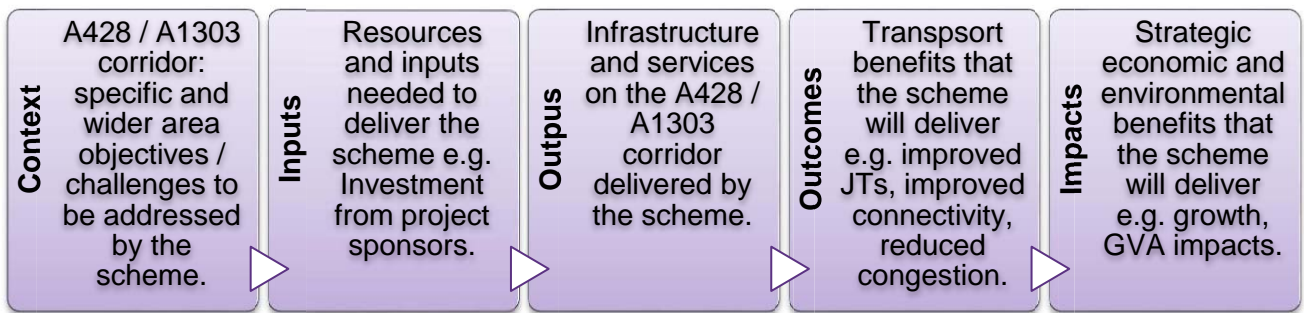
According to the Department for Transport (DfT) publication *The Transport Business Cases*, the primary purpose of the Strategic Case is to clearly articulate the case for change and the **need** for a project¹.

Given that there are many calls on public investment, it is essential that a transport scheme is able to provide convincing evidence of need and of how transport and wider policy objectives are addressed as a direct result of the intervention. This involves comparing the intended benefits with a “Reference Case” situation where the scheme would not be built.

The purpose of the Strategic Case is to set out the strategic and policy context, demonstrate the need for the scheme and provide an assessment of the scheme options impact in addressing transport and wider policy requirements.

The assessment and demonstration of need for the Cambourne to Cambridge Better Bus Journeys Scheme will follow a clear logic chain:

Figure 1-1 Logic chain for the Strategic Case



The Logic Chain approach demonstrates a clear progression from the scheme context through to the transport outcomes and higher level strategic impacts that will be delivered by the scheme.

¹ DfT. (2013). *The Transport Business Cases*.

1.2. Strategic Outline Business Case

The Strategic Outline Business Case (SOBC) sets out the case for change and how this will further the Sponsors' aims and objectives (the strategic fit). It provides suggested or preferred ways forward and presents the evidence for decision¹.

Atkins has been commissioned by the City Deal Partners to produce an SOBC for the Cambourne to Cambridge Better Bus Journeys Scheme. The SOBC will be submitted to the Greater Cambridge City Deal (GCCD) Board for approval to proceed to a single option development in the late summer of 2016.

The SOBC will follow the format of DfT and HMT's 5-Case Business Case Model. In specific terms, the SOBC:

- Continues to align the progress of the scheme towards achieving the relevant local objectives and confirms the strategic fit with these objectives and articulates the case for change in the **Strategic Case**;
- Sets out a detailed assessment of the options and provides details of the options' overall Value for Money, assessing the balance of benefits and costs against objectives in the **Economic Case**;
- Refines the investment / intervention proposal and sets out the financial and funding implications for the scheme in the **Financial Case**; and
- Sets out the proposed management and governance approach and commercial situation for procuring and delivering the scheme in the **Delivery Case and Commercial Case**.

This section is the *Strategic Case* section of the SOBC.

1.3. Structure of the Strategic Case

The Strategic Case is "objectives-led" and sets out a clear narrative as to how and why investment in public transport (PT) on the A428 corridor will deliver benefits to the Greater Cambridge area.

The Strategic Case commences by considering the high level strategic issues and scheme objectives, before proceeding with a detailed analysis of the problems and challenges, setting out the options and concluding with an assessment of the groups of people who benefit. There are individual chapters dealing with:

- The Cambridge phenomenon and vision;
- The Greater Cambridge City Deal;
- Contextual information;
- Spatial, Economic and Environmental challenges;
- Transport problems to be addressed by the scheme;
- Scheme objectives;
- Option identification;
- Scheme beneficiaries; and
- Performance of options.

An assessment of the people who benefit is important in order to ensure that the scheme is appraised, designed and ultimately delivered against transport user and community needs.

2. The Cambridge phenomenon and vision

2.1. The Cambridge success story

The Greater Cambridge area has an exceptionally successful story to tell. Proposed transport infrastructure schemes financed through the GCCD should be placed within a strategic economic and policy context of delivering continued high and sustainable growth for Cambridge.

Cambridge is a member of the UK's Fast Growth Cities group that contains some of the UK's most successful cities in terms of economic indicators such as productivity and knowledge based jobs². Cambridge's GVA per worker was £55,900 in 2014, having grown 21% since 2004. Over the same period Cambridge's population grew by 14.5%².

Greater Cambridge competes on a global stage and is a gateway for high-tech investment into the UK. It is also the innovation capital of the country, with more patents per 100,000 population than the next six UK cities combined³.

Greater Cambridge's current economic success is attributed to being a **networked and connected city-region characterised by world-leading innovation**. Research³ into the "Cambridge Phenomenon", the cluster of technology firms around Cambridge, presented in the GCCD Document shows this success is due to:

- A world class university drawing talent into the area from across the globe, fostering innovation and encouraging business spinout which has developed into strong hi-tech, bio-medical and other clusters (with over 1,525 technology companies employing more than 54,000 people and a combined revenue over £12 billion);
- The area's scale and connectedness which allows overlapping networks to develop and facilitate a culture of co-operation and cross-fertilisation between entrepreneurs and with academics; and
- Being an attractive place and competing with other world cities as a good place for business leaders and their families to live, not just a good place to do business.

Greater Cambridge therefore has a diverse economic base with strengths across a broad base of knowledge-intensive sectors: professional, scientific, bio-medical, clean-tech, technology and advanced manufacturing.

Whilst economic success to date has been widely celebrated, it is now contributing to **a shortage of housing and significant transport congestion** that threatens to choke further economic growth and compromise the high quality of life that has hitherto existed.

The GCCD proposes that growth up to 2031 will lead to the need for 33,500⁴ new homes and generation of 45,000 new jobs. In order to deliver more jobs, housing and economic growth, and to unleash the next wave of the "Cambridge Phenomenon", the Greater Cambridge area has to:

- Grow physically to accommodate the houses and employment sites that are spread across the area;
- Maintain ease of movement between key economic hubs - new economic centres of gravity including the Addenbrooke's Bio-Medical campus to the south, and the University of Cambridge (UoC) sites to the west and north-west; and

² Centre for Cities, Williams, M, March 2016: Fast Growth Cities: The opportunities and challenges ahead

³ City Deal, Greater Cambridge City Deal Document

⁴ Revised figures from GCCD website <http://www.gccitydeal.co.uk/citydeal/housing>

- Protect and enhance the high quality of life that contributes so significantly to the area's attractiveness and success.

Economic growth in a successful area such as Cambridge is dependent on investing in physical infrastructure capacity that addresses key issues such as housing shortages and a congested transport network, in line with the vision and relevant policies for the area.

2.2. The vision for Cambridge and South Cambridgeshire

The purpose of a vision is to set out a compelling “alternative future”, so that it inspires people to start taking practical steps towards achieving it. The Cambridge City Council (CaCC) Local Plan (proposed) sets out its vision for Cambridge and highlights the need for sustainable growth that offers opportunities for all citizens.

*“The vision for Cambridge is of a compact, dynamic city, located within the high quality landscape setting of the Cambridge Green Belt. The city will draw inspiration from its iconic historic core, heritage assets and structural green corridors, achieving a sense of place in all its parts, with generous, accessible and biodiverse open spaces and well-designed architecture. Building on the city’s reputation for design excellence, **Cambridge’s new development will be innovative and will promote the use of sustainable modes of transport, helping to support the transition to a more environmentally sustainable and successful low carbon economy.** The city will continue to develop as a centre of excellence and world leader in the fields of higher education and research, and will foster the dynamism, prosperity and further expansion of the knowledge-based economy, while **retaining the high quality of life and place that underpins that economic success.** It will also grow in importance as a sub-regional centre for a wide range of services. Housing provision in the city will be of a high quality and will support the development and enhancement of balanced and mixed communities through provision of housing of a mix of sizes and types, including a high proportion of affordable housing. **The Cambridge Local Plan 2014 seeks to guide and facilitate growth and the infrastructure required to support development, so that the city grows in a sensitive and sustainable manner.** This will ensure that the high environmental quality of the city is protected and enhanced and that future developments offer a full range of opportunities to all.”⁵*

The South Cambridgeshire Local Plan is consistent with the Cambridge Local Plan Vision.

*“South Cambridgeshire will continue to be the best place to live, work and study in the country. Our district will demonstrate **impressive and sustainable economic growth.** Our residents will have a **superb quality of life** in an exceptionally beautiful, rural and green environment”⁶.*

The Long Term Transport Strategy (LTTTS), which forms part of the Local Transport Plan, contains more details on the major transport schemes planned for the region, discussed in further detail in Section 5.4

As part of the transport strategy to deliver this vision, it is stated that there is a need to maximise potential for journeys to be undertaken by sustainable modes of transport including walking, cycling, bus and train.

In terms of public transport (PT), both the South Cambridgeshire and Cambridge Local Plans promote the accessibility of new housing development by High Quality Passenger Transport (HQPT), noting that new homes should be located close to employment centres or HQPT routes which have access to the City Centre and major employment centres. HQPT is discussed in more detail in Section 7.5.

This vision is articulated through a number of local economic, planning and development policies which are discussed in more detail in Section 7. In particular these documents are supported by the Transport Strategy for Cambridge and South Cambridgeshire (TSCSC) that sets out a detailed policy framework and programme of schemes for the area and is consistent with the Local Transport Plan 2011-2016 (LTP3). The TSCSC also supports the Cambridge and South Cambridgeshire Local Plans, outlining like transport infrastructure to deliver expected growth⁷.

⁵ CaCC. (2013). Cambridge Local Plan 2014: Proposed submission.

⁶ SDCDC (2013). South Cambridgeshire Local Plan: Proposed submission.

⁷ CCC. (2014). TSCSC

The vision set out in the TSCSC is:

“In the future, Cambridge and the surrounding area of South Cambridgeshire will be renowned for its efficient, accessible and sustainable transport system which will support a thriving and beautiful historic core, and provide efficient and networked links to and from the city, its major employment hubs, and the bustling villages and key centres beyond.

More and more people will walk, cycle or use community or passenger transport as the more sustainable option when travelling. This will help to reduce car traffic on key routes and protect the area’s distinctive character and environment while supporting continued growth of the area as an internationally important cluster for high tech industries and research and development.

There will be an extended network of dedicated passenger transport routes with fast and frequent links to and from key destinations. This will link up with community or local transport at hubs which will connect with some more rural parts of the area. An improved system of safe and direct cycle and walking routes will provide a viable alternative for journeys between key destinations. Information about sustainable travel options will be readily available and new technology will make this even easier to access. This enhanced accessibility will help to sustain and enhance the quality of life and wellbeing of residents.

Both the strategic and local road networks will operate efficiently and reliably, with most car traffic choosing to access the rural hubs or Park & Ride hubs. Accident clusters and congestion hotspots will be addressed and the impacts of congestion on the bus network will be reduced significantly. Although car trips to the City Centre will still be possible, they will be channelled along routes away from buses and cyclists. A frequent and reliable rail service with enhanced services and capacity to London, market towns and cities across the region will ensure that rail travel will continue to be a popular choice for a growing number of residents, commuters and visitors. The Science Park Station and improved City Station will provide links to St Pancras International, Stansted and Gatwick airports, to the European mainland, and to the rest of the UK. The Cambridge City Region’s profile as a thriving, attractive and accessible business destination will be further enhanced.”

The GCCD was set up to align for the wider visions of Cambridge and the wider Greater Cambridge area. The GCCD is an agreement to invest in infrastructure to stimulate growth between the government and Greater Cambridge partners – namely CaCC, South Cambridgeshire District Council (SCDC), CCC, the UoC and the Greater Cambridge, Greater Peterborough Local Enterprise Partnership (LEP).

The Cambridge and South Cambridgeshire Local Plans, and the TSCSC, present a clear and distinct overall vision that there is a need to ensure that growth takes place in a sensitive and sustainable manner and that development offers opportunities to all of its citizens. New development will promote the use of sustainable modes of transport and should seek to facilitate the infrastructure required to support growth. The transport system will encourage sustainable modes and will be centred on high quality “dedicated passenger transport routes with fast and frequent links to and from key destinations. There will be an improved system of direct cycling and walking routes. The visions indicates that car use will continue in the future, but that car trips will be on routes away from buses and cyclists.

3. The Greater Cambridge City Deal

3.1. Purpose and objectives

Since 2010, the government has pursued a policy of devolving increasing levels of powers and funding away from Whitehall and down to local / regional areas.

City Deals are a key part of the devolution process and a means for central government and local partners to agree key investment programmes and outcomes, especially around promotion of local economic growth and development.

The GCCD Assurance Framework establishes the key **strategic objectives** against which investment projects will be prioritised:

- To nurture the conditions necessary to enable the potential of Greater Cambridge to create and retain the international high-tech businesses of the future;
- To better target investment to the needs of the Greater Cambridge economy by ensuring those decisions are informed by the needs of businesses and other key stakeholders such as the universities;
- To markedly improve connectivity and networks between clusters and labour markets so that the right conditions are in place to drive further growth; and
- To attract and retain more skilled people by investing in transport and housing whilst maintaining a good quality of life, in turn allowing a long-term increase in jobs emerging from the internationally competitive clusters and more UoC spin-outs.

The SOBC will be assessed by GCCD Growth Partnership Members to ascertain the extent to which any transport investment meets the strategic objectives of the GCCD:

1. **How** do options **support business investment** and confidence?
2. **How** do options represent **targeted investment** where business needs it?
3. **How** do options **link effectively the key growth sites**?
4. **How** do options **support the transport infrastructure and quality of life**?

In addition the Assurance Framework sets out the requirements of Value for Money in which it states that, “Schemes with a **BCR of less than 2:1 will not normally be funded, unless wider appraisal evidence provides a compelling case for investment.**”

The document goes on to state that a compelling case may be:

*“...where a scheme is required to **unlock a barrier to growth, deliver wider economic benefits, environmental and or social/distributional impacts.** Where this occurs, scheme promoters will be required to justify the investment through provision of an evidence base and a proportionate quantitative analysis of benefits not included in the central benefit-cost analysis, and to demonstrate how these help deliver the policy objectives, to enable a comparative assessment of the Economic Case and comparison of the Value for Money with other schemes in the programme”⁸.*

Any proposed GCCD funded transport investment must provide clear evidence that it is able to meet the relevant objectives as well as delivering Value for Money.

⁸ GCCD Draft Assurance Framework

The City provides the framework through which up to £500 million of funding toward infrastructure is proposed to be invested in the region to “help Greater Cambridge to maintain and grow its status as a prosperous economic area” and toward achieving the following outcomes in support of economic growth:

- Accelerating delivery of **over 33,500 new homes** on a combination of major sites and rural exception sites in and around the city;
- Delivering **45,000 new jobs**, via a number of employment growth sites identified and in development around Cambridge to build on the city’s world leading science research business credentials; and
- **Improving transport infrastructure** to support this housing and employment growth while retaining the high quality of life in the region.

The last of these outcomes – improving transport infrastructure – is the focus of the Strategic Case for the Cambourne to Cambridge Better Bus Journeys Scheme. However, this investment also is clearly linked back to GCCD objectives, such as the delivery of new homes and jobs; linking growth sites; targeted investment and business investment and confidence. Businesses are more likely to invest in areas that are well connected and have a skilled and mobile workforce than an area that does not have these key attributes that development in Cambridge aspires to.

To that end, the GCCD has created an **investment fund** for the five year period 2015/16 to 2019/20 - which consists of £100 million from the government (£20 million per year). In addition, Greater Cambridge partners have pledged to invest over £500 million from a range of sources. Depending on the economic impact of this local investment, a “gain share” mechanism could potentially lead to an additional £400 million over a 10-15 year period.

It is essential the transport investment is targeted such that it delivers strongly against each of the GCCD objectives; improving quality of life and connectivity whilst ensuring business investment, confidence and the provision of more housing is encouraged in line with the Local Plans. In turn this could maximise the wider economic benefits that can be achieved through infrastructure investment.

3.2. The City Deal proposal

To meet the GCCD objectives it is essential that wider policy benefits are delivered as a result of investment in transport infrastructure. These benefits include those which accrue to businesses within an area, and result from transport interventions addressing capacity bottlenecks and improving connectivity between different spatial locations.

In order to deliver more jobs and economic growth, the Greater Cambridge city region has to accommodate new and growing businesses and research centres and house the people who work in them whilst ensuring ease of movement between the key economic hubs. Greater Cambridge also needs to connect new developments to each other, and to existing research institutes, science and business parks; to Cambridge City Centre and transport hubs, and to the Alconbury Enterprise Zone; to both universities and to residential areas.

To achieve this, the GCCD proposes an ambitious programme to enhance transport capacity in the area especially in areas where capacity is identified as an issue (Figure 3-1). This capacity is needed along key **strategic corridors** to and from the city (particularly along those corridors where significant new housing and / or employment growth is planned) as well as within the built up area of the city. Development of a sustainable transport network aims to improve access to employment hubs and high-tech clusters in Greater Cambridge by making movement between them more straightforward, efficient and convenient (Figure 3-2).

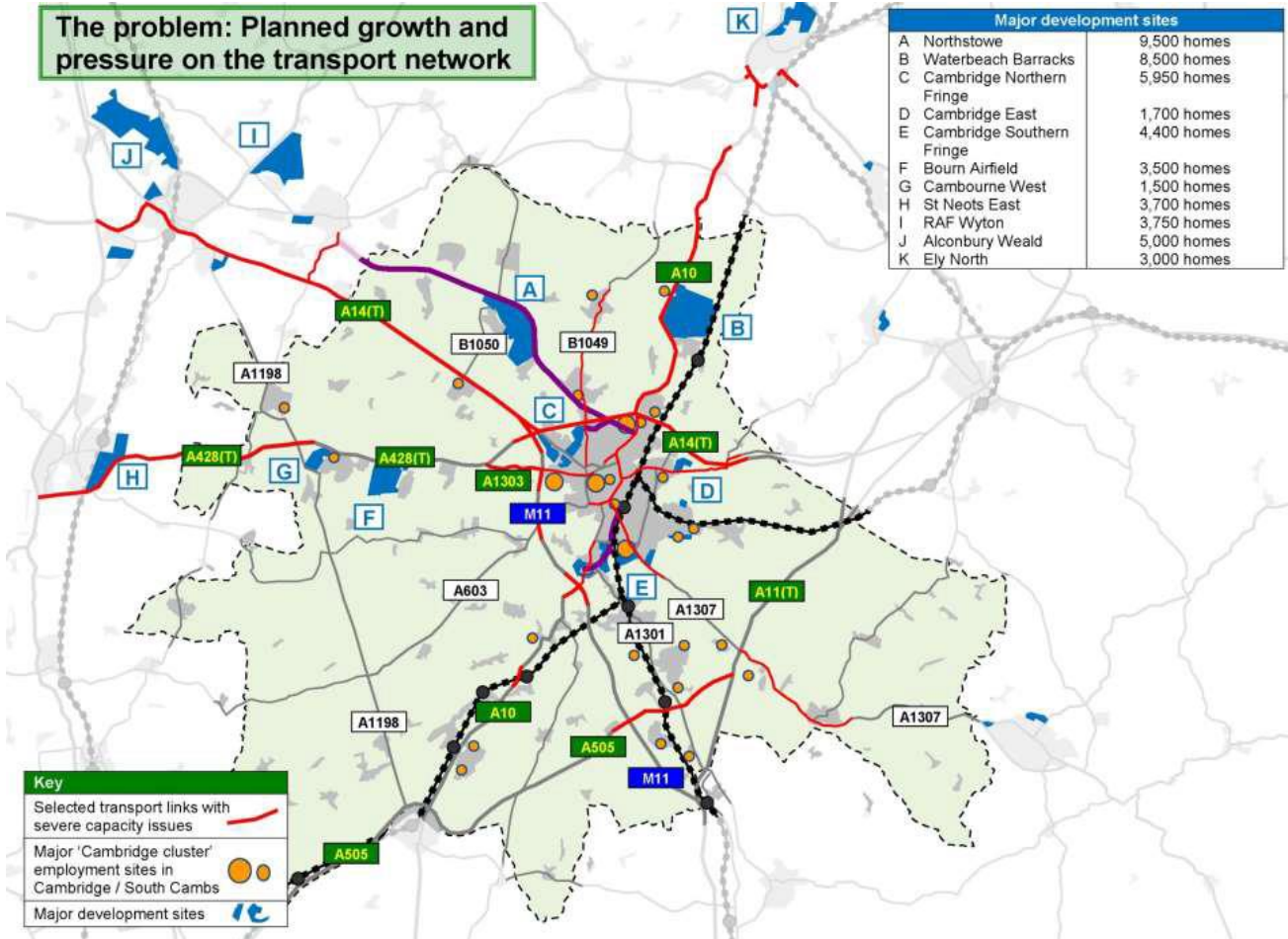
The backbone of the proposed strategy is a transport network to link areas of population and employment within the GCCD area, featuring:

- New orbital bus routes around Cambridge that taken together provide a wider variety of direct bus connections than would be traditionally possible under a traditional radial City Centre “hub and spoke” model;
- New HQPT links into Cambridge on key corridors, connecting existing and new housing developments with major employment centres;

- A comprehensive network of pedestrian and cycle routes within Cambridge; and
- The main radial routes will have high quality bus priority measures.

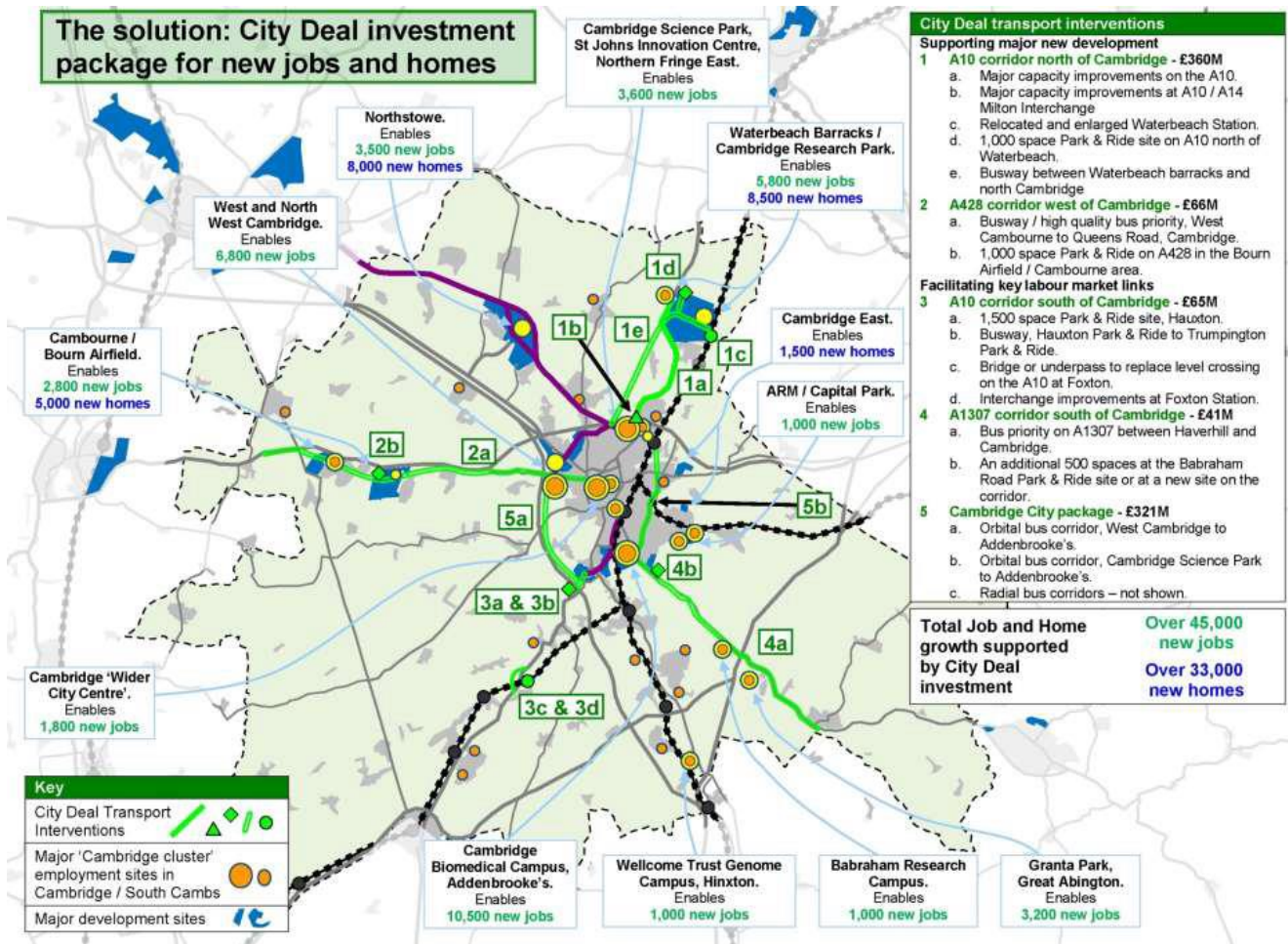
This strategy will transform connectivity within and beyond the GCCD area, and consequently allow significant increases in bus and cycle use that will maximise the **capacity for movement**, particularly within the historic core of Cambridge. This strategy also supports carbon reduction objectives and promotes high quality of life for local communities by minimising the environmental impact of transport whilst promoting the ability for the area to grow.

Figure 3-1 Planned growth and pressure on the transport network



Source: Greater Cambridge City Deal

Figure 3-2 GCCD Transport Investment package



Source: Greater Cambridge City Deal

There is a clear and coherent transport and wider economic investment strategy for Cambridge which is based on developing efficient and high capacity radial and orbital movement corridors. The A428 Western Corridor contributes to a much wider network of movement and connectivity, which if enhanced sufficiently to link growth sites and support transport infrastructure and quality of life, could support wider business investment and confidence and ensure investment is targeted where businesses need it.

3.3. Wider economic benefits

3.3.1. Introduction

An important aspect of a scheme business case is to capture any Wider Economic Benefits (WEBs) of transport investment. These benefits arise as a result of changes to transport system connectivity and capacity – both of which enable greater levels of mobility for people and goods in order to support increased economic activity. WEBs of transport investment are in addition to the direct transport user benefits.

The DfT WebTAG appraisal guidance identifies a number of potential Wider Economic Impacts of transport investment, including:

- Agglomeration – increases business density and interaction in a particular area;
- Output change in imperfectly competitive markets – as a result of changes to costs of transport to business; and

- Tax revenues arising from labour market impacts –through people gaining greater access to employment opportunities.

The appraisal of WEIs, that is the wider impacts of transport interventions on welfare at a national level, is quantified in the Economic Case and contributes to a scheme or option's adjusted Benefit Cost Ratio.

In addition to the WebTAG measure of WEIs, a further strategic economic appraisal of Wider Economic Benefits (WEBs) may be conducted to provide an initial assessment of the broader potential of a scheme to deliver WEBs. This is quantified through the change in Gross Value Added (£GVA) which is a measure of economic productivity.

A strategic economic analysis of the Cambourne to Cambridge Better Bus journeys Scheme was conducted by Mott Macdonald⁹. The analysis captures the indirect wider economic impacts at the Greater Cambridge and UK level deriving from land utilisation changes linked to the scheme and is discussed further in section 10.3.1 of this Strategic Case.

In principle, a scheme to improve bus infrastructure and services could result in delivery of WEIs through a number of mechanisms:

- Enabling a greater level of employment density – on the basis that buses can move many more people into an area that the private car (which requires more road space and car parking capacity than is often available);
- Reducing levels of traffic congestion resulting from the private car, and therefore freeing up road space for the more efficient (and cost effective) movement of goods; and
- Increasing the range of employment opportunities available to the work force, in particular for people who do not have access to a private car.

⁹ Mott MacDonald. (2016). *Strategic Economic Appraisal of A428-A1303 Bus Scheme. Wider Economic Benefits.*

4. Spatial context

4.1. Introduction

The general and geographic context is essential for understanding how potential transport improvements relate to existing and future spatial development patterns – in particular where people live and the destinations they need to get to for specific journey purposes such as employment, education and shopping.

This chapter sets out the geographic context of the A428 Western Corridor and focusses on a description of the corridor, its transport function and spatial context.

The corridor runs west-east from the A428 from St Neots to Madingley Mulch roundabout, and then onwards along the A1303 Madingley Road into Cambridge City Centre. However the corridor also covers a much wider area than the A428 and A1303 roads themselves, and also includes:

- The large development areas of Cambourne and Bourn Airfield immediately to the south and east of the A428 at Caxton Gibbet roundabout;
- The section of the old A428 from Caxton Gibbet roundabout to Madingley Mulch, that was bypassed by the dual carriageway; and
- Open countryside either side of the A428 and A1303 roads.

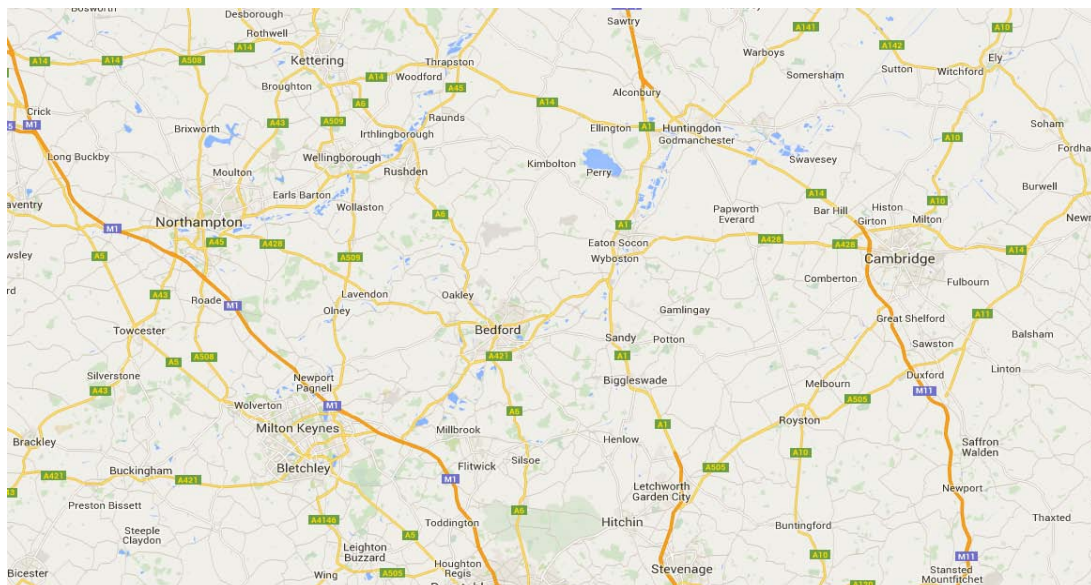
4.2. Corridor description

Describing how a corridor connects different places is essential for understanding travel demand and wider economic roles of the transport network.

4.2.1. A428 Road

The A428 is a road which runs broadly west to east for around 83 miles from Coventry to Cambridge. East of the M1 motorway, the route connects the county towns of Bedford, Northampton and Cambridge (Figure 4-1).

Figure 4-1 A428 strategic route (Northampton – Bedford – Cambridge section)



Source: Google Maps

The route runs broadly parallel to the M6 motorway / A14 Trunk Road corridor to the north. On several occasions, the A428 “multiplexes” with other roads, so that for a few miles it effectively becomes part of another route. For example between Bedford and St Neots, the A428 “disappears” and the route is either numbered as the A421 (for 11 miles between Kempston and the A1) and then the A1 (for around 1.5 miles).

The section of route between St Neots and Cambridge is classified as a Trunk Road and is managed by Highways England. The route (Figure 4-2) provides a second strategic west-east link between the A1 Trunk Road and Cambridge, as an alternative to the A14 further to the north. In conjunction with the A421, the A428 also provides a strategic link to the M1 motorway near Milton Keynes. At the Cambridge end, the A428 links to the Junction 14 of the M11 motorway and Junction 31 of the A14 Trunk Road, to the north west of the city.

Figure 4-2 A428 and A1303 in Cambridgeshire



Source: Google Maps

For around nine miles, from the Black Cat roundabout south of St Neots to Caxton Gibbet (Junction with the A1198), the A428 is single carriageway. Thereafter, for a further nine miles the road is dual carriageway as far as the Junction with the A14.

In 2014, the government announced proposals to dual the remaining single carriageway of the A428 to create a continuous “expressway” from Cambridge to Bedford and Milton Keynes, helping some of the UK’s fastest-growing towns and cities to work together, with a new strategic study considering the case for extending this expressway from Milton Keynes to Oxford.

4.2.2. A1303 Madingley Road

Access to Cambridge itself is along the A1303 Madingley Road (Figure 4-3), which intersects with the A428 at Madingley Mulch interchange to the west of the city.

As the A428 approaches the western edge of Cambridge it veers north to join the M11 and A14. The radial route into Cambridge continues eastbound as the single carriageway A1303 Madingley Road.

The first section of this route from Madingley Mulch roundabout to M11 Junction 13 is primarily in open countryside, with the American Cemetery being a prominent feature located immediately to the north. The inbound approach towards the Junction with the M11 motorway has a bus lane. The Junction with the M11 is limited movement only with south facing slip roads enabling entry towards London and exit from London.

East of the M11 Junction, the road enters the outskirts of the built up area of Cambridge with the existing Madingley Road Park & Ride site on the left. There are a large number of campus-style research facilities associated with UoC on the south side of the road, as well as sports fields / open spaces. At this point there is still very little direct frontage land use, although footways are present. Further into Cambridge this starts to change with houses and a number of UoC sites on both sides of the road. The presence of mature trees gives a very pleasant overall townscape. Once at the Junction with Northampton Street, the A1303 becomes part of the inner ring road and there is much more direct frontage development.

Figure 4-3 Madingley Road corridor from M11 to City Centre



Source: Google Earth

4.3. Route function

The function of a route describes the types of travel demand that are present – for both private vehicles using the highway and for PT (bus) services.

4.3.1. Highway

The corridor from St Neots to Cambridge has a number of transport functions, which can be summarised as follows:

- A nationally important strategic Trunk Road that provides a link between the A1 and M11 (towards the M25 and East London) and A14 (towards the port of Felixstowe);
- A very busy commuter route from traditional settlements to the west of Cambridge – notably Bedford and St Neots, as well as a large number of villages; and
- A significant growth corridor to support large scale additional housing development at St Neots, Cambourne and Bourn Airfield.

The TSCSC identifies the A428 Trunk Road as a nationally important route in the region. The government’s recent commitment to upgrade the western section of the A428 to dual carriageway is evidence of the route’s importance at a national level and for long distance trips. Within this context, the A428 also forms a key corridor at a local and regional level; and this has been recognised by The TSCSC’s designation of the “St Neots and Cambourne to Cambridge corridor”.

4.3.2. Public Transport

There is currently no railway line running east to west from St Neots to Cambridge and so PT is entirely based around bus and coach.

Stagecoach run a half hourly commercial coach service X5 directly along the A428 which links Oxford, Milton Keynes, Bedford, St Neots and Cambridge. The route has seen recent investment in new coaches and is an important strategic link between destinations across the East and South East of England.

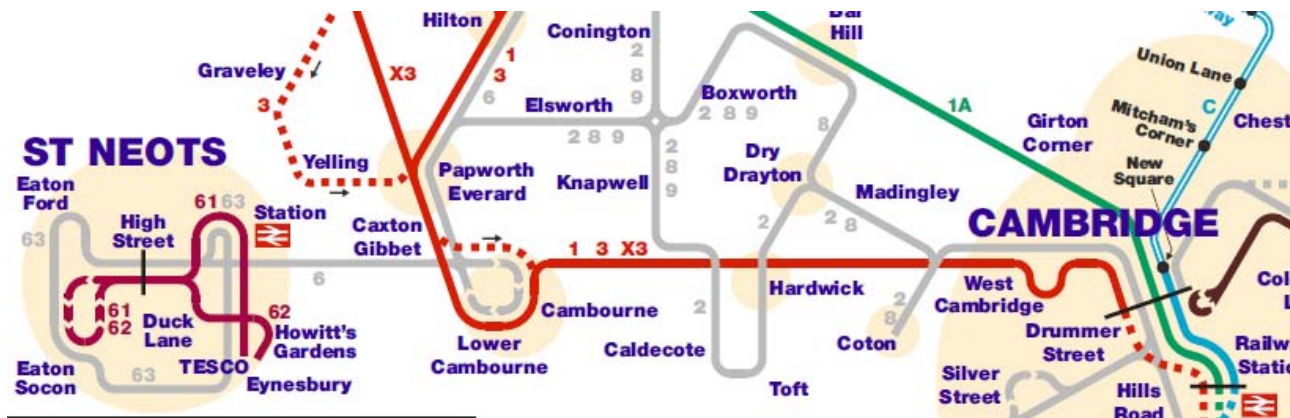
Local bus services are most frequent between Cambourne and Cambridge, with route 4 running every 20 minutes (along the old A428) when demand is greatest. The smaller villages generally have a much lower frequency service – which can range from one service per hour to only one or two per day. Local services are provided by two main operators – Stagecoach East and Whippet Coaches.

Figure 4-4 Stagecoach Bus Routes on A428 / A1303 corridor



Source: Stagecoach East

Figure 4-5 Whippet Coaches Bus Routes on A428 / A1303 corridor



Source: Whippet Coaches

At the western edge of Cambridge, the current Maddingley Road Park & Ride site provides a facility for people to drive and park their car before taking a bus into the City Centre. The Park & Ride service runs every 10-15 minutes depending on the time of day.

The A1303 Maddingley Road is a particularly important bus corridor as it provides onward access to various parts of the city – especially the centre. There is also a public bus service, operated with financial support from the UoC, which runs through the West Cambridge and Newnham areas and down to Addenbrooke's Hospital in the south of the city.

4.4. Development context

The development context sets out the location of the areas where people live and work, which is essential starting point for understanding travel demand.

4.4.1. Existing development

The A428 / A1303 corridor features two major settlements and a variety of smaller villages.

The market town of St Neots is located on the A1 road and East Coast Main Line and is therefore a very attractive location for commuters into London and Peterborough. The A428 also provides opportunities for commuting westbound towards Bedford / Milton Keynes and eastbound to Cambridge. Demand for housing in St Neots remained consistently strong even through the recent recession, and further significant housing development is planned.

Further east towards Cambridge, the new village of Cambourne has a different history. Twenty years ago, there was very little on the site of a settlement (population around 8,820 in 2012) that contains around 3,250 houses (2012 figures), a large business park, retail centre and the offices of SCDC. The settlement also has a strategic location at the Junction of the A428 and A1198. The former Ermine Street Roman Road, the A1198, is a locally important route which connects Huntingdon with Royston and onwards to north Hertfordshire.

Both north and south of the A428 there are a number of much smaller traditional villages located in an attractive landscape. The largest of these – Papworth Everard – is home to the world famous heart hospital, although this is moving to Addenbrooke's. Other larger village settlements include Gamlingay, Hardwick and Dry Drayton. All of these villages, which are attractive commuting locations for Cambridge, are not located directly on the A428 / A1303 corridor but are close enough to be considered as within its sphere of influence.

4.5. Context summary

Based on this review of the general and geographic context the key issues on the A428 / A1303 corridor are:

- The A428 performs both a nationally important strategic role as well as being a vital local access route into Cambridge from the west;
- The A1303 Madingley Road is an important radial access route into Cambridge City Centre;
- The whole corridor is an important bus route, especially from Cambourne to Cambridge;
- There is an important strategic opportunity to link the corridor to the Western Orbital proposal in order to improve access to the development areas to the south and avoid the congested City Centre.

5. Spatial, economic and environmental challenges

5.1. Introduction

Transport is not an end in itself and is instead a means of addressing a wider range of demographic, economic, spatial, social and environmental challenges. It is also often the case that in the existing situation, transport directly contributes to the problems in these wider policy areas.

This chapter considers the wider policy challenges being faced in the GCCD area and outlines how promotion of bus-based PT can help to address them.

5.2. Demographic challenges

Both the total population level and the mix of socio-demographic factors can strongly influence the demand for travel.

At the 2011 census, the Cambridge and South Cambridgeshire population totalled approximately 275,000. Population growth in Cambridgeshire as a whole from the 2001 to 2011 census was faster than in any other English county.

By 2031, now just 15 years away, the population is projected to increase by another 70,000 – to 345,000. This alone will significantly increase the demand for transport, even if the average person does not travel any further. In fact, there are also grounds for believing that average levels of travel could increase as well.

This increase in population by 2031 is forecast to be matched by:

- 33,000 extra houses;
- 40,000 extra jobs; and
- 27,000 of these being in research.

In overall terms, the result of these demographic trends will be more people who are travelling further and therefore placing significant additional pressure on the transport network and (in particular) areas of existing congestion on major road corridors such as the A428.

Bus services have a vital role to play in mitigating the potentially negative impact of these demographic trends by accommodating demand on PT rather than increasing private car usage.

5.3. Economic challenges

The level of economic development strongly influences demand for travel – traditionally, higher levels of economic growth and rising personal incomes lead to more car use in particular.

5.3.1. Introduction

The Cambridge area has historically been one of the most economically successful areas of the United Kingdom.

The Greater Cambridge Greater Peterborough (GCGP) Strategic Economic Plan (SEP) states that the area is one of the UK's fastest growing and most dynamic areas and makes a strong contribution to UK plc, in the form of £30 billion Gross Value Added (GVA) per annum. However, it is argued that transport infrastructure constraints represent a key challenge to supporting housing and employment growth and continued economic prosperity, in particular:

- Road and rail “bottlenecks” causing congestion and unreliable journey times;

- Limitations on the capacity of the rail network;
- Barriers to the delivery of housing for local workers;
- Limited PT in rural areas;
- East-west connectivity across the LEP area, and beyond;
- Potential for mode shift towards sustainable travel modes which are not fully realised; and
- Access issues in relation to Stansted and Luton airports as well as Heathrow and Gatwick.

The SEP states that these are current problems that will worsen without further investment – especially in transport.

Bus services make a valuable contribution to the UK and local economy. The University of Leeds Report *Buses and Economic Growth* estimates that 12% of the UK working population (accounting for £64 billion Gross Added Value) rely on the bus for commuting. People use the bus to make shopping and leisure trips to a value of £27.2 billion per annum; of which £21.5 billion is spent in town and city centres.

5.3.2. Use of road space

If they are well-used, buses are much more efficient in moving people (per unit of road space) compared with the private car.

The bus can be a relatively efficient means of using scarce road space. Table 5-1 shows the number of vehicles required to move a nominal 10,000 people one kilometre:

Table 5-1 Relative efficiency of private car versus bus

Vehicle	Theoretical Number of Passengers Per Vehicle	To Move 10,000 People 1 Kilometre		
		Number of Vehicles Required	Road Space Occupied (Square Metres)	Fuel Required (Litres)
Private car	5	2,000	24,000	200
Midi bus	25	400	8,800	120
Double Deck Bus	100	100	3,400	50
Articulated Bus	175	57	2,850	35

Source: Volvo Corporation

It can be seen that to transport 10,000 people, on the basis of the table above, using fully laden 100-seat double decker buses the road-space requirement would be around one-sixth of the road space required by private cars. Of course these are theoretical numbers and are not based on actual occupancy. However if each double deck bus carried only 20 passengers instead of 100, the additional number of vehicles required would occupy 17,000 square metres - still only 70% of the road space of the 2,000 fully occupied cars. If an average occupancy of 1.2 is used, the number of private cars increases to 8,333 and the road space occupied to 100,000 square metres. This would be nearly six times the road space occupation of the bus with 20 passengers.

This relative space efficiency is one of the most important benefits that any scheme to improve bus-based PT can bring. If there is to be an increase in travel demand as a result of housing and employment growth, there needs to be a transport system that makes the best use of what will always be limited road space.

5.3.3. Housing Growth

If people are to be attracted to work in an area, houses need to be both attractive to live in and affordable to buy or rent.

The most acute housing challenge in the GCCD area is one of affordability. The GCCD document notes that:

- The area's economic success and high quality of life have made it an attractive place to live and work;
- The shortage of available, and affordable, housing within a reasonable distance of key employment centres has driven an unsustainable increase in house prices, which in turn affects the recruitment and retention of talented employees; and
- Average house prices in Cambridge have increased 50% in the last eight years, and are now 9.2 times average salary compared to 6.7 for England as a whole.

In transport terms, the impact is likely to be an increase in commuting distances as people are forced to live in areas away from the city which are relatively cheaper. In many cases, the car is the most attractive or only realistic option for this commuting activity.

The GCCD proposes a number of pro-active approaches to significantly accelerate house building in order to tackle the affordability issue:

- Provision for a number of large strategic sites within Local Plans (including those within the A428 corridor at Cambourne and Bourn Airfield);
- A Joint Venture (JV) company to draw in land holdings from a range of partners in order to quickly deliver 2,000 affordable housing units for rent to locally-based employees;
- Early review of Local Plans to adapt to the changing market and infrastructure situation;
- Working with the Statutory Environmental Bodies and Department for Farming and Rural Affairs (Defra) to address environmental constraints to growth; and
- A streamlined and joined-up "one-stop-shop" approach to planning.

5.3.3.1. Planned future housing development

A number of key future housing developments could have an impact on demand on the A428 Corridor:

- Further development at Cambourne at Cambourne West will significantly expand the size of the settlement. In addition, a further new settlement is proposed on the site of Bourn Airfield.
- The North West Cambridge Development is the largest single capital project that the UoC has undertaken in its 800-year history. Outline planning permission was granted in February 2013 for the scheme, on the 150-hectare site of UoC farmland situated in between Huntingdon Road, Madingley Road and the M11.
 - The master plan includes 3,000 homes (50% key worker housing, available for qualifying UoC and Colleges employees), 2,000 post-graduate student spaces, 100,000 square metres of research space, a local centre and community facilities including a primary school, nursery, doctors' surgery, supermarket and retail units.

5.3.4. Employment growth

Employment growth in the GCCD area will be heavily dominated by high value jobs in both traditional and emerging sectors that are part of the continuing Cambridge success story.

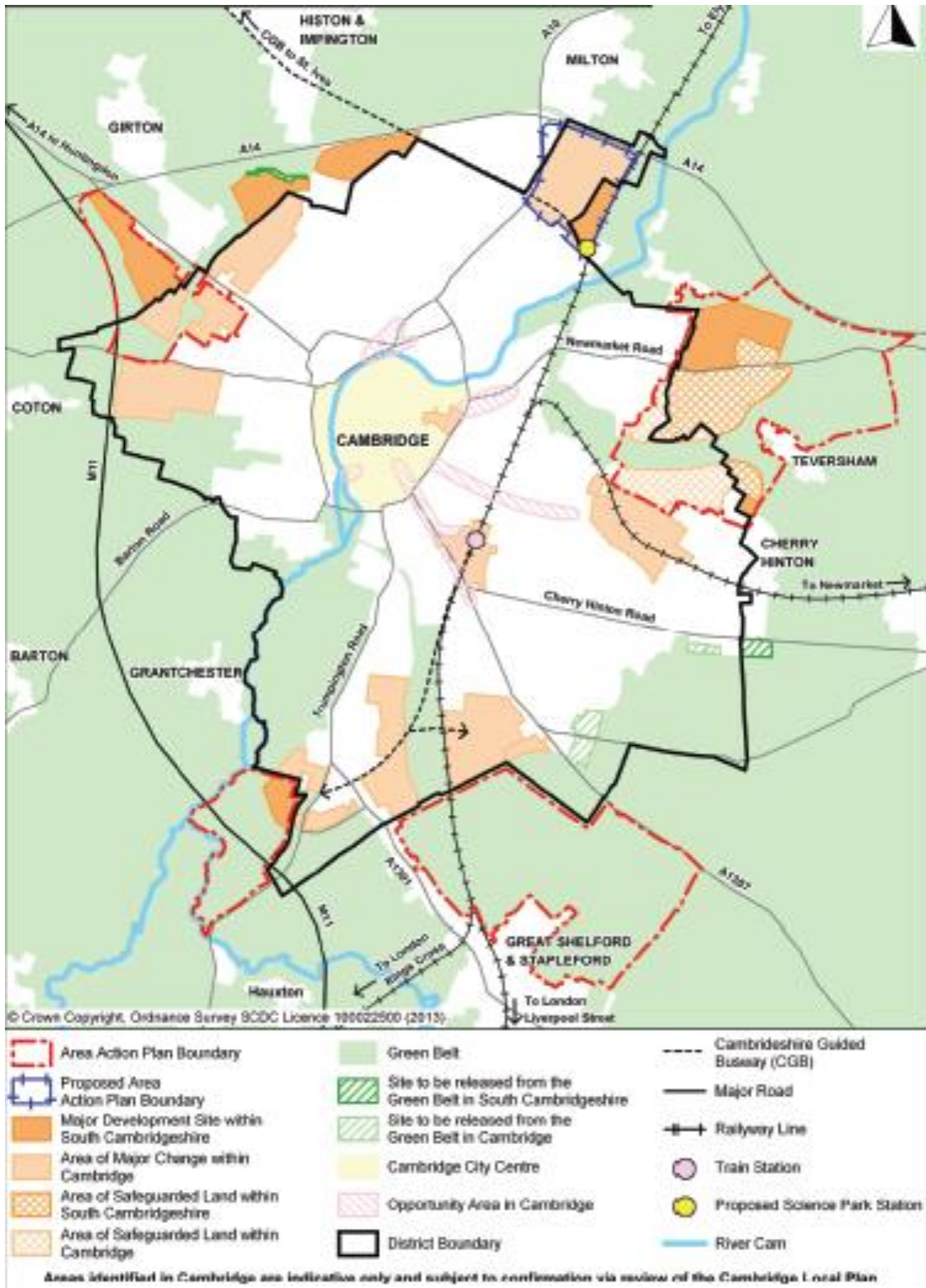
According to the CaCC Local Plan, the Council's aim is to ensure sufficient land is available to allow the forecast of 22,100 new jobs in Cambridge by 2031, including some 8,800 in B-use class (offices and industry). The plan seeks to deliver new employment land at six key locations in Cambridge:

- Area around Cambridge Station;
- West Cambridge;
- Cambridge Biomedical Campus (including Addenbrooke's);

- North West Cambridge (covered by the North West Cambridge Area Action Plan);
- Fulbourn Road; and
- Cambridge Northern Fringe East.

The challenge is that these jobs will be created on a range of sites outside of the traditional City Centre area of Cambridge (see Figure 5-1). This means that catering for travel demand by PT, which is strong on radial corridors into city centres, becomes more of a challenge.

Figure 5-1 Development sites in Cambridge and South Cambridgeshire



Source: SCDC Local Plan

Key employment sites on the A428 corridor include the West Cambridge “Area of Major Change” immediately south of Madingley Road, and a large development site at North West Cambridge to the north. However there are also large development areas to the north, east and south of the city which will necessitate cross-city travel by PT if they are to be accessible from the A428 / A1303 corridor.

5.4. Spatial challenges

The spatial challenge in the GCCD area involves finding suitable land to allocate for housing and employment development in particular.

In a historic city – surrounded by attractive countryside – it is a challenge to identify and progress suitable sites for new development.

In purely environmental terms, there are many considerations regarding the suitability of potential sites – which include impacts on landscape, water quality, flooding, heritage and biodiversity.

In transport terms, “suitability” is defined in paragraph 30 of the National Planning Policy Framework (NPPF):

“In preparing Local Plans, local planning authorities should therefore support a pattern of development which, where reasonable to do so, facilitates the use of sustainable modes of transport.”

In more specific terms, the NPPF states that Spatial Plans and individual decisions should take account of whether:

- Opportunities for sustainable transport modes have been taken up depending on the nature and location of the site, to reduce the need for major transport infrastructure;
- Safe and suitable access to the site can be achieved for all people; and
- Improvements can be undertaken within the transport network that cost effectively limit the significant impacts of the development (and development should only be prevented or refused on transport grounds where the residual cumulative impacts of development are severe).

The NPPF then states:

“Plans and decisions should ensure developments that generate significant movement are located where the need to travel will be minimised and the use of sustainable transport modes can be maximised. However this needs to take account of policies set out elsewhere in this Framework, particularly in rural areas.”

Within the context of the planned 19,000 new homes in South Cambridgeshire, some 8,880, are planned on major development sites along or adjacent to the A428 corridor, summarised in Table 5-2. This further highlights the importance of the A428 corridor in the region’s long term growth plans.

Table 5-2 Committed and future housing development on A428 corridor

Site	Total New Homes
St Neots East	3,700
West Cambourne	1,500
Bourn Airfield New Village	3,500
Comberton	90
Gamlingay	90
Total	8,880

Source: TSCSC

The Long Term Transport Strategy (LTTS) action plans for the Cambridge and South Cambridgeshire areas identify transport interventions needed to “directly support the delivery of major development allocations”, with specific reference to the Cambourne and Bourn Airfield sites (LTTS, p.37). The “necessary interventions” are shown in Table 5-3.

Table 5-3 Strategic developments and supporting transport infrastructure schemes

Development	Supporting Transport Infrastructure Scheme	Timescale	Cost (£m)
West Cambourne and Bourn Airfield	West Cambourne bus links. Segregated bus links from the A428 at Caxton Gibbet through the West Cambourne site, linking to Great Cambourne by the Cambourne Business Park and School Lane Lower Cambourne.	By 2020/21	20
	Bourn Airfield bus links. A segregated bus link from Cambourne to Bourn Airfield, and on through the development to the Junction of St Neots Road with Highfields Road.		
	Bourn Airfield to A428 / A1303 Junction bus links. Any measures necessary to ensure that a bus journey between Highfields and the Junction of the A428 and the A1303 is direct and unaffected by any congestion suffered by general traffic.		
	A1303 Bus priority measures, A428 to M11. On-line or off-line bus priority measures between the A428 and M11.	By 2016/17	9
	A1303 Bus priority measures, M11 to Queens Road, Cambridge. On-line bus priority measures between the M11 and Queens Road.	By 2018/19	24
	A1303 / A428 corridor outer Park & Ride capacity. One or more Park & Ride or rural interchange sites accessed from the A428, to take advantage of the bus priority measures on the A1303 between the A428 and the M11.	By 2016/17	8
	Wider Cambourne pedestrian / cycle network. Direct, segregated high quality pedestrian / cycle links to west Cambridge, Papworth Everard, Highfields, Hardwick, Caxton, Bourn, Caldecote, Comberton, Bar Hill and Dry Drayton.	By 2018/19	10
	A428 / A1198 Caxton Gibbet Junction improvements (see also Wintringham Park below). Scheme to be identified informed by Highways England's Midlands to Felixstowe Route Strategy. May be delivered as part of the A428 Caxton Gibbet to Black Cat dualling scheme.	To be determined	To be determined
	Mitigation of local impacts. Delivery or funding of any measures required to mitigate the traffic impact of the developments on Bourn, Caldecote, Toft, Comberton and Barton.	To be determined	To be determined
West Cambridge	A1303 Bus priority measures High quality segregated bus priority measures between the A428 at its Junction with the A1303 and Queens Road in Cambridge. Scheme includes: <ul style="list-style-type: none"> On-line or off-line bus priority measures between the A428 and M11. On-line bus priority measures between the M11 and Queens Road. 	By March 2018	25

Source: LTTS, CCC

5.5. Environmental challenges

The fundamental principle of sustainable development is that growth should not compromise the health of the natural and built environment on which we ultimately rely for our existence.

5.5.1. Introduction

In transport terms, environmental challenges can be divided into two types:

- Localised impacts; and
- Global impacts.

5.5.2. Localised environmental impacts

Localised impacts are those which are either directly attributable to vehicle movements or the infrastructure (primarily roads and railways) that supports them.

For vehicle movements the most significant impacts relate to air quality – from fossil-fuel powered units – and noise.

In air quality terms, PT schemes are considered to have lower environmental impacts because they are able to move a greater number of people per unit of pollutant emitted. If buses are able to avoid stop-start traffic conditions, then emissions of pollutants are likely to be lower. Furthermore, if bus priority schemes are able to reduce costs to operators then it is more likely that they can invest in more modern cleaner vehicles - perhaps as part of Quality Bus Partnership (QBP) arrangements.

For infrastructure the impacts are potentially very varied and, depending on the precise location, can include:

- Landscape (primarily in rural areas);
- Townscape (primarily in urban areas);
- Bio-diversity;
- Heritage;
- Flooding; and
- Water quality.

It is difficult to generalise about whether PT infrastructure schemes have greater or lesser impacts than those primarily concerned with private motor vehicles.

5.5.3. Global environmental impacts

Global environmental impacts do not necessarily directly affect an area where they are initially generated, but are collectively represent a huge challenge for the whole world because of their impact on the climate and dependent activities such as agriculture and resource use.

Global environmental impacts primarily relate to:

- Non-renewable energy use associated with infrastructure construction and usage by fossil-fuel powered vehicles; and
- Greenhouse Gas (GHG) emissions also associated with infrastructure construction and usage by fossil-fuel powered vehicles.

In both cases, promotion of PT services for the movement of people is generally considered to have greater environmental benefits. This is because the vehicles (buses, coaches and trains) should be able to move a greater number of people per unit of energy and GHG emissions.

In terms of infrastructure, the global environmental impact of constructing new transport alignments is related to the energy and GHG emissions associated with construction processes. The type of scheme – either road-based or PT is perhaps less relevant than the decision to build the infrastructure in the first place. The design and construction industry have various techniques available to minimise the overall global environmental impact of infrastructure delivery.

6. Transport problems to be addressed by the scheme

6.1. Introduction

The transport problems that can be addressed by a scheme are those that are experienced by users of the network on a regular basis and that can be a significant influence on demand for travel. Transport schemes are likely to offer better value to a wider range of transport users where they successfully address these problem areas.

The Cambourne to Cambridge Better Bus Journeys Scheme aims to tackle a range of transport problems that are specific to the route, as a means of making a significant contribution to addressing wider problems across the GCCD area. In doing so there could be an opportunity to satisfy the wider objectives of the GCCD.

These transport problems are summarised as follows:

- High demand for motor vehicle (especially car-based) travel resulting in significant current and forecast levels of traffic congestion;
- Bus services on the A428 corridor do not provide an attractive alternative to car travel;
- Complex and diverse travel patterns of network users in Greater Cambridge;
- High levels of car-dependency, especially in the more rural areas away from the A428 corridor;
- Lack of direct and continuous cycle routes from existing villages and future developments into Cambridge; and
- No clear and consistent approach to demand management for car-based travel.

Each of these problems has a number of root causes which (as far as is possible) the scheme needs to tackle and resolve. Furthermore these problems are very much inter-linked and therefore need to be tackled in an integrated way. For example, high demand for car-based travel in any location is at least partly a function of the lack of a viable alternatives that are as or more attractive as the car to offer a viable alternative. In this context high levels of car use may be an indicator that PT alternatives are not sufficiently attractive to encourage mode shift and that there may be insufficient demand management to discourage car use and encourage the use of PT and active modes.

Moreover each of these issues could be considered to be general barriers to achieving the GCCD Objectives (Section 3) which seek to improve connectivity to key growth sites, support transport infrastructure and quality of life and in doing so support business investment. Where congestion is high and the complex and diverse travel patterns of the area are not sufficiently connected, then this could hinder movement between growth locations and businesses as demand increases if it is not managed.

6.2. High demand for motor vehicle travel

Private cars, vans and Heavy Goods Vehicles (HGVs) currently constitute the most significant elements of travel demand in virtually all areas of the United Kingdom.

6.2.1. Current demand

Current demand provides the “baseline” against which all future development and transport scheme proposals are judged.

As an economically successful area, there is already a very high demand for motor vehicle travel in Cambridge which is leading to increasing levels of congestion and delay.

The 2014 Traffic Monitoring Report for Cambridgeshire found that:

- Traffic density on Cambridgeshire’s rural trunk A roads is almost twice the national average;
- The highest growth since 2002 on trunk roads within the County has occurred on the A428 (25%) which is related to the development of Cambourne.

Average Annual Daily Traffic (AADT) flows on the A428 and A1303 corridor are summarised as follows in Table 6-1.

Table 6-1 Average annual daily traffic on A428 and A1303

Location	Pedal Cycle	Motor Cycle	Car and Taxi	Bus and Coach	Light Van	HGV	All
A428 east of St Neots	2	69	12,491	34	2,448	1,601	16,643
A428 east of Caxton Gibbet	8	111	21,580	167	3,446	1,800	27,104
A1303 American Cemetery	257	221	12,323	151	1,394	436	14,524
A1303 east of Park & Ride	354	142	11,881	487	1,646	277	14,434
A1303 west of Park & Ride	357	144	12,000	492	1,663	279	14,578

Source: Average of Last Five Years Available Data from DfT

The dual carriageway section of the A428 has a traffic flow which is nearly two-thirds higher than the adjacent single carriageway section, although modelling indicates that this section has sufficient capacity to accommodate increased demand from currently planned growth. There is capacity for additional housing growth along this section of the corridor, which is likely to materialise in the future and this may lead to additional travel demand on the corridor compared with the current model assumptions. The A1303 Madingley Road is currently very busy for an urban route and congestion here is indicated to be an issue.

Cars and taxis make up the majority of motor vehicle traffic at all the locations – between 75% and 85% of the total. The numbers of HGVs and light vans are higher on the rural sections of the A428, reflecting its use as part of the Strategic Road Network (SRN). The flows for pedal cycles and buses / coaches are much higher on the A1303 into the urban centre of Cambridge.

The 2014 Options Appraisal Report (OAR) has summarised evidence of current problems on the corridor using data from Trafficmaster:

- A428 between Caxton Gibbet and St Neots shown to have high journey time variability, with delays of up to 10 minutes eastbound in the AM Peak and 3 minutes in the PM Peak period as a result of:
 - Congestion at A1198 / A428 Junction when travelling eastbound;
 - Congestion at Junctions to the east and south of St Neots when travelling westbound; and
 - General capacity as a result of single lane in each direction.
- The A1303 approach into Cambridge is shown to have greater levels of variability and congestion, with delays of up to 18 minutes travelling in to Cambridge in the AM Peak, and 4 minutes travelling westbound in the PM Peak. The problem arises from the combination of two significant traffic streams at the A1303 / M11 Junction as well as downstream junctions entering Cambridge itself when travelling eastbound, with up to 80% of the route experiencing queuing in the AM Peak. A further factor is the interaction of traffic entering and leaving the well-used Madingley Road Park & Ride site, with the signalised junction here contributing to variability and delay. This combination of different streams of traffic leads to the greatest level of flow between M11 Junction 13 and the Park & Ride site, with peak direction traffic flows of up to 1,200 vehicles per hour.

6.2.2. Future forecast demand

Future demand forecasts are based on both changes to demand as a result of economic growth and also changes to the supply of transport infrastructure.

Future traffic forecasts in the Cambridge area indicate a significant increase in demand for travel, which will exacerbate existing problems east of Maddingley Mulch roundabout.

The OAR sets out Cambridge Sub-Regional Model (CSRМ) forecasts. The key conclusions are:

- Car trips on the A428 corridor towards Cambridge are forecast to increase by 45% in the AM Peak hour; 70% in the Inter-peak period; and 50% in the PM Peak period between 2011 and 2031;
- The model also predicts that traffic flow levels on Maddingley Road will remain relatively unchanged in the AM Peak as the road is already at capacity and therefore unable to accommodate additional traffic;
- It is expected that congestion in the corridor will increase as a result of these traffic increases. Maddingley Rise is currently at saturation point in AM Peak, so queues would get worse on upstream sections with adverse impacts on journey times;
- A proportion of residents of Bourn and Cambourne may work locally or travel to work by car; and
- Car is likely to continue to be the dominant mode of transportation, with most of the households forming in Bourn and Cambourne having high levels of car ownership.

The OAR also highlights a number of other possible threats:

- 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;
- Growth that is likely to occur adjacent to Maddingley Road will also become more difficult to serve, particularly by Park & Ride; and
- Should development to the south of the City also intensify, these areas are currently not served well by PT from the A428 / A1303 corridor, and are limited in their potential due to a lack of orbital routes that can be utilised to provide a high quality service.

6.3. Car dependency

The study area is subject to high levels of car ownership which, in the absence of viable alternatives, is likely to exacerbate levels of traffic and congestion still further.

Once people invest often substantial costs in the purchase of a car, there is a great temptation to use it as much as possible and even when buses provide a viable alternative. Lack of demand means that the ability for operators to provide commercially viable bus services could also be undermined – which reduces choice for people who do not have access to a private car.

The 2011 Census shows that:

- 85% of households have access to a car compared with the national average of 74%;
- 42% have access to more than one car; and
- High car ownership is matched by high levels of employment, with an unemployment figure of 2.3% compared to the national average of 3.2%, with a bias towards highly skilled occupations.

There are a number of key employment areas within the City Centre including the UoC 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:

Table 6-2 Mode split for Travel to Work

Area	Car Driver (%)	Bus (%)	Walk (%)	Cycle (%)
Upper Cambourne	61.7	4.7	3.6	2
Lower Cambourne	64.8	3.1	3.5	0.9
Eynesbury, St Neots	45.1	1.1	11.0	4.4
Eaton Socon, St Neots	65.5	1.6	4.7	2.9
St Neots centre	34.3	10.4	14.2	3.8
Hardwick	58.3	8.5	2.8	3.6
Comberton	41.7	3.1	1.8	7.0
Madingley Road, Cambridge	17.3	4.1	12.4	22.6

Source: 2011 Census (Datashine)

The new settlement of Cambourne is particularly car-dominated – which illustrates the challenge in delivering mode shift in these types of locations and, therefore, the solution needs to provide a viable alternative to the car. In contrast, parts of the established settlement of St Neots have relatively high levels of non-car mode use. On Madingley Road in Cambridge, the levels of cycling are far higher than bus use and even exceed levels of car travel.

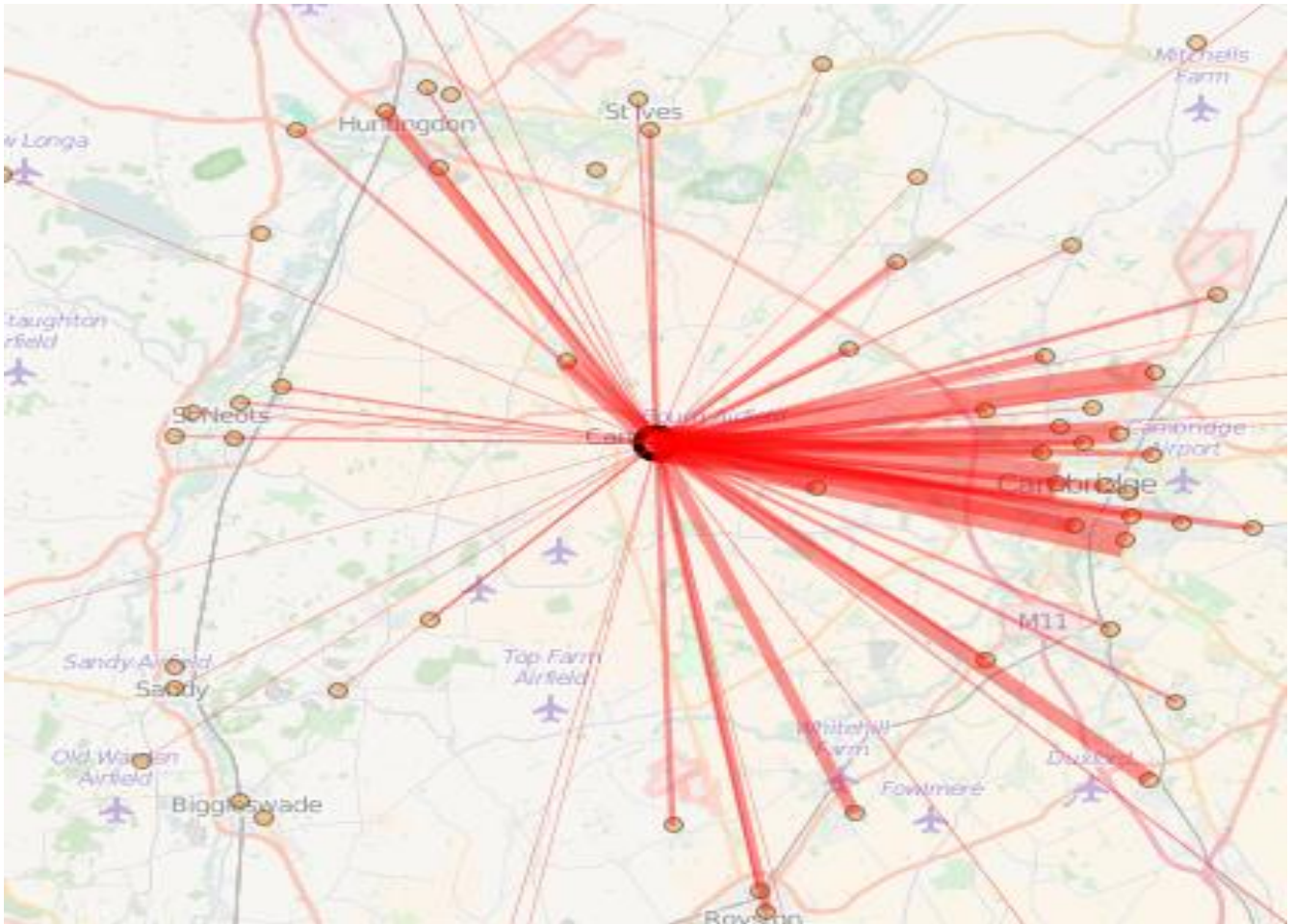
6.4. Complex and diverse travel patterns

Travel patterns describe where people wish to travel from and to, and they are crucial in determining the options for choice of travel mode.

In addition to the current and future forecast demand, origin to destination travel patterns are a key challenge. Private cars are inherently flexible and can be driven between any two points where a road exists. Bus services are likely to be most attractive for origin to city centre movements, and as a result tend to follow fixed routes without the same degree of flexibility. Therefore a particular challenge for developing attractive and commercially viable bus services comes when there are significant multiple destinations across an urban area. Figure 6-1 shows how car commuting from Cambourne has a wide variety of destinations within the city of Cambridge itself (which has the majority of the travel demand). The car gives commuters the flexibility to travel to any employment centre in the area. In contrast, Figure 6-2 shows that there are only four destinations for bus commuting from the same origin, with the City Centre being the main reported work destination.

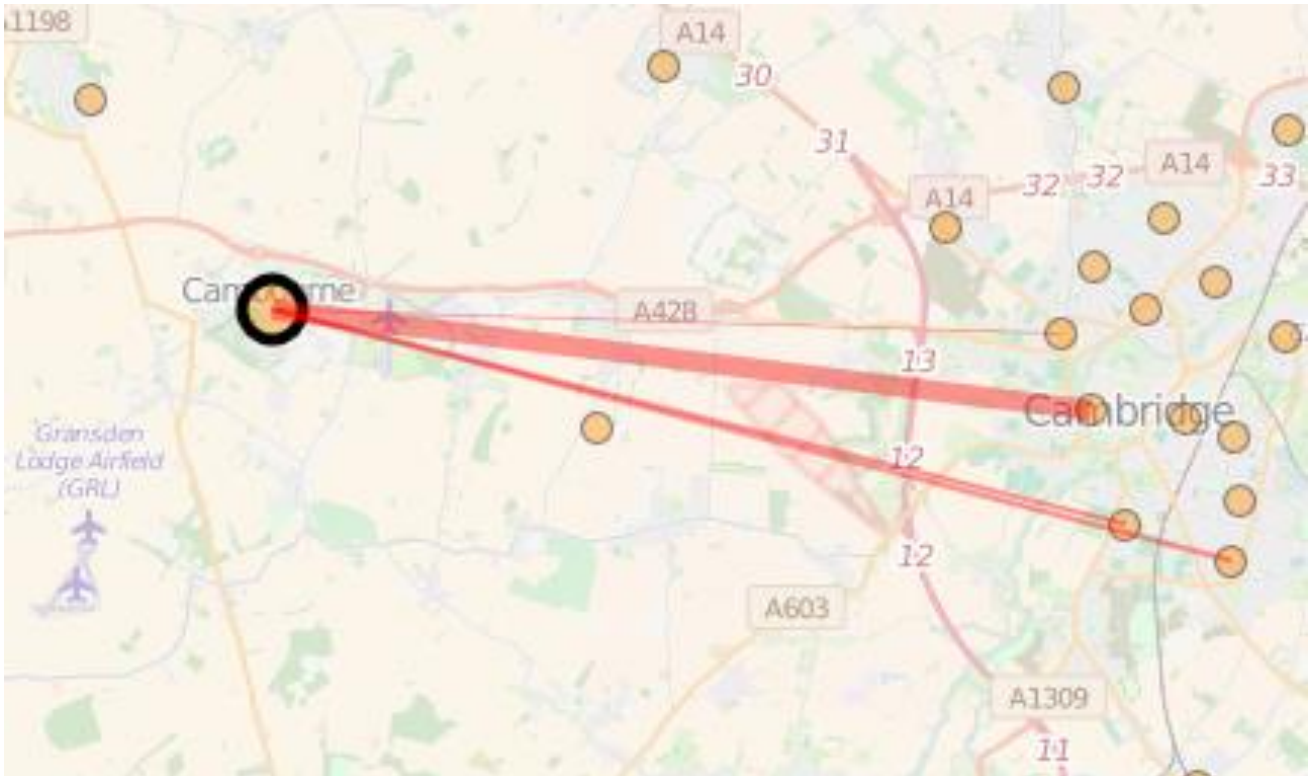
Therefore the challenge is to plan and design bus infrastructure and services that, as far as possible, provide journey options for a wider range of destinations within Cambridge – especially towards the north and south of the city where significant additional development is planned. This presents a key opportunity for future development to better connect growth areas to key employment centres, in line with the GCCD objectives.

Figure 6-1 Travel to Work destinations from Cambourne by car



Source: 2011 Census (Datashine Commute)

Figure 6-2 Travel to Work destinations from Cambourne by bus



Source: 2011 Census (Datashine Commute)

6.5. Bus service attractiveness

Since the 1960s numbers of passengers on bus services in the UK have declined as use of the private car has increased, although there is growing evidence to suggest that this trend can be tackled.

In order to provide a service which is likely to be attractive to people who have access to a private car, a frequent and fast HQPT service is required. Where demand is greatest, HQPT services seek to provide services frequencies that allow a passenger to “turn up and go” – which means a minimum of a bus every 10 minutes in the peak. Journey times (including walking elements at either end and the wait at the stop) need to be comparable with those of the private car. Most importantly, services need to provide reliable and consistent journey times – day in and day out.

Table 6-3 sets out the frequencies of buses which use the A428 corridor:

Table 6-3 Highest bus service frequencies for A428 corridor

Number	Routing (<i>Non A428 / A1303 Corridor Sections in Italics</i>)	Highest Corridor Frequency	
		Monday-Friday	Saturday
1	<i>St Ives – Papworth Everard</i> – Cambourne – Hardwick – Coton – Cambridge	1 per day	0
2	Boxworth – Highfields - Hardwick – Madingley – Coton – Cambridge	1 per day	0
3	<i>Huntingdon – Papworth Everard</i> – Cambourne – Hardwick – Coton – Cambridge	2 per day	1 per day
X3	<i>Huntingdon – Papworth Everard</i> – Cambourne – Hardwick – Coton – Cambridge	1 per hour	6 per day
4	Cambourne – Hardwick – Coton – Cambridge	3 per hour	3 per hour

Number	Routing (<i>Non A428 / A1303 Corridor Sections in Italics</i>)	Highest Corridor Frequency	
		Monday-Friday	Saturday
18	Cambourne – Bourn – Comberton - Cambridge	1 per hour	1 per hour
X5	<i>Oxford – Milton Keynes – Bedford - St Neots – Madingley Road</i> PARK & RIDE – Cambridge	2 per hour	2 per hour
Red	Madingley Road PARK & RIDE – Cambridge City Centre – Newmarket Road PARK & RIDE	6 per hour	6 per hour

Source: CCC

With the exception of routes 4, X5 and the Madingley Road Park & Ride, bus services are low frequency - one per hour or significantly less in some cases. Only the Park & Ride attains a “turn up and go” frequency of one bus every 10 minutes.

In the absence of substantial bus priority along the route, the congestion and delays experienced by existing bus services mean that buses offer no competitive advantage over private cars in terms of journey times and reliability. Table 6-4 shows that scheduled peak hour journey times from Cambourne in particular are very slow – taking over an hour for a journey of around 10 miles. This is partly due to the length of time that the bus takes to traverse the roads within Cambourne. However, the impact of peak hour congestion into Cambridge City Centre is the major reason in the variation between the peak and off peak periods. Interestingly, the X5 limited stop service from St Neots has a much lower journey time than the Cambourne services. Perhaps most surprisingly, there is no variation in the peak and off peak times for the Park & Ride service.

Table 6-4 Monday to Friday Peak and Off Peak bus journey times (most frequent routes)

Number	From / To	Peak (Minutes)	Off Peak (Minutes)	Variation (Minutes)
3 / X3	Cambourne to Cambridge	77	52	25
4	Cambourne to Cambridge	73	53	20
X5	St Neots to Cambridge	55	43	12
Red	Madingley Road Park & Ride to City Centre	12	12	0

Source: CCC

The main highway pinch points for buses are along the A1303 Madingley Road into Cambridge, particularly between the A428 and the M11 adjacent to the existing Park & Ride site.

The Options Assessment Report states that the existing Park & Ride site on Madingley Road close to M11 Junction 13 has shown consistent growth in patronage. Surveys suggest that the facility captures up to 45% of “in-scope” traffic passing the site. This indicates that the Park & Ride is attractive to car drivers because it provides both a fast and reliable journey into the City Centre, which is not the case with bus services that come from the Cambourne area and beyond. There are however increasing difficulties in accessing the Park & Ride site due to existing congestion on the adjacent highway network.

A key factor that may be a barrier to improved services is the limited priority for bus services, with a short bus lane on the approach to M11 Junction 13 being the only significant measure along the corridor. PT therefore is not able to offer a significant journey time and reliability benefit compared to car travel on the highway network.

Moving forward, commercial bus operators will only be able to provide fast, frequent, reliable and high capacity services if they are given priority over other traffic and protection from congestion. Back in 2005, the then Commission for Integrated Transport (CfIT) identified series of factors which could impact upon the ability to deliver a mass transit scheme and / or which could affect its operational viability (Table 6-5).

Table 6-5 Local context for Mass Transit schemes

Factor	Key Issues
Problems	<p>Could include:</p> <ul style="list-style-type: none"> • High levels of current or forecast demand between identified origins and destinations, or on key corridors; • Severely congested sections of the highway network, resulting in unreliable journey times or large delays; • Need to encourage mode shift and reduce car use; • Need to encourage regeneration or redevelopment; • Need to cater for development pressures in a sustainable way; • Congestion of rail infrastructure; • Identification of air quality problems; • Identification of accessibility problems; and • Need to make more effective use of existing railway routes.
General policy objectives	<p>Could include:</p> <ul style="list-style-type: none"> • Reduction of PT travel time to and from the city centre; • Increased highway journey time reliability; or • Improved accessibility to the city centre
Scheme specific policy objectives	<p>Examples:</p> <ul style="list-style-type: none"> • Reduce average PT journey time by x% in a corridor / area; • Achieve mode shift of x% in a corridor / area; • Provide capacity of x number of passengers per hour (pph) in the corridor / area; • Improve accessibility in area x; • Result in an overall reduction in identified air quality pollutants; • Provide a maximum 10 minute headway on all corridors; • Allow for system variability and functionality e.g. accommodate feeder services and Park & Ride; • Ensure scheme flexibility to cater for changing demand patterns; and • Ensure implementation in the short-term.
Contextual factors	<ul style="list-style-type: none"> • Policy context - the technical and political environment in which mass transit must perform in terms of influences upon travel demand and the policies in relation competing transport modes such as private car; • Competition environment – such as degree of regulation and integration, noting that the majority of patronage for new mass transit systems is typically drawn from existing PT; • Public / political acceptability – including economic, environmental and physical impacts on communities / businesses (both during construction and when operational); • Physical impact of geography and topography on catchments; and • Ability / need to upgrade the system / infrastructure in response to increases in demand as a result of development proposals for example.
Physical opportunities and constraints	<p>These could include:</p> <ul style="list-style-type: none"> • Space (width) necessary to construct system whilst mitigating impacts of properties or environmental assets in close proximity; • Opportunities for physical segregation of the mass transit services (for example through disused rail corridors or within highway boundaries); • Built environment – where there are environmentally sensitive areas or potential conflicts with other transport system users; • The potential impact on, and need to divert, other types of physical infrastructure such as utilities (gas, water, electricity, fibre optic cable etc.);

Factor	Key Issues
	<ul style="list-style-type: none"> • Street geometry and topography which can impact on issues such as manoeuvrability and braking distances; • Ability to construct the system within a constrained urban environment which has significant pressure on space; and • Severance impacts on routes used by vulnerable road users in particular.

Source: Commission for Integrated Transport (2005)

This table provides an excellent summary of the issues and for the most part they are highly relevant to the A428 / A1303 corridor and the urban area of Cambridge. Therefore it is important that the scheme options – and the preferred option – address these in order to ensure that a wide range of benefits can be achieved by implementation of any new scheme.

The Cambridgeshire Guided Busway is leading the way in developing an attractive HQPT product and the following conclusions from ex-post surveys are particularly relevant for aspirations on the A428 / A1303 (Table 6-6). These characteristics should be incorporated into the future design of an optimal solution.

Table 6-6 Conclusions for ex-post-evaluation of Cambridgeshire Guided Busway

Evaluation Topic	Key Conclusions
User characteristics of the Busway	<ul style="list-style-type: none"> • 83% working age (16-64) • 51% from £20k-£50k income group • 80% from car available households
Distance home to stop	<ul style="list-style-type: none"> • 60% within 1km • 10% more than 5km
Frequency of use	<ul style="list-style-type: none"> • 44% daily • 22% 2-3 times per week
Journey purpose	<ul style="list-style-type: none"> • 40% commuting • 20% education • 19% shopping • 6% healthcare
Type of passenger	<ul style="list-style-type: none"> • 20% concessionary passes • 80% paid a fare
Car availability	<ul style="list-style-type: none"> • 48% had a car available as a driver • 14% had a lift available
Previous mode	<ul style="list-style-type: none"> • 75% previously used bus • 24% changed from car as driver • 13% changed from car as passenger
Passenger attitudes	<ul style="list-style-type: none"> • Busway service is comfortable (91%) • The Service frequency suits my travel needs (90%) • The experience is pleasant because the bus doesn't stop very often (85%) • I find the Real Time Information useful (83%) • The Busway halts / stops are pleasant places to wait (81%) • The arrival time at my destination is more reliable than using a car (78%) • I like having the choice of Stagecoach or Whippet (74%) • The Busway is quicker than using a car (74%) • The ability to drive and park my car at The Busway is useful to me (64%) • The ability to cycle/be dropped off at The Busway is useful to me (63%)

Evaluation Topic	Key Conclusions
	<ul style="list-style-type: none"> • The availability of free WiFi on the bus is useful to me (60%) • I appreciate the ability to productively use my time on the bus (60%) • Car parking charges encourage me to use the Busway (59%)

Source: Cambridgeshire Guided Busway: What the People Think, Dr Alan Brett, Atkins

6.6. Cycling

Cycling is one of the healthiest and space-efficient modes of transport and is particularly attractive for shorter journeys within urban areas.

Walking and cycling provision is provided locally to Cambridge, including off-road routes to Coton and between Hardwick and Caldecote. However cycle routes do not extend along the entire length of the corridor, meaning that there is no connection between the new development sites at Cambourne and Bourn Airfield and Cambridge. This may partly explain the very low levels of cycling for journeys to work referred to above.

Other than the former A428 St Neots Road, there are no minor roads running west to east between Cambourne and Cambridge. There is the potential to cycle along St Neots Road, although it may still not be desirable for the less confident cyclist without any dedicated provision.

Therefore, cycling is not currently seen as a viable option for many people living along this corridor, despite their proximity to major retail, employment and healthcare destinations in Cambridge.

6.7. Contribution of the scheme to addressing the problems

The Cambourne to Cambridge Better Bus Journeys Scheme reports on options that aim to improve bus infrastructure and services on the corridor in order to improve connectivity, address the current high levels of car dependency and accommodate the forecast increases in traffic as a result of growth.

The vision for the A428 / A1303 corridor is to deliver a HQPT service which will feature:

- At least four buses per hour between Cambourne and Cambridge City Centre throughout weekdays and Saturdays;
- A fast, frequent and reliable peak hour journey time between Cambourne and Cambridge City Centre; and
- A direct service between the A428 / A1303 and the south of Cambridge in conjunction with the Western Orbital proposal.

The aim is to replicate the success of the Cambridgeshire Guided Busway which has taken only three years to meet the initial forecast of 3.5 million trips per annum.

6.8. Consequences of not implementing the scheme

Whilst not implementing a scheme is always an option, there are potentially undesirable consequences which need to be considered.

If the Cambourne to Cambridge Better Bus Journeys Scheme is not implemented, and there is a continuation of high levels of car use, there are likely to be a number of potentially undesirable consequences:

- As housing and development progresses, people will feel they have little choice but to travel by car – especially for journeys to work;

- Developments on the corridor will therefore become locked into a cycle of car dependency and low use of other modes;
- HQPT will not be a reality and services will not be able to offer the speed, quality and reliability necessary to deliver a significant and sustained modal shift;
- Traffic growth and congestion will continue to increase, and people will spend more of their time stuck in traffic rather than doing something much more productive;
- These direct economic costs to users could also have indirect economic costs by making the area less attractive in which to live and work; and
- In some instances new development could be considered as unviable or unsustainable.

It is sometimes assumed that car usage and economic growth automatically go hand in hand. However there are locations in the world where high car dependency is correlated with very poor economic performance and a low quality of life – for example the American city of Detroit. There are also cities – for example the Swiss city of Zurich – where very high PT usage coincides with strong economic growth and a high quality of life. In economic terms, Cambridge clearly has far more in common with Zurich than Detroit. The challenge will be to use HQPT provision on the A428 corridor to move the PT system into the same league and therefore deliver sustainable and high value economic growth.

7. Scheme Objectives

7.1. Introduction

The definition of objectives is an essential part of any Strategic Case, as it provides a clear set of outcomes which a scheme has to meet in order to address current challenges and deliver the future vision.

Furthermore, definition of objectives in terms of “spatial units” – such as areas or corridors - ensures that schemes also focus on wider outcomes and not those simply related to transport infrastructure or services. It is essential that potential beneficiaries of schemes – transport users and local communities in particular - are explicitly recognised in the scheme objectives.

This chapter firstly reviews objectives from a range of documents and outlines how the Cambourne to Cambridge Better Bus Journeys Scheme is able to meet them. Secondly, the scheme specific objectives are discussed with reference to the previous technical work undertaken by CCC and Atkins.

7.2. High level and planning objectives

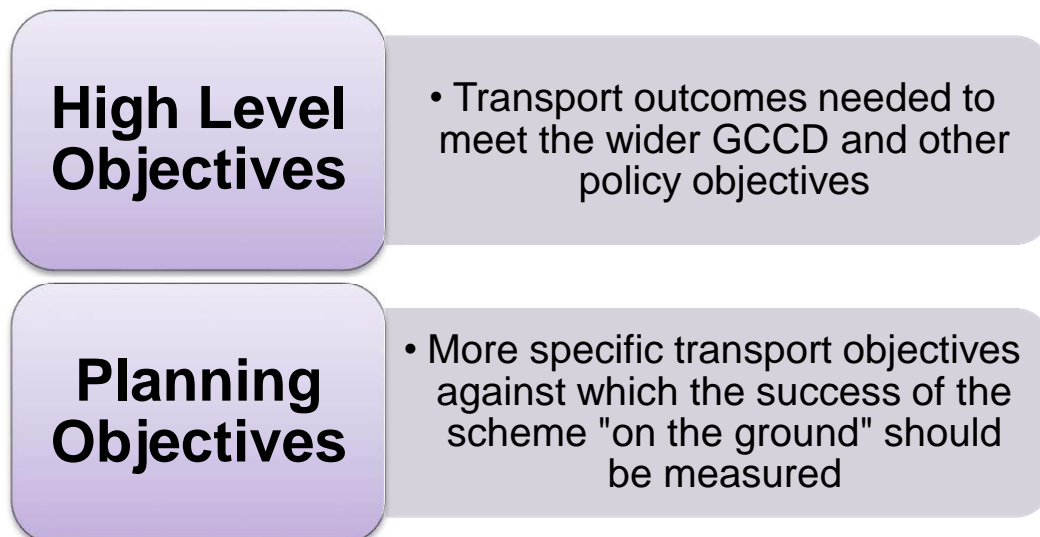
Transport objectives can be set both for outcomes (that is changes in travel behaviour that are considered to be beneficial) and methods (the practical means of achieving those outcomes). This section of the report summarises these key high level planning objectives that scheme options should attempt to align with.

7.2.1. Introduction

An Options Assessment Report (OAR) sets out a structured approach to identifying current / future challenges, setting objectives and formulating / sifting / appraising scheme options.

The scheme Options Assessment Report (OAR) sets out a range of high level and planning objectives, which were considered as the transport outcomes that need to be achieved in order to meet wider GCCD, SEP, Highway England and LTP3 objectives (all of which are set out in more detail later in this chapter). Figure 7-1 summarises the distinction between high level and planning objectives.

Figure 7-1 High level and planning objectives



7.2.2. High level objectives

High level objectives describe the transport outcomes that should be achieved across the Cambridge area in order to deliver economic growth and other policy objectives.

The high level objectives (Table 7-1) are based on a review of policy documents including the Draft South Cambridgeshire Local Plan, Draft Cambridge City Local Plan, Draft TSCSC, Huntingdonshire Draft Local Plan, and the NPPF. Some of the objectives are **outcomes to be achieved**, whilst others relate to **methods of achieving those outcomes**.

Table 7-1 High level objectives

Type	Objective
Outcome	To maximise potential for journeys to be undertaken by sustainable modes of transport including walking, cycling, bus and train.
	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.
Method	To provide bus-based HQPT corridor along the A428 connecting Cambridge and St Neots.
	To provide high quality segregated bus priority measures on the A1303 between its junction with the A428 and Queens Road, Cambridge.
	To provide improved PT links and access along the A428 and A14, in order to enhance economic growth opportunities and connectivity with Milton Keynes, Oxford, Luton / Bedford and the East Coast Ports.

Source: Adapted from Options Assessment Report (Atkins, 2014)

7.2.3. Planning objectives

Planning objectives are more localised scheme-specific targets for addressing user needs and therefore changing travel behaviour.

The **planning objectives** have been derived based on an understanding of the solutions needed to achieve the high level goals identified in policy documents. These objectives were agreed at a workshop with CCC¹⁰ and will need to be incorporated into the optimal option design.

The planning objectives are to provide **HQPT** which:

- Serves key current / future trip generators in the A428 corridor (west of the M11), including Cambourne and Bourn;
- Serves key current / future trip attractors in Cambridge – Cambridge City Centre and other employment sites;
- Intercepts trips from new developments from the outset;
- Provides additional capacity for at least 500 passengers per AM Peak hour;
- Attracts a mode share equivalent to 100% of growth in trips due to development and background growth, which may require:
- A peak service frequency of no less than six buses per hour (assumes standing);
- Quality of waiting and in-vehicle environments comparable to the Guided Busway;
- Peak journey times no more than the equivalent journey by car (and preferably less); and
- End to end journey time reliability better than the car alternative.
- Results in no growth in delays on the A428 corridor for highway trips.

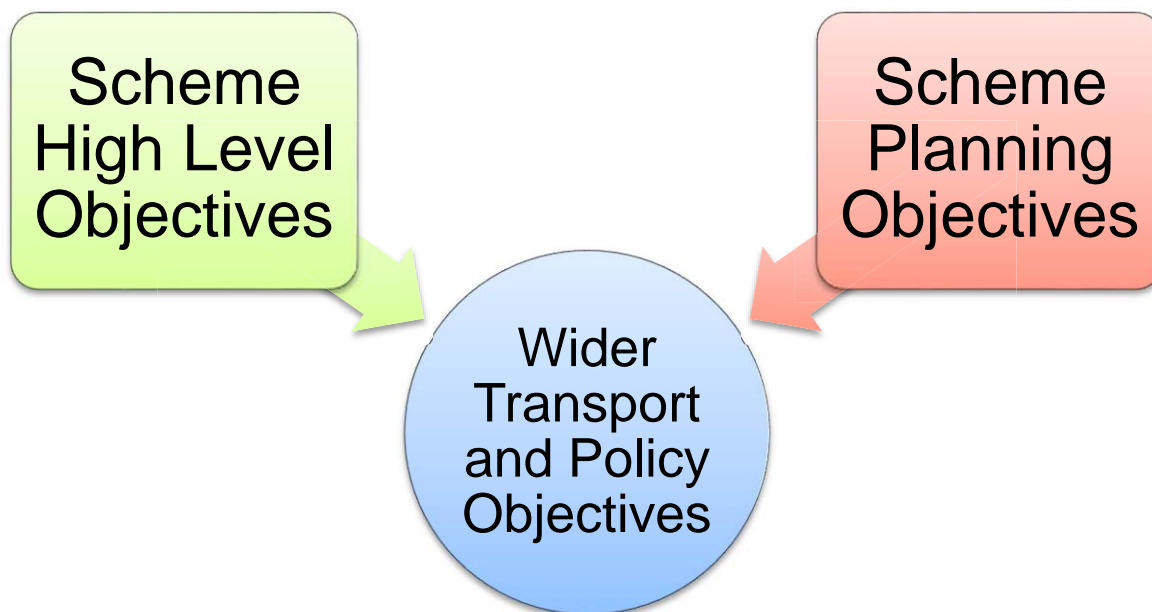
¹⁰ Workshop held at Shire Hall offices on 8th May 2014.

7.2.4. Contribution to wider objectives

Provision of transport infrastructure and services can have a direct impact on a range of wider policy objectives – everything from economic development through to environmental protection.

Both the high level and planning objectives for the Cambourne to Cambridge Better Bus Journeys Scheme contribute to both wider transport and policy outcomes (Figure 7-2).

Figure 7-2 Scheme contribution to wider objectives



The critical linkage is firstly to demonstrate that what happens “on the ground” when a scheme is implemented can **directly influence travel behaviour** – both causes (i.e. how and why people make decisions to travel more sustainably) and symptoms (e.g. reducing traffic congestion).

Secondly and even more importantly, it is necessary to demonstrate how travel behaviour then leads to **positive change for wider policy objectives** – in particular economic growth, environmental sustainability and quality of life for communities. Examples of potential links between transport investment and wider policy objectives are outlined in Table 7-2.

Table 7-2 Transport and links to wider strategic economic benefits

Wider Benefit	Contribution of Transport Investment
Economic Growth	<ul style="list-style-type: none"> • Reducing transport-related costs to businesses. • Widening labour markets. • Attracting inward investment to an area. • Direct employment in the transport industry. • Opening up land for employment and housing development. • Enabling clustering of businesses in an area (agglomeration).
Environmental sustainability	<ul style="list-style-type: none"> • Improving local air quality. • Reducing noise. • Reducing GHG emissions. • Removing traffic from sensitive areas.
Quality of Life	<ul style="list-style-type: none"> • Increasing access to a range of services and facilities. • Improving safety and security.

Wider Benefit	Contribution of Transport Investment
	<ul style="list-style-type: none"> Promoting healthier living.

7.3. Transport and wider policy objectives

7.3.1. Introduction

Any major road corridor has to perform a number of transport and wider policy functions, which need to be clearly addressed by policy objectives.

The A428 corridor performs a number of functions:

- Route for long distance strategic freight traffic between the M1, A1 and A14 Trunk Roads;
- Linkages between economic growth areas in the East and South East of England – in particular Milton Keynes, Bedford and Cambridge; and
- Local access into Cambridge from housing areas in St Neots, Cambourne and the surrounding villages.
- The PT function is very important – with the A428 providing the route for the X5 regional coach route as well as the local Cambridge services.

Transport and wider policy objectives which the Cambourne to Cambridge Better Bus Journeys Scheme seeks to address are contained in a number of documents which have been reviewed as part of this Strategic Case (Table 7-3).

Table 7-3 Key policy documents

Type of Objective	Document
Transport	Cambridgeshire LTP3
	Highways England Road Investment Strategy (RIS)
Economic	Greater Cambridge and Peterborough Strategic Economic Plan
	Greater Cambridge City Deal
Spatial Planning	South Cambridgeshire Core Strategy
	Cambridge Core Strategy

Based on a review of these documents, a number of scheme-specific objectives have been defined.

7.3.2. Cambridgeshire Local Transport Plan

The CCC LTP3 sets out a 20-year set of policies, transport strategy and delivery plan for transport investment across the county.

The LTP is important for demonstrating how policies and plans for transport will contribute towards the County Council's vision to create, "*Communities where people want to live and work: now and in the future.*"

The LTP has five wider policy objectives. Table 7-4 sets out how the PT infrastructure and services delivered by the Cambourne to Cambridge Better Bus Journeys Scheme can contribute to achieving the LTP wider policy objectives:

Table 7-4 LTP wider policy objectives and Cambourne to Cambridge Better Bus Journeys Scheme contribution

LTP Wider Policy Objective	Cambourne to Cambridge Better Bus Journeys Scheme Contribution
Enabling people to thrive, achieve their potential and improve their quality of life.	<ul style="list-style-type: none"> • PT is an essential aspect of enabling people to travel – especially for work, education and leisure purposes - without reliance on a private car. • A greater range and quality of bus services that will enable people to have a greater level of choice around when and where to travel for a variety of journey purposes.
Supporting and protecting vulnerable people.	<ul style="list-style-type: none"> • Bus-based PT is a vital service for people who do not have access to a private car. • Investment in PT infrastructure and services will tackle the cycle of decline where greater car use and traffic congestion reduces the attractiveness and commercial viability of bus services.
Managing and delivering the growth and development of sustainable communities.	<ul style="list-style-type: none"> • If higher levels of traffic congestion are to be avoided, bus services will need to play a much stronger role in the accommodation of additional travel demand as a result of new sustainable communities. • HQPT services will connect people living in new sustainable communities with the city of Cambridge, which is the main focus of additional employment opportunities.
Promoting improved skill levels and economic prosperity across the county, helping people into jobs and encouraging enterprise.	<ul style="list-style-type: none"> • For people without access to a car, PT is one of the main alternative options for accessing education and employment opportunities. • Better bus services will enable people to access a wider range of education and employment opportunities which would otherwise only be accessible by private car.
Meeting the challenges of climate change and enhancing the natural environment.	<ul style="list-style-type: none"> • The private car is responsible for significant levels of air pollution, noise and GHG's; and increasing levels of traffic and congestion will have serious environmental consequences. • Better bus services will provide a more environmentally friendly alternative to mass car travel, as buses are able to transport more people per unit of pollution emitted (especially if the vehicles are modern).

Source: Objectives Take from the Cambridgeshire LTP3

7.3.3. Highways England Road Investment Strategy

The A428 is an important part of the SRN which is managed by Highways England, and the RIS sets out plans for its future development.

The first RIS outlines a long-term programme for motorways and major trunk roads with the stable funding needed to plan ahead. The RIS 1 comprises:

- A long-term vision for England's motorways and major roads, outlining how we will create smooth, smart and sustainable roads;
- A multi-year investment plan that will be used to improve the network and create better roads for users; and
- High level objectives for the first roads period 2015 to 2020.

The high level objectives, and the potential contribution of the Cambourne to Cambridge Better Bus Journeys Scheme, are shown in Table 7-5.

Table 7-5 Highways England strategic objectives and bus-based PT contribution

Strategic Objective	Cambourne to Cambridge Better Bus Journeys Scheme Contribution
Providing capacity and connectivity to support national and local economic activity.	Bus services can provide essential inter-urban connections, which help put more people within reach of a wider range of jobs.
Supporting and improving journey quality, reliability and safety.	Buses can provide an efficient alternative to car use, especially for longer distance journeys (for example the X5 service which runs from Oxford to Cambridge). Buses are also a very safe mode of travel.
Joining our communities and linking effectively to each other.	Buses are able to provide these links, using Trunk Roads as the fast element of the journey and then calling at communities located along the corridor.
Supporting delivery of environmental goals and the move to a low carbon economy.	If they are well patronised, buses provide a relatively efficient means of moving people per unit of carbon emitted from a vehicle exhaust. If buses services did not exist and everyone had to drive, carbon emissions could increase substantially.

Source: Objectives Taken From Highways England RIS

The RIS has identified the A428 Black Cat to Caxton Gibbet improvement as a committed scheme. The aim is to link the A421 to Milton Keynes with the existing dual carriageway section of the A428 to Cambridge, thereby creating an “Expressway” standard link between the two cities via Bedford. The scheme is expected to include significant improvements to the Black Cat roundabout, where the A1 currently meets the A421.

This A428 between the A1 Trunk Road and Cambridge will become even more important PT corridor with new developments at St Neots, Cambourne and Bourn Airfield.

7.3.4. Strategic Economic Plan (SEP)

In terms of “Transport Connectivity”, the Greater Cambridgeshire Greater Peterborough Strategic Economic Plan (SEP) sets out a number of objectives. Table 7-6 summarises the relevant SEP objectives and the potential contribution of the Cambourne to Cambridge Better Bus Journeys Scheme:

Table 7-6 SEP objectives and potential scheme contribution

SEP Objective	Potential Scheme Contribution
A transport network fit for an economically vital high growth area.	<ul style="list-style-type: none"> A transport network has to provide the right capacity and connectivity between origins and destinations in a way that makes best use of the available infrastructure. The scheme will help to deliver an integrated an efficient PT network across the Greater Cambridgeshire area and provide genuine PT options for a wider range of destinations (especially the development areas on the edge of the city and the new communities in South Cambridgeshire).
Smart technology.	<ul style="list-style-type: none"> The highest performing cities have transport networks that are enabled by technology – particularly with respect to information and wireless connectivity at bus stops and on vehicles. The scheme will enable buses to gain priority at traffic signals and provide information to feed into real time passenger information (RTPI). The design and implementation of scheme will provide opportunities to include technology facilities that will be value by business users in particular.
Work with partners to facilitate improvements to key routes.	<ul style="list-style-type: none"> In addition to CCC as the Local Transport Authority, there are a number of partners who have a key interest in the improvement of transport routes – including the LEP, Highways England, SCDC, CaCC, transport operators and user representative groups (e.g. for bus and cycling).

SEP Objective	Potential Scheme Contribution
	<ul style="list-style-type: none"> The scheme will be planned and designed in partnership with the relevant stakeholders, in particular: <ul style="list-style-type: none"> HE: who are the highway authority for the A428; Bus operators: who have the essential task of running the buses that will use the infrastructure; SCDC and CaCC: as the planning authorities who will need to take decisions on strategic applications; and User groups: who will wish to ensure that infrastructure and services are planned and designed based on evidence of their needs.
Ensure linkage with national transport investment decisions.	<ul style="list-style-type: none"> It is essential that local and national transport schemes are planned together to deliver a single integrated network to the end user (who does not care about organisational boundaries). The scheme is partly located on a Trunk Road and so it will support investment priorities that have been identified in the RIS.
Identify scalable interventions that open up access to significant growth locations.	<ul style="list-style-type: none"> With constrained public sector investment, especially in the short to medium term, there is a need for transport solutions that can be implemented and then “scaled up” if there is evidence of further need and demand. The scheme is inherently scalable because it features a number of options which range from lower through higher cost; and it is also relatively easy to add capacity (in the form of extra services in response to demand) in the bus industry (certainly compared with rail).

Source: Greater Cambridge and Greater Peterborough SEP

The SEP states that in Cambridge and Peterborough, and on a number of the main corridors linking them with neighbouring towns, there is great potential to significantly grow patronage and reduce the demand for new car trips that would otherwise occur. The SEP suggests that major growth at new settlements such as Northstowe, Bourn Airfield and Waterbeach can achieve very significant levels of bus use if the quality of service is such that it offers a reliable and timely alternative to a car trip. The evidence from the Guided Busway and Park & Ride services has demonstrated that travellers will choose to use the bus when a high quality service is provided.

7.3.5. Local plans for South Cambridgeshire and Cambridge

The Local Plans for the two districts set out a vision, practical objectives and detailed proposals for spatial development - which will both deliver the economic plans and address the resulting travel demand.

7.3.5.1. South Cambridgeshire

Table 7-7 summarises the relevant Local Plan objectives and the contribution of the Cambourne to Cambridge Better Bus Journeys Scheme:

Table 7-7 South Cambridgeshire local plan objectives and Cambourne to Cambridge Better Bus Journeys Scheme contribution

Local Plan Objective	Cambourne to Cambridge Better Bus Journeys Scheme Contribution
To support economic growth by supporting South Cambridgeshire's position as a world leader in research and technology based industries, research, and education; and supporting the rural economy.	<ul style="list-style-type: none"> Economic growth is predicated upon the ability for people to access their place of work by non-car modes and to travel easily / efficiently during the course of their working day. A HQPT system will significantly improve connectivity – by improving journey options and times between housing areas and major employment areas; and between the major employment areas themselves (as part of an integrated network covering the whole of the Greater Cambridge area).

Local Plan Objective	Cambourne to Cambridge Better Bus Journeys Scheme Contribution
To protect the character of South Cambridgeshire, including its built and natural heritage, as well as protecting the Cambridge Green Belt. New development should enhance the area, and protect and enhance biodiversity.	<ul style="list-style-type: none"> The built and natural heritage of the area will come under increasing threat from higher levels of air pollution and noise, which are the result of high forecast road traffic. Better PT services will seek to reduce forecast levels of road traffic by moving people in buses which (if well-used) are a much more environmentally sustainable means of moving large numbers of people.
To provide land for housing in sustainable locations that meets local needs and aspirations, and gives choice about type, size, tenure and cost.	<ul style="list-style-type: none"> If housing is to be both economically and environmentally sustainable the travel demand that it generates will need to avoid a large increase in levels of car traffic. Furthermore, housing affordability could be supported, if it is possible to get around without a household having to own and run a large number of cars. Better bus services will provide a viable alternative to driving for commuting, education, personal business and leisure trips into Cambridge from new developments located in the rural hinterland.
To deliver new developments that are high quality and well-designed with distinctive character that reflects their location, and which responds robustly to the challenges of climate change.	<ul style="list-style-type: none"> An important aspect of development design is to ensure that bus services are able to move efficiently within areas (in particular avoiding long and circuitous routes) and also gain access to as many people as possible within a walk distance of around 400 metres. Bus infrastructure will be integrated into the design of new developments, especially around Cambourne and Bourn Airfield and will also serve the employment areas of West Cambridge and North West Cambridge.
To maximise potential for journeys to be undertaken by sustainable modes of transport including walking, cycling, bus and train.	<ul style="list-style-type: none"> The reason for delivering the scheme is to take advantage of the potential that undoubtedly exists and to ensure that bus-based PT is a viable and credible alternative.

Source: Objectives Taken From South Cambridgeshire Local Plan

7.3.5.2. Cambridge City

Table 7-8 summarises the relevant Local Plan objectives and the contribution of the Cambourne to Cambridge Better Bus Journeys Scheme.

Table 7-8 Cambridge local plan objectives and Cambourne to Cambridge Better Bus Journeys Scheme contribution

Local Plan Objective	Cambourne to Cambridge Better Bus Journeys Scheme Contribution
Contribute to the vision of Cambridge as an environmentally sustainable city, where it is easy for people to make a transition to a low carbon lifestyle. This means making best use of energy (including community energy projects), water and other natural resources, securing radical reductions in carbon emissions, minimising environmental impact and being capable of adapting to the impacts of climate change.	<ul style="list-style-type: none"> The delivery of significantly better bus services – as part of a wider sustainable mobility plan – will make it much easier for people to choose to live a low-carbon / low-energy lifestyle which does not rely on the private car. A much better choice of efficient and reliable bus services along one of the key transport corridors in Cambridge, will serve the very important development areas in the west and north-west of the city.
Meet the housing needs of the city within its sub-region, delivering an appropriate mix of housing types, sizes and tenures to meet	<ul style="list-style-type: none"> If housing is to be both economically and environmentally sustainable the travel demand that it generates will need to avoid a large increase in levels of car traffic.

Local Plan Objective	Cambourne to Cambridge Better Bus Journeys Scheme Contribution
existing and future needs, including affordable housing.	<ul style="list-style-type: none"> • Furthermore, housing affordability could be supported, if it is possible to get around without a household having to own and run a large number of cars. • Better bus services will provide a viable alternative to driving for commuting, education, personal business and leisure trips within Cambridge.
Assist the creation and maintenance of inclusive, environmentally sustainable communities.	<ul style="list-style-type: none"> • Bus-based PT is an important part of inclusivity, as it is more likely to be affordable for a larger proportion of the population than car travel (which generally requires purchase and maintenance of a vehicle) and rail (where fares can often be quite high, especially at peak times). • Bus infrastructure measures will assist operators to keep bus fares as low as possible by minimising the operating costs associated with traffic congestion delays, and the consequent need to provide additional buses to maintain a specific service headway.
Promote and support economic growth in environmentally sustainable and accessible locations, facilitating innovation and supporting Cambridge's role as a world leader in higher education, research, and knowledge-based industries, while maintaining the quality of life and place that contribute to economic success.	<ul style="list-style-type: none"> • Bus-based PT can – if based on strong radial corridors and high density urban form – promote development in locations which minimise the need to travel, both as part of the daily commute and also during the course of business. • Furthermore, economic benefits associated with greater levels of face to face collaboration can be promoted by the use of PT. • Bus services on the A428 corridor will, as part of a wider network for Cambridge, help to link up various employment and research establishments across the city and make travel easy by high quality HQPT.
Support Cambridge's vibrant and thriving centres, with a varied range of shopping facilities in accessible locations that meet the needs of people living, working and studying in, or visiting, the city and the Greater Cambridge Area.	<ul style="list-style-type: none"> • Research suggests that retail centres (especially those in traditional city centre locations) receive a very large economic contribution from bus passengers, dispelling the myth that everyone travels by car. • Improved bus services running into Cambridge along the A428, from the expanding housing areas to the west, will provide a further boost to the retail economy by enabling more people to access the City Centre without a large increase in traffic and congestion.
Development located to help minimise the distance people need to travel, and be designed to make it easy for everyone to move around the city and access jobs and services by sustainable modes of transport.	<ul style="list-style-type: none"> • Bus-based PT can – if based on strong radial corridors and high density urban form – promote development in locations which minimise the need to travel, both as part of the daily commute and also during the course of business. • Better bus infrastructure and services will encourage development to be located on the A428 corridor, which can become a strong radial spine which provides sufficient numbers of passengers to support a frequent service.
Ensure appropriate and timely provision of environmentally sustainable forms of infrastructure to support the demands of the city, including digital and cultural infrastructure.	<ul style="list-style-type: none"> • If constructed as part of major developments, PT infrastructure is able to support better bus services which can be used (for example) by new residents before their travel patterns have been too firmly set in favour of the private car. • Provision of PT infrastructure and services as part of both housing and employment developments, and will therefore enable sustainable travel choices to be designed in from the start.

7.4. Transport strategy proposals

The A428 / A1303 corridor has a range of transport and spatial functions which, taken together, could generate high demand for travel by private car in particular.

In the local and regional context, the A428 connects the market town of St Neots, villages and employment areas around Cambourne and the major employment, healthcare, educational and retail destinations in Cambridge. In the medium to long term the route's importance will increase as significant housing growth is planned in St Neots, Cambourne and Bourn Airfield – coupled with employment growth in Cambridge itself. The housing and employment growth will therefore contribute to significant additional travel demand along the corridor, particularly for shorter distance local trips.

The TSCSC recognises that, attempting to cater for current and future local travel demand by car will increase congestion in Cambridge and surrounding towns.

The TSCSC proposes that travel demand is catered for by:

“...increasing walking, cycling and use of passenger transport for journeys into and out of Cambridge; and in particular on passenger transport services on main radial corridors to Cambridge and other key destinations.” (Policies TSCSC 2: Catering for travel demand in Cambridge and TSCSC 3: Catering for travel demand in South Cambridgeshire)

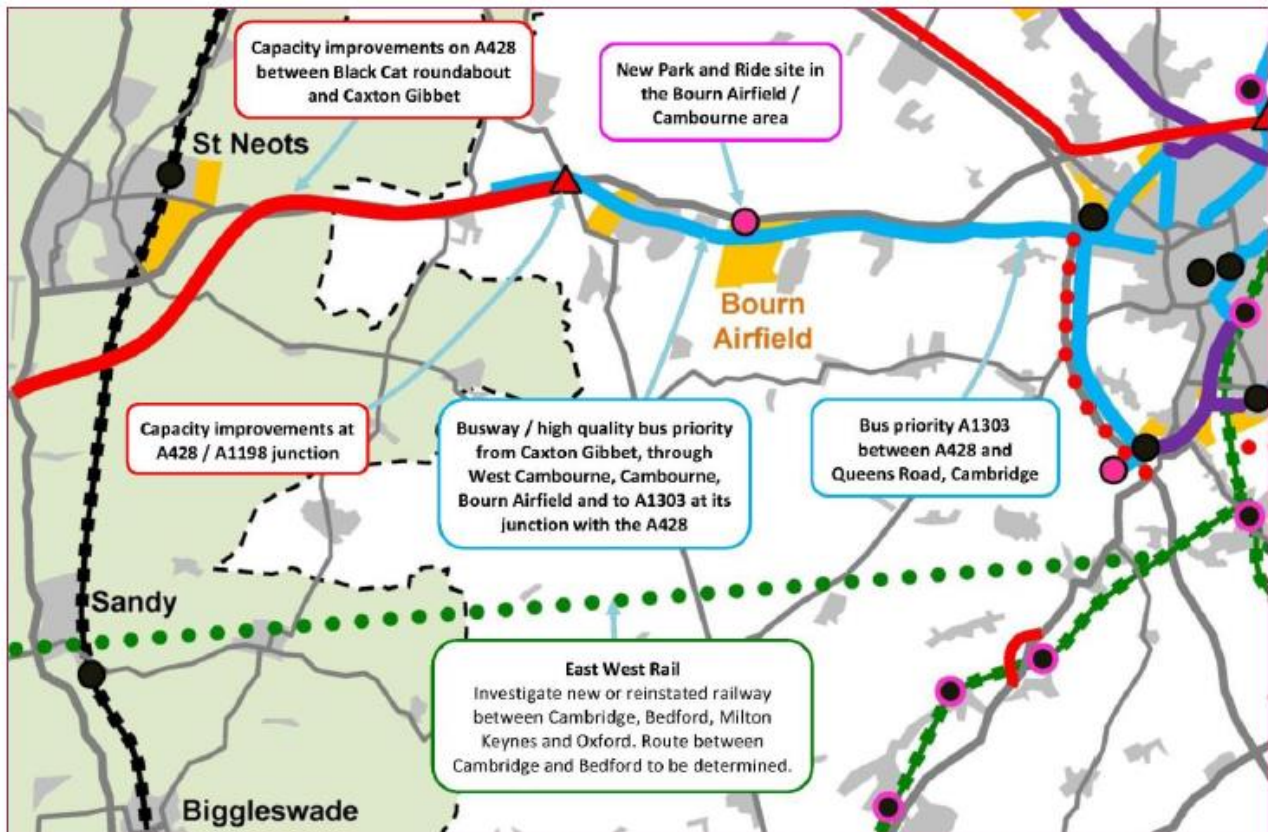
The TSCSC proposes (Figure 7-3):

- Providing bus priority in locations where services currently get caught up in congestion, **in particular between the A1303 and A428 [covered by this scheme]** and also **around the A428 / A1198 Caxton Gibbet roundabout** [covered by a Highways England scheme];
- Interchange at strategic points along the corridor to enable trips that begin in some of the villages off the route to be able to access **HQPT services**;
- A **cycling and walking network** which links into the interchanges along the corridor, but that also connects the outlying villages to employment sites, such as at Cambourne and also to secondary schools in Comberton, Cambourne and further afield in Gamlingay; and
- **Busway or HQPT bus infrastructure along the A1303 section of the corridor to completely segregate buses from other traffic**, servicing service a second Park & Ride site between Cambourne and the A1303, which will intercept traffic further out from Cambridge and free up more capacity at the existing Madingley Road site which would then be used principally for traffic coming off the M11.

The A1303 Madingley Road is a key radial route into the centre of Cambridge and also a significant employment / research destination in its own right. The TSCSC notes that a major impediment to the reliability of and the further increase in usage of bus services within and into Cambridge is the delay experienced by buses due to congestion caused by general vehicular traffic in the city. With the growth that is planned for the city, this impediment must be removed if the bus network is to become the mode of choice for many more journeys. A step change in the quality, availability and reliability of bus services within the city is needed. To achieve this, comprehensive bus priority is required over time on main routes used by buses, including Madingley Road.

The TSCSC states that inbound bus priority measures will be introduced on Madingley Road between the M11 and Queens Road in Cambridge. Between the M11 and A428, options for segregated high quality bus priority will be investigated on the current alignment of the A1303 and on off-line alignments. The strategy also states that bus-only links will be provided between Histon Road and Madingley Road as part of the development of the NIAB and North West Cambridge sites. An orbital bus service from Cambridge Science Park would be able to travel on to Addenbrooke's and the Cambridge Biomedical Campus adjacent to the M11. A demand management option that looks at the Queens Road / Grange Road area might also facilitate such a service travelling through or round the City Centre and using the Guided Busway to access the Addenbrooke's area.

Figure 7-3 Summary of A428 / A1303 strategy



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Source: TSCSC

With reference to the A428, 'Policy TSCSC 21: Planning obligations for Bourn Airfield and West Cambourne' indicates consideration of the following:

- Segregated bus links between the A428 and the M11;
- A1303 / A428 outer Park & Ride capacity;
- Direct, segregated high quality pedestrian/cycle links to west Cambridge, Papworth Everard, Highfields, Hardwick, Caxton, Bourn, Caldecote, Comberton, Bar Hill and Dry Drayton;
- Any mitigation measures needed at the junctions of the A428 with the A1303 and A1198;
- Delivery of funding of any measures required to mitigate the traffic impact of the developments on Bourn, Caldecote, Toft, Comberton and Barton; and
- A smarter choices package including residential school and workplace travel planning for a busway between West Cambourne and the junction of the A1303 and A428.

Other key related policies highlight a number of requirements for PT, Walking and Cycling:

- 'Policy TSCSC 1: The strategy approach' notes that 'The backbone of the strategy will be a HGPT network of bus, guided bus and rail services, fed and complemented by comprehensive pedestrian and cycle networks. Highways capacity enhancements will ensure that traffic can move efficiently in appropriate locations without interfering with passenger transport corridors.'
- 'Policy TSCSC 8: Improving bus services' notes that 'The County Council will work with partners and passenger transport operators to develop an improved and integrated network of HQPT.'
- 'Policy TSCSC 9: Access to jobs and service's notes that the transport network needs to be efficient and effective with HQPT and cycle network routes near major employment, education and service centres.
- 'Policy TSCSC 12: Encouraging cycling and walking' makes a number of suggestions to improve capacity and also notes that where feasible, pedestrian and cycle facilities will be provided alongside HQPT and new road infrastructure (citing the Busway facilities as a standard example).
- 'Policy TSCSC 15: Managing travel demand' highlights that measures for managing demand could include reallocation of road space to be used by passenger transport, pedestrians and cyclists.

7.5. Wider High Quality Passenger Transport vision

The Cambourne to Cambridge Better Bus Journeys Study is part of an integrated and long term strategy for improving access throughout Cambridge – based around a vision for an integrated and connected HQPT system.

Compared with the convenience and comfort of the private car, bus-based PT in particular suffers from a poor image, which is often at odds with the current reality. In order to tackle these perceptions with practical actions, it is therefore important to set out an attractive vision of future travel by bus. The vision for Cambridge is clear in that sustainable transport along dedicated routes is key in achieving the vision and HQPT networks will be a key driver in the ability to deliver more sustainable travel patterns in Greater Cambridge.

HQPT can be broadly defined as PT provision which is “generally perceived, by local politicians and in the media, to be reliable, frequent, good-value, reasonably comfortable (throughout the journey), reasonably fast, operate at convenient times, and to be suitable for most core journeys between key traffic generators (including residential areas) and the town / city centre.¹¹”

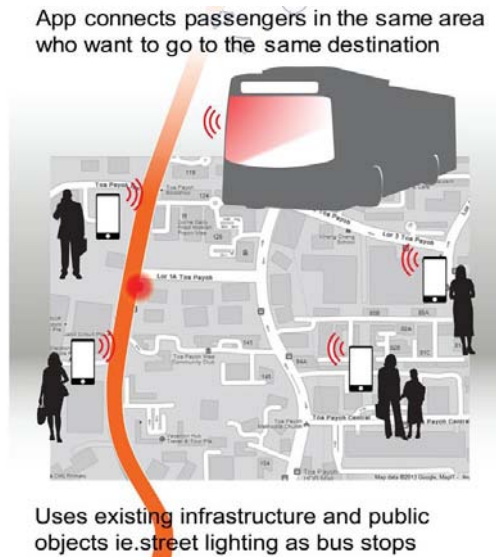
The following additional characteristics can define HQPT:

- “Service on core routes will have ‘tram-like’ features: comfortable, fast, frequent;
- There will be a significant degree of bus priority;
- There will be a strong focus on passenger / customer service and on ease of use;
- The system will be efficiently operated, minimizing costs for a specific level of service;
- Services will be well-integrated with each other, and the system as a whole will be well-integrated with other modes;
- The system will be strongly branded; and
- There will be a noticeable amount of public support for the system, perhaps even local pride in it”.

Such a vision for HQPT could range from a significant improvement in the various parts of the traditional fixed route bus transport system – essentially the same service but higher quality and making use of features typical of Bus Rapid Transit (BRT) schemes – through to a radical re-thinking of the whole concept of bus travel, which has (for example) been considered by the likes of Philips (Figure 7-4). It is important to note that HQPT does not consist of a mandatory list of features, but instead should be defined by the needs of future passengers.

¹¹ PROCEED Consortium. (2009). Guidelines for European HQPT in small and medium sized towns.

Figure 7-4 Re-imagining the bus service



Source: BBC News¹²

The Cambridge guided busway already provides passengers in Cambridgeshire with a model that could be delivered on other corridors leading into the city (Figure 7-5). It delivers a HQPT service with the required high frequency through the provision of dedicated rights of way, offline busways, priority treatment at junctions and step free access. This type of service supports the vision to provide sustainable alternatives to the private car in the form of HQPT and has already demonstrated an ability to increase the uptake of sustainable travel modes.

Figure 7-5 Vision to reality: better quality PT on the Guided Busway



Source: Photo from Cambridge News

In the local context, the A428 Western Corridor is likely to consider bus as the mode of PT choice and in that regard a HQPT service is defined in the TSCSC as “One that provides, high quality, low floor/easy access

¹² BBC News. (2013). Reimagining the bus service. Retrieved from: <http://www.bbc.com/future/story/20130327-building-bus-stops-via-smartphone>

buses, air conditioning, prepaid / electronic ticketing, RTPI and branding to encourage patronage.⁷ It also specifies that a HQPT service will provide “at least a 10 minute bus frequency during the peak periods and a 20 minute frequency Inter-peak.” The TSCSC intends to create new HQPT corridors and enhance existing corridors to provide a greater capacity for sustainable travel.

The TSCSC states that PT services will provide a cost effective and reliable travel choice through meeting the following objectives:

- Addressing barriers to the reliability and timeliness of services;
- Improving accessibility of services; and
- Improving the integration of different types of PT, so as to make them more attractive and reduce the need to travel by car.

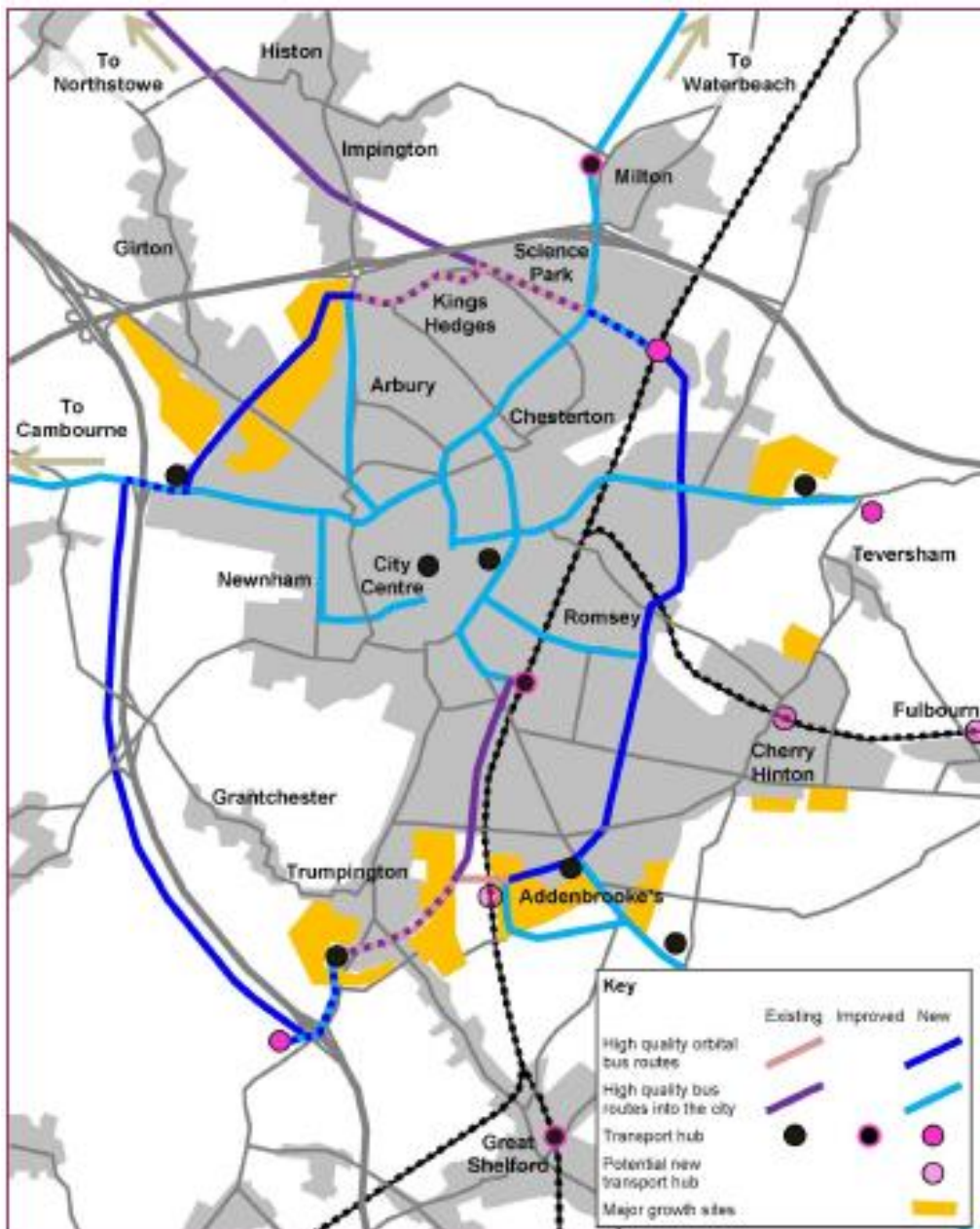
Within the Cambridge urban area (Figure 7-6) these objectives will be met through:

- Bus and guided bus priority measures introduced on radial routes and other key links in the bus network, where congestion severely impacts on the timeliness and reliability of services;
- Comprehensive treatment of routes to give a consistent level of priority along the whole length (medium to longer term); and
- Prioritisation of orbital bus movements:
 - Bus links between Chesterton, Cambridge Science Park and West Cambridge, and onwards to Addenbrooke’s and the Cambridge Biomedical Campus, either through the City Centre or on the M11; and
 - Longer term options to complete the circuit to the east of the city, linking Cambridge Science Park, Cambridge Airport, Cherry Hinton, Fulbourn, Addenbrooke’s and the Cambridge Biomedical Campus.

Along transport corridors and in rural areas these objectives will be met through:

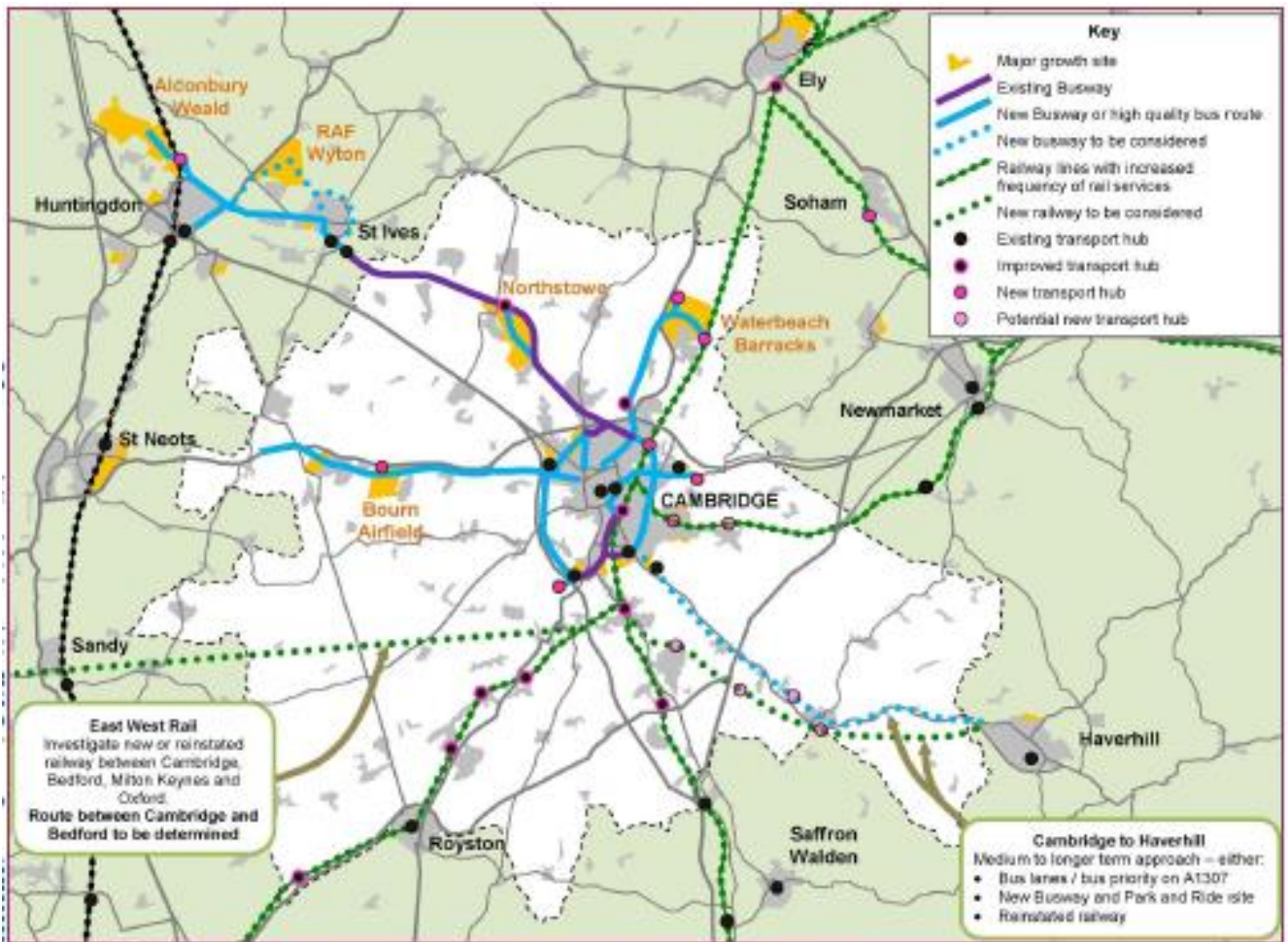
- Creating new HQPT corridors (Figure 7-7) and enhancing existing corridors (where bus or guided bus services are the focus on a corridor, frequencies of every 15 minutes or better will be sought);
- Addressing particular pinch points on the corridors that cause problems for buses (short term);
- Introducing more comprehensive Guided Bus or bus priority infrastructure along a route (long term);
- Introducing outer Park & Ride sites to take advantage of the new infrastructure (long term);
- Expanding or relocating the current inner ring of Park & Ride sites (long term); and
- Introducing smaller rural interchanges.

Figure 7-6 HQPT in Cambridge City



Source: TSCSC

Figure 7-7 HQPT on the corridors



Source: TSCSC

From a passenger perspective the level of bus service connectivity is described by:

- The ability to travel between two points as efficiently as possible – either using direct bus or Park & Ride;
- The temporal coverage – i.e. first and last buses on each day; and
- The frequency of the coverage (in terms of number of buses per hour).

Figure 7-8 sets out an initial view around potential service connections and frequencies – with each blue line representing one bus per hour. The diagram shows that the core central section of the A428 (Cambourne – Madingley Park & Ride) could feature at least 10 buses per hour and offer connections both to the City Centre and to the growth areas but north and south of the city.

A scheme that is particularly important to view in combination with improvements on the A428 corridor is the Western Orbital Bus scheme (Figure 7-9), which aims to create a new, fast and reliable link for buses between the west and south of Cambridge either along or near the M11.

In order to progress from A1303 Madingley Road to the development areas in the south of the city (e.g. around Addenbrooke’s), buses have to traverse the congested City Centre. Bus operator Stagecoach timetables its “Uni 4” service at 32 minutes for a journey of just five miles. It is estimated that journeys along an M11 bus link would take approximately 18/19 minutes; and a bus link parallel to the M11 approximately 15/16 minutes.

Given the scale of existing and future development to the south of Cambridge, it would appear important that bus passengers travelling from the A428 corridor are able to benefit from a direct orbital journey at times

competitive with the private car (which can already use the M11 to bypass the City Centre). A combination of the Cambourne to Cambridge Better Bus Journeys Scheme and Western Orbital schemes would therefore open up a much wider range of PT possibilities and deliver an integrated network that links corridors and the various development areas.

Figure 7-8 Outline of network options for A428 corridor

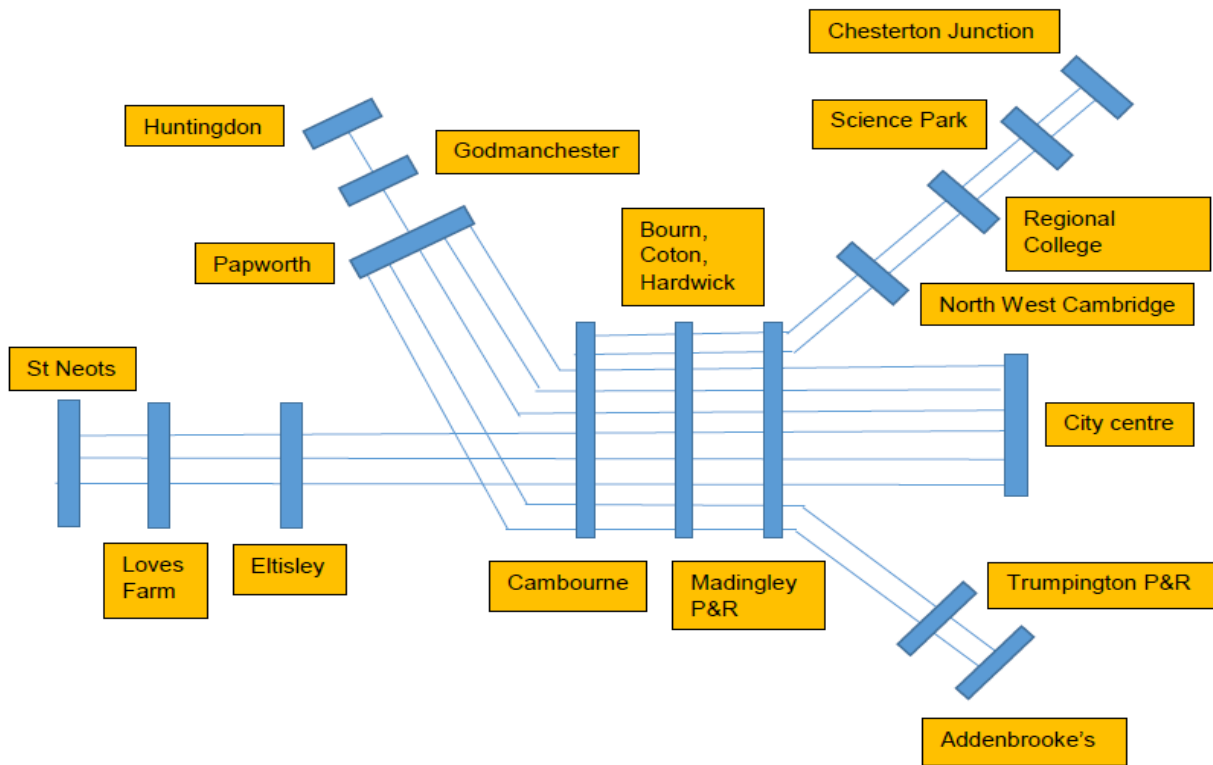
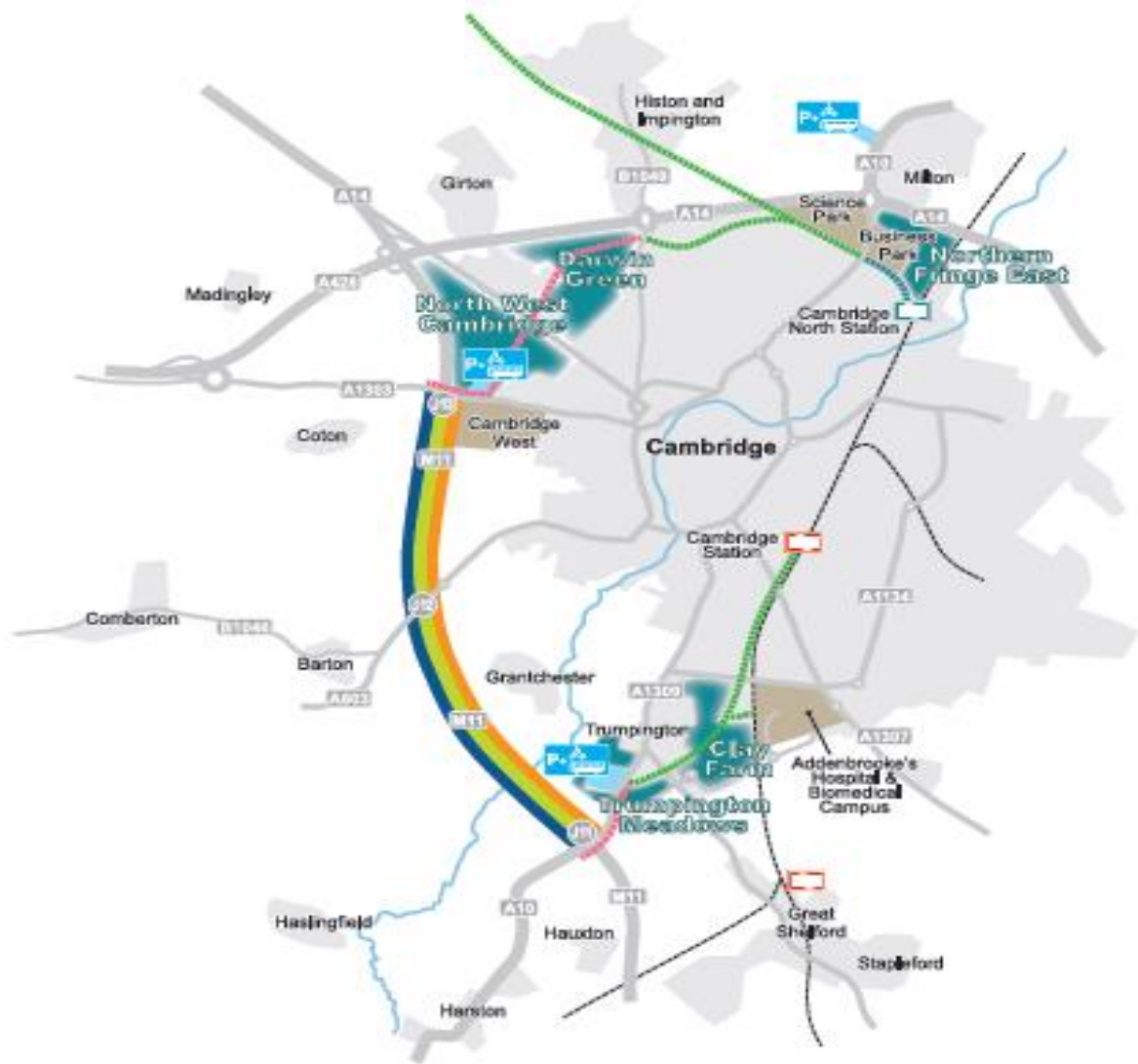


Figure 7-9 Western Orbital proposal



Source: Greater Cambridge City Deal

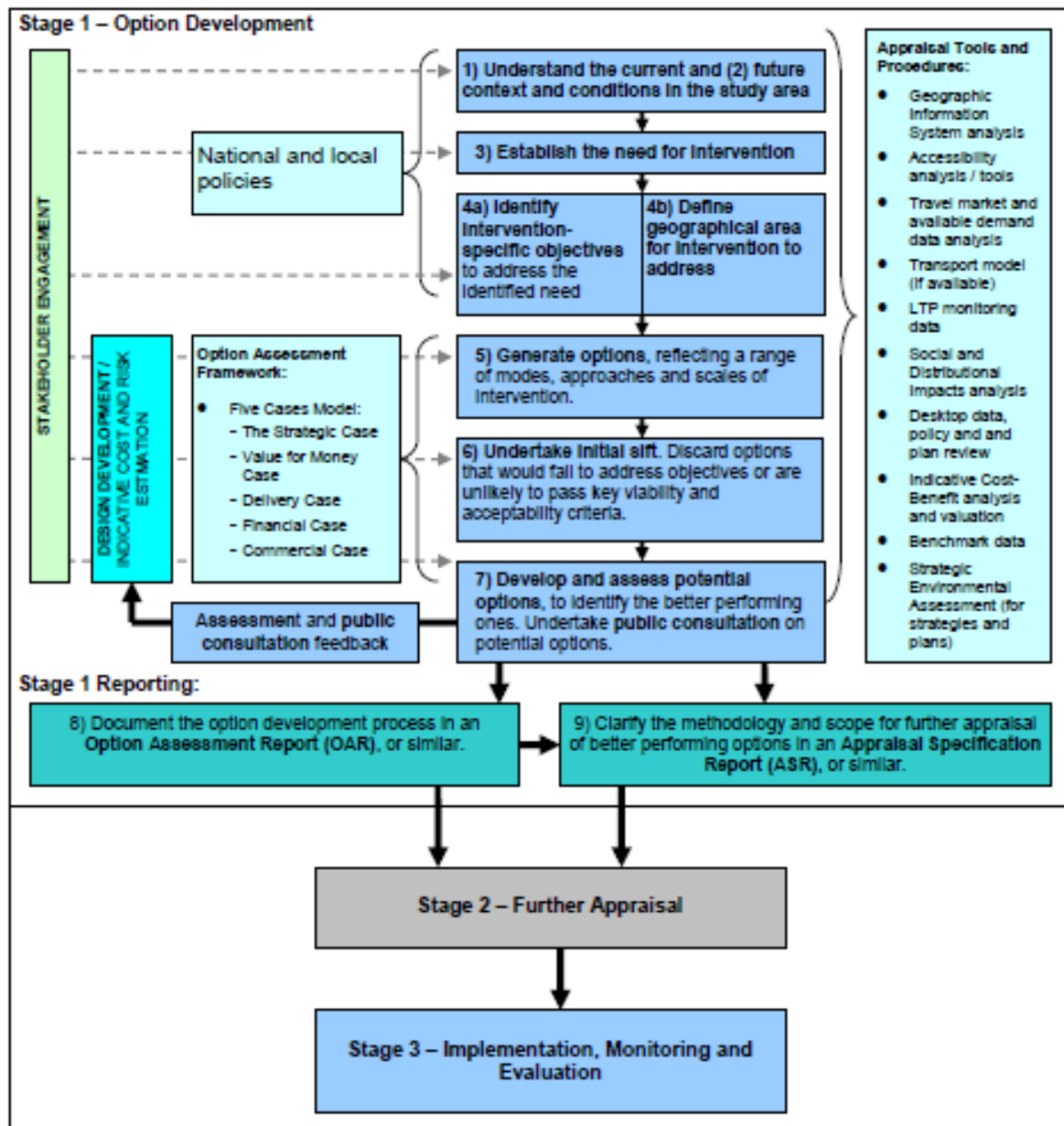
8. Option identification and outline selection criteria

8.1. Introduction

For any set of objectives and challenges, there are a series of intervention options for tackling them – which can range in type and scale.

Any process of scheme development must go through a rigorous process of option development as set out in WebTAG (Web Transport Analysis Guidance).

Figure 8-1 Option development process



Source: The Transport Appraisal Process, DfT

The Cambourne to Cambridge Better Bus Journeys Scheme is following the process outlined by the DfT (Figure 8-1).

8.2. Option development work

Option development needs to start from “first principles” and should not identify the solution until there has been a comprehensive assessment of the possible interventions necessary to meet objectives and address problems.

8.2.1. Introduction

This section sets out what has to date been a very comprehensive option assessment process. To date there have a number of phases completed:

- Phase 1: Options Assessment Report (OAR); and
- Phase 2a: Option identification and sifting;
- Phase 2b: Shortlisted options; and
- Phase 2c: Option assessment.

Option development is an iterative process based on the refinement of strategic goals, on-going performance analysis and stakeholder engagement. Our understanding of scheme objectives has evolved throughout the course of this project and the strategic fit of each option is reflective of this. The modelling and analysis conducted in Phase 2 of the work has further developed our understanding of key drivers of option performance, such as access to Park & Ride.

8.2.2. Phase 1: Options assessment report

In June 2014, Atkins produced an Options Assessment Report (OAR) which is one of the key processes recommended by WebTAG.

Phase 1 of the Cambourne to Cambridge Better Bus Journeys Scheme Study involved an initial assessment of options based on potential demand and feasibility. The work produced an assessment of the options against an agreed framework in order to generate a shortlisted set for further consideration and assessment in a subsequent Phase 2. The OAR set out the findings from the first phase of the study.

In Phase 1 the option packages were generated and refined through a series of workshops and assessments to ensure the process was thorough and considered a range of factors, which can be summarised as:

- An initial brainstorming and package generation process, in which 21 individual elements were combined to generate 34 packages;
- An initial sifting process involving refining the grouping of the elements into options followed by further analysis and sifting;
- A workshop during which the options underwent further evaluation, and three additional options were subsequently added to the shortlist; and
- A more detailed option assessment process which ultimately sifted the shortlist down to five recommended options (See Section 8.4.1).

This study identified a series of problems and challenges on the A428 corridor, and established the high level and detailed planning objectives that any proposed interventions would need to achieve before proceeding to option generation and assessment. This approach allowed a deep understanding of the corridor characteristics to be obtained before deriving any solutions.

The study demonstrated that some sections of the A428 corridor (particularly on the A1303 Madingley Road, eastbound into Cambridge) suffers from congestion, slow journey times, and poor journey time reliability during morning and evening Peak hours. The study noted that planned growth along the corridor, specifically at Cambourne, Bourn Airfield, and St Neots would, in future, add extra pressure onto already congested

sections of the A428, east of Madingley Mulch, as residents' access employment sites in Cambridge City Centre, Cambridge Science Park, and Addenbrooke's hospital. The evidence suggested that the A1303 Madingley Road would not be able to physically accommodate any more vehicular traffic during the morning Peak hour with a danger that the current queue length could, in future, extend onto the dualled A428, having an adverse impact on the efficient journey times associated with this section.

8.2.3. Phase 2a: Option identification and sifting

In July 2015, Atkins produced an Interim Report which set out the option development work undertaken as part of Phase 2.

Following on from the OAR, an interim report further developed shortlisted options from Phase 1 by taking a whole view across the corridor and looking:

- Top-down (provision of infrastructure to support growth); and
- Bottom-up (forecast growth that will require infrastructure to support it).

The options were developed and discussed during a series of workshops and then assessed using a framework consistent with the HMT's "Five Cases" model:

- **Strategic Case:** the degree to which options were supportive of those planning objectives relating to the type and scale of intervention;
- **Economic Case:** the degree to which options were supportive of those planning objectives relating to the impact on ability to intercept trips and journey time reliability; environmental impacts; GHG emissions, social and distributional impacts;
- **Financial Case:** the cost and affordability of the option;
- **Commercial Case:** commercial viability of the option; and
- **Delivery Case:** engineering feasibility, stakeholder and public acceptability.

Each option was assessed against the criteria above using a Red / Amber / Green (RAG) rating, based on previously-determined definitions of what constituted each score for each criterion. Scoring was undertaken based on the team's understanding of the corridor drawn from the SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis and professional knowledge. Sense checking followed to ensure spurious results did not emerge, and the sifting table and results were then verified via a peer group analysis with members of the team not involved in the initial scoring. Based on this initial sift, the six best performing options were presented and discussed at a workshop.

8.2.4. Phase 2b: Shortlisted options

The process of short listing options was the result of the work from phases 1 and 2a.

During the option development work, further clarification on timescales for GCCD indicated the Cambourne to Cambridge Better Bus Journeys Scheme would be delivered in two distinct tranches:

- Tranche 1 (to 2020) would include the part of the corridor which runs from the A428 / A1303 Junction at Madingley Mulch roundabout, east to Cambridge City Centre; and
- Tranche 2 / 3 (up to 2030) would include the part of the corridor which runs west of Madingley Mulch to Caxton Gibbet and assumes that one of the options of Tranche 1 had already been committed.

Options for the eastern section of the corridor (Tranche 1) comprised:

- **Option 1 Central (was 1A):** Online eastbound bus lanes from the A1303 / A428 Junction along Madingley Rise and Madingley Road to Lady Margaret Road;

- **Option 1 North (was 1B):** A new offline dedicated bus route running north-east from the A1303 / A428 Junction, connecting to Madingley Road just west of the M11. A further eastbound bus lane on Madingley Road would be provided to lady Margaret Road; and
- **Option 1 South (was 1C):** A new offline dedicated bus route running north of Coton, parallel to Madingley Road and Madingley Rise to Grange Road, with a connection to the West Cambridge UoC site.

Options for the western section of the corridor (Tranche 2 / 3) comprised:

- **Option 2 North (was 2A):** Improvement to bus services, which will run along the existing roads with no infrastructure improvements to the A1303 / A428 Junction;
- **Option 2 Central (was 2B):** A new route linking Cambourne and Bourn Airfield, before services running along St Neots Road with bus priority measures in place to the A1303 / A428 Junction; and
- **Option 2 South (was 2C):** A new offline dedicated bus route connecting Cambourne and Bourn Airfield before running south of Hardwick to Madingley Mulch roundabout.

8.2.5. Phase 2c: Option assessment

A preliminary assessment of the shortlisted options was carried out to identify key risks and determine their feasibility prior to proceeding to public consultation.

The preliminary assessment was necessary to ensure options were sufficiently developed to allow meaningful discussions to take place when engaging with stakeholders.

The assessment was carried out under four categories:

1. Alignment to GCCD criteria:
 - a. Housing; and
 - b. Employment.
2. Traffic and operational considerations:
 - a. Travel demand and accessibility to local centres;
 - b. Highway network performance (including impacts on congestion and journey times);
 - c. Potential bus patronage;
 - d. Walking and cycling; and
 - e. Road safety.
3. Environmental impacts on:
 - a. Landscape;
 - b. Townscape;
 - c. Heritage assets;
 - d. Air quality; and
 - e. Noise.
4. Engineering considerations:

- a. Requirement for land acquisition and legal processes; and
- b. Costs.

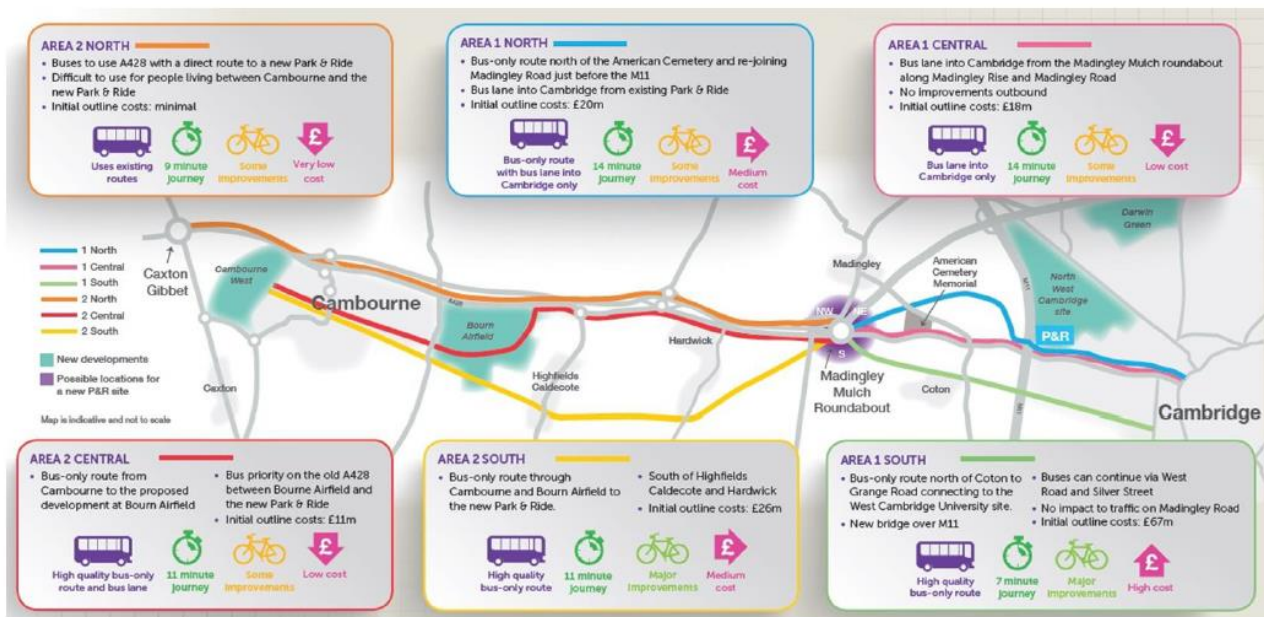
The option assessment then undertook a SWOT analysis, the results of which are summarised in 11. Appendix A, which resulted in the selection of the options short listed for assessment in this SOBC.

8.3. Public and stakeholder consultation on the options

The public consultation for this initial stage of the option development process was held between 5th October and 23rd November 2015.

The options presented in the public consultation are outlined in Figure 8-2:

Figure 8-2 Scheme options as presented to consultees



Source: CCC

The consultation used nominal routes (“North”, “Central” and “South”) in order to engage the public as widely as possible with the issues and link them to the key GCCD transport objectives. The routes were divided into east and west of Madingley Mulch roundabout, in line with the prioritisation of the eastern section of the route in Tranche 1 GCCD funding. In addition, a possible Park & Ride site in the vicinity of Madingley Mulch roundabout included in the consultation.

In addition four member and stakeholder briefings were held in advance of the consultation and during the consultation itself a series of roadshows were held to allow people to ask specific questions and raise issues of concern. Around 300 people were recorded as having attended the exhibitions.

The public consultation provided the opportunity for respondents to submit additional proposals, which were then reviewed as part of the ongoing technical assessment.

The consultation report was published by the Cambridge Research Group in February 2016. The key conclusions are summarised as follows (Table 8-1):

Table 8-1 Key findings from scheme consultation

Item	Response
Need for better bus journeys	<ul style="list-style-type: none"> 70.3% agreed in principle to better bus journeys between Cambourne and Cambridge.
Existing traffic conditions	<ul style="list-style-type: none"> Over 50% indicated that they were often in slow or stationary traffic between the Madingley Road Roundabout and the M11 Junction.
Travel from Cambourne	<ul style="list-style-type: none"> Just over a quarter (29.5%) indicated that they travelled between Cambourne and Cambridge on a daily basis.
Mode of travel	<ul style="list-style-type: none"> 77.2% indicated their usual mode of travel was by car as a driver.
Factors for better bus travel	<ul style="list-style-type: none"> “Reliable journey times” was cited as being key to making bus travel a better alternative to the car by 50.7%. 44.3% cited a need for “faster journey times”. 43.1% cited a need for “more buses per hour”.
Pedestrians and cyclists	<ul style="list-style-type: none"> 66.3% of respondents felt it was important or very important that cycling and pedestrian facilities are improved within this scheme.
Journey frequencies	<ul style="list-style-type: none"> Over 60% of people travelling during peak morning and evening times commute to and from Cambridge daily. Only 17.2% of the day time off peak travellers travelled daily.
Journey purpose	<ul style="list-style-type: none"> Reasons for travel were equally divided, with 39.4% indicating they travelled for leisure purposes and 37.9% for business. 22.7% indicated they travelled for both reasons.
Park & Ride	<ul style="list-style-type: none"> Almost half stated that they did not use the existing Madingley Road Park & Ride and only 9.0% indicated they used it regularly. 46.1% approved of a new Park & Ride site near the Madingley Mulch roundabout, with 28.3% against the suggestion. Just under half had no preference about its specific location (45.8%). 221 comments included reference to the Park & Ride facilities (10.1% of all survey respondents), with some talking about existing services and others about the potential new developments. The need for a new Park & Ride positioned so closely to an existing one was questioned by a number of respondents, as were proposals to develop a new dedicated road specifically for its buses. It was felt by some that improved Park & Ride facilities would not ease congestion, and other possible issues – such as badly timed traffic lights, and a lack of bus stops in locations such as Coton – were mentioned.
Attitudes to the scheme options	<ul style="list-style-type: none"> Options Area 1 Central and Area 2 Central received majority support (66.8% and 58.1% respectively). Options Area 1 South and Area 2 South received majority opposition (65.5% and 58.2% respectively) as did Option Area 1 North (57.8%). From comments and communications sent in separately to the survey, the most opposition was seen for Area 1 South. 176 responses gave direct additional comments to the six options supplied within this consultation (8.0%).
Environmental concerns	<ul style="list-style-type: none"> Strong opinions against Area 1 South were expressed, due to the damaging effect it might have on Coton village and the landscape of the area. The most frequently commented issue focused on the significance of green spaces and the landscape of the area – and the impact

Item	Response
	that each proposal might have on existing locations. 270 comments referred to this (12.3% of all survey respondents).
Profile of Respondents	<ul style="list-style-type: none"> • A higher proportion (43.4%) were aged between 35 and 54. • Just over half indicated that they were in employment – 53.9%.

Source: Cambridgeshire Research Group

8.4. Post-consultation option assessment

The post-consultation assessment was undertaken to re-visit the options in the light of comments received from stakeholders and the general public.

Following completion of the public consultation and analysis of the responses it was necessary to combine a number of the options for further assessment, as described in the following sections. All options propose a new Park & Ride site at Madingley Mulch roundabout.

8.4.1. Scheme options

Five options have been assessed in this Strategic Outline Business Case, as described below. We describe how each of these options could serve the A428 corridor (based on indicative routes) with both offline and online sections and levels of high and low segregation. It should be noted that all offline alignments on greenfield and privately held land would need significant stakeholder agreement and associated permissions and as such the areas shown are indicative and subject to further design development.

8.4.1.1. Option 1: 1 Central 2 North (also known as 1A+2A)

Infrastructure

This option is a 'low-cost alternative' which no infrastructure improvements west of the A1303 / A428 Junction. An eastbound bus lane is provided east of the A1303 / A428 Junction towards the City Centre. This bus lane is interrupted before the M11 Junction 13 bridge where buses re-join traffic for approximately 1200m. There are five left turns along this section of carriageway, which would mean that even if a bus lane were to be provided it would have to be interrupted to allow left turning traffic to use these accesses. The bus lane continues from beyond JJ Thompson Avenue to Lady Margaret Road. Walking and cycling facilities will remain largely unaltered from current provision (shared cycle and footway along Madingley Road), as there is insufficient width to improve them.

Proposed service provision

Bus services from Cambourne to the new Park & Ride at Madingley Mulch have been assumed to remain unchanged from the current Citi 4 route and frequency.

From Madingley Mulch Park & Ride, three different services have been assumed. The most frequent (every 10 minutes at peak times) travels towards the City Centre. Services to both the Science Park and Addenbrooke's have also been assumed (at 20 minute frequencies at peak times), potentially using a Western Orbital route for Addenbrooke's and proposed bus links through the Cambridge North West and Darwin Green developments to access the Science Park.

Figure 8-3 Option 1: Indicative route location



8.4.1.2. Option 2: 1 North 2 Central (also known as 1B+2B)

Infrastructure

This option provides a new route linking Cambourne and the proposed Bourn Airfield development. Within Cambourne, the nature of the development (relatively narrow, curved roads) will not allow BRT, which can only be provided upon exit from the settlement, and through the new development at Bourn.

Services continue running on carriageway with existing traffic along St Neots Road. Given that the parallel route of the A428 is free-flowing at this location (in normal circumstances), it has been assumed that a rising bollard, TROs (or similar) to restrict car access beyond Long Road will be sufficient to provide the required level of bus priority.

Walking and cycling facilities will remain largely unaltered from current provision on Madingley Road and St Neots Road, although there will be an opportunity to provide a shared track adjacent to offline and new sections (north of the A1303 and through the Bourn development).

From the Madingley Mulch Park & Ride, a new offline dedicated bus route is provided routing north-east from the A1303 / A428 Junction, connecting to the existing bus lane on the A1303 just west of the M11. This bus lane is interrupted before the M11 Junction 13 bridge where buses re-join traffic for approximately 1200m. There are five left turns along this section, which would mean that the bus lane would be interrupted to allow left turning traffic to access. The bus lane continues from beyond JJ Thompson Avenue to Lady Margaret Road.

Proposed service provision

Bus services from Cambourne to the new Park & Ride at Madingley Mulch have been assumed to increase to 12 buses an hour during peak periods, in addition to the current Citi 4 provision.

From Madingley Mulch Park & Ride, three different services have been assumed. The most frequent (every 10 minutes at peak times) travels towards the City Centre. Services to the Science Park and Addenbrooke's have also been assumed (at 20 minute frequencies at peak hour), using a potential Western Orbital route for Addenbrooke's and proposed bus links through the Cambridge North West and Darwin Green developments for the Science Park route.

Figure 8-4 Option 2: Indicative route location



8.4.1.3. Option 3: 1 South 2 South (also known as 1C+2C)

Infrastructure

This option provides a new offline route from Cambourne to Cambridge running south of the existing A428. Within Cambourne, the nature of the development (relatively narrow, curved roads) will not allow BRT, which can only be provided upon exit from the settlement and through the new development at Bourn. The route will then run to Madingley Mulch roundabout. From here a new offline dedicated bus route would be provided, running north of Coton and parallel to Madingley Road and Madingley Rise, with a connection to the West Cambridge UoC site. The route will connect to the existing highway and Grange Road and continue onwards into the City.

This option provides the opportunity of improving walking and cycling by providing a shared track adjacent to the entire offline section of the route.

This option has been modelled as following a completely segregated offline route to the south of the A428. However, there is an opportunity to achieve a similar level of benefits, while still fulfilling with the City Deal's vision, by providing a segregated route adjacent to St Neots Road. While this route variation has not been modelled, it has the potential to reduce costs and environmental impacts.

Proposed service provision

Bus services from Cambourne to the new Park & Ride at Madingley Mulch have been assumed to increase to 9 buses an hour during peak periods, in addition to the current Citi 4 provision.

From Madingley Mulch Park & Ride, two different services have been assumed. The most frequent (every 10 minutes at peak times) travels towards the City Centre, and alternate services continue to Addenbrooke's via the train station. Services to the Science Park have been assumed at 20 minute frequencies at peak times, using proposed bus links through the Cambridge North West and Darwin Green developments.

Figure 8-5 Option 3: Indicative route location



8.4.1.4. Option 4: 1 Hybrid 2 Central (also known as 1BC+2B)

Infrastructure

This option provides a new route linking Cambourne and the proposed Bourn Airfield new settlement. Within Cambourne, the nature of the development (relatively narrow, curved roads) will not allow BRT, which can only be provided upon exit from the settlement, and through the new development at Bourn.

Services will then run along St Neots Road with normal traffic. Given the parallel route of the A428 is free-flowing at this location (in normal circumstances), it has been assumed that a rising bollard, TROs (or similar) to restrict car access beyond Long Road will be sufficient to provide the required level of bus priority.

From the Madingley Mulch Park & Ride, a new offline dedicated bus route going north-east from the A1303 / A428 Junction, will connect into the existing bus lane on the A1303 just west of the M11. This bus lane is interrupted before the M11 Junction 13 bridge and buses re-join traffic at this location. After crossing the bridge, buses will turn right into the West Cambridge site, before continuing south and east to Grange Road on a new offline dedicated bus route running parallel to Madingley Road. The route will connect to Grange Road and continue online from this location.

Walking and cycling facilities will remain largely unaltered from current provision on St Neots Road, although there will be an opportunity to provide a shared track adjacent to offline and new sections (north of the A1303 and through the Bourn development).

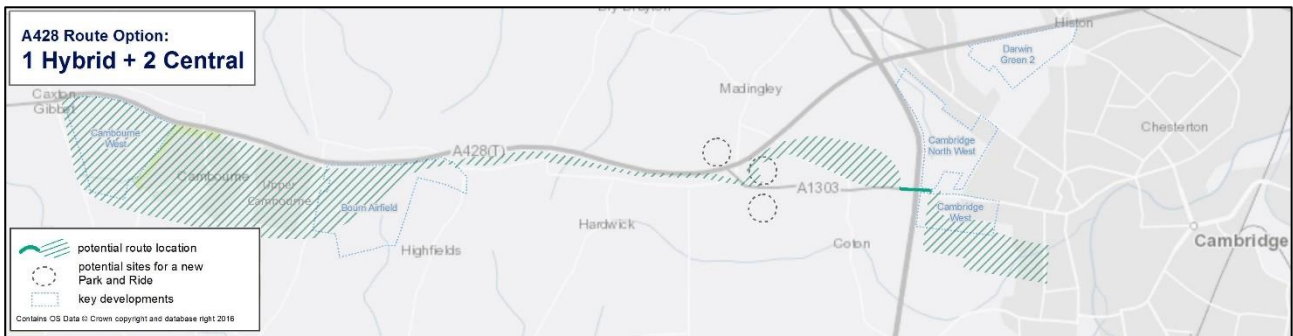
Proposed service provision

Bus services from Cambourne to the new Park & Ride at Madingley Mulch have been assumed to increase to 9 buses an hour during peak periods, in addition to the current Citi 4 provision.

From Madingley Mulch Park & Ride, two different services have been assumed. The most frequent (every 10 minutes at peak times) travels towards the City Centre, and alternate services continue to Addenbrooke's via

the railway station. Services to the Science Park have been assumed at 20 minute frequencies at peak times, using proposed bus links through the Cambridge North West and Darwin Green developments.

Figure 8-6 Option 4: Indicative route location



8.4.1.5. Option 5: Option 1 South 2 Central (also known as 1C + 2B)

Infrastructure

This option provides a new route linking Cambourne and the proposed Bourn Airfield new settlement. Within Cambourne, the nature of the development (relatively narrow, curved roads) will not allow BRT, which can only be provided upon exit from the settlement, and through the new development at Bourn.

Services will then run along St Neots Road with normal traffic. Given the parallel route of the A428 is free-flowing at this location (in normal circumstances), it has been assumed that a rising bollard, TROs (or similar) to restrict car access beyond Long Road will be sufficient to provide the required level of bus priority.

From here a new offline dedicated bus route will be provided, running north of Coton and parallel to Maddingley Road and Maddingley Rise, with a connection to the West Cambridge UoC site. The route will connect to Grange Road and continue online towards the City Centre from this location.

Walking and cycling facilities will remain largely unaltered from current provision on St Neots Road, although there will be an opportunity to provide a shared track adjacent to offline and new sections (south of the A1303 and Maddingley Road, and through the Bourn development).

Proposed service provision

Bus services from Cambourne to the new Park & Ride at Maddingley Mulch have been assumed to increase to 9 buses an hour during peak periods, in addition to the current Citi 4 provision.

From Maddingley Mulch Park & Ride, two different services have been assumed. The most frequent (every 10 minutes at peak times) travels towards the City Centre, and alternate services continue to Addenbrooke’s via the railway station. Services to the Science Park have been assumed at 20 minute frequencies at peak times, using proposed bus links through the Cambridge North West and Darwin Green developments.

Figure 8-7 Option 5: Indicative route location



Table 8-2 below summarises this information and other key characteristics relating to the assumed bus service patterns for each option.

Table 8-2 Options description summary

	Option 1	Option 2	Option 3	Option 4	Option 5
Description	<ul style="list-style-type: none"> • Bus lane on A1303 • Bus lane on Madingley Road 	<ul style="list-style-type: none"> • Services through West Cambourne and Cambourne • Segregated through Bourn Airfield • Uses old A428 • Segregated north of American Cemetery • Bus lane on Madingley Road 	<ul style="list-style-type: none"> • Services through West Cambourne and Cambourne • Segregated from Bourn Airfield to new Park & Ride • Segregated south of A1303 • New bridge across M11 • Segregated south of Madingley Road 	<ul style="list-style-type: none"> • Services through West Cambourne and Cambourne • Segregated through Bourn Airfield • Uses old A428 • Segregated north of American Cemetery • Uses existing bridge at Junction 13 • Travels through West Cambridge site, and then segregated south of Madingley Road 	<ul style="list-style-type: none"> • Services through West Cambourne and Cambourne • Segregated through Bourn Airfield • Uses old A428 • Segregated south of A1303 • New bridge across M11 • Segregated south of Madingley Road
Level of segregation	No segregation	Partially segregated	Fully segregated	Partially segregated	Partially segregated
Number of services (peak time)	12 per hour, only from new Park & Ride to City	12 per hour	9 per hour	9 per hour	9 per hour
Destinations served	<ul style="list-style-type: none"> • City Centre (every 10 mins) • Science Park (every 20 mins) • Addenbrooke's (every 20 mins) 	<ul style="list-style-type: none"> • City Centre (every 10 mins) • Science Park (every 20 mins) • Addenbrooke's (every 20 mins) 	<ul style="list-style-type: none"> • City Centre (every 10 mins), with alternative services (every 20mins) continuing to Addenbrooke's • Science Park (every 20 mins) 	<ul style="list-style-type: none"> • City Centre (every 10 mins), with alternative services (every 20mins) continuing to Addenbrooke's • Science Park (every 20 mins) 	<ul style="list-style-type: none"> • City Centre (every 10 mins), with alternative services (every 20mins) continuing to Addenbrooke's • Science Park (every 20 mins)
Park & Ride sites served	Stops at existing and new Park & Ride	Stops at existing and new Park & Ride	Stops at new Park & Ride	Stops at new Park & Ride	Stops at new Park & Ride
PT Journey times (2031, Cambourne - Drummer Street, Inbound, AM Peak)	46 mins	23 mins	20 mins	22 mins	22 mins

9. Beneficiaries

9.1. Introduction

Transport schemes are not simply about building new infrastructure or providing better services. Ultimately they are about meeting people's needs, in a way that is sustainable and does not have undesirable consequences for others.

The various options for the Cambourne to Cambridge Better Bus Journeys Scheme will aim to meet the needs of a broad cross-section of beneficiaries. This chapter provides an outline assessment of the groups of people who will benefit from implementation of the scheme.

The assessment of the various benefits to different users forms the basis of the Economic Case.

9.2. Business travellers

Business travellers are people who use their vehicle during the course of their working day – and can be sub-divided into car, van and HGVs.

Business travellers represent a hugely important segment of beneficiaries because their travel activity makes a direct contribution to the wider economy – especially through the exchange of ideas / information and the physical movement of goods. If business travellers are not able to undertake journeys or experience delays in doing so, then there are consequential direct and indirect costs to the economy. This can either be through activities that do not take place or additional costs for activities that do. For this reason, economists consider that business travellers have a high value of time.

The primary benefit of the scheme options for business travellers will be journey time savings and better reliability as a result of the reduction of traffic congestion on the A428 corridor. As greater numbers of people switch to PT, the relative space-efficiency of the bus will mean a reduction in the forecast numbers of cars on the road. In turn, fewer cars means lower levels of traffic congestion and delays.

Traditionally, bus services have not played a large role in business travel as they are often considered to be either too slow or simply not able to provide the necessary connectivity at all. However there is no necessary reason why this situation cannot be addressed, especially if there is potential demand within an urban area for movement between different employment areas for the purposes of collaboration.

9.3. Commuters

Commuters are people who travel from home to their place of employment or education on a regular (often daily) basis.

Commuters generally are the most numerous group of transport network users, with the result that demand tends to be highest in the “traditional” weekday morning and evening Peak hours (generally 0800 to 0900) and (1700 to 1800). Greater flexibility of working patterns, coupled with a wider spread of employment hours (especially at weekends), means that increasingly demand for commuting is taking place at other times of the day and week.

Where scheme options increase the range of direct bus services from residential to employment areas, a likely benefit to commuters is to increase the potential journey options available by other modes. So where a car might have previously been essential, a new bus route provides a greater degree of choice for car drivers (irrespective of whether this choice is actually taken up). For people of working age who do not have access to a car, this benefit is likely to be much more significant as it opens up employment opportunities that may have been impossible before.

As with business travellers, there will also be journey time savings associated with reductions in forecast traffic and congestion if there is mode switch to the bus. The extent of these benefits will depend on the potentially attractiveness of the service if journey times and reliability are competitive with the private car. Bus services are usually less able to perform radial movements, although if sufficient demand is present there is no particular reason why bus services cannot be provided.

9.4. People without access to a car

Even though it is often assumed that everyone has access to a car, there are still a significant number of people who rely on other modes – especially PT.

Whilst perhaps slightly less the case in Cambridge, people without access to a car are often the poorer members of society – the young, the elderly and people on low incomes. This means that such people completely rely on bus services for a whole range of journey purposes – including employment, education, shopping and personal business (in particular in relation to medical appointments). A lack of any viable bus service means a reduction in choice, especially in comparison to people who have access to a car.

Where existing frequencies are either very low or non-existent, improvements to bus services will be of particular benefit to people without access to a car – for example where they enable people to get to and from time-dependent journey purposes (e.g. jobs which have fixed start and finish times). Where already higher frequency services are improved still further, the additional “marginal” benefit to people without a car may be less significant.

9.5. Local communities

Local communities describe the places where people live – typically villages or defined areas within towns and cities.

Bus services can make communities more attractive places to live because of the additional accessibility that they offer – both for people who have access to a car and for those who don't.

There is also a potential local traffic reduction benefit if bus services are able to encourage people to leave their car at home. This can be the result of travel choices of residents within the area (i.e. less people driving from an origin within the community) and those from elsewhere (i.e. less people driving through other communities). Irrespective of its source, less traffic travelling within communities has benefits in terms of better air quality, lower levels of noise and fewer accidents.

9.6. Businesses, research institutions and the wider economy

Economies rely on transport systems to bring people together to create economic value.

Modern businesses and economies are increasingly reliant on people working together in concentrated areas or “clusters” of activity. Traditionally these clusters (or “agglomerations”) have formed around compact urban centres (so-called “Central Business Districts”) but increasingly they are spreading out across wider urban areas. The key economic facet of agglomerations is that they enable businesses to trade and collaborate with one another – for example as part of complex supply chains or through sharing ideas for new products and services – without the need to travel long distances and incur resulting costs. Educational institutions are increasingly contributing to this economic growth as a result of their cutting edge research, and they also represent an additional source of travel demand.

Because of their relative density, agglomerations attract significant travel demand especially by private car. In the medium to longer term, the resulting traffic congestion from this very dense development can make economic areas less attractive because of the delays and financial costs of access. But on the flip side they can also provide a market for mass PT.

Better PT services – both bus and rail – can make a significant contribution to economic performance of agglomeration areas by enabling many more people to gain access than would be physically possible if everyone drove their own car. Collectively, the businesses and research institutions in the agglomeration area benefit from the fact that there are more people working there – as they can trade, exchange ideas and collaborate more intensively. PT services also benefit agglomeration economies in other ways – for example by widening pools of labour and encouraging inward investment.

10. Performance of options

Scheme-specific objectives provide the performance metrics against which the options are assessed, both for their “strategic fit” to policies and in terms of their direct economic benefits.

10.1. Introduction

Based on a review of the LTP, Local Plan and GCCD objectives, we have set out a range of scheme-specific objectives and criteria / measures that provide a practical means of measuring the impact of the different options.

Given that it is proposed to fund the Cambourne to Cambridge Better Bus Journeys Scheme through the GCCD, it is essential that the transport infrastructure and service improvements meet the objectives that have been set.

10.2. Methodology

A bespoke Multi Criteria Assessment (MCAF) has been developed in order to appraise each scheme option against specific strategic goals. The MCAF approach allows assessment against a range of criteria such that the overall performance of each option can be taken into account based on a wider range of evidence than compared to Value for Money alone.

The assessment criteria fall into the following categories:

- Scheme costs and benefits;
- Transport impacts;
- Risks;
- Accessibility;
- Environmental impacts;
- Stakeholder support.

The framework is developed from high level strategic objectives from a review of key policy documents (outlined in full in Section 7.3 of this Case) and aims to make an assessment of the extent to which each scheme achieves specific, measurable outcomes as outlined in

Table 10-1. The high level objectives are based on a review of policy documents including the Draft South Cambridgeshire Local Plan, Draft Cambridge City Local Plan, Draft TSCSC, Huntingdonshire Draft Local Plan, and the NPPF. These policies together represent the vision statutory obligations and implementation plans/strategies for potential scheme development.

Table 10-1 MCAF: Goals, outcomes and metrics

Strategic Objectives	Corridor goals within scheme bounds (from TSCSC)	Measurable outcomes	Metrics considered in the MCAF
<ul style="list-style-type: none"> • Nurture the conditions necessary to enable the potential of Greater Cambridge to create and retain the international high-tech businesses of the future. • To markedly improve connectivity and networks between clusters and labour markets so that the right conditions are in place to drive further growth. • To better target investment to the needs of the Greater Cambridge economy by ensuring those decisions are informed by the needs of businesses and other key stakeholders such as the universities. • Source: GCCD Assurance Framework 	<ul style="list-style-type: none"> • Focus on bus and addressing issues that prevent a good service being delivered. • Segregated links or offline alignments on the A428 and M11. • Bus priority measures • Outer ring Park & Ride on A428 between Cambourne and A1303 • Busway / HQPT infrastructure to serve Bourn Airfield / Cambourne • Walking and cycling improvements, including direct links • Highway capacity improvements 	<ul style="list-style-type: none"> • Value for Money • Increased transport capacity • Improved transport connectivity • Improved journey times • HQPT 	<ul style="list-style-type: none"> • HQPT Attributes (vehicle quality / ride quality / RTPI / branding / ticketing) • Level of quality bus service that segregation of buses from general vehicular traffic provides • Improvements in walking infrastructure • Improvements in cycling infrastructure • Disruption to existing traffic during construction • Deliverability risk (planning/permissions) • PVC • PVB • Journey times (2031, Cambourne - Drummer Street, Inbound, AM Peak) • Bus frequency (AM Peak, Buses Per Hour, Inbound) • Bus and Park & Ride mode share • Car mode share • Agglomeration • Constructability risk (complexity of delivery) • Operability risk • Reliability • Sub-total • Accessibility • Total change in air quality over the 60 year appraisal period • Change in CO2 emissions (£,NPV) • Change in noise impacts on households (£,NPV) • Impact on the water environment • Landscape and visual impact • Heritage impact • Biodiversity impact • Reduction in road traffic accidents • Stakeholder feedback from public consultation

For all qualitative metrics (e.g. HQPT attributes), each option was assigned an integer score from 1-5, with a score of five representing the 'best performing' scheme and one the 'worst performing'. The rationale for scoring qualitative measures is outlined in the Economic Case and is based on a comparison of each

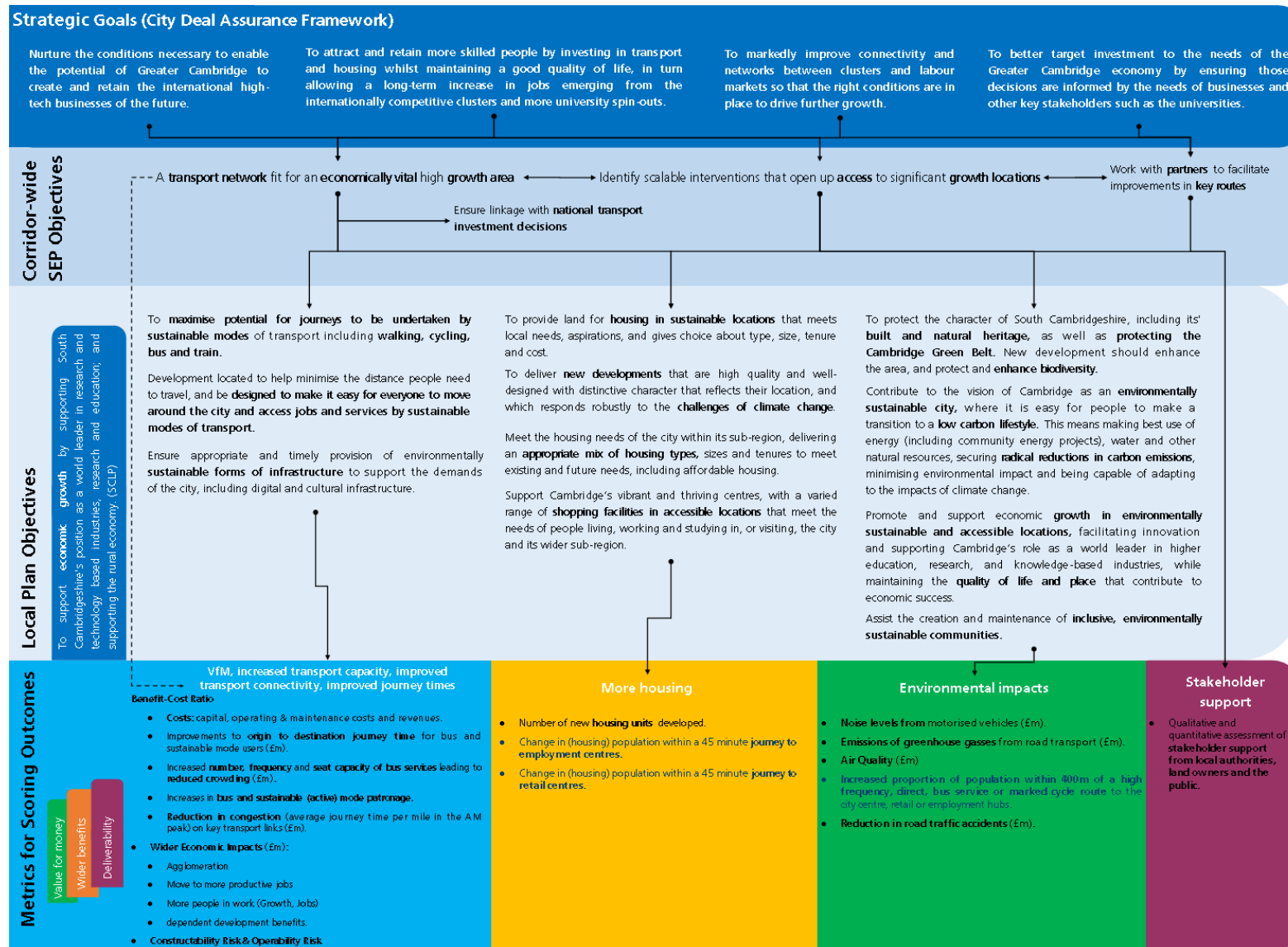
scheme specification against its potential ability to perform against each of the metrics. For example in terms of delivery HQPT, it would be envisaged that a scheme with the highest levels of segregation would provide a higher quality ride for passengers and offer more reliability than a scheme with the least level of segregation, where buses are travelling with general traffic on the highway. In this regard a fully 'offline' option would score 5 (best performing) and a fully online option would score 1 (less comparative ability for the option to achieve the goal).

Where quantitative metrics were used, then the best performing option was given a score of five and this was then scaled proportionally based on the underlying data for each option. Using journey times as an example, the fastest journey time would score 5 (best performing). If the fastest time was (hypothetically) 10 minutes from the origin to destination, then a scheme that took twice as long (20 minutes) would be allocated half of the top score, in this example 2.5.

The scores are summed across all metric and the total score provides an overall indication of performance against a range of strategic fit, impact and Value for Money criteria. These scores must be considered alongside the wider Value for Money context and cannot be used as the sole basis for any investment decisions.

Figure 10-1 sets out the detailed logic map that underpins the development of this MCAF analysis.

Figure 10-1 Logic map for Cambourne to Cambridge Better Bus Journeys Scheme



The scoring of the MCAF is based on a qualitative rationale which sets out a proposition as to how and why the option will impact on the relevant performance metric. This rationale was developed as part of an internal workshop and is shown in Table 10-2.

Table 10-2 Scoring assessment rationale

Outcomes	Performance Metric	Rationale
Value for Money Increased transport capacity improved transport connectivity improved journey times HQPT	HQPT Attributes (rolling stock / ride quality / RTPI / branding / ticketing)	Options with no dedicated infrastructure score lower than those with dedicated infrastructure, as ride quality is expected to deteriorate over time. Options with dedicated infrastructure over part of the route score slightly higher, and options with dedicated infrastructure over the entire route score highest, as it is assumed they can maintain both ride quality and lower start/stop frequency. Branding is also expected to be stronger on an offline scheme.
	Level of service that segregation provides	More segregation will be indicative of greater route control and fewer permissions issues e.g. utilities / general highway maintenance works that could be undertaken during operation.
	Improvements in walking infrastructure	Where segregated / offline sections are provided, direct walking infrastructure will be included within the scheme.
	Improvements in cycling infrastructure	Where segregated / offline sections are provided, direct cycling infrastructure will be included within the scheme.
	Disruption to existing traffic during construction	No full assessment of construction disruption has been undertaken, however construction impacts may be greatest where infrastructure is proposed on Madingley Road / Madingley Rise. Diversion options for traffic using Madingley Road are very limited.
	Deliverability risk (planning/consents)	Deliverability risk (in terms of planning requirements and permissions) is expected to be lowest where schemes are based on upgrades to existing infrastructure. New infrastructure on greenfield sites is expected to have the highest risk. Any relevant environmental / statutory consents would be required.
	Present Value of Costs (PVC)	Results from modelling undertaken.
	PT Benefits	Results from modelling undertaken. Does not include environmental impacts (captured separately below)
	Journey times (2031, Cambourne - Drummer Street, Inbound, AM Peak)	Results from modelling undertaken.
	Bus frequency (AM Peak, Buses Per Hour, Inbound)	Reported as no. of buses per hour. For Option1 divide by two as it is 12 buses per hour, but not on the full route
	Bus and Park & Ride mode share	Results from modelling undertaken.
Car mode share	Results from modelling undertaken.	

Outcomes	Performance Metric	Rationale
	Agglomeration	Results from modelling undertaken.
	Constructability risk (complexity of delivery)	Delivery will be most complex where the route options include a new bridge over the M11. In addition, Madingley Road has traffic management restrictions in peak periods, so construction windows are likely to be restricted, increasing the complexity of construction.
	Operability risk	Bus operations are easier where 2-way priority is given to buses. This gives operators more consistent and reliable journey times to enable easier planning for turn-around.
	Reliability	Expected that offline options will offer a more reliable service than those that run online.
More Housing	Accessibility	Based on qualitative assessment of accessibility plots.
Environmental Impacts	Total change in air quality over the 60 year appraisal period	Environmental assessment undertaken based on vehicle flows extracted from the traffic model.
	Change in CO2 emissions (£,NPV)	
	Change in noise impacts on households (£,NPV)	
	Impact on the water environment	Based on environmental assessment undertaken
	Landscape and visual impact	Based on environmental assessment undertaken
	Heritage impact	Based on environmental assessment undertaken
	Biodiversity impact	Based on environmental assessment undertaken, based on the principal of 'most adverse category'. Impact of options and potential mitigation measures to be assessed during design development.
	Reduction in road traffic accidents	Minimal change across all options, compared to do-minimum
Stakeholder support	From public consultation	Based on assessment of consultation responses to date.

Based on this approach, each option has been scored against qualitative and quantitative metrics and these results are shown in the **Economic Case**.

10.3. Option assessment against strategic fit

Key points relating to strategic-fit assessment for each option are outlined below.

Option 1 – (1A2A, 1 Central + 2 North)

- The lowest cost option (Option 1) is unlikely to offer a step change in capacity, connectivity and journey efficiency (i.e. combination of speed and reliability) in order to deliver a HQPT service on the corridor.
- The existing Park & Ride at Madingley Road allows traffic to be intercepted from both the A1303 / Madingley Road and from the M11
- In increasing bus usage this option meets some, but not all, of the strategic criteria. Critically, the TSCSC aspires to deliver a HQPT service along the corridor, with increasing levels of segregation. As a fully online option with bus priority measures on the existing highway, has a limited ability to achieve this key strategic objective. The restrictions of the online alignment on the A1303 also mean that bus priority provision can only be accommodated in an inbound (eastbound) direction, meaning that there is no priority for services travelling away from Cambridge.
- This option does not provide improvements west of Madingley Mulch as there is little congestion expected there up to 2031 based on the modelling undertaken. This means that this option is not likely to fully achieve the aspirations (set out in the TSCSC) for providing 'busway / HQPT infrastructure' that connects Cambourne West and Bourn Airfield.
- This option does not extend or interfere with cycling or pedestrian provision. In not doing so it does not support the aspirations of the TSCSC, which aims to provide more direct cycling and walking routes.

Option 2 – (1B2B, 1 North + 2 Central)

- The option is offline between Cambourne and Bourn Airfield which directly addresses the objective in the TSCSC to create a HQPT corridor that provides a busway/HQPT infrastructure to serve Bourn Airfield / Cambourne.
- The offline busway section increases cost compared to Option 1, however due to the use of existing infrastructure along St. Neots Road, this provides a compromise between fully offline and fully online options. The restrictions of the online alignment on Madingley Road also mean that bus priority provision can only be accommodated in an inbound direction, meaning that there is no priority for services travelling away from Cambridge.
- The option is considered to be a compromise between costs, connectivity, accessibility and HQPT to the west of Madingley Mulch. This broadly addresses strategic objectives for the western section of the option. In addition this option provides direct walking and cycling infrastructure along the offline section of the route, directly addressing walking and cycling objectives for this section of the route (but not for the section from the M11 to the Lady Margaret Road).

Option 3 – (1C2C, 1 South + 2 South)

- Option 3 performs best in terms of strategic fit, mainly because the fully offline route provides the highest level of connectivity, capacity and journey efficiency. This is assumed to make bus travel much more attractive and to deliver wider economic benefits as a result of the potential to intensify development.
- This option looks to build on the success of the current Guided Busway in addressing Cambridge's ambitious long term vision as a fast growing highly productive City that maintains a high quality standard of living, in terms of: accessibility of housing to employment; the promotion of PT; increasing sustainable growth and encouraging use of active modes.
- This option does not serve the existing Madingley Road Park & Ride (as services would need to significantly divert from their route to do so).
- The aim of this option is to maximise fulfilment of the vision and strategic objectives set out by relevant policy documents which is interpreted as being achieved through a fully segregated system and a high level of HQPT. As a result the option is the most costly due to significant conception, design and construction costs (plus other costs, revenue and indirect tax impact).
- Being off Madingley Road and segregated, the 1 South section of the route does not add to congestion on Madingley road as it is not online which indicates a good strategic fit in this area, in that it addresses HQPT objectives whilst also addressing congestion issues in this part of the corridor.

Option 4 – (1BC2B, 1 Hybrid + 2 Central)

- This option is offline between Cambourne and Bourn Airfield, which directly addresses the objective in the TSCSC to create a HQPT corridor that provides a busway/HQPT infrastructure to serve Bourn Airfield / Cambourne.
- This option does not include a bridge over the M11 and instead re-joins the main carriageway where the buses will integrate with general traffic. Having utilised the existing bridge, the services will continue on dedicated bus infrastructure through the West Cambridge site and towards Grange Road, which is also consistent with the strategic requirement for segregation along the corridor.
- Being off Madingley Road and segregated, the 1 Hybrid section of the route does not add to congestion on Madingley road as it is not online which indicates a good strategic fit in this area, in that it addresses HQPT objectives whilst also addressing congestion issues in this part of the corridor.

Option 5 – (1C2B, 1 South + 2 Central)

- The option is offline between Cambourne and Bourn Airfield which directly addresses the objective in the TSCSC to create a HQPT corridor that provides a busway/HQPT infrastructure to serve Bourn Airfield / Cambourne. This option includes a bridge over the M11 and continuous busway infrastructure east of Madingley Mulch Park & Ride.
- This option does not serve the existing Madingley Road Park & Ride as services would need to significantly divert from their route to do so.
- Being off Madingley Road and segregated, the 1 South section of the route does not add to congestion on Madingley road as it is not online which indicates a good strategic fit in this area, in that it addresses HQPT objectives whilst also addressing congestion issues in this part of the corridor.

10.3.1. Strategic economic appraisal

Mott MacDonald was appointed in April 2016 to provide a strategic economic appraisal of the A428-A1303 Cambourne to Cambridge bus scheme¹³. The purpose of this work was to provide an initial assessment of the potential of scheme options to deliver indirect Wider Economic Benefits (WEBs) over and above those captured in conventional appraisal.

The approach taken was to examine the indirect wider economic impacts at the Greater Cambridge and UK level deriving from land utilisation changes linked to the scheme and its options through closely examining the type of transport benefits that will emerge and comparing with the strategic planning framework (i.e. major development sites bringing about land use changes). The economic impacts from land utilisation relate to residential dwellings, jobs and the associated GVA. The assessment also includes consideration of the extent to which the impacts can be considered a net gain at the UK level. The full methodology is presented in the Mott MacDonald Report appended to the SOBC.

The Mott MacDonald Strategic Economic Appraisal considers three scheme variants based on the level of segregation of buses from general traffic; 'low' (on-highway only), 'medium' (hybrid option with some on-highway and some segregated elements) and 'high' (fully segregated) and these are broadly comparable with Options 1, 4 and 3 respectively in Section 8 of this report.

The Strategic Economic Appraisal of GVA considers the net additional impacts at the UK level of:

- Land utilisation changes – where jobs and associated GVA are net additional to the UK, i.e. the attraction of the internationally mobile knowledge-based employees;
- Access to more productive jobs within the UK – the benefits derived from those jobs created in Greater Cambridge which support existing UK residents to access more productive jobs than they may currently hold;

¹³ Mott MacDonald. (2016). *Strategic Economic Appraisal of A428-A1303 Bus Scheme. Wider Economic Benefits.*

The analysis concludes that the Segregated (high) and Hybrid (medium) options are likely to deliver the most benefits in terms of supporting business investment and growth and labour market mobility. The analysis highlights that **the “Segregated route (Option 3) delivers against the longer term strategic aims of Greater Cambridge in terms of promoting a positive image and perceptions and investment in capacity for post 2031 growth”** and the **“maximum level of growth attributed to the scheme is attributed to the Segregated Option given it will provide the greater stimulus via transport benefits and investment in long term capacity to support the GCCD objectives.”**

The Strategic Economic Appraisal reports the UK level GVA benefits in 2010 values and prices discounted over a 30 year period. Table 10-3 replicates the Mott MacDonald appraisal of UK level GVA benefits from the Strategic Economic Appraisal of the A428-A1303 Bus Scheme.

Table 10-3 A428-A1303 Bus Scheme: UK indirect wider economic benefits GVA impacts¹⁴

Benefit	Option (£m in discounted 2010 factor prices)		
	Low – On highway (Option 1)	Medium – Hybrid (Option 4)	High – Segregated (Option 3)
GVA benefits – UK Level			
Land Utilisation – net additional jobs to the UK	38.4	129.7	167.5
Move to more productive jobs within the UK	7.0	23.7	30.6
Total GVA	45.4	153.4	198.1

The full analysis and results can be consulted in ‘Mott MacDonald. (2016). Strategic Economic Appraisal of A428-A1303 Bus Scheme. Wider Economic Benefits’ in the appendix to this SOBC.

¹⁴ Excerpt from Mott MacDonald strategic economic appraisal of the A428-A1303 Bus Scheme: UK indirect wider economic benefits GVA impacts over a 30-year period

11. Conclusions

The Strategic Case identifies a case for change along the A428 / A1303 corridor.

The GCCD's mandate to maintain and grow Greater Cambridge includes accelerating the delivery of 33,500 new homes and delivering 45,000 new jobs and this requires improving transport infrastructure and services to support and connect housing and employment sites.

To maintain the high quality of life enjoyed in Greater Cambridge there is a need to reduce car dependency and alleviate congestion along key corridors. Investment in high quality and segregated PT will help achieve these aims.

The GCCD's mandate is to "help Greater Cambridge to maintain and grow its status as a prosperous economic area" and toward achieving the following outcomes in support of economic growth:

- Accelerating delivery of over 33,500 new homes on a combination of major sites and rural exception sites in and around the city;
- Delivering 45,000 new jobs, via a number of employment growth sites identified and in development around Cambridge to build on the city's world leading science research business credentials; and
- Improving transport infrastructure to support this housing and employment growth while retaining the high quality of life in the region.

There is a clear Strategic Case to be made for improvements to PT infrastructure and services on the A428 / A1303 given the corridor's important contribution to meeting GCCD's mandate. Overall it is clear that there is a consistent and direct relationship between the Local Plans, Transport Strategies and the City Deal priorities. As well as defining specific corridor objectives related to new developments, they all indicate a need to provide HQPT and walking and cycling improvements in order to offer an alternative to the private car. The Local Plans indicate that consideration should be given to attempting to ensure that PT services are not affected by general traffic.

The A428 / A1303 corridor contributes to a wide network of movement and connectivity around the city of Cambridge. However, along with high levels of car dependency, some sections of the corridor (particularly on the A1303 Madingley Road, eastbound into Cambridge) suffer from congestion, slow journey times and poor journey time reliability during morning and evening Peak hours. If PT provision along this corridor is enhanced sufficiently to link growth sites, this could support wider business investment and confidence and maintain a high quality of life in the corridor.

Future housing growth at Cambourne, Bourn Airfield and St Neots will, in future, add extra pressure onto already congested sections of the A428. If travel demand is not tackled with more efficient modes of transport, this transport congestion could constrain further high levels of growth and compromise the high quality of life that is enjoyed in Cambridge. Economic growth in a successful area such as Cambridge is reliant on targeted investment in physical infrastructure that addresses key issues such as housing shortages and a congested transport network, in line with the vision for Cambridge and its policy framework.

The Cambridge and South Cambridgeshire Local Plans, and the TSCSC, present a clear and distinct overall vision based on a need to ensure that growth takes place in a sustainable manner, and that development offers opportunities to all of its citizens. New housing development will therefore need to be accompanied by investment in sustainable transport. The transport system should encourage sustainable modes and be centred on high quality dedicated PT routes with fast and frequent links to and from key destinations along with expanded segregated provision for walking and cycling. The vision recognises that whilst car use will continue in the future where it is necessary, alternative modes of travel – PT as well as cycling and walking – may, with targeted investment, become an attractive alternative to private car use and therefore deliver a step change in levels of patronage.

In terms of the A428 corridor, the vision for PT is ambitious; defined as high quality, segregated, fast frequent and reliable. Further, investment in transport infrastructure and bus services will need to take into account environmental considerations and improve the provision for pedestrians and cyclists.

Previous phases of this work identified five options to improve the PT provision on the A428 Corridor, ranging from a fully offline option with the highest strategic fit to an entirely online option, with the lowest strategic fit. These are summarised below:

- **Option 1:** this is the lowest cost option, involving provision of a bus lane on the A1303 and Madingley Road. This option is unlikely to offer a step change in capacity, connectivity and journey efficiency (i.e. combination of speed and reliability) in order to deliver a HQPT service on the corridor.
- **Option 2:** this option makes use of St Neots Road, also providing a segregated bus link between Cambourne and Bourn Airfield and to bypass Madingley Rise. From here buses continue on an inbound-only bus lane on Madingley Road. This option provides a compromise between fully offline and fully online options.
- **Option 3:** is fully offline between Cambourne and Grange Road. This option performs best in terms of strategic fit, mainly because the fully offline route provides the highest level of connectivity, capacity and journey efficiency. This is assumed to make bus travel much more attractive and to deliver wider economic benefits as a result of the potential to accommodate intensification of development. This option does not add to congestion on Madingley road as it is not online which indicates a good strategic fit in this area, in that it addresses HQPT objectives whilst also addressing congestion issues in this part of the corridor.
- **Option 4:** this option makes use of St Neots Road, also providing a segregated bus link between Cambourne and Bourn Airfield and to bypass Madingley Rise. From here buses use the existing bridge to cross the M11 and continue through the West Cambridge site and offline towards Grange Road. This option does not add to congestion on Madingley road as it is not online which indicates a good strategic fit in this area, in that it addresses HQPT objectives whilst also addressing congestion issues in this part of the corridor.
- **Option 5:** this option makes use of St Neots Road, also providing a segregated bus link between Cambourne and Bourn Airfield. A segregated bus link is also provided between the A428 / A1303 Junction and Grange Road. This option does not add to congestion on Madingley road as it is not online which indicates a good strategic fit in this area, in that it addresses HQPT objectives whilst also addressing congestion issues in this part of the corridor.

The Strategic Economic Appraisal of the scheme conducted by Mott MacDonald concludes that the Segregated (high) and Hybrid (medium) options are likely to deliver the most GVA benefits in terms of supporting business investment and growth and labour market mobility. The Strategic Economic Appraisal calculates the UK level GVA for Option 1 to be £45.4m (in 2010 discounted values and factor prices), Option 3 to be £198.1m and option 4 to be £153.4m.

In the Economic Case, we conduct a qualitative and quantitative assessment of performance of Options 1 to 5 against a set of strategic, transport, environmental, wider economic and Value for Money criteria. The eventual choice of option by CCC for submission to the GCCD Board will need to consider all of these criteria and come to a balanced assessment of the strategic fit, costs, benefits and wider impacts.

Appendices



Appendix A. SWOT analysis

A.1. Option 1 Central (was 1A)

<p>Strengths</p> <ul style="list-style-type: none"> • P&R capacity in the corridor is increased • New P&R located at onset of greatest delay on the road network • No new structures are required • Makes good use of existing infrastructure • Relatively low cost of implementation • Efficient at intercepting majority demand • Efficient at providing PT priority on links of most acute congestion in AM peak 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Inbound bus lanes will only benefit morning peak bus journeys and will not address issues with PM westbound peak congestion • The route along Madingley Rise and Madingley Road is potentially restricted by the width of the corridor available for construction • Cost of providing infrastructure along Madingley Rise and Madingley Road
<p>Opportunities</p> <ul style="list-style-type: none"> • Any works could be accommodated in the existing road network which could make links to wider strategic network of bus priority measures easier to achieve • The route beyond the A428 has the potential to deliver a route into Cambridge linking with the existing park and ride site 	<p>Threats</p> <ul style="list-style-type: none"> • Less flexible route as it uses existing highway • Possible loss of cycle amenity on Madingley Road • Environmental impacts on road facing properties

A.2. Option 1 North (was 1B)

<p>Strengths</p> <ul style="list-style-type: none"> • P&R capacity in corridor increased. • New P&R located at onset of greatest delay on the road network. • No new structures are required. • Fully segregated bi-directional route from P&R to the M11 offers benefits in both AM and PM peaks. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Some green field construction. • Stopping the project during construction would leave some infrastructure that may not serve any purpose to the local area or communities. • High cost to provide new infrastructure • Inbound bus lane on Madingley Road will only benefit morning peak bus journeys and will not address issues with PM peak congestion. • The route along Madingley Road is potentially restricted by the extent of the corridor available for construction.
<p>Opportunities</p> <ul style="list-style-type: none"> • As the route runs through open land west of the M11, there is flexibility to alter the alignment if required. • The route beyond the A428 has the potential to deliver a route into Cambridge linking with the existing park and ride site. 	<p>Threats</p> <ul style="list-style-type: none"> • Lack of fixed route alignment and scale of forecast traffic change prevents certainty on a number of impacts. • Due to the various constraints, such as listed buildings and SSSI's, there is limited capability to change the route without impacting on areas that may restrict the route.

A.3. Option 1 South (was 1C)

<p>Strengths</p> <ul style="list-style-type: none"> • P&R capacity in corridor increased • New P&R located at onset of greatest delay on the road network. • Segregated bi-directional busway offers AM and PM peak congestion avoidance on direct approach to the City. • Efficient at providing PT priority at areas of most acute congestion. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • New M11 over-bridge required. • High level of green field construction needed. • Options for crossing the M11 are limited to localised areas due to known constraints. • Improvements to journey times from existing Madingley Road P&R site would only be delivered through additional link to proposed alignment via West Cambridge University site.
<p>Opportunities</p> <ul style="list-style-type: none"> • The route runs mainly through non-built up land and there is flexibility to alter the route in this area. • Potential ease of connectivity to Western Orbital routes • Potential to upgrade cycle facilities along line of the Coton Footpath through to Grange Road. 	<p>Threats</p> <ul style="list-style-type: none"> • Unknown conditions for M11 bridge gives rise to a large range in cost. • Unknown available land through/adjacent to the West Cambridge University site. • Lack of fixed route alignment and scale of forecast traffic change prevents certainty on a number of impacts. • Stopping the project during construction would leave some infrastructure that may not serve any purpose to the local area or communities. • The constraint of the M11 and nearby Coton and the University limit any revisions that may be required to the route. • Possible environmental impact could be high.

A.4. Option 2 North (was 2A)

Strengths <ul style="list-style-type: none">• Makes good use of existing infrastructure• Low capital costs, no new infrastructure.	Weaknesses <ul style="list-style-type: none">• Does not provide PT priority directly to/from Cambourne, Bourm Airfield or St Neots.
Opportunities <ul style="list-style-type: none">• Lack of fixed infrastructure west of Madingley Mulch allows for a range of service patterns to be adopted.	Threats <ul style="list-style-type: none">• Lack of scale of traffic change prevents certainty on environmental impact.• Change in traffic conditions on A428 could slow bus journey times without dedicated public transport priority.

A.5. Option 2 Central (was 2B)

<p>Strengths</p> <ul style="list-style-type: none"> • No new structures are required. • Minimises need for green field route construction. • Makes good use of existing infrastructure. • Efficient at intercepting demand directly from Cambourne and Bourm Airfield. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Use of the old A428 will make journey times slower than using the dual carriageway.
<p>Opportunities</p> <ul style="list-style-type: none"> • A number of the individual elements within the option could be scaled up or down whilst utilising the existing network. • Stopping the project during construction would have a lesser impact than some of the routes and any works could be accommodated in the existing road network. If the route was stopped then the improved road network will be utilised in the existing network. • Submission South Cambridgeshire Local Plan Policies require segregated public transport provision through the developments, and a bus link across the Broadway. 	<p>Threats</p> <ul style="list-style-type: none"> • Unknown how the route will link to/through the developers' sites and how they will be connected. • Lack of fixed route alignment through these sites and scale of forecast traffic change prevents certainty on a number of impacts. • Environmental impacts of off-line route and along St Neots Road.

A.6. Option 2 South (was 2C)

<p>Strengths</p> <ul style="list-style-type: none"> • No new structures are required • Efficient at intercepting demand directly from Cambourne and Bourn Airfield. • Fully segregated bi-directional route from Cambourne to the new P&R offers benefits in both AM and PM peaks • Services pass close to both Highfields Caldecote and Hardwick, providing connectivity to both. 	<p>Weaknesses</p> <ul style="list-style-type: none"> • Significant green field construction. • Stopping the project during construction would leave some infrastructure that may not serve any purpose to the local area or communities. • High cost to provide new infrastructure.
<p>Opportunities</p> <ul style="list-style-type: none"> • As the route runs through non-built up land there is flexibility to change route to accommodate additional locations and nodes. • Submission South Cambridgeshire Local Plan Policies require segregated public transport provision through the developments, and a bus link across the Broadway. 	<p>Threats</p> <ul style="list-style-type: none"> • Unknown how the route will link to the developers' sites and how they will be connected. • Unknown proximity of route to wildlife site and size of wildlife sites near Highfields, Caldecote and Hardwick. • Lack of fixed route alignment and scale of forecast traffic change prevents certainty on a number of impacts. • Due to the various constraints, such as listed buildings and SSI's, there is limited capability to change the route without impacting on areas that may restrict the route or development.

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