MOTT MACDONALD

Outline Business Case - Cambridge South Rail Station

February 2021

Mott MacDonald
10 Fleet Place
London EC4M 7RB
United Kingdom

T +44 (0)20 7651 0300
mottmac.com

Strategic Case

Outline Business Case - Cambridge South Rail Station

February 2021

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
0.1	29th Jul 2020	O Haycock			Skeleton document prepared from SOBC
0.2	10th Aug 2020	V Robins	O Haycock		Policy context checked for changes/updates
0.3	30th Sept 2020	O Haycock			Option Sifting updates
0.4	15th Oct 2020	O Haycock	C Judge		Updates following internal review. Draft issued to DfT/NR.
0.5	15th Jan 2021	O Haycock	C Judge	C Judge	Update following receipt of Network Rail comments, and completion of the draft Economic Case
0.6	10th Feb 2021	O Haycock			Update following receipt of additional Network Rail comments
1.0	11th Feb 2021	O Haycock	C Judge	C Judge	Issued to DfT

1 Strategic Case

This paper sets out the Strategic Case at Outline Business Case (OBC) stage for a new rail station, Cambridge South, serving the internationally significant Cambridge Biomedical Campus and Southern Fringe development areas of Cambridge. This work builds on the Strategic Outline Business Case (SOBC) produced in 2017.

The SOBC set out the outline case for the new station, explaining how it would contribute to the long term success of the Cambridge South area advancing economic growth and contributing to local and national Government policy objectives.

Since the SOBC, significant work has been undertaken by Network Rail and other stakeholders to develop the project, in particular to understand the level of train service which can be provided, the interaction with the wider train service in the context of major enhancements such as East West Rail, and the practicalities of construction and station location.

This Strategic Case therefore sets out the need for the scheme and the 'case for change' in the context of three years further of more detailed study by Network Rail and by Mott MacDonald, and in the midst of the current COVID-19 pandemic.

As well as presenting the case for the new station, this paper also examines the case of other options to improve public transport access to and from Cambridge South, considering whether there are better ways than a new station to deliver the same objectives. Two or more of the options could ultimately be implemented as a package of measures to improve public transport access to and from Cambridge South, however that is not the focus of this OBC.

This Strategic Case references the other OBC cases, where these other cases provide quantitative evidence on how well the various options deliver the strategic objectives set out below.

1.1 Business Strategy

The Government intends to continue investing in transport infrastructure across the UK, in support of an industrial strategy for post-Brexit Britain which creates the right conditions for businesses to invest for the long term. Achieving economic growth and improved living standards are key objectives for Government.

The 2017 *Transport Investment Strategy* command paper[1], prepared by the Department for Transport (DfT), states that through investment the Department must seek to:

- Create a more reliable, less congested and better-connected transport network that works for the users who rely on it;
- Build a stronger, more balanced economy by enhancing productivity and responding to local growth priorities;
- Enhance our global competitiveness by making Britain a more attractive place to trade and invest; and
- Support the creation of new housing.

[1] Transport Investment Strategy.pdf (publishing.service.gov.uk)

On 25th November 2020 HM Treasury published the *Green Book Review 2020: Findings and response*[2]. This paper sets out requirements for some key changes to UK investment appraisal. At the heart of this is a greater emphasis on how schemes contribute to key national policies, in particular:

- Net Zero.
- Levelling Up.
- Equalities and Distributional Effects.

The review also requires a greater emphasis on Place Based Impacts to take explicit consideration of the effect of investment on the local area.

The 2020 *Decarbonising Transport* DfT Policy Paper[3] sets out the challenge of reducing transport emissions to achieve Government's Net Zero target. Key pillars of DfT's policy are:

- Accelerating modal shift to public and active transport; and
- Place-based solutions.

Promoting investment in transport infrastructure within the Cambridge Southern Fringe is aligned entirely with the Department's Transport Investment Strategy and Decarbonising Transport policy. Investment in this area responds to local growth priorities, will help to enhance the internationally significant Cambridge Biomedical Campus, and will support major residential development.

The Biomedical Campus is a unique development for the UK. Attracting and retaining skills and investment in this field will be critical to the UK's new industrial strategy. A reliable, well connected and effective transport network will be essential to the success of the Biomedical Campus. As a development of such national and strategic significance, the Department is taking the lead in promoting and developing a transport solution.

Providing a substantial enhancement in public transport accessibility between a wide catchment of the Biomedical Campus has the potential to make a positive contribution to the Levelling Up agenda and improve Equalities and Distributional Effects. This would be achieved by bringing this major employment site with a mixture of higher and lower skilled opportunities, into the range of the more deprived parts of the wider region, and also by opening up improved healthcare opportunities to a wider cohort of society.

Achieving a modal shift to public transport is also likely to improve the wider Cambridge South area as a place to live and work, helping to avoid problems of highway congestion and the associated impacts seen over the last few years.

At the time of writing the UK is in the third wave of the COVID-19 Pandemic, with a near UK-wide lockdown in place, home working commonplace and GB rail passenger numbers at around one third of the 2019 level. Nationally significant employment locations, not least those at the forefront on medicine and healthcare look sure to have a strategic role in the UK's economic recovery from the crisis. Given COVID-19 safe measures for passengers and/or post COVID-19 direct rail links to and from London, regional employee catchments and international gateways will be a catalyst for the future success of the site and the wider growth of the regional and UK economy.

[2] Green_Book_Review_final_report_241120v2.pdf (publishing.service.gov.uk)

[3] Decarbonising Transport: Setting the Challenge (publishing.service.gov.uk)

1.2 The Case for Change

1.2.1 Opportunities and Aspirations

Cambridge Biomedical Campus

Addenbrooke's Hospital to the south of Cambridge is a major employment centre and a renowned teaching hospital linked to Cambridge University. Surrounding the hospital is the emerging Cambridge Biomedical Campus. At present approximately 20,000 people are employed on the hospital and biomedical campus, with this figure expected to rise by an additional 1,000 staff by 2021[4], with 27,000 jobs by 2031. Royal Papworth Hospital has relocated to the Biomedical Campus, with a new 310-bed specialist cardiac facility.

The Cambridge Biomedical Campus is soon expected to house the largest concentration of biomedical expertise in Europe, including an international conference centre and high capacity hotel. Strong employment growth is anticipated to continue as the campus develops. Based on the current employment growth trajectory, the number employed could reach almost 27,000 by the early 2030s.

Transport connectivity is key to enabling this growth and the economic potential of the site, but at present is limited by significant highway and motorway congestion, and a lack of direct longer distance public transport.

Given the nature of the biomedical industry, excellent transport provision will be required so that the highly skilled workforce and visitors are able to travel to the campus.

Improving access from areas where accommodation costs are lower than in the city of Cambridge will open high-skilled training and employment opportunities to people who may not otherwise find equivalent prospects elsewhere.

Life Sciences Industrial Strategy[5]

Cambridge Biomedical Campus is expected to become an integral part of the UK life sciences industry. The industry is a key economic sector for the UK, generating £74 billion turnover and employing almost a quarter of a million people. The health life sciences industry also achieves high productivity compared to many other industrial sectors.

The UK Life Sciences Industrial Strategy aims to put the UK in a world-leading position to take advantage of the health technology trends of the next 20 years. The strategy includes efforts to maintain scientific strength and international competitiveness, encourage growth of companies in the sector, support industry collaboration with the NHS, make the best use of data and digital tools, and to ensure the sector has a strong supply of skilled people.

The UK has an internationally recognised life sciences cluster known as the Golden Triangle, which comprises Oxford, Cambridge and London and the area between. It houses four of the world's top twenty universities (three in the top ten), four top ten medical sciences faculties in the world and some of the world's largest research institutes. Many international pharmaceutical companies wish to be located close to the most successful universities for biomedicine. For example, AstraZeneca is currently in the final stages of constructing a new global research and development centre in Cambridge, at which they expect to employ 2000 staff. The Golden Triangle cluster also contains substantial science infrastructure and a large number of small and medium-sized life sciences companies. Cambridge alone has over 200 biotech companies and the largest array of science infrastructure in the cluster.

[4] Estimate provided by Addenbrooke's Hospital, October 2017.

[5] Life Sciences Industrial Strategy – A report to the Government from the life sciences sector, Professor John Bell, August 2017

Core recommendations of the Life Sciences Industrial Strategy point to the need for government and industry to work together to ensure the right infrastructure is in place to support life science cluster and network growth. This includes transport into and across clusters. Several Initiatives have since been established to increase funding for life sciences companies, as well as an additional £4bn spent on R&D since 2017 to invest in infrastructure to achieve the goals of the Life Sciences Industrial Strategy.

Attracting a highly skilled workforce

A successful biomedical science base in UK will require highly skilled workers. Potential disruption associated with Brexit could lead to some loss of talent from the sector. Therefore 'creating an opportunity to bring very high-level talent into the country over the next five years is important'[6].

Growth of the Cambridge Biomedical Campus will help to attract a highly skilled workforce. Accompanying investment in transport infrastructure will be required to provide national and international connectivity for businesses and their employees.

Area of Major Change

The Cambridge Local Plan[7] identifies the Southern Fringe as an 'area of major change' in which extensive development is to take place over the 2011-2031 plan period. The vision for the Southern Fringe is 'to create attractive, well-integrated, accessible and sustainable new neighbourhoods for Cambridge.' The Southern Fringe development comprises approximately 3,300 new homes (plus additional housing in adjacent sites and sites outside the City boundary in South Cambridgeshire) during the plan period.

The Southern Fringe development will be integrated with the adjacent Cambridge Biomedical Campus, which by the mid-2020s could be home to more than 15% of all employment within the Cambridge City boundary[8]. As noted above, unlocking longer distance access to this site will enable this growth and help to maximise the economic potential of the activity there.

East West Rail

East West Rail is a major rail infrastructure project with preparatory work well underway for both the committed and proposed route sections. It is expected to connect Oxford, Milton Keynes, Bedford, Cambridge and further into East Anglia. East West Rail is being planned in three stages. Stage 3 of the East West Rail (EWR) project would increase the train service quantum through Cambridge South. At the time of writing, funding has only been announced for Stage 1 of this scheme, the section between Oxford and Bletchley/Milton Keynes. If completed, this scheme will provide an opportunity for people to access direct rail services from Cambridge to destinations across the Golden Triangle.

Thameslink Programme

Fundamental changes to timetables along the West Anglia Main Line were completed in 2018 connecting Cambridge into the Thameslink network. New services allow the potential for direct access between Cambridge and London Gatwick airport, as well as a range of other destinations, via central London, including a direct link to London St Pancras International allowing for easier access to the Eurostar.

---

[6] *Ibid.*

[7] Cambridge Local Plan, October 2018

[8] Nomis official labour market statistics estimate that in 2016 there were 101,000 employee jobs within the Cambridge City area.

1.2.2 Problems Identified

The scale and type of growth taking place within the Southern Fringe and Cambridge Biomedical Campus necessitates excellent transport infrastructure. A range of existing and future transport problems have been identified and are summarised in this sub-section:

- Lack of Long-Distance Public Transport Opportunities to the Cambridge Biomedical Campus and the Southern Fringe;
- Indirect public transport connectivity to international gateways;
- Indirect public transport accessibility, with a dependence on public transport infrastructure within Cambridge city centre;
- Highway congestion and associated environmental concerns; and
- Parking availability.

Indirect Connectivity to International Gateways

International connectivity will be important to the success of the Cambridge Biomedical Campus, as it is intended to attract a highly skilled workforce from around the world. Even with new Thameslink rail services, public transport access to major airports will be limited and journey times increased by the need to travel via Cambridge station, as summarised in **Table 1**.

Table 1: Public transport access to major international gateways in 2022

Gateway	Public transport journey	Number of interchanges	Generalised Journey Time (minutes)[9]
London Heathrow	Cambridge Busway Addenbrooke's Hospital to Cambridge station. *Interchange*. Thameslink rail service Cambridge to Farringdon. *Interchange.* Elizabeth line (Crossrail) service to Heathrow once open.	2	245
London Stansted	Cambridge Busway Addenbrooke's Hospital to Cambridge station. *Interchange*. Rail Cambridge to Stansted Airport.	1	150
London Gatwick	Cambridge Busway from Addenbrooke's Hospital to Cambridge station. *Interchange*. Thameslink rail service Cambridge to Gatwick Airport.	1	280

Source: Mott MacDonald

Indirect Public Transport Accessibility

The majority of public transport trips with an origin or destination in the Southern Fringe or Cambridge Biomedical Campus will need to travel via Cambridge city centre. Furthermore, all rail trips will need to route via Cambridge station. Given the scale of development proposed over the next 10-15 years this arrangement would be likely to place considerable pressure on Cambridge station, leading to significant overcrowding issues exacerbating problems seen prior to the COVID-19 pandemic.

An indirect public transport journey which requires an interchange between modes (rail / bus) is also likely to discourage greater use of public transport among those who would otherwise choose to travel by private car. For example, the research summarised in the Passenger Demand Forecasting Handbook (PDFH6) suggests that passengers perceive the inconvenience

[9] Generalised Journey Time represents journey time, frequency of service and interchange in a single term and is expressed entirely in equivalent minutes of journey time

of an interchange to be the equivalent of up to 25 minutes for the types of journeys relevant here.

Highway Congestion and Environmental Concerns

The rural nature of Cambridgeshire means that commuting journeys are currently dominated by private car use (estimated at 42.2% in the 2011 census). Only 2.5% of working age residents currently commute by train. As a result, highway congestion is a significant problem for Cambridge.

Congestion on all radial routes into Cambridge during the morning peak period and in both directions during evening peak periods. Routes in the Southern Fringe area that are particularly affected are:

- A1134 Hauxton Road / High Street from M11 Junction 11.
- A1307 Babraham Road

Peak period congestion on all main roads within the Cambridge City boundary.

Congestion on trunk and primary routes towards Cambridge in the morning peak period, and away from Cambridge in the evening peak period, affecting the A10 from Ely, A14 from Huntingdon, and the A428 / A1303 route from St Neots in particular.

Evening peak period congestion on Addenbrooke's Road and on other local routes surrounding the Biomedical Campus, including Shelford Road and Long Road.

The congestion issues that already exist around the Biomedical Campus are concerning, as this will almost certainly be exacerbated by continued employment growth. The sustainable transport offer will need to be increased considerably in order to mitigate this issue.

As well as causing delays to transport users, highway congestion across Cambridge will continue to lead to local air quality concerns. In 2005 Cambridge City Council declared an Air Quality Management Area (AQMA) covering the entire city centre. The southern boundary to the AQMA is approximately 1 mile north of the Biomedical Campus. Any large increase in traffic flow associated with the Biomedical Campus would therefore have the potential to affect emissions levels within the AQMA.

Parking Availability

In recognition of the congestion and environmental issues associated with high levels of private car use, parking availability at the Cambridge Biomedical Campus is currently constrained and will continue to be constrained as the area develops. However, in order for parking constraints to deliver the desired outcome of reduced car use without affecting overall development viability, alternative sustainable forms of transport must be available and need to be attractive to use. This is consistent with local planning policy[10].

Rail Infrastructure Renewals

Some of the rail infrastructure in the Cambridge South area is nearing the end of its normal life, and will require renewal within the next 10 years. This is likely to include elements of the signalling system, and the track and points at Shepreth Junction. A rail infrastructure enhancement, such as a new station at Cambridge South and the associated track and signalling work, would be likely to enable the renewal activity at the same time as the enhancement. This would result in potential cost efficiencies, and limit disruption to passengers. The interface with other planned projects is discussed below.

[10] Cambridge Local Plan - Policy 82, "Parking Management"

1.2.3 Impact of Not Changing

Taking into account the current opportunities, aspirations, and issues and without further significant investment in public transport infrastructure within the Southern Fringe and Cambridge Biomedical Campus, the following impacts are likely:

- Increased pressure on an already constrained Cambridge station, as all rail tips associated with the Southern Fringe and Biomedical Campus route through the main city centre station.
- Increased levels of highway congestion on radial routes, and local routes throughout the Southern Fringe, and for longer periods of the day. Increased congestion may reduce the attractiveness and viability of later development phases.
- Accessibility problems for employees based at the Biomedical Campus, due to highway congestion, constrained parking availability, and indirect public transport journeys.
- Increased emissions and reduced air quality within the Cambridge AQMA.

Together these problems have the potential to affect the ability for businesses at the Biomedical Campus to retain their highly skilled and globally mobile employees, and ultimately the success of the entire Biomedical Campus.

Supporting the workforce with good connectivity between key employment and residential sites will continue to be important for Cambridge's current and future economic competitiveness on an international scale. This is likely to increase in importance as competitor cities around the world enhance their transport networks and may become more favoured as places to live by talented workers and places to invest by global and high-tech businesses. For example, the BioValley life sciences cluster in the North Rhine valley is accessible from a number of desirable locations across France, Germany and Switzerland, and has excellent international transport connections. Similarly, the Medicon Valley life sciences cluster in Scandinavia has a residential catchment including the picturesque Copenhagen area in Denmark and southern Sweden, as well as regular and convenient transport to elsewhere in Europe and beyond.

1.3 Policy Context

Any investment in transport infrastructure at the Southern Fringe and Cambridge Biomedical Campus needs to align with national, regional, and local policy and strategy. Alignment with national (Department for Transport) objectives is outlined in Section 1.1. Key relevant points identified in regional and local policy and strategy documents are set out in this sub-section.

Greater Cambridge Greater Peterborough Enterprise Partnership Strategic Economic Plan (SEP)

The SEP, which was revised in 2016, seeks to generate a £2.8bn per annum uplift in GVA, by delivering 70,000 new jobs and 50,000 new dwellings. The Cambridge Biomedical Campus and the Cambridge Southern Fringe development will contribute to achieving these targets. These developments require sustainable access, although it is acknowledged that the road network already experiences significant peak period congestion.

Without targeted investment in sustainable transport measures, the economic growth benefits of the Southern Fringe and Biomedical Campus are unlikely to be realised. The SEP therefore proposed further consideration of a new station to serve Addenbrooke's Hospital and the Biomedical Campus, as part of East West Rail.

Greater Cambridge City Deal (GCCD)

The City Deal emerged from the SEP process and is a deal with Government that will enable a new wave of innovation-led growth by investing in infrastructure, housing and skills, thereby addressing housing shortages and high congestion levels. By investing in infrastructure, the City

Deal will ensure that Greater Cambridge can deliver the current growth identified in the Local Plans and that the conditions are in place to deliver post-2031 growth. The growth strategy will require a transport network that addresses congestion and public transport capacity issues, to help stimulate further economic growth.

The four strategic objectives of the GCCD are to:

- **Create and retain investment** to nurture the conditions necessary to enable the potential of Greater Cambridge to create and retain the international high-tech businesses of the future.
- **Target business investment supporting the Cambridge Cluster** to the needs of the Greater Cambridge economy by ensuring those decisions are informed by the needs of businesses and other key stakeholders such as the universities.
- **Improve connectivity and networks** between clusters and labour markets so that the right conditions are in place to drive further growth.
- **Attract and retain skills** by investing in transport and housing whilst maintaining a good quality of life, in turn allowing a long-term increase in jobs emerging from the internationally competitive clusters and more university spinouts.

Cambridge Local Plan

The Cambridge Local Plan[11] (2018) sets out the way in which the development needs of Cambridge will be met during the 2011 to 2031 period. Compared to the previous growth strategy, greater emphasis is placed on mitigating transport impacts. Policy 5 (strategic transport infrastructure) states that Cambridge City Council will support a range of sustainable transport interventions. In particular, by promoting sustainable transport and access for all to and from major employers, education and research clusters, hospitals, schools and colleges.

Investment in sustainable transport infrastructure within the Cambridge Southern Fringe can contribute towards the following Local Plan strategic objectives:

New development will contribute to the vision of Cambridge as an environmentally sustainable city, where it is easy for people to make a transition to a low carbon lifestyle… (strategic objective 1).

New development will promote and support economic growth in environmentally sustainable locations, facilitating innovation and supporting Cambridge's role as a world leader in higher education, research, and knowledge-based industries… (strategic objective 10).

New development will be located to help minimise the distance people need to travel, and be designed to make it easy for everyone to move around the city and access jobs and services by sustainable modes of transport (strategic objective 13).

South Cambridgeshire Local Development Plan

The South Cambridgeshire Local Plan[12], which covers the area immediately to the south of the Cambridge Biomedical Campus as well as part of the Southern Fringe development area, contains six key objectives. Investment in sustainable transport infrastructure to serve the Southern Fringe and Biomedical Campus can contribute to two of these:

To support economic growth by supporting South Cambridgeshire's position as a world leader in research and technology-based industries, research, and education; and supporting the rural economy.

[11] south-cambridgeshire-adopted-local-plan-270918_sml.pdf (scambs.gov.uk)

[12] south-cambridgeshire-adopted-local-plan-270918_sml.pdf (scambs.gov.uk)

To maximise potential for journeys to be undertaken by sustainable modes of transport including walking, cycling, bus and train.

Cambridgeshire Local Transport Plan (LTP) 2011-2031

Investment in sustainable transport infrastructure in the Southern Fringe area aligns well with the current LTP, which sets out challenges associated with tackling road congestion in Cambridgeshire and the resultant socio-economic and climate change problems. These challenges include:

Reducing the length of commute and the need to travel by private car.

Making sustainable modes of transport a viable and attractive alternative to the private car.

More specifically, the LTP identified the need for a new rail station at Cambridge South.

Transport Strategy for Cambridge and South Cambridgeshire (TSCSC), 2014

The TSCSC identified a longer-term opportunity for a new rail station at Cambridge South. This is part of an overall strategy that aims to 'strengthen the employment hubs and high-tech clusters in Cambridge and South Cambridgeshire, and in the surrounding towns, by making movement between them straightforward and convenient'. The strategy also seeks to reduce reliance on the private car.

1.4 Objectives

1.4.1 Scheme Objectives

A set of scheme objectives has been established to both deliver the key Government policies and key opportunities and aspirations set out in sections 1.1-1.3 as well as to address the problems set out in these sections. These objectives have been used as a guide option assessment for a significant investment in sustainable transport infrastructure within the Cambridge Southern Fringe. They are also aligned to national, regional and local policy and strategy.

The scheme will need to:

- Improve sustainable transport access to housing, services, and employment within the Cambridge Southern Fringe and Biomedical Campus area, to fulfil existing and future demands.
- Contribute to minimising highway congestion associated with the Southern Fringe and Cambridge Biomedical Campus by increasing the mode share for sustainable transport modes.
- Reduce reliance on Cambridge city centre transport infrastructure for serving the Southern Fringe and Biomedical Campus.
- Be capable of integrating with and enhancing the opportunities presented by Thameslink and East West Rail, to support development of the Biomedical Campus as part of the Golden Triangle life sciences cluster.
- Increase public transport connectivity between the Cambridge Biomedical Campus and international gateways, in recognition of its international significance.

1.4.2 Measures for Success

For each objective at least one indicator is proposed to allow the success of the scheme that is delivered to be measured over time, as shown in Table 2. The first three and final indicators in the table can be measured by desk-based analysis, while the mode share and routeing indicators will require employee survey data to be collected.

Table 2: Proposed success indicators

Proposed indicator	Relating to objective
Change in the average total end to end (generalised) journey time and cost for public transport trips to the Biomedical Campus. *This is a new indicator added at the OBC stage as it is a strong measure of sustainable transport access*	1 – sustainable transport access
Total population within a specific public transport journey time band (to be defined) from the centre of the Southern Fringe development and the centre of the Biomedical Campus (with and without the scheme)	1 – sustainable transport access
Total capacity of all public transport services arriving into the Southern Fringe and Biomedical Campus area during the AM peak hour (with and without the scheme)	1 – sustainable transport access
Journey to work % mode shares for Biomedical Campus employees (before and after scheme implementation)	2 – minimise highway congestion
Estimated % of Biomedical Campus journeys to work by public transport that travel via Cambridge city centre during the AM peak period, including Cambridge station (before and after scheme implementation)	3 – reduce reliance on Cambridge city centre transport infrastructure
Time taken (minutes) to access Thameslink and East West Rail service (if delivered) from the centre of the Southern Fringe development area and the centre of the Biomedical Campus.	4 – integrating and enhancing Thameslink and East West Rail opportunities
End to end public transport journey times between the centre of the Biomedical Campus and London Heathrow, Gatwick, and Stansted airports (with and without the scheme)	5 – connectivity to international gateways

Source: Mott MacDonald

1.5 Option Assessment

1.5.1 Potential Options

A list of four public transport options has been considered for meeting the objectives set out in Section 1.4.1. This was developed by considering the potentially feasible ways to meet these objectives. These options are as follows:

New Cambridge South rail station and associated rail line improvements: Located on the West Anglia Main Line, between the Southern Fringe development area and the Cambridge Biomedical Campus. This option will improve transport accessibility, in particular to and from the sizeable medium-longer distance catchments on the existing rail network, as well as to and from international gateways.

New longer distance direct bus or coach services: Operating between the Biomedical Campus and other urban centres within the Cambridge travel to work area, such as Bury St Edmunds, Ely, Huntingdon, and St Neots. This is the closest substitute to the new station option, albeit with a smaller geographical cover due to probable slower journey times than by rail, and with a likely lower overall capital cost.

Busway service enhancement: Increased service frequency and capacity on Cambridge Busway routes that serve Addenbrooke's Hospital, the Biomedical Campus and the busway towards Trumpington Park and Ride. This option will improve transport accessibility, mainly within the Cambridge area.

Expanded Park and Ride sites: Larger car parks and increased bus service capacities at Trumpington and Babraham, with Babraham services operating a loop around the Biomedical Campus. Since the SOBC, increased Park and Ride capacity at Babraham serving the Campus and Cambridge City Centre is now planned to be delivered as part of the Cambridge South East Transport (CSET) project promoted by the Greater Cambridge Partnership. This option will improve accessibility to and from areas where the highway network generally operates effectively.

The four options have been scored against the scheme objectives, along with additional viability and acceptability criteria, and have been allocated an overall risk rating in Section 0. It may be that more than one of these options could be implemented as a package of measures to meet the scheme objectives.

Option Assessment

Each of the options has been scored against the scheme objectives described above using a seven-point scale – large, moderate, slight beneficial / adverse, or neutral. The options have also been awarded a red, amber or green rating for deliverability, financial affordability, and stakeholder acceptability risks. This sifting method follows the principles set out in Step 6 of the WebTAG transport appraisal process.

Option scores are shown in Table 3. Further information on stakeholder opinion, which has informed the stakeholder acceptability rating, is provided in Section 1.6.1.

Table 3: Option Scoring

	Option			
Objective	**Busway service enhancement**	**New longer distance direct bus or coach services**	**New Cambridge South rail station**	**Expanded Park and Ride sites**
1 – sustainable transport access	Moderate beneficial	Moderate beneficial	Large beneficial	Slight beneficial
2 – minimise highway congestion	Slight beneficial	Slight beneficial	Moderate beneficial	Slight adverse
3 – reduce reliance on Cambridge city centre transport infrastructure	Neutral	Moderate beneficial	Large beneficial	Slight beneficial
4 – integrating and enhancing Thameslink and East West Rail opportunities	Neutral	Neutral	Large beneficial	Neutral
5 – connectivity to international gateways	Slight beneficial	Moderate beneficial	Large beneficial	Neutral
Deliverability (risk level)	Low	Low	Medium	Medium
Financial affordability (risk level)	Low	Medium	Medium	Low
Stakeholder acceptability (risk level)	Medium	Medium	Low	Medium

Source: Mott MacDonald

1.5.1.1 Travel Time Savings and Benefits to Passengers

When assessing the economic benefits of a transport intervention to passengers, the monetised value of time saved is the key metric. Our option sifting has identified that a new Cambridge South rail station stands to deliver the highest passenger benefit, due to the superior point-to-point journey times that can be delivered by rail, compared to other modes. The journey time advantages also enable rail to cover a wider catchment area, delivering benefit to a larger demand base than could be offered by bus or direct coach alternative.

We have undertaken a demand scoping exercise to identify both the current and future origins of demand for travel to the Biomedical Campus. An appreciation for the true origin and destination of passengers is intrinsic to the understanding of how best to meet the needs of the

travelling public, promote demand growth and influence behavioural change. A key aspiration (and improvement over the SOBC) was the inclusion of primary travel data for organisations at the site. It was envisaged that some primary data would have been made available to support OBC, but unfortunately this has not been possible.

In the absence of new primary data, we have utilised data from the Cambridge Sub-Regional Model (CSRM), a strategic model maintained by Cambridgeshire County Council and Greater Cambridge Partnership, used to inform both local and regional transport policy and planning decisions.

The 2015 demand matrix from the CSRM indicates that the Biomedical Campus has a wide-reaching catchment area, covering the majority of East Anglia. The 2026 scenario from the CSRM, which contains known changes in housing, jobs and planned transport schemes, indicates that key growth areas for travel to the campus are:

- Central London
- Outer London
- Ely
- Stevenage
- Letchworth Garden City
- Bishop Stortford
- Gatwick, Heathrow & Stansted Airports.

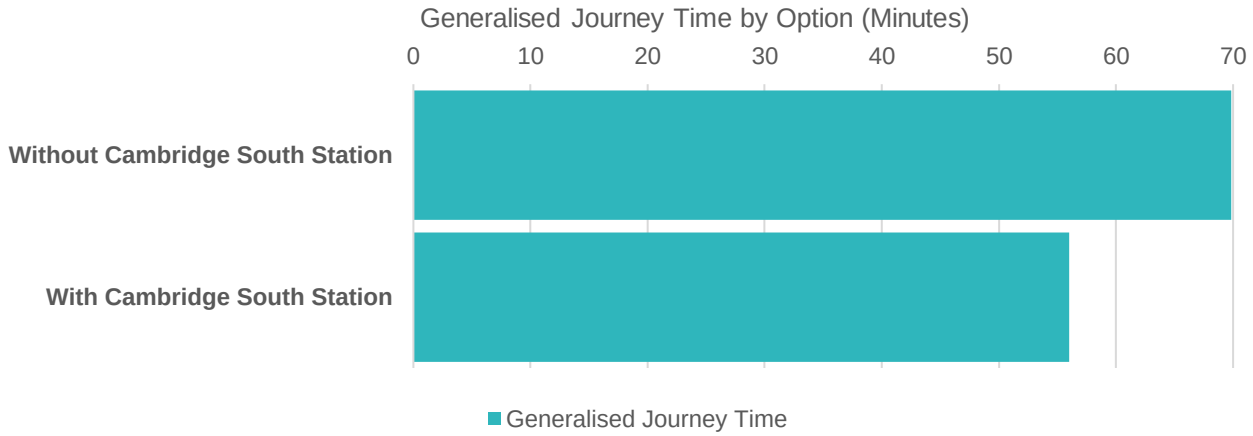
The growth areas identified are of a distance from the Biomedical Campus where bus or coach services are unlikely to deliver journey time benefits comparable to rail.

Figure 1 illustrates the potential saving in generalised journey time for an average trip to the Biomedical Campus, both with and without the new station. It can be seen that for the average rail journey, a new station could reduce the generalised journey time by approximately 20%, with this significant saving delivered to a large catchment of both current and potential travellers. The SOBC indicated that 1.8m passengers per annum could be attracted to Cambridge South Station.

By comparison, enhancing bus services that serve the campus (probably via an increase in frequency or routes) is unlikely to deliver significant journey time advantages, due to the constraints of the current highway network. In addition, local bus catchment areas are significantly smaller than rail, due to the slower average speed of bus transit. At present, it is estimated that approximately 600,000 bus journeys are made to and from the campus[13]. Using average journey times from the CSRM model, doubling bus frequency could reduce bus GJT by 15%, increasing demand by 158,000 passengers per year. This is compared to an increase in circa 1.0m journeys per year to and from the campus by rail, with the construction of a new station.

[13] Daily CSRM Model Refence Case for travel to Zone 147, scaled via annualization factor

Figure 1 - Average generalised journey time by rail for a trip to the CBC, with and without a new station at Cambridge South.



Similarly, whilst direct coach/bus services could offer journey time advantages over conventional buses, the same highway constraints exist, limiting the journey time savings that could be realised.

1.5.1.2 Sustainable Transport Access & Highway Congestion

The Cambridge Local Plan (2018) places a significant emphasis on mitigating transport impacts of housing and employment growth. It states that Cambridge City Council will support a range of sustainable transport interventions, by promoting sustainable transport and access for all to and from major employers, education and research clusters, hospitals, schools and colleges.

Our option sifting has identified that a new Cambridge South rail station would be the best scheme for providing sustainable transport access. Rail passenger count data published by the Department for Transport for 2019[14] indicate that for trains arriving into Cambridge Station during the AM Peak period (07:00 - 09:59), 54% of seated capacity is unused. For the AM Peak hour (08:00-08:59), 36% of seated capacity is unused. With a proportion of these services passing the Biomedical Campus, a new station at Cambridge South provides the opportunity for new passengers to utilise existing capacity on the network, thereby improving the commercial viability of existing services. In addition, utilising existing capacity removes the need to provide additional services, thus not impacting on rail network congestion. Whilst some passengers accessing Cambridge South, this option would also abstract travellers from private cars, with the potential of reducing road congestion and vehicle emissions.

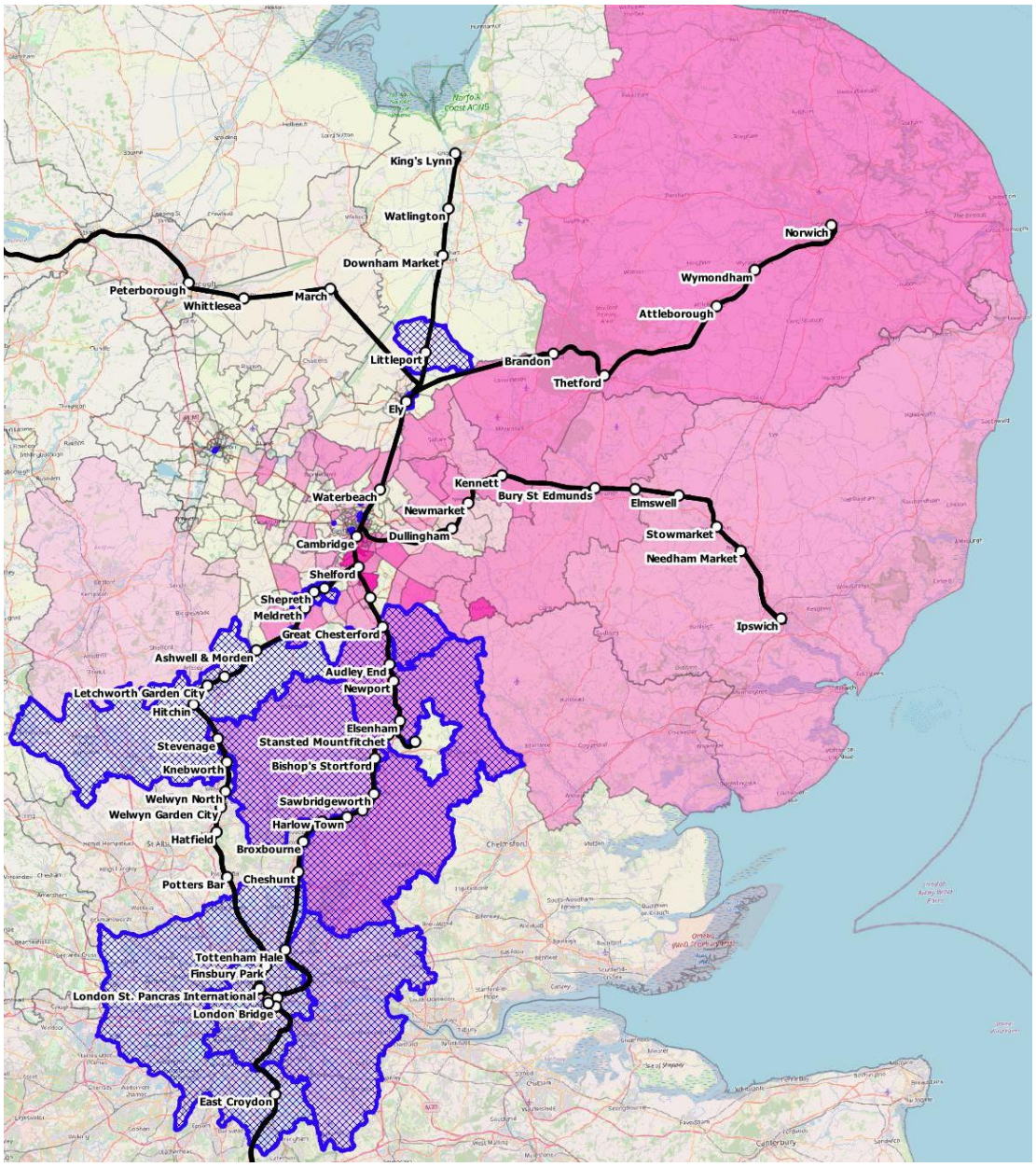
Both busway enhancements and longer distance bus/coach services would offer a degree of sustainable transport access, due to the potential for travellers to transfer from private cars, reducing road congestion and vehicle emissions. However, this would require the provision of additional services and capacity, unlike rail where the capacity is already present. Local busway enhancements could arguably better serve communities closer to the Biomedical Campus than rail, due to the comparably lower infrastructure requirements for new busways. However, this is only beneficial if there is a sufficiently large local demand base for travel to the Biomedical Campus.

Analysis has been undertaken to understand the origins of current passengers and likely future growth areas. Figure 2 illustrates the origin of demand for travel to the Cambridge Biomedical Campus, with the depth of the purple shading corresponding to a higher number of origins. This data is taken from the Cambridge Sub-Regional Model (CSRM), for a base year of 2015. This

[14] Department for Transport - Rail passenger numbers and crowding on weekdays (RAI02), Table RAI202

was one of the input sources used to inform the Strategic Outline Business Case previously undertaken for this scheme. Even in the absence of a rail station, the Biomedical Campus has a wide-reaching catchment area, covering the majority of East Anglia.

Figure 2 - Origins of 2015 Demand to the Cambridge Biomedical Campus (Purple) and Potential Future Growth Areas



Source: Mott MacDonald / CSRM Model

Also shown on the map are areas identified either from the SOBC or from the CSRM model future scenarios, that are likely to generate significant increases in trips to the Biomedical Campus (blue shading). Except for Ely, the major growth areas are forecast to be concentrated in South Cambridgeshire, Hertfordshire and Greater London.

The current wide-reaching catchment and distance of the identified growth areas from the Biomedical Campus will be more difficult to serve through bus/coach enhancements due to the

complexity of the network required, as well as the comparably lengthy journey times compared to rail.

In the absence of a rail station at Cambridge South, it is likely that future growth in these areas identified would see a proportional increase in private car access to the campus. Expanding Park and Ride sites could therefore reduce traffic on the Campus, but vehicular access to the Park and Ride sites would still contribute to increased levels of highway congestion at points on the network.

1.5.1.3 City Centre Reliance

A new rail station at Cambridge South will reduce city centre reliance, as passengers travelling by rail no longer need to interchange at Cambridge Station.

As the benefits of enhanced bus options would be of limited reach from the campus, passengers from further afield would still be reliant on the city centre, therefore offering no change. Direct bus/coach services may be able to serve catchments slightly further away but are unlikely to offer a competitive service at more significant distances, thus only marginally benefitting city centre reliance.

1.5.1.4 Integration with Other Schemes

A station at Cambridge South allows integration with other schemes, such as East West Rail and the recent Thameslink upgrades. In addition to this, it would also offer a direct service to Liverpool Street for connections to the Elizabeth Line.

Network Rail's Cambridge Re-Signalling project (C3R)[15], scheduled for completion by 2024, will see a state-of-the-art renewal of the signalling equipment in the Cambridge area. This will therefore provide an opportunity to deliver elements the Cambridge South project at the same time, resulting in likely cost efficiencies and reducing the need to take separate sets of potentially disruptive track possessions.

The Cambridge South East Transport (CSET) project[16], under the sponsorship of the Greater Cambridge Partnership, will improve the transport corridors between the Cambridge south area and each of Haverhill and Babraham. These schemes are likely to compliment other improvements in public transport provision to the site.

1.5.1.5 International Connectivity

The UK Life Sciences Industrial Strategy highlights the importance of international competitiveness to put the UK in a world-leading position to take advantage of the health technology trends of the next 20 years. International connectivity will therefore be important to the success of the Cambridge Biomedical Campus, as it is intended to attract a highly skilled workforce and visiting professionals from around the world. Minimising the travel time to international gateways, such as London Heathrow, Gatwick, and Stansted Airports should therefore be closely considered.

Our option sifting has identified that a new Cambridge South rail station would be the best scheme for reducing travel times to international gateways. With existing rail services to Stansted Airport already operating on the track passing the Biomedical Campus, the new station creates the opportunity for a direct rail link between Cambridge South and Stansted Airport via existing services. The same is true of Thameslink services, which could provide direct rail access to Gatwick Airport. For Heathrow, Cambridge South Station could offer direct rail

[15] Cambridge resignalling - Network Rail
[16] Cambridge South East Transport

services to London, with onward connections to Heathrow via the Elizabeth Line from Liverpool Street or Farringdon, or Piccadilly Line from Kings Cross.

By comparison, whilst busway enhancements may increase local bus frequency and the possibility of bus journey time reductions, travelling to/from international gateways will still require passengers to travel via Cambridge city centre to interchange at Cambridge Station. The Passenger Demand Forecasting Handbook[17] identifies passengers travelling to/from airports as the most time sensitive user class, with their sensitivity to changes in generalised journey time up to 35% higher than other passengers. Therefore, the necessity to interchange (due to the associated impact on generalised journey time) can be a significant detractor for using public transport for airport access and may ultimately deter passengers from travelling at all.

Longer distance direct bus or coach services performed better than busway enhancements in our assessment, as it may be possible to provide frequency and journey times comparable to rail for travel to and from Stanstead Airport. However, due to the distance and potential for highway congestion in and around London, bus or coach connectivity to Heathrow and Gatwick Airports is unlikely to offer journey times or frequencies comparable to rail.

Expanding Park & Ride sites is unlikely to have an impact on international connectivity, as this method of access/egress is unlikely to be utilised by passengers travelling to/from international gateways.

1.5.2 Preferred Option

Cambridge South Station has the potential for large beneficial impacts aligned to four of the five objectives. It therefore achieves the highest rating.

- A new Cambridge South rail station would connect the Biomedical Campus directly to international airports including London Stansted and London Gatwick, via the rail network. Long distance coach services could also be beneficial, but only if direct services were provided from multiple airports to the Biomedical Campus. The other options would not lead to a noticeable benefit for international travellers.
- All options improve sustainable transport accessibility, but Cambridge South Station is rated above other options because it represents a substantial upgrade in provision and allows existing unused network capacity to be utilised.
- Three of the four options would help to minimise highway congestion associated with the development areas. However, Park and Ride expansion received an adverse rating as this would be likely to encourage higher traffic volumes in the Southern Fringe area.
- To effectively reduce reliance on city centre transport infrastructure, the scheme must provide direct access to the Biomedical Campus from the national transport network. Long distance coach services could contribute to this. Cambridge South Station would contribute the most by connecting the Southern Fringe area to London and in future the East West Rail link would connect the area to other parts of the Golden Triangle.
- The Cambridge South Station proposal is designed to integrate with and complement the Thameslink and East West Rail schemes. The other options have less of an ability to integrate with these major investment programmes.
- Deliverability risk is considered to be higher for options requiring a significant level of new infrastructure.

Cambridge South Station is likely to be the most challenging option in terms of deliverability as it requires by far the largest infrastructure intervention. It is also the highest cost option as can be seen from the evidence presented in the Economic Case.

Despite this, the assessment presented in this Strategic Case, shows that Cambridge South Station is the most effective way to deliver the scheme objectives, principally because it

[17] Passenger Demand Forecasting Handbook (PDFH) Version 6, Section B4.5.1

provides the most substantial improvement in public transport accessibility between the Biomedical Campus and the Southern Fringe and the largest potential catchment area. The assessment presented in the Economic Case supports this, with the Cambridge South option generating the highest Value for Money (VfM).

Construction of a rail station at Cambridge South is therefore the preferred option.

This option would not necessarily preclude implementation of the other options. For example, park and ride improvements at Babraham would compliment Cambridge South Station, as the corridor to the south east of Cambridge does not have a railway line. This has been recognised by the Greater Cambridge Partnership with park and ride improvements at Babraham included in the CSET project.

1.6 Geographic Scope

The geographic scope of works for the preferred option, a new station at Cambridge South and associated rail line improvements, extends over a section of the West Anglia Main Line between Shepreth Junction (Great Shelford) and the existing three track section to the south of Cambridge station. The works would require the partial four tracking of the West Anglia Main line between Shrepreth Junction and Cambridge Station, including associated track, signalling, overhead line equipment (OLE) and electrification & plant works.

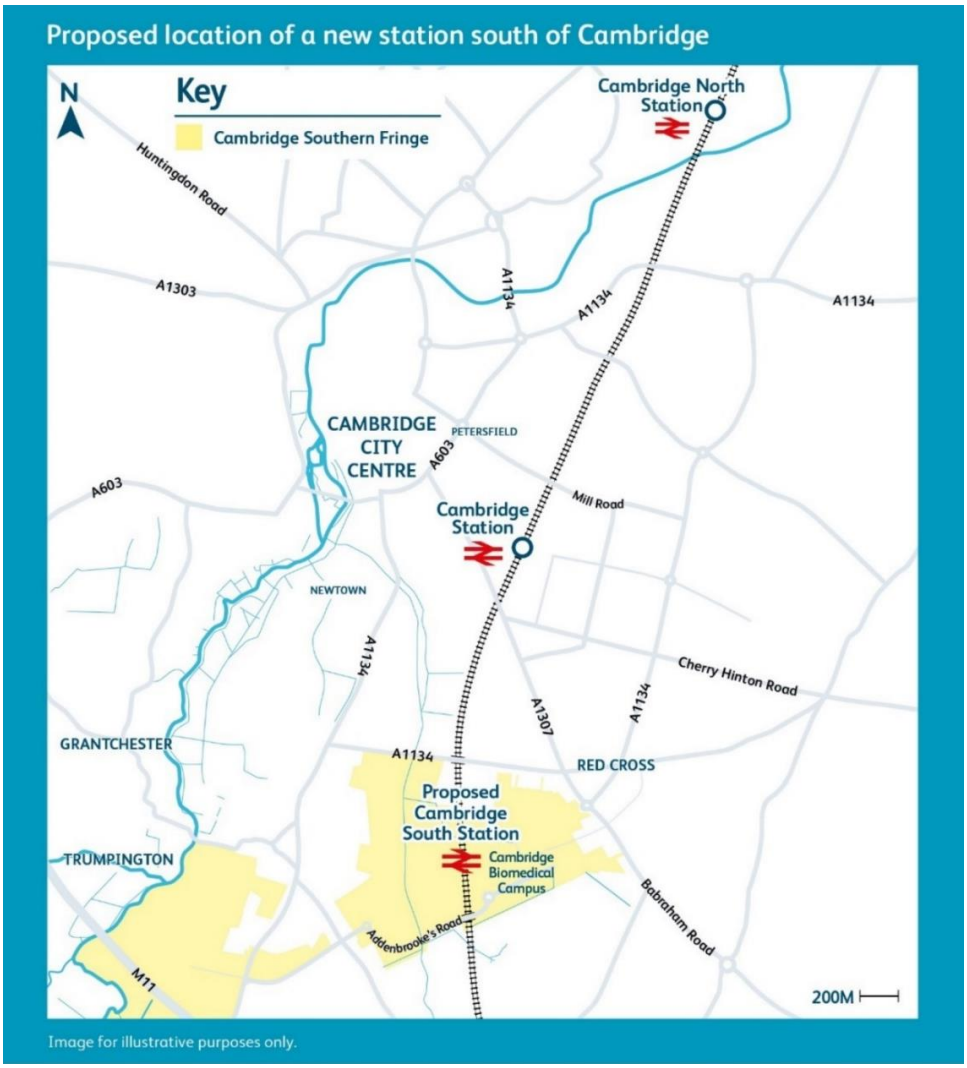
The strategic benefits associated with a new station at Cambridge South are expected to be experienced in the following areas:

- In the immediate vicinity of the Southern Fringe development area and Biomedical Campus, as a result of increased public transport mode share and reduced private car use.
- At Cambridge rail station, as over 1m trips per year will transfer to the new station, reducing overcrowding issues.
- At settlements along the West Anglia Main Line, Shepreth Branch and East Coast Main Line to the north and south, as anyone travelling to the Biomedical Campus will find it easier to use the train. Associated rail line improvements to the south of Cambridge might also improve overall journey time reliability along the rail corridor.

1.6.1 Site Location

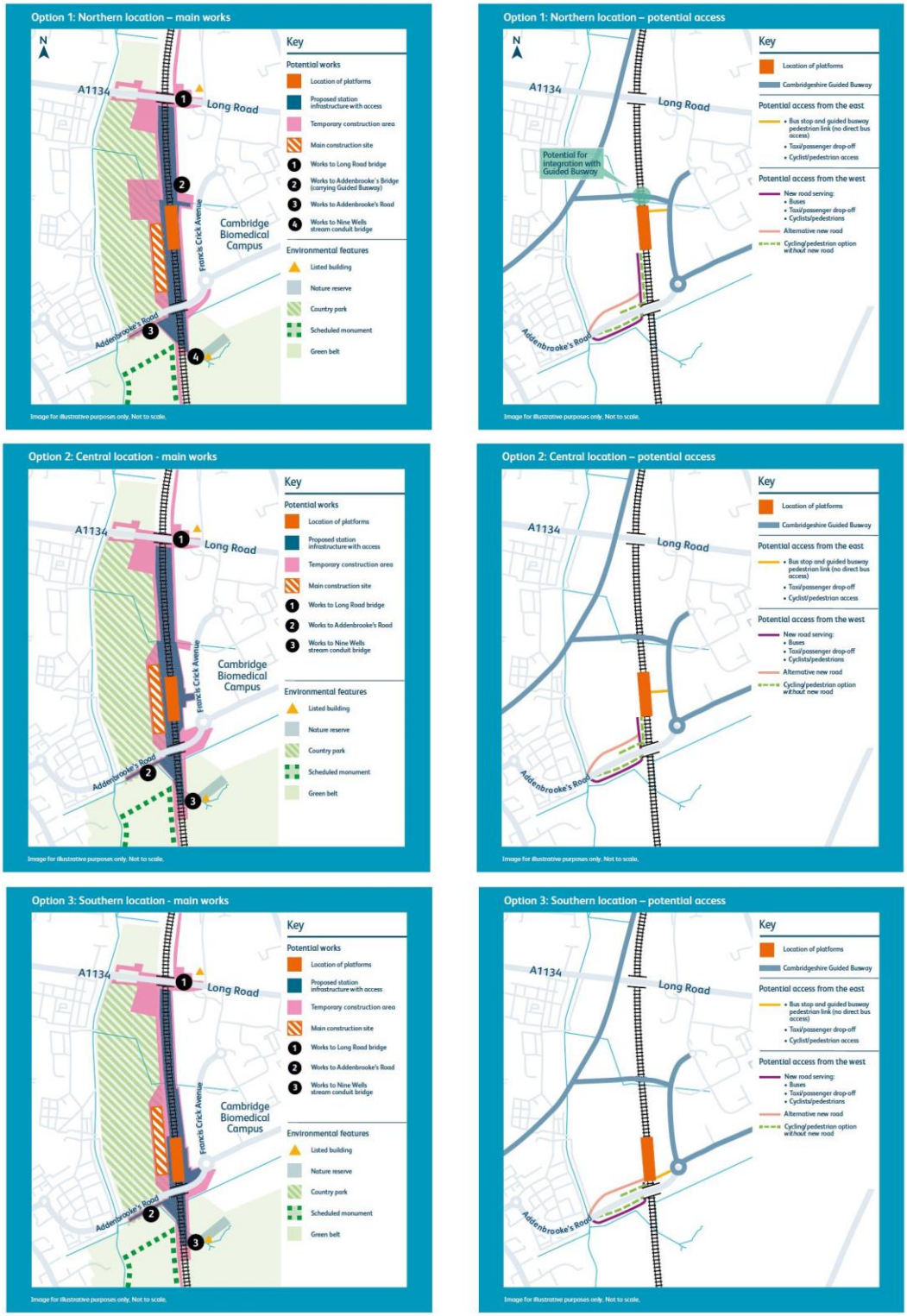
Figure 3 illustrates the new station location, approximately 1.5 miles (or 2.4km) from Cambridge Station on the WAML located to the west of the CBC and to the east of the village of Trumpington.

Figure 3 - Proposed location for Cambridge South Station (Source: Network Rail)



Network Rail developed three station location options positioned between Addenbrooke's Bridge which carries the Guided Busway, and Nine Wells Bridge which carries Addenbrooke's Road, shown in Figure 4.

Figure 4 - Potential locations for the new station site, North, Central and Southern (Source: Network Rail)



Network Rail undertook an initial round of consultation (further detail provided in section 1.8.4), where it was established that more consultees preferred the Northern location, followed by the Southern location and then the Central location.

Stakeholders challenged Network Rail to either avoid or not damage places of significance such as Hobson's Park; consider the impacts on the environment and businesses on the east side of the railway, consider impacts on sustainable travel modes, including walking, cycling and public transport and enhance connections.

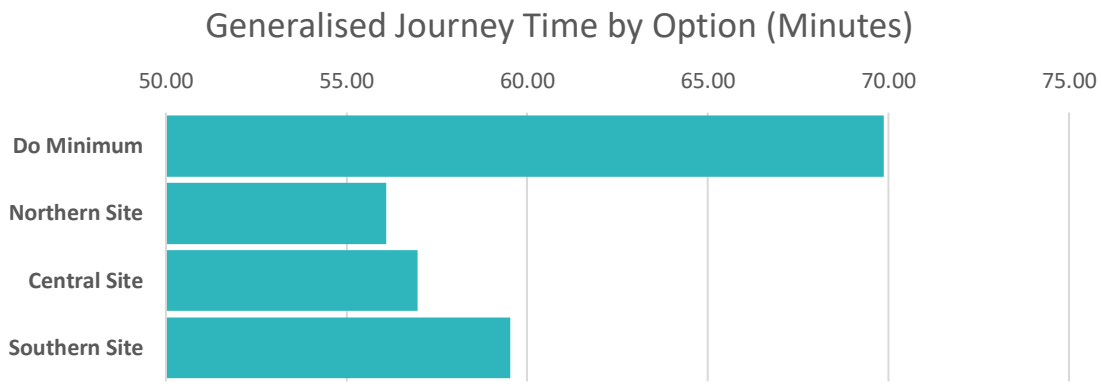
The consultation also established that people welcomed the ability to easily access the hospitals and places of work on the Cambridge Biomedical Campus as well as the ability to travel to destinations by rail without going to Cambridge Station.

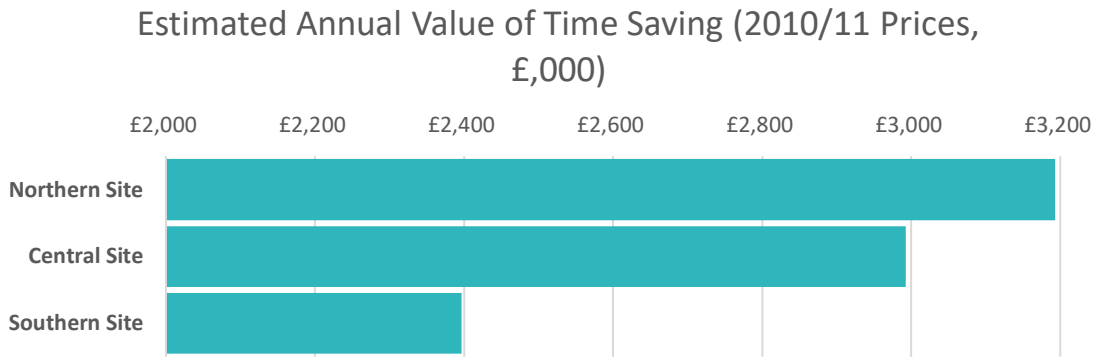
Looking at the three options in turn:

- The Northern location is closest to the centre of the CBC, offers best opportunity for interchange between services on the Busway and bus stops, however there are concerns that this location could cause most disruption to Addenbrooke's Bridge (Guided Busway) during construction and therefore may be the most challenging location to build the station at.
- The Central location is still provides good access to/from the CBC, with a slightly increased transfer time to the bulk of the campus. It allows connections to both roads and the Guided Busway and does not require disruption to the Guided Busway, unlike the Northern site. However, it would result in a substantial loss of development area on CBC and appears to have more significant impacts on Hobson's Park.
- The Southern location is the least restricted site from a construction perspective and is therefore likely to be the simplest to build. However, it is the least convenient point of access to/from the bulk of the current CBC resulting in the longest transfer times. Location of the station on this site may also cause congestion on the adjacent roundabout, on the main south west highway access route to the CBC.

Mott MacDonald undertook analysis of the overall (generalised) journey time (GJT) for each station location for an average rail journey to the central point on the Biomedical Campus. This analysis identified the Northern site at the most convenient location for access to the CBC , with shorter overall GJTs than the other sites. This was used to produce a monetised estimate of the value of time to passengers, providing one measure of the relative value of each site. The results of the journey time and value of time analysis are shown below.

Figure 5 - Average generalised journey time by rail for a trip to the CBC and estimated value of time savings for each proposed station location





In addition to the Stage 1 consultation exercise described in Section 1.8.4, Network Rail undertook a multi-criteria analysis of the three potential station sites, of which initial consultation and the Mott MacDonald journey time assessment were pieces of evidence considered. This multi-criteria assessment identified the Northern site as the preferred station location, with confirmation of this outcome provided by DfT.

1.7 Wider Economic Impacts

A high level wider economic impact assessment has been undertaken in line with HM Treasury Green Book principles and the Homes and Communities Agency's Additionality guidelines. The assessment measures the potential stimulus to economic activity attributable to Cambridge South Station, by estimating the consequential employment, Gross Value Added (GVA)[18] and investment benefits that would otherwise not have arisen. This assessment is summarised below and presented in more detail in the Economic Case.

The analysis shows that 219 net additional jobs could be supported which could deliver £12.4m GVA per annum once the site is fully developed and occupied.

With a 20% level of attribution this would mean that **44 net additional jobs** could be attributed to the station, delivering approximately **£2.5m GVA per annum**.

The development of housing sites identified near the proposed station would also provide economic benefits through construction, tax revenues and Land Value Uplift (LVU). These estimates are outlined below:

- 105 jobs and £7.0m GVA pa in construction benefits for the development of the 3,300 total dwellings around the station.

[18] Gross Value Added is measure of contribution to the economy from goods and services produced in a defined sector or area.

  - With a 20%[19] level of attribution this would mean that **21 jobs** and **£1.4m GVA** in construction benefits could be attributed to the station from the construction of these dwellings.
- £6.7m p.a**.** in Council Tax revenues from the construction of 3,300 dwellings.
  - With a 20% level of attribution this would mean that **£1.3m per annum** of housing related Council Tax revenue is projected from dwellings which may not be brought forward but for the proposed Cambridge South Station.
- In total £271m net additional (Present value over 30 years) in LVU benefits will be achieved through the development of the proposed residential sites identified around the station.
  - With a 20% level of attribution this would mean that £**54m of LVU** (Present value over 30 years) could be attributed to the station.

1.8 Strategic Influences

1.8.1 Constraints

The most significant constraint that will impact on the preferred option is the capacity of the existing rail network to the south of Cambridge. Construction of the station on the existing pair of running lines would introduce a capacity bottleneck likely to impact on punctuality across the Cambridge area and beyond. The infrastructure specification developed by Network Rail sees the number of tracks increase from two to four, thereby allowing segregation of stopping trains and through trains. The station platforms would be built on passing loops, with operational priority therefore given to through traffic. This is a standard practice for the design of stations such a Cambridge South. Network Rail's specification includes associated signalling, switches and crossings, and additional overhead line equipment required to deliver this track and station layout.

A further constraint will be access to the rail line for construction works. Land to the east of the proposed station location is currently under development and land to the west is Green belt and parkland which restricts available access points for plant and machinery. The Cambridge South East Transport (CSET) project currently expects to use similar areas for construction compounds potentially at similar times to Cambridge South. Furthermore, the Shelford Cycleway runs adjacent to the rail line between Addenbrooke's Road and Shepreth Junction. This cycle route will need to be retained as part of the scheme design.

1.8.2 Interdependencies

The success and financial viability of a new station at Cambridge South will be dependent on continued successful growth and development at the Cambridge Biomedical Campus, to attract sufficient passenger demand. The extent of existing development and further committed development provides some confidence, however the ongoing COVID-19 pandemic is clear risk to future prospects economic prospects and transport usage. This risk is discussed in the Economic Case.

The Cambridge Resignalling, Re-lock and Re-control (C3R) project provides interlocking capacity necessary for the increased signalling complexity arising from the implementation of Cambridge South.

Any benefits arising from East West Rail Central Section services calling at the station are dependent upon the delivery of that programme,

[19] Considered to be a realistic based on previous experience

Careful co-ordination will be required with the planning and delivery of the CSET project. This is particularly the case given the close proximity of the two schemes and the likely requirement for a TWA to enable construction of the station.

1.8.3 Stakeholders

Key stakeholders in the proposed new station are:

- DfT;
- Network Rail;
- Local authorities – Cambridgeshire County Council as the local transport authority, and Cambridge City Council and South Cambridgeshire District Council as the local planning authorities;
- Other parts of the rail industry, in particular TOCs and FOCs;
- Other statutory stakeholders such as utilities and Natural England;
- Greater Cambridge Partnership, as the local delivery body for the City Deal with Government. The Partnership includes the three local authorities, University of Cambridge, and the Cambridgeshire and Peterborough Combined Authority;
- Organisations that will invest in the Cambridge Biomedical Campus, including AstraZeneca, Cambridge University Hospitals NHS Foundation Trust, The MRC Laboratory of Molecular Biology, and Papworth Hospital NHS Foundation Trust;
- Local residents, employees, patients and other users of the campus and Hobson's Park;
- Landowners affected by the proposed scheme; and
- Lineside neighbours.

The local authorities have identified the opportunity for a new rail station at Cambridge South as part of their transport strategies – Cambridgeshire Local Transport Plan 2011-2031, and the Transport Strategy for Cambridge and South Cambridgeshire (TSCSC) 2014.

Cambridge University NHS Foundation Trust has a vision to be one of the best academic healthcare organisations in the world and as such requires good accessibility to specialist staff and visiting experts, who may travel long distances. The Trust have made great progress in encouraging sustainable travel by staff, but have ambitions to improve levels of public transport use among visitors. As a Major Trauma Centre and a centre of excellence for specialist services, patients and visitors travel from a wide area would benefit from a rail connection to the rail network. Papworth Hospital has previously stated that the new station would help with the delivery of their sustainable transport goals for patients and staff.

The MRC Laboratory of Molecular Biology anticipate significant further growth in staff and visitor numbers. They have previously given support to the idea of a new station, stating that it is already challenging for existing staff to get to the Campus. A direct rail service would also improve connectivity with other organisations along the Cambridge-London corridor as it develops, such as the newly opened Crick Institute in London.

Cambridge Ahead supports the idea of a new railway station at Addenbrooke's to serve the growing Biomedical campus

At present there are not considered to be any potential conflicts between key stakeholders, although reducing or mitigating impact on Hobson's Park where possible is a key priority for many.

1.8.4 Consultation

Network Rail undertook an initial round of consultation, which ran for a six-week period from 20 January to 2 March 2020[20]. The consultation was open to everyone who wanted to participate. Consultation planning recognised that effective and on-going engagement with the following wide range of stakeholders is key to the successful promotion of the Transport and Works Act Order (TWAO):

- Prescribed consultees (as identified within Schedule 5 or 6 of the Transport and Works Act 1992, known as Schedule 5 or 6 consultees);
- Those with potential land interests (potential to be a Schedule 6 consultee);
- Local access, user, and interest groups;
- Elected representatives;
- The public, including local residents and commuters.

Over the consultation period, 989 people visited the consultation events, 967 items of consultation feedback were received and there were 47,000 impressions driving 2,054 engagements via social media.

A total of 923 respondents recorded their views on the station:

- 94% expressed their support for the scheme;
- 2% did not support the scheme; and
- 4% were undecided.

Network Rail undertook a second phase of consultation concluding late 2020. At the time of writing the results of this consultation exercise had not been received.

1.9 Strategic Case Summary

The importance of improved transport networks and connectivity to support economic growth and development in Cambridge is clear. In particular, the Cambridge Biomedical Campus is of national significance and it is therefore essential that it is served by an efficient transport network that provides international connectivity, as well as promoting a quality of life that will allow the Biomedical Campus and Southern Fringe area to compete internationally as a place to live, work and invest.

The Strategic Case has identified the key existing and future problems for the transport network in the Southern Fringe and Biomedical Campus area and generated a series of six specific objectives for public transport investment. A new Cambridge South Station is considered to best meet the objectives set and have the strongest strategic case.

A new station has significant potential to contribute to Government's national policy objectives as set out in HM Treasury's 2020 review of the Green Book:

- Improving public transport journey opportunities therefore promoting a mode shift away from car travel will help move towards Net Zero carbon emissions for travel to and from this major employment and residential catchment area. This modal shift would also improve the Cambridge South area as a Place to live and work.
- Increasing the catchment of the strategically important employment cluster at the Cambridge Biomedical Campus will support the Levelling Up agenda, at least for the more deprived parts of the region and improve Equalities and Distributional effects. Key to achieving these outcomes is bringing the Biomedical Campus into the range of a significantly increased catchment population, including lower income areas. The Economic Case shows how the overall catchment population would be expanded significantly by the new station, both in absolute terms and relative to the other options

[20] Network Rail, Cambridge South Round One Consultation Summary, 2020

discussed in this Strategic Case. Overall we expect that GVA would increase by circa £3.9m per annum as a result of the new station, with a significant number of new jobs created.

The new station is well aligned with local transport investment strategy, including dovetailing with the Cambridge South East Transport project. There is also an opportunity to avoid some potentially abortive renewals expenditure by implementing the construction work for the new station at the same time as the Cambridge Area Re-signalling project (C3R), currently being planned by Network Rail. A station site to the north of the locations considered was selected by Network Rail, based on a multi-criteria analysis supported by evidence produced as part of this OBC.

Other non-rail options to achieve the same outcomes as the new station have been considered but performed less well than the new station when assessed as standalone schemes. One or more of these improvements may, however, complement a new station as part of a wider investment package.

Mott MacDonald
10 Fleet Place
London EC4M 7RB
United Kingdom

T +44 (0)20 7651 0300
mottmac.com

Economic Case

Outline Business Case - Cambridge South Rail Station

February 2021

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
0.5	19th Dec 2020	O Haycock	C Judge	C Judge	OBC draft economic case
0.8	18h Jan 2021	O Haycock	C Judge	C Judge	Update following DfT/NR initial comments
0.8	10h Feb 2021	O Haycock	C Judge	C Judge	Update following DfT/NR additional comments
1.0	11h Feb 2021	O Haycock	C Judge	C Judge	Issued to DfT
1.1	02h Mar 2021	O Haycock	C Judge	C Judge	Addition of WEBs sensitivity and additional text on optimism bias

Information class: Standard

Click or tap here to enter text.

2 Economic Case

This paper sets out the Economic Case at the Outline Business Case (OBC) stage for a new rail station, Cambridge South, serving the internationally significant Cambridge Biomedical Campus and Southern Fringe development areas of Cambridge. This work builds on the Strategic Outline Business Case (SOBC) produced in 2017.

Since the SOBC, significant work has been undertaken by Network Rail and other stakeholders to develop the project, in particular to understand the level of train service which can be provided, the interaction with the wider train service in the context of major enhancements such as East West Rail, and the practicalities of construction and station location. At the time of writing, Network Rail development work was ongoing with GRIP 3 expected to conclude in Spring 2021.

The assessment presented in the Strategic Case identified the construction of a rail station at Cambridge South as the preferred option, as it indicated that that Cambridge South station is the most effective way to deliver the scheme objectives, principally because it provides the most substantial improvement in public transport accessibility between the Biomedical Campus and the Southern Fringe and the largest potential catchment area.

Considering the conclusions of the Strategic Case, in producing this Economic Case our primary focus has been in relation to the construction of a new railway station. However, as the Strategic Case recognised that some of the scheme objectives could also be delivered through either busway service enhancements or new longer distance direct bus/coach services, we have undertaken some exploratory modelling to identify an indicative Value for Money (VfM) for these schemes for comparison with the new rail station option.

We have assessed the potential options identified in the Strategic Case to improve transport links to the Cambridge Biomedical Campus and Southern Fringe development, against a do-minimum scenario where the investment does not go ahead. Specifically, we have identified the range of economic, environmental, social, and public accounts impacts that are expected to arise from the scheme, and therefore demonstrates the scheme's anticipated VfM. Consistent with DfT's requirements at OBC stage, the results of this VfM assessment will enable a comparison of the options presented, enabling the selection of a preferred option.

We have also conducted sensitivity tests on the best performing option to demonstrate the likely impact of key upside and downside risks on VfM.

Earlier analysis from this Economic Case was shared with Network Rail helping the project development team to understand some of the relative merits of the potential sites for a new station. This has helped inform single option selection for the project in parallel to the work to produce this business case.

Finally, as at least some of the options would involve a permanent change to transport infrastructure, we have selected an appraisal period of 60 years, which is the longest term normally permitted by TAG.

2.1 Background Assumptions

To produce the Economic Case we have made a series of background assumptions which are common to both the Do-Minimum Scenario and the options. They are described below.

2.1.1 Underlying/background passenger usage levels

Do-minimum background growth has been forecast using outputs from the EDGE model supplied by the Department for Transport. The outputs of the EDGE model were supplied in a format aligned with the MOIRA Anglia (OR16) zoning structure.

This model utilises the August 2020 vintage of DfT's Demand Driver Generator (DDG) dataset, which in turn encompasses the July 2020 Office for Budgetary Responsibility (OBR) economic forecasts.

Consistent with DfT's current forecasting guidance, we have applied the DDG-based projections to the pre-COVID-19 (2018/19) demand and revenue base to produce our central case.

However, this forecast does to explicitly capture the anticipated full impact of the ongoing COVID-19 crisis on future passenger demand. Whilst the July 2020 OBR forecast contains the latest projections for economic recovery, it does not capture potential changes in future passenger behaviour (e.g. greater levels of home-base working). Modelling undertaken by the Department's Rail Analysis team has calculated three sets of "long-term factors" to apply to the base forecast to indicate the potential long run impacts of behavioural change (Version 14). DfT's current forecasting guidance is to apply each set of long-term factors as a sensitivity test. The results of these tests are presented in Section **Error! Reference source not found.**.

2.1.2 Rail fares inflation

We have assumed that all fares remain in line with DfT's policy for Regulated fares, which from January 2021 is annual growth of RPI+1%. This assumption is consistent across the Do-Minimum and the options.

2.1.3 Local development and land usage

Background assumptions relating to employment and housing growth on development sites surrounding the proposed Cambridge South station site are based on information contained within the Cambridge Local Plan and information provided by Addenbrooke's Hospital. It should be noted that neither of these sources have been updated since the commencement of the COVID-19 pandemic.

- Between 2019/20 and 2031/32 approximately 3,300 additional houses are to be constructed within development sites across the Southern Fringe and adjacent areas, of which approximately 2,400 will be constructed on the Clay Farm development site immediately west of the rail line and all within 1 mile of the proposed new station. For the same period, 1,120 additional homes are included in the TEMPRO[1] forecast for the zones covering the Southern Fringe, therefore an allowance for an additional 2,180 homes has been made in our forecast.
- Over the next two years (2019/20-2021/22) approximately 1,000 additional jobs will be based at Addenbrooke's Hospital and the Cambridge Biomedical Campus. For the same period, 700 additional jobs are included in the TEMPRO forecast for the zones covering the Biomedical Campus, therefore an allowance for an additional 300 jobs has been made in our forecast.
- Between 2021/22 and 2031/32, an additional 6,000 jobs will be based on the Biomedical Campus. For the same period, only 860 additional jobs are included in the TEMPRO forecast for the zones covering the Biomedical Campus, therefore an allowance for an additional 5,140 jobs has been made in our forecast. Total additional jobs estimated over the 2017/18-

[1] DfT planning software containing projection on land usage and other relevant variables.

2031/32 period is therefore 7,000, bringing the total number of employees based at the Biomedical Campus to an estimated 27,000 by 2031/32.

- In the development of this OBC, it has not been possible to accurately quantify the proportion of additional jobs during the 2021-2031 period that would be reliant on the delivery of Cambridge South station. At SOBC stage, it was estimated that 20% of jobs could be contingent on the delivery of the station. We have therefore assumed this value when considering the potential Wider Economic Benefits of the scheme, but have assumed that no jobs are contingent on the scheme in our demand modelling.
- The Cambridge Biomedical Campus, including Addenbrooke's Hospital and the relocated Papworth Hospital, will account for approximately 15% of all jobs across the Cambridge City local authority area by the end of the Local Plan period (2031).
- Background growth in housing and employment, and therefore growth in trips, relating to the rest of Cambridge is assumed to be in line with forecasts contained in the National Trip End Model (NTEM), as this is the source for the relevant drivers in the DfT's DDG model, from which our background growth assumptions are sourced.

Two sensitivity tests have been undertaken to present the reliance of the business case on the additional background growth, where the forecast for additional employment and housing growth are separately delayed by 10 years. These are presented in Section **Error! Reference source not found.**.

2.2 Do-Minimum Scenario

2.2.1 Purpose of the Do-Minimum Scenario

The Do-Minimum scenario is the situation which is most likely to occur in the absence of the investment at Cambridge South. In this Economic Case we present an assessment of the Value for Money (VfM) of each investment option against the Do-Minimum, or in other words the VfM of the incremental expenditure required to move from the Do-Minimum to each option.

The Do-Minimum scenario is set out below.

2.2.2 The future passenger and train service

The assumed do-minimum Train Service Specification is the equivalent of the December 2019 timetable. During 2020 various timetables have been operated, in response to low demand caused by the COVID-19 pandemic and the resultant Government policy. We are not aware of a policy to permanently scale back the service quantum, so have used the latest pre-COVID timetable in the Do-Minimum. There is a planned timetable recast on the West Anglia Main Line in May 2022, but this is not proposed to change the quantum of trains. Stage 3 of the East West Rail (EWR) project would increase the train service quantum through Cambridge South. At the time of writing, funding has only been announced for Stage 1 of this scheme, the section between Oxford and Bletchley/Milton Keynes. As funding for Stage 3 has not yet been committed, we have not included the additional services in the Do-Minimum.

The Cambridge South East Transport (CSET) project is a proposed new public transport (bus) route that would link the Cambridge Biomedical Campus via Stapleford and Sawston to a new travel hub near the A11/A1307 with connections to Babraham, the Babraham Research Campus and Granta Park. This scheme is also currently at OBC stage. It has not been included in our Do-Minimum, as CSET is viewed as complementary to Cambridge South Station, as the corridor to the south east of Cambridge does not have a railway line and therefore serves a different catchment area to the options tested in this Economic Case.

2.2.3 The future cost of maintaining and renewing the rail network

Elements of the signalling system in the Cambridge South area are nearing life expiry and are likely to require renewal within the next 10 years. Similarly, the track and point work at Shepreth Junction is likely to require renewal in the next 10 years. We have therefore assumed that investment will be required[2] to undertake this renewal activity. It should be noted that this is currently marked as a Control Period 7 activity, therefore funding has not yet been allocated.

2.3 Options

As set out in the SOBC, a new railway station looks to be the best way to deliver the strategic aims of improving transport connectivity to/from the Cambridge South area, and the associated benefits of this improvement. However, in developing this Economic Case we have examined the Value for Money of both a new rail station, and alternative improvements to other modes of public transport. This has resulted in three options:

- A new rail station
- Busway enhancements
- New longer distance bus or coach services

Each option is described below. The VfM assessment of the Busway and long distance bus/coach options is for indicative purposes, to check that the VfM is not materially superior to the rail station option. If this was the case then it would potentially contradict the conclusions of the Strategic Case, requiring a reassessment. In developing the non-rail options we have assumed routes and frequencies which would offer a significant public transport improvement to locations these options could serve. We have not looked to optimise the assumed level of bus or coach service frequency at this stage, given the indicative purpose of the assessment.

2.3.1 Option 1. New Cambridge South rail station and associated rail line improvements.

This option is for a rail station on the West Anglia Main Line as it passes between the Southern Fringe development area and the Cambridge Biomedical Campus. The station would be served by the addition of calls in train services which currently pass through the area. Figure 1 below shows the approximate location of the station.

Three potential station sites (North, Central and South) were identified, all of which were positioned between Addenbrooke's Bridge which carries the Guided Busway, and Nine Wells Bridge.

The Train Service Specification (TSS) has been developed by Network Rail with agreement from the Department for Transport, based on what is operationally feasible and with aim of providing a good level of service to the likely key origin and destination catchment areas. Under this TSS Cambridge South would be served by 7.5 trains per hour (7 or 8 depending on the direction of travel) in the off peak and 6.5 trains per hour in the peak. These station calls would be spread across the various types of existing services which operate the line to Cambridge, including trains/from London King's Cross, London Liverpool St, Stansted Airport, Birmingham New Street, Peterborough and Norwich.

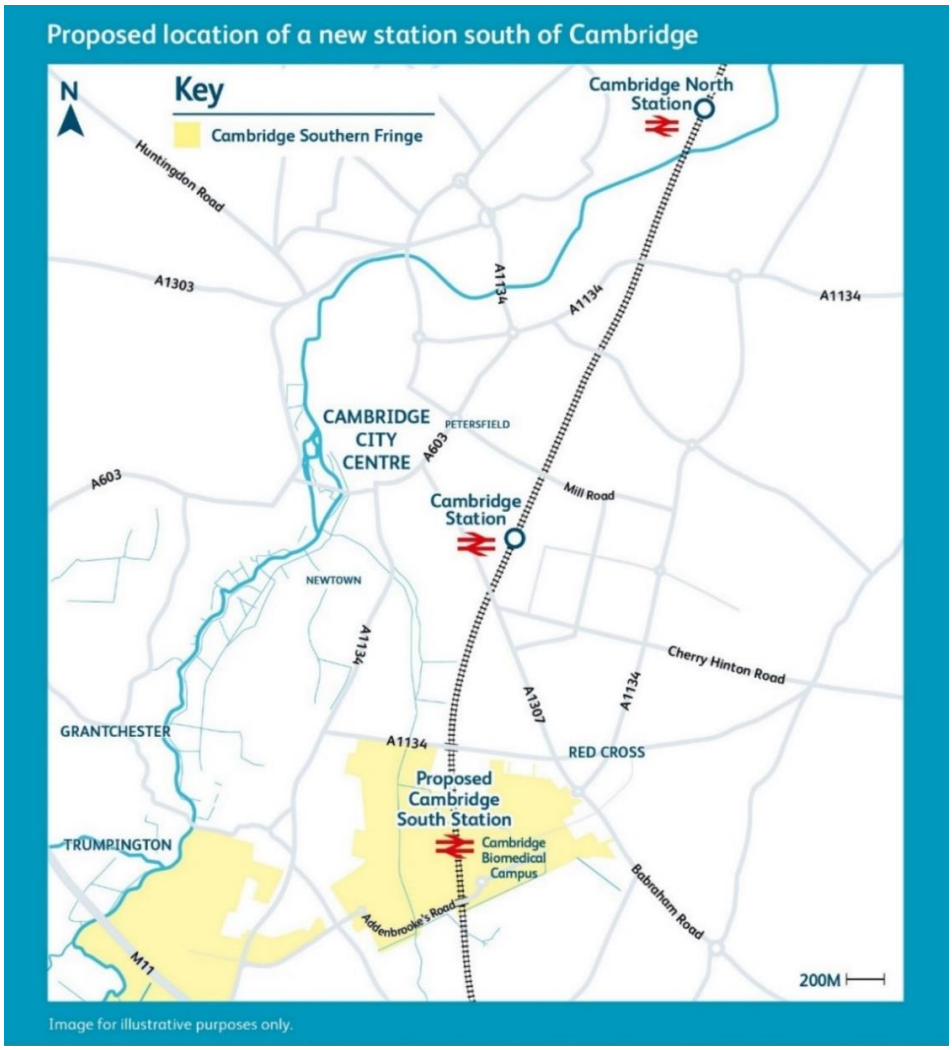
Car parking (with the exception of a small number of bays for blue budge holders) will not be provided at the station or in the immediate vicinity, given the station's likely role as a gateway to the major employment site at the Cambridge Biomedical Campus and close proximity to

[2] Network Rail's renewals budget, which runs until March 2024 does not include a provision for this work. In the Do-Minimum scenario we would expect the renewals budget for Control Period 7 (April 2024 – March 2029) to include provision for a signalling renewal at Cambridge South and a renewal of Shepreth Junction.

planned housing in the South Fringe development. This is also consistent with local planning policy.

We have assumed that the new station will open in 2025 following a five-year development, design and construction period. This date is potentially feasible if the project can continue to accelerate as part of Project SPEED as planned.

Figure 1 - Approximate location of the proposed station at Cambridge South



Source: Network Rail

2.3.2 Option 2. Cambridge Busway service enhancements

This is an option to increase the service frequency and capacity on Cambridge Busway routes that serve Addenbrooke's Hospital, the Biomedical Campus and the busway towards Trumpington Park and Ride. As previously mentioned, this is an exploratory option to identify the potential magnitude of benefits associated with busway enhancements, therefore detailed frequency and route optimisation has not been undertaken.

We have assumed a frequency of service which would be likely to be attractive to passengers, however there would be flexibility to adjust frequency as appropriate. Table 1 sets out the assumed frequency by route.

Table 1 – Option 2 Bus Frequencies

Origin Zone Description	Origin Zone Description	Base Frequency (per hour)	Option 2 Frequency (per hour)
Central Cambridge	Biomedical Campus	7	10
South Cambridge	Central Cambridge	4	6
Trumpington East	Central Cambridge	5	8
Trumpington North	Central Cambridge	3	4
Trumpington South	Central Cambridge	5	7
Shelford	Central Cambridge	4	6

This option could be provided without any additional infrastructure as the busway already exists, and bus stops are or will be prevalent across the Cambridge South area. The option would however require the procurement of additional busses and hiring of additional drivers to run the services.

2.3.3 Option 3. New longer distance bus/coach services

This is an option to introduce new coach services between the Cambridge South area and a selection of catchment locations. Consistent with the SOBC, we have assumed that the catchments of Bury St Edmunds, Ely, Huntingdon and St Neots would be served in this option, with busses/coaches running “non-stop” to the Biomedical Campus, to deliver the best possible journey times. No additional infrastructure would be required as the services would use public highways. The option would however require the procurement of a fleet of coaches/busses and hiring of drivers to run the services. As previously mentioned, this is an exploratory option to identify the potential magnitude of benefits associated with longer distance bus/coach services, therefore detailed frequency and route optimisation has not been undertaken.

As per Option 2, we have modelled a level of frequency that we assume would be attractive to passengers. Table 2 sets out the assumed frequency by route.

Table 2 – Option 3 Bus/Coach Frequencies

Origin Zone Description	Origin Zone Description	Base Frequency (per hour)	Option 3 Frequency (per hour)
Bury St Edmunds & Ipswich	Biomedical Campus	0	2
Ely Central	Biomedical Campus	0	2
Huntingdon	Biomedical Campus	0	2
St Neots, Bedford & Biggleswade	Biomedical Campus	0	2

Demand and revenue forecasts

2.4 Forecasting approach

2.4.1 Overview

A three-stage approach was used to forecast passenger demand under each of the options described in the previous section. This is summarised below:

1. Define the pre Covid-19 demand base. This is the annual number of passenger journeys made to and from the Cambridge Biomedical Campus and the Southern Fringe area (referred to henceforth as the Cambridge South area).
2. Estimate the growth in this demand base, as a consequence of the reduction in the total journey time to/from the Cambridge South area once the transport improvements under each option have been delivered.
3. Forecast background demand changes (e.g. through local land usage, economic changes, the impact of Covid-19) and apply this to the demand base.

This methodology is explained in more detail in the following sections.

Since the subject of our work is the OBC for a new rail station, we have used a TAG-consistent forecasting approach most commonly used in the rail sector. We have applied this approach to the other non-rail modes as consistently as possible.

This methodology was favoured over alternative approaches, such as the construction of a gravity model. This was primarily due to the lack of a suitable station for benchmarking with similar characteristics to Cambridge South, which would have made calibrating a gravity model challenging.

A key assumption relates to the value of time we have assumed. The evidence in TAG suggests that rail passengers have a higher average value of time than other surface transport users. In the case of the Cambridge South work, this would lead to rail time savings resulting in higher benefits. Given the land usage at the Biomedical Campus in particular we have instead assumed that all transport users have the same (rail) value of time and journey purpose splits, with current modal choice determined mainly by network coverage.

2.4.2 Demand base definition

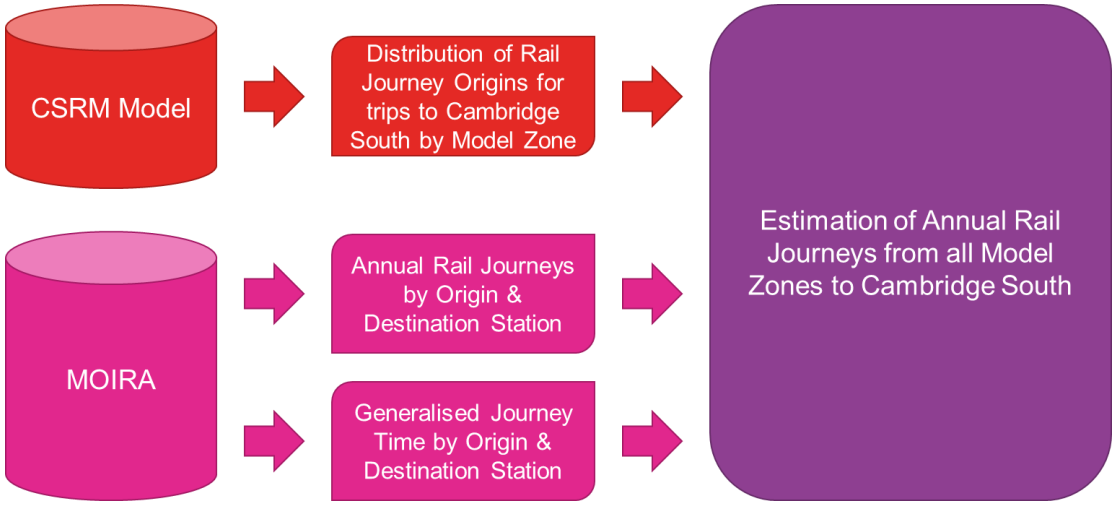
Two sources of data were used to estimate the current demand base, with the flow of data illustrated in Figure 2.

For modes other than rail we used the Cambridge Sub Regional [transport] Model (CSRM). This is the most granular source of information, containing data on the origin and destination of all transport trips made to, from and within the Cambridge area. Crucially, the origin and destination of travel within Cambridge and the Cambridge South area is very detailed, with a disaggregation broadly equivalent to the size of postcode sectors. This therefore enables us to understand the number of passengers traveling to/and from the Cambridge South area itself.

For rail travel, we accessed data held in the forecasting software MOIRA (version 1). This data is ultimately from the national ticket sales database, and so provides the most accurate picture of demand for forecasting purposes. The data available from MOIRA shows the annual number of passenger journeys made to and from stations in the appropriate GB region as well as the

associated fares revenue. It does not provide the ultimate origin and destination of passengers, which means that it is not possible to tell whether passengers currently using Cambridge station are looking to travel to or from a location which is closer to or within the Cambridge South area. The CSRM data does show the ultimate origin/destination of passengers who currently use Cambridge station. We were therefore able to use this to estimate the proportion of current passengers who board/alight at Cambridge station and make an access/egress trip to/from the Cambridge South area, and who would prefer to use a station at Cambridge South because it is more convenient. We therefore took total rail demand numbers from MOIRA and then used CSRM data to split this into the those who would use Cambridge South station and those who would continue to use Cambridge station. This is shown in the diagram below.

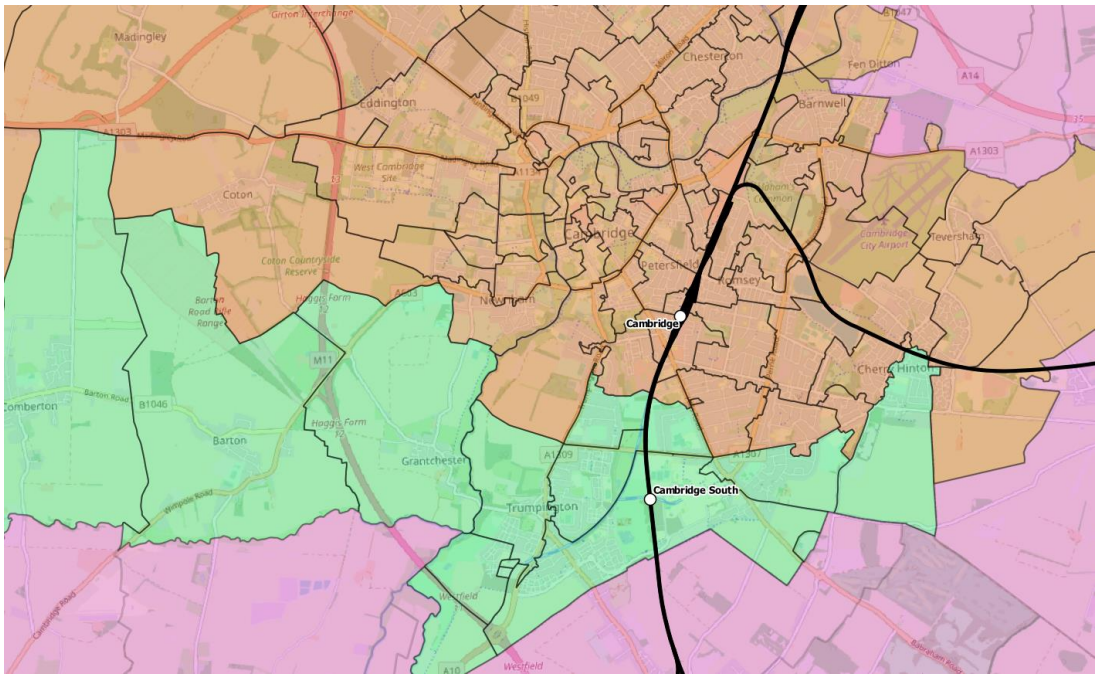
Figure 2 - Utilisation of source data in estimating the level of base demand



We also requested data from local employers on the origin of employees and visitors, as a useful means of sense checking the CSRM information. At the time of writing this had not been supplied to us. We were, however, able to access publicly available data on the current and expected future employee numbers at the Biomedical Campus, as well as on proposed future land usage within the Southern Fringe development.

Figure 3 below shows the origin-destination structure from CSRM, with the colour scheme denoting whether access/egress is quicker from Cambridge Station (orange), Cambridge South (green), or another station (purple).

Figure 3 - CSRM Model Zoning, showing indicative rail station catchments



Due to the volume of zones within the CSRM model, it was necessary to amalgamate some zones to create an appropriate level of segmentation for use in our spreadsheet model. For the local Cambridge area, this segmentation is illustrated in Figure 4.

Figure 4 - Example of Zone Amalgamation

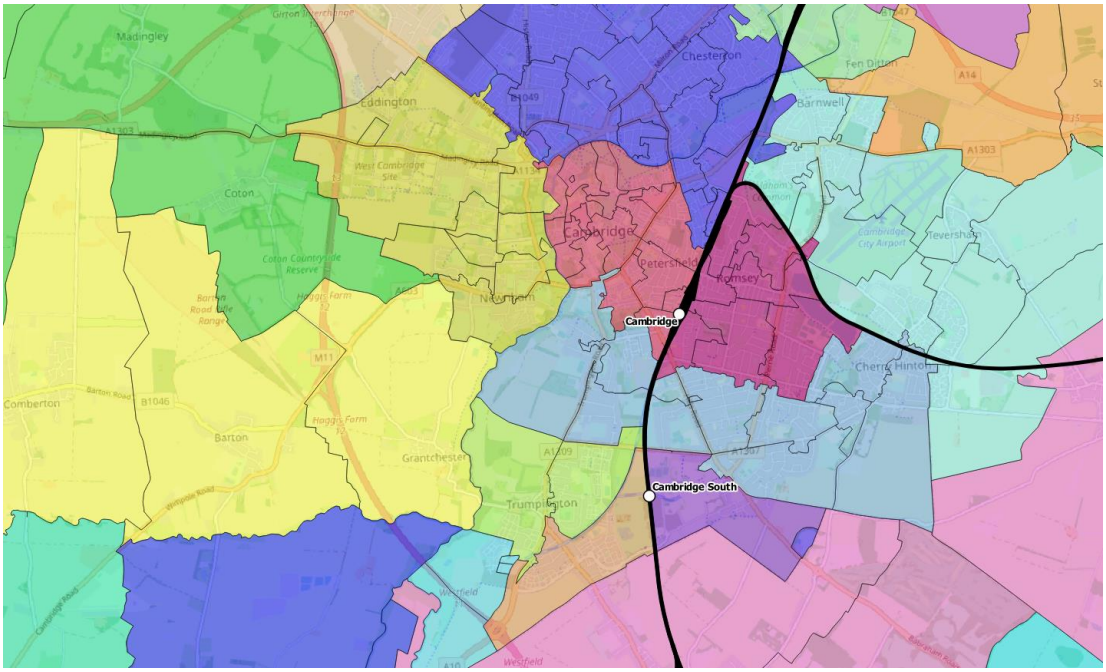


Table 3 below shows total travel to/from the Cambridge South area, with the top 10 busiest public transport flows (pairs of places) highlighted.

Table 3 – Top 10 busiest public transport flows to/from model zones which are likely to fall within the catchment of a new station at Cambridge South

	Origin Zone Description	Destination Zone Description	Journeys made in 2019
1	Trumpington South	Central Cambridge	303,600
2	South Cambridge	Central London	253,562
3	Shelford	Central Cambridge	233,422
4	South Cambridge	Central Cambridge	155,820
5	Central Cambridge	Biomedical Campus	141,057
6	North Cambridge	Biomedical Campus	131,844
7	Central London	Biomedical Campus	98,784
8	East Cambridge	Biomedical Campus	89,001
9	South Cambridge	North Cambridge	87,139
10	Shelford	Biomedical Campus	80,878

** Purple zones are likely to be within the catchment of a station at Cambridge South*

To support Network Rail's work on the selection of a preferred station site we developed a further disaggregation of demand between the various locations on the Biomedical Campus. In the absence of primary data we had requested, we assumed that 50% of passengers are travelling to hospital sites and 50% of passengers are travelling to organisations based on the campus, such as AstraZeneca. This split is a simplifying assumption, based on the knowledge that there are approximately 2,500 AstraZeneca employees and 3,300 hospital employees, but with AstraZeneca likely to generate a larger proportion of rail demand, due to:

- Hospital shift workers being less attracted to rail (early/late rail service provision)
- Hospital patients being less attracted to rail (infrequent travellers, potential mobility/accessibility concerns)
- AstraZeneca sites being located closer to the proposed station locations

The assumed distribution of passenger destinations is shown in Table 4.

Table 4 – Assumed distribution of passenger destinations

Campus Location	Weighting
AstraZeneca Sites	50%
New Papworth hospital	7.1%
Addenbrooke's Treatment Centre	7.1%
Rosie Maternity Hospital	7.1%
MRIS	7.1%
Oncology & Haematology	7.1%
Outpatients	7.1%
Accident and Emergency	7.1%

2.4.3 Forecasting the demand base growth

For each option we have estimated the total uplift in passenger journeys, based on the improvement in the Generalised Journey Time (GJT) for the mode of transport in question between the do-minimum scenario and the relevant option. GJT is the sum all of the constituent parts of journey time which passengers, for example access time, in vehicle time, wait time. A unimodal forecast of this nature is consistent with the way that rail schemes are normally appraised under TAG guidance.

For each option we have forecast demand from the perspective of the mode in question, as follows:

$$Do = Dc(GJTo/GJTdm)\text{^}e$$

Where:

- *Do* = Forecast demand in the option in question
- *Dc* = Current (pre COVID-19) demand
- *GJTo* = Generalised Journey Time under the option in question
- *GJTdm* = Generalised Journey Time under the Do-Minimum scenario
- *e* = The elasticity of demand with respect to Generalised Journey Time

Two sets of demand elasticities have been used:

1. In the production of our Central Cases, elasticities of demand with respect to GJT were taken from the Passenger Demand Forecasting Handbook (*PDFH6*). These elasticities were estimated based on the rail component of journeys and do not include station access and egress time, which is a key issue in forecasting demand for a new station. These elasticities are therefore likely to result in an under-forecast.
2. As a sensitivity, with the same PDFH6 elasticities, we have scaled upwards to reflect the proportion of GJT that does not occur as part of the rail only journey. This approach has been used previously to scale down GJT elasticities, e.g. for application in forecasting the impact of a change in rail only in vehicle time. These have been presented as a sensitivity due to the lack of empirical evidence to validate the scaled elasticity approach.

We have included the following components in the calculation of GJT:

- Main mode in vehicle time. This is the average journey time for the main mode of travel pertaining to the option in question.
- Main mode frequency penalty. This is a time penalty to cover the time and inconvenience of waiting for the main mode of travel. For rail we have used frequency penalties from PDFH6, which are a function of frequency and travel distance. For other modes, where available we have taken the frequency penalty from the CSRM model. Where not available, we have used the frequency penalties from PDFH6.
- Access/egress mode in vehicle time. Where applicable this is the access/egress journey time at the Cambridge South end of the trip.
- Access/egress walk time.

We have excluded the following components:

- Journey cost. This is because it is unclear whether there will be a material travel cost difference between the Do-Minimum scenario and the various options. In the case of a new rail station it may be that passengers who alight at Cambridge South instead of Cambridge save the cost of the onward connection, so our approach may result in a conservative estimate for the rail option.

Table 5. GJT comparisons (minutes) for selected key demand flows

	Option 1. New Station		Option 2. Busway Improvements**		Option 3. Long Distance Bus/Coach***	
Cambridge South to/from	DM*	Option	DM*	Option	DM*	Option
Central London	156	131	156	148	-	-
Ely Rural	117	95	117	109	-	-
Kings Lynn	154	151	154	146	-	-
Newmarket	147	131	147	139	-	-
Peterborough	162	131	162	154	-	-
Meldreth & Royston	119	77	119	111	-	-
Ely Central	117	95	117	109	117	138**
West Hertfordshire	143	100	143	135	-	-
East Midlands	270	241	270	262	-	-
East Hertfordshire	136	93	136	128	-	-

* Do-Minimum scenario

** Option 2 provides GJT benefits on many flows, due to rail passengers interchanging to buses at Cambridge station to access the CBC

**In Option 3, Ely Central is the only flow in this table which has a Long-Distance Bus/Coach service. For this flow, the Long-Distance Bus/Coach does not offer a competitive GJT vs the Do Minimum

2.4.4 Application of background demand change

Our GJT-based forecasts produced using the above methodology use a 2018/2019 demand base. This means that they are predicted levels of demand if the options were implemented and fully operational in 2019.

We have therefore applied estimated background demand change to convert the forecasts into expected future usage, once the options are complete and operational.

We used a four-stage approach to estimate the change in background demand:

1. Application of DfT's July 2020 EDGE model output aggregated to the MOIRA Anglia zoning structure to the 2018/19 demand base. This approach estimates change on current demand levels as a result of factors such as economic change, change in employment, change in population, modal competition and transport costs, using DDG data as its input. It uses the forecasting framework set out in PDFH6. In common with the rest of our methodology, we have applied the same assumptions across all modes of transport. EDGE outputs were used to forecast two future years, 2023/24 and 2040/41, with the appraisal assuming linear growth between the modelled years.

2. The EDGE model outputs are too coarse to show the impact of land usage in Cambridge South area, which is problematic given the level of current and planned future employment and house building. For the Biomedical Campus we have therefore adjusted the employment forecasts by comparing projected levels in the Cambridge Local Plan (CLP) between 2011-2031 with the levels in DfT TEMPRO software. The latter almost identically tracks employment growth in DDG (an input to the EDGE model) so we have uplifted DDG employment levels by the proportionate difference between the CLP and TEMPRO. This uplift has been applied in our demand model to both the Do-Minimum scenario and the options.
3. Similarly, DGG (and TEMPRO) does not account for the planned level of new housing in the Southern Fringe development. We have therefore adjusted population levels in DGG by the proportionate difference in future dwellings between the CLP and TEMPRO. This uplift has been applied in our demand model to both the Do-Minimum scenario and the options.
4. The DDG inputs are of August 2020 vintage and therefore do include the economic impact of COVID-19. They do not however include the behavioural impact of COVID-19, such as long-term shifts to home working. Consistent with DfT policy, we have:
    a. Applied the forecast growth from DfT's EDGE model to produce our Central case. This factor takes into account the longer-term economic damage caused by the pandemic, but does not capture possible long-term behavioural change.
    b. Conducted three sensitivity tests by applying DfT's scenarios based on various long-term behavioural impacts, in particular a greater prevalence of home working. These are reported in Section **Error! Reference source not found.**.

Any demand growth in addition to the background demand forecast is assumed to be newly generated.

2.4.5 Revenue forecasts

For the new rail station (Option 1) we have multiplied our forecast number of passenger journeys by the average yield (2018/19 revenue divided by 2018/19 journeys) from the MOIRA data.

For the Bus and Long-Distance Bus/Coach options we have multiplied our forecast number of passenger journeys by current advertised fares, noting that this may result in an overestimate of revenue as some passengers receive free or concessionary travel.

2.5 Demand and revenue projections

This section presents forecast journeys and revenue for the four options. It should be noted that the "Base" and "Option" figures reported include all public transport demand and revenue to the South Cambridge area.

2.5.1 Option 1 - New Rail Station at Cambridge South

Table 6. Option 1 vs Do Minimum. 2019 Demand (000) (bi-directional, all public transport)

	Origin Zone	Destination Zone	Base Demand	Option Demand	Absolute Change	% Uplift
1	Meldreth & Royston	Biomedical Campus	26	62	36	135.9%
2	Central London	Biomedical Campus	99	133	34	34.4%
3	East Hertfordshire	Biomedical Campus	25	51	26	101.8%
4	Ely Rural	Biomedical Campus	40	59	19	48.4%
5	Ely Central	Biomedical Campus	35	52	17	48.4%
6	West Hertfordshire	Biomedical Campus	15	28	13	89.4%
7	Whittlesford	Biomedical Campus	4	11	7	163.9%
8	Stansted Airport	Biomedical Campus	7	14	7	93.1%
9	Peterborough	Biomedical Campus	13	18	5	40.9%
10	East Midlands	Biomedical Campus	24	28	4	18.2%
	Other Flows		1,540	1,796	256	16.6%
	Total Demand		1,829	2,253	425	23.2%
	Total Demand Generated			425		

Table 7. Option 1 vs Do Minimum. 2019 Revenue (£000, 2018/19 Prices) (bi-directional, all public transport)

	Origin Zone	Destination Zone	Base Demand	Option Demand	Absolute Change	% Uplift
1	Central London	Biomedical Campus	[redacted]			
2	East Hertfordshire	Biomedical Campus				
3	East Midlands	Biomedical Campus				
4	Meldreth & Royston	Biomedical Campus				
5	West Hertfordshire	Biomedical Campus				
6	Stansted Airport	Biomedical Campus				
7	Ely Rural	Biomedical Campus				
8	Peterborough	Biomedical Campus				
9	Ely Central	Biomedical Campus				
10	South Cambridge	Central London				
	Other Flows					
	Total Revenue					
	Total Revenue Generated					

As show in Table 6, it can be seen that Meldreth & Royston, East Hertfordshire and Stansted Airport to the Biomedical Campus all experience a large percentage uplift in demand. This is due a comparably large change in the overall GJT on these flows, due to a low rail frequency in the base. Central London to the Biomedical Campus generates the second largest increase in journeys in absolute terms. Whilst the GJT change is smaller on this flow (due to the rail GJT being higher to Cambridge South vs Cambridge due to the lower frequency, therefore the overall GJT benefit being driven by the reduction in egress time), there is already a significant level of base demand on this flow.

Central London to the Biomedical Campus dominates the revenue change presented in Table 7. This is due to the higher yield (fare) paid by longer distance passengers.

Table 8. Option 1 Demand and Revenue Forecast (£,000, 2018/19 Prices)

	2018/19	2023/24	2040/41
Total Cambridge South Station Demand			
Abstracted from other stations			
Newly Generated			
Total Cambridge South Station Revenue			
Abstracted from other stations			
Newly Generated			
Net Rail Demand			
Net Rail Revenue			

Of the 2,253k option passengers shown in Table 6, it is estimated that 1,612k will transfer to the new station (2018/2019 demand levels). Table 8 shows the forecast for Cambridge South station itself, with demand estimated to rise to 1,833k passengers in 2023/24 and 2,334k by 2040/41.

It is estimated that approximately 75% of this demand is comprised of existing rail passengers, who are abstracted from other rail stations (predominantly Cambridge Station). The remaining 25% of demand is assumed to be newly generated trips to the rail industry.

2.5.2 Option 2 - Local Bus Enhancements

Table 9. Option 2 vs Do Minimum. 2019 Demand (000) (bi-directional, all public transport)

	Origin Zone	Destination Zone	Base Demand	Option Demand	Absolute Change	% Uplift
1	South Cambridge	Central London	254	259	6	2.2%
2	Central London	Biomedical Campus	99	100	1	1.4%
3	South Cambridge	Ely Central	27	28	1	3.0%
4	Ely Rural	Biomedical Campus	40	41	1	1.9%
5	Ely Central	Biomedical Campus	35	36	1	1.9%
6	Meldreth & Royston	Biomedical Campus	26	27	0	1.8%
7	South Cambridge	Stansted Airport	19	19	0	2.4%
8	South Cambridge	Meldreth & Royston	15	15	0	2.9%
9	East Hertfordshire	Biomedical Campus	25	26	0	1.6%
10	Trumpington North	Central London	14	14	0	2.8%
	Other Flows		1,275	1,295	20	1.6%
	Total Demand		1,829	1,860	31	
	Total Demand Generated			31		

Table 10. Option 2 vs Do Minimum. 2019 Revenue (£000, 2018/19 Prices) (bi-directional, all public transport)

	Origin Zone	Destination Zone	Base Demand	Option Demand	Absolute Change	% Uplift
1	South Cambridge	Central London	[redacted]			
2	Central London	Biomedical Campus				
3	Trumpington North	Central London				
4	East Midlands	Biomedical Campus				
5	South Cambridge	Stansted Airport				
6	South Cambridge	South East				
7	South Cambridge	Ely Central				
8	Ely Rural	Biomedical Campus				
9	East Hertfordshire	Biomedical Campus				
10	Shelford	Central London				
	Other Flows					
	Total Revenue					
	Total Revenue Generated					

Table 9 presents the shows a more consistent percentage increase across flows, when compared to Option 1, due to the local bus enhancements offering a smaller (but more consistent) reduction in overall GJT vs the new rail station. Option 2 does still drive an increase in rail demand, due to the shortening of access/egress time to Cambridge station for a portion of the demand base.

Table 11. Option 2 Demand and Revenue Forecast (£,000, 2018/19 Prices)

	2018/19	2023/24	2040/41
Total Bus Demand	[redacted]		
Total Bus Revenue			
Net Industry Demand			
Net Industry Revenue			

It is estimated that Option 2 would generate 31k of additional demand to and from the South Cambridge area (2018/2019 demand levels). This is forecast to rise to 37k passengers by 2023/24 and 50k by 2040/41.

2.5.3 Option 3 - Long Distance Bus/Coach Services

Table 12. Option 3 vs Do Minimum. 2019 Demand (000) (bi-directional, all public transport)

	Origin Zone	Destination Zone	Base Demand	Option Demand	Absolute Change	% Uplift
1	Huntingdon	Biomedical Campus	55	106	52	94.0%
2	St Neots, Bedford & Biggleswade	Biomedical Campus	4	7	3	72.0%
3	Bury St Edmunds & Ipswich	Biomedical Campus	13	14	1	7.3%
4	Ely Central	Biomedical Campus	72	72	-	0.0%
	Total Demand		143	199	55	38.7%
	Total Demand Generated			55		

Table 13. Option 3 vs Do Minimum. 2019 Revenue (£,000, 2018/19 Prices) (bi-directional, all public transport)

	Origin Zone	Destination Zone	Base Demand	Option Demand	Absolute Change	% Uplift
1	Huntingdon	Biomedical Campus	[redacted]			
2	St Neots, Bedford & Biggleswade	Biomedical Campus				
3	Bury St Edmunds & Ipswich	Biomedical Campus				
4	Ely Central	Biomedical Campus				
	Total Revenue					
	Total Revenue Generated					

Table 12 & Table 13 show the demand and revenue uplifts for Option 3. Unlike the other options, only 4 flows are reported as this option only provides services to the catchments of Bury St Edmunds, Ely, Huntingdon and St Neots. Huntingdon and St Neots both see a large percentage increase in demand due to the significant GJT reduction that an express bus/coach could offer. This is because public transport access from these locations is slow in the Do Minimum, due to the need to interchange multiple times to reach the Biomedical Campus.

Bury St Edmunds has a competitive public transport GJT in the Do Minimum, so additional demand is marginal. Due to Ely's high rail frequency in the Do Minimum, our modelling indicates that the express bus/coach is unlikely to offer an overall GJT lower than the Do minimum GJT to the biomedical campus. We have therefore not assumed a demand uplift for this flow.

Table 14. Option 3 Demand and Revenue Forecast (£,000, 2018/19 Prices)

	2018/19	2023/24	2040/41
Total Express Bus/Coach Demand	[redacted]		
Total Express Bus/Coach Revenue			
Net Industry Demand			
Net Industry Revenue			

It is estimated that Option 3 would generate 55k of additional demand to and from the Biomedical Campus (2018/2019 demand levels). This is forecast to rise to 60k passengers by 2023/24 and 70k by 2040/41.

Cost estimates

2.6 Introduction

This section of the report sets out the cost estimates used in the economic appraisal. The costs presented show the infrastructure (capital) and operating costs for each option versus under the Do-Minimum scenario.

All costs are presented in 2020/2021 prices unless stated, with any known Risk and Contingency shown at the P-Mean level.

Costs are subsequently adjusted for use in the VfM analysis in the way set out in TAG. The principal changes are conversion to 2010 prices and values, and bespoke treatment of Risk and Contingency, and Optimism Bias depending on the characteristics of the scheme and maturity of the cost estimates. For simplicity, these adjusted figures are not reported in this section of the report.

2.7 Infrastructure costs

2.7.1 Option 1. New railway station

Table 15 below shows the Anticipated Final Cost (AFC) for the new station at Cambridge South, along with the enabling infrastructure work. The AFC is £162.2m is inclusive of £23.0m of Risk and Contingency at the P-Mean level. Approximately £10.8m of cost has already been incurred or cannot now be avoided, which is the level of funding allocated to GRIP 1-3.

Table 15. Cambridge South Station Infrastructure Cost Estimates, £m. Risk and Contingency at P-Mean

Base Estimate	Risk and Contingency	Anticipated Final Cost	Cost of Work Done*
139.3	23.0	162.2	10.8

Source: Network Rail

* Cost which cannot be avoided even if DfT's next decision were not to continue with the scheme. This is the funding allocated to GRIP 1-3.

The base estimate includes a £5.1m provision for possessions and blockades required during the construction period.

For the purposes of appraisal, we have applied a further 18% optimism Bias to the AFC. This is consistent with TAG for conventional rail projects at Stage 2 (GRIP 3 Option Selection)[3]. This increases the AFC to £191.4m in 2020/2021 prices.

As well as the cost of construction, the new station will also impact future renewals costs in two ways:

[3] TAG UNIT A1.2 Scheme Costs (publishing.service.gov.uk)

- Elements of the new station will wear out within the 60-year appraisal period and require one or possibly two renewals.
- Some of the existing rail infrastructure including signalling equipment and point work at Shepreth Junction are nearing the end of the normal life expected for these components. We anticipate that renewal would be required in, perhaps, Control Period 7. Construction of the station would involve replacement of some of the infrastructure, which is nearing life expiry, therefore avoiding the need for renewal. Additionally, a major upgrade of this nature would provide Network Rail the opportunity to schedule other renewal and maintenance work during the planned construction, saving the need for other route closures and planning work.

Network Rail have indicated that the scope for future renewal works at Shepreth Junction would likely encompass the 'like for like' renewal of 4 switching and crossing units, costing approximately £4.0m. We have therefore removed this cost from our Central Case.

Network Rail's Cambridge Re-Signalling project (C3R), scheduled for completion by 2024, will see a state of the art renewal of the signalling equipment in the Cambridge area. At present, it is estimated that £5-7.5m of efficiencies could be realised with the construction of Cambridge South. Given the uncertainty and range, the potential additional cost savings are reported as sensitivities in Section **Error! Reference source not found.**.

2.7.2 Option 2. Cambridge Busway improvements

We have estimated that 14 additional vehicles would be needed to operate this option and for simplicity, we have assumed that these vehicles would be capital funded at a cost of £350,000 per unit (desktop research). This generates a total cost of £4,900,000 (2018/19 prices).

We have also assumed that vehicles would be replaced every 12 years, with old vehicles being sold for 20% of their new price at this point (desktop research).

2.7.3 Option 3. New Long-Distance Bus/Coach services

We have estimated that 21 additional vehicles would be needed to operate this option and for simplicity, we have assumed that these vehicles would be capital funded at a cost of £500,000 per unit (desktop research). This generates a total cost of £10,500,000 (2018/19 prices).

We have also assumed that vehicles would be replaced every 12 years, with old vehicles being sold for 20% of their new price at this point (desktop research).

2.8 Operating costs

2.8.1 Option 1. New railway station

Operating costs are expected to be relatively modest as all of the trains which would call at the station would operate in the Do-Minimum scenario. This means that costs associated with train procurement, train mileage and train crew are zero. Any additional costs associated with acceleration and braking are assumed to be negligible, therefore no allowance has been made for these.

We have assumed that the station is staffed with three employees during the weekday peak, two during the off peak, and two on Saturdays. This equates broadly to 6 full time equivalent (FTE) staff members. We have assumed at total cost per employee of £35,000 per year, which multiplied by six is a total annual cost of £210,000 (2018/19 prices).

Based on our experience of stations of a similar size elsewhere, we have assumed an allowance of £50,000 (2018/19 prices) per year for station running costs, such as electricity, light maintenance and cleaning.

2.8.2 Option 2. Cambridge Busway improvements

Based on the number of vehicles required, we have assumed that 20 full time equivalent (FTE) staff members are required to operate the additional services. We have assumed at total cost per employee of £35,000 per year, which multiplied by twenty is a total annual cost of £700,000 (2018/19 prices).

We have assumed an allowance of £334,400 (2018/19 prices) per year to cover operational costs. This is calculated from an assumption of £0.41 per vehicle mile, calculated from the PCV consumption parameters stated in TAG A1.3.8.

2.8.3 Option 3. New Long-Distance Bus/Coach services

We have assumed that 27 full time equivalent (FTE) staff members are required to operate the additional services. We have assumed at total cost per employee of £35,000 per year, which multiplied by twenty-seven is a total annual cost of £945,000 (2018/19 prices).

We have assumed an allowance of £425,400 (2018/19 prices) per year to cover operational costs. This is calculated from an assumption of £0.41 per vehicle mile, calculated from the PCV consumption parameters stated in TAG A1.3.8.

Option Value for Money Assessment

2.9 Introduction and assumptions common to all options

This section presents the economic appraisal results for the three main options tested. All values are presented in 2010 Prices and Values over a 60-year appraisal period.

We have assumed that all options are complete and enter service in 2025. This is the expected opening year for the new station at Cambridge South based on Network Rail's accelerated programme proposed as part of Project SPEED. For reasons of consistency we have retained the same opening year for all options, although it may be possible to implement the non-rail options earlier.

Demand, revenue and cost figures are as presented in the previous sections. A cap on demand growth is applied after 20 years (2040) consistent with TAG. A demand ramp-up profile has been used based on the evidence presented in PDFH6, whereby it takes 4 years after opening for passenger levels to reach forecast levels.

2.10 Option 1. Cambridge South Station

2.10.1 Scheme specific assumptions

The following assumptions support the economic appraisal of this option, in addition to those listed in Section 4.1:

- Some through-passengers on trains that call at Cambridge South will incur a time penalty due to the requirement for existing services to slow down, stop at, and accelerate from the new station. The impact of this time penalty has been calculated using train planning work undertaken by Network Rail, where trains in a standard peak and off-peak hour were timetabled. The journey time differences indicated by this work were entered into MOIRA on a train-by-train basis, with the modelling indicating that the impact of increased journey times would lead to a revenue reduction of £716k, and a demand reduction of 107k passengers per annum (2018/19 demand/prices). This impact is relatively modest, as the timetable planning work indicated that the additional 1-2 minutes required to stop at Cambridge South can in most instances be made up on route, with the majority of trains recovering the additional time by the time they make their next station call. The value of time impact arising from this additional journey time is included within our appraisal.
- The AFC for Cambridge South includes a £5.1m provision for possessions and blockades required during the construction period.
- Passenger demand for Cambridge South station will comprise existing rail users (switching from Cambridge station) and new rail users. A proportion of new users are assumed to switch from private car, ranging from 21% to 35% depending on journey origin and destination, based on factors set out in the TAG Databook. No switching factor is included for passengers transferring from bus, as this is not necessary for the calculation of MECs.

2.10.2 Economic appraisal results

Table 16 below shows the headline appraisal outputs for a new rail station at Cambridge South.

This option is estimated to deliver benefits of £173.9m, comprising £165.5m of User Benefits and £8.4m of Non-User benefits.

The net impact on Franchise Premium is £70m, generated by trains calling at the station net of the impact of slowing down trains for through-passengers.

The infrastructure cost is £159.5m, which gives a net cost to DfT of £89.5m. Overall the scheme is estimated to have a Benefit Cost Ratio (BCR) of 1.9. Our assessment therefore suggests that this is a medium Value for Money (VfM) scheme based on the WebTAG categorisation, indicated by a BCR of between 1.5 and 2.0.

Table 16. Option 1 economic appraisal summary results £M 2010 prices and values

Item	Results
Transport User Benefits *(1)*	165.5
Non-User benefits *(2)*	8.4
Present Value of Benefits (PVB) *(4) = (1) + (2) + (3)*	**173.9**
Franchised Revenue *(5)*	[redacted]
Franchised and Network Rail Operating Costs *(6)*	
Net impact on Premium *(7) = (5) + (6)*	
Total Infrastructure Costs *(8)*	-159.5
Present Value of Costs (PVC) *(9) = (7) + (8)*	**-89.5**
Net Present Value (NPV) *(10) = (4) – (9)*	**84.4**
BCR *(11) = (4) / -(9)*	**1.9**

2.11 Option 2. Busway Improvement

2.11.1 Scheme specific assumptions

The following assumptions support the economic appraisal of this option, in addition to those listed in Section 4.1:

- The additional bus services are procured by DfT, therefore all revenue flows back to the government. This may not happen but sets this option on a consistent footing with Option 1.

2.11.2 Economic appraisal results

Table 17 below shows the headline appraisal outputs for enhancing local bus services in the South Cambridge area.

This option is estimated to deliver benefits of £32.3m, comprising £31.4m of User Benefits and £0.9m of Non-User benefits.

The net impact on Franchise Revenue is -£23.7m, driven by the additional bus operating costs exceeding the forecast revenues.

The capital cost is £8.6m, which gives a net cost to DfT of £32.2m. Overall the scheme is estimated to have a Benefit Cost Ratio (BCR) of 1.0. Our assessment therefore suggests that this is a low Value for Money (VfM) scheme based on the WebTAG categorisation, indicated by a BCR of between 1.0 and 1.5.

Table 17. Option 2 economic appraisal summary results £M 2010 prices and values

Item	Results
Transport User Benefits *(1)*	31.4
Non-User benefits *(2)*	0.9
Present Value of Benefits (PVB) *(4) = (1) + (2) + (3)*	**32.3**
Bus and Rail Revenue *(5)*	[redacted]
Bus Operating Costs *(6)*	
Net impact on Premium *(7) = (5) + (6)*	
Total Capital Costs *(8)*	-8.6
Present Value of Costs (PVC) *(9) = (7) + (8)*	**-32.2**
Net Present Value (NPV) *(10) = (4) – (9)*	**0.1**
BCR *(11) = (4) / -(9)*	**1.0**

2.12 Option 3. New Long-Distance Bus/Coach services

2.12.1 Scheme specific assumptions

The following assumptions support the economic appraisal of this option, in addition to those listed in Section 4.1:

- The additional bus/coach services are procured by DfT, therefore all revenue flows back to the government.
- As the bus/coach services will not impact rail demand, the impact of MECs[4] have been excluded from this appraisal. This is acknowledged as a modelling simplification, but is unlikely to have a material impact on the benefits generated by this option.

2.12.2 Economic appraisal results

Table 18 below shows the headline appraisal outputs for providing new long-distance bus/coach services to the Biomedical Campus.

[4] Marginal cost of reduced highway traffic

This option is estimated to deliver benefits of -£1.0m, comprising £0.7m of User Benefits and -£1.7m of Non-User benefits. The negative non-user benefits are driven by a reduction in indirect taxation.

The net impact on Premium is -£38.4m, driven by the operating costs exceeding the forecast revenues.

The capital cost is £13.1m, which gives a net cost to DfT of £51.5m. Overall the scheme is estimated to have a Benefit Cost Ratio (BCR) of 0. Our assessment therefore suggests that this is a poor Value for Money (VfM) scheme based on the WebTAG categorisation, indicated by a BCR of less than 1.0.

Table 18. Option 3 economic appraisal summary results £M 2010 prices and values

Item	Results
Transport User Benefits *(1)*	0.7
Non-User benefits *(2)*	-1.7
Present Value of Benefits (PVB) *(4) = (1) + (2) + (3)*	**-1.0**
Coach Revenue *(5)*	[redacted]
Coach Operating Costs *(6)*	
Net impact on Premium *(7) = (5) + (6)*	
Total Capital Costs *(8)*	-13.1
Present Value of Costs (PVC) *(9) = (7) + (8)*	**-51.5**
Net Present Value (NPV) *(10) = (4) – (9)*	**-52.5**
BCR *(11) = (4) / -(9)*	**0.0**

2.13 Comparison of the headline appraisal results

Table 19 shows a comparison of the three options tested.

Option 1 delivers significantly more benefits than the other options. User benefits are high due to higher patronage levels and overall time reductions, leading to a significantly greater level of time savings. The higher patronage levels also create non-user benefits greater than the other options, due to subsequent decrease in highway traffic. Option 3 delivers negative non-user benefits due to the exclusion of MECs in this option. The -£1.7m represents the loss of indirect taxation.

Option 1 is the only option to deliver a positive impact on operating premium to DfT. The higher levels of demand generation in Option 1 enable the rail option to deliver significantly higher revenue benefits with comparably low operating costs. Due to a larger number of staff and vehicle operating costs in Options 2 & 3, revenues do not exceed operating costs in these options.

Option 1 does have significantly higher capital costs than Options 2 & 3, due to the additional infrastructure requirements for the new station, which ultimately leave this option with the highest Present Value of Costs.

However, the benefits generated by Option 1 are significant enough to offset the PVC at a ratio of 1.9. This appraisal therefore indicates that Option 1 presents a Value for Money significantly greater than the other two options.

Table 19. Comparison of the three options tested. £M 2010 prices and values

Item	Option 1	Option 2	Option 3
Transport User Benefits *(1)*	165.5	31.4	0.7
Non-User benefits *(2)*	8.4	0.9	-1.7
Present Value of Benefits (PVB) *(4)* = *(1)* + *(2)* + *(3)*	**173.9**	**32.3**	**-1.0**
Fares Revenue *(5)*	[redacted]		
Franchised and Network Rail Operating Costs *(6)*			
Net impact on Premium *(7)* = *(5)* + *(6)*			
Capital Costs *(8)*	-159.5	-8.6	-13.1
Present Value of Costs (PVC) *(9)* = *(7)* + *(8)*	**-89.5**	**-32.2**	**-51.5**
Net Present Value (NPV) *(10)* = *(4)* – *(9)*	**84.4**	**0.1**	**-52.5**
BCR *(11)* = *(4)* / -*(9)*	**1.9**	**1.0**	**0.0**
VfM Category	***Medium***	***Low***	***Poor***

2.14 Alignment to the Key Objectives

The strategic case outlined 5 key objectives and set out 7 indicators of success. The economic case has allowed some of these to be quantified. Given the Low and Poor VfM of Option 2 and 3 respectively, this section only compares Option 1 against the Key Objectives.

Indicator 1: Change in the average total end to end (generalised) journey time and cost for public transport trips to the Biomedical Campus. *This is a new indicator added at the OBC stage as it is a strong measure of sustainable transport access*

Table 19Table 20 below shows the weighted average GJT for trips to and from the Biomedical Campus in both the Do Minimum and Option 1, by ticket type. A new station at Cambridge South has the potential to deliver significant GJT reductions.

Table 20. Weighted average GJT for trips to and from the Biomedical Campus

	Full	Reduced	Season
Do Minimum GJT	144.4	175.4	131.5
Option 1 GJT	122.3	137.5	98.7
Change	-15%	-22%	-25%

Indicator 2: Total population within a specific public transport journey time band (to be defined) from the centre of the Southern Fringe development and the centre of the Biomedical Campus (with and without the scheme).

Table 21 below shows the total population by GJT band from the Biomedical Campus (cumulative). The construction of a new station would bring an additional 599k people within 60 minutes, and 1.775m within 90 minutes. Population from this assessment was sourced from ONS[5] at an LSOA level.

Table 21. Cumulative population by GJT band to/from the Southern Fringe and Biomedical Campus area

	<30 mins	<60 mins	<90 mins	<120 mins	<240 mins
Do Minimum	-	169,617	297,815	2,308,232	19,201,672
Option 1	-	768,534	2,072,544	5,554,943	28,208,444
Change	-	598,917	1,774,728	3,246,711	9,006,771

Indicator 3: Total capacity of all public transport services arriving into the Southern Fringe and Biomedical Campus area during the AM peak hour (with and without the scheme)

Whilst capacity is not intrinsically included within our modelling, building a new rail station at Cambridge South is likely to increase public transport carrying capacity to the campus by approximately 4,000 passengers per hour.

Indicator 4: Journey to work % mode shares for Biomedical Campus employees (before and after scheme implementation)

We have not received the necessary employee survey data necessary to measure the completion of this objective.

Indicator 5: Estimated % of Biomedical Campus journeys to work by public transport that travel via Cambridge city centre during the AM peak period, including Cambridge station (before and after scheme implementation)

We have not received the necessary employee survey data necessary to measure the completion of this objective.

[5] Lower layer Super Output Area population estimates - Mid-2019: SAPE22DT2 edition

Indicator 6: Time taken (minutes) to access Thameslink and East West Rail service (if delivered) from the centre of the Southern Fringe development area and the centre of the Biomedical Campus.

The TSS developed by Network Rail assumes that some Thameslink services will call at Cambridge South. Whilst not yet a committed scheme, it is envisioned that a proportion of East West Rail services will also stop at the station. Therefore, access to these services reduces from a GJT of 41 minutes to 9 minutes.

Indicator 7: End to end public transport journey times between the centre of the Biomedical Campus and London Heathrow, Gatwick, and Stansted airports (with and without the scheme)

Table 22 below shows the GJT for trips to and from the Biomedical Campus to the model zones containing Stansted, Heathrow and Gatwick airports in both the Do Minimum and Option 1, by ticket type. A new station at Cambridge South has the potential to deliver significant GJT reductions to all of these international gateways.

Table 22. GJT for trips to and from the Biomedical Campus to International Gateways

Stansted	Full	Reduced	Season
Do Minimum GJT	150.1	138.9	143.6
Option 1 GJT	103.6	95.2	100.1
Change	-31%	-31%	-30%
Heathrow	**Full**	**Reduced**	**Season**
Do Minimum GJT	245.3	213.9	185.4
Option 1 GJT	206.1	175.5	146.1
Change	-16%	-18%	-21%
Gatwick	**Full**	**Reduced**	**Season**
Do Minimum GJT	280.6	292.0	303.9
Option 1 GJT	243.6	254.4	276.8
Change	-13%	-13%	-9%

2.15 Wider Economic Benefit Assessment

The importance of improved transport networks and connectivity to support economic growth and development in Cambridge is highlighted in local policy documents including the GCCD and Local Plans for Cambridge and South Cambridgeshire. The proposed Cambridge South station reflects the overarching policy objectives and, more specifically, has the potential to significantly contribute to developing sites around the Cambridge Biomedical Campus. The Campus, which is key to economic growth in Cambridge and the wider region, is already an internationally recognised centre of excellence and will continue to grow in future, as global companies such as Astra Zeneca move to the site and the region's hospitals are consolidated in the area. This growth requires strategic transport improvements, especially as congestion in Cambridge is already recognised as a problem. While it is likely that the next phase of development at the Campus (Phase 2) will go ahead without the station, guidance from DfT provided at SOBC

stage indicates that development would be reduced by about 20% if the station is not constructed. Further work could refine this high-level assessment but in lieu of further information this has not been possible. Overall, we conclude that the station will have a positive effect on the site's economic development, on the basis that it will help to reduce congestion and support the attractiveness of site for businesses, residents and workers choosing to locate here.

The proposed station will support the GCCD strategy by providing new transport links between areas of population and employment growth within Greater Cambridge, thereby addressing congestion and public transport issues to help stimulate further economic growth[6]. There are a number of key routes by which the proposed station will contribute towards this, namely:

- By supporting **business investment and growth** – better connectivity and capacity for the future (through lower congestion and investment in long term infrastructure) to enhance the investment prospects of the corridor area and potentially result in quicker development along the corridor at the key growth sites.
- By supporting **labour market mobility** – journey time savings will improve labour market mobility as journeys to work become more efficient. This will improve the connectivity between key employment sites and labour markets. Ultimately, this will benefit both the workforce, who can access more opportunities, as well as employers, who can access a wider labour market.
- By contributing to the **positive image and perceptions of Greater Cambridge –** high quality and efficient infrastructure promotes a positive image of Greater Cambridge as a place to live, invest and do business. Helping to tackle congestion, by promoting alternatives to the private car, contributes to a higher quality of life through reduced severance, improved air quality, reductions in road safety concerns etc. These help to sustain and improve attributes that have played a crucial role in the city's success to date.
- By contributing towards **future development and growth –** significant development is planned around the station, which is likely to only increase as time progresses, especially as Greater Cambridge has the quantum of employment land supply, and the demand therefore, to support further growth. Options that could provide higher capacity in the future and which provide possible upgrades for the future will represent an investment for longer term economic growth. In practice, there may be scope for both further accelerated development through infrastructure investment prior to 2031 and/or an increased rate of growth post-2031.

Based on the land use information provided in the local development plans of Cambridge City Council, the following outputs were generated by Mott MacDonald's Transparent Economic Assessment Model (TEAM). The results of our quantitative assessment for Phase 2 at Cambridge Biomedical Campus are:

- A total of 219 net additional jobs could be supported which could deliver £12.4m GVA per annum once the site is fully developed and occupied.
  - With a 20% level of attribution this would mean that **44 net additional jobs** could be attributed to the station, delivering approximately **£2.5m GVA per annum**.

The development of housing sites identified near the proposed station would also provide economic benefits through construction, tax revenues and LVU. These estimates are outlined below:

[6] GCCD, UK Government, p.3

- 105 jobs and £7.0m GVA p.a. in construction benefits for the development of the 3,300 total dwellings around the station.
  - With a 20% level of attribution this would mean that **21 jobs** and **£1.4m GVA** in construction benefits could be attributed to the station from the construction of these dwellings.
- £6.7m p.a**.** in Council Tax revenues from the construction of 3,300 dwellings.
  - With a 20% level of attribution this would mean that **£1.3m per annum** of housing related Council Tax revenue is projected from dwellings which may not be brought forward but for the proposed Cambridge South Station.
- In total £271m net additional (Present value over 30 years) in LVU benefits will be achieved through the development of the proposed residential sites identified around the station.
  - With a 20% level of attribution this would mean that £**54m of LVU** (Present value over 30 years) could be attributed to the station.

Sensitivity tests

2.16 Sensitivity Test Results

This section presents the sensitivity tests undertaken.

Table 23: Sensitivity tests summary

Test	PVB (£ million)	PVC (£ million)	BCR	VfM Category
Central case	173.9	89.5	1.9	Medium
COVID Long Term Behavioural Impact Sensitivities[7]				
Option 1 (New Rail Station) - High Recovery	171.8	90.5	1.9	Medium
Option 1 (New Rail Station) - Medium Recovery	142.9	103.7	1.4	Low
Option 1 (New Rail Station) - Low Recovery	115.0	116.4	1.0	Low
Option 2 (Bus Enhancements) - High Recovery	29.1	32.4	0.9	Poor
Option 2 (Bus Enhancements) - Medium Recovery	24.2	34.6	0.7	Poor
Option 2 (Bus Enhancements) - Low Recovery	19.5	36.8	0.5	Poor
Option 3 (Long Distance Bus/Coach) - High Recovery	-1.0	51.6	-	Very Poor
Option 3 (Long Distance Bus/Coach) - Medium Recovery	-0.8	53.4	-	Very Poor
Option 3 (Long Distance Bus/Coach) - Low Recovery	-0.7	55.2	-	Very Poor
Option 1 Cost Sensitivities				
£5m additional renewals efficiencies (C3R)	173.9	84.3	2.1	High
£7.5m additional renewals efficiencies (C3R)	173.9	81.7	2.1	High
Switching Point - High VfM[8]	173.9	87.0	2.0	High
Switching Point- Low VfM[9]	173.9	115.9	1.5	Low
Option 1 Timescale Sensitivities (Delay Only - No Cost Escalation)				
2 Year Delay - Station Opening Date of 2027	171.4	92.3	1.9	Medium
5 Year Delay - Station Opening Date of 2030	167.6	96.7	1.7	Medium
Option 1 Modelling Sensitivities				
GJT elasticity uncapped[10]	431.6	184.8	-2.3	Very High & Financially Positive
10 Year Delay - Additional Employment Growth[11]	173.6	90.0	1.9	Medium
10 Year Delay - Additional Housing Growth[12]	173.9	89.6	1.9	Medium
Inclusion of WEBs[13] (Adjusted BCR)	228.1	89.5	2.5	High
Option 1 WebTAG sensitivities				
Passenger growth capped 10 years from now	161.3	106.1	1.5	Medium
Passenger growth capped 30 years from now	183.1	75.2	2.4	High

Source: Mott MacDonald

[7] DfT Long-Term COVID Demand Recovery Factors v13 for Greater Anglia: High: 98.8%, Medium: 82.2%, Low: 66.1%.

[8] Requires a capital cost reduction of £2.4m (AFC reduction of 1.5%)

[9] Requires a capital cost increase of £25.4m (AFC increase of 15.7%)

[10] Weighted average GJT elasticity increases from -1.25 to -3.49. This significantly increased demand (and PVB), as well as premium paid back to govt (PVC).

[11] Impact is small due to the delay impacting both the Do-Minimum and the option

[12] Impact is small due to the delay impacting both the Do-Minimum and the option

[13] Includes the Land Value Uplift identified in the WEBs assessment. Benefit of jobs/temporary construction jobs excluded, as these were not deemed to be net additional to the UK.

A. Appraisal summary tables

This appendix sets out the detailed appraisal results for the best performing option.

A.1.1 Option 1. Cambridge South Station

Analysis of Monetised Costs and Benefits

Noise	194,147	*(12)*
Local Air Quality	499,314	*(13)*
Greenhouse Gases	1,921,635	*(14)*
Journey Quality		*(15)*
Physical Activity		*(16)*
Accidents	3,053,095	*(17)*
Economic Efficiency: Consumer Users (Commuting)	99,590,407	*(1a)*
Economic Efficiency: Consumer Users (Other)	59,913,648	*(1b)*
Economic Efficiency: Business Users and Providers	22,706,714	*(5)*
Wider Public Finances (Indirect Taxation Revenues)	-14,113,455	*- (11) - sign changed from PA table, as PA table represents costs, not benefits*
Present Value of Benefits (see notes) (PVB)	173,765,505	*(PVB) = (12) + (13) + (14) + (15) + (16) + (17) + (1a) + (1b) + (5) - (11)*

Broad Transport Budget	89,484,416	*(10)*
Present Value of Costs (see notes) (PVC)	89,484,416	*(PVC) = (10)*

OVERALL IMPACTS		
Net Present Value (NPV)	84,281,089	NPV=PVB-PVC
Benefit to Cost Ratio (BCR)	1.94	BCR=PVB/PVC

Note: This table includes costs and benefits which are regularly or occasionally presented in monetised form in transport appraisals, together with some where monetisation is in prospect. There may also be other significant costs and benefits, some of which cannot be presented in monetised form. Where this is the case, the analysis presented above does NOT provide a good measure of value for money and should not be used as the sole basis for decisions.

Economic Efficiency of the Transport System (TEE)

Non-business: Commuting	**ALL MODES**		**ROAD**		**BUS and COACH**	**RAIL**		**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**		**Passengers**	**Passengers**		
Travel time	99,590,407		9,081,212			90,509,195		
Vehicle operating costs								
User charges								
During Construction & Maintenance								
NET NON-BUSINESS BENEFITS: COMMUTING	99,590,407	*(1a)*	9,081,212		-	90,509,195		

Non-business: Other	**ALL MODES**		**ROAD**		**BUS and COACH**	**RAIL**		**OTHER**
User benefits	**TOTAL**		**Private Cars and LGVs**		**Passengers**	**Passengers**		
Travel time	59,913,648		5,742,934			54,170,714		
Vehicle operating costs								
User charges								
During Construction & Maintenance								
NET NON-BUSINESS BENEFITS: OTHER	59,913,648	*(1b)*	5,742,934		-	54,170,714		

Business								
User benefits			**Goods Vehicles**	**Business Cars & LGVs**	**Passengers**	**Freight**	**Passengers**	
Travel time	22,706,714			1,897,579			20,809,134	
Vehicle operating costs								
User charges								
During Construction & Maintenance								
Subtotal	22,706,714	*(2)*		1,897,579			20,809,134	
Private sector provider impacts						**Freight**	**Passengers**	
Revenue	[redacted]						[redacted]	
Operating costs								
Investment costs								
Grant/subsidy								
Subtotal	-	*(3)*				-	-	
Other business impacts								
Developer contributions		*(4)*						
NET BUSINESS IMPACT	22,706,714	*(5) = (2) + (3) + (4)*						

TOTAL		
Present Value of Transport Economic Efficiency Benefits (TEE)	182,210,769	*(6) = (1a) + (1b) + (5)*

Notes: Benefits appear as positive numbers, while costs appear as negative numbers.
All entries are discounted present values, in 2010 prices and values

B. Wider Economic Benefit Assessment

1 Introduction

In this technical note, we provide a high-level analysis of the potential economic impacts of development around the proposed Cambridge South station. Through understanding the land allocations in the surrounding area, including the nearby Cambridge Biomedical Campus, we identify the employment and residential development potential for sites. This note considers:

- Policy context
- Employment site impacts
    - Jobs and GVA impacts from identified employment sites;
- Housing site impacts
    - Temporary construction impacts - Jobs and GVA supported through the construction of housing;
    - Council tax benefits from housing; and
    - Land value uplift from identified housing sites

1.1 Scheme Objectives

The proposed Cambridge South station would serve the area south of the city with trains into the centre of Cambridge, including Addenbrooke's Hospital and Cambridge Biomedical Campus. Addenbrooke's Hospital to the south of Cambridge is a major employment centre and a renowned teaching hospital linked to Cambridge University. Surrounding the hospital is the emerging Cambridge Biomedical Campus. At present approximately 20,000 people are employed on the hospital and biomedical campus, with this figure expected to rise by an additional 1,000 staff by 2021[14], with 27,000 jobs by 2031. Royal Papworth Hospital has relocated to the Biomedical Campus, with a new 310-bed specialist cardiac facility.

The Cambridge Biomedical Campus is soon expected to house the largest concentration of biomedical expertise in Europe, including an international conference centre and high capacity hotel. Strong employment growth is anticipated to continue as the campus develops. Based on the current employment growth trajectory, the number employed could reach almost 27,000 by the early 2030s.

Given the nature of the biomedical industry, excellent transport provision will be required so that the highly skilled workforce and visitors are able to travel to the campus.

Cambridge South would be served by 7.5 trains per hour (7 or 8 depending on the direction of travel) in the off peak and 6.5 trains per hour in the peak. These station calls would be spread across the various types of existing services which operate the line to Cambridge, including trains/from London King's Cross, London Liverpool St, Stansted Airport, Birmingham New Street, Peterborough and Norwich.

[14] Estimate provided by Addenbrooke's Hospital, October 2017.

2 Economic Growth Context

The UK's long term economic plan, besides focusing on reducing the public deficit, looks at delivering supply side reforms, including investment in infrastructure, necessary to improve long-term productivity growth[15]. However, the outlook for the global economy has declined and in advanced economies there are growing concerns about productivity growth, high debt levels and deflationary risks. The UK is not immune to global slowdowns and shocks which reinforce the importance of long term supply-side investments and ensuring the growth of competitive and sustainable economic activity (namely innovation-led sectors).

Cambridge is one of the UK's most successful cities where economic success, high quality of life and quality of place are inextricably linked[16]. In 2018, Cambridge was ranked as the most vibrant place to live and work in England (a position Cambridge has held for the last 5 years) according to Grant Thornton's Vibrant Economy Index, which takes into account measures including: prosperity; inclusion & equality; community; well-being, and opportunity[17], The thriving hi-tech and biotech industry, which has developed since the 1960s and is known as the 'Cambridge Phenomenon', accounts for 17.8% of employment in Greater Cambridge boasts one of the highest concentration of Nobel prize winners in the world[18]. Cambridge is one of the UK's fastest-growing and most productive cities and is integral to the UK's long term economic plan which seeks to improve productivity and international competitiveness. It helps the UK to compete globally, attracting high value jobs and net economic growth through internationally mobile employees in knowledge-based industries. Cambridge overachieves in all key economic areas with low unemployment (in 2019, 2.9% of Cambridge residents were unemployed, compared to 4.0% for Great Britain[19]), a competitive structured economy, and high levels of knowledge intensive activities (as of 2020, 17.8% of Cambridge's workforce was engaged in Professional, Scientific and Technical Activities compared to 8.7% for Great Britain)[20].

Despite this economic success, Cambridge faces supply-side threats to its economic growth, as evidenced by increasing congestion and rising house prices, both directly influenced by a lack of housing supply. Cambridge's success is founded upon the connectivity across the city and its surrounds that has allowed wide networks to develop and facilitated a culture of cooperation and cross-fertilisation between entrepreneurs, businesses, and academia. The infrastructure of the area therefore needs to support the area's actual and potential pace of growth and the opportunities that exist to continue growing an advanced economy and competing on the international stage.

2.1 Policy and planning review

The **Greater Cambridge Greater Peterborough Enterprise Partnership Strategic Economic Plan (SEP),** which was revised in 2016, seeks to generate a £2.8bn per annum uplift in GVA, by delivering 70,000 new jobs and 50,000 new dwellings.

[15] HM Treasury (2016) 2016 Budget

[16] Cambridge City Council (2018) Cambridge Local Plan

[17] Grant Thornton (2018) 'Vibrant Economy Index'

[18] Using EEFM Baseline Forecast 2019 data. Relates to Greater Cambridge core high-tech and biotech industry as can be best defined in the data as encompassing telecoms, computer related activity, research & development, and business services.

[19] ONS Annual Population Survey (2019)

[20] ONS Business Register and Employment Survey (2019)

The **Greater Cambridge City Deal**[21] (GCCD) emerged from the SEP process and is a deal with Government that will enable a new wave of innovation-led growth by investing in infrastructure, housing and skills, thereby addressing housing shortages and high congestion levels in order to support and facilitate the continued growth of the Cambridge Phenomenon. The City Deal aims to deliver the sustainable growth that is identified in the two local plans:

- 44,100 jobs; and
- 33,500 dwellings.

As part of the assurance framework, Greater Cambridge[22] authorities will prioritise projects that deliver against the following four strategic objectives of the GCCD:

- **Create and retain investment** to nurture the conditions necessary to enable the potential of Greater Cambridge to create and retain the international high-tech businesses of the future.
- **Targeted business investment supporting the Cambridge Cluster** to the needs of the Greater Cambridge economy by ensuring those decisions are informed by the needs of businesses and other key stakeholders such as the universities.
- **Improve connectivity and networks** between clusters and labour markets so that the right conditions are in place to drive further growth.
- **Attract and retain skills** by investing in transport and housing whilst maintaining a good quality of life, in turn allowing a long-term increase in jobs emerging from the internationally competitive clusters and more university spin-outs.

A Cambridge South station will contribute to all of these strategic objectives, as it would provide the necessary conditions for Cambridge to flourish. By improving connectivity with the proposed station, new and existing high-tech businesses in both southern Cambridge and the city centre, including the Cambridge Biomedical Campus in southern Cambridge, will be able to attract and retain a skilled workforce from across the region.

The growth targets within the GCCD come from the **Local Plans**[23] which set out the planning frameworks to guide the future development of Greater Cambridge over 2011-2031. The strategies were informed by various documents[24] which provided the basis for the population, employment and housing growth targets.

Overall, the total growth over the planning period (2011-2031) was established as an additional 44,100 jobs and 33,500 dwellings in Greater Cambridge, based on a projected population growth of 64,000 people. This translates in business floorspace terms to a net demand for 213,200m^2 of additional floorspace and approximately 20,460 B-use jobs. Considering the existing stock of employment land only (not considering the quality or suitability), particularly in southern Cambridge, demonstrates that Greater Cambridge has the land availability to support the targets of both this planning period and growth ambitions post-2031.

[21] Greater Cambridge City Deal (2014) available at: https://www.scambs.gov.uk/sites/default/files/documents/Greater_Cambridge_City_Deal_Document.pdf

[22] Defined as Cambridge City and South Cambridgeshire District

[23] Cambridge Local Plan 2018 and South Cambridgeshire Local Plan 2018

[24] Strategic Housing Land Availability Assessment (SHLAA), August 2013 and the Employment Land Review Update and Review of Selective Management Employment Policies, SQW with Savills, July 2012. The projections within the SHLAA are informed from the following technical paper - Population, Housing and Employment Forecasts Technical Report, Cambridgeshire County Council Research and Performance Team, April 2013

Table 2.1: Cambridge and South Cambridgeshire – Development levels 2011-2031

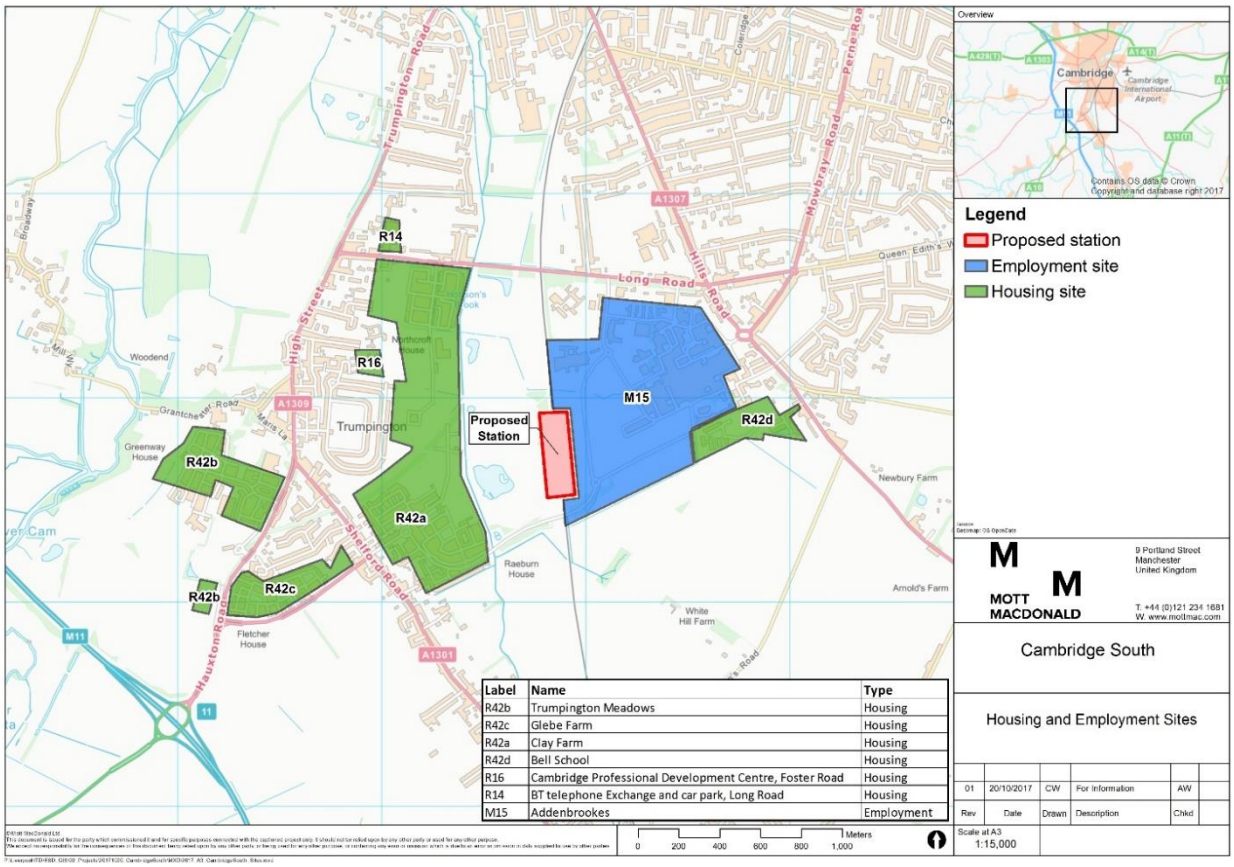
		Housing		Employment		
	Population change (persons)	Dwellings	Total jobs	B-use jobs	Additional net B-use floorspace	Employment land supply
Cambridge	26,000	14,000	22,100	8,800	70,200 m2	12.0 ha
South Cambridgeshire	38,000	19,500*	22,000	11,800-12,000	143,000m2	80.3 ha
Greater Cambridge	64,000	33,500	44,100	20,600	213,200m2	92.3 ha

Source: Cambridge Local Plan 2018 and South Cambridgeshire Local Plan 2018

The proposed station at Cambridge South would support employment and housing development land to be brought forward, helping to fulfil the need for development land around the city.

The employment and housing development sites close to the proposed Cambridge South station are shown in Figure 2.1 below.

Figure 2.1: Development sites around the proposed South Cambridge station



Source: Mott MacDonald, based on Cambridge Local Plan 2018

2.2 Cambridge Biomedical Campus

The Cambridge Biomedical Campus, located in southern Cambridge near to the proposed station site, is one of the largest centres of health science and medical research in the world and the largest such centre in Europe. Managed by the University of Cambridge, the site is funded by organisations including the Cambridge University Hospitals NHS Foundation Trust, the Wellcome Trust, Cancer Research UK, the UK government's Medical Research Council and has National Institute for Health Research Biomedical Research Centre status. It is an accredited UK academic health science centre (Cambridge University Health Partners) and home to Addenbrooke's Hospital and the university's medical school. The Papworth Hospital was also relocated to the site in 2018.

The expansion of the Campus is taking place in two phases. Phase 1 comprises 70 acres of which one third will accommodate Cambridge University Hospitals, with the remaining two thirds for commercial and other uses. All of the Phase 1 land has now been allocated and construction of several sites has started. Phase 1 has predominantly been concluded in 2020, with the final units delayed due to the coronavirus pandemic. In February 2017, the developer (Liberty and Countryside) submitted an application for outline planning consent for Phase 2 which comprises an additional 14 acres of land which was ring-fenced for future development by the local authority in 2009[25].

To reflect this planned growth, access to the Campus has been significantly enhanced with the opening of two new roads leading to and from the M11 motorway (Addenbrooke's Road and Francis Crick Avenue). A new multi-storey car park has opened, and a state-of-the-art energy centre is also planned[26].

There is also a drive to increase sustainable methods of transport to the Campus. A Campus-wide Travel Transport and Sustainability working group has been set up to ensure that the Campus is established as a recognised centre of excellence in the provision of environmentally sustainable physical and social infrastructure for the benefit of the campus partners as well as the local community. A Transport strategy and 5-year implementation plan was produced in 2018 to support this which sets out their strategy to increase sustainable transport to and around the campus, acknowledging the challenges the area faces in terms of increased congestion resulting in unpredictable journey times, poor air quality and poor walking and cycling infrastructure provision[27].

2.3 Summary

There is strong support for Cambridge South station from local policy and planning documentation and the station supports all of the key objectives outlined in the GCCD. The Cambridge Biomedical Campus is already a centre of excellence and will require strategic transport improvements to continue along its positive trajectory.

[25] Cambridge Biomedical Campus 'Masterplan and new buildings' available at: http://cambridge-biomedical.com/about-the-campus-2/masterplan-2/

[26] Cambridge Biomedical Campus 'Masterplan and new buildings' available at: http://cambridge-biomedical.com/about-the-campus-2/masterplan-2/

[27] CBC Transport Strategy and 5-Year Implementation Plan | Cambridge Biomedical Campus (cambridge-biomedical.com)

3 Employment site impacts

3.1 Introduction

In this section, we identify and quantify the potential economic benefits of the development at the employment site identified in Figure 2.1. This site forms part of the development around Addenbrooke's hospital and is Phase 2 of the Cambridge Biomedical Campus. The details of the site are shown in Table 3.1 below.

Table 3.1: Employment development sites

Site name	Use	GEA floorspace (sq m)	NIA Floorspace (sqm)[28]
CBC Phase 2 – Site 1	Research and Development (B1b)	49,710	42,254
CBC Phase 2 – Site 2	Research and Development (B1b)	15,900	13,515
Abcam Site (part of Phase 2)	50% Research and Development (B1b); 50% Professional services (B1a)[29]	9,290	7,897
Total		**74,900**	**63,665**

Source: Cambridge Biomedical Campus – Phase 2: https://cambridge-biomedical.com/property/

3.2 Methodology

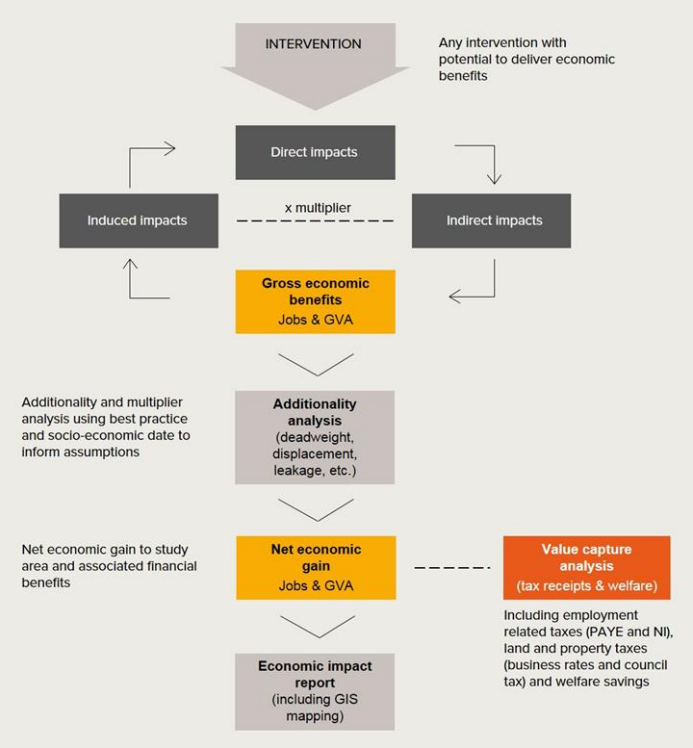
The quantitative economic analysis of land utilisation has been undertaken using Mott MacDonald's proprietary Transparent Economic Assessment Model (TEAM) to assess high level economic impacts. TEAM (as summarised in Figure 3.1 below) is a versatile tool designed to calculate the economic impact of proposed infrastructure intervention and policy measures. It has been designed by experts in economics, economic development and regeneration and is in-line with HM Treasury Green Book principles and Homes & Communities Agency's (HCA) Additionality guidelines. The tool measures the potential stimulus to economic activity within an impact area (in this case southern Cambridge) from interventions by estimating the consequential employment, salary, GVA and investment benefits that would otherwise not have arisen.

The findings from our research have been used to deliver a high-level run of TEAM. The assumptions we have used are detailed below, followed by the findings from this economic assessment. At each stage of our analysis we have endeavoured to produce conservative estimates.

[28] Gross floorspace has been converted to net internal area by applying a GEA to NIA converter of 85%

[29] The use has assumed to be split equally between

Figure 3.1: TEAM Methodology



Source: Mott MacDonald

The potential economic benefits of the development site identified have been assessed using TEAM through the following steps:

- Calibrating the model with the key site details as outlined in Table 3.1
- Calculation of **direct** economic impacts through feeding the proposed uses by size through TEAM to calculate the direct effects of the sites in terms of employment and economic output (measured by GVA) of the sites being fully developed.
- **Indirect** and **induced** effects of the sites being developed from those supported further down the supply chain and employment and activity supported by the incomes of those directly or indirectly employed (through consumption multiplier effects).

3.3 Assumptions

The key assumptions used in our analysis for the site are as follows:

Table 3.2: Assumptions used in TEAM calculation

Effect	Level	Justification
Displacement	25%	At this point, it is not known whether any of the activity on the site will be relocated from elsewhere within Cambridge. However, the speculative development at the site indicates that there is demand for these development sites and jobs in the area and the future residents of the adjacent residential sites will likely benefit from the employment opportunities. As such, while there are expected to be some displacement effects, this will be to a limited extent and a figure of 25% has been assigned, in accordance with guidance from the HCA Additionality Guide 2014[30].

[30] 'Homes & Communities Agency (2014) 'Additionality Guide', page 30, available at:
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/378177/additionality_guide_2014_full.pdf

Leakage	60%	In Cambridge, 60% of those working in the area live outside of the boundary. The leakage set reflects this. This is based on Travel to Work (TTW) data from the 2011 UK census.
Deadweight	50%	Given the demand for employment space at the Campus, it is considered very likely that many of the jobs and GVA generated by these developments would be created without the station at some stage. However, the construction of the station is likely to accelerate development. Accordingly, a medium figure of 50% for deadweight has been selected.
Composite multiplier	1.29	The knock-on multiplier effects within the economy from: • Supply linkages due to purchases made as a result of the intervention and further purchases associated with linked firms along the supply chain (indirect effects). • Indirect or induced effects associated with local expenditure as a result of those who derive incomes from the direct and supply linkage impacts of the intervention. A composite multiplier of 1.29 has been applied, in accordance with guidance from the HCA Additionality Guide 2014 which states that this level is suitable when assessing B1 interventions in a local area. This multiplier models the indirect and induced economic impacts. This composite multiplier includes a supply linkage multiplier and a consumption multiplier. The supply linkage multiplier is *"due to purchases made as a result of the intervention and further purchases associated with linked firms along the supply chain"*[31]. The consumption multiplier is *"associated with local expenditure as a result of those who derive incomes from the direct and supply linkage impacts of the intervention"*[32].
GVA per worker (2021 prices)	£57,278	GVA figures have been calculated based on applying average GVA per worker at the East of England level. This figure has been sourced from the ONS Economic Output and Productivity data set from 2018 and has been inflated using ONS quarterly national accounts data.
Occupancy rate	75%	An occupancy rate of 75% has been applied.
Employment density	50m² of NIA/FTE	This is the assumption that one FTE job is generated for every 50m² of employment space, in Net Internal Area for **B1b** land use (research and development). This assumption is based on the HCA Employment Density Guide 2015.
	12m² of NIA/FTE	This is the assumption that one FTE job is generated for every 12m² of employment space, in Net Internal Area for **B1a** land use (professional services). This assumption is based on the HCA Employment Density Guide 2015.
Land use	B1a	The project team have applied B1a Professional Services land use for sites intended for office space.
	B1b	The project team have applied B1b Research and Development land use for sites intended for laboratory buildings and clinical floorspace.

Source: Mott MacDonald

3.4 Findings

The potential economic impacts of the Cambridge Biomedical Campus Phase 2 are displayed below, based on the full development of the site and the assumptions regarding occupancy and additionality (detailed above). Across the site and including multiplier effects, a total of **219 net additional jobs** could be supported which could deliver **£12.4m GVA per annum** once the site is fully developed and occupied. This is shown in Table 3.3 below.

Table 3.3: Economic Impacts calculated using TEAM

Site	Jobs		GVA per annum (£m)	
	Gross direct	**Total net**	**Gross direct**	**Total net**
CBC Phase 2 – Site 1	634	122	36.3	6.9

[31] Ibid., page 33.

[32] Ibid., page 33.

CBC Phase 2 – Site 2	203	39	11.6	2.2
Abcam site	306	59	17.5	3.3
Total	**1,143**	**219**	**65.4**	**12.4**

Source: Mott MacDonald

Guidance from the Department for Transport (DfT) at SOBC stage indicated that 20% of the economic benefits arising from development of the site at the Campus can be attributed to development of the proposed station. This would mean that **44 net additional jobs** could be attributed to the station, delivering approximately **£2.5m GVA per annum**. Further work could refine this high-level assessment but in lieu of further information this has not been possible. Overall, we conclude that the station will have a positive effect on the site's economic development, on the basis that it will help to reduce congestion and support the attractiveness of site for businesses and workers choosing to locate there.

4 Housing site impacts

4.1 Introduction

In this section, we quantify the potential economic benefits that may arise following the development of the housing sites identified in Figure 2.1. These sites and their relative hectarage are shown in Table 4.1 below.

Table 4.1: Housing Sites

Name	Size (ha)
Trumpington Meadows	15.50
Glebe Farm	9.79
Clay Farm	60.69
Bell School	7.61
Cambridge Professional Development Centre, Foster Road	1.49
BT telephone Exchange and car park, Long Road	2.01
TOTAL	**97.09**

Source: Annual Monitoring Report 2016

At the time of writing the number of dwellings by site is not available. However, between 2019/20 and 2031/32 approximately 3,300 additional houses are to be constructed within development sites across the Southern Fringe and adjacent areas, of which approximately 2,400 will be constructed on the Clay Farm development site immediately west of the rail line and all within 1 mile of the proposed new station. For the same period, 1,120 additional homes are included in the TEMPRO[33] forecast for the zones covering the Southern Fringe, therefore an allowance for an additional 2,180 homes has been made in our forecast. The following analysis is therefore based on the impacts from the development of 3,300 housing units in total.

4.2 Temporary construction benefits

The construction of these sites will have temporary economic impacts in terms of jobs and economic output (GVA). Whilst the jobs generated by the construction of the sites will only

[33] DfT planning software containing projection on land usage and other relevant variables.

persist during the construction period, they are likely to have a substantial impact on the local economy, with some impacts persisting in the longer term. Construction related expenditure, including local construction costs (or expenditure) directly on site through spending on goods, services and labour, plus the wider indirect costs in the construction supply chain across the intervention areas overall would generate further expenditure in related and unrelated industries. This acts as a boost to the local and national economy and makes investment in construction particularly powerful in fuelling expansion in the economy.

These indirect jobs are part of the wider economic impact of the construction projects across the local regional economy and are 'knock on' economic effects generated by the construction project. These 'knock on' effects include:

- Indirect benefits created in the construction supply chain across the intervention areas, via the procurement of goods and services that enable housing to be constructed; and
- Induced benefits resulting from employees (both those directly employed and in the supply chain) spending their wages within each of the intervention areas.

Increased numbers of jobs and activity in the intervention area will have significant positive impacts on economic growth in the region. We note however, that many of these benefits will only be fully realised if goods and services are procured locally.

The value of the temporary construction impacts can be assessed using data on local salaries, origin destination statistics and percentage of cost spent on salaries, and standard assumptions about construction costs.

The construction phase will also trigger some negative impacts for the area surrounding the sites. For example, during construction it can be assumed that there will likely be additional noise pollution affecting residents in affected areas, there may be disruption to the road network and there may be issues in terms of access. However, these negative impacts can be mitigated with careful planning to ensure there is minimal disruption on the roads and transport network. The potential cost of these negative impacts has not been estimated as part of this assessment.

The economic impact arising from the construction of the residences at the sites are calculated using an estimate for capital expenditure (CAPEX) of construction.

4.2.1 Findings

By applying a standard assumption of £100,000 of CAPEX per house as a construction cost[34], the temporary employment impacts of constructing the 3,300 dwellings can be modelled. The findings are shown below in Table 4.2.

Table 4.2: Construction impacts of housing developments

Construction phase impact	Value	Formula	Source
Construction cost for 3,300 dwellings	£330,000,000	(a)	Assumption of £100,000 CAPEX per dwelling, for 3,300 dwellings
% of cost spent on salaries	26.7%	(b)	Annual Business Survey, ONS, 2018 (construction sector)
Salary expenditure	£88,110,000	(c)=(a)*(b)	Calculation
Average mean salary	£43,171	(d)	Annual Survey of Hours and Earnings, ONS, 2018 (Full time mean wages in construction sector) – Inflated to 2021 prices

[34] Industry estimate from major UK housebuilder.

Direct job years supported	2,041	(e)=(c)/(d)	Calculation
1 FTE=10 employment years	10	(f)	Best practice assumption
Direct jobs supported	**204**	**(g)=(e)/(f)**	**Calculation**
Leakage	60%	(h)	Origin destination statistics, ONS
Net direct FTEs	**82**	**(i)=(g)-((g*(h))**	**Calculation**
Composite multiplier of 1.29	0.29	(j)	HCA Additionality Guide 2014, p.35
Indirect & induced jobs	**24**	**(k)=(j)*(i)**	**Calculation**
Total net jobs supported	**105**	**(l)=(k)+(i)**	**Calculation**
Average GVA per worker for construction	£66,316	(m)	Regional Accounts and Workforce jobs - July 2018, ONS - Inflated to 2021 prices
Total GVA supported	**£6,984,019**	**(n)= (l)*(m)**	**Calculation**

Source: Mott MacDonald

Taking the average annual salary figure in the East of England construction sector for the latest year available (2018) and inflating to 2021 prices (£43,171), the direct salary expenditure will support approximately 2,041 direct job years. Given in standard guidance one “permanent” full-time equivalent (FTE) job is equal to 10 job-years, in total, the job-years are equivalent to approximately 204 FTE jobs being directly created from the construction of these dwellings. Adjusting this to account for 60% leakage, we estimate that approximately 82 FTE direct jobs could be supported through the construction of the 3,300 dwellings. When considering indirect and induced jobs and leakage levels, a further 24 jobs are supported. Therefore, **approximately 105 jobs** and **£7.0m GVA** are supported in total from the construction of the 3,300 dwellings

As above guidance from the Department for Transport (DfT) at SOBC stage indicated that 20% of the economic benefits arising from development of the site at the Campus can be attributed to development of the proposed station. Further work could refine this high-level assessment but in lieu of further information this has not been possible. Consequently, 20% attribution has been applied to these temporary construction impacts. Therefore, approximately **21 jobs** and **£1.4m GVA** could be attributed to construction of dwellings which may not be brought forward should Cambridge South Station not proceed.

4.3 Property related taxes

The development of the six housing sites shown in Table 4.1 will contribute towards taxes generated from the land use changes including Council Tax from the housing development. Using the above estimates for 3,300 dwellings, we have estimated the amount of Council Tax revenue that would be generated.

We have based our calculations on the following assumptions:

- Average house price of £466,827[35] for the open market sales element (using January 2021 average house price for Cambridge).
- Council tax bands by house value and band rates for Cambridge sourced from Cambridge City Council[36].

This residential land, if developed, is estimated to provide **£6.7m per annum** of housing-related Council Tax revenue. Applying the DfT assumption of 20% attribution means that **£1.3m per**

[35] Zoopla (2021): House Prices in Cambridge, Cambridgeshire

[36] Council Tax bands and charges - Cambridge City Council

annum of housing related Council Tax revenue is projected from dwellings which may not be brought forward but for the proposed Cambridge South Station.

4.4 Land value uplift

The benefit to those occupying new residential accommodation is best quantified through measuring the change in the land value of a site[37]. Therefore, consideration has been given to the land value uplift (LVU) associated with the residential component of each development option. LVU analysis quantifies the change in the value of the land from its current use to its future use as a result of an intervention. In this case therefore we have sought to capture the uplift in land value of the residential sites identified within Table 4.1.

LVU captures the net private benefits of a development by calculating the land value before and after an intervention in its current and future use. The difference between the calculated current and future land value represent the uplift attributable to the scheme and is calculated by the following equation:

LVU = Land Value (future) – Land Value (current)

$$LVU = Land\ Value\ (future) - Land\ Value\ (current)$$

The key inputs for calculating land value uplift impacts and additional identified impacts for each potential option are:

- anticipated development;
- phasing of this development;
- a development appraisal

It is best practice to utilise a development appraisal or local market data on land values to support LVU in compliance with MHCLG appraisal guidance. However, MHCLG provides land value estimates for policy appraisal[38] which can be utilised in the absence of this. All sites identified in Table 4.1 are currently located on greenfield sites and therefore agricultural land values for Greater Cambridge and Greater Peterborough[39] from the VOA land value estimates have been used as an estimate of existing use value in compliance with MHCLG appraisal guidance. All sites identified within Table 4.1 are anticipated to be residential in future and so residential land values for Cambridge from the VOA land value estimates data have been used to estimate future land values. Construction has been assumed to start in 2022 with 10% completed per annum with development completing in 2031.

In calculating land value uplift, a 5% per annum increase in land values has been assumed. This is in line with the MHCLG Appraisal Guide, which identifies a 20-year average annual growth in residential land values of 7%. The 20-year average growth in general inflation is 2%. Therefore, the average annual real terms growth in residential land values is 5%. The key assumptions that have been used in the modelling of LVU impacts from housing development are set out in Table 4.3 below.

[37] As set out in the MHCLG appraisal guide

[38] MHCLG 2020 Land value estimates for policy appraisal 2019: guidelines for use - GOV.UK (www.gov.uk)

[39] Agricultural land values are not available for Cambridge and the closest alternative is are only available for

Table 4.3:LVU assumptions

Assumption	Level	Justification
Discount rate	3.5%	This is a public sector discount rate which adjusts for social time preference (defined as the value society attaches to present, as opposed to future, consumption).This is compliant with HM Treasury Green Book guidance
Deadweight	50%	Given the demand for housing at the Campus, it is considered very likely that development would be created without the station at some stage. However, the construction of the station is likely to accelerate development. Accordingly, a medium figure of 50% for deadweight has been selected.
Displacement	25%	Displacement is considered to be low (25%), given the high level of housing demand within Cambridge and constrained supply.
Land Value Appreciation	5%	This is in line with the MHCLG Appraisal Guidance, which identifies a 20-year average annual growth in residential land values of 7%. The 20-year average growth in general inflation is 2%. Therefore, the average annual real terms growth in residential land values is 5%.
Agricultural land value per hectare	£23,153	This is the land value per hectare of agricultural land for Greater Cambridge and Greater Peterborough. This has been sourced from MHCLG 2020 land value estimates for policy appraisal using VOA data. This has been applied to estimate the current use value of all residential sites identified and is presented in 2021 prices.
Residential land value per hectare	£6,890,625	This is the land value per hectare of residential land for Cambridge. This has been sourced from MHCLG 2020 land value estimates for policy appraisal using VOA data. This has been applied to estimate the future use value of all residential sites identified and is presented in 2021 prices.

Source: Mott MacDonald

4.4.1 Findings

The results of the analysis show that in total £271m net additional (Present value over 30 years) in LVU benefits will be achieved through the development of the proposed residential sites identified in Table 4.1. As previously, guidance from the DfT at SOBC stage indicated that 20% of the economic benefits arising from development of the site at the Campus can be attributed to development of the proposed station. This would mean that **£54m of LVU** (Present value over 30 years) could be attributed to the station. Further work could refine this high-level assessment but in lieu of further information this has not been possible.

5 Summary

The importance of improved transport networks and connectivity to support economic growth and development in Cambridge is highlighted in local policy documents including the GCCD and Local Plans for Cambridge and South Cambridgeshire. The proposed Cambridge South station reflects the overarching policy objectives and, more specifically, has the potential to significantly contribute to developing sites around the Cambridge Biomedical Campus. The Campus, which is key to economic growth in Cambridge and the wider region, is already an internationally recognised centre of excellence and will continue to grow in future, as global companies such as Astra Zeneca move to the site and the region's hospitals are consolidated in the area. This growth requires strategic transport improvements, especially as congestion in Cambridge is already recognised as a problem. While it is likely that the next phase of development at the Campus (Phase 2) will go ahead without the station, guidance from DfT provided at SOBC stage indicates that development would be reduced by about 20% if the station is not constructed. Further work could refine this high-level assessment but in lieu of further information this has not been possible. Overall, we conclude that the station will have a positive effect on the site's economic development, on the basis that it will help to reduce congestion and support the attractiveness of site for businesses, residents and workers choosing to locate here.

The proposed station will support the GCCD strategy by providing new transport links between areas of population and employment growth within Greater Cambridge, thereby addressing congestion and public transport issues to help stimulate further economic growth[40]. There are a number of key routes by which the proposed station will contribute towards this, namely:

- By supporting **business investment and growth** – better connectivity and capacity for the future (through lower congestion and investment in long term infrastructure) to enhance the investment prospects of the corridor area and potentially result in quicker development along the corridor at the key growth sites.
- By supporting **labour market mobility** – journey time savings will improve labour market mobility as journeys to work become more efficient. This will improve the connectivity between key employment sites and labour markets. Ultimately, this will benefit both the workforce, who can access more opportunities, as well as employers, who can access a wider labour market.
- By contributing to the **positive image and perceptions of Greater Cambridge –** high quality and efficient infrastructure promotes a positive image of Greater Cambridge as a place to live, invest and do business. Helping to tackle congestion, by promoting alternatives to the private car, contributes to a higher quality of life through reduced severance, improved air quality, reductions in road safety concerns etc. These help to sustain and improve attributes that have played a crucial role in the city's success to date.
- By contributing towards **future development and growth –** significant development is planned around the station which is likely to only increase as time progresses, especially as Greater Cambridge has the quantum of employment land supply, and the demand therefore, to support further growth. Options that could provide higher capacity in the future and which provide possible upgrades for the future will represent an investment for longer term economic growth. In practice, there may be scope for both further accelerated development through infrastructure investment prior to 2031 and/or an increased rate of growth post-2031.

[40] GCCD, UK Government, p.3

Based on the land use information provided in the local development plans of Cambridge City Council, the following outputs were generated by Mott MacDonald's TEAM. The results of our quantitative assessment for Phase 2 at Cambridge Biomedical Campus are:

- A total of 219 net additional jobs could be supported which could deliver £12.4m GVA per annum once the site is fully developed and occupied.
  - With a 20% level of attribution this would mean that **44 net additional jobs** could be attributed to the station, delivering approximately **£2.5m GVA per annum**.

The development of housing sites identified near the proposed station would also provide economic benefits through construction, tax revenues and LVU. These estimates are outlined below:

- 105 jobs and £7.0m GVA p.a. in construction benefits for the development of the 3,300 total dwellings around the station.
  - With a 20% level of attribution this would mean that **21 jobs** and **£1.4m GVA** in construction benefits could be attributed to the station from the construction of these dwellings.
- £6.7m p.a**.** in Council Tax revenues from the construction of 3,300 dwellings.
  - With a 20% level of attribution this would mean that **£1.3m per annum** of housing related Council Tax revenue is projected from dwellings which may not be brought forward but for the proposed Cambridge South Station.
- In total £271m net additional (Present value over 30 years) in LVU benefits will be achieved through the development of the proposed residential sites identified around the station.
  - With a 20% level of attribution this would mean that £**54m of LVU** (Present value over 30 years) could be attributed to the station.

Mott MacDonald
10 Fleet Place
London EC4M 7RB
United Kingdom

T +44 (0)20 7651 0300
mottmac.com

Commercial Case

Outline Business Case - Cambridge South Rail Station

February 2021

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
0.1	12/01/21	O Haycock	C Judge	C Judge	Initial Draft
0.2	10/02/21	O Haycock			Update following NR comments
1.0	11/02/21	O Haycock	C Judge	C Judge	Issued to DfT

Information class: Standard

Click or tap here to enter text.

3 Commercial Case

This paper sets out the Commercial Case, at Outline Business Case (OBC) stage, for a new rail station at Cambridge South adjacent to the site of the Cambridge Biomedical Campus and the Southern Fringe housing development.

This Commercial Case demonstrates the ways in which the scheme can be procured, including the constriction of the station and the ongoing operation of the station and the rail services which would call there.

3.1 Introduction

The scheme to be procured is a conventional rail station and infrastructure project, for which the construction industry is capable of delivering within a competitive procurement environment if required. Scheme procurement is therefore considered to be commercially viable.

This Commercial Case sets out the outputs that are likely to be required from some form of competitive procurement, and the procurement options that exist.

3.2 Outline Output-based Specification

The following outputs are likely to be required:

- A new station at Cambridge South, comprising of;
  - Four platforms, with step-free access via a footbridge and lifts
  - Seating and shelter for waiting passengers
  - A ticket office and ticket machines, along with automatic ticket gates
  - Taxi and passenger drop off areas
  - Facilities such as a retail/catering unit
  - A waiting room and toilets
  - Blue badge parking
  - Cycle parking.
- Provision of additional railway lines required to serve all of the platforms. This would include;
  - Two track loops in the area of the station
  - Replacement of the existing interlocking as it is close to life expiry and not amenable to modification to provide the additional capacity required by Cambridge South
  - Provision of overhead line electrification (OLE) and supporting infrastructure such as substations
  - Provision of new signalling and associated cabling
  - Provision of new telecommunications facilities and associated cabling
  - Refurbishment and reconstruction of existing culverts and track drainage
  - Additional elements to ensure the scheme is built and operated in a safe, efficient manner, such as fencing, lighting, electrical connections
- Suitable access routes between local highways, footways and cycleways, and the station entrance.
- A train service level of approximately 7.5 trains per hour (7 or 8 depending on the direction of travel) in the off peak and 6.5 trains per hour in the peak. These station calls would be

spread across the various types of existing services which operate the line to Cambridge, including trains/from London King's Cross, London Liverpool St, Stansted Airport, Birmingham New Street, Peterborough and Norwich.

Two public and statutory consultations have been undertaken to inform scheme development and as part of the Transport and Works Act Order workstream.

3.3 Procurement Options

3.3.1 Infrastructure Procurement Options

Following previous early stage funding approval, Network Rail is currently proceeding with development up to end of GRIP 4. GRIP 4 support was procured using standard Network Rail processes.

Cambridge South has been selected for round 2 of Project SPEED, a programme developed by Network Rail, with the aim to accelerate project delivery. To achieve this, some procurement timescales will need to be accelerated.

A range of procurement options still exist for GRIP stages 5-8, which are outlined below:

- Traditional contract, where design and construction procurement are separated;
- Emerging cost contract (a form of management contract);
- Design and Build;
- Design, Build, Operate, and Maintain (this is not suitable for any of the line infrastructure elements, as the scheme is part of an existing Network Rail operational route); and
- Engineering Procurement and Construction (turnkey design and build) contract.

A variety of Public Private Partnership (PPP) arrangements also exist, including concessions and Private Finance Initiatives (PFI). Previous analysis undertaken by a third party in 2016, as part of a New Stations Fund application for Cambridge South, identified PPP as a suitable approach. This was in relation to the new station only and did not include other line infrastructure works. In 2019, Mott MacDonald produced a Funding, Financing and Delivery Study for Cambridge South Station. This assessed the opportunities to use innovative funding, financing, and delivery models for Cambridge South station. Further details of this are included within the appendix to the Financial Case.

The range of procurement options available for the rail line infrastructure improvements are more limited, as the upgraded infrastructure would need to be managed and maintained by Network Rail as part of the GB rail network.

At present, the most likely procurement route would be via Network Rail's normal delivery process. It should be noted that there are significant infrastructure schemes in the vicinity of Cambridge South, such as the Cambridge Resignalling, Relock and Recontrol (C3R) programme. Where there is value in the approach to procurement being adapted in light of other projects, this will be explored.

3.3.2 Station Facility Operator

At the time of writing, the Williams Rail Review is yet to conclude. It is not known whether this "root and branch" review of the railway will recommend a change in the relationship between facilities, track and train. In addition, rail franchising has been replaced with agreements which operate more like concessions since the reduction in demand caused by COVID-19. The final form of successor agreements has not yet been confirmed.

DfT has confirmed that Greater Anglia will be the Station Facility Operator for Cambridge South station. This may change due to the factors set out above.

3.3.3 Train Services

The train services calling at the new station will be provided by the train operators that run services along the line on which the station is located. The working assumption is that services will be operated by Greater Anglia, Thameslink, Southern & Great Northern and Cross Country or any successor operators.

At the time of writing, all Train Operating Companies (TOCs) have been transferred onto Emergency Recovery Measures Agreements (ERMA), to provide commercial support during the COVID-19 pandemic. These agreements saw fees set at a maximum of 1.5% of the cost base of the franchise before the COVID-19 pandemic began, intended to incentivise operators to meet reliability, punctuality and other targets.

The Department for Transport plans to transition TOCs onto New Rail Contracts (NRCs). These agreements, which will run for in some cases up to several years, are designed to place TOCs on more sustainable contracts. It is likely that the bulk, if not all, of cost and revenue risk with sit with the Department. Under this model DfT would take all of the commercial revenue such as rail fares and station retail income.

When the next round of contracts end, it may be that services (and station operations) return to procurement via a competitive tendering process with some longer-term risk and revenue transferring to the private sector[1]. This will depend on the eventual outcome of links to the Williams Review, which is yet to be published.

Regardless of the commercial model, new arrangements will be in place for all of the franchises prior to the opening of Cambridge South. Therefore, service levels for the new station can be included within the new train service specifications.

3.4 Commercial Case Summary

The following key points are raised in this Commercial Case:

- Scheme procurement is considered to be commercially viable, as this is a conventional rail station and infrastructure project.
- A detailed scheme specification has been produced, but there are still factors that could influence the final specification.
- A range of procurement options exists for station infrastructure delivery, but it is likely that Network Rail's normal delivery process will be followed with some aspects accelerated due to the project's inclusion in Project SPEED. It is likely that a rail operator would be designated as the Station Facility Operator.
- The range of procurement options available for the rail line infrastructure improvements is more limited, as the upgraded infrastructure would need to be managed and maintained by Network Rail as part of the GB rail network.
- The train services calling at the new station will be provided by the train operators that run services along the line on which the station is located. Service levels can be included within the service specifications at the next contract renewal date.

[1] Rail update: Emergency Recovery Measures Agreements - GOV.UK (www.gov.uk)

Mott MacDonald
10 Fleet Place
London EC4M 7RB
United Kingdom

T +44 (0)20 7651 0300
mottmac.com

Financial Case

Outline Business Case - Cambridge South Rail Station

February 2021

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
0.1	12/01/21	O Haycock			Initial Draft
0.2	21/01/21	O Haycock	C Judge	C Judge	Draft circulated with DfT / NR for comment
0.2	10/01/21	O Haycock			Incorporation of DfT / NR comments
1.0	11/01/21	O Haycock	C Judge	C Judge	Issued to DfT

Information class: Standard

Click or tap here to enter text.

4 Financial Case

4.1 Introduction

This paper sets out the Financial Case, at Outline Business Case (OBC) stage, for a new rail station at Cambridge South adjacent to the site of the Cambridge Biomedical Campus and the Southern Fringe housing development.

The Financial Case sets out anticipated expenditure and potential funding sources.

Department for Transport business case guidance[1] identifies the expected level of detail for each of the five cases (Strategic, Economic, Financial, Commercial, Management) at each business case stage. At the OBC stage, three requirements are identified for the Financial Case:

- Update the approach being taken to assess affordability
- Provide details of the anticipated costs
- Update the budget and funding cover for the project.

4.2 Cost Information Sources

The bulk of the cost of the new station scheme is associated with the construction of the station and enabling track and signalling changes. Operating costs are relatively very small as the ongoing operating cost of the station is likely to be modest and trains which would serve the station are already passing through the site.

The Anticipated Final Cost (AFC) for Cambridge South Station and associated line improvements has been estimated by Network Rail. This AFC was calculated at GRIP 3 and is informed by a Quantitative Cost and Schedule Risk Assessment (QCRA and QSRA).

Operating costs were estimated directly by Mott MacDonald using typical rates seen elsewhere.

The latest cost information, along with other elements of this OBC, will inform the overall affordability assessment to be undertaken by the Department for Transport, and underpins the Value for Money assessment presented in the Economic Case. If a decision is made to progress the scheme, then more detailed cost estimates will need to be prepared to inform the Full Business Case.

4.3 Scheme Costs

This section sets out the current scheme cost estimates. The costs presented show the infrastructure (capital) and operating costs versus the Do-Minimum scenario where the station is not constructed.

4.3.1 Investment Cost Summary

Network Rail has calculated a Base Estimate cost for the station of £139.3m (Q3, 2020 Prices). The components of this estimate are shown in Table 1.

[1] The Transport Business Cases, January 2013

Table 1. Base Estimate Disaggregation, £m (Q3, 2020 Prices)

Description	Base Estimate
Railway Control Systems	6.6
Train Power Systems	5.3
Electric Power and Plant	2.2
Permanent Way	10.3
Operational Telecommunications Systems	2.3
Buildings & Property	17.3
Civil Engineering	19.9
Enabling Works	4.4
Total Direct Construction Works *(A)*	**68.2**
Preliminaries	17.3
Overheads and Profit	11.5
Total Indirect Construction Works *(B)*	**28.8**
Total Construction Works *(A + B)*	**97.0**
Design Team Fees	13.2
Project Management Team Fees	13.0
Other Project Costs	16.0
Total Project / Design Team & Other Project Costs *(C)*	**42.2**
Total Base Estimate *(A + B + C)*	**139.3**

Source: Network Rail

Table 2 below shows the Anticipated Final Cost (AFC) for the new station at Cambridge South, along with the enabling infrastructure work. The AFC range is £177.1m - £190.4m (cash prices).

Table 2. Cambridge South Station Infrastructure Cost Estimates, £m

QRA Level	Base Estimate*	Risk and Contingency*	Anticipated Final Cost*	Inflation Risk**	Anticipated Final Cost**
P-Mean	139.3	23.0	162.2	15.1	**177.3**
P 50	139.3	22.7	162.0	15.1	**177.1**
P 80	139.3	28.8	168.0	15.7	**183.7**
P 95	139.3	34.9	174.1	16.3	**190.4**

Source: Network Rail
***** Quarter 3, 2020 Prices; ****** Cash Price to Quarter 3, 2023 (mid-point of construction)

Some of the existing rail infrastructure including signalling equipment and point work at Shepreth Junction are nearing the end of the normal life expected for these types of components. We anticipate that renewal of the track at Shepreth Junction would be required in approximately Control Period 7 (2024-2029). Renewal of the signalling system is within the current scope for Cambridge, Re-Signalling, Re-Lock and Re-Control (C3R) but the scope of that project is evolving. Construction of the station would involve replacement of some of the infrastructure, which is nearing life expiry, therefore avoiding the need for renewal. Additionally, a major upgrade of this nature would provide Network Rail the opportunity to schedule other renewal and maintenance work during the planned construction, saving the need for other route closures and planning work.

Network Rail has indicated that the scope for future renewal works at Shepreth Junction would likely encompass the 'like for like' renewal of four switching and crossing units, reducing the net cost of the scheme by approximately £4.0m (Q3, 2020 Prices).

Network Rail's Cambridge Re-Signalling project (C3R), scheduled for completion by 2024, will see a state-of-the-art renewal of the signalling equipment in the Cambridge area. At present, it is estimated that a further £5.0-7.5m (Q3, 2020 Prices) of efficiencies could be realised with the construction of Cambridge South.

Table 3 shows the maximum impact of these efficiencies on the anticipated final cost.

Table 3. Anticipated Final Cost Including Renewal Efficiencies (Cash Prices)

QRA Level	Anticipated Final Cost	Renewal Efficiencies	Anticipated Final Cost (Including Efficiencies)
P-Mean	177.3	12.7	164.6
P 50	177.1	12.7	164.4
P 80	183.7	12.7	171.0
P 95	190.4	12.7	177.7

In addition, Network Rail has advised that £10.8m of cost has already been incurred or cannot now be avoided, which is the level of funding allocated to GRIP 1-3.

An indicative capital cost spend profile is shown in **Error! Not a valid bookmark self-reference.**. This aligns with draft GRIP 3 P80 costs supplied by Network Rail. The majority of the scheme costs would be incurred during construction. However, a proportion would be incurred before construction begins, to cover project development through the various business case and Network Rail GRIP/PACE stages.

Table 4. Indicative Capital Cost Spend Profile (P 80, Cash Prices)

Financial Year	Capital Cost Spend	Proportion of Capital Spend
Work to Date	10.1	5.5%
2021/22	8.2	4.4%
2022/23	18.0	9.8%
2023/24	46.2	25.2%
2024/25	82.6	45.0%
2025/26	18.6	10.1%

Source: Network Rail

The total cost range for the Cambridge South scheme is therefore £164.6m - £190.4m (cash prices), with the lower range assuming that maximum renewal efficiencies are realised. £10.8m has already been incurred or cannot now be avoided.

It is anticipated that elements of the station and associated infrastructure will require renewal over the life of the 60 year period covered by this OBC. Based on the Cost Plan supplied by Network Rail (summarised in Table 1) it has been assumed that:

- In 2039/40, 15 years after the station opens, operational telecommunications systems will require replacing at a cost of £2.3m. It is assumed that this work is repeated every 15 years thereafter.
- In 2054/55, 30 years after the station opens, elements of the Train Power Systems, Electric Power and Plant, Permanent Way, Operational Telecommunications Systems and Buildings and Property will require renewal and cost £13.9m. It is assumed that this work is repeated every 30 years thereafter.

4.3.2 Ongoing Operating and Maintenance Costs

Operating costs are expected to be relatively modest as all of the trains which would call at the station would operate in the Do-Minimum scenario. This means that costs associated with train procurement, train mileage and train crew are zero. Additional costs associated with acceleration and braking are likely to be second order, therefore no allowance has been made for these.

We have assumed that the station is staffed with three employees during the weekday peak, two during the off peak, and two on Saturdays. This equates broadly to six full time equivalent (FTE) staff members. We have assumed at total cost per employee of £35,000 per year, which multiplied by six is a total annual cost of £210,000 (2018/19 prices).

Based on our experience of stations of a similar size elsewhere, we have assumed an allowance of £50,000 (2018/19 prices) per year for station running costs, such as electricity, light maintenance and cleaning.

4.4 Funding Sources

In 2019, Mott MacDonald produced a Funding, Financing and Delivery Study for Cambridge South Station. This assessed the opportunities to use innovative funding, financing and delivery models for Cambridge South station and related infrastructure, using evidence from the Strategic Outline Business Case (SOBC). This study set out the potential value of the station to the range of stakeholders affected, and set out options for securing a funding contribution from these organisations. The study is appended to this document.

Funding of £6m was in authorised in January 2021 to undertake Early Contractor Involvement (ECI), the completion of GRIP 4 works, and remit production for GRIP 5-8, including investigating early land acquisition where feasible. This funding was secured via change control and approved by Anglia Programme Board, Portfolio Board, and DfT Ministers and HM Treasury. No additional funding authority is sought with this business case.

This OBC identifies the need for CP6 funding of £72.3m, and CP7 funding of £101.2m. These figures will be confirmed as part of a Full Business Case submission. The release of this funding will be subject to a further investment case assessment at Commit to Deliver stage, and

consideration of the programme alongside other schemes within the DfT Rail Enhancements Portfolio.

As noted above, £6m of funding for the current phase of works (up to a Commit to Deliver decision) has been allocated from DfT Rail Enhancements Portfolio. Alternative (i.e. third party) funding and financing options to deliver the scheme will be considered as part of a Full Business Case prior to a Commit to Deliver decision, including those presented as part of the 2019 study appended to this document.

The funding for Cambridge South is managed through the joint NR and DfT governance arrangement set out in the 2016 enhancements MOU between NR and DfT. In this case, that will be through the Anglia Programme Board and Enhancement Portfolio Board. Changes to spend profiles or forecast costs will be governed through the joint change control process with impacts on the overall enhancement portfolio spending considered as part of this process.

4.5 Financial Case Summary

The capital cost range identified for the scheme is £164.4m - £195.5m (cash prices), with the lower range assuming that maximum renewal efficiencies are realised. £10.8m has already been incurred or cannot now be avoided.

Ongoing operating and maintenance costs associated with the scheme are likely to include station operating and maintenance costs, and the net increase in maintenance and renewals for additional infrastructure and are estimated to be £260,000 per annum (2018/19 prices).

A. Funding, Financing and Delivery Study for Cambridge South Station

See *"4_250319 Revised Cambridge South Station Funding Study report - vOS5_sensitivity analysis.pdf"*

Mott MacDonald
10 Fleet Place
London EC4M 7RB
United Kingdom

T +44 (0)20 7651 0300
mottmac.com

Management Case

Outline Business Case - Cambridge South Rail Station

February 2021

Issue and Revision Record

Revision	Date	Originator	Checker	Approver	Description
0.1	12/01/21	O Haycock			Initial Draft
0.2	18/01/21	O Haycock			Updated Draft
0.3	19/01/21	O Haycock	C Judge	C Judge	Draft supplied to DfT / NR for comments
0.4	10/02/21	O Haycock			Update to incorporate DfT / NR comments
1.0	11/02/21	O Haycock	C Judge	C Judge	Issued to DfT

Information class: Standard

Click or tap here to enter text.

5 Management Case

This paper sets out the Management Case, at Outline Business Case (OBC) stage, for a new rail station at Cambridge South adjacent to the site of the Cambridge Biomedical Campus and the Southern Fringe housing development

The Management Case includes details on the project programme, and commentary on governance, Quality Assurance, communications, and risk management.

5.1 Introduction

This Management Case is preliminary in nature and will need to be developed as the scheme is progressed through the business case and Network Rail GRIP stages. Department for Transport business case guidance[1] identifies the most important areas of the Management Case at OBC stage as:

- Update of elements discussed at SOBC stage;
- Further clarity around project dependencies and planning; and
- Detailed communications and stakeholder management plan.

5.2 Evidence of Similar Projects

In recent years, several new stations have been delivered across the UK rail network.

These new stations comprise a range of station types, locations, promoters, and delivery approaches. Examples of stations serving major employment areas or new developments include:

- Meridian Water, which opened in June 2019, serving the "Meridian One" development of new homes and retail space, the first phase of a 20-year regeneration programme.
- Cambridge North, which opened in May 2017, serving the Cambridge Science Park and Cambridge Business Park.
- Kirkstall Forge, which opened in June 2016, to serve a new mixed-use development site.
- Oxford Parkway, which opened in October 2015, to serve north Oxford. This station is on the proposed route of East West Rail (western section).

5.3 Project Programme

5.3.1 Milestones

An indicative programme between OBC submission and station opening, showing key milestones, is provided in Table 1. The programme combines the Department's three stage business case requirements, with Network Rail's GRIP process.

5.3.2 Project SPEED

Cambridge South has been selected for round 2 of Project SPEED, a programme developed by Network Rail, with the aim to accelerate project delivery and reduce costs.

Opportunities identified as part of Project SPEED could substantially accelerate the programme and reduce the anticipated final cost by collaboration both within Network Rail and with the

[1] The Transport Business Cases, January 2013

industry, to challenge existing processes in order to find efficiencies where possible. This approach is supported and encouraged at the most senior levels within Network Rail, with DfT in agreement to provide funding for GRIP 4 and Early Contractor Involvement (ECI), with a remit to commence from February 2021 (subject to Treasury approval and final decisions by stakeholders). The Network Rail project team has identified that Project Speed could accelerate the programme from 2027 to 2025, although this will require working differently across multiple workstreams involved in delivering rail enhancements.

As a result of this approach future programme dates are subject to change.

The anticipated completion dates of key project milestones are shown in Table 1. The programme is currently targeting the accelerated Project SPEED timescales. The baseline plan dates are also shown for comparison.

Table 1: Indicative programme

Milestone	Anticipated Completion Date	
	Project Speed 2	**Baseline Plan**
SOBC Sign-off	*Completed: End 2017*	
GRIP Stage 1 – Output Definition	*Completed: October 2018*	
GRIP Stage 2 – Pre-Feasibility	*Completed: March 2020*	
Outline Business Case Sign-off	Early-Mid 2021	
GRIP Stage 3 – Option Selection	May 2021	
Full Business Case Sign-off	Late 2021 / Early 2022	
Procurement: GRIP Stages 5-8	December 2021	June 2024
GRIP Stage 4 – Single Option Development	March 2022	March 2023
GRIP Stage 5 – Detailed Design	October 2022	June 2025
GRIP Stage 6 – Implementation	March 2025	May 2027
GRIP Stage 7 – Project Hand Back	August 2025	September 2027
GRIP Stage 8 - Project Close Out	August 2026	September 2028

Source: Mott MacDonald / Network Rail

5.3.3 Programme Dependencies

The success of a new station at Cambridge South will be supported by the continued growth and development at the Cambridge Biomedical Campus, to attract sufficient passenger demand. However, this is deemed low risk due to the extent of the existing development, works already on site, and further committed development. An anticipated opening date of 2025 will also reduce the risk of insufficient demand existing, as there will have been further development site build-out and occupation by the time the station opens.

As the Cambridge South infrastructure enhancements do not seek to deliver additional services, dependencies are less complex compared to schemes which consider new end to end train paths. However, there are key dependencies. These are addressed in turn below.

5.3.3.1 Cambridge Resignalling, Relock and Recontrol (C3R):

This is a large signalling renewal covering a wider area of the network, including the area of Cambridge South station. As the proposed signalling for Cambridge South is more complex than the infrastructure in place in the area currently, the new interlocking C3R seeks to deliver what is needed. Were C3R not to proceed or to substantially change scope, it would be necessary for Cambridge South to replace the existing interlocking as it is close to life expiry and not amenable to modification to provide the additional capacity Cambridge South needs. Similarly, C3R will renew and reorganise Cambridge Signal Box, which will include consideration of the needs of Cambridge South.

5.3.3.2 East Coast Main Line and West Anglia Main Line May 2022 recast:

The East Coast Main Line is subject to a significant timetable recast in May 2022 for which preparations are already underway. This in turn drives a recast in the Cambridge Area due to changes to services which travel to/from this route. This new timetable still requires further development. Once a full draft is available, it will be necessary for Cambridge South performance modelling to be rerun, to confirm that changes to the timetable do not negatively impact performance of the provisional calling pattern.

5.3.3.3 Cambridge South East Transport (CSET):

CSET is a proposed public transport route which will connect a new Travel Hub at Babraham to Cambridge City Centre. The proposed route would run up Francis Crick Avenue before joining the existing Cambridgeshire Guided Busway. As Francis Crick Avenue provides the road access to Cambridge South station and will be substantially remodelled as part of the CSET proposals, it will be necessary for the two projects to consider the requirements of one another when further developing highway designs.

Construction programmes and logistics will also need to be coordinated in order to reduce the likelihood of delay to one or both project as they are seeking to deliver infrastructure in adjacent areas at similar times and have identified some overlapping land for construction compounds.

5.3.3.4 Other North Anglia Projects:

It is recognised that the baseline infrastructure, rolling stock and resulting timetable in North Anglia is expected to undergo a number of significant changes in the coming years. This is driven by a multitude of factors;

- Renewals, such as C3R mentioned above and CP7 ETCS adoption for the Peterborough and Kings Lynn branch lines.
- Additional enhancements (in varying levels of commitment/stage in the project lifecycle) such as Soham Station, Ely Area Capacity Enhancement, Soham Area Capacity Enhancement, EWR Central section etc.
- Timetable changes associated with wider changes and/or significant rolling stock changes such as the Great Eastern Main Line recast December 2021, and the ECML/WAML recast in May 2022 mentioned previously.
- Refranchising activities or other changes to agreements with operators.

Such complexity and volume of changes will affect the outcomes in the area, and in order to ensure the projects deliver the desired outcomes, the Network Rail Anglia Route proposes to establish a formal North Anglia Oversight ‘Guiding Mind’ function, which will monitor benefits across a wider area relative to each project’s planned infrastructure works.

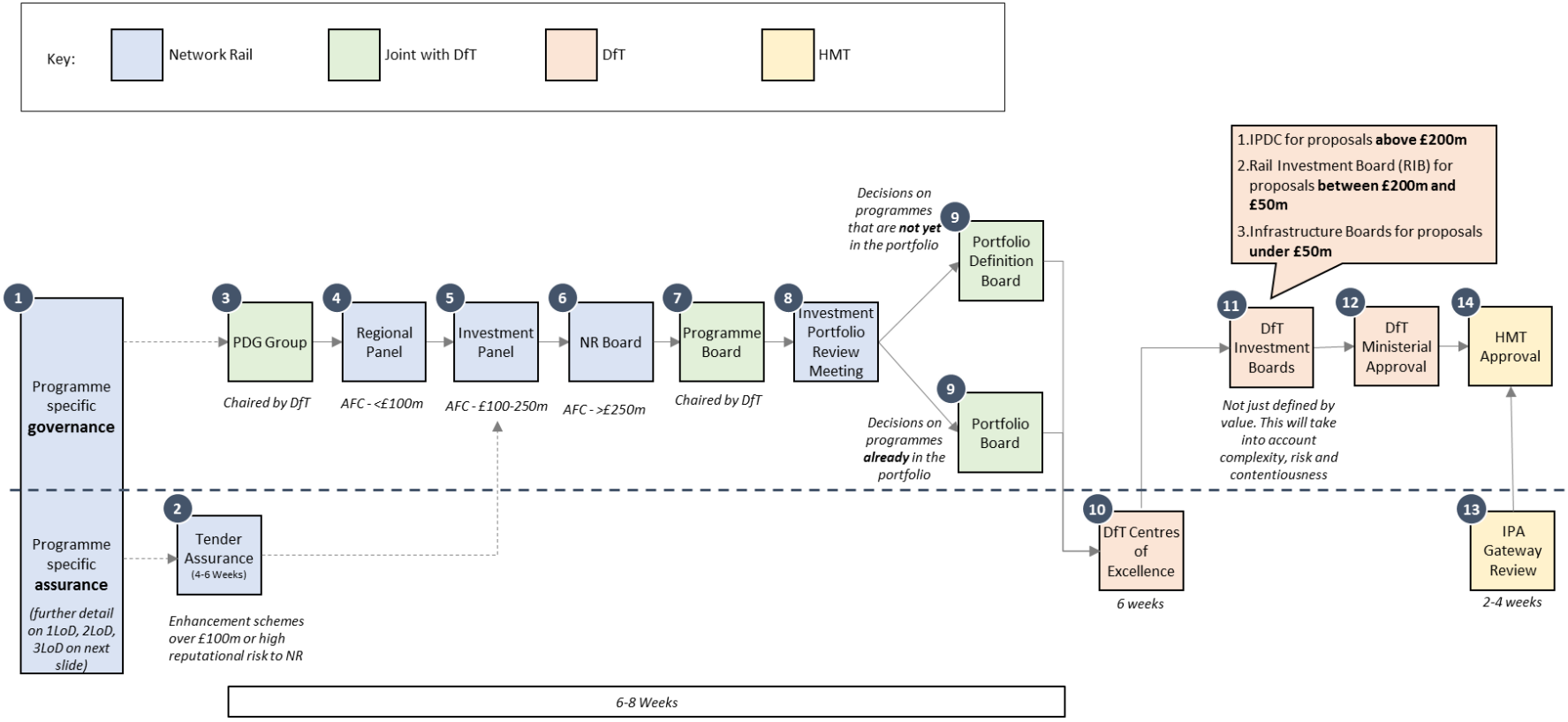
This will be supported by a need from a system engineering perspective to understand all the opportunities to minimise interventions, align delivery approach, access and understand dependency management across the portfolio. This portfolio will be in different levels of development and delivery, with different funders, business cases and timelines. It will be essential to ensure a clear baseline for all infrastructure interventions on this geography to maximise the value for money and reduce disruption to a crucial route for freight and passengers at a critical time for the rail industry.

5.4 Governance Arrangements

Cambridge South is funded as part of the Rail Network Enhancements Pipeline (RNEP) and is expected to broadly adhere to standard governance therein. The typical process for funding approvals is set out in Figure 1.

Figure 1 - RNEP Governance and Assurance Flow

Below is an indicative overview of the governance and assurance flow for each major decision point within RNEP for an Enhancement scheme that is requesting further funding. Please note that there is flexibility in the number of approvals outlined and may not be sequential as depicted.



Source: Network Rail

In addition, should changes to milestones, scope, or funding be required, these will pass through the well-established Enhancements Change Control Process which is somewhat similar to the process illustrated in Figure 1.

It should be noted that as Cambridge South has been identified as a priority for acceleration, some of these processes may be approached differently. For example, funding for the Design stage (equivalent to GRIP 4 for this project) was secured via an Enhancements Change Control in order to bring forward the start of that stage.

In addition, Project SPEED, of which Cambridge South is part, is seeking to reshape governance and assurance to better suit the individual needs of projects. These recommendations will likely be implemented during the Design stage meaning that parts of the Decision to Deliver for Cambridge South could look quite different to the process illustrated in Figure 1.

5.5 Quality Assurance

Good governance and assurance are critical to ensuring the effective delivery of the project whilst ensuring delivery of funder outcomes without exposing either Network Rail, the Funder, or other Stakeholders to risk which is not within agreed tolerances.

5.5.1 Department for Transport Quality Assurance (Centres of Excellence)

Centres of Excellence (“CoEs”) are specialists in their relevant areas of expertise. They give assurance and clearance of business cases before their submission to a DfT investment board for approval. There is a CoE for each of the five cases in a business case: Policy and Strategy Units for Strategic case, Transport Appraisal Strategic Modelling (TASM) for Economic case, Strategic Finance and Planning for Financial case, Group Procurement and Corporate Finance for Commercial case, and Project & Programme Management (PPM) for Management case.

5.5.2 Economic Case Quality Assurance

The work to develop the Cambridge South Economic Case has been subject to Mott MacDonald’s Quality Assurance process.

Mott MacDonald understands the importance of a robust Quality Assurance (QA) process. The foundations of our QA are our corporate QA Procedures, which are based on audited Quality Management Systems (QMS), which adhere to internationally recognised standards, including ISO9001. They also reflect government advice including HM Treasury’s Aqua book and DfT’s Quality Assurance of Analytical Modelling.

The core principle of this process is that analysis, models and written deliverables are reviewed by a qualified individual other than the author of the work. Reviewers consider the following categories of issues:

- **Assumptions**: Whether the key assumptions made are plausible and well-evidenced.
- **Methodology**: Whether the methodology undertaken is consistent with WebTAG.
- **Calculations**: Whether there are errors or simplifications in the calculations made; and of the materiality of these issues.
- **Model inputs**: Whether inputs are consistent across models, and whether the model inputs are representative of the intention for the options tested.
- **Reporting**: Whether the reporting is clear, unambiguous and an accurate reflection of the model outputs.

Our Quality Assurance is embedded in the work with reviews undertaken as the models have been developed.

5.5.3 Network Rail Quality Assurance

Network Rail has multiple governance and assurance mechanisms for infrastructure projects. Governance of Rail Investment Projects (GRIP) is the most commonly used project management framework within Network Rail, and that which Cambridge South used for the Develop stage, which for Cambridge South was aligned to GRIP 1-3.

5.5.3.1 Project Acceleration in a Controlled Environment (PACE)

Cambridge South has been identified as a pilot project for Project Acceleration in a Controlled Environment (PACE) which will be rolled out to replace GRIP over the course of 2021. The PACE Framework replaces GRIP and has been developed in response to Project SPEED and the challenge to significantly reduce the time and cost associated with the development, design, and delivery of infrastructure projects onto the rail network.

The purpose of PACE is to provide a project delivery framework that can be tailored by the project to the individual needs of each project. PACE is designed to maximise value and minimise bureaucracy when applied appropriately.

PACE Project Lifecycle

The PACE Framework Lifecycle is made up of five phases as shown in Figure 2, starting with the light touch Project Initiation phase and providing a framework to progress through the development, design, delivery, and closeout of the project.

Figure 2 - PACE Lifecycle

Source: Network Rail

The aims and outcomes of each lifecycle phase are shown in Table 2.

Table 2: Aims of PACE Lifecycle Phases

Phase		Aim
0	**Project Initiation**	• Appoint the Project Sponsor • Appoint the team required to plan and enter Phase 1 • Prepare the Project Management Plan
1	**Strategic Development & Project Selection**	• Determine and baseline the client requirements for the project • Identify constraints that will impact the feasibility of the project • Determine a single option (the project) that meets the client requirements within the identified constraints.
2	**Project Development & Design**	• Undertake development of the single option to agree Approval in Principle and standards to which the project shall be constructed • Produce an approved ready for construction design
3	**Project Delivery**	• Safe and efficient delivery of the project to the specification • Testing and commissioning successfully undertaken • Asset enters service
4	**Project Close**	• Transfer of asset from the project team to the operator • Project Manager closes project systems and demobilizes • Sponsor formally closes the project and related support systems

Source: Network Rail

5.5.3.2 Phase Gate Reviews

Phase gate reviews are critical control points in the project lifecycle whereby the Project Manager provides the Sponsor assurance that agreed commitments have been delivered before the project proceeds to the next phase of the lifecycle. Phase gate reviews allow the project and Sponsor to assure themselves that they are not proceeding 'at-risk' into the next phase.

Additional reviews may be required where:

- Investment Authority is required for the next Phase of the project
- The project is being handed over to an internal or external party for further development or delivery.

The Phase Gate Review provides assurance that:

- The phase has been completed and achieved the intended outcomes within agreed tolerances
- The PACE framework has been effectively followed
- The project is ready to proceed to the next phase

5.6 Consents

Whilst some parts of the land required for the Scheme fall within Network Rail's ownership, there are areas in private ownership which will need to be temporarily or permanently acquired to deliver the Project, e.g. for temporary construction compounds and for permanent additional track.

5.6.1 Transport and Works Act

Network Rail will require powers under the Transport and Works Act 1992 for a Transport and Works Act Order (TWAO) to acquire land and rights over land compulsorily as well as powers to construct, operate and maintain the station, track and associated railway infrastructure.

These powers will include, but are not limited to:

- Compulsory purchase of land and property which is required for the Scheme
- The right to use land temporarily
- Provision for temporary alternative routes and permanent diversions
- Powers for making byelaws
- Powers to stop up or alter roads and level crossings permanently and temporarily
- Powers to divert any utilities
- Amendments to other legislation

Applications for TWAOs are made, in England, to the relevant Secretary of State and are made by (or on behalf of) the promoters of the scheme. The purpose of the procedure is to assist the Secretary of State to come to an informed view on whether it is in the public interest to grant the TWAO. The following section summarise good practice for TWA order applications[2].

5.6.1.1 Appointment of Legal Advisors

TWA orders are complex legal documents which, if approved, are made by way of a statutory instrument (SI). The department will wish to be satisfied that the powers sought are appropriate, are suitably drafted for an SI, and can be justified in the public interest. But the onus is on applicants and their advisers in the first place to ensure that they are seeking all the powers they will need to implement their scheme properly, as the department cannot 'second guess' these.

How well a draft order is prepared in the first place, and how promptly and satisfactorily the applicant's agents later respond to queries from the department, will have a critical bearing on how long an application takes before it is decided. If a draft order has significant defects, the process is liable to stall at an early stage while problems are addressed. In view of this, and since the TWA procedures are quite detailed and complex, it will be in the promoter's interests to engage legal advisers who have the right skills and experience to draft a TWA order and to be able to respond to questions on it, and who have a good understanding of the statutory procedures.

Network Rail have legal advisors in place to provide guidance in relation to the TWA order.

5.6.1.2 Environmental Statement

An environmental statement (ES) will be required for any scheme which is likely to have significant environmental effects. It is a particularly important document, which must comply with the legal requirements. A well-prepared ES will form the backbone of the applicant's case at a public inquiry, or during exchanges of written representations; and it can help to head off objections before then. Conversely, an inadequate ES is likely to lead to requests for further environmental information during the application process, which can cause considerable delay and could possibly result in a legal challenge. It is therefore very important to ensure that an ES, where required, is thoroughly prepared by people with relevant expertise in this field.

[2] Department for Transport, Transport and Works Act orders: good practice tips for applicants, 2013

Network Rail will prepare the TWAO working closely with the current GRIP 3 supplier who is producing the Environmental Impact Assessment, Environmental Statement and town planning drawings. In GRIP 3, the design and environmental works were awarded to the same supplier to maximise integration of all deliverables to support TWAO.

Deliverables will provide sufficient detail for the TWAO submission at the start of GRIP 4. However, by accelerating early contractor involvement works, there is the opportunity for the supplier to review constructability work to date and consequently for the project to address any concerns prior to TWAO submission, minimise later rework, seek early buy in and accountability for the GRIP 4 design baseline, as well as allowing early access conversations to commence. Network Rail will lead on integrating two suppliers during the short overlapping period. As GRIP 3 constructability work and designs are completed, the supplier can commence with the review as the primary activity. This will de-risk the TWAO application significantly.

5.6.1.3 Pre-Application Consultations

Undertaking thorough and effective consultations before an application is made will almost certainly reap dividends later. The extent of consultations required will depend upon the size and nature of the scheme. But having a constructive and meaningful dialogue with those likely to be interested in or affected by a project can provide helpful feedback into its design, can help to allay fears and suspicions that may be based on a lack of understanding of the scheme, and can help greatly to limit the number of objections once an application is made.

Promoters are asked to consult key players in their area, such as local authorities, development agencies, public service providers, MP's etc. The importance of meaningful pre-application consultation is reinforced by the statutory procedure rules which require a report summarising the consultations that have been carried out to accompany the application.

Network Rail have identified key stakeholders and are in the process of finalising the results of the second round of consultation. This is covered in further detail in Section 5.7.

5.6.2 Deemed Planning Permission

As well as applying to the Secretary of State for a TWAO, Network Rail will also need to apply to the Secretary of State for a direction for deemed planning permission for the project.

5.7 Communications Strategy

The Communication Strategy will follow Network Rail and the Department for Transport's standard process, as well as being compliant with the requirements of the TWA. This requires both the identification of key (including statutory) stakeholders and the undertaking of consultation.

Two formal rounds of consultation have been undertaken. Each consultation round was a formal period where key information was provided to statutory consultees and events held for community consultees to attend, view materials and speak to the Project team. A campaign to publicise the consultation period, events and how to feedback views was undertaken; this involved press releases, adverts in local newspapers, door drops to residents and businesses within the consultation zone, leafleting in stations and social media activities. The intention was to build a close working relationship with all stakeholders. Consultation will not be limited to formal consultation rounds; it will be ongoing with site visits, meetings and presentations.

5.7.1 Identification of Key Stakeholders

Key stakeholders in the proposed new station are:

- DfT;
- Network Rail;
- Local authorities – Cambridgeshire County Council as the local transport authority, and Cambridge City Council and South Cambridgeshire District Council as the local planning authorities;
- Other parts of the rail industry, in particular TOCs and FOCs;
- Other statutory stakeholders such as utilities and Natural England;
- Greater Cambridge Partnership, as the local delivery body for the City Deal with Government. The Partnership includes the three local authorities, University of Cambridge, and the Cambridgeshire and Peterborough Combined Authority;
- Organisations that will invest in the Cambridge Biomedical Campus, including AstraZeneca, Cambridge University Hospitals NHS Foundation Trust, The MRC Laboratory of Molecular Biology, and Papworth Hospital NHS Foundation Trust;
- Local residents, employees, patients and other users of the campus and Hobson's Park;
- Landowners affected by the proposed scheme; and
- Lineside neighbours.

5.7.2 Consultation - Round One

Network Rail undertook an initial round of consultation, which ran for a six-week period from 20 January to 2 March 2020[3]. The consultation was open to everyone who wanted to participate. Consultation planning recognised that effective and on-going engagement with the following wide range of stakeholders is key to the successful promotion of the Transport and Works Act Order (TWAO):

- Prescribed consultees (as identified within Schedule 5 or 6 of the Transport and Works Act 1992, known as Schedule 5 or 6 consultees);
- Those with potential land interests (potential to be a Schedule 6 consultee);
- Local access, user, and interest groups;
- Elected representatives;
- The public, including local residents and commuters.

Over the consultation period, 989 people visited the consultation events, 967 items of consultation feedback were received and there were 47,000 impressions driving 2,054 engagements via social media.

A total of 923 respondents recorded their views on the station:

- 94% expressed their support for the scheme;
- 2% did not support the scheme; and
- 4% were undecided.

Key topics/themes identified during the first round of consultation were as follows:

- Provide a high-quality station environment
- Road access to the station from Francis Crick Avenue was preferred
- Provide sufficient cycle parking capacity for station trips
- Retain the cycle path (NCN Route 11) under Nine Wells Bridge
- Protect the environment and enhance biodiversity

[3] Network Rail, Cambridge South Round One Consultation Summary, 2020

- Provide public transport links including safe pedestrian and cycle access to both sides of the railway
- Avoid as far as possible intrusion into Hobson's Park.

5.7.3 Consultation - Round Two

Network Rail undertook a second phase of consultation concluding late 2020. At the time of writing, the results of this consultation exercise had not been finalised.

The second round of consultation put emphasis on both station facilities and access arrangements, to ascertain whether the current proposals adequately cater for future station users.

This round did not include any in-person events owing to restrictions implemented to combat COVID-19. To help offset this, greater focus was placed on digital feedback channels and full brochures with response slips were sent to around 11,000 homes and businesses.

5.7.4 Consultation with Landowners

Stakeholders with land interests that could potentially be affected by the Scheme are key to the Scheme. The Scheme will require some private land to be acquired; some land will be required temporarily for construction purposes and some will be required permanently. Those with any interest in land needed for the Scheme are being identified and consultation with these groups and individuals will form an integral part of Scheme development. Those owners will also be notified and will have the ability to object as part of the TWAO application process.

5.8 Risk Management

Risk management is a structured approach to identifying, assessing, and responding to risks that arise during a project. It is important to identify key risks at an early stage in scheme development.

The project is using Network Rail's standard risk identification and management methodology. Risks are stored in ARM; and reviewed and updated every period. A QCRA and QSRA were undertaken in November 2020 and used to inform the AFC presented in this OBC. The key risks to overall completion identified at this stage are summarised below.

Challenge of Business Case during TWAO

- **Risk:** Chance that the business case is challenged leading to overall delays to the TWAO process as further works is carried out assessing the benefits and/or costs of other strategic options.
- **Mitigation**: The Project is working closely with DfT and NR Legal Teams who are working on the business case to ensure evidence is substantial, accurate and to understand and maintain key benefits.

Rework of Chapters Impacting GRIP 4 Design

- **Risk:** The re-work of the Chapters in the TWAO submission documents has an impact on the GRIP 4 works that are occurring in parallel.
- **Mitigation**: The Project team is providing stakeholder feedback and clear requirement of any changes to both parties, prior to commencing Grip 4 works, before commencement of works. Design freeze planned to occur prior to Grip 4 start.

Statutory Consultees / Judicial Review

- **Risk:** Consultees are not adequately consulted, and a Judicial Review is carried out leading to overall delay of the consents sign-off.

- **Mitigation**: Ongoing liaison with stakeholders including contractual agreements with key statutory stakeholders to ensure timely feedback to inform design upfront and minimise chance of objection later.

Consents Management Strategy

- **Risk:** Poorly defined consents strategy leading to late deliverables and potential changes in route resources having an impact on the TWAO submission date and construction planning.
- **Mitigation**: Additional consent support procured to maintain programme and additional support from Eastern Head of Consents.

Documentation update (Surveys)

- **Risk:** Late surveys may result in design assumptions being invalidated leading to the need for re-design works impacting the TWAO submission date.
- **Mitigation**: Procure framework supplier in GRIP 3 to do early gap analysis and plan early surveys in Spring 2021.

APIS Taking Longer

- **Risk:** Additional works emerging from the interim safety works leading to delay to the overall completion of the works with associated cost for delay and the potential for additional works being required.
- **Mitigation**: Works are assumed to be self-assured by the supplier and NCB are on board and have agreed to conduct assurance on a progressive basis.

Green belt restrictions

- **Risk:** The Greenbelt assessment will identify additional offset and design works being required to facilitate the project's construction methodology and overall implementation. This would lead to prolongation as well as increased implementation costs.
- **Mitigation**: Works underway and assessments are being carried out and ongoing consultation with local authorities to seek timely agreement on requirements.

Piling solution for platforms

- **Risk:** Need to do more onerous foundation works for the platforms.
- **Mitigation**: Procure framework supplier in GRIP 3 to do early gap analysis and plan early surveys in Spring 2021 to inform GRIP 4.

Business Case not Positive at OBC

- **Risk:** The Business case is not positive at the OBC leading to additional studies being required impacting the early stages of the TWAO process.
- **Mitigation**: The Project is working closely with DfT and NR Legal Teams who are working on the business case to ensure evidence is substantial, accurate and to understand and maintain key benefits.

Design update following consultation

- **Risk:** More works than envisaged emerge from the consultation round. This would lead to a longer design update impacting the start of the TWAO process.
- **Mitigation**: Substantial consultation prior to consultation round to minimise chance of change. The Project team is providing stakeholder feedback and clear requirement of any changes to both parties, prior to commencing GRIP 4 works.

5.9 Management Case Summary

The Management Case for Cambridge South station is based on information currently available (as at January 2021). It is therefore subject to review and amendment as the scheme is progressed.

Key points from the preliminary Management Case are:

- Several new stations have been delivered across the UK rail network in recent years. The Cambridge South scheme is therefore a conventional scheme type.
- The programme needs to combine the Department for Transport's business case requirements, with Network Rail's GRIP/PACE process. The anticipated station opening date is 2025 should Project SPEED opportunities be realised.
- The programme is being delivered to accelerated timescales, as part of Network Rail's "Project SPEED".
- Programme dependencies include industry timescales in relation to planning and technical approvals, Cambridge Resignalling, Relock and Recontrol (C3R), ECML and WAML May 2022 timetable recast, Cambridge South East Transport (CSET), as well as a selection of other North Anglia Projects.
- Quality assurance for the Economic Case will be undertaken by Mott MacDonald. Other aspects of the scheme will be assured either by adherence to Network Rail's GRIP/PACE process and other internal assurance, or through the Department for Transport's governance process (Centres of Excellence).
- A Communications Plan has been developed and two rounds of statutory and public consultation have been completed.
- A Risk Management strategy is in place and a risk register has been prepared and will be kept up to date throughout the remainder of the scheme's development, via Network Rail's ARM process.

mottmac.com