



GREATER  
CAMBRIDGE  
PARTNERSHIP

Growing and sharing prosperity  
Delivering our City Deal

# Greater Cambridge CaMKOx First/Last Mile Strategy

Submission to the National Infrastructure  
Commission

September 2017

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# 1 Greater Cambridge: success and challenges

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## 1.1 Introduction

Greater Cambridge is one of the most successful areas in Britain. Cambridge City has the highest number of patent applications per resident, making it the most innovative city in the country, and that is reflected in very high productivity levels for workers.<sup>1</sup> This is also reflected in Cambridge's leading skills levels and wages and future success is supported by generally successful local schools.

Cambridge is also a young, active and vibrant city. It has the second highest proportion of 20-29 year olds as any city in Britain, and a high proportion of working age adults aged 30-44. As well as being economically dynamic, its people are physically active, with the highest proportion of commuting by cycling and one of the lowest proportions of commuters by private vehicle.<sup>2</sup>

Greater Cambridge's success could be its biggest threat. The highly-skilled, educated and productive workforce and businesses attract residents and firms from across the country and around the world. This inevitably puts pressure on the local housing market and on the transport network.

Greater Cambridge is becoming increasingly unaffordable for workers, with a house price to income ratio amongst the highest in the country outside of London. The city's greenbelt is an asset in terms of maintaining the quality of life, environmental quality and character of Cambridge, but makes delivering growth and expansion more challenging.

The Local Authorities and the Local Enterprise Partnership are working together to provide the infrastructure which will support the fast growth of the area, but housing shortfalls and road and rail congestion are starting to impede on the quality of life that plays a big part in attracting business and workers.

The National Infrastructure Commission (NIC) recognised this fact in their interim report to government which finds that a lack of sufficient and suitable housing presents a fundamental risk to the success of Oxford, Cambridge and Milton Keynes. Without a joined-up plan for housing, jobs and infrastructure across the corridor, it will be left behind by its international competitors. By providing the foundations for such a strategy, new east-west transport links present a once in-a-generation opportunity to secure the area's future success.<sup>3</sup>

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<sup>1</sup> Cambridge ranks 9<sup>th</sup> in the UK according to Centre for Cities 2017. GVA per worker is estimated at £59,241—well above the national average.

<sup>2</sup> Centre for Cities. 2017. <http://www.centreforcities.org/city/cambridge/>

<sup>3</sup> NIC. 2016. National Infrastructure Commission interim report | Cambridge – Milton Keynes – Oxford corridor. [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/569867/Cambridge-Milton\\_Keynes-Oxford\\_interim\\_report.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/569867/Cambridge-Milton_Keynes-Oxford_interim_report.pdf)

## 1.2 Economy

Greater Cambridge is a major contributor to UK's private sector economic success, and one of the UK's prime locations for companies. It is an increasingly attractive place to locate a business and trade within the corridor. Employment and especially the innovation economy show many signs of growth. There are several reasons why Greater Cambridge is attractive for business and enterprise.

Greater Cambridge is a place where large multinationals and SMEs are prospering and want to locate to benefit from agglomeration economies generated by its vibrant innovation sector such as knowledge spill overs and the local pool of highly educated professionals. Established firms located within Cambridge are expanding and attracting more workers. Firms are also relocating to Cambridge, and new businesses are being created locally.

Greater Cambridge's key distinctive assets lie in its competitiveness in fast growing knowledge-based industries and its capacity to innovate. The city ranks first among UK cities for patent applications per number of residents, and 4<sup>th</sup> globally.

Innovation in the Greater Cambridge area is boosted by the quality of its universities, and its pool of students, researchers and professors.

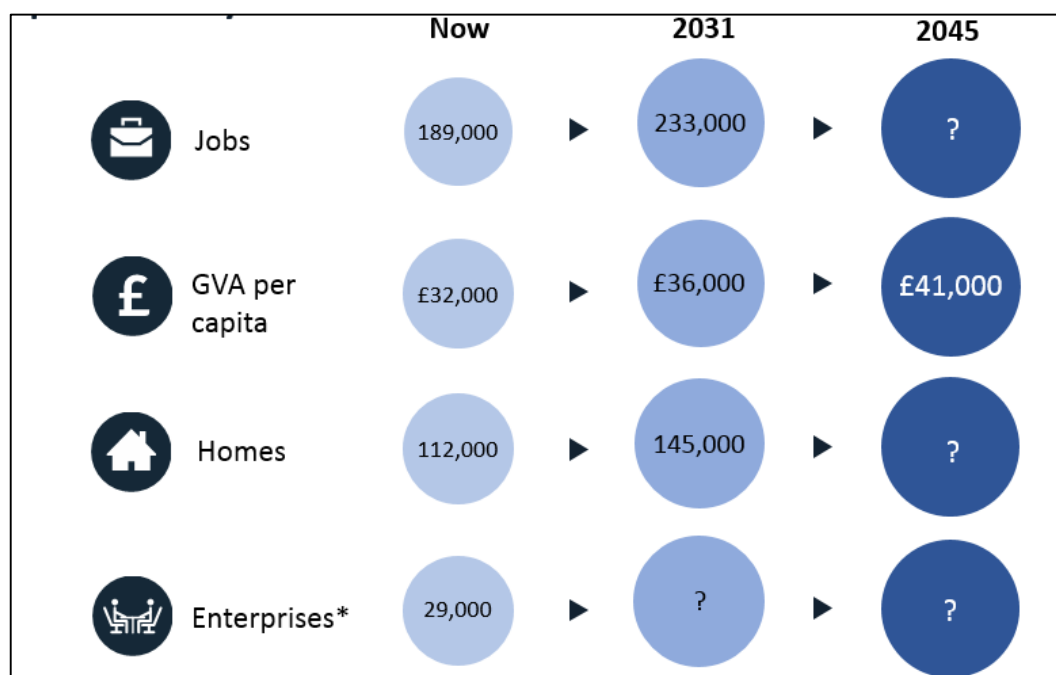
University and anchor firms are driving a large rate of start-ups and scale-ups. 705 business start-ups were registered in 2015. Businesses making Greater Cambridge's knowledge and innovation economy are benefitting most from the forces of agglomeration. Such businesses are indeed able to co-locate and interact more easily, which is then reflected in increased levels of productivity, for a variety of reasons.

However, major challenges are constraining Greater Cambridge's capacity to realise its full potential, such as housing availability and affordability, greenbelt constraints on growth and city centre congestion. With the right investments in transport infrastructure alongside strategic interventions, more land could be released for housing (easing affordability pressures) and urban congestion could reduce.

The Government's Industrial Strategy Green Paper is explicit in stating that supporting knowledge industries is a central plank of national economic policy. Greater Cambridge has the potential to greatly contribute to achieve this national objective through its density of highly-skilled jobs in high value-added sectors. And by creating the links between Cambridge, Milton Keynes and Oxford, the NIC's interventions will establish the infrastructure and connectivity necessary to generate agglomeration across these highly productive cities.

The CaMKOx corridor is one of the fastest growing, and most successful areas in the country. With the appropriate investment, recent growth forecasts highlight Greater Cambridge's potential to attract even more jobs, deliver more homes and increase local productivity.



Figure 1. Growth forecasts for the Greater Cambridge Partnership (GCP) area<sup>4</sup>

### 1.3 Housing market

Housing affordability is one of the greatest challenges facing the Greater Cambridge area. With a buoyant economy and projected growth, the ability to access housing is becoming increasingly difficult, even for average income working households. Local businesses have voiced their concern over the affordability gap for their employees. There is a growing acknowledgement that local authorities are under pressure to support affordable housing not only for those on low incomes, but for key workers and those on mid-range incomes.

House prices are very high relative to local income in Cambridge and South Cambridgeshire. With an average house price of £475,000, Cambridge has the 3rd highest ratio of average home price to average wages among British cities. The median quartile house price in Cambridge is 11.6 times the median income of those working in the area, and 8.3 in South Cambridgeshire, compared to 7.6 nationally. For those on lower incomes, the affordability is worse at 16.4 times lower quartile price to lower quartile incomes for Cambridge and 11.8 for South Cambridgeshire.

The number on the housing register seeking affordable rented accommodation continues to grow, with over 5,000 applicants looking for homes in the Greater Cambridge area. In terms of privately renting, the average median private rent for a 2 bed property is £1,150 in the City and £900 in South Cambridgeshire, compared with the Local Housing Allowance rate of around £610 per month. Therefore, those households dependent on housing benefit face a huge deficit in being able to pay for their rent within the Greater Cambridge area or face moving further out of the area to more affordable rents. The huge disparity between the LHA and rents

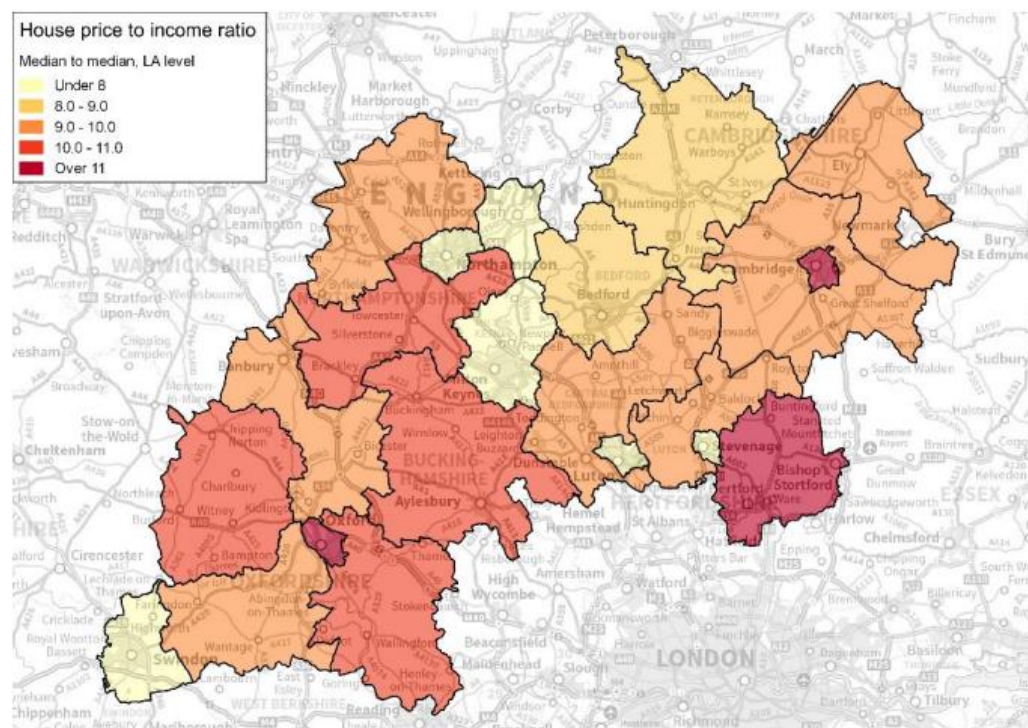
<sup>4</sup> The area covered by forecasts corresponds to the Greater Cambridge Partnership perimeter (Cambridge City + South Cambridgeshire) except for enterprises which is county level data. Most realistic estimates have been chosen amongst several official forecasts (2016 East of England Forecasting Model, 2011 Cambridge Local Economic Assessment, Local plans)

needs to be reviewed to take account of the local housing market for Greater Cambridge rather than the Broad Rental Market Area currently set for Cambridge.

High house prices and rents in Cambridge are pushing commuters into South Cambridgeshire and further afield. This puts stress on the transport network as people move further away from work than can be supported by active travel modes.

Meeting the demand for housing, and the provision of affordable housing in particular, is a key strategic and economic priority for the area. This problem is replicated along the length of the CaMKOx corridor as set out in the NIC's interim report of last year.

Figure 2. Housing affordability across the CaMKOx corridor. Ratios of median house prices to median earnings across the corridor

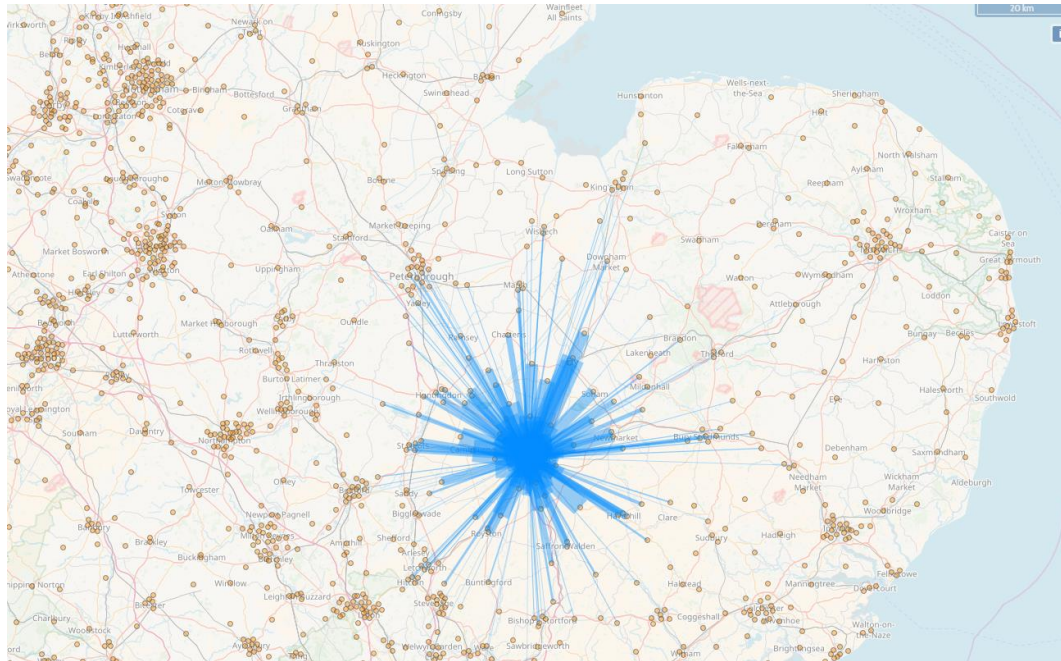


Source: Savills for NIC -The Property Market Within The Cambridge – Milton Keynes – Oxford Corridor (2016)

## 1.4 Transport network and commuting patterns

Transformational growth in Cambridge is hindered by poor East-West connectivity, which is visible in the high levels of road congestion. Places reachable by a 120-minute public transport journey from Cambridge city centre are indeed mainly located along the North-South axis. On the contrary, even relatively close places along the East-West axis cannot be reasonably reached within 2 hours on public transport.

Typical commuters can travel up to 1 hour by car or public transport to access central Cambridge, as shown in figure 3. The reach of the commuter labour market to the east and west is much less than to the north and south: no more than around 17 miles on that basis.

**Figure 3. Origins within an hour travel to Cambridge City Centre commuter reach**

NB only origins with daily flows of more than 6 people are included. Thicker lines indicate higher flows. Based on 2011 Census data.

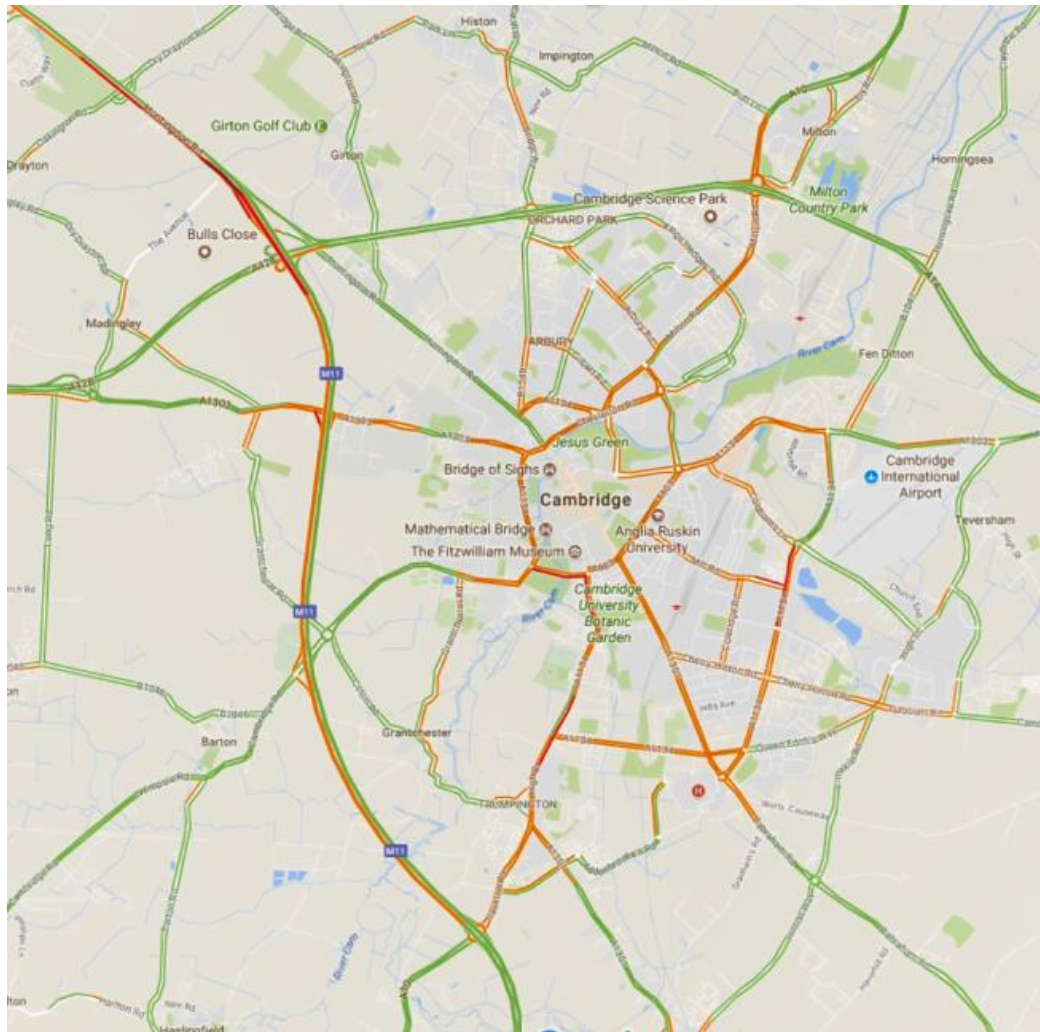
Source: DataShine

This pattern exacerbates the road traffic congestion problem and hinders growth potential in the Greater Cambridge area. Congestion is growing, with negative impacts on productivity, business growth and liveability.

Congestion is a serious concern particularly within Cambridge city centre. Cambridge is ranked second in the country for slowest commuter journeys in the city centre. As shown in the map below (figure 4), there is a chronic congestion on constrained arterial routes. Traffic and congestion increasingly generate high levels of pollution on major routes and in the city centre. Roads in the city centre are particularly busy at work commuting times. Our City Access programme pays significant attention to this current challenge.



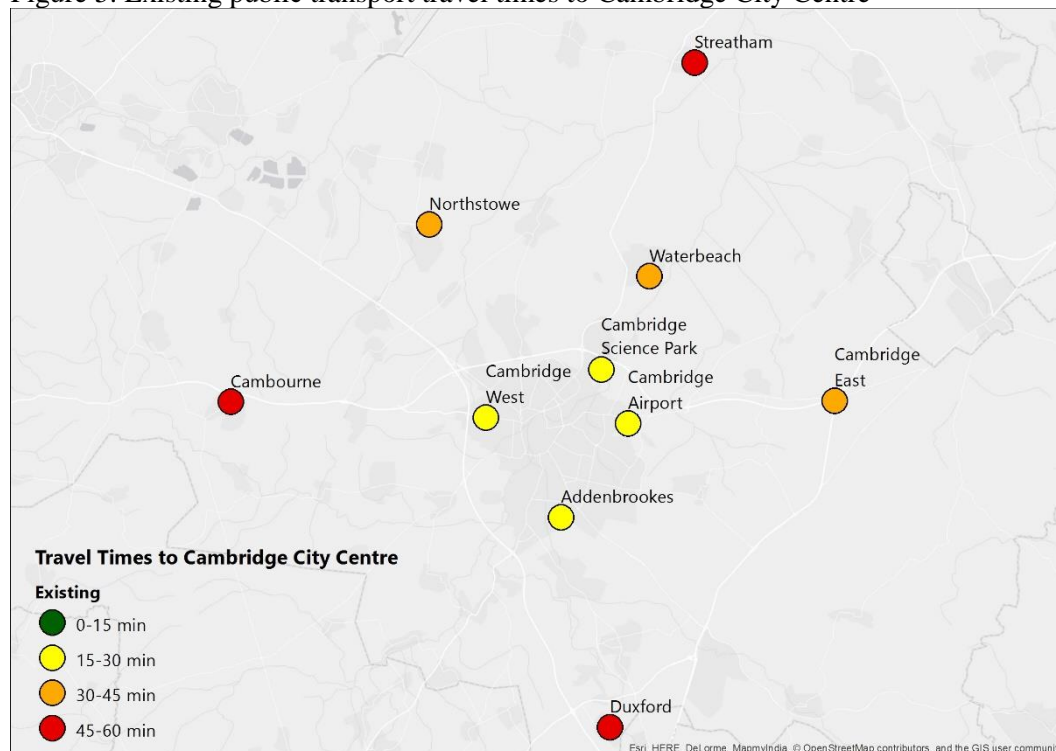
Figure 4. The Greater Cambridge congestion problem at 17:00.



Source: Google Maps

At present, even places such as Northstowe which are nominally well served by public transport face long public transport journey times to get to Cambridge City Centre because the bus is on-street and subject to congestion when it leaves the guided busway and enters the city. The four main employment areas are up to 30 minutes away from the city centre, despite being only three or four miles, radially, from the centre. In Chapter 5 we demonstrate how our proposed transformational mass rapid transit solution would improve these journey times to less than 15 minutes into the centre from any of the points below.

Figure 5. Existing public transport travel times to Cambridge City Centre



Source: Arup

## 1.5 Utilities' challenges and future opportunities: water, energy and digital connectivity

High rates of growth in the region create pressure on utilities and natural resources, including energy, water, waste, and digital connectivity. An integrated resilience and supply strategy needs to be developed to ensure that housing and commercial development is not held back by provision of utilities and required environmental investments.

The East of England, including the Cambridge area, is the driest region in the UK. Security of long term water resources and drought resilience, especially in the context of high demand for development, are important considerations for the sustainability of the area as well as viability of developments.

Energy resilience and self-sufficiency is another strategic challenge for Greater Cambridge. If land use planning, economic growth planning and energy infrastructure planning are not coordinated, it creates delays and significant costs to connect to the local distribution network. As the demand for sufficient energy infrastructure is likely to grow, higher investments in energy utilities will be required. Substantial increases in demand, such as the electrification of transport will also put significant pressure on the existing grid infrastructure.

The Greater Cambridge Partnership (GCP), the Combined Authority and the LEP want to work more closely with Government to ensure that central government policy is jointly developed. We want to do this to secure and enable the delivery of our shared growth ambitions (see Appendix I for our observations on partnership

working across the public sector, based on our experience of bringing forward Northstowe).

Finally, digital connectivity is essential to unlock commercial and housing growth. The combined Cambridgeshire and Peterborough area has ambitious targets to ensure that current and future digital connectivity infrastructure supports growth. These include precise coverage objectives for superfast broadband, 3G and 4G and 5G pilots' technologies, as well as public access Wi-Fi. By 2020, 99 percent of homes and businesses in Cambridgeshire and Peterborough will have access to superfast broadband.

## 2 City region growth strategy (to 2031)

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Greater Cambridge is growing. Over a twenty-year period between 2011 and 2031, the area is expected to build 33,000 homes, housing 65,000 new people and attracting 44,000 new jobs.

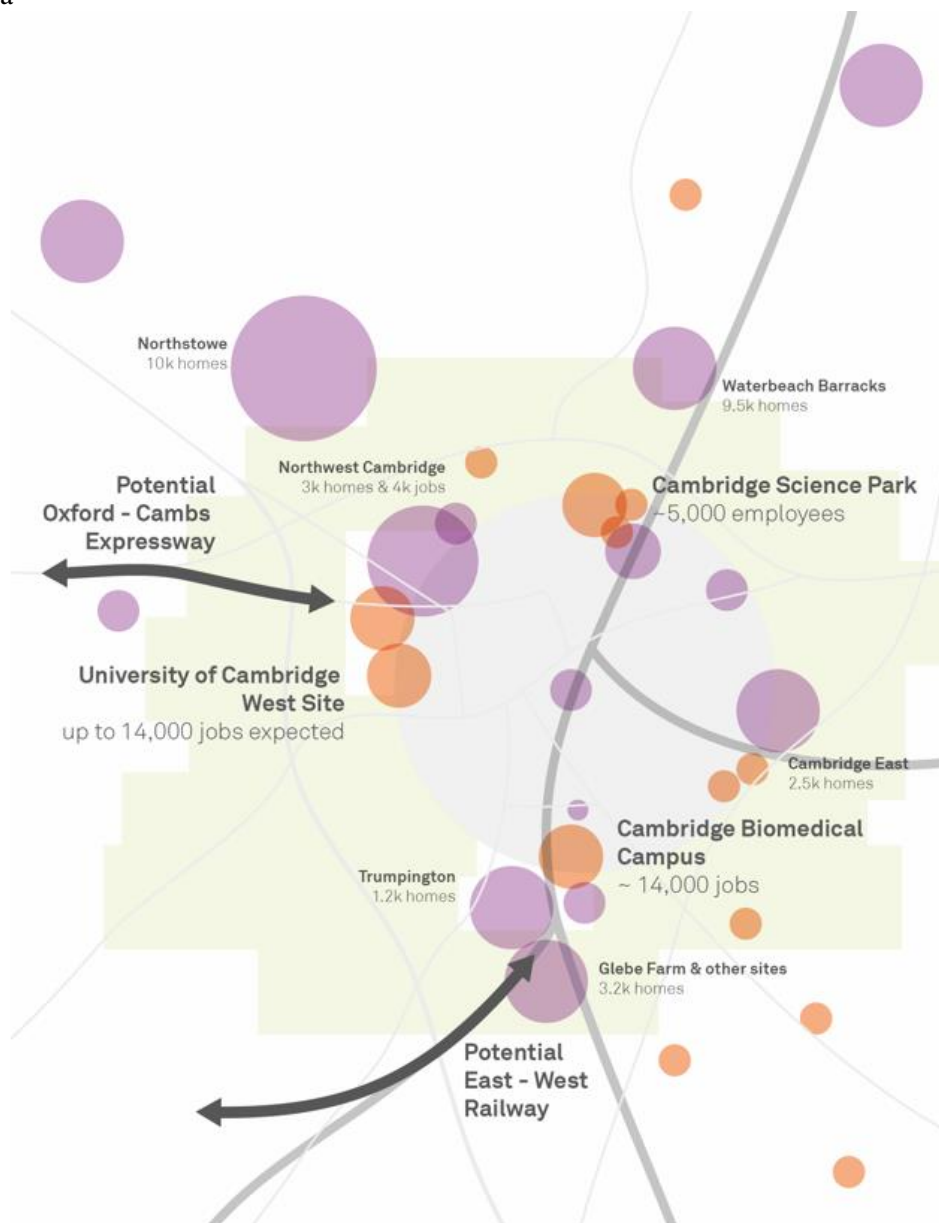
The Greater Cambridge Partnership (GCP) with its local authority partners, Cambridge City Council, Cambridgeshire County Council, and South Cambridgeshire District Council, have identified an aligned strategy to deliver this expected growth. Two aligned Local Plans – the *South Cambridgeshire Local Plan* and the *Cambridge Local Plan* – identify the areas of future housing and commercial development that are required to support the expected population and job growth for the area. The Local Plans are also supported by a joint *Transport Strategy for Cambridge and South Cambridgeshire (TSCSC)*. The Transport Strategy was developed in conjunction with the Local Plans and was adopted by Cambridgeshire County Council in 2014.

### 2.1 The spatial growth plan for Greater Cambridge

Greater Cambridge is oriented spatially like a hub and spoke network. The City of Cambridge is the hub, which is anchored by the university plus a growing number of technology and biomedical research firms. To accommodate future growth several areas have been identified for development within and on the edge of Cambridge, as well as key strategic sites for new towns.

Around Cambridge, housing is being allocated nearby the city including at Northstowe, Trumpington and Waterbeach as shown in the map below (figure 6). The market requires a fast pace of delivery to meet the 2031 growth target of 33,000, which is identified within the Objectively Assessed Need for South Cambridgeshire District and the City, which forms part of the Draft Local Plan evidence base.

Figure 6. Major housing and employment developments in Cambridge and surrounding area



Source: Arup

Furthermore, housing trajectory forecasts contained in the Cambridge Local Plan (2014) indicate that the future housing provision will fall under the 700 dwellings average annual requirement after 2023. By 2031, the provision of net additional dwellings planned in existing commitments will be less than half the average annual dwellings requirement.

Beyond the city, local planning documents also identify seven radial corridors (or spokes) connecting Cambridge to new developments and the local villages within and adjacent to South Cambridgeshire. These corridors include:

- Cambridge – Waterbeach and Ely (to the north);
- Cambridge – Newmarket (to the east);
- Cambridge – Haverhill (to the southeast);



- Cambridge – Saffron Walden (to the south);
- Cambridge – Royston (to the southwest);
- Cambridge – Cambourne and St Neots (to the west); and
- Cambridge – Northstowe, St Ives, Huntingdon and Alconbury (to the northwest).

Details of specific housing sites allocated, with number of homes at each, are included at Appendix B.

The seven key corridors surrounding Cambridge are illustrated in Figure 7. Transport interventions along these corridors (detailed in Appendix C) are important to provide a viable alternative to the car to reduce car use from South Cambridgeshire into the City of Cambridge, and to enable future capacity for housing and employment growth. Investment in these corridors are intended to bring the areas that surround Cambridge closer to the city centre. Therefore, any investment better connecting other smaller settlements to Cambridge, including the East-West Rail or the Oxford-Cambridge Expressway, would bring spread the impact of investment in the arc to the wider region.

Figure 7. Cambridge is the hub of seven key corridors



Source: Transport Strategy for Cambridge and South Cambridgeshire

## 2.2 Transport investment to support growth

There are currently £2.6 billion of projects scoped in the Transport Strategy and City Deal and Growth Deals. This is a significant amount which will allow a mix of rail stations, busways and highways upgrades.

However, projects scoped in the Transport Strategy, through the GCP and packaged within Growth Deals will only accommodate growth pressure to a certain degree. In order to achieve long term, sustainable growth, including further prosperity across the CaMKOx corridor, a more comprehensive and long-term solution is required to keep pace with economic growth trends and support a faster housing delivery pace. Additional investment in transport is required to build up confidence in delivering more homes in the area, including more affordable homes.

The Transport Strategy for Cambridge and South Cambridgeshire (TSCSC) prioritises investment in the bus, rail, cycling, and walking networks. It envisages a multi-faceted approach to address existing congestion concerns and enable future demand growth in and around Greater Cambridge, including:

- Bus priority measures within Cambridge where congestion impacts bus performance;
- Provision of high quality passenger transport<sup>5</sup> and additional park and ride locations along its seven key corridors;
- Improving passenger waiting areas and providing real time information at stations;
- Providing direct, safe, and accessible walking and cycling routes within Cambridge and along its seven key corridors; and
- Highway capacity enhancements in appropriate locations without interfering with passenger transport corridors.

The specific transport interventions planned for each of the seven identified corridors are detailed in Appendix C.

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<sup>5</sup> i.e. 10 min peak / 20 min interpeak frequencies for bus-only corridors; or 15 min peak / 30 min interpeak bus frequencies along corridors with a 30 min frequency parallel rail service

## 3 City centre congestion reduction: City Access

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### 3.1 Objectives and themes

The future of Greater Cambridge's success relies on the city's ability to evolve with growing demand. Congestion is a symptom of success—high demand from businesses, residents and workers for the limited space in the city centre. But, without measures to alleviate that congestion, the costs associated with it can detract from Cambridge as an attractive place to live, work and play. If left unaddressed, congestion could become a real threat to economic growth, business success and resident health and wellbeing.

GCP is developing an innovative and comprehensive city centre congestion-alleviating programmes—City Access. It aims to develop a sustainable transport network for Greater Cambridge that keeps people, business and ideas connected, as the area continues to grow; to make it easy to get into, out of, and around Cambridge by public transport, by bike and on foot.

The Future Investment Strategy for Transport beyond 2020, currently under development by GCP, will assist with the further development of the City Access Strategy. The following key objectives have been identified for tranche 1:

- **Ambitious vehicle reduction targets:** a reduction in the number of vehicles in the city (absorbing the impact of Cambridge's growth on total vehicle movements and, beyond that, a 10 to 15% reduction over 2011 numbers by 2031)
- **Modal shift to sustainable transport:** make sustainable transport the default option including cycling, walking and using buses (measures of modal shift)
- **Better, intelligent services that attract people to public transport:** improved public transport services and customer experience (measures of cost i.e. fares, average journey times, reliability against timetable and bus patronage)
- **Improved air quality** for a better environment and enjoying public life
- **Attractive public realm** which encourages people to make choices for active travel and makes the most of cleaner air and more pleasant streets with less traffic

GCP recognises that a strategy which drives real modal shift and positive outcomes to reduce congestion must involve both incentives to change in behaviour (reward or 'carrots') balanced with the need to control movement into and around the City (control or 'stick'). These are summarised in the table below.

Figure 8. City centre congestion strategies

#	Strategy	Type
1	Make the transition to sustainable transport (public transport, bike, foot) easier especially for those arriving from outside the city	Reward
2	Make buses and other vehicles more reliable and attractive	Reward
3	Make cycling and walking more attractive options	Reward
4	Reduce cross-city vehicular journeys by providing attractive alternatives	Reward
5	Provide better information to help travellers make more informed choices	Reward
6	Make vehicular access around the city relatively less attractive including the management of parking to align with the objectives	Control
7	Use funds generated by fiscal measures to fund reward strategies	Reward
8	Make enhancements for all to the city centre environment	Reward

Source: GCP

### 3.2 Current and future initiatives to deliver City Access strategy

The City Access strategy aims to deliver a city centre with less congestion, more active transport, better air quality and improved public realm. Together, these initiatives bring together accessibility beyond the city centre to make sure those in Greater Cambridge have attractive and affordable public transport options.

These initiatives make the most of Greater Cambridge's access to technology, understanding of commuting patterns and modal shift and behaviour change methods. While each one could make a small change on their own, the synergies between initiatives are intended to generate an outcome greater than the sum of its parts.

The initiatives are summarised below, and full detail is provided in Appendix D.



#### **Travel hubs provide public transport options for those travelling from further afield**

GCP is developing a series of large travel hubs/Park & Ride sites, with an aspiration for free parking and a 'turn up and go' frequency at least in the peak hours. The precise number and scale is still to be determined, but this would be likely to require a ring of sites with capacity for 2,000+ cars around Cambridge, complementing the existing network of Cambridge Park & Ride sites. These large travel hubs/Park & Ride sites will cater for and be accessible to a large number of cyclists, encouraging people to park and cycle.

Smaller rural interchange sites provide the potential for public transport passengers from rural areas to connect quickly and easily to that network of 'turn up and go' frequency services at the large travel hubs/Park & Ride sites.

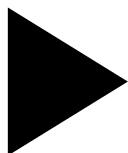


#### **Public transport that offers an attractive and affordable alternative**

Public transport services will be able to make journeys more quickly and reliably than private cars. Currently, city centre congestion makes bus reliability and journey times an unviable option for many. In the short-term, road space may be reallocated to buses and pinchpoints will be addressed, creating bus priority lanes and potential for express

services. In the medium- to long-term, more transformative upgrades will be made, including an improved network of rural services.

Cleaner buses (e.g., electric/hybrid) are being investigated for services from these large travel hubs/Park & Ride sites to ensure that increased bus movements do not have a negative impact on air quality.



### **Making public transport simple**

Integrated ticketing and reliable information are the cornerstones of user-friendly and accessible public transport. Ticketing and information services need to incorporate multiple bus operators and the rail network to make multi-modal journeys simpler and cost-effective.

Public transport users should have access to accurate and reliable real-time information, which ties in with Greater Cambridge's Smart Places work, using technology to improve the services residents and workers use.



### **Intelligent traffic management**

State-of-the-art intelligent traffic signals in Cambridge and on key parts of South Cambridgeshire's road network will allow priority to be given to buses, cyclists and pedestrians to improve the speed and reliability of public transport and active travel options.

These traffic lights will use new technology to understand traffic conditions and the road network more broadly and give priority to the types of journey which should be incentivised.



### **Decoupling economic growth from increased freight movements**

Freight is a key contributor to congestion and air quality issues in Greater Cambridge. While increased economic activity will require more freight movements and deliveries, smart solutions can reduce freight's impact on the city. Attractive alternatives to logistics operators for the 'last mile' of deliveries could include freight consolidation centres which intercept freight before it enters Cambridge and reduce the number of deliveries and vehicles in the city centre.



### **Putting active travel at the top of the list**

By providing high quality, segregated routes along the main radial and orbital corridors in particular, cycling can become a substantially more attractive option for many residents. The villages that form a necklace around Cambridge in particular sit an ideal distance from the city to offer the potential for increased cycling mode share.

A substantial increase in cycle parking capacity will accompany cycle improvements, including the potential for a new dedicated cycle park and for expansion of existing facilities.

Pedestrian facilities throughout the city with safe, convenient and frequent crossings can play an important role in the door-to-door journeys.

### 3.3 Demand management for long-term change

Investment in public transport and active travel infrastructure will not be sufficient to curb demand for personal vehicle use. Those improvements provide the positive incentives (rewards) which are provided up front and supplemented with the disincentives (control measures) relating to private vehicle demand management.

Work is underway to consider the most impactful and appropriate forms of demand management. This decision will be evidence-led and will pull in intelligence on experiences elsewhere in the world where innovative and high tech approaches to demand management have been successfully used<sup>6</sup>. To support this, an ANPR exercise was commissioned which will provide a much more granular level of data on radial entry points and traffic movement patterns through the city and by time of day. The data will help local authorities understand journey times and trip chains (therefore delays, congestion and journey time reliability), fleet make-up (diesel/petrol/hybrid/electric) and their collective impacts on air quality

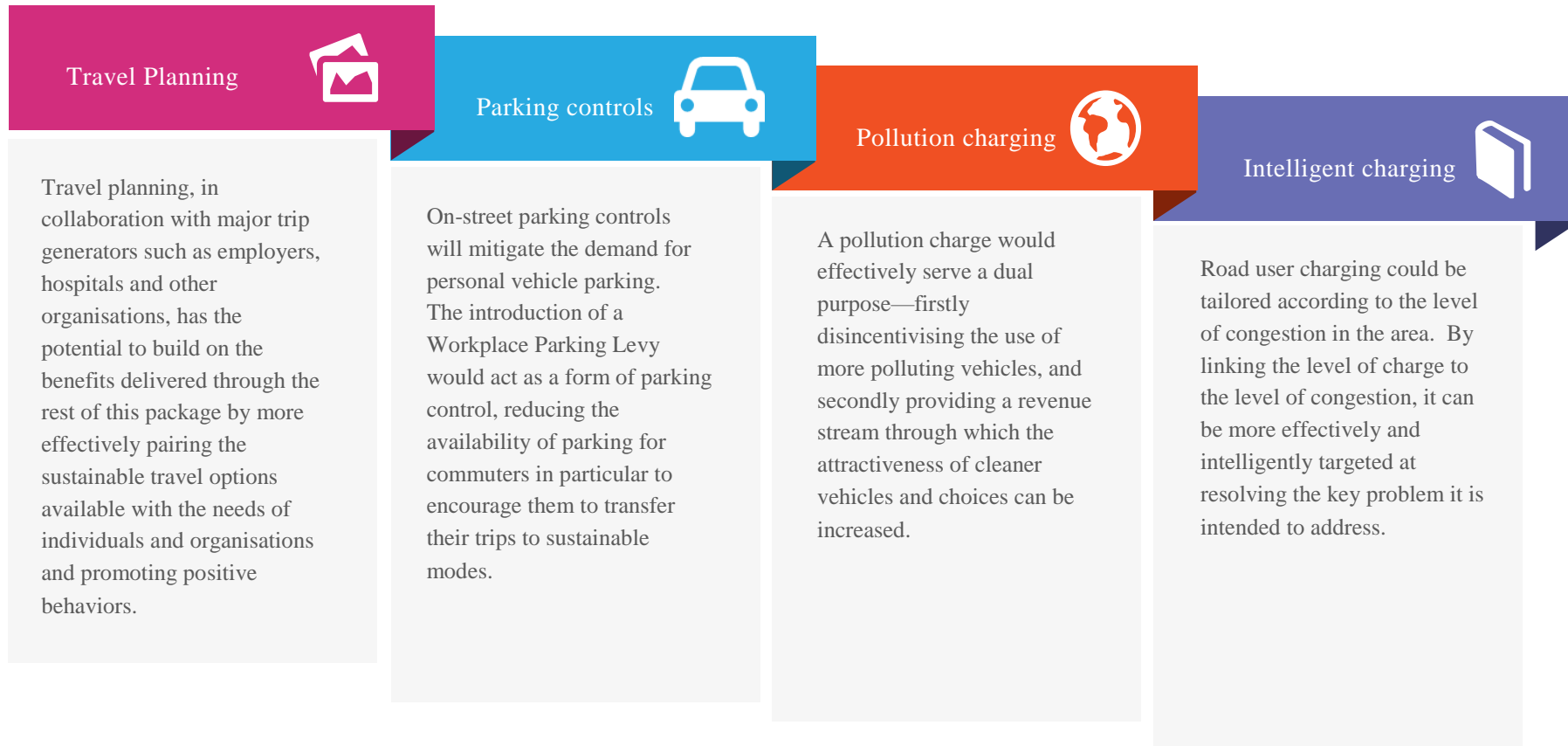
Additionally, the GCP have set up a public consultation roadshow, during Autumn 2017, to open up these conversations to the public, explain the growth challenges of Cambridge and tell the story of how revenue-raising demand management measures can be used to cross subsidise and improve public transport measures.

Demand management measures under consideration, either separately or in combination are outlined in figure 9 and discussed in more detail in Appendix F.

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<sup>6</sup> Steer Davies Gleave, 'First and Last Mile Demand Management' paper August 2017, unpublished

Figure 9. Demand management measures under consideration



Source: GCP

### 3.4 Cambridge South station

A station at Cambridge South has been identified as part of Cambridgeshire's long term Transport Strategy. The Cambridge Biomedical Campus (CBC) is a significant asset in the development of the UK's life science sector. It already hosts some 12,000 jobs and will host an additional 14,000 by 2031. Its anchor tenants include Cambridge University, Cambridge University Hospitals, the Medical Research Council, GSK, AstraZeneca and a highly networked biomedical ecosystem of academics, businesses and clinicians.

Network Rail and the Department for Transport are considering the case and have indicated informally that they are minded to help deliver the station.

Although the station's footprint nor location have been finally determined, initial timetabling analysis does show the need for four tracks to accommodate the train stopping at the station. In any case, to accommodate an East West rail connection four tracks would be required. We are currently looking at the most effective way to deliver to four tracks and so maximise the potential of a new station.

There is also the potential for significant private sector investment but it is likely that the requirement to account for four tracks means that the project will not be solely privately funded.

### 3.5 SMART Cambridge

Cambridge is taking the opportunity, in collaboration with the rest of the corridor, to harness its unique characteristics to become a world leader in delivering smart solutions to urban problems

The way that people will use and access transport is changing rapidly. These opportunities and imperatives are reflected in the City Access project and will evolve in planning for what follows from 2020.



Being able to seize these opportunities and use digital solutions and emerging technologies in our future plans enables us to realise the growth potential and enhance quality of life.

Examples include:

- Using emerging developments in sensing technology to monitor and address air quality which has a direct effect on people's quality of life (working with the University of Cambridge, small and medium enterprises)



in the local hi-tech community and Natural Environment Research Council);

- Considering new proposals like AVRT (see Chapter 5);
- Taking forward proposals for autonomous vehicles as part of the public transport network (potentially between Trumpington and CBC, Cambridge North and the Science Park);
- Dynamic pricing (of roads and parking);
- Better use of real time data to bring more intelligence to the systems in use including the signals network, information about public transport and sustainable travel such as using MotionMap software to integrate real time public transport and parking availability information in travel planning; and
- Helping to relieve traffic congestion by a smart approach to logistics. Using digital technology to underpin a range of solutions from conventional freight consolidation to more futuristic solutions. For example, Amazon Prime Air drone delivery testing is taking place in Cambridgeshire - the only location in the UK where this is being carried out under special Civil Aviation Authority licence.

For further details of the SMART Cambridge future investment areas identified, please see Appendix E.



## 4 Summary: investment profile and expected impacts to 2031

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### 4.1 Investment

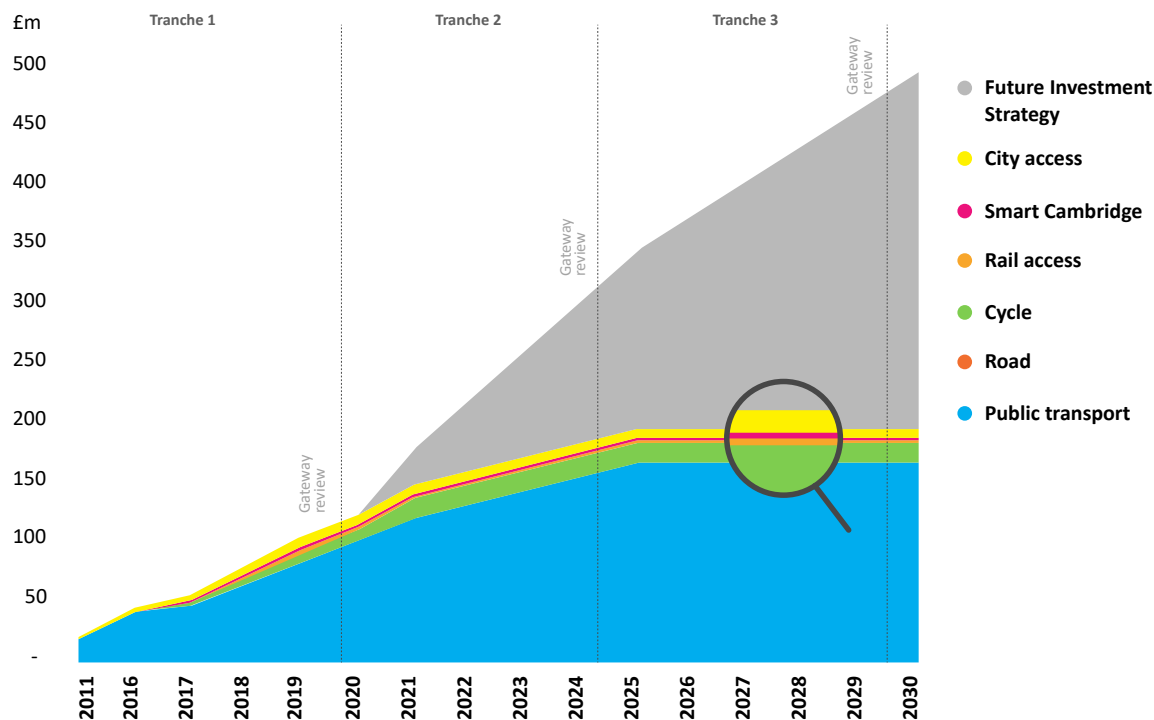
The transport strategy to date includes interventions on the main growth corridors identified in Chapter 2, and on reducing city centre congestion detailed in Chapter 3.

To support this, we have identified a programme of investment covering £500m+ over the 15 years from now until 2031. Some of this is clearly allocated to programmes and projects already, other elements are in development and pending the result of technical studies or business cases that are currently underway.

The current programme of Greater Cambridge Partnership investment: £100 million to 2020 is focused primarily on public transport, cycle, road and rail access (cycle and park and ride schemes at rail stations). The Future Investment Strategy that is currently emerging will allocate a further £400m over the following 10 years and also plan how to channel revenues from the demand management mechanisms discussed above, which are intended to be recycled into subsidising bus fares or bus services to further incentivise a shift to public transport for commuters into Cambridge.

Front and centre of the future investment strategy is a clear prioritisation process that will allow the area to develop future projects and schemes and in doing so, considering as a core factor, the additional investment from outside the Gainshare funds allocated by Government through the City Deal agreement. Further information on specific timed and costed schemes included in this future investment profile are included at Appendix G.

Figure 10. GCP investment profile to 2031



## 4.2 Impacts

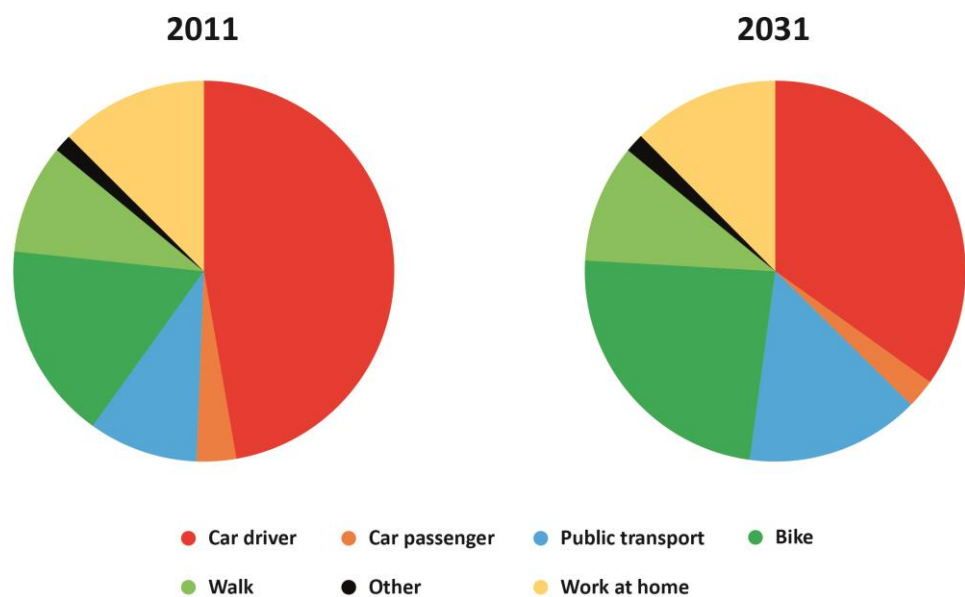
Traffic in Cambridge is expected to grow by 30% by 2031 (over 2011 levels). The objective of the City Access programme is to reduce peak-time traffic levels in the centre of Cambridge by 10-15%. This implies a reduction of 40-45% over the future baseline traffic level in 2031.

If this is to be achieved, the current mode split cannot be sustained. With a projected 25% increase in population by 2031 (2011 base year), the share of bike, bus and rail needs to be even higher than now. This implies an increase in public transport mode share from 9% to 15%, and of cycling from 17% to 25%. It is worth noting, though, that Cambridge already has the highest number of cycling trips in the country, and recent private sector investment by bike share company OfO shows investor confidence in Cambridge's ability to drive up mode share.

The City Access programme of positive incentives for public transport and active travel along with demand management mechanisms will play a pivotal role in achieving the stated mode share objectives. The aim for mode shift is indicated in figure 11.

Figure 11. Target mode shift 2011: 2031 to achieve a 10-15% reduction in 2011 car traffic levels in the city centre.

	Car Driver	Car passenger	Public Transport	Bike	Walk	Other	Work at Home	Total trips
2001	52.2%	4.3%	7.5%	14.7%	9.2%	2.0%	10.1%	100%
2011	47.3%	3.4%	9.3%	16.8%	9.3%	1.5%	12.5%	100%
2021	38.8%	2.8%	13.0%	21.5%	9.8%	1.6%	12.5%	100%
2031	34.9%	2.5%	14.8%	23.8%	10.0%	1.6%	12.5%	100%



#### 4.2.1 Who benefits?

The main losers of the current situation are the existing residents and businesses of Greater Cambridge. Some of the worst housing affordability in the country is forcing people, particularly those on lower earnings, to live ever further out of the city centre, which exacerbates already bad traffic conditions in the centre and on the main radial routes.

A shift away from the private car and towards public transport, and an unlocking of growth potential to support delivery of more housing supply will be of benefit to all of those, and particularly those on lower than average incomes. It will support those who live outside of Cambridge to more easily and reliably access a greater range of jobs than they are currently able. It will allow residents to reclaim time currently lost to traffic congestion and live higher quality lives. And it will allow families greater choice and flexibility over where they might live to allow them to access jobs across the length and breadth of the CaMKOx corridor.

Businesses stand to gain from reduced time and money lost to congestion, increased labour market catchments from which they can select the best and

brightest employees and the potential for increased productivity as they can network more easily with one another across the city and across the CaMKOx corridor.

## 5 Where next? To 2050 and beyond

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### 5.1 Transformational growth within the CaMKOx corridor

The current Greater Cambridge Partnership programme of investment will run through to 2031 (pending gateway reviews of the success of the Deal). The aligned Local Plans and Local Transport Plan (LTP3) congruently run until 2031. Previous chapters have set out the plan of action to achieve an ambitious level of growth in jobs and homes, supported by a substantial shift away from private car towards public transport and active travel.

However, unconstrained growth forecasts undertaken by Cambridge Econometrics for NIC suggest that there is likely to be a high demand for additional homes and jobs beyond that. Transport and housing analysis undertaken by Arup and Savills suggested that investment in East West Rail and the Expressway could unlock an additional 10,000 homes p.a and an additional 400,000 jobs (234,000 jobs in the Cambridge area) by 2050, compared with a more incremental package of transport interventions. However, the calculation of that total was constrained by the fact that many of the opportunity areas do not lie on or particularly near to the proposed East West Rail or Oxford-Cambridge Expressway alignments. In fact, the areas around those corridors are heavily constrained by greenbelt. There is no current or foreseeable political appetite for large scale greenbelt release and any such release risks compromising one of Cambridge's real quality of place attributes.

The solution, then, must be to think creatively about supporting growth beyond the greenbelt. This can only realistically work when those places are well linked into the jobs and leisure opportunities offered in the city. This problem is complicated by the fact that the city has a very polycentric employment structure – characterised by concentration in the city centre and then a series of nodes out of centre. Hence, a traditional small city hub and spoke model of radial connections to a single central point does not work well. The need for business around these out of town networks to interact and share knowledge that is unique to the knowledge-intensive services in which Cambridge specialises adds to this problem.

The solution must facilitate not only home-to-work commuting, but also business-to-business and business-to-University interaction. A many-to-many system of connections is therefore needed, in a small city which is unlikely ever to generate the number of passengers needed to financially support such a complex network of traditional heavy or light rail systems.

Greater Cambridge is reaching the conclusion of a 5-year local planning process which promotes the development of three new settlements – Northstowe, Waterbeach and Bourn and the extension to Camborne.

Including current plan numbers (c33,000) we can identify a total of c50,000 new homes proposed (or are shown to be promoted) in past or present local plans and Development Plan Document's in this part of the corridor.

We are in the process of developing a detailed piece of modelling, in partnership with the Department of Land Economy at Cambridge University that will give us a more detailed idea of additional growth sites across the area. Subject to this work coming forward the area is bold in its ambition for additional housing growth and considering how we can optimise the density of our new settlements can also be part of our overarching strategy.

## 5.2 Creating a cohesive CaMKOx corridor

The Cambridge -Milton Keynes- Oxford (CaMKOx) corridor has for a long time been seen as a high growth region based on knowledge-intensive sectors.<sup>[1]</sup> But, on the whole, the cities are generally more economically and physically connected to London than to one other. The NIC found that the area currently operates principally as several largely independent ‘wedges’, extending outwards from London on radial routes.

The NIC’s interim report to government described a region of “neighbouring, but largely independent, sub-regions, that share similar characteristics in virtue of their similar geographic proximity to (and functional interconnections with) a major world city.” Thus, it is currently not a functioning growth corridor.<sup>[2]</sup>

Investment in east-west connectivity along the CaMKOx corridor could:

- open up physical, economic and social pathways to more collaboration, commuting and cultural interaction between these similar, yet disparate, cities<sup>[3]</sup>,
- allow workers across the corridor to more easily access highly skilled work opportunities across the corridor, rather than being more limited to their nearest urban centre, reducing friction in the labour market across the corridor;
- allow businesses across the corridor to have access to the knowledge generated from Cambridge, Milton Keynes and Oxford alike.

The CaMKOx corridor investments will allow workers to more easily access highly skilled work opportunities across the corridor, rather than being more limited to their nearest urban centre. It will also allow businesses across the corridor to have access to the knowledge generated from Cambridge, Milton Keynes and Oxford alike.

<sup>[1]</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/601163/Economic-analysis-Cambridge-Econometrics-SQW-report-for-NIC.PDF](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/601163/Economic-analysis-Cambridge-Econometrics-SQW-report-for-NIC.PDF)

<sup>[2]</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/601163/Economic-analysis-Cambridge-Econometrics-SQW-report-for-NIC.PDF](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/601163/Economic-analysis-Cambridge-Econometrics-SQW-report-for-NIC.PDF)

<sup>[3]</sup>[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/601163/Economic-analysis-Cambridge-Econometrics-SQW-report-for-NIC.PDF](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/601163/Economic-analysis-Cambridge-Econometrics-SQW-report-for-NIC.PDF)

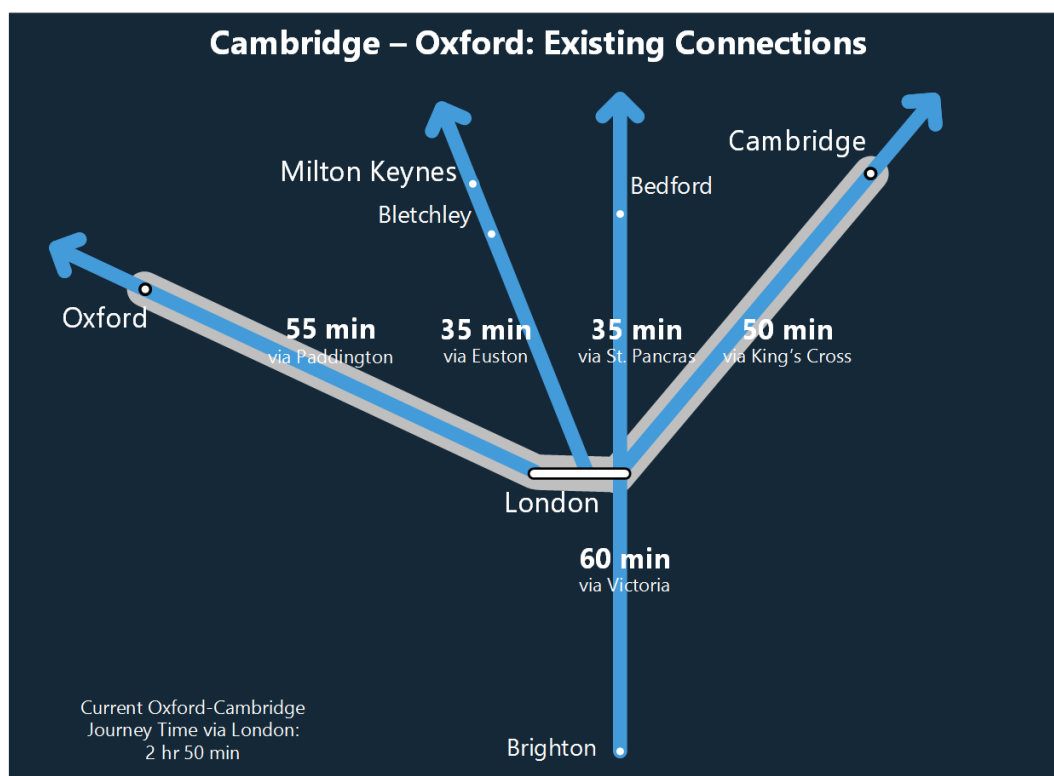


### 5.3 A faster East West Rail connection, supported by a mass transit feeder system, delivers most for the corridor

At present, the major cities of the South East are all connected by rail with London with a journey time of an hour or less. By contrast, the rail journey times between them are very poor, because they require going into London and out again including an interchange via London Underground. Travelling from Cambridge to Oxford by rail currently takes 2 hours 50 (including interchange time through London) and Cambridge to Milton Keynes takes upwards of 2 hours, or 2 hours 22 minutes to Bletchley (including interchange time).

To deliver a truly polycentric region that can rival the USA's Silicon Valley, the ideal must be for all areas of the corridor to be connected to one another by public transport as well, or better, than they are connected to London. Furthermore, within the context of Cambridge, journey to work data (see figure 3 in Chapter 1) suggests that typical commuters to Cambridge travel as much as one hour by car or by public transport for work. This means a target journey time from end to end of under one hour.

Figure 12. Cambridge - Oxford: Existing Connections



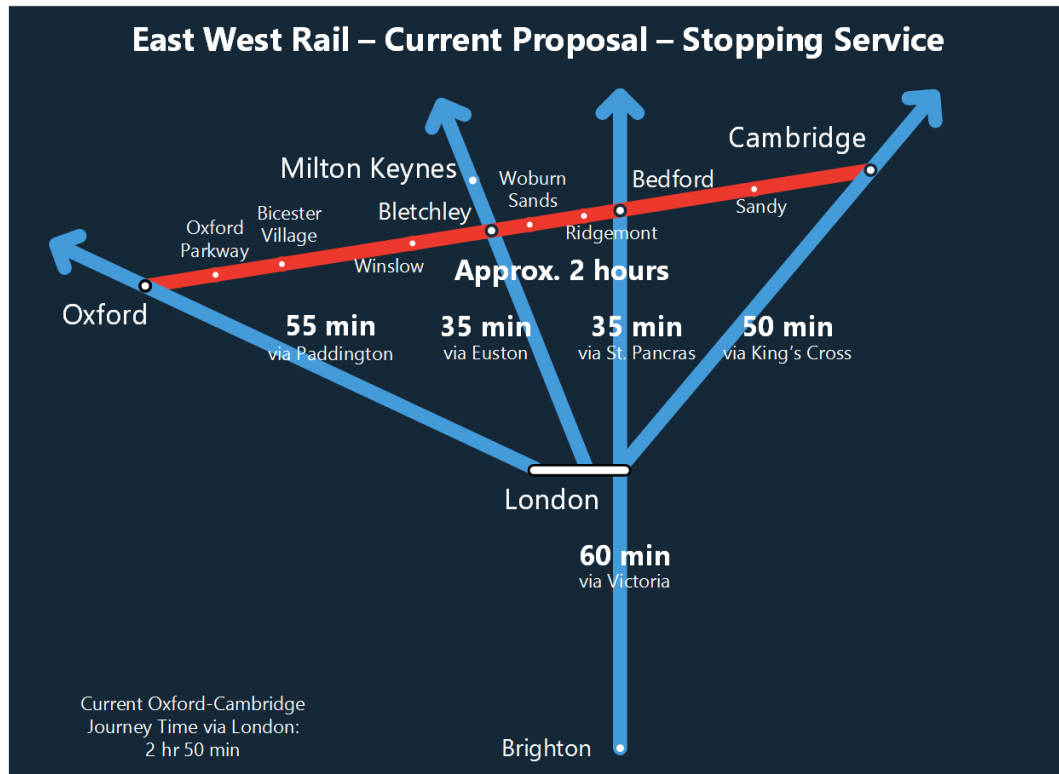
Source: Arup

Current East West Rail proposals identify eight stopping points between Cambridge and Oxford, giving an end to end journey time of 1 hour 30 minutes.

The National Infrastructure Commission's interim report is supportive of a higher number of stops because of the imperative for the line to deliver on the housing

potential of the region, identifying a target of approx. 1m delivered until 2050 in the transformational scenario. If the housing potential is restricted to the heavy rail alignment, this is the best way to maximise housing, but it comes at the expense of end to end journey times, which would be the drive of agglomeration benefits and potentially labour market catchment impacts: the slower the link is, the less likely are businesses and scientists to use it to interact and the less likely are people to consider commuting the length of the corridor to be a valid option.

Figure 13. East West Rail - Current Proposal - Stopping Service



Source: Arup

Our preference for East West Rail is for a faster, limited-stop service. Our analysis suggests that an express service with a speed of up to 125mph with only three interim stops at the key points of interchange with the existing rail mainlines (Bletchley, Bedford and Sandy for WCML, MML and ECML respectively) could be delivered with a journey time of just over an hour.

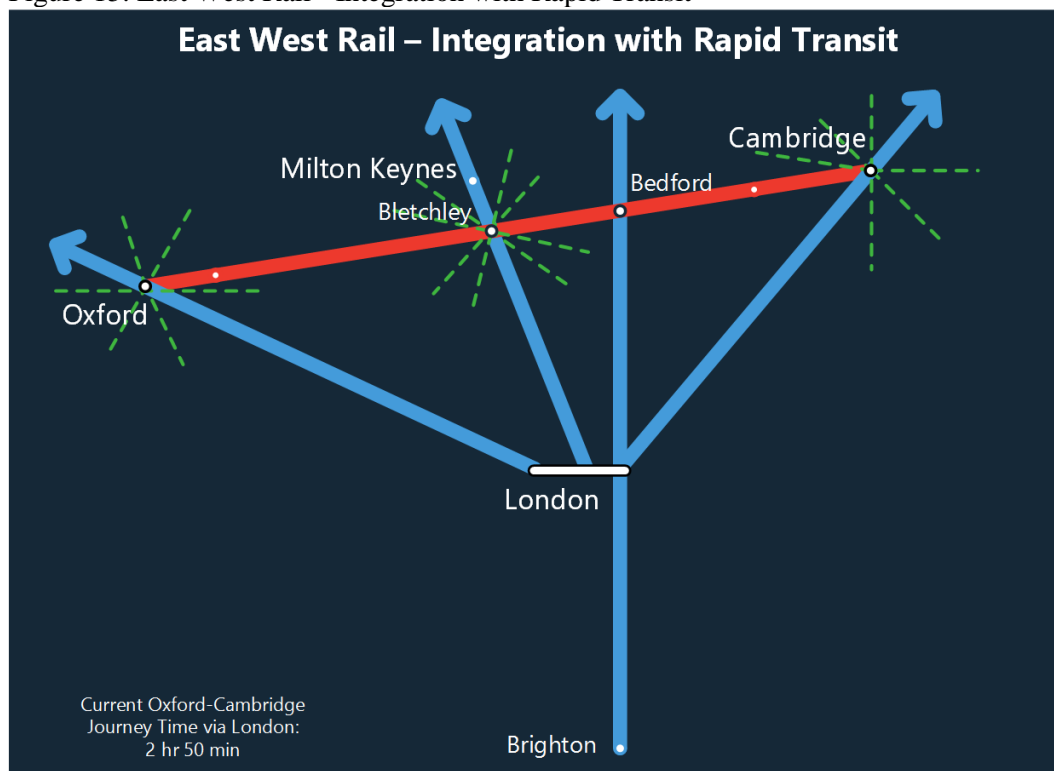
Figure 14. East West Rail - Preferred - Express Service



Source: Arup

Alone, this will probably not be sufficient to unlock that level of housing. Overlaid with a less expensive feeder system, though, it has the potential over the long term to unlock that level of housing delivery as well being able to be more flexible and agile to future changing development patterns than is conventional heavy rail. A fixed heavy rail link with a rapid service, supported by a flexible and cheaper mass transit system to spread the benefits of the service to the hinterlands of the three principal cities gives the best of both worlds and allows for more flexibility and future potential in terms of the location of potential housing growth around the three cities, rather than constraining it to the corridor itself.

Figure 15. East West Rail - Integration with Rapid Transit



Source: Arup

The connectivity benefits for Cambridge will be national as well as regional. Major UK cities such as Edinburgh, Sheffield and Manchester could potentially all be accessible with just one change of train (at Sandy, Bedford and Bletchley respectively) potentially saving over an hour on journeys to each city and putting Cambridge on the national rail map. Public transport journey times to connect with these key national strategic routes could drop significantly from around an hour and a half to under half an hour, making longer distance rail journeys to the key cities more viable.

Figure 16. East West Rail national connectivity benefits (journey times)

Train journey times from Cambridge to	Current	With rapid East West Rail connection
Sandy (for ECML)	1h 10m via Hitchin	20m
Bedford (for MML)	2h 20m via London	30m
Bletchley (for WCML)	2h 22m via London	45m
Oxford	2h 50m via London	73m

\* NB: current timetabling does not allow for transfer from a hypothetical East West Rail train at Bletchley or Sandy onto long distance service on WCML or ECML respectively. It is assumed that in the long term, timetabling might be adjusted through the refranchising process to allow long distance connections to be made between East West Rail and the national mainlines.

Source: Arup

Figure 17. East West Rail national connectivity benefits



Source: Arup

Furthermore, in addition to the improved connections from Cambridge to the national network via East-West Rail, King's Lynn is approximately 45 minutes north of Cambridge. With the introduction of East-West Rail, journey times from Oxford towards East Anglia (e.g. Ely, King's Lynn, Norwich, etc.) will be reduced. This has the potential to enable economic development in these areas.

## 5.4 Metro feeder services: what does success look like?

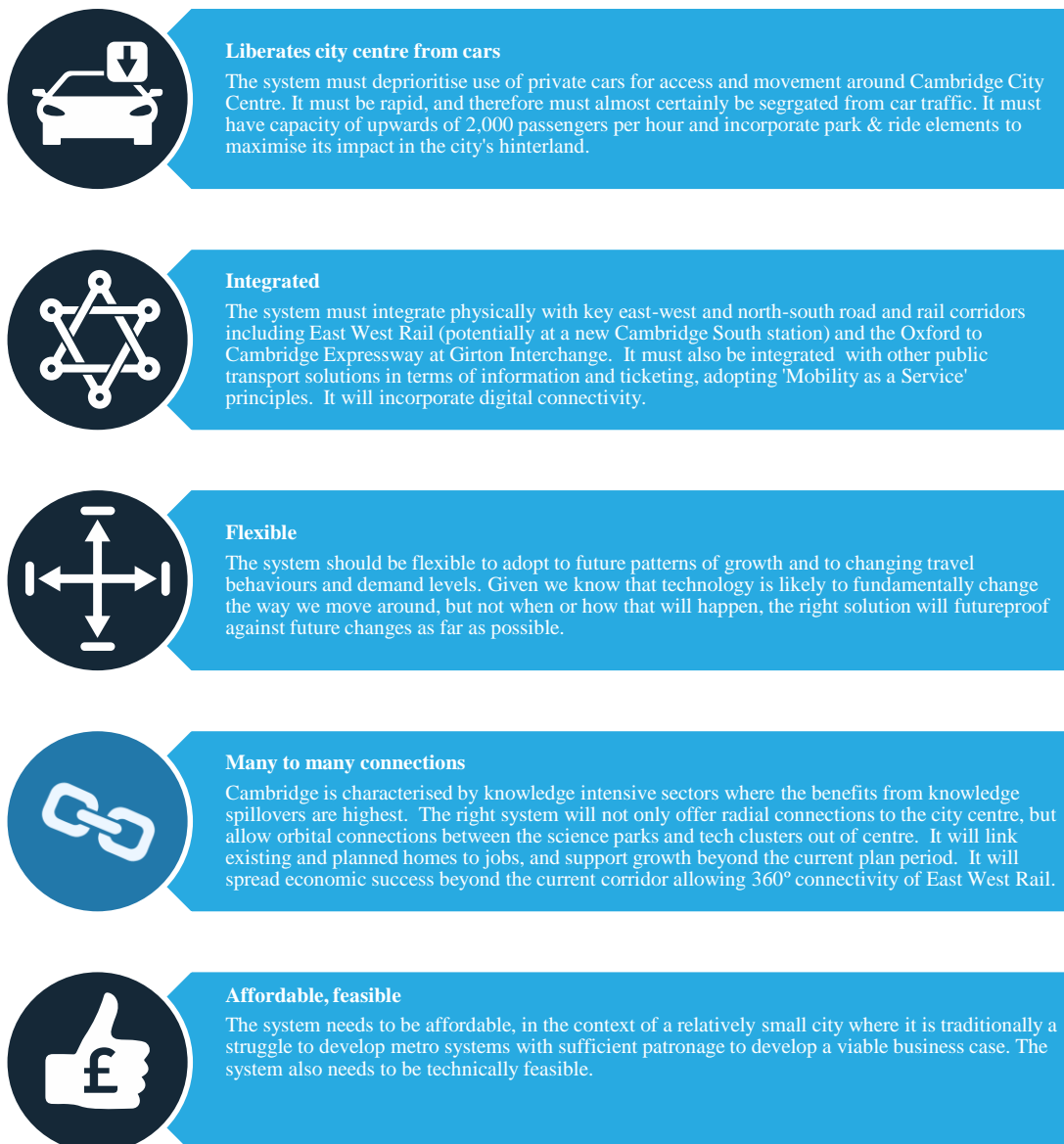
The right last mile system for the city and the corridor has not yet been decided, and feasibility studies are underway for various concept proposals for mass rapid transport, which principally includes Affordable Very Rapid Transit (AVRT), a new form of public transport system based on autonomous buses and a conventional light rail system. Most agree that, given the constraints posed by the

historic streets of central Cambridge, the city centre network would need to be tunnelled to be feasible.

GCP has commissioned an independent review, in conjunction with the Cambridgeshire and Peterborough Combined Authority, to establish which of these competing proposals offers the best solution for Cambridge in terms of specification, cost and feasibility.

Irrespective of the technical solution adopted, there is consensus on the characteristics that the future metro travel system will need to embody. These are outlined below.

Figure 18. Principles for a good feeder system



Source: GCP

## 5.5 Beyond the corridor

Cambridge is not an ‘end of the line’ destination and it cannot be a ‘bookend’ to the UK’s high tech growth corridor. The benefits of East West Rail and the promotion of a metro feeder system is a critical part of ensuring that the line is able to offer 360° connectivity to the surrounding regions. For example, King’s Lynn would only be a further 45 minutes from Cambridge, which will spread the economic benefits from the corridor investment to other areas of the country.

Cambridge is part of significant knowledge-based corridors beyond the CaMKOx arc. There is a strong life science corridor reaching out to the east, and high-value added links with Ipswich, Norwich and beyond. Bolstering growth in Cambridge could bring more opportunities to strengthen those corridors as well.

For the purposes of this transport strategy, we have set out proposals that focus on pulling in Cambridge’s commuter hinterland. The commuter hinterland will be significantly expanded by the CaMKOx investment to credibly include as far as Oxford which, with a high speed service would be within an hour’s public transport journey time.

It will be far easier and cost efficient to expand a light rail or bus-based system to feed a fixed heavy rail link between Oxford and Cambridge than to extend the heavy rail line.

The nature of a heavy rail line running westwards from Cambridge towards Milton Keynes and Oxford suggests that Cambridge ‘looks west’ economically but in fact it has functional economic linkages in all directions. Better connecting Cambridge to the west offers huge potential advantage for those settlements to the north, south and east of Cambridge that will also benefit from improved radial connectivity. The right feeder metro system will offer them park and ride connectivity to the corridor and, in the longer term depending on development patterns and viability, particularly if an AVRT system is pursued, could be extended to offer them a direct connection to the CaMKOx corridor.

The mass transit system that we are pursuing aims to support Cambridge to grow outside of the greenbelt which sustains and protect its unique quality of life. It offers the potential for a new development model outside of the city, focused on car-free, compact development patterns based on transit oriented development principles. We see potential in the longer term (post 2031) to unlock growth at key locations first at Cambridge North East fringe and at Cambridge Airport and latterly potentially at Duxford and along the A11 corridor.

## 5.6 Potential solutions

A study has been commissioned to independently examine the range of proposals put forward for the specification of a mass public transport system to serve Greater Cambridge. Two of these systems are outlined below. Both include tunnelled options in the central area. The ancient layout of the streets of central Cambridge are not well suited to addressing the needs of modern day housing and transport.

### 5.6.1 Affordable Very Rapid Transit (AVRT)

Affordable Very Rapid Transit (AVRT) is a proposition for a new form of mass transit which would use segregated vehicles running on segregated corridors running at surface level through extra-urban areas and through a network of small-bore tunnels within the city limits. It is a system designed to counter some of the principal perceived drawbacks of a conventional light rail or tram system: high capital cost per mile requiring large passenger flows to be financially justifiable; and the surface traffic disruption caused by and during construction. Fundamentally it aims to provide an affordable mass transit option for smaller cities like Cambridge, Oxford and Milton Keynes, all of which are also considering an AVRT style solution.

#### **Why are tunnels necessary? Why not ban all cars from the city centre?**

The historic layout, including small streets with sharp turn, do not allow for fast speeds of public or private transport throughout much of the city. Tunnels allow vehicles to travel at high speed safely, increase reliability of the system as it is removed from general traffic, and reduces impacts on air quality at street level.

In addition, road-based transport is essential to the mix of transport systems. Shorter, stopping bus services, taxis, and some private car journeys are all necessary to get people where they need to go.

Tunnelled systems allow rapid mass transit to safely operate as a piece of the wider connectivity offer.

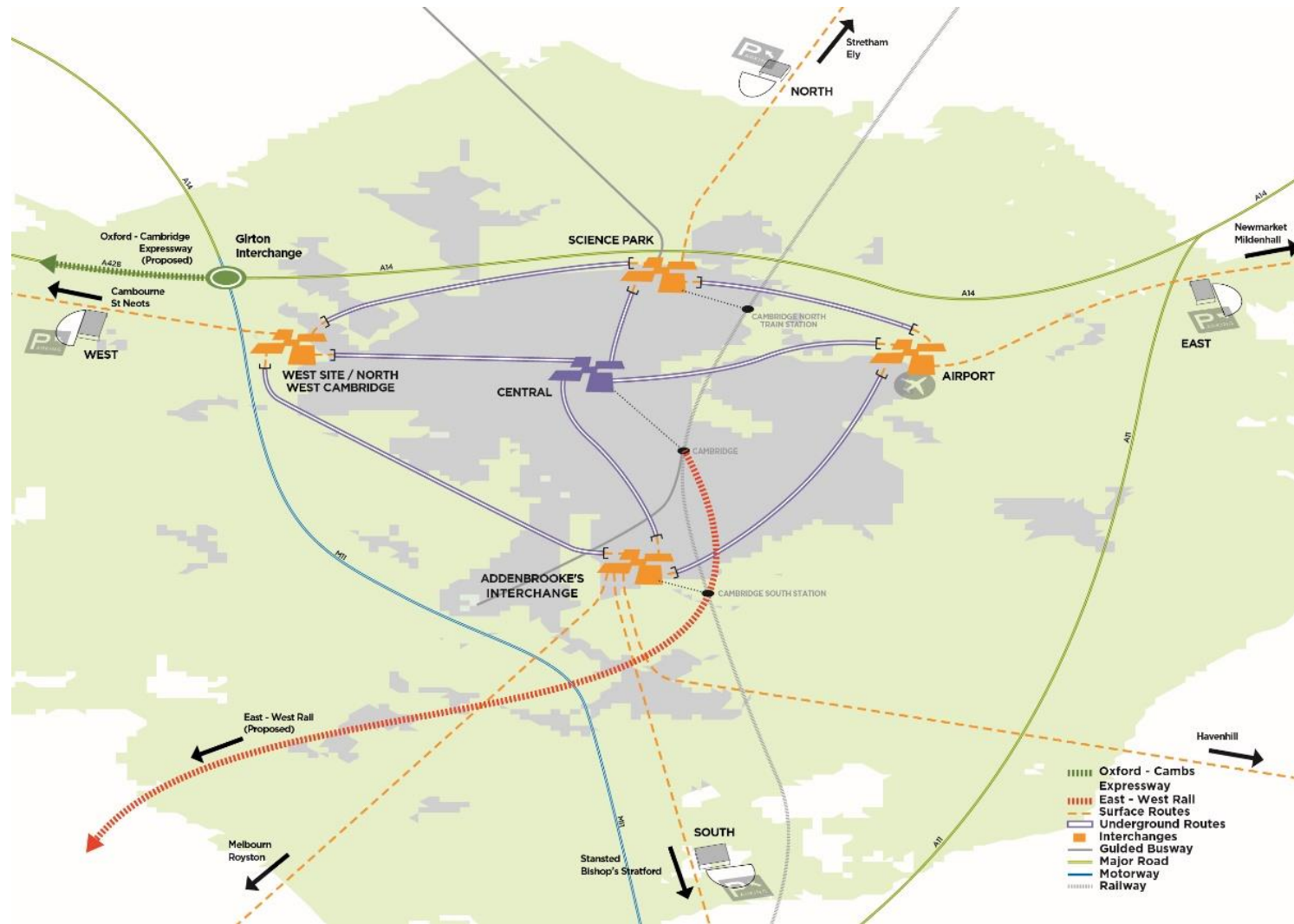
The technical details of the proposed system have recently been published in a report by Smart Cambridge<sup>7</sup> and are not rehearsed here. The technology involved is new when considered as a system but not untested as individual components: there would be some development of vehicle technology required but the electric charging technology proposed is already in use on demonstrators in other UK cities, and the level of autonomous vehicle capability required would be limited by the simple repeat character of the journeys which take place on strictly segregated routes. The tunnelling proposed is of a similar nature to tunnelling currently carried out for cabling and the UK is a world leader in tunnelling technology.

The figure below shows a potential approach to introducing AVRT and its interchange with the corridor. Delivering interchange improvements at Girton (to create an all-ways junction) and a new station at Cambridge South, serving Addenbrooke's /Cambridge Biomedical Campus will be crucial to unlocking the benefits of the corridor investment. By linking the AVRT with the CaMKOx corridor rail link at Cambridge South, it establishes seamless connection between rail and the mass rapid transit system.

<sup>7</sup> <http://www.connectingcambridgeshire.co.uk/wp-content/uploads/2015/10/Affordable-Very-Rapid-Transit-AVRT-Report.-Vol-1..pdf>



Figure 19. Concept map of AVRT

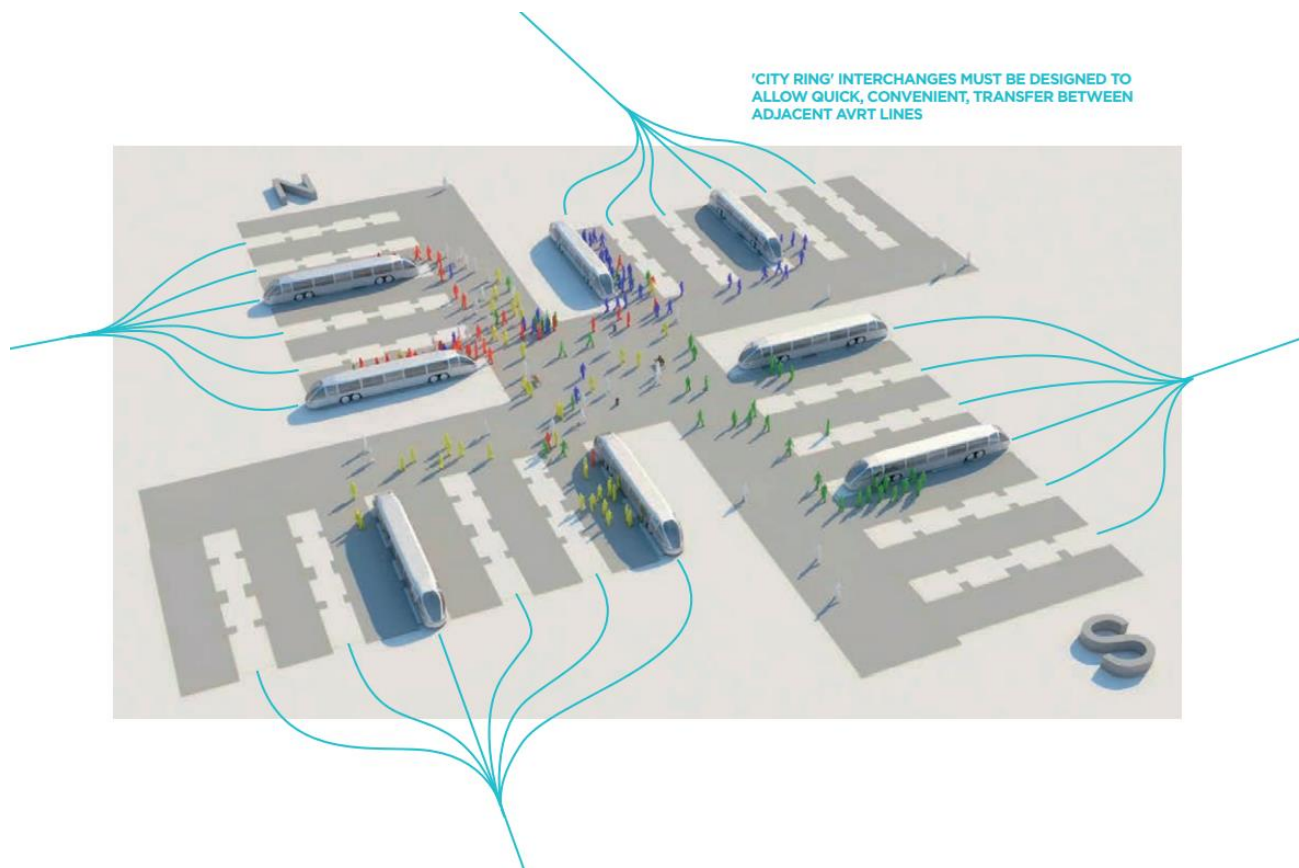


Source: AVRT report – Connecting Cambridgeshire

The system is lean and is purposely designed to have few central interchanges (to reduce cost and maximise frequency). However, the five key proposed central interchanges are estimated to be within 15 minutes' walking distance of around 70% of Cambridge jobs, making the potential for mode shift high notwithstanding the number of stations.

A new Cambridge South station could potentially even be the eastern terminus of East West Rail, avoiding the expense and disruption of bringing the heavy rail link into the centre of the city, but connecting it to the city with a seamless interchange to an AVRT link (see below). Each AVRT station, in turn, would be integrated with options for last mile travel such as walking, cycling, on-demand flexible bus services, traditional bus services and perhaps autonomous pod focused on 'Mobility as a Service' (MaaS) principles.

Figure 20. Concept layout for seamless cross-platform interchange between AVRT lines

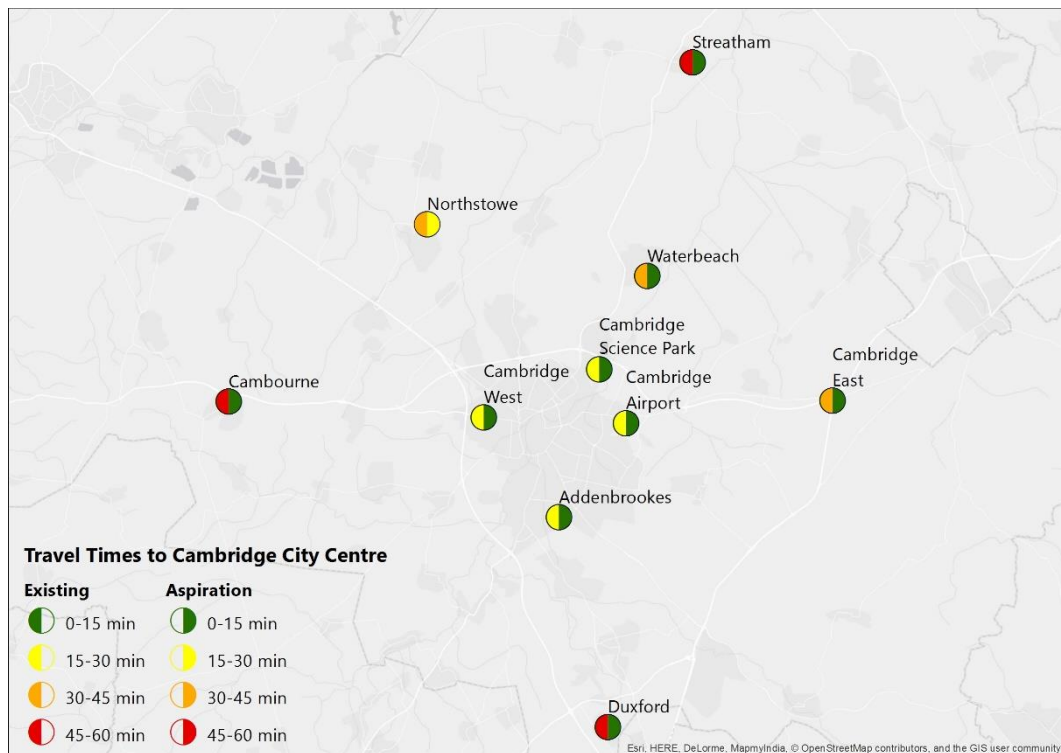


Source: AVRT report – Connecting Cambridgeshire

High level calculations of the type of accessibility changes implied by an AVRT type system suggest that city centre access times from around Greater Cambridge could change radically. Due to traffic congestion, the four main employment areas are up to 30 minutes away from the city centre, despite being only three or four miles, radially, from the centre.

The aspiration under an AVRT-style system would be that cross-platform interchanges would be frictionless, and minimum service frequency would be every 3 minutes, giving a target cross-city transit time of a maximum of 15 minutes from the further out park and ride sites to an employment location on the opposite side of the city centre.

Figure 21. Existing and Aspirational public transport travel times to Cambridge City Centre



Source: Arup

## 5.6.2 Cambridge Connect

The Cambridge Connect consortium propose a conventional light rail proposal which makes use of disused line in some places, with a tunnelled section in the city centre. A light rail solution would be a more expensive solution in capital cost terms but offers potentially higher capacity and is also scalable to future demand levels. Cambridge Connect has developed five conceptual plans for a Cambridge light rail system based around the 'Isaac Newton line' which would follow a route of around 22km via University West Campus, the city Centre, the Cambridge Central rail station, through Addenbrooke's and the Biomedical Campus, terminating at Granta Park to the south east of Cambridge.

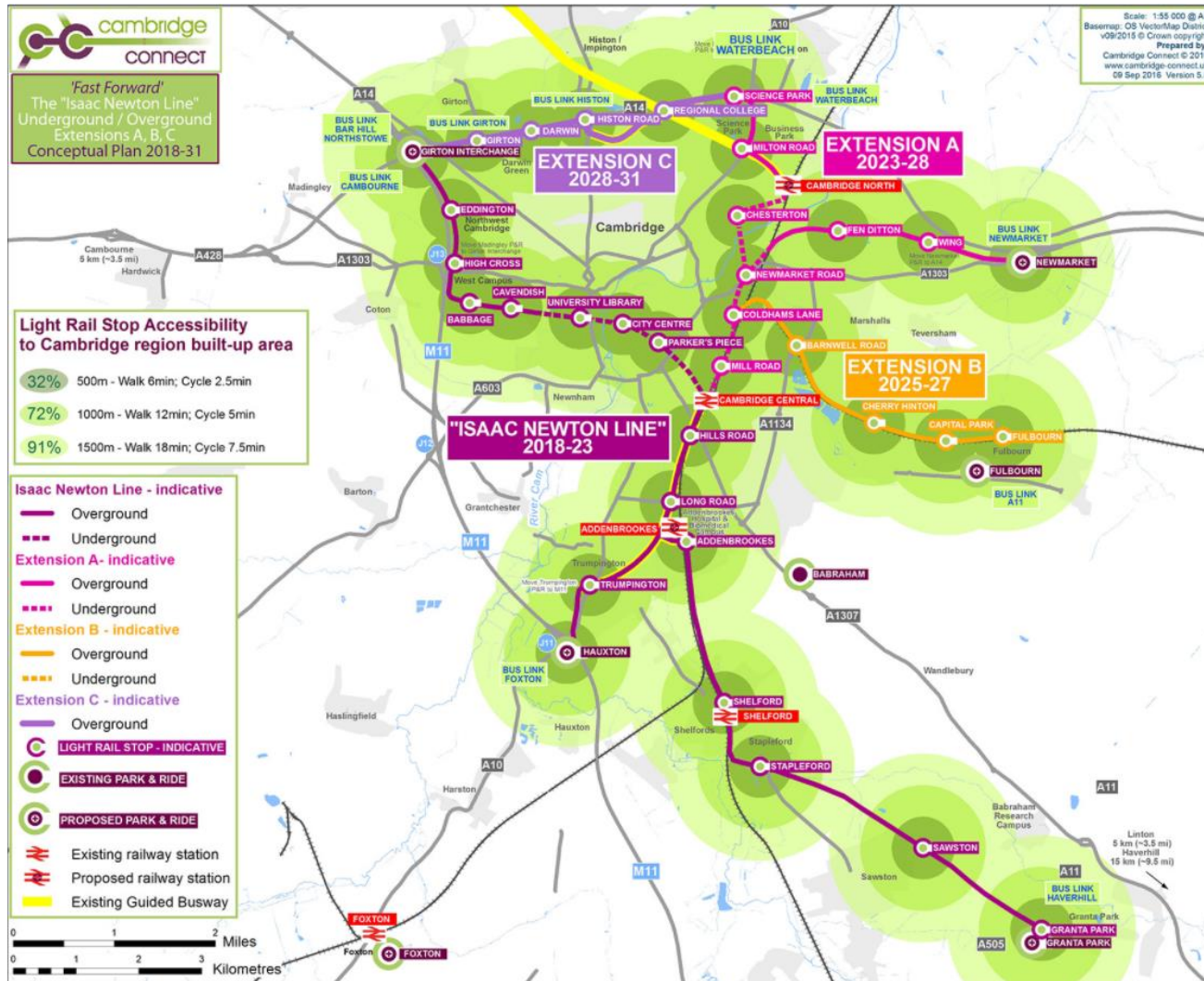
Within the historic core of Cambridge an underground section would run 3.2km from Cambridge Central rail station to the Cavendish area on the West Campus. The remainder of the network would run at surface level.

Future extensions are proposed to link in Cambridge Central with Cambridge North and the Science Park, Cambridge Station with Fulbourn, Cambridge Science Park with Girton Interchange and, potentially, regional connections with Cambourn and Haverhill.

The network is designed to integrate with and support infrastructure developments proposed for the CaMKOx corridor, connecting at Girton Interchange (which should become an all-ways movement junction with the development of the Oxford to Cambridge Expressway) and at the proposed new Cambridge South Station as well as at Cambridge Central. It would include an interchange with intercity and tourist coaches at a new coach station at junction 11 on the M11.



Figure 22. Cambridge Connect map

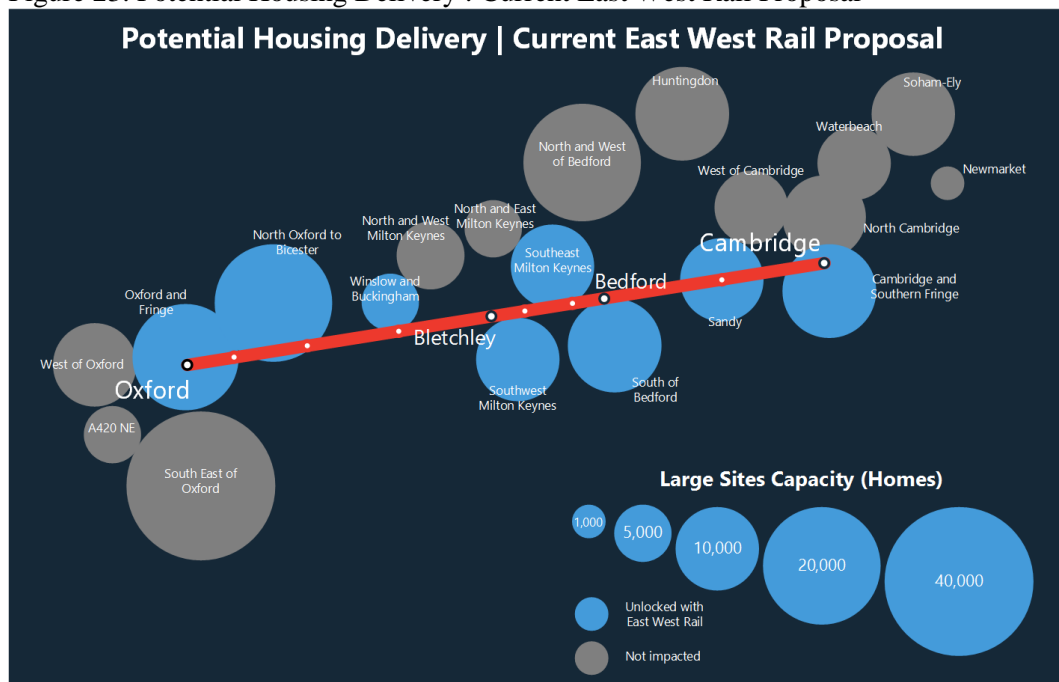
Source: [www.cambridge-connect.uk](http://www.cambridge-connect.uk)

### 5.6.3 Growth Potential

We believe that a rapid heavy rail link, connecting Oxford to Cambridge and interchanging with the three main national strategic rail routes (Bletchley for the West Coast Main Line; Bedford for the Midlands Main Line; Sandy for the East Coast Main Line) gives the most potential for transformative growth.

The currently proposed stopping service is limited in its ability to deliver growth because it relies on housing and employment opportunity areas being along or near the direct alignment. An analysis of the key identified opportunity areas along the corridor demonstrates that many of them do not. The East West rail proposal schematically illustrated below demonstrates how few of the major sites identified would be supported, even with a comparatively slow stopping service that would still leave Oxford and Cambridge around 90 minutes apart by public transport (still far more remote from one another than either is from London).

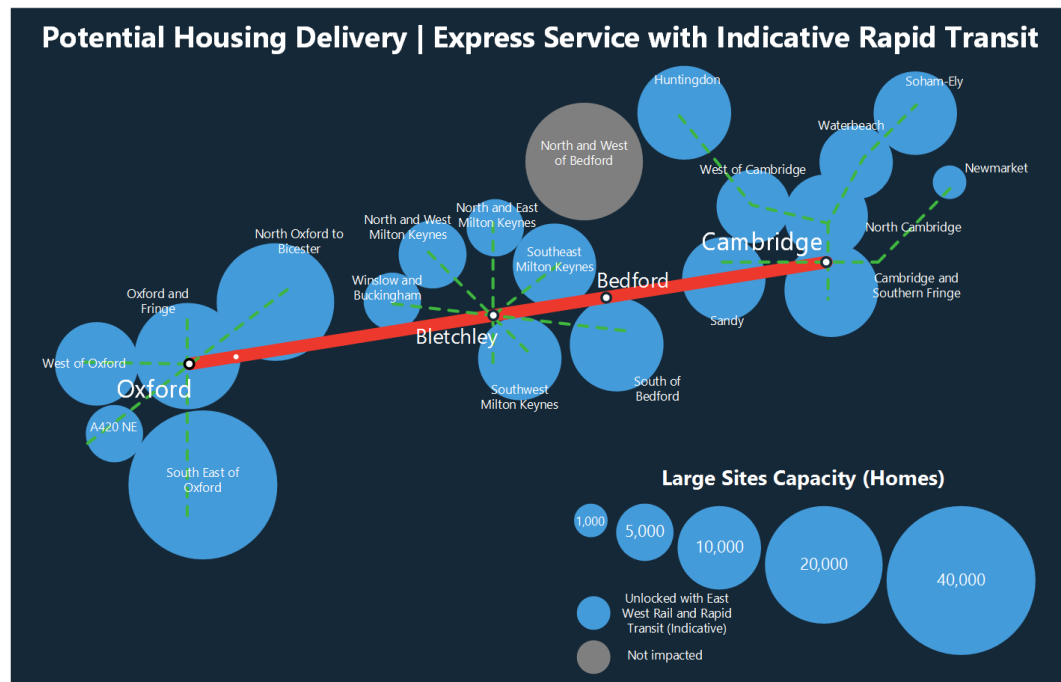
Figure 23. Potential Housing Delivery : Current East West Rail Proposal



Source: Arup

By contrast, a rapid connection linking the two ends of the corridor in under an hour, supported by a mass transit system is illustrated below. The mass transit system can be flexibly designed to maximise the growth potential of each city by targeting its main opportunity areas, and the system will be sufficiently agile that it can respond to future changes in development pressure or opportunity area in each of the three key cities.

Figure 24. Potential housing delivery: Express Service with indicative Rapid Transit



Source: Arup





## 6 Delivery

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### 6.1 Stakeholders

#### 6.1.1 Broad-based political and institutional support

There is broad-based support for the proposals set out above. From the principles outlined in the strategic documents (see Appendix A), it is clear there is alignment in the aspirations of the councils, GCP, LEP and Combined Authority. GCP is working alongside those stakeholders to develop a proposition that will meet their mutual needs and deliver the most housing, jobs and growth.

The Cambridgeshire and Peterborough Combined Authority has set its key priorities, and the first three directly align to the proposals outlined in this report:

- doubling the size of the local economy
- accelerating house building rates to meet local and UK need
- delivering outstanding and much needed connectivity in terms of transport and digital links.<sup>8</sup>

The Mayor of the Combined Authority, James Palmer, has voiced support for a mass transit option to support the growth of Cambridgeshire and stem affordability issues. The Mayor and the GCP have already jointly launched a study into the rapid mass transit options in Cambridge within his first 100 days, demonstrating his support to this initiative in principle.<sup>9</sup> And, GCP will continue to work with the Mayor and Combined Authority to align the strategy for mass transit.

Cambridge University is another key stakeholder for delivering AVRT and ensuring rapid mass transit suits the needs of the city's students and university staff. The idea originated within Cambridge University, in fact, and the initial feasibility report was co-funded by the university, GCP and Cambridge Ahead.<sup>10</sup> The links between the University and the businesses they have attracted, largely to the business parks, demonstrate the growing need to develop a mass transit solution that suits the needs of the business community and university alike.

The alignment of interests between GCP, the combined authority, the LEP, Cambridge University and the local authorities provides a strong foundation for further developing the AVRT model.

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<sup>8</sup> <http://www.cambspboroca.org/>

<sup>9</sup> <http://cambridgeshirepeterborough-ca.gov.uk/assets/Mayor/100-Day-Plan-Final-Review.pdf>

<sup>10</sup> <http://www.connectingcambridgeshire.co.uk/wp-content/uploads/2015/10/Affordable-Very-Rapid-Transit-AVRT-Report.-Vol-1..pdf>

### 6.1.2 Our big conversation (consultation)

GCP is seeking to make the decision making process inclusive and reflective of local stakeholders' needs. The campaign for consulting on this, and wider issues, is called "Our Big Conversation."

From mid-September through to November, GCP have created a range of opportunities to talk to stakeholders about the Greater Cambridge growth story, how it affects them, how GCP could help, and listen to their thoughts for the future of the area.



Residents, businesses and other stakeholders can join the big conversation by:

- Joining one of many big conversation sessions at public places all around Greater Cambridgeshire
- Finding GCP at one of the many local events they are attending
- Taking part in the big travel survey during October, telling GCP about their travel needs now, and what they might be in the future
- Connecting with GCP on Facebook and joining them for a live Facebook video chat
- Chatting to GCP on Twitter and join in with their Twitter Talk #BigConvo #Transport #Housing #Skills #Smart

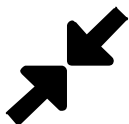
## 6.2 Delivery principles

It is crucial that the solutions implemented are focused on what evidence tells us are the biggest problems. And solutions must be responsive to changes over time, for example traffic conditions. By tailoring solutions to respond to this evidence and data, we can be confident that the solutions will make the biggest impact, and we will be able to effectively communicate them and sell the benefits to the public and businesses.

Our delivery principles are as follows:

**Incentives and disincentives must be appropriately balanced**

Any successful package requires an appropriate balance of incentives and disincentives, with measures to encourage people to travel by sustainable modes rather than private car, and with measures to discourage people from driving.

**Incentives should typically precede disincentives**

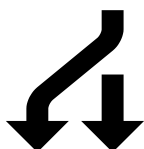
Where disincentives to driving are required, these are far more likely to be successful if feasible alternatives are provided beforehand so that journey choices can be altered more easily. This is also important in ensuring public support for the package overall.

**Value for money is a key consideration**

Interventions must be prioritised based on impact and value for money to ensure that budgets are effectively targeting the most important interventions.

**Efficient use must be made of existing assets**

Where possible, existing transport assets should be reconsidered, redesigned or repurposed to ensure they are meeting their highest and best use. Road space and rail connections are two examples where more can be done to increase capacity without building new assets. But, new investments and construction can be most effective given certain constraints.

**We should be open to the possibility of trials**

In some cases it may be feasible to trial the introduction of measures, and in such cases that may be the most appropriate way forward. And, trials may not prove to be successful, so rigorous evaluation and learning will be crucial where trials are carried out (whether successful or not).

**The solutions must be tailored to fit the local context**

Greater Cambridge is one of the most attractive areas of the UK to live and work, and it is crucial to our ongoing competitiveness and economic success that it remains as such. The package has to be grounded within the local context – whether that means being sensitive to the constraints of Cambridge's historic city centre, protecting the visual amenity of the South Cambridgeshire countryside, or preventing rat-running/over-spill parking. Whilst lessons must be learned from other city-regions within the UK and around the world, application to the Greater Cambridge area must be sensitive to the local context.

**The solutions must be future-proofed**

Solutions should consider long-term issues, such as how to respond to social, economic, environmental, political, and technological changes. Current and short-term challenges, thus, should be considered with an eye towards the future, making systems as adaptable as appropriate.

## 6.3 Delivering the GCP's City Deal

The cornerstone of GCP's City Deal agreement is the Gain Share Programme.

Between 2015/6 to 2019/20, Government will provide Greater Cambridge with £100m, consisting of five annual payments of £20m. In respect of the economic impact of the local investments, Greater Cambridge will be able to access up to an additional £400m over 10-15 years from Government.

Government's investment will sit alongside over £500m that Greater Cambridge has pledged to invest in enabling infrastructure to unlock growth. Together, this creates a total potential investment of £1bn over the City Deal period.

Some of the measures require considerable amount of capital investment, others require continuous funding stream. Accordingly, investment has been divided into tranches:

- Tranche 1 (2015/16-2019/20): £20m/year guaranteed.
- Tranche 2 (2020/21-2024/25): Up to £40m/year depending on an independent economic assessment in 2019.
- Tranche 3 (2025/26-2029/30 or 2034/35): Up to £200m, paid in equal annual instalments either over 5 years or 10 years, depending on an independent economic assessment in 2024.

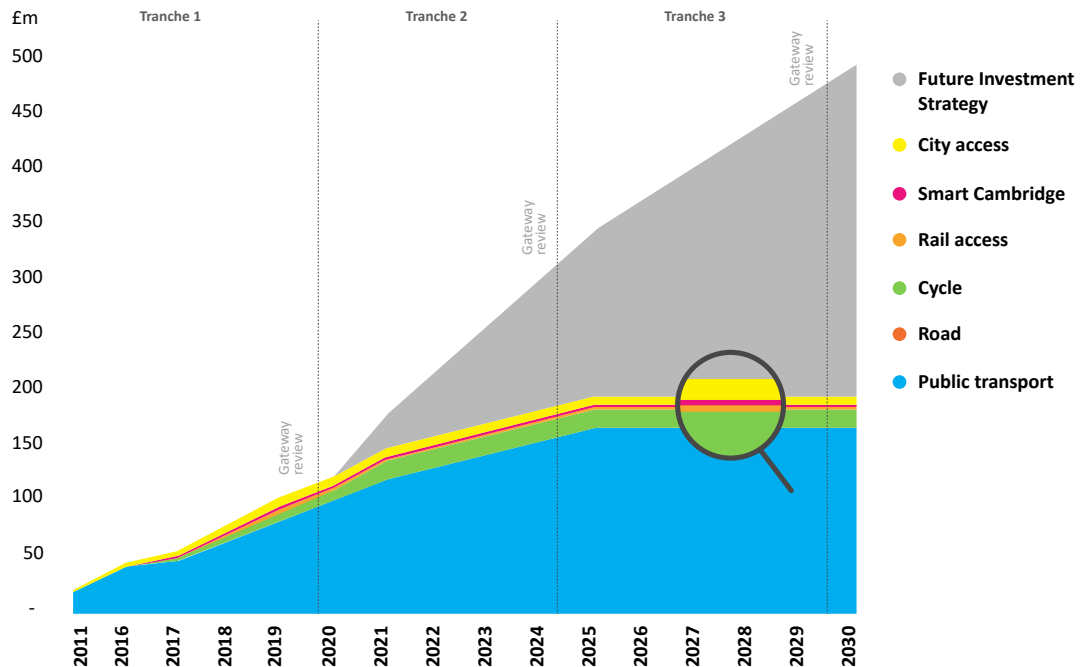
Tranche 1, detailed below, is the current and most detailed investment programme. Tranches 2 and 3 are outlined in a Future Investment Programme, which is discussed in section 6.4.

Figure 25. Investment programme in Tranche 1 schemes

Tranche 1 Schemes	Budget	Forecast opening	Spend to 2019/20
A428 to M11 segregated bus route / A428 corridor Park & Ride / Maddingley Road bus priority	£59m	2024	--
A1307 corridor bus priority / A1307 additional Park & Ride	£39m	2020	£26m
A10 cycle link	£550k	Open	£550k
City Access	£8m	TBC	£8m
Chisholm Trail cycle links	£8.4m	2020	--
Cross-city cycle improvements	£8m	2017-2019	£8m
Histon Road bus priority	£4.3m	2022	£2.6m
Milton Road bus priority	£23m	2021	£13.8m
Greenways for segregated cycling	£480k	TBD	£480k
Cambridge Science Park public transport	£44m	2015-16	£44m
Smart Cambridge	£2.3m	2017-2020	£2.3m
<b>TOTAL</b>			<b>~£100m</b>

Figure 26 depicts the estimated investment programme for Tranches 1, 2 and 3 to realise the Future Investment Programme detailed in the following section.

Figure 26. Investment programme until 2030 (Tranche 1, 2 and 3)



Source: GCP

## 6.4 Future Investment Programme: revenue implications and delivery considerations

The Future Investment Strategy attempts to distinguish between measures that could be generating revenue and those that could be subsidised. More detail on delivery considerations for each of these elements are included in Appendix H.

**Revenue generating**

- Workplace Parking Levy
- Pollution charging
- Congestion charging
- Parking controls

**Revenue neutral**

- Travel hubs
- Bus priority & segregation
- Traffic signals
- Freight consolidation centres (could be self-funding)
- Travel planning (soft intervention)

**Subsidised**

- Orbital & rural bus services
- Ticket integration, fare discounts
- Maintaining pedestrian & biking facilities

In order to realise the full potential of the transport investments and strategy already set into action by the GCP and local authorities, local government will require additional resources and capabilities in three specific areas:

**Dynamic road user charging:** we believe that dynamic road user charging could be allowed with permission from the Secretary of State under the existing legislation, which allows for charges to define the circumstances under which a charge will be imposed, and allows in principle for the charge to vary according to certain parameters. Whilst prevailing road speeds or congestion levels are not explicitly listed we believe the principle is set out in the legislation<sup>[1]</sup>.

**Transport & Works Act Order (TWAO) flexibility and futureproofing:** We need our mass transit system to be flexible to changing patterns of demand and volumes of passengers – potentially to upgrade from a bus based mode to a full light rail system depending on demand thresholds. We believe that under existing legislation there may be room to file for a Transport Works Act (TWA) Order which allows for the provision of more than one scheme, system or mode of transport, although there is no precedent for a TWAO which covers multiple modes.

**Traffic enforcement:** currently, local authorities are not permitted to install speed and red light cameras, including “yellow box” enforcement of moving traffic offenses. London local government has had this power for some time and it has

<sup>[1]</sup> House of Commons Library. Louise Butcher. 19 December 2016. “Local road charges.” Briefing Paper Number SN01171.

proven to be an effective and cost neutral way to ensure the effectiveness and cost-efficiency of the transport network.

As the NIC works with Whitehall Departments, advocacy for these three issues would help ensure that Cambridgeshire and its councils have the ability to deliver safe, effective and affordable transport for its citizens and businesses.

## **6.5 Other funding options for consideration**

### **6.5.1 Land value capture (publicly held land)**

A promising means of helping fund rapid mass transit solutions and city access will include capturing land value uplift through publicly-owned assets. Through greater accessibility, publicly-held property often increases in value, which can either be captured by the public sector through rents or asset sales. Further feasibility and asset identification studies will need to be conducted to assess the potential of land value capture.

If full business rates retention is passed by Government (which is currently stalled in the legislative process), then the combined authority may have the capability to use business rates uplift to forward fund a portion of the rapid mass transit investment. However, the uncertainty of this passing means it cannot be assumed at this stage.

### **6.5.2 Tax Increment Finance**

If full business rates retention is passed by Government (which is currently stalled in the legislative process), then the combined authority may have the capability to use business rates uplift to forward fund a portion of the rapid mass transit investment. Given the sustained price buoyancy and steady floorspace growth of the commercial markets in Cambridge (akin to those TIF projects in London), Cambridge could be a very suitable tested for TIF outside of the capital. However, the uncertainty of this passing means it cannot be assumed at this stage.

### **6.5.3 CIL/s106 regime**

Developer contributions are expected to play an important role in local infrastructure delivery. While S106 obligations are negotiated on a site-by-site basis and relate to direct impacts of development, the Community Infrastructure Levy (CIL) has more freedom to be applied to infrastructure investments which serve the wider impact of development. CIL is unlikely to pay for the majority of any infrastructure scheme, but it often plays an important role in part-funding development of transport infrastructure in particular. As CIL is a clear, transparent and certain funding stream from development, it reduces the risk of the funding mix and offers benefits to that end.





## 7 Summary: taking the next steps, together

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### 7.1 A plan for success

Cambridge is a major driver of the UK economy, and it is growing very rapidly. We have set out a clear, plan of investment to support that growth, fully funded with one or two exceptions.

Cambridge will probably continue to grow regardless but there are risks, and it could grow very much more with support from investment in the missing east-west connectivity offered by investment in East West Rail and the Oxford to Cambridge Expressway. These investments will help develop a truly polycentric and integrated high tech corridor for the UK. Such an investment could help to rebalance the UK economy away from London and the financial services.

We have ambitious plans for growth to 2031, with a target of 33,000 homes and 44,000 jobs provided for over that period. Beyond that, we believe that a step change in infrastructure investment – transport and digital connectivity will be required to deliver transformative levels of growth.

As an historic, underbounded district entirely surrounded by greenbelt, Cambridge and South Cambridgeshire Councils, working in partnership as Greater Cambridge, have delivered phenomenal levels of growth. To take growth to the next level whilst protecting our natural environment and the greenbelt which helps to maintain Cambridge's unique beauty, we will need to make a serious investment in connectivity beyond the immediate hinterland.

We have set out a strategy that is 'win/win' for the corridor as a whole and for Cambridge as the UK's pre-eminent location for some of the UK's most advanced technology and knowledge intensive businesses. We have shown detailed deliverable plans for the short to medium term, and set out the current state of thinking about the longer term. The principles and objectives of our future direction is clear whilst the technical work that underpins it is ongoing.

Figure 27. Greater Cambridge Network 2050



Source: Arup

## 7.2 The tools to grow

To achieve the aims set out in this report, we need:

- A **defined east-west rail route**, preferably express with minimal stops outside of the key mainline interchange points.
- **Around 1 hour travel time** between Cambridge and Oxford to support the corridor's business productivity through knowledge spillovers and labour market benefits.
- **Rapid Mass Transit (including underground in the city centre)** to support maximum home building around established urban centres and to ensure that all residents, particularly lower income residents from outside

of Cambridge, are easily able to access the jobs and growth opportunities it affords.

- Rapid Mass Transit **connections between Cambridge's science parks** to facilitate knowledge transfer and innovation through person-to-person and business-to-business connections
- A connection to East West Rail at **Cambridge South**, in preference to Cambridge Central (or both, if possible) to make the link with the national rail network without the cost and disruption of bringing the heavy rail link right through to the city centre, and to facilitate the delivery of a station which is widely regarded as essential to deliver on the potential of Cambridge Biomedical Campus. Cambridge South is already the location for 12,000 jobs with 14,000 more expected by 2031 but a lack of public transport connectivity could threaten the pace of delivery at this UK strategic employment location.
- The inclusion of an all-ways movement intersection at **Girton Interchange** as part of the core Oxford to Cambridge Expressway scheme.

We ask for the National Infrastructure Commission's consideration of these mutually beneficial objectives in its definition of the right space for investment in the CaMKOx corridor, to allow Greater Cambridge to deliver its potential in supporting the growth of the UK high tech economy.

Beyond this, we would also welcome the support of the NIC with the following:

**Making the case to government to fund the development of AVRT:** to take the next step with AVRT, if that is selected as the right option for Greater Cambridge. We are committed to part funding this through our city deal allocation. However, this is really about investing in a technological solution to a problem that plagues the UK's smaller cities: how to develop a mass transit system that is affordable in the face of lower passenger flows than are typically needed to support a conventional light rail system? There is clearly a benefit to sharing these one-off development costs with Milton Keynes and Oxford, who we understand to be also considering an AVRT approach, and there is a clear case for national level investment (seed funding) to continue to develop the concept, using Cambridge and the CaMKOx corridor as a national test bed for a high tech solution that could have nationwide answers to the question of how to address congestion through cost-effective mass transit systems.

**Supporting us in our engagement with key infrastructure partners:** such as DfT, Highways England and Network Rail on complementary improvements which, whilst not part of the direct CaMKOx story, will address capacity problems on the existing network. Those schemes are: M11 smart motorway proposals; local rail station upgrades on existing lines and A505 and A10 upgrade proposals.

## 7.3 The next steps forward

We recognise that transport investment alone will not deliver jobs, homes and economic growth. Transport is the enabling platform through which those higher goals are achieved. We have outlined our strategies for implementing transport measures to unlock wider goals that improve the competitiveness, prosperity and quality of life that make Cambridge—and the CaMKOx corridor—a success.

Our long term vision is for a Cambridge that can overcome the challenges of growth, to adapt to the ever-changing needs of businesses and families within the constraints of an historic setting. We will be a city that learns from its innovative firms and university, to use technology to bring people closer together and benefit the quality of place.

Greater Cambridge can achieve this future through a connected mass rapid transit system. This system will transformative growth in jobs and homes, improve quality of life and support the agglomeration with other successful cities through express East West Rail.



GREATER  
CAMBRIDGE  
PARTNERSHIP

Growing and sharing prosperity

Delivering our City Deal

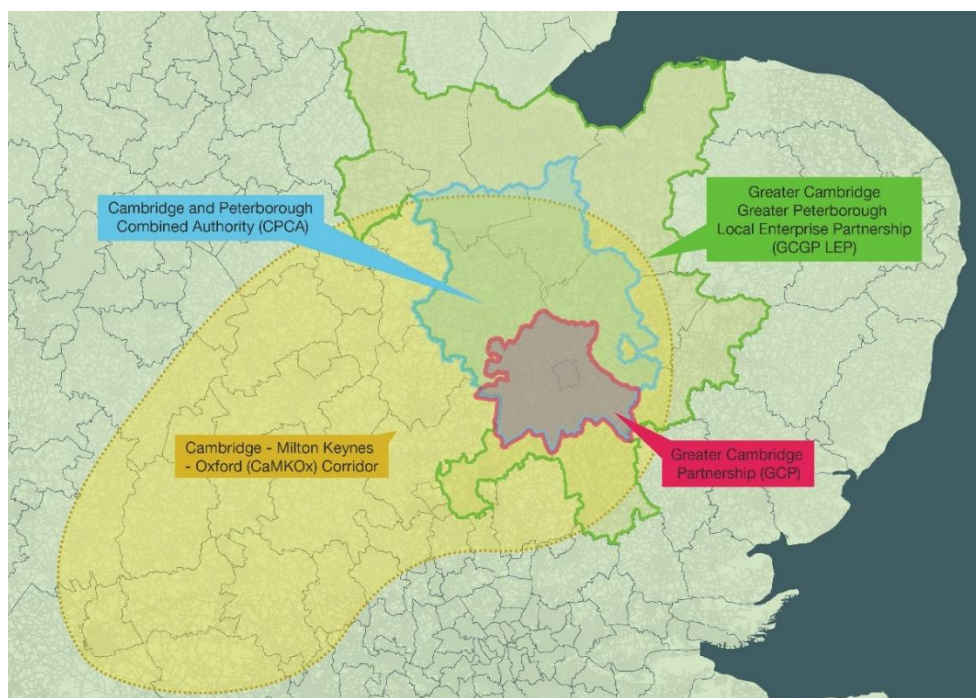
# Appendices



## Appendix A: Mapping strategic objectives and partnerships

The successful implementation of the CaMKOx corridor relies on the collaboration of a cohesive group of local and regional governing bodies, including the Greater Cambridge Partnership (tasked with delivering the City Deal), the Cambridge and Peterborough Combined Authority, and the Greater Cambridge Greater Peterborough Combined Authority. Figure 28 highlights the geographic overlap of local governance structures

Figure 28. Overlap of local governance structures in the Cambridge area and the CaMKOx corridor



Source: Arup

The Greater Cambridge Partnership and other local authorities work toward similar targets. The CaMKOx corridor and Cambridge will see mutual benefits from their investment across their programmes.

The table overleaf demonstrates the mutual objectives of the Greater Cambridge Partnership, CPCA and Mayor, the LEP and the CaMKOx programme. It is clear to see how these investments can be mutually reinforcing and potentially create efficiencies between the programmes.

Figure 29. Synergies between GCP, CPCA and Mayor, GCGP (LEP) and CaMKOx objectives

Synergies Axis	The Greater Cambridge Partnership objectives	Cambridge and Peterborough Combined Authority Mayor objectives	Strategic Economic Plan objectives	NIC objectives for the CaMKOx Corridor
Transport	<p>Creating better and greener transport networks, connecting people to homes, jobs, study and opportunity.</p> <p>Using smart technology to transform public transport.</p>	<p>Spending nearly £140 million to develop the CaMKOx corridor as recommended by the National Infrastructure Commission.</p> <p>Will commit £100 million to develop the Oxford to Bedford (west) section of East-West rail, with £27 million to develop the Oxford to Cambridge Expressway road links and £10 million for the Bedford to Cambridge (central) section of East West rail.</p>	<p>Provision of strategic funding for congested roads, campaigning for improvements to our rail network. Adding value to major transport schemes / key growth corridors and provide better sustainable transport or rapid transport solution to help people access train stations along major routes.</p> <p>Use of smart technology.</p> <p>Identify scalable interventions that open up access to significant growth locations.</p>	<p>Focussing on lifting the major constraints, targeting existing urban transport pinch points first, to create better access to the future employment opportunities in the major town centres.</p>
Housing	<p>33,000 homes by 2031.</p> <p>Accelerating delivery of new homes for all.</p>	<p>Tackle planning system barriers to be able to deliver more homes.</p> <p>Invest in making the planning system more open and accessible, improve the co-ordination of public investment in infrastructure, support timely connections to utilities, and</p>	<p>Up to 50,000 new homes from 2016 to 2021.</p> <p>10,000 new homes to be supported by funding from Growth deals 1 and 2. Growth deal 3 to support another 2,700 new homes</p>	<p>Greater coordination between transport and housing (higher investment and coordination from public sector).</p>



		tackle unnecessary delays by giving councils and developers the tools they need to build more swiftly.  Support Community Land Trusts.		
Skills	Supporting jobs and apprenticeship growths in the region. 420 additional apprenticeships.	Support the establishment of a university in Peterborough (campus in the centre of the city will attract business opportunities).  Provide apprenticeships.	Align skills provision with business demand (Local Skills Teams; Centres of Excellence for key skills shortages; Address shortage of higher-level skills in tech).  Create an appropriately skilled workforce ready to support our local growing economy by aligning publicly funded training with local business demand.	Investment in infrastructure, including enhanced east-west transport links must be properly aligned with a strategy for new jobs.
Economic growth	44,000 new jobs by 2031.  Funding for transport infrastructure to boost economic growth.	Reduce tax, support apprenticeships, homeownership and small businesses.	15,500 new jobs (Growth deals 1 and 2) by 2021.  10,000 new jobs (Growth deal 3) by 2021.  Help boost economic growth by getting the required infrastructure built to enable the creation of new jobs and homes by getting stalled projects moving again.  Supporting business growth through investment in infrastructure,	The long term vision up to 2050 is to achieve a single, knowledge based cluster, a growth in economic performance within the corridor and to support growth outside of London.  The area could support a further 700,000 jobs by 2050, increasing GVA by £163bn.  The long term strategy for growth should not focus exclusively on east-west connectivity across the Corridor.

			<p>premises or equipment where there are clear gaps in market provision.</p> <p>Translate innovation from start-up to commercialisation</p>	<p>whole corridor, there are segments of it, particularly in between Milton Keynes and</p> <p>Cambridge that could support growth in specific locations.</p>
Environment	Addressing the damaging effects of air pollution.	-	<p>Maximise the number of journeys undertaken by sustainable travel modes.</p>	-
Competitiveness	“Smart Cambridge” Harnessing and developing smart technology, to support transport, housing and skills.	Boosting science, research and innovation with a £2 billion R&D funding package	<p>To be the UK’s exemplar area for digital connectivity</p> <p>Exploring opportunities to support scale-up activities and encourage disruptive innovation in key sectors and to spread the benefit of the Cambridge phenomenon.</p> <p>Support the delivery of Innovation &amp; Incubation space in partnership with the private and public sector</p> <p>Help cement the core vision of the Alconbury Enterprise Campus by attraction of high technology businesses as ‘early adopters’ of the site.</p>	The CaMKOx corridor could be the UK’s Silicon Valley – a world renowned centre for science, technology and innovation.

Quality of Life	Improving quality of life for existing and new communities	<p>Improving schools in the Cambridgeshire and Peterborough</p> <p>Increasing funding for healthcare in the East of England (more doctors and nurses, Investing over £114 million in health research at Cambridge University Hospitals NHS Foundation Trust)</p> <p>Reduce crime in the Cambridgeshire Police Force Area - making the streets and communities safer.</p>	-	Sustainable communities need to be supported by the right infrastructure. This includes the immediate, local connections into specific sites and developments, as well as the broader transport links that connect homes to jobs and services, allowing people to access the wider economy and supporting their quality of life.
Governance and collaboration	Local delivery body for a City Deal with central Government, bringing powers and investment, worth up to £1 billion over 15 years, to vital improvements in infrastructure.	Work alongside the Local Enterprise Partnership to develop a plan for inward investment post Brexit	<p>Work with partners to facilitate improvements on key routes</p> <p>Ensure linkage with national transport investment decisions</p>	Enhance local governance arrangements to be able to deliver ambitious investment program: greater coordination between the many organisations involved, including local authorities, LEPs, national transport bodies such as Highways England and Network Rail, other infrastructure providers, and housing providers.

Source: Arup



## Appendix B : Growth allocations

This appendix details the main housing and employment growth allocations made through the joint local planning process, as summarised in the Transport Strategy for Cambridge and South Cambridgeshire.

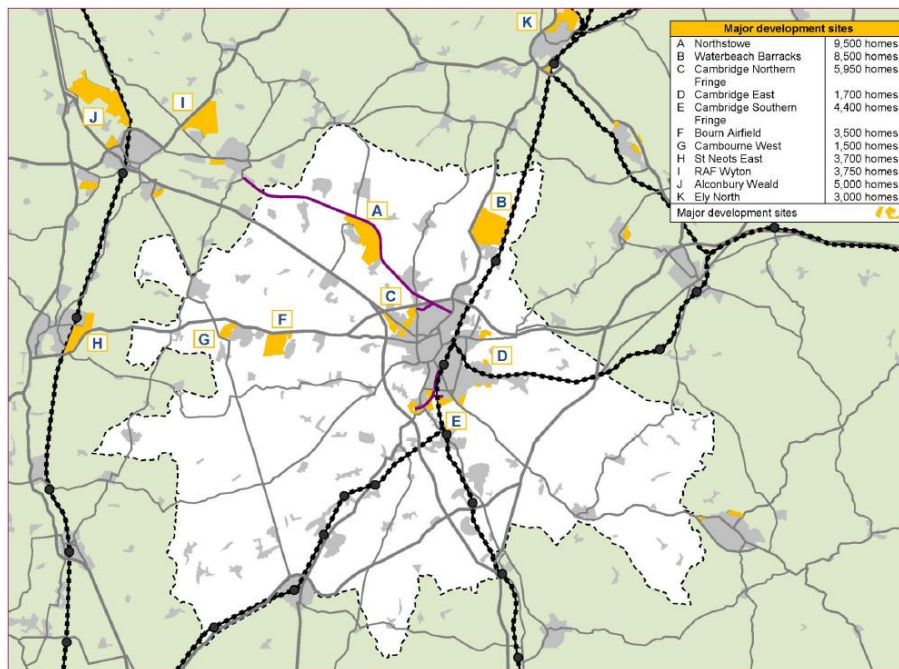
Figure 30. Major housing development site

Letter	Area	Corridor	Homes
A	Northstowe	Cambridge – Northstowe, St Ives, Huntingdon and Alconbury	9,500
B	Waterbeach Barracks	Cambridge – Waterbeach and Ely	8,500
C	Cambridge Northern Fringe	Cambridge – Cambourne and St Neots	5,950
D	Cambridge East	Cambridge – Newmarket	1,700
E	Cambridge Southern Fringe	Cambridge – Royston / Cambridge – Saffron Walden / Cambridge – Haverhill	4,400
F	Bourn Airfield	Cambridge – Cambourne and St Neots	3,500
G	Cambourne West	Cambridge – Cambourne and St Neots	1,500
H	St Neots East*	Cambridge – Cambourne and St Neots	3,700
I	RAF Wyton*	Cambridge – Northstowe, St Ives, Huntingdon and Alconbury	3,750
J	Alconbury Weald*	Cambridge – Northstowe, St Ives, Huntingdon and Alconbury	5,000
K	Ely North*	Cambridge – Waterbeach and Ely	3,000
Total			50,500

*\*Note: St Neots East, RAF Wyton, Alconbury Weald and Ely North are external to South Cambridgeshire.*

Source: Transport Strategy for Cambridge and South Cambridgeshire

Figure 31. Major housing developments in and around Greater Cambridge



Source: Transport Strategy for Cambridge and South Cambridgeshire (Figure A.2)

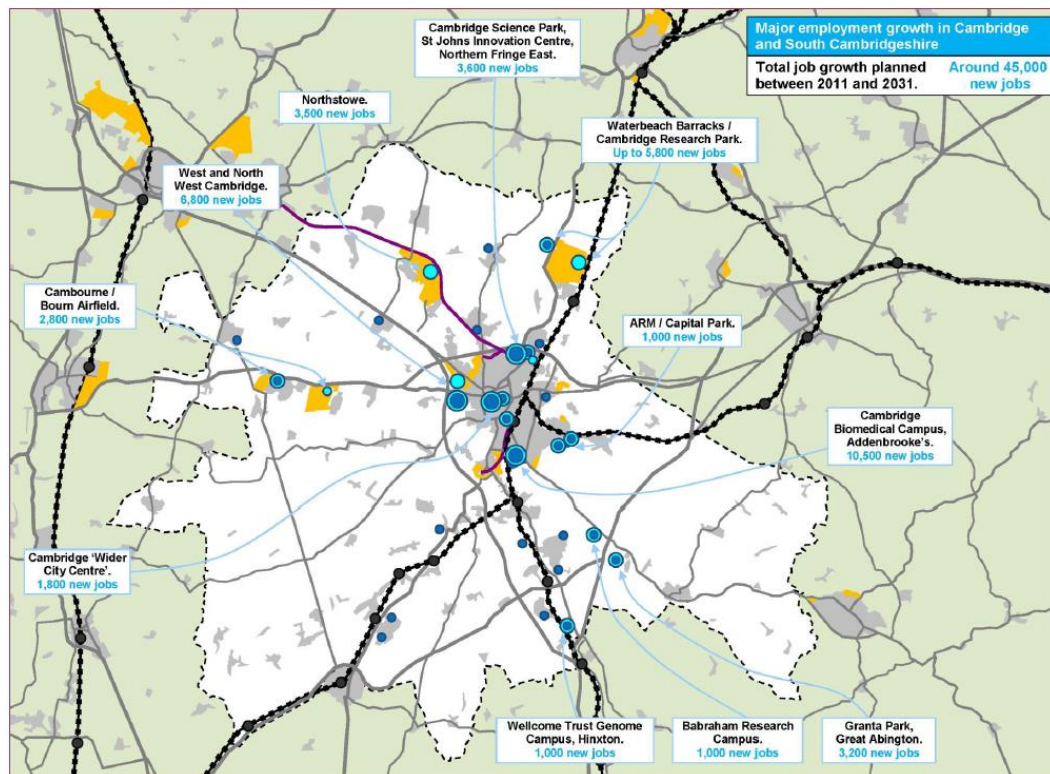
Growth in employment follows a similar pattern with a significant proportion of jobs located within Cambridge, and some employment located within key strategic sites to the north and west in South Cambridgeshire. Furthermore, there are key employment sites towards the south, in particular, the Cambridge Biomedical Campus at Addenbrooke's Hospital.

Figure 32. Major employment growth centres in Greater Cambridge

Letter	Area	Corridor	New Jobs
A	Cambridge 'Wider City Centre'	Cambridge	1,800
B	Cambourne/Bourn Airfield	Cambridge – Cambourne and St Neots	2,800
C	West and North West Cambridge	Cambridge – Cambourne and St Neots	6,800
D	Northstowe	Cambridge – Northstowe, St Ives, Huntingdon and Alconbury	3,500
E	Cambridge Science Park, St. Johns Innovation Centre, Northern Fringe East	Cambridge – Waterbeach and Ely	3,600
F	Waterbeach Barracks / Cambridge Research Park	Cambridge – Waterbeach and Ely	5,800
G	ARM / Capital Park	Cambridge – Newmarket	1,000
H	Cambridge Biomedical Campus, Addenbrooke's	Cambridge – Royston / Cambridge – Saffron Walden / Cambridge – Haverhill	10,500
I	Granta Park, Great Abington	Cambridge – Haverhill	3,200
J	Babraham Research Campus	Cambridge – Haverhill	1,000
K	Wellcome Trust Genome Campus, Hinxton	Cambridge – Saffron Walden	1,000
Total			41,000

Source: Transport Strategy for Cambridge and South Cambridgeshire

Figure 33. Major employment growth in Greater Cambridge



Source: Transport Strategy for Cambridge and South Cambridgeshire



## Appendix C: Transport strategy by corridor

This appendix details the main transport interventions planned by corridor to support growth in and around Greater Cambridge, as set up in the Transport Strategy for Cambridge and South Cambridgeshire.

### C1 Ely-Waterbeach-Cambridge (North)

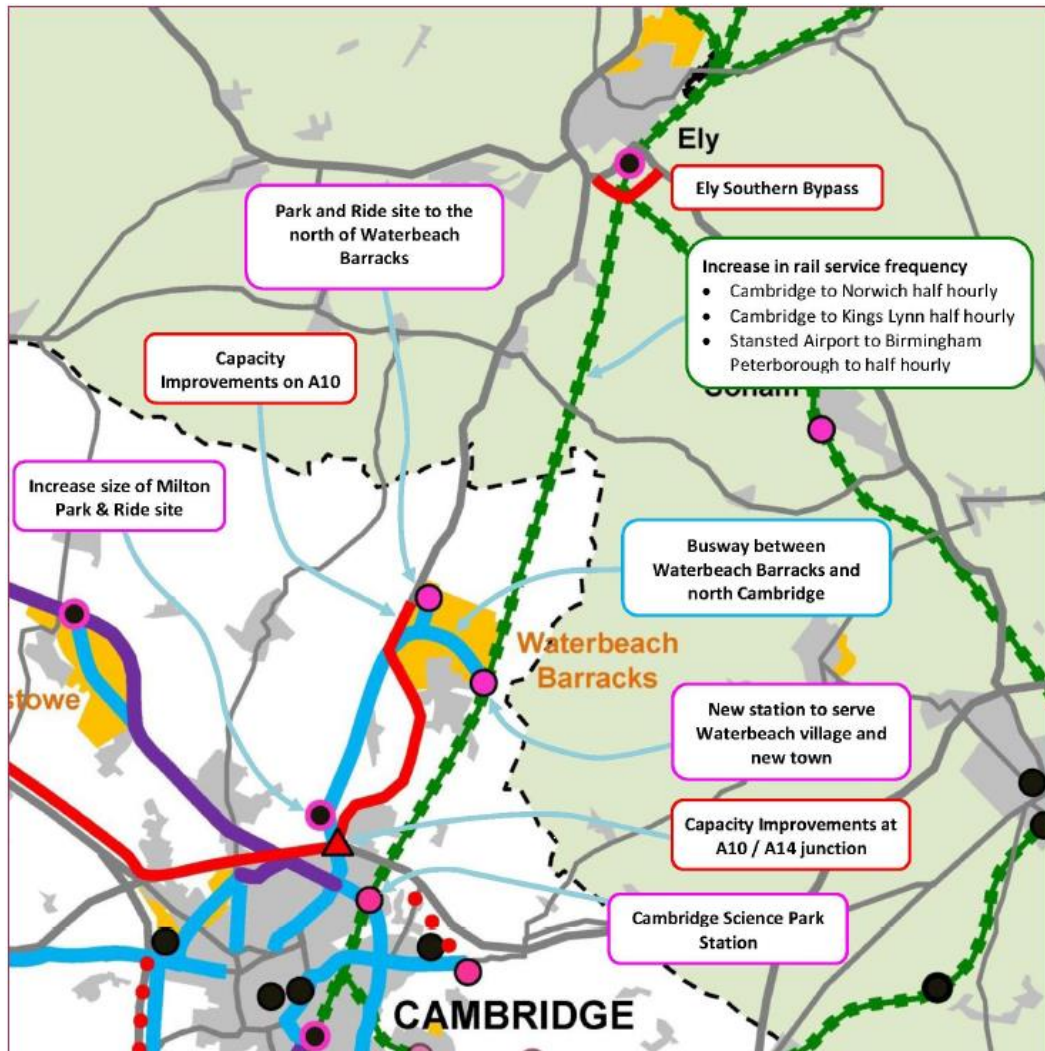
This corridor connects the northern edge of Cambridge to Ely. It is currently served by the A10 and an existing rail line connecting Cambridge and Ely. Two major developments are expected along this corridor to 2031 including the key strategic site of Waterbeach Barracks (8,500 homes / 5,800 jobs), and Ely North (3000 homes).

Figure 34. Major transport interventions between Ely and Cambridge

Intervention	Location	Timeframe
Increase rail service frequency to 30 min	King's Lynn – Cambridge service Norwich – Cambridge service	2016/17 – 2020/21
New Rail Station	Waterbeach Barracks	2021/22 +
New Busway	North Cambridge – Waterbeach Barracks	2021/22 +
New Park and Ride	Waterbeach Barracks	2021/22 +
New Cycle Link	Cambridge to Waterbeach at A10	2016/17 – 2020/21
New Cycle Link	Waterbeach at A10 to Stretham / Ely	2021/22 +
Capacity Enhancements	A10 between A14 and Waterbeach	2016/17 – 2021/22+
Junction Enhancements	A10 / A14 Milton Interchange	2016/17 – 2021/22+

Source: Transport Strategy for Cambridge and South Cambridgeshire

Figure 35. Map of Major Interventions



Source: Transport Strategy for Cambridge and South Cambridgeshire

## C2 Newmarket – Cambridge Corridor (East)

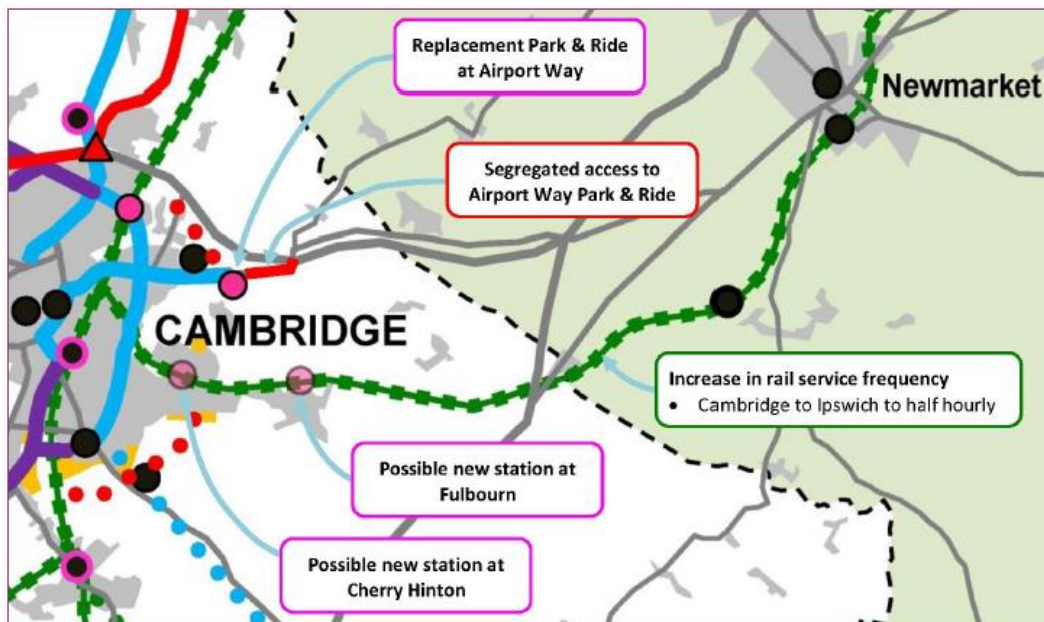
This corridor connects the eastern edge of Cambridge towards Newmarket. It is served by both road (via the A14 and A1303) and rail (via an existing service between Cambridge and Ipswich). Around 1,700 homes and 1,000 new jobs are planned for this corridor in Cambridge East and the ARM / Capital Park.

Figure 36. Major transport interventions between Newmarket and Cambridge

Intervention	Location	Timeframe
Increase rail service frequency to 30 min	Ipswich – Cambridge service	2016/17 – 2020/21
Double track / passing loops	Between Newmarket and Cambridge	2016/17 – 2021/22+
Possible railway station	Cherry Hinton (closest to ARM / Capital Park)	2016/17 – 2021/22+
Possible railway station	Fulbourn	2016/17 – 2021/22+
Replacement park and ride	Airport Way (2,500 spaces)	2021/22 +
New Road Access	Connects to Airport Way Park and Ride	2021/22 +

Source: Transport Strategy for Cambridge and South Cambridgeshire

Figure 37. Map of major interventions



Source: Transport Strategy for Cambridge and South Cambridgeshire

## C3 Haverhill – Cambridge Corridor (Southeast)

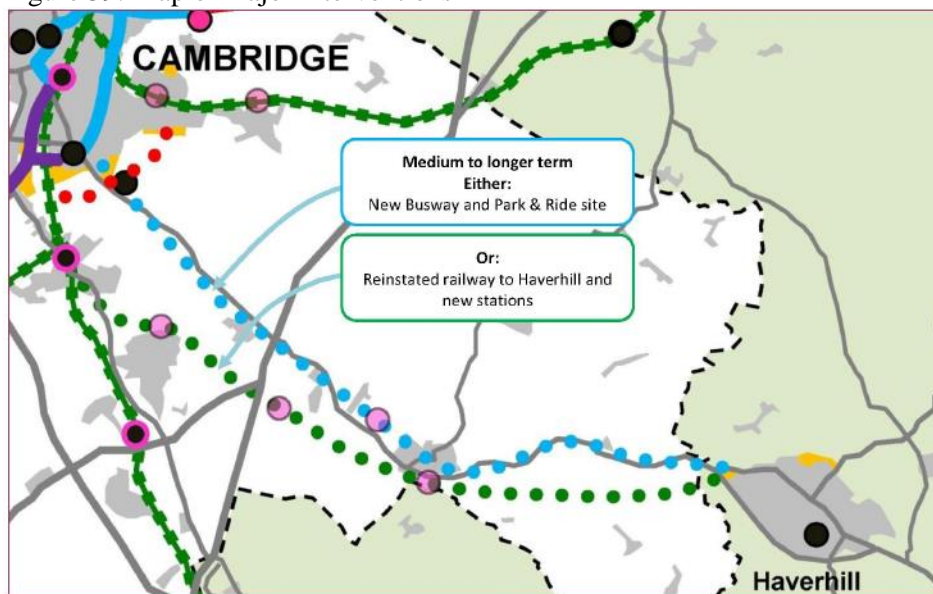
This corridor connects Haverhill with the southern edge of Cambridge. The A1307 provides the main connection along this corridor. There is also an old rail line between Cambridge and Colchester. Within this corridor, 4,400 homes are planned at the Cambridge Southern Fringe, plus 10,500 jobs in the Cambridge Biomedical Campus and Addenbrooke's Hospital. Further employment growth is expected in Granta Park (3,200 jobs) and Babraham Research Campus (1,000 jobs). Haverhill (outside of South Cambridgeshire) is also expected to add up to 4,200 homes through to 2031.

Figure 38. Major transport interventions between Haverhill and Cambridge

Intervention	Location	Timeframe
Bus priority	Key congestion points on A1307	2016/17 – 2020/21
New Car Access	Babraham Road Park and Ride	2016/17 – 2020/21
New Park and Ride	Between A11 and Linton	2021/22 +
New Cycle Link	Cambridge to Babraham Research Campus and Granta Park	2016/17 – 2020/21
New Cycle Links	Babraham Research Campus/ Granta Park to Genome Campus	2016/17 – 2020/21
New Cycle Link	Granta Park to Haverhill	2021/22 +
Possible new station	Addenbrooke's (South Cambridge)	2016/17 – 2021/22 +
Busway / Rail Corridor	Along old rail alignment or near A1307	2021/22 +

Source: Transport Strategy for Cambridge and South Cambridgeshire

Figure 39. Map of major interventions



Source: Transport Strategy for Cambridge and South Cambridgeshire

## C4 Saffron Walden – Cambridge Corridor (South)

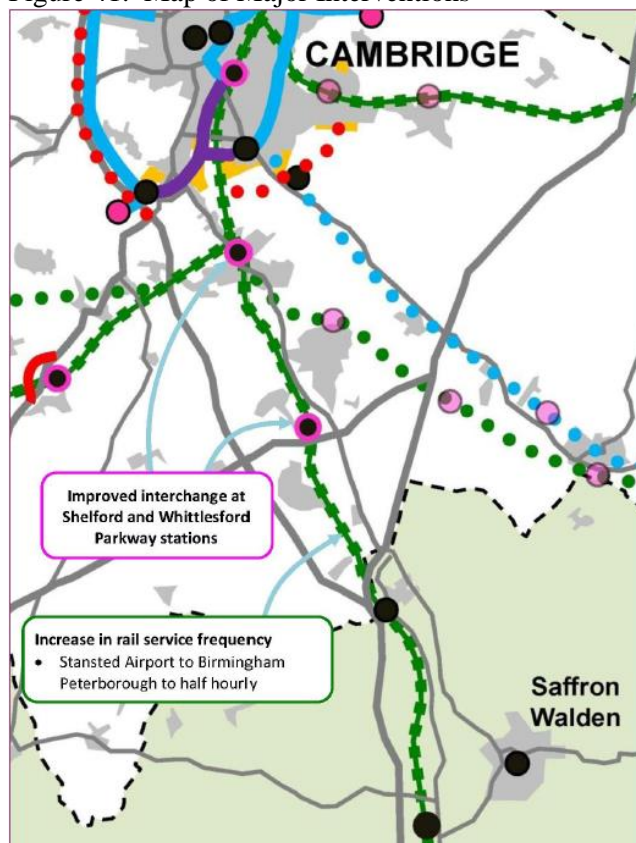
This corridor follows the M11 and the West Anglia Main Line towards the south. It connects the south edge of Cambridge to Saffron Walden and points beyond including Stansted Airport and London via Liverpool Street. Within Greater Cambridge, there is planned development at the Cambridge Southern Fringe (4,400 homes), the Cambridge Biomedical Campus and Addenbrooke's Hospital (10,500 jobs), and Wellcome Trust Genome Campus (1,000 jobs).

Figure 40. Major transport interventions between Saffron Walden and Cambridge

Intervention	Location	Timeframe
Improve station interchanges	Shelford, Whittlesford Parkway, and Great Chesterford stations	2016/17 – 2020/21
Increase local rail service frequency to 30 min	Shelford, Whittlesford Parkway, and Great Chesterford stations	2016/17 – 2020/21
Possible new station	Addenbrooke's (South Cambridge)	2016/17 – 2021/22 +
New Cycle Link	Shelford to Saffron Walden	2016/17 – 2020/21
New Cycle Links	Babraham Research Campus/ Granta Park to Genome Campus	2016/17 – 2020/21

Source: Transport Strategy for Cambridge and South Cambridgeshire

Figure 41. Map of Major Interventions



Source: Transport Strategy for Cambridge and South Cambridgeshire



## C5 Royston – Cambridge Corridor (Southwest)

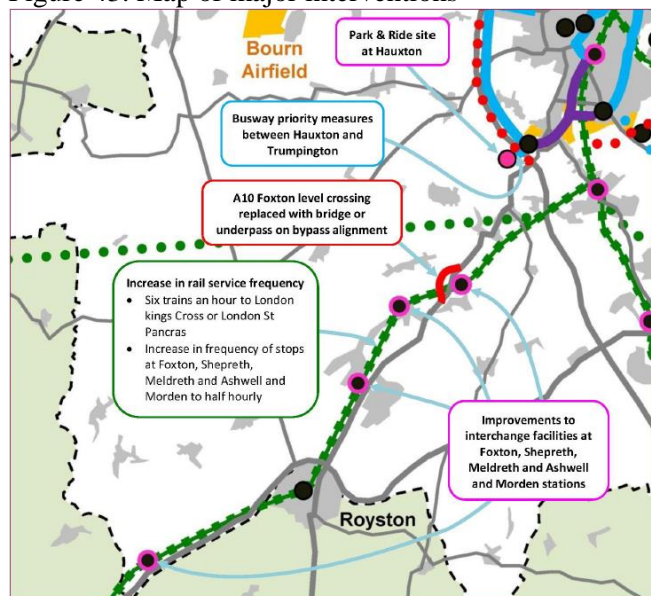
This corridor follows the A10 and the Cambridge rail line (connecting to the East Coast Main Line) towards the southwest. It connects the southern edge of Cambridge and Royston and points beyond including Hitchin and London via King's Cross. This corridor will serve developments along the Cambridge Southern Fringe, the Cambridge Biomedical Campus and Addenbrooke's Hospital. It is also possible that a future East-West Rail alignment from Oxford and Milton Keynes would connect to Cambridge through this corridor joining the Cambridge line west of the junction to the West Anglia Main Line.

Figure 42. Major transport interventions between Royston and Cambridge

Intervention	Location	Timeframe
Improve station interchanges	Foxton, Shepreth, Meldreth, and Ashwell stations	2016/17 – 2020/21
Increase destinations accessible by local rail stations	Cambridge, Shelford, Whittlesford Parkway, and Great Chesterford stations via Thameslink	2016/17 – 2020/21
Possible new station	Addenbrooke's (South Cambridge)	2016/17 – 2021/22 +
New Park and Ride	Hauxton (1000 spaces)	2016/17 – 2020/21
Bus Priority Measures	Between Hauxton and Trumpington	2016/17 – 2020/21
New busway	Between New Hauxton Park and Ride and Trumpington	2016/17 – 2021/22+
New off-road cycle links	Along A10	2016/17 – 2020/21

Source: Transport Strategy for Cambridge and South Cambridgeshire

Figure 43. Map of major interventions



Source: Transport Strategy for Cambridge and South Cambridgeshire

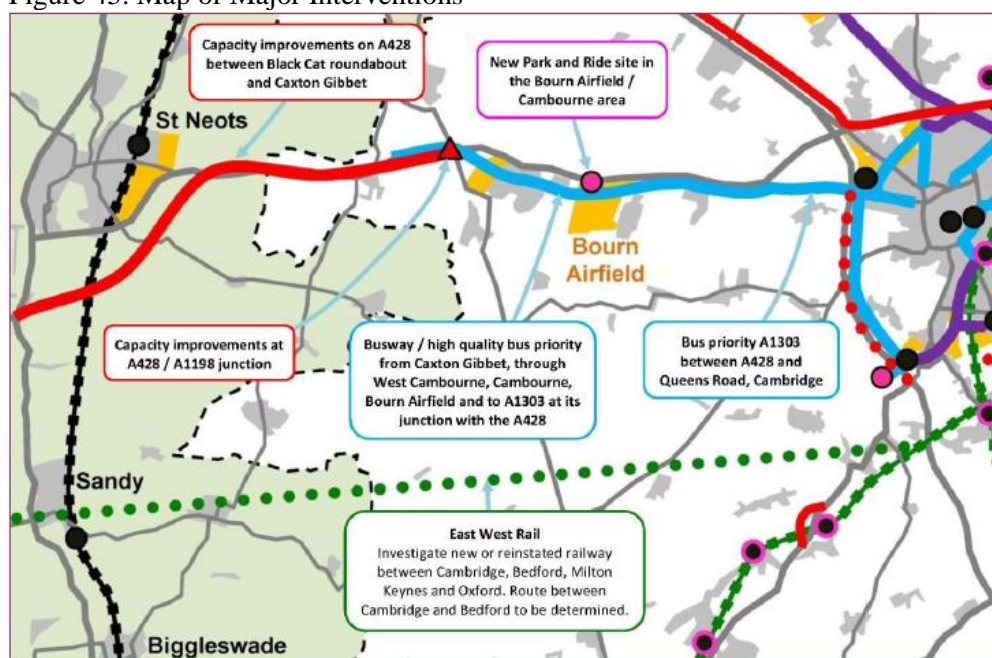
## C6 St Neots and Cambourne - Cambridge Corridor (West)

This corridor connects the western edge of Cambridge towards St Neots with the A428. It is also part of the proposed alignment for the Oxford-Cambridge Expressway. A number of key strategic sites within South Cambridgeshire are located along this corridor including: Cambridge Northern Fringe (5,950 new homes), West and North West Cambridge (6,800 new jobs), Bourn Airfield (3,500 new homes and 2,800 new jobs), and West Cambourne (1,500 new homes). Additionally, St Neots East (outside of South Cambridgeshire) is expected to have an additional 3,700 new homes. Investments to the transport network, particularly in the road and bus network, will bring future residents in this area closer to Cambridge and to major employment centres towards the west, such as Milton Keynes.

Figure 44. Major transport interventions between St Neots and Cambridge

Intervention	Location	Timeframe
Segregated bus link	A1303 between M11 and A428	2016/17 – 2020/21
New busway	A428 between A1303 and Cambourne	2016/17 – 2021/22+
Bus priority (eastbound)	A428 / A1198 Caxton Gibbet Roundabout	2016/17 – 2020/21
New park and ride	Near Bourn Airfield / Cambourne area	2016/17 – 2021/22+
New cycle link	Between Cambridge, Cambourne and St Neots	2016/17 – 2021/22+
Highway capacity improvements	A428 Caxton Gibbet to Black Cat (part of the Oxford-Cambridge Expressway)	2016/17 – 2021/22+

Figure 45. Map of Major Interventions



Source: Transport Strategy for Cambridge and South Cambridgeshire

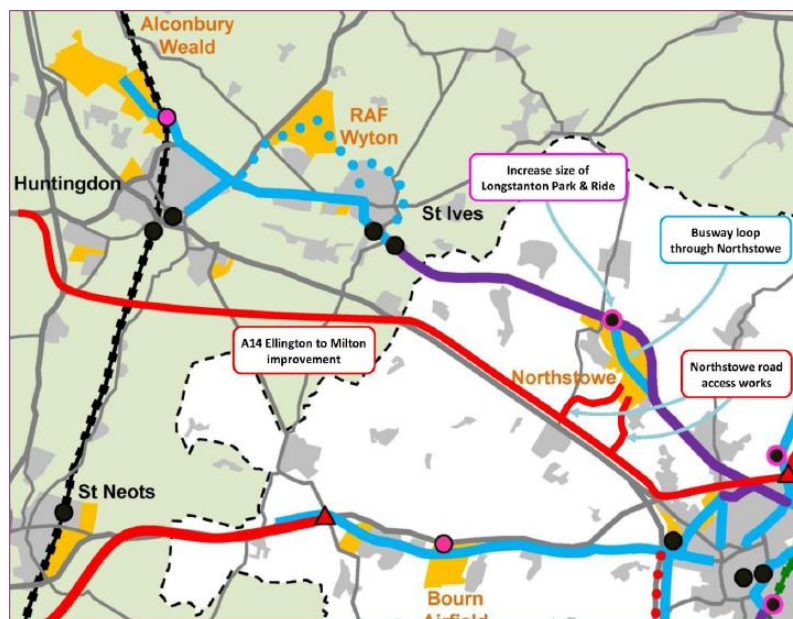
## C7 Alconbury, Huntingdon, St Ives and Northstowe – Cambridge (Northwest)

This corridor connects the northern edge of Cambridge towards St Ives and Huntingdon in the northwest. The A14 is the primary road connecting the communities in this corridor. As well, there is the existing guided busway providing frequent bus service in this area. Within Greater Cambridge, future development is expected within the key strategic site of Northstowe, where there is planned growth for 9,500 homes and 3,500 jobs. Beyond South Cambridgeshire, there is expected development at RAF Wyton (3,500 homes) and Alconbury (5,000 homes).

Figure 46. Major transport interventions between St Ives, Huntingdon and Cambridge

Intervention	Location	Timeframe
Bus priority measures	Between St Ives and Huntingdon	2016/17 – 2020/21
New busway loop	Through Northstowe development	2016/17 – 2020/21
Park and ride expansion	Longstanton (to 1000 spaces)	2016/17 – 2020/21
Highway capacity improvements	A14 Cambridge to Huntingdon	2015/16 (completed?)
New road access	Between A14 and Northstowe development	2016/17 – 2020/21
Highway capacity improvements	A428 Caxton Gibbet to Black Cat (part of the Oxford-Cambridge Expressway)	2016/17 – 2021/22+

Figure 47. Map of Major Interventions



Source: Transport Strategy for Cambridge and South Cambridgeshire



## Appendix D : Current and future initiatives to deliver City Access strategy

This appendix sets out greater detail on the initiatives proposed to deliver the City Access strategy to reduce city centre congestion, outlined in Chapter 3.

### D1 Travel Hubs

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The large number of cars coming in to the Cambridge area every day, and the expected growth in numbers, makes intercepting trips outside of the city extremely important to the overall package in ensuring that many more trips are shifted on to public transport as they approach areas of substantial congestion. The passenger transport network (including bus and rail) has the potential to intercept many more trips than it currently does. GCP and the constituent authorities are actively improving opportunities for passengers to interchange conveniently between transport modes or services is a driver of change in travel behaviour.

GCP is developing a series of **large travel hubs/Park & Ride sites**, with free parking and a ‘turn up and go’ frequency at least in the peak hours. These could also provide opportunities for locating ‘click & collect’ and similar services. The precise number and scale of these hubs needs to be determined by the needs of the specific corridor, but this would be likely to require a ring of sites with capacity for 2,000+ cars around Cambridge, complementing the existing network of Cambridge Park & Ride sites. These may be complemented where appropriate by smaller sites further out. Whilst much of the focus is likely to be on road corridors, there is also the potential for rail stations to provide a focus for interchanges and to act as travel hubs on certain corridors.

Linked to these large travel hubs/Park & Ride sites needs to be a series of **rural hubs** that, through the provision of service buses that might require an element of subsidy, complement and connect in to that network. Smaller rural interchange sites provide the potential for residents in the rural areas to connect quickly and easily to that network of ‘turn up and go’ frequency services at the large travel hubs/Park & Ride sites. These in turn effectively then form a network of hubs that collectively provide a very attractive public transport offering for local residents and for those travelling from further afield.

As well as connecting these by public transport to a wider series of rural hubs, these large travel hubs/Park & Ride sites should cater for and be accessible to a large number of cyclists, with the necessary infrastructure available to make cycling to them an attractive option for those able to do so – encouraging people to **park and cycle**.

### D2 Public transport services & infrastructure

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The success of Park & Ride and rural transport hubs relies on public transport services to be able to make journeys more quickly and reliably than private cars.

A major impediment to the reliability of, and the further increase in usage of, bus services around Cambridge is the delay experienced by buses due to congestion caused by general traffic in the city. That means **reducing bus journey times and increasing their reliability** as a matter of priority. To achieve this, road space may need to be reallocated, looking both at particular pinch points in the shorter term and more transformative upgrades in the medium- and long-term.

With this comprehensive network of large travel hubs/Park & Ride sites and suitable levels of **bus priority**, it would be possible to introduce **dedicated express services** that provide an attractive alternative to driving for many commuters. It may prove desirable to **subsidise the fares** of these services to make them even more attractive and to ensure that the choice of bus for journeys is in effect locked in, with the benefits retained over the long term.

**Cleaner buses (e.g., electric/hybrid)** should be purchased for services from these large travel hubs/Park & Ride sites to ensure that increased bus patronage does not have negative impacts on air quality.

A **network of rural services** will make public transport a genuine alternative to driving for the residents of many rural areas, who may otherwise have no feasible choice but to drive every day. This type of network would require some level of ongoing subsidy, but it would have the potential to deliver substantial benefits and potentially become financially viable in the long term.

### **D3 Simplifying the use of public transport**

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Part of ensuring that public transport is that attractive journey choice is the adoption of **integrated ticketing** among bus operators and with the rail network. For instance, if a resident of Fowlmere is considering how to travel in to Cambridge, a simple and single ticket for the bus to Shepreth Station and the train from there to Cambridge would make that a more convenient and viable journey.

Further benefit along these lines could be realised through discounting bus and rail tickets, again making those journeys more attractive compared to the private car than they currently are. This discounting could be targeted at certain groups if desired, for instance subsidising travel to work for apprentices, or adopted for passengers more broadly. Again this would require a level of ongoing subsidy, but could deliver substantial benefits.

Aligned with integrated ticketing in making public transport much more user-friendly is the provision of effective and reliable information. A resident who is looking to make a journey needs to be able to access the most up-to-date information available about their journeys, for instance including **accurate and reliable real-time information** and, where possible, through integrated timetables, and these initiatives are currently being developed through our Smart Places workstream.

## D4 Traffic signals

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To further enhance the priority given to buses, cyclists and pedestrians and therefore their speed and reliability, it would be beneficial to roll out **state-of-the-art intelligent traffic signals** around Cambridge and on key parts of South Cambridgeshire's road network. These signals allow sensors to recognise where there is a large number of buses for instance on the road, to understand what traffic conditions are on the road network more broadly, and to give a longer green phase for the bus and cycle traffic to allow more of that traffic through, allowing them to get ahead of the queues.

On its own rolling out intelligent signals would make a minimal contribution to enhancing the reliability and capacity of Greater Cambridge's road network, however as part of a wider package that includes clear priority measures and a large number of frequent bus services and cyclists, it has the potential to increase the benefits that can be realised through the delivery of that package. It could therefore play a significant role in making public transport or cycling a more attractive journey choice.

## D5 Freight consolidation

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Freight movements in and around Cambridge contribute significantly to congestion and air quality issues. Reducing the number of freight journeys into the city centre has a number of benefits, in particular reducing emissions affecting air quality and Nitrogen Oxides, reducing CO<sub>2</sub> emissions, and reducing congestion as well as allowing for better use of the road space available. Whilst recognising that increased economic activity will mean that freight movements continue to be essential, it is crucial to handle them more efficiently to reduce their impact on congestion and air quality.

Reducing the number of freight movements in and around Cambridge requires the provision of attractive alternatives to logistics operators for the 'last mile' of deliveries (although it is not essential that this is actually within one mile). In practical terms this means intercepting freight movements outside of Cambridge through the provision of **Freight Consolidation Centres**.

## D6 Walking & cycle improvements

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In order to successfully meet the increasing pressures in Cambridge and across South Cambridgeshire the proportion of walking and cycling needs to increase. There is an opportunity through the programme, and linking with new developments in the area to create a step change in the level and quality of walking and cycling facilities, which can be integrated into the wider network. This will not only reduce congestion it will also bring further public health benefits.

In cycling terms the route alongside the Busway in particular has demonstrated that, if high quality, direct routes are provided, people become more willing to

consider cycling greater distances. The villages that form a necklace around Cambridge in particular sit at an ideal distance from the city to offer the potential for increased cycling mode share. By providing **high quality, segregated routes** along the main radial and orbital corridors in particular, cycling can become a substantially more attractive option for many residents.

The potential of the cycling network to accommodate more trips is constrained not only by the capacity of on- or off-road cycling routes, but also by the availability of **cycle parking**. In central Cambridge in particular this can also make pedestrian journeys more difficult and impact on at least the perception of the urban realm due to street clutter. A substantial increase in cycle parking capacity needs to accompany this package, including the potential for a new dedicated cycle park and for expansion of existing facilities.

Pedestrian facilities throughout the city with safe, convenient and frequent crossings can play an important role in the door-to-door journeys.

The ambitious target as part of the Cycle City Ambition programme is to achieve 40% mode share in Cambridge by 2023.

South Cambridgeshire has seen significant increases in cycling levels with the investment in new routes. As part of the Cycle City Ambition programme the ambitious target is to achieve 20% mode share in South Cambridgeshire by 2023.

## Appendix E: SMART Cambridge - Future Investment Proposals

This appendix sets out greater detail on the measures under consideration as part of the SMART Cambridge initiative, outlined in Section 3.5.

### E1 Autonomous Vehicles (AVs)

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Connected and autonomous vehicles incorporate a range of technologies which allow vehicles to understand their environment, communicate with each other and interact with relevant infrastructure thus allowing them to operate without human input.

#### **Vision**

*Autonomous vehicles hold the promise of a future free from congestion and road accidents in which communities could turn large areas of their cities currently given over to parking into parks and cycle ways. Radical public transport solutions, which operate flexibly according to demand on a 24 \* 7 basis could be developed. Travellers could put time spent in cars to better use by working on the move or sleeping in an autonomous vehicle while travelling overnight, and those currently excluded from driving could be empowered in a variety of ways.*

An alternative and less benign vision of the future is one in which the removal of the driver will not only lead to a wide scale loss of jobs, but by making travel by taxi so cheap, it will undermine the public transport system and create greater levels of congestion.

Although it is difficult to predict with accuracy the long term implications of this technology, the development of AVs has gathered significant momentum and cities need to begin to plan for their arrival. There are strong arguments both in terms of the local and national economy and leadership, for the Greater Cambridge area to be in the vanguard of their development and deployment in the UK.

#### Wider context

Over recent years we have seen vehicles becoming more connected with greater degrees of autonomy. For example, cars are available with autonomous emergency braking systems, lane assist technology and self-parking systems. New types of driverless vehicles have started to emerge with driverless pod systems being piloted in a number of areas including Milton Keynes and Greenwich.

The UK Government is driving the development of autonomous vehicles and have invested £200million in their development through the Centre for Connected and Autonomous Vehicles (CCAV). The funding will support the development of an enabling regulatory framework, investment in digital infrastructure and government funding for R&D. Their development is also being driven by organisations such as Google who have already been testing driverless vehicles in

San Francisco and Uber who have built their business model on an autonomous future.

## Opportunities for Cambridge

Cambridge has an opportunity to be one of the first cities to commercially deploy driverless pods. This is in part due to Cambridge's unique infrastructure in terms of the guided busway which is a segregated traffic corridor and an ideal environment for AVs. The pods would help fill in gaps in the transport system where conventional modes do not currently operate for example last mile transport hub to campus links or out of hours on-demand operations on the guided busway. Specific case studies include:

- **Biomedical Campus** - The campus operates 24hrs a day and the number of organisations and jobs located on the campus is set to increase substantially over the next decade, but guided bus services finish at 9 o'clock at night. So anyone who lives off campus but works late is more likely to drive onto and park on the campus which will cause significant congestion. The pod would enable them to park at the Park & Ride safe in the knowledge that on the return journey they will be able to call up an on-demand pod that would take them out to the Park & Ride to pick up their car up for the onward journey.
- **Wellcome Trust** – the genome campus is also expected to increase the number of jobs over the next 5 years but currently only 1% of staff use the rail line to Whittlesford station to get to work on the Wellcome trust campus. One of the reasons is the last 2/3 mile journey from the station to the campus. The Wellcome trust would like to build a dedicated track from the station to their campus with on-demand AV's shuttling visitors and staff back and forth. This would encourage more people to use the train and leave their cars home.

These represent exciting opportunities for the deployment of Autonomous Pods in the short term although it will be some time until we see fully autonomous cars appearing on our roads. However, that doesn't mean that we shouldn't be planning for their impact now by thinking about the effect they will have on infrastructure, the cityscape and how the city can ensure that they create positive outcomes and not just more cars.

In the short term there are also likely to be opportunities to facilitate industry/academic/ government consortia for advanced AVRT or "pod" demonstrators via the next round of CCAV funding, expected to be announced shortly.

## Technology aspects:

In terms of transport innovation AVs are unique in the broad range of advanced technology required to support their development. This encompasses ubiquitous, high speed, low latency digital connectivity, advanced machine learning, end to end digital service delivery, as well as advanced security design, engineering and manufacturing techniques. Many of these are areas of strong local academic and business interest which creates a natural fit with the GCP's objectives to support the local economy and maintain and enhance quality of life in the long term.

## E2 Mobility as a Service (MaaS)

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The concept of “Mobility as a Service” puts the transport user at the centre of the transport system, understanding their specific needs and matching them to the most appropriate transport mode. This is enabled by the availability of real time data, increased computing power and the ubiquity of the smart phone all of which come together to create the best possible user experience. This mirrors the “hyper personalisation” trends in the retail market, which have to date not been reflected in the transport industry. The thinking behind MaaS concepts are that these offerings will be so compelling that users won’t own a car and the payment/ticketing element of their mobility needs will be covered through a daily, weekly or monthly payment hence ‘as a service’ which mirrors other aspects of consumer behaviour which is moving away from physically owning a tangible object.

Where commercial bodies roll out MaaS, an area loses the ability to be able to shape the offering to help it address issues such as congestion. The vision for Greater Cambridge is to facilitate the roll out of MaaS as a collaborative process which can shape a system to create benefits for everyone. Travellers will have a much more personalised and reliable experience with the current ‘friction points’ removed which will mean more travellers getting out of their cars and using more sustainable modes of transport. The city region will ensure that any deployment encourages sustainability, helping to address issues of congestion and transport operators to increase their user numbers.

MaaS also begins to support other models of delivery such as On-Demand Transport and Car Sharing because the underpinning data system is open, meaning that the ticketing and payment platform supports new innovative models.

### Wider context

The first full trial of a MaaS system in the UK is underway in the Midlands where MaaS Global serves as an operator between transport services providers, users and third parties. It combines all the existing transport services into a single mobile application on the ‘single-ticket’ principle and offers personalised transport plans tailored to customer needs.

### **Cambridge Case Studies: How could MaaS work?**

Jane lives with her husband and two children in Balsham just outside of Cambridge, where the most convenient transport mode option is the private vehicle. Jane’s household owns two cars. Her husband, Colin, uses one of the vehicles every day to commute to his workplace on the biomedical campus in Cambridge, which is 10 miles away and usually takes him a minimum of 45 minutes, but in some cases up to 90 minutes. Jane uses their other vehicle to drop the children at school on the edge of Cambridge and then drives to her workplace in the centre of Cambridge. Both Jane and her husband suffer a lot of traffic problems when driving and decide they want a change.

The family subscribe to a MaaS offering in an attempt to make their daily travels less stressful. She first downloads the MaaS Provider’s app to her and her husband’s smartphones, and opens their family account. During the registration, she answers a number of questions and the MaaS app offers her and her husband a ‘Family Package’ which she finds very appealing. The package



includes national rail, bus, on-demand mini-bus and bike sharing as well as a small number of taxi trips to be used when there are no other options available.

The next day, Jane has a look at the options she has for taking the children to school. She types in the address of the school and sees that the MaaS operator offers an on-demand school bus that can pick her children up and take them straight to school. She hits 'submit' and can see the real-time location of the bus, its predicted arrival time, its registration plate and driver. The school bus arrives at her front door 15 minutes later. She uses the MaaS app to log that her children have boarded the bus.

Jane's husband Colin also plans his journey to work in the morning. He orders the mini-bus, which shortly arrives. As he boards the mini-bus, the MaaS app starts counting the distance travelled. The mini bus arrives at the park and ride for a connecting bus and Colin uses the MaaS app as a virtual ticket. Arriving at the campus Colin is alerted that his meeting has been moved a mile into town and through the app he is able to pick up a hire bike which ensures he arrives on time.

After a month of using MaaS, Jane's family life has completely changed. They have sold her car and offer the other car for short term rental using the MaaS operator's website (community car club). In exchange, Jane's family gets credit in their MaaS account which they use to buy mobility services.

## E3 Smart Logistics

In the UK, 17% of total retail spend is made on-line and this is higher than anywhere else in Europe. This trend has been driven by companies like Amazon and ASOS who trade solely on-line as well as supermarkets who have developed on-line grocery shopping, and further growth is predicted.

Newcastle University research shows that online shopping can only be environmentally sustainable if more than 25 items are consolidated into a single delivery order, otherwise the impact on the environment is worse than physically driving to the shops.

At the same time, consumers are demanding a better quality experience with ever shorter delivery times and more flexibility in the customer experience including free returns, and this in turn has led to more speculative purchases. These trends are resulting in less consolidation of items for delivery, and there is currently limited understanding of the impact of this on congestion and air quality. Cities therefore need to understand the impact that deliveries are having so that they can plan to mitigate these effects. Recent evidence from London indicates that congestion is growing and the effectiveness the congestion charge is being eroded, due in large part to an increase in the number of delivery vehicles.

Potential solutions

- **Click-and-collect centres** receive consolidated goods in larger shipments from retailers, reducing the number of journeys needed, while offering the purchaser the flexibility to pick up near their home at a convenient time. These consolidation businesses increasingly offer late-opening locations to pick up packages near people's homes. Some even offer changing room facilities to allow clothing to be tried or returned on the premises. One such company, Doodle, suggest their click-and-collect model would take

31,000 vans off UK roads during the busy months of November and December.

- **Vehicle capacity and route optimisation:** currently companies will drive deliveries into the city whether they have one package or 100 packages to deliver. This means that vehicle capacity is not being optimised. By having a third party aggregate packets from various delivery companies onto vans you can reduce the number of vehicles coming into the city and have the opportunity to look to electrify the fleet. This can be further improved by refining the route optimisation algorithms used and bringing in live data from around the city.
- **New delivery mechanisms** are emerging into the market and Cambridge is leading the way being the first city region to have an Amazon delivery by drone. Although there is no commercial deployment of this technology we have a unique opportunity to begin to think about how drones could help ease the pressure that delivery vehicles put on the city.

## E4 Internet of Things and connectivity transforming services

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The “Internet of Things” (IoT) is the generic term used to describe both the increasing numbers of devices connected to the internet and which have the ability to exchange data without human intervention, as well as the supporting infrastructure and systems that support them. With the cost of computing continually falling and the ubiquity of connectivity making it cheaper and easier to connect, an upsurge in connected devices is anticipated with Gartner indicating the market for IoT connected devices is poised to reach nearly 21 billion by 2020. This has the potential to radically transform many business processes as well as everyday activities, including the way that the public sector delivers services helping to meet residents’ expectations at a time of falling budgets.

### Current developments

We are already seeing this technology being deployed in this area. Cambridge City Council are trialling the use of sensors in bins which tell the operator when they are almost full to optimise the resource needed to empty them. The County Council are deploying sensor based devices to support independent living in elderly and vulnerable people. There are multiple examples where using a cheap sensor and inexpensive ubiquitous connectivity such as a Low Power Wide Area Network can lower the costs of operation, and we have seen other areas use sensors in rat traps, roadside gullies, soap dispensers and flower beds all of which give information on when to empty, clean, fill or water.

### Transformational potential

IoT technology can fundamentally transform services when interconnected devices communicate with each other and use Machine Learning (also known as AI or Artificial Intelligence) which has the potential to greatly reduce the cost of service delivery and transform outcomes. An example of this is healthcare and the

use IoT sensors to help the elderly live independent lives. By monitoring environmental factors and taking actions such as altering room temperature, reminding people to take their medication or go for a walk, IoT devices can empower the elderly to take control of their everyday routine. Weight, blood pressure and ECG can be monitored remotely, allowing problems to be detected early on and in the moment. Families are also able to ensure that their relative is eating by monitoring activity in the fridge and cooker as well as the kettle, and this information can be used to automatically order a grocery delivery. IoT can help the vulnerable build a community of people around them that is personalised to their exact needs, taking advantage of technology where possible and empowering people to take control of their well-being.

### Prerequisite

IoT solutions are dependent on connectivity and so we have an ambition for Cambridgeshire to become Hyperconnected. This means ubiquitous mobile and fibre broadband coverage as well as the deployments of technologies like 5G/NB IoT and Low Power Wide Area Networks such as LoRa on which the Intelligent City Platform is based. Without these layers of connectivity, transformed services such as the ones described above cannot be deployed.

## **E5 Unleashing the power of data**

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Data is at the core of the digital revolution. It is transforming the way we do business and shop as well as driving changes in the way we move around and interact with cities. Three types of change are revolutionising our use of data:

- The quantity of data available is set to grow exponentially as the Internet of Things rapidly expands the volume, velocity and variety of data.
- Our rapidly growing ability to gain insight, knowledge and wisdom from data.
- The use of new techniques in big data, machine learning and AI, data analytics and visualisation is unleashing the power of data helping to create new and innovate ways of doing things.

### The Challenge

As organisations, the County Council, City Council and South Cambs District Council are data rich but face a number of problems in deriving and maximising its benefits. This impacts the way that data can be utilised to support the three key areas of the GCP objectives – housing, skills and in particular transport. Data tends to be locked into legacy systems and is not easily available, and the terms and conditions that are frequently attached to the data mean that re-use is difficult. Data held in different systems is sometimes inconsistent meaning that there is no ‘single version of the truth’. The infrastructure and culture needed to maximise the benefit of this data is only beginning to emerge.

### Progress and next steps

The Smart Cambridge programme has begun to take the first steps along with others to enable the better use of data. We have built a real time platform where we can aggregate real-time data for re-use and we are storing the data so we can begin to use machine learning techniques to predict how city systems operate. To help in the collection of missing data we have built a Low Powered Wide Area Network which facilitates the low cost deployment of sensors and are working to identify other data sources which could help to better quantify the city. There is an opportunity to undertake a more comprehensive exercise to identify gaps affecting the Greater Cambridge Partnership programmes and add to the richness of the data we have, to make it more usable and to make data discoverable so anyone who wants to use it can easily find it.

This data will then begin to underpin work in a number of areas including:

- Intelligent mobility since new models such as Mobility as a Service rely on good quality real time data that is open for re-use
- Smart grids which rely on real-time data exchange between energy users and the grid
- Providing the underlying data to generate an evidence base to support decision making and delivery of housing and transport schemes within the GCP Programme

## **E6 Transforming Place**

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*“Increasingly, the world is becoming an intelligent, digitally enabled mesh of people, things and services. Technology will be embedded in everything in the future, and ordinary people will experience a digitally-enabled world where the lines between what is real and what is digital blur”*

**Gartner predictions for 2017-2020**

New and emerging technologies and advances in connectivity (including those laid out in previous sections) are set to change the places in which we live. Already digital technology touches every part of our lives including the work place, our shopping habits and the way we organise our lives.

These are some areas in which we are likely to see significant changes:

### Health and Social Care

There are a number of technologies that are beginning to transform the delivery of health services, changing the way residents access health care, for example:

- **Telehealthcare (telecare and telehealth):** support and assistance provided at a distance using ICT and the remote exchange of clinical data between a patient and their clinician. This will be supported by the

exchange of health data via sensors on patients and in the home as well as better teleconferencing facilities.

- **Health:** mobile phone applications relating to health and/or wellbeing and connected wearable devices which can measure everything from hydration to the on-set of diabetes. More and more data will be collected from information on the amount of exercise/sleep people are getting, to other biometric data such as heart rate and health analytic packages which mine data and which will be able to identify early symptoms of diseases allowing for early interventions. All this information will be kept on a single record that can be accessed by multiple practitioners.
- **Community resilience:** we have already seen digital platforms being developed which put residents who are vulnerable together with neighbours. Examples include a casserole club which encourages people to cook an extra portion of food and then identifies an elderly neighbour they can give it to, and running clubs that deliver food or goods to elderly people unable to leave their homes.

### Everything will be connected

From our homes, cars, neighbourhoods, work and retail. All these things will begin to talk to each other and work together to create a more seamless experience. What will the experience of living in such a place be like? Imagine you have an 8.00 meeting in London and the trains are delayed. The real time train information will talk to your diary, rearranging the meeting for later in the day whilst changing the alarm on your clock which was due to go off at 5.30 and re-setting for your normal time. You were due to be picked up by an on-demand minibus, and a later time is automatically booked for you. You have your breakfast and almost finish your milk which is noticed by your fridge which adds it to your internet shopping due to be delivered that evening.

Residents will also be able to get much more contextual information about their place for example: what the air quality is like now, the best way to get to the station, when my bin will be emptied, how busy town is, whether there is a risk of flooding etc. All of this could be personalised and delivered in a manner convenient for the user.

### Transport

Autonomous Vehicles are likely to have the biggest impact on what place could look like in the future. If transport can be accessed in real time and at a reasonable cost, a reducing number of people will own cars as they become a shared resource. This will mean that parking is likely to start disappearing and we can begin to use streets differently. Residents especially children will be able to use them safely and they can be greened to provide a much more pleasant environment. Any vehicles that are owned are likely to be electric and will be part of a localised smart grid feeding electricity to the grid at peak times while receiving charge at quieter times.

Deliveries may be by drone while some products will be printed on 3D printers either at home or at local centres.

## Work

Connectivity has already changed the way we work with more and more people working flexibly which reduces the need for travel and has reduced the costs of providing physical workspaces. This is supported by technologies such as Skype which allows easy video conferencing and Dropbox which supports the easy sharing of files. Increasingly we will be able to perform more and more tasks at home as augmented reality and virtual reality allow us to be in virtual environments. We are also seeing more co-working spaces being developed which allows workers to remain local but still retain the sociability of an office, also seeding greater collaboration. Cities that are seeing these new ways of working being adopted are observing a drop in office space in their central areas as well as an impact on traffic.

Artificial intelligence is the technology that will have the greatest impact on the way we work as we are able to automate more and more jobs. What impact this will have is very difficult to predict

## Energy

As both batteries and solar photovoltaic (PV) systems become more efficient and more affordable there is likely to be a move away from a centralised model of energy supply to much more localised grids which will be managed from a local platform able to balance loads across a locale utilising high load businesses such as supermarkets and local data centres, a network of electric vehicles and home appliances all connected to the 'IoT' to balance the load at peak times.

## Housing

Technology is set to have a significant impact on houses of the future from new construction techniques such as modular construction and 3D printing which will enable houses to be built more quickly than traditional houses and support the delivery of passive house standards which will significantly decrease the energy needed to run a home. As renewable energy technologies and battery technology improves, homes will be able to generate much of their own electricity allowing grids to become more decentralised. These grids could combine a variety of energy producers and storage units with adjustable consumer devices in order to ensure grid stability. Moreover, smart grids can get actively involved in the sale of energy.

Homes will become much more connected. For example, we already see companies such as nest and Samsung creating connected heating controls and smoke alarms. Fridges and washing machines are connected and voice activation technology such as Alexa are supporting the human interface with these devices. This is only the beginning as more and more things become connected within the home, and homes are able to exchange data with external agents through the 'Internet of Things'. Artificial intelligence will mean that houses will be able to both optimize their efficiency and help us to manage our lives. The connected home will support people living in their homes for longer as sensors measure our health and support preventative interventions as well as allowing remote diagnostics and consultations. Being part of a connected community will support greater resilience.

To support this increased connectivity, homes will need to be connected to ultra fast fibre to support multiple screens streaming ultra high quality video, 100's of connected devices as well as managing things like the house's energy supply. This will also support more flexible working practices which may see work become further decentralised.

## Appendix F: Demand management mechanisms

Demand management measures under consideration, either separately or in combination are set out here (and summarised in Section 3.3).

### F1 Travel planning

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Lack of information often presents a barrier to the uptake of sustainable travel, therefore improving sustainable travel awareness is very important to getting more people out of their cars. **Travel planning**, working with employers, schools and other organisations, has the potential to build on the benefits delivered through the rest of this package by more effectively pairing the sustainable travel options available with the needs of individuals and organisations.

### F2 Parking controls

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One of the constraints to the potential for prioritising sustainable travel modes is the widespread allocation of road space to parking in Cambridge. Whilst a level of on-street parking is necessary, there is the potential to make much more efficient use of existing road space by controlling this. There may also be a need to adopt some **on-street parking controls** to mitigate the impacts of other interventions.

The introduction of a **Workplace Parking Levy**, which is one of the options being considered, would simultaneously act as a form of parking control, reducing the availability of parking for commuters in particular to encourage them to transfer their trips to sustainable modes, but from Nottingham's experience to primarily act as a revenue raiser to support interventions such as those outlined in this proposition rather than a tool for demand management.

Controlling parking in the city centre for those travelling in to Cambridge, including looking at both on- and off-street parking together, will make the use of those controls much more effective in dissuading people from driving into the city centre, instead encouraging them to change at one of the travel hubs. This comprehensive approach to managing parking within Cambridge would make a significant contribution to reducing congestion. The widespread adoption of on-street parking controls would also act to disincentivise some drivers, who may spend a long time driving around looking for parking spaces, in turn contributing further to overall congestion.

### F3 Pollution charging

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Poor air quality is detrimental to the environment and to public health, and is linked to asthma and breathing problems, with children being particularly susceptible to these conditions. It is thought to result in more death and illness than road traffic accidents. The most severe transport-related air quality problems are generally associated with roads which have slow moving or stationary traffic on a regular basis, or which have very high traffic flows. Buses are a major contributor to air quality problems in Cambridge city centre, and Heavy Commercial Vehicles have the greatest impact on air quality in South Cambridgeshire (particularly along the A14 and M11) and in Cambridge city centre.



There has been more of a drive recently from Government to tackle the issue of air quality, with the possibility of charging being introduced to tackle transport-related air quality issues (as is the case for many of Greater Cambridge's air quality issues). The introduction of a **pollution charge** would effectively serve a dual purpose, firstly disincentivising the use of more polluting vehicles, and secondly providing a revenue stream through which the attractiveness of cleaner vehicles and choices can be increased.

The revenue generated through a pollution charge could feasibly be invested into any part of this package, and the potential contribution it could make to delivering the broader package would of course depend on the level of charge and what vehicles are covered by it. Given the inherently environmental nature of the charge though its revenue could be prioritised for focusing on measures that make a greater contribution to the improvement of air quality, for instance into cleaner buses, recognising that buses are essential in solving Greater Cambridge's transport problems but in their current guise are also substantial contributors to the air quality issues in Cambridge city centre at least.

For this to be as effective as possible the charge would need to apply to vehicle movements within the charge area, i.e. based on an area charge rather than a cordon charge. To adopt a cordon charge would have the perverse effect of encouraging more private car trips within the most affected area, as some of the people who currently travel by sustainable modes between two points in that area would instead drive given the reduction in general vehicular traffic.

## F4 Intelligent charging

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Whereas a pollution charge may be deliverable in the nearer future to tackle air quality issues in particular, it would be unlikely to simultaneously tackle the full scale of the area's congestion problems. Whilst air quality would be enhanced, the issue of congestion and its constraint on economic performance in particular would still exist. In the longer term therefore there may still be a need to consider some form of road user charging, which is tailored according to the level of congestion in the area. By linking the level of charge to the level of congestion it can be more effectively and intelligently targeted at resolving the key problem it is intended to resolve.

As much of the package outlined above would be likely to require some form of ongoing revenue support, whether that is in terms of directly operating a service or of subsidising services, or indeed expanding the amount of priority infrastructure improvements that is deliverable, intelligent charging could facilitate the delivery of this transformative package of improvements. It would have to be introduced in a way that allows the alternatives introduced to offset the impact a charge would have on individuals so as to reduce the cost of transport and increase the feasibility of travelling by non-car modes, which will mean substantial up-front funding being made available.

## Appendix G : Investment profile

This section sets out the detail of the specific schemes that underlie the investment profile described in Section 4.1.

Themes	Measures	Description	What year?	Cost?	Status	Category
1	A10 Foot and Cycleway	High quality, consistent foot and cycle link extend from Cambridge all the way through to Melbourn aligning with the A10 route.		£550,000	Open	Cycle
1	Chisholm Trail cycle links	<ul style="list-style-type: none"> <li>-Cutting Congestion</li> <li>-Quick, direct route linking major employment and railway stations</li> <li>-Quiet, mostly motor traffic-free routes</li> <li>-Opens up currently private green spaces to the public</li> <li>-Makes cycling a more attractive way to get to work</li> <li>-Provides major health benefits</li> </ul>	2021	£8,400,000	<p>Phase 1 of the scheme and the new bridge have received planning consent, and construction is due to begin in 2017 (pending a potential Judicial Review).</p> <p>£8.4m of City Deal funding has been allocated to the Chisholm Trail. This does not include funding for the separate Abbey-Chesterton bridge project, which comes from a Cycle City Ambition grant and developer contributions. This is anticipated to cost in the region of £4.3m.</p>	Cycle
1	Cross-city cycle improvements	<ul style="list-style-type: none"> <li>-ARBURY ROAD ROUTE</li> <li>-LINKS TO CAMBRIDGE NORTH RAIL STATION AND THE SCIENCE PARK</li> <li>-DITTON LANE AND LINKS TO EAST CAMBRIDGE</li> <li>-HILLS ROAD AND ADDENBROOKE'S ROUTE</li> </ul>	2017-2019	£8,000,000	Delivery of the five routes is either in progress or due to start by early 2018. The Hills Road/Addenbrooke's route is due to open in September 2017.	Cycle

		-FULBOURN/CHERRY HINTON EASTERN ACCESS				
2	Greenways A 'Greenway' will be an attractive route segregated from traffic or on quiet roads.	Waterbeach Greenway Horningssea Greenway Swaffham Greenway Bottisham Greenway Fulbourn Greenway Linton Greenway Sawston Greenway Melbourn Greenway Haslingfield Greenway Barton Greenway Comberton Greenway St Ives Greenway		£480,000	£480,000 of City Deal funding was awarded to the project which started in April 2017. This is allocated over two years to complete the public engagement and consultation phase of all 12 schemes.	Cycle
1	Cambourne to Cambridge better journeys schemes	Creating better public transport journeys along the A428 and the A1303 corridor, and improve the cycling and walking links. It will help connect communities with employment sites, the city and each other.	2024	£59,000,000	In October 2016, a recommended option was presented to the Executive Board, who agreed in principle, that a segregated route between Cambourne and Cambridge with a Park & Ride near the Madingley Mulch roundabout best meets the strategic objectives of the City Deal.	Public transport

1	A1307 corridor bus priority / A1307 additional Park & Ride	<p>The preferred options include:</p> <ul style="list-style-type: none"> <li>-bus lanes along the A1307 in Linton and between Babraham and Cambridge</li> <li>-bus-only road from Babraham Road Park &amp; Ride to the Cambridge Biomedical Campus</li> <li>-new Park &amp; Ride site near the A11</li> <li>-high-quality cycle routes</li> <li>-safe walking routes</li> <li>-road safety improvements between Horseheath and Linton</li> </ul>	2020	£39,000,000	<p>A range of options for the scheme were presented to the Greater Cambridge City Deal Executive Board and Joint Assembly in March 2017. These were developed following detailed technical work and the analysis of results gathered from a public consultation on initial concepts.</p> <p>The Executive Board approved further technical work to refine these options. Local Liaison Forum workshops and stakeholder engagement are taking place this summer, ahead of a full public consultation.</p>	Public transport
1	Histon Road bus priority	<ul style="list-style-type: none"> <li>-Quicker and more reliable bus journeys</li> <li>-Wider cycle lanes, segregated where possible</li> <li>-New public areas</li> <li>-Attractive public spaces</li> <li>-Improved road safety</li> </ul>	2022	£4,300,000	<p>In winter 2015/16 an initial consultation was carried out on bus priority and cycling and walking improvements on Histon Road. The project is scheduled for delivery after the Milton Road scheme, to avoid closing off two key neighboring arterial routes at the same time.</p>	Public transport
1	Milton Road bus priority	<ul style="list-style-type: none"> <li>-Quicker and more reliable bus journeys</li> <li>-Wider cycle lanes, segregated where possible</li> <li>-New public areas</li> <li>-Attractive public spaces</li> <li>-Improved road safety</li> </ul>	2021	£23,000,000	<p>Final concept approved for detailed design. Design workshops being conducted with community groups.</p>	Public transport

## Appendix H : Delivery Considerations

### H1 Future Investment Programme

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The Future Investment Strategy (outlined in Chapters 3 and 4) attempts to distinguish between measures that would be generating revenue and those that will have to be subsidised.

#### H1.1 Revenue generating

##### H1.1.1 Workplace Parking Levy

Access to workplace parking in the urban environment significantly contributes to congestion and emissions. A WPL does not directly create changes to traffic in the same way as Traffic Management measures might; instead it is identified as being a process through which revenue can be raised, the monies from which can be used to invest in the provision of alternative transport and the transport network. This can enable growth in housing and employment to take place, by increasing sustainable transport use and, therefore, increasing the capacity of the transport network.

The majority of the revenue received from the Nottingham WPL is provided by medium to large business; these are likely to have a significant presence on the transport network and a greater impact on congestion, particularly in peak periods. They are, however, often better placed to support change in travel habits by working with their staff to enable flexibility and ease a transition to increased use of sustainable transport. In Cambridge this is already taking place, with some of the larger businesses on the Cambridge Science Park trialling electrically assisted bikes for local business transport.

With the addition of Controlled Parking Schemes to restrict the ability of any displaced vehicles from using on-street parking, WPL can have an impact on congestion and encourage modal shift to more sustainable transport modes.

Evidence from Nottingham suggests that a WPL does not provide an immediate reduction in congestion, but one that it is likely to happen over time. To support this, it will be important to ensure that other modes of travel are improved. A bus network that is efficient is more likely to encourage modal shift than one that is regularly stuck in congestion alongside the rest of the traffic. Streets that have less traffic become more attractive areas for people to cycle and walk.

A WPL would require Secretary of State Approval for implementation to take place. To achieve this, we would need to demonstrate that we have consulted widely with the Business community and largely addressed their concerns. We would also need to demonstrate that transport measures we are providing support WPL; this would include improvements to public transport and cycling infrastructure in the areas affected by the levy.

Discussions with Nottingham have made it clear that engagement needs to be early and extensive. Their success in delivering a WPL was linked directly to the engagement they had carried out with the business community.

As part of the wider engagement ‘conversation’ with the business community in respect of their and their employees’ travel requirements, it is recommended that early engagement with the business community as part of the travel diary process should start in the autumn

### **H1.1.2 Pollution charging**

Poor air quality is detrimental to the environment and to public health, and is linked to asthma and breathing problems, with children being particularly susceptible to these conditions. The introduction of a pollution charge would effectively serve a dual purpose, firstly disincentivising the use of more polluting vehicles, and secondly providing a revenue stream through which the attractiveness of cleaner vehicles and choices can be increased.

The revenue generated through a pollution charge could feasibly be invested into any part of this package, and the potential contribution it could make to delivering the broader package would of course depend on the level of charge and what vehicles are covered by it.

### **H1.1.3 Congestion Charging**

City Access plans involve plans for a Workplace Parking Levy to provide a level of revenue generation that could support a package such as this. Whereas a Workplace Parking Levy would be primarily focused on revenue generation, intelligent charging would focus on demand management, but would also as a result raise revenue.

As with a pollution charge, congestion charging could also be kept under review to build in scheduled review points where the level of charge may be varied depending on the level of congestion. By linking the level of charge to the level of congestion it can be more effectively and intelligently targeted at resolving the key problem it is intended to resolve.

### **H1.1.4 Parking controls**

A comprehensive approach to on-street parking in Cambridge and the fringes of the city would make a strong contribution to maximising the efficiency and capacity of the overall transport network. This could include measures such as Controlled Parking Zones, residents’ permit schemes, limited waiting times and prohibition of parking at certain times. It should be noted that on-street parking is a responsibility of Cambridgeshire County Council, which it has delegated to its Highways & Community Infrastructure Committee and to the Cambridge Joint Area Committee.

Public finance rules stipulate that local authorities can only set a fee for parking charges “based solely on the need to manage parking; if that level generates a

surplus then it may be used for other purposes.”<sup>11</sup> Parking charges can, thus, be used as a part of the City Access programme to manage parking and ensure good flow of traffic. But, the programme cannot use parking charges to purposefully cross-subsidise other transport investments. That being said, the transport authorities will have the ability to set parking charges required to manage parking effectively and pay for park-and-ride services associated with the rapid mass transit solution.

## **H1.2 Revenue neutral**

### **H1.2.1 Travel Hubs**

The large number of cars coming in to the Cambridge area every day, and the expected growth in numbers, makes intercepting trips outside of the city extremely important to the overall package in ensuring that many more trips are shifted on to public transport as they approach areas of substantial congestion. The passenger transport network (including bus and rail) has the potential to intercept many more trips than it currently does. Improving opportunities for passengers to interchange conveniently between transport modes or services is a driver of change in travel behaviour.

Key to this is a series of large travel hubs/Park & Ride sites, with free parking and a ‘turn up and go’ frequency at least in the peak hours. These could also provide opportunities for locating ‘click & collect’ and similar services. The precise number and scale of these hubs needs to be determined by the needs of the specific corridor, but this would be likely to require a ring of sites with capacity for 2,000+ cars around Cambridge, complementing the existing network of Cambridge Park & Ride sites. These may be complemented where appropriate by smaller sites further out. Whilst much of the focus is likely to be on road corridors, there is also the potential for rail stations to provide a focus for interchanges and to act as travel hubs on certain corridors.

Linked to these large travel hubs/Park & Ride sites needs to be a series of rural hubs that, through the provision of service buses that might require an element of subsidy, complement and connect in to that network. Smaller rural interchange sites provide the potential for residents in the rural areas to connect quickly and easily to that network of ‘turn up and go’ frequency services at the large travel hubs/Park & Ride sites. These in turn effectively then form a network of hubs that collectively provide a very attractive public transport offering for local residents and for those travelling from further afield.

### **H1.2.2 Bus priority and segregation requires capital investment**

All major routes into the city need to have a high quality passenger transport option, with comprehensive bus priority required on the main routes used by buses within Cambridge and further out throughout South Cambridgeshire. This needs

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<sup>11</sup>

[http://www.racfoundation.org/assets/rac\\_foundation/content/downloadables/elliott%20-%20parking%20enforcement%20-%20main%20report%20-%2016082010.pdf](http://www.racfoundation.org/assets/rac_foundation/content/downloadables/elliott%20-%20parking%20enforcement%20-%20main%20report%20-%2016082010.pdf)

to be accompanied by a reduction in the level of general vehicular traffic in order to manage the knock on effects this could have on the wider transport network if not tackled.

With this comprehensive network of large travel hubs/Park & Ride sites and suitable levels of bus priority, it would be possible to introduce dedicated express services that provide an especially attractive alternative to driving for many commuters. It may prove desirable to subsidise the fares of these services to make them even more attractive and to ensure that the choice of bus for journeys is in effect locked in, with the benefits retained over the long term.

### **H1.2.3 Traffic signals**

To further enhance the priority given to buses, cyclists and pedestrians and therefore their speed and reliability, it would be beneficial to roll out state-of-the-art intelligent traffic signals around Cambridge and on key parts of South Cambridgeshire's road network. These signals allow sensors to recognise where there is a large number of buses for instance on the road, to understand what traffic conditions are on the road network more broadly, and to give a longer green phase for the bus and cycle traffic to allow more of that traffic through, allowing them to get ahead of the queues.

On its own rolling out intelligent signals would make a minimal contribution to enhancing the reliability and capacity of Greater Cambridge's road network, however as part of a wider package that includes clear priority measures and a large number of frequent bus services and cyclists, it has the potential to increase the benefits that can be realised through the delivery of that package. It could therefore play a significant role in making public transport or cycling a more attractive journey choice.

### **H1.2.4 Freight Consolidation Centres may be self-funded**

If done right, Freight Consolidation Centres have the potential to deliver benefits for local businesses by maximising retail space, reducing delivery costs and helping to meet corporate social responsibility targets. There should also be cost savings for the logistics industry more broadly in the context of rising fuel prices and the time lost in terms of road congestion. As the operation of Freight Consolidation Centres would require funding, it may be that there is the potential for them to become self-funding by capturing some of these cost savings (depending of course on specific details and more in-depth evaluation). If they are not able to become self-funding there would be likely to be some need for ongoing revenue support.

### **H1.2.5 Travel planning (soft intervention and low capital cost)**

Lack of information often presents a barrier to the uptake of sustainable travel, therefore improving sustainable travel awareness is very important to getting more people out of their cars. Travel planning, working with employers, schools and other organisations, has the potential to build on the benefits delivered through the rest of this package by more effectively pairing the sustainable travel options



available with the needs of individuals and organisations. This would help to highlight to people the real problems that are currently faced in the area and will be more so in future without significant change, and to highlight the other options that are available. This also has a large role to play in ensuring that people are able to adapt to the measures put in place, particularly to the disincentives.

## **H1.3 Subsidised**

### **H1.3.1 Orbital and rural bus services**

Whilst much of the bus network will by its nature need to focus on radial movements between these large travel hubs/Park & Ride sites, housing and employment centres, the network's effectiveness would be substantially increased by the inclusion of orbital services that serve hubs and key centres. These are not often provided by bus operators, partly due to the inconsistent provision of orbital roads that could take these services, and partly because they are not typically financially viable. They may also therefore require some ongoing subsidy.

### **H1.3.2 Ticket integration, fare discounts**

Part of ensuring that public transport is that attractive journey choice is the adoption of integrated ticketing, among bus operators and with the rail network. Integrating ticketing in this way is a more complex manner than it may appear, but as part of this package the potential to do so needs to be explored. Further benefit along these lines could be realised through discounting bus and rail tickets, again making those journeys more attractive compared to the private car than they currently are. This discounting could be targeted at certain groups if desired, for instance subsidising travel to work for apprentices, or adopted for passengers more broadly.

### **H1.3.3 Maintaining pedestrian and biking facilities**

An important part of ensuring that pedestrian and cycling facilities are, and remain, attractive parts of people's journeys is ongoing maintenance. In a range of situations maintenance of these facilities has suffered from Local Authorities' constrained financial situations and/or insufficient priority being given to that expenditure. Loading of Heavy Commercial Vehicles can also cause substantial damage. If the network is to be as successful as possible it needs to be kept in good condition, which means a need for ongoing revenue support.

## **H2 Further considerations**

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In order to realise the full potential of the transport investments and strategy already set into action by the GCP and local authorities, local government will require additional resources and capabilities. As the NIC works with Whitehall Departments, advocacy for the following three issues would help ensure that Cambridgeshire and its councils have the ability to deliver safe, effective and affordable transport for its citizens and businesses.

Summaries of key specific considerations for Dynamic road user charging schemes, Transport & Works Act Order (TWAO), and “yellow box enforcement” are outlined below.

## H2.1 Dynamic road user charging

Local road charging schemes can be introduced by local transport authorities to combat congestion and tackle poor air quality. However, use of these powers has been limited. The only congestion scheme in the UK is the one in London.

In England charges can be introduced by county councils; metropolitan district councils; Transport for London; a London borough council or the Common Council of the City of London; and Passenger Transport Executives (PTEs)/Integrated Transport Authorities (ITAs). Devolution arrangements in England mean that in practice the relevant authority in some areas would be an entity such as Transport for Greater Manchester.

There is separate legislation governing England, London, Wales and Scotland. For the GCP area, Part III and Schedule 12 of the Transport Act 2000, as amended by the Local Transport Act 2008, provide for the introduction of road charging. Charging schemes may only be made “if it appears desirable for the purpose of directly or indirectly facilitating the achievement of policies in the charging authority’s local transport plan”. Local Transport Plans (LTPs) contain the strategic transport priorities of the relevant charging authority.

The procedure is quite straightforward: the charging authority makes an Order for a scheme. There is no requirement to hold local referenda or to obtain approval from the Secretary of State or anyone else.

The charging authority may seek views from local people or representatives but this is at the authority’s discretion. In practice, as road charges are so controversial, most authorities would likely choose to consult their stakeholders.

An Order establishing a charging scheme must:

- Designate the relevant roads;
- The circumstances under which a charge will be imposed;
- The classes of motor vehicle(s) in respect of charges will be imposed; and
- State the duration of the charge.

A charging scheme may determine which charges are made and how they are collected, recorded and paid. The charges that may be imposed by a charging scheme can vary based on different:

- days;
- times of day;
- roads;
- distances travelled;
- classes of motor vehicles; and
- methods or means of recording, administering, collecting or paying the charge.

The final allowance in the list above may create the space for dynamic congestion charging under the right circumstances, and this will be explored further.<sup>12</sup>

## H2.2 Transport & Works Act Order (TWAO)

The most likely consenting mechanism for the AVRT system would be a Transport & Works Act Order (TWAO). This allows for the construction or operation of railways, tramways, trolley vehicle systems and other prescribed modes of guided transport.

The TWA does not limit who can apply for a TWAO – this can be private companies and public authorities. Typical TWAO applicants are passenger transport executives, LU, local authorities, private operators of heritage and leisure railways, and private companies wishing to develop guided transport schemes or works that interfere with navigation rights.

A key advantage of the TWAO process (as opposed to town planning measures) is that a TWAO wraps up a number of powers into one process, including:

- Powers to construct, alter, maintain and operate a transport system;
- Powers to carry out and use works that interfere with navigation rights;
- Compulsory powers to buy land;
- The right to use land (for example, for access or for a work site);
- Amendments to, or exclusion of, other legislation;
- The closure or alteration of roads and footpaths;
- Provision of temporary alternative routes;
- Safeguards for public service providers and others;
- Powers for making bylaws; and
- Planning permission for the development.<sup>13</sup>

TWAOs have been used on a number of other recent comparable schemes, for example:

- Cambridgeshire Guided Busway (2005)
- Manchester Metrolink Tram Trafford Park Extension (2016)
- Leeds Trolley Vehicle System (2016)
- Ashton Vale to Temple Meads and Bristol City Centre Rapid Transit (2013)
- Chester Guided Busway (2002)
- Greater Manchester: Leigh Guided Busway (2005)

According to the Transport and Works Act 1992, there may be room to file for a Transport Works Act (TWA) Order which allows for the provision of more than one scheme, system or mode of transport.

<sup>12</sup> House of Commons Library. Louise Butcher. 19 December 2016. “Local road charges.” Briefing Paper Number SN01171.

<sup>13</sup> <https://www.tfwm.org.uk/media/1354/mmd-20-3-transport-and-works-act-orders-a-brief-guide.pdf>

Under Section 5(2): “An order under section 1 or 3 above may make provision in relation to more than one scheme, system or mode of transport.”<sup>14</sup>

Section 1 allows the Secretary of State to make an order relating to the following kinds of transport:

- a) a railway;
- b) a tramway;
- c) a trolley vehicle system;
- d) a system using a mode of guided transport prescribed by order made under section 2.

Therefore, while there is no precedent for a TWAO which covers multiple modes, it may be possible to file a single order with multiple modes, schemes or systems as a single TWAO to the Secretary of State. Advocacy from the NIC which will ensure that the future technology used in any system adopted by GCP—be it AVRT or otherwise—is included within the powers of a TWA Order, would help future proof the investment and ensure that England’s cities are at the cutting edge of mobility and transport innovation.

## H2.3 Traffic enforcement

Traffic monitoring and enforcement is an essential tool for managing urban roads safely and keeping traffic moving. London’s ability to install speed and red light cameras has helped TfL target problem areas and prevent an estimated 500 deaths or serious injuries each year.<sup>15</sup>

The objective of “yellow box” enforcement is to share with the rest of the country the ability to enforce moving traffic offences that is enjoyed by London. The benefit would be to improve the utilisation of the local highway network and reduce unnecessary delays that significantly affect the reliability of local bus services. This is tried and tested in London and is effective and cost neutral.

Support from the NIC for local authorities’ ability to use this technology and such measures outside of London as well would help ensure the effectiveness and cost-efficiency of the future Cambridgeshire transport system.

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<sup>14</sup> <http://www.metroalliance.co.uk/wp-content/uploads/2017/05/BEE-B1-Transport-and-Works-Act-1992.pdf>

<sup>15</sup> <https://tfl.gov.uk/corporate/safety-and-security/road-safety/safety-enforcement-cameras>

## Appendix I: Northstowe: lessons in partnership working

At the request of the National Infrastructure Commission, this appendix briefly summarises our views on ways in it might be possible to optimise which relationships and ways of working between local partners and Government departments and agencies, with the objective of accelerating project delivery.

### Encouraging better communication and relationships between stakeholders

- Local authorities should be considered as legitimate partners able to deliver large scale development projects. Notably, through the establishment of local authority vehicles.
- Regular dialogue between local representatives and developers can attenuate tensions and facilitate planning and development processes by solving project-arising challenges and difficulties ahead.
- Government officers could also play a part in facilitating dialogue between local representatives and promoters and allowing local assembly members to engage directly with promoters.

### Ways of working

- Government should give as early warning as possible on changes related to local development strategy and policy objectives and to planning practice guidance modifications
- More transparency from government would be welcomed on motives for changing local development objectives and/or project timescales.
- A “phased approach” for several local development permissions should be adopted, rather than individual permissions.
- Local Strategy and Policy level documents should be detailed enough to avoid back and forth on details at the planning permission and development stage.
- More transparency on evidence and data underlying development economics studies, and viability appraisals in particular.

### Public consultation

- Consulting the local population can be very helpful in clarifying difficult questions policy makers face, and should be encouraged. However, this needs to be done efficiently as local population is likely to lose interest if masterplanning processes are too long.

### Examples of the governance structure successful in facilitating delivery in the Northstowe context

- Umbrella organization such as *Cambridgeshire Horizons* established in 2004 to facilitate infrastructure delivery. The structure acted as a clearing house among the constituent local authorities, and regularly brought people together for networking, sharing ideas, and assess schemes on design merits. The structure also helped foster an atmosphere of confidence and high aspiration among local representatives.
- Dedicated delivery group made of local representatives to maintain local requirements in front of other Government departments such as DfT.

- Group allowing local representatives to ask questions directly to developers and their contractors, and establishing a regular dialogue among all participants to allow potential problems to be identified and dealt with as soon as they arise.





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