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Cambridge Biomedical Campus Transport Needs Review

Part 3 Report

Cambridgeshire County Council

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Executive Summary

What is this Transport Needs Review?

Cambridgeshire County Council (CCC), on behalf of the Greater Cambridge Partnership (GCP), commissioned Atkins to undertake a transport needs review of the Cambridge Biomedical Campus (CBC). CBC is an international centre of innovation and excellence in healthcare. Significant development is in progress on the Site and further growth is planned over the next 10 to 15 years, increasing demand for travel to the Site.

This Report is Part 3 of a three-part Study. This Report:

- Draws together Potential Interventions suggested in the Part 1 and Part 2 Reports to build a picture of the level and phasing of intervention required to sustainably manage growth on the CBC Site up to 2031; and
- Presents a demand forecast for Cambridge South Station and assesses the impact that the Station could have on access to CBC.

What did Part 1 Conclude?

Part 1 of the Study[1] covered a wide range of evidence on transport supply (including available services and quality factors such as reliability and congestion) and on transport demand (travel patterns). Analysis of this evidence built up a picture of what travel to CBC looks like now and how it could look in 2022 when considering the planned growth on the Site.

There are several existing challenges, particularly:

- Highway congestion on Babraham Road and Addenbrooke's Road;
- Gaps in the range of direct bus services available from key travel origins;
- Concern over staff parking impacts on surrounding residential streets;
- Low levels of walking (1% mode share for patients and visitors and 3% mode share for staff); and
- A deficit in cycle parking capacity.

Part 1 of the Study also presented information on travel supply and demand in 2022, taking account of planned development on the Site. Planned development will lead to future challenges, with planned development up to 2022 increasing overall travel demand at CBC by 30%-40%. Increases in parking supply are proposed, but the highway network does not have the capacity to accommodate additional vehicular trips which would worsen air quality, increase congestion and lengthen journey times.

Part 1 of the Study suggests Potential Interventions for the short term (to 2022) which are focused on improving access for sustainable modes. For growth to be managed effectively, car use must be discouraged where possible to maintain access to the Site for patients with no option other than travel by private vehicle and for emergency vehicles. Implementation should be undertaken through a coordinated, holistic approach to ensure that measures are as effective as possible.

What did Part 2 Conclude?

Part 2 of the Study looked at transport access to CBC from 2022 to 2031 and presented how travel demand and supply could look with and without Cambridge South Station. Part 2 focused on a set of Targets for traffic levels accessing the CBC Site as follows:

- **Target:** Maintaining traffic at 2018 levels up to 2031; and
- **Stretch Target:** A 10% to 15% reduction in peak highway trips from 2011 levels, which is aligned with the Target of the GCP City Access Strategy.

For CBC, this means a reduction in daily one-way person-trips of between 16,825 and 23,800 on the highway is required by 2031.

[1] Cambridge Biomedical Campus Transport Needs Review: Part 1 Report (April 2018)

To accommodate the extensive growth planned at CBC up to 2031, significant Potential Interventions are required to manage access alongside the provision of Cambridge South Station. These measures are needed to manage growth, aim to meet the highway traffic reduction targets and ensure that CBC achieves its vision of becoming a sustainable travel campus. Potential Interventions suggested by this Study include:

- Demand management measures such as further restrictions on parking and car access to CBC;
- Hard infrastructure improvements such as new or improved footpaths/footways or cycleways;
- Behavioural change programmes such as car sharing initiatives; and
- Other sustainable transport interventions, such as enhancements to bus, Park and Ride, walking and cycling provision.

With high levels of growth anticipated over the next 6 to 18 months, Potential Interventions should be bought forward as soon as possible to ensure that sustainable travel patterns are enabled and instilled in users from the outset.

The proposed Cambridge South Station would contribute significantly to meeting CBC's transport needs by:

- Offering direct rail access from a wide range of locations where staff, patients and visitors live now and could live in the future – making rail access easier, quicker and more reliable for existing users and more attractive to potential new users;
- Relieving capacity pressure on other parts of the transport network, providing the opportunity to accommodate more new trips in a sustainable way; and
- Providing additional sustainable transport capacity to support other interventions aimed at reducing car traffic to CBC.

What has Part 3 Looked at?

Part 3 has assessed the impact of Potential Interventions identified in the Part 1 and Part 2 Reports, as well as Cambridge South Station and Planned Transport Schemes, on access to CBC between 2018 and 2031. Impacts are measured against the Targets identified within the Part 2 Report in terms of how they contribute to achieving an overall highway trip reduction. The impact on highway trip reduction is also assessed against parking demand and supply at CBC to determine supply requirements looking forward to 2031.

Part 3 also looks at the phasing required to manage highway demand between now (2018) and 2031. It assesses the impact of measures in line with existing phasing and looks at what changes could be made to phasing in order to smooth the impact of growth at CBC providing the greatest opportunities to encourage sustainable travel behaviours. Part 3 concludes with recommendations for implementation and phasing of measures as well as avenues for further Study.

What Impact Will Planned Schemes, Cambridge South Station and Other Potential Interventions Have on Demand for Access to CBC by Highway?

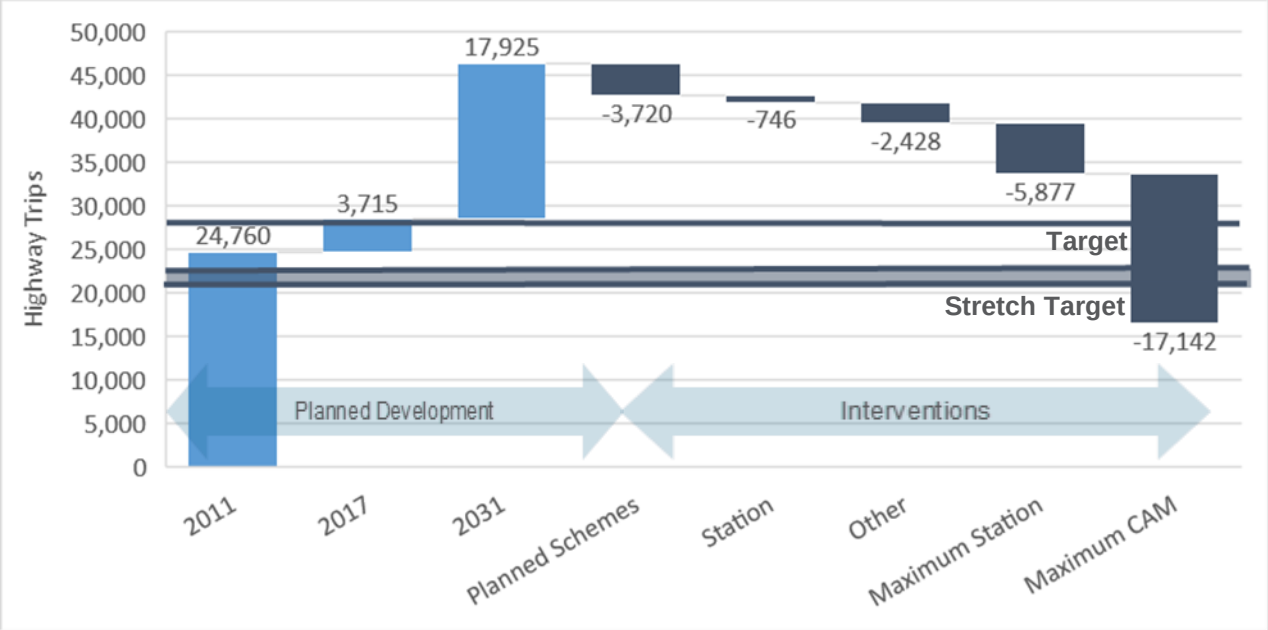
To determine whether the Planned Schemes, Cambridge South Station and Potential Interventions have the potential to meet the Targets for reducing highway trips to CBC, a spreadsheet model has been developed. Year-on-year results determine the phasing requirements to meet travel demand as development at CBC grows. Table 1 summarises the impact of all schemes and interventions on access to CBC by highway.

Table 1 - Summary of Daily Impacts of Planned Schemes, Cambridge South Station and Potential Interventions

Scheme	Impact on number of highway trips
Planned Schemes	-3,720
Cambridge South Station – Maximum Potential	-6,623
Other Potential Interventions	-2,428
Total	**-12,771**

Figure 1 shows the impact of all schemes and interventions on access to CBC by highway.

Figure 1 - Impact of Planned Schemes, Cambridge South Station and Other Potential Interventions on Highway Access to CBC



Looking at the 2031 horizon, the Target requires a reduction of 17,925 trips. The Planned Schemes, basic Station demand and Other Interventions, go some way towards achieving the Target, however accompanying demand management measures are also required to meet the Target. Maximum CAM and Maximum Cambridge South Station scenarios are required to fully meet the targets.

Phasing of Interventions

Phasing of Interventions has also been assessed to determine whether existing phasing proposals can manage demand or whether improvements can be made to smooth the impact of growth at CBC. Figure 2 shows highway trips to CBC year-on-year based on the existing phasing of schemes.

Figure 2 - Impact of Phasing on Highway Trips to CBC

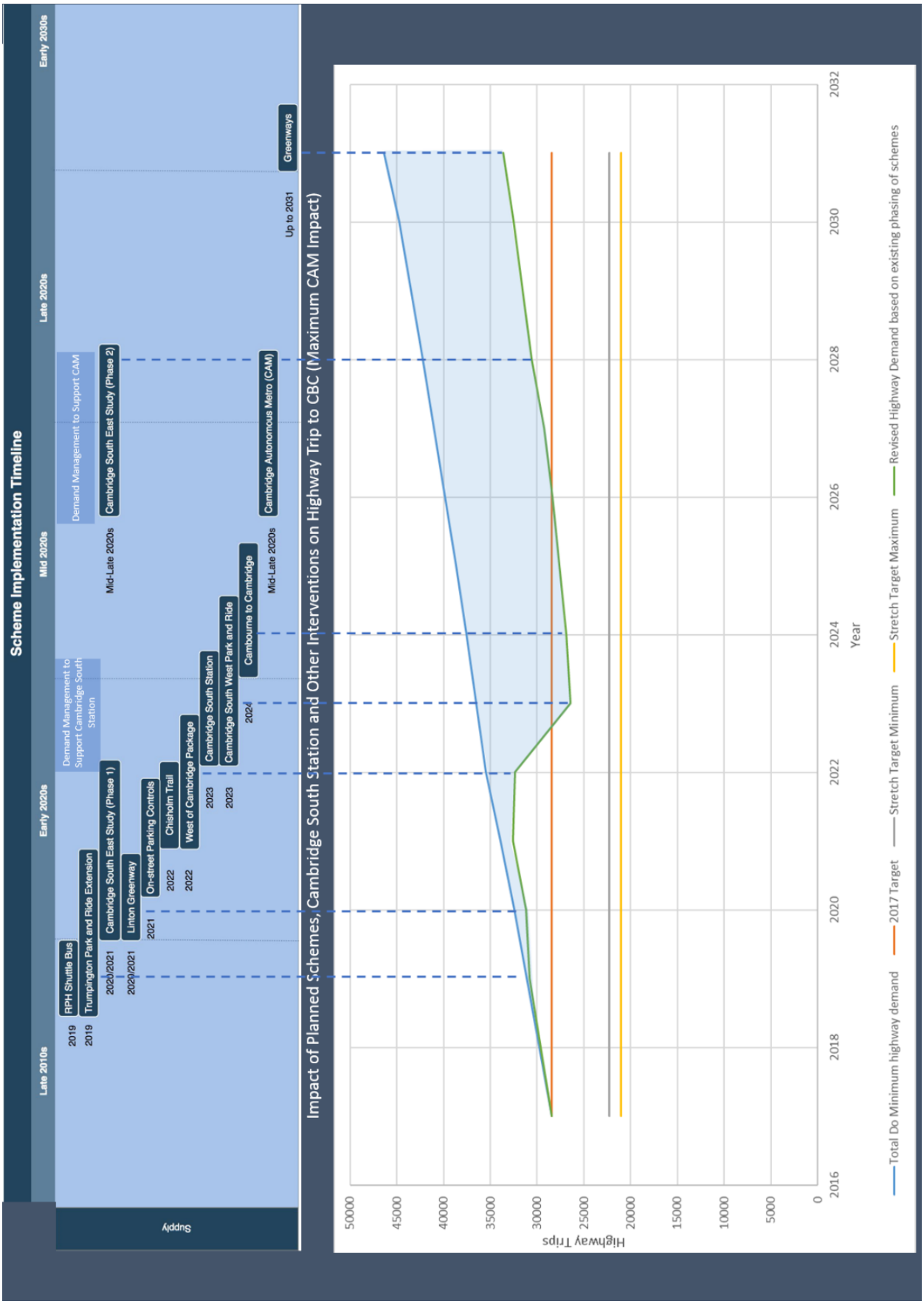


Figure 2 shows that with existing phasing of Planned Schemes, highway trips to CBC are likely to rise slowly until 2022, when a number of Planned Schemes and Cambridge South Station are scheduled to be implemented. These are predicted to reduce the demand for highway trips to CBC to below 2017 levels up until 2026. From 2024 onwards, highway trips are predicted to rise gradually until 2031.

It is recognised that the demand impact of CAM in Figure 2 is relatively modest which reflects the public transport improvements already assumed to be in place due to GCP schemes and other Potential Interventions. The demand assumption for CAM is based on a 35% increase in public transport demand with no dis-incentives to car travel. By 2028, it is considered that demand management measures implemented at CBC in terms of restricting car park growth and wider GCP measures could lead to significant dis-incentives to car travel. Therefore, Figure 3 shows the impact of CAM based on the alternative scenario that CAM will lead to a 40% decrease in highway traffic in 2031. It should be noted that this is the maximum impact predicted for the CAM scheme which is very early in its development stages and further work is required to fully understand the impact. It is assumed that this CAM scenario is likely to require associated demand management measures in Cambridge City Centre.

Figure 3 - Impact of Revised Phasing with CAM Maximum Impact on Highway trips to CBC

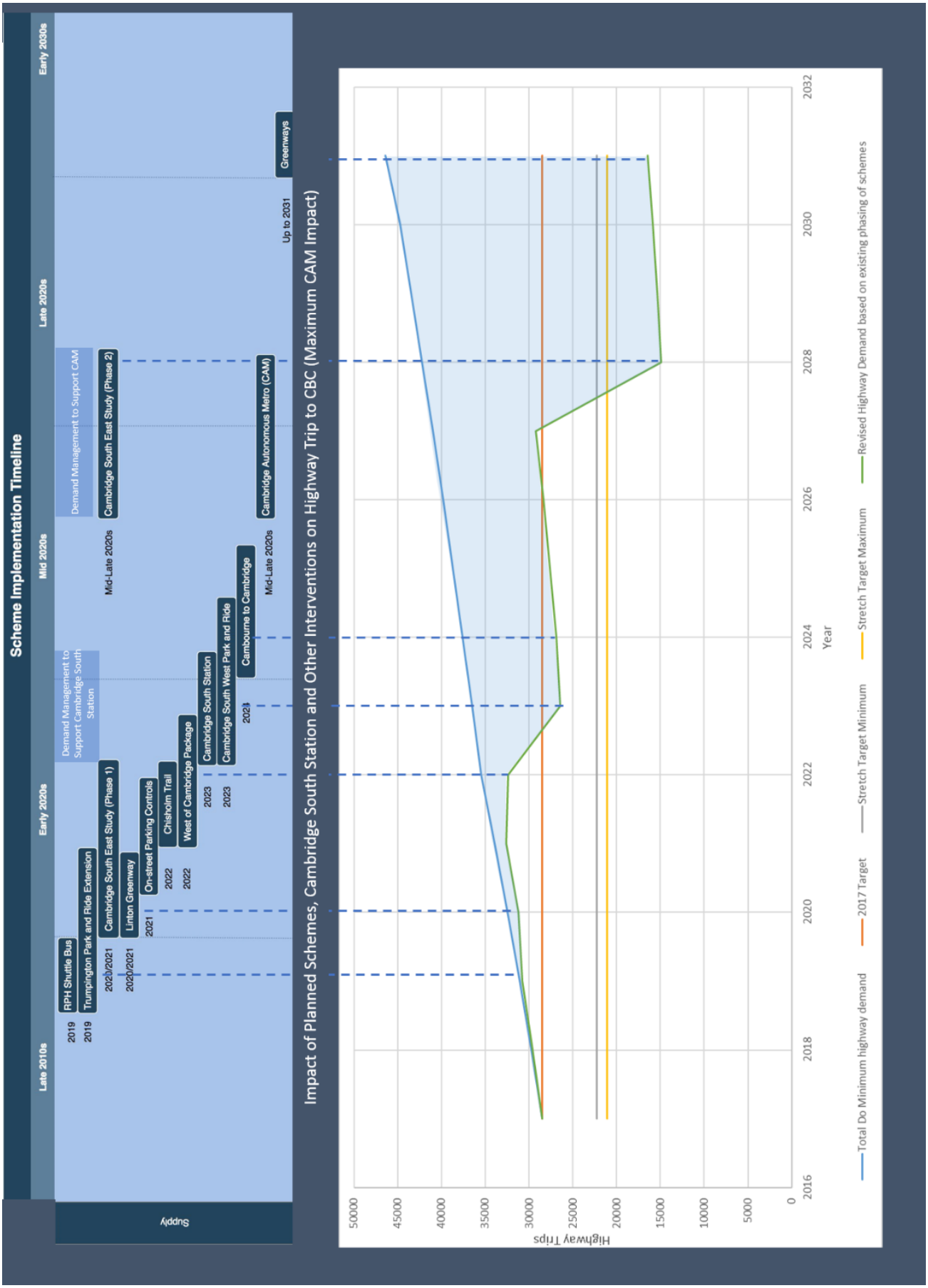


Figure 3 shows that CAM, with associated demand management measures, has the potential to exceed the Targets for reducing highway trips to CBC. The phasing plan is critical for meeting the Targets, to ensure that sustainable alternatives are in place when demand management measures are implemented. Schemes are likely to have the maximum impact if phased effectively. Maintaining the programme for the Planned Schemes is also critical for enabling growth, avoiding abortive expenditure on those Schemes, and in avoiding a negative impact on the Campus operation, such as increased congestion within CBC.

Parking Demand and Supply

In order to determine how the demand for car parking could change following implementation of the Planned Schemes, Cambridge South Station and Other Potential Interventions (outlined in the Part 1 and Part 2 Reports) car park space turnover data has been obtained from CBC. This has been used to factor the impact of the interventions, which are currently presented in the form of highway trips, into demand for car parking spaces.

Analysis of the period between 2018 and 2031 shows that demand is predicted to exceed supply from 2019 to 2022. Cambridge South Station, in the maximum Station scenario, is predicted to have the largest impact on car park demand in 2023 leading to a surplus in supply. Overall, the impact of all the Potential Interventions leads to a reduction in car park demand of 8,460 spaces per day in 2031 (compared to a situation without these interventions) and has the potential to negate the need for additional car park spaces to be provided in 2025 as currently proposed, whether this be through retiring surface level car parks or not building the multi-storey car parks associated with the Phase 2 development. Reducing the need for additional parking to be provided has the potential to release space to be used for public realm enhancement or further development on-campus.

What are the Overall Findings and Recommendations from the Part 3 Report?

Overall, Part 3 of the CBC Transport Needs Review has shown that Planned Schemes, Cambridge South Station and Other Potential Interventions have the potential to have a significant positive impact on access to CBC, including encouraging more trips by sustainable modes and abstracting trips from the highway. Together, if phased effectively, the measures have the potential to exceed the Targets for highway trip reduction by 2031. Phasing is critical to managing highway demand, in line with growth, between now (2018) and 2031 to maintain demand broadly in line with 2017 levels.

Effective phasing will also help manage demand for car parking on-site. The earlier that significant sustainable transport options are available the easier highway trips become to manage as some growth at CBC will be yet to occur and positive travel habits will be encouraged for new trips from the start.

Conclusions

- Highway trips are expected to continue to grow between 2017 and 2031;
- Although some imminent developments at CBC (Royal Papworth Hospital and AstraZeneca) have been delayed, these are still expected become operational before most of the planned major transport schemes are implemented;
- GCP Schemes that are planned to come forward between 2022 and 2024, and Cambridge South Station, could have a significant impact on highway demand to CBC, bringing total highway demand to below 2017 levels in 2023. The ‘Maximum Station’ impact is required to meet this Target and therefore supporting measures and demand management are critical to doing so. The availability and management of car parking at CBC is critical to achieving the Target;
- Post-2023, CAM has the potential for the greatest impact. The level of impact depends on supporting demand management measures to encourage the transition from private car to sustainable transport;
- For the Station and CAM to have maximum impact, citywide demand management needs to be in place;
- Achieving the Target for highway trip reduction opens up headroom in the parking supply and creates opportunities to avoid planned parking construction, retire existing car parks and release space to enhance public realm, and/or provide additional development sites; and

- The maximum impact of Cambridge South Station is not only dependant on supporting measures implemented at CBC itself, but also on the ability of the wider network to support that level of ridership. For example, early engagement with the Rail Industry around train capacity and the potential contribution of East-West Rail are important to provide the most effective assess to the Station.

Recommendations

- It is critical that GCP schemes are kept to programme (as identified in this Report) to address short-term continued highway traffic growth, mitigating negative impacts on Campus operation and quality of life;
- Key stakeholders should collaborate to coordinate phasing of planned schemes, growth and any demand management measures, in order to have the maximum impact in the identified timescales. These players include CBC, Cambridgeshire County Council, GCP, University of Cambridge, the Cambridgeshire and Peterborough Combined Authority and the rail industry;
- Carry out further scheme development work on the measures identified for securing the transport and public realm goals relating to Cambridge South Station;
- Further work to understand the increase in footfall at rail stations at the other end of the rail journey, to determine if they need any infrastructure improvements to support the new rail trips to CBC via Cambridge South Station; and
- Further development of Potential Interventions identified in this Study, including possible ‘quick wins’ to help address the initial highway growth is recommended. This should commence as soon as possible.

It will be essential to bring these workstreams forward swiftly to ensure that measures are in place to promote the required mode shift to accommodate growth at CBC.

1. Introduction

1.1. Background and Context

Atkins has been commissioned by Cambridgeshire County Council (CCC), on behalf of the Greater Cambridge Partnership (GCP), to undertake a Transport Needs Review of Cambridge Biomedical Campus (CBC).

CBC, including Cambridge University Hospitals NHS Foundation Trust (CUH), generates intense travel activity, with over 28,000[2] person-trips to and from the Site daily in 2017. This is comprised of staff, patients and visitors, alongside other trips through the Site. CBC strives to be considered as an exemplar sustainable travel Campus and an example of best practice in terms of delivering environmentally sound, active and healthy outcomes.

Considerable growth is planned at CBC up to 2031. The Part 2 Report[3] sets the context for this growth at CBC and in the wider Cambridge area.

The purpose of this Study is to consider the future transport needs of CBC beyond the current programme of works and in scenarios with and without a new Cambridge South Station.

This Report, Part 3 of the Study, sets out:

- The potential impact of Planned Schemes on access to CBC;
- The potential impact of Cambridge South Station on access to CBC;
- The impact of the Potential Interventions (derived in Part 1 and Part 2) required in the short and long term to accommodate CBC's transport needs and support Cambridge South Station; and
- The phasing of all of the above interventions required to manage demand to CBC as the Site expands up to 2031.

1.2. About this Study

This Study has three parts, as set out below:

Part 1: Baseline to 2022

Part 1 provided an understanding of the following for a five-year horizon:

- Current travel demand to, from and within CBC, including the volume of travel to and from the Site and the breakdown by mode, purpose and direction;
- Current travel supply for these trips, including the challenges and opportunities;
- Current mismatches between supply and demand for trips to, from and within CBC;
- Future travel demand to, from and within CBC;
- Future travel supply for these trips, including CBC proposals, GCP proposals and bus and rail improvements; and
- Future mismatches between the supply and the demand for trips.

Part 1 recommended Potential Interventions up to 2022 to manage growth and reduce the gaps between supply and demand.

Part 2: 2022 to 2031

Part 2 examines the transport needs of CBC beyond 2022 and recommends additional Potential Interventions needed for CBC during this time period, for scenarios both with and without the addition of a Cambridge South Station.

Consideration of Cambridge South Station includes:

- The fit of a new Station within CBC and regional growth strategy;
- Options for access to a new Station; and
- Wider economic impacts of a new Station.

[2] Part 1 Report – Section 5.3.5
[3] 'Cambridge Biomedical Campus Transport Needs Review Part 2 Report' Section 1.1.1 and 1.1.2

Part 3: Impact of Interventions and Cambridge South Station on Access to CBC

Part 3 assesses the impact of the Potential Interventions identified in the Part 1 and Part 2 Report, as well as Cambridge South Station and Planned Schemes, on access to CBC between 2018 and 2031. This determines the level of intervention required as well as the phasing in line with growth on the CBC Site.

This Report provides the output of Part 3 of the Study. A separate Non-Technical Summary summarises the outcomes of the entire Study (Parts 1, 2 and 3).

1.3. Part 1 Summary

Part 1 of the Study covered a wide range of evidence on transport supply, available routes and services, plus quality factors such as reliability, congestion and travel patterns. Analysis of this evidence built up a picture of what travel to CBC looks like now (2018) and what travel could look like in 2022 when considering the planned growth on the Site. The key findings of the Part 1 Report are:

- There are several existing challenges, particularly highway congestion on Babraham Road and Addenbrooke's Road;
- There are gaps in the existing range of direct bus services available from key travel origins;
- There is concern over staff parking impacts on surrounding residential streets;
- Mode share indicates low levels of walking (1% mode share for patients and 3% mode share for staff) and a deficit in cycle parking capacity;
- Planned development will increase travel demand by 30% to 40% by 2022 for all modes;
- Although additional car parking is planned, the highway network has little capacity to accommodate additional car trips to / from the Site between 2018 and 2022;
- Congestion and journey times will increase and access to the Site by car will be further constrained; and
- Highway traffic growth would also have a consequential impact on air quality.

Potential Interventions for the short term (a five-year horizon) proposed in the Part 1 Report focused on improving access for sustainable modes. Given the relocation of Abcam and Royal Papworth Hospital to CBC in 2019, and AstraZeneca in 2020, pressure on transport infrastructure on the CBC Site is an immediate short-term concern, with some interventions required within the next 6 to 18 months to accommodate travel demand. Given the interactions between the availability and use of sustainable modes, the level and management of highway capacity and the level and management of parking capacity, these factors must be addressed through a coordinated, holistic approach.

A full list of the Potential Interventions identified in the Part 1 Report is included within Appendix A of this Report.

1.4. Part 2 Summary

Part 2 of the Study looks at transport access to CBC from 2022 to 2031 and assesses how it could look with and without Cambridge South Station.

Part 2 focuses on a set of Targets for traffic levels accessing the CBC Site as follows:

- **Target**: Maintaining traffic at 2017 levels up to 2031; and
- **Stretch Target**: a 10% to 15% reduction in peak highway trips from 2011 levels, which is aligned with the Target of the GCP City Access Strategy.

For CBC, this means a reduction in daily one-way person-trips of between **17,925** (Target) and **25,354** (Stretch Target) on the highway is required by 2031.

To accommodate the extensive growth planned at CBC up to 2031, significant Potential Interventions are required to manage access alongside the provision of Cambridge South Station. These measures are needed to manage growth, meet the highway traffic reduction Targets and ensure that CBC continues to achieve its vision of being a sustainable travel campus. Potential Interventions suggested by this Study include:

- Demand management measures such as further restrictions on parking and car access to CBC;
- Hard infrastructure improvements such as new or improved footpaths/footways or cycleways;

- Behavioural change programmes such as car sharing initiatives; and
- Other sustainable transport interventions, such as enhancements to bus, Park and Ride, walking and cycling provision.

With high levels of growth anticipated over the next 6 to 18 months, Potential Interventions should be bought forward as soon as possible to ensure that sustainable travel patterns are enabled and instilled in users from the outset.

A full list of the Potential Interventions identified in the Part 2 Report is included within Appendix B of this Report.

The proposed Cambridge South Station would contribute significantly to meeting CBC's transport needs by:

- Offering direct rail access from a wide range of locations where staff, patients and visitors live now and could live in the future – making rail access easier, quicker and more reliable for existing users and more attractive to potential new users;
- Relieving capacity pressure on other parts of the transport network, providing the opportunity to accommodate more new trips in a sustainable way; and
- Providing additional sustainable transport capacity to support Other Potential Interventions aimed at reducing car traffic to CBC.

1.5. Report Structure

The remainder of this Report is structured as follows:

- Chapter 2 presents the context for growth at CBC from 2017 to 2031;
- Chapter 3 sets the context for parking demand and supply to 2031;
- Chapter 4 presents the impact of Planned Schemes on access to CBC by car;
- Chapter 5 presents the impact of Cambridge South Station, using two methodologies, on access to CBC by car;
- Chapter 6 presents the impact of Potential Interventions identified in the Part 1 and Part 2 reports on access to CBC by car;
- Chapter 7 presents demand management measures and their impact in access to CBC;
- Chapter 8 assesses the impact of growth, Planned Schemes, Cambridge South Station and Other Potential Interventions on car parking demand;
- Chapter 9 assesses the phasing of schemes required to manage demand to CBC in the most sustainable way; and
- Chapter 10 concludes this Study.

2. Growth

This Chapter sets the context for growth at CBC and introduces the Targets set by the GCP to encourage growth to occur in a sustainable way.

2.1. Context for Growth

Section 3.2 of the Part 1 report comments on the planned growth in the Cambridge Sub-region and identifies CBC as a key Site to deliver a sizeable proportion of this growth.

Figure 4 shows the impact of the planned growth in terms of staff numbers, patient and visitor numbers and the number of trips predicted to travel to or through CBC[4].

Figure 4 - Impact of Growth at CBC on trips to or through the Campus[5]



Figure 4 shows that growth at CBC between 2017 and 2031 is predicted to lead to a significant increase in the number of vehicle trips accessing the Site. The Part 1 Report showed that the highway network around CBC is at capacity during peak hours, therefore additional vehicle trips as a result of growth at CBC are predicted to put considerable pressure on the highway network as well as on-site infrastructure such as car parks.

2.2. Accommodating Growth

The Part 2 Report shows that to accommodate the extensive growth planned at CBC up to 2031, significant Potential Interventions are required to manage access to the Campus, alongside the provision of Cambridge South Station. These measures are needed to achieve sustainable growth and reduce the number of highway trips to the Site. Targets to reduce the number of vehicles accessing CBC are as follows:

- **Target:** Maintaining traffic at 2017 levels up to 2031; and
- **Stretch Target:** A 10% to 15% reduction in peak highway trips from 2011 levels, which is aligned with the Target of the GCP City Access Strategy.

[4] Through trips include drop-off trips and those travelling through the Campus to access destinations such as Long Road Sixth Form College. Vehicle traffic originates from 2017 Travel Survey Counts which capture all vehicles travelling into and out of the Site including these through trips.

[5] Values within Figure originate in the Part 2 Report Tables 1, 2 and 3 and the Part 1 Report Table 3-1.

It is important to recognise that although this level of reduction is significant, a lot of the growth included within the 2022 and 2031 scenarios is yet to happen. If actions are taken now to mitigate traffic growth before it happens (i.e. to capture growth using sustainable modes), the 10%-15% Stretch Target for reduction could involve fewer established car trips.

Figure 5 shows the Target and Stretch Target in the context of the number of highway person-trips.

Figure 5 - Forecast Change and Target Reduction in Daily Highway Person Trips

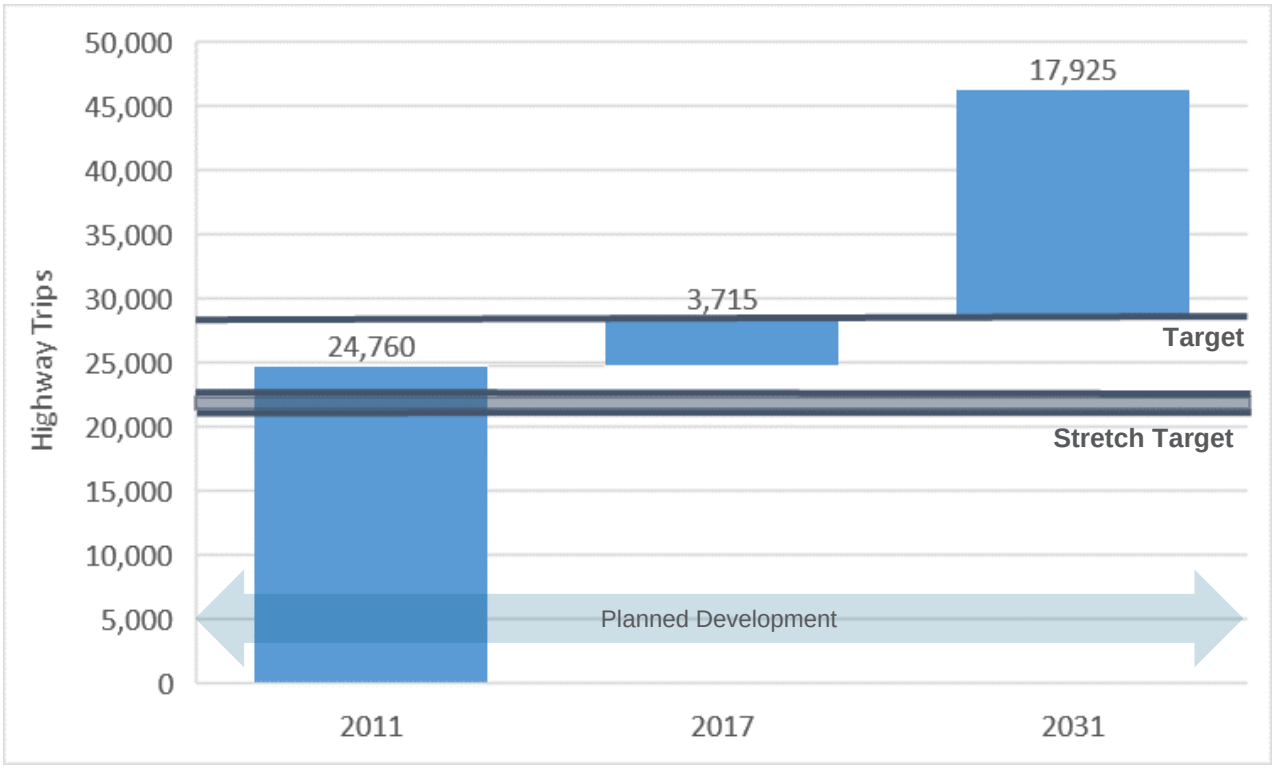


Figure 5 shows that:

- To maintain traffic at 2017 levels up to 2031, a reduction of **17,925 daily person-trips** to 28,475 daily person-trips will be required;
- To achieve a Stretch Target of a reduction to 10% below the 2011 traffic levels by 2031, a reduction of **24,116 daily person-trips** to 22,284 daily person trips will be required. This figure is equivalent to 85% of the 2017 traffic levels accessing the Site; and
- To achieve a reduction of 15% below the 2011 traffic levels by 2031, the more ambitious end of the Stretch Target, a reduction of **25,354 daily person-trips** to 21,046 daily person-trips will be required; equivalent to 89% of the existing 2017 traffic levels accessing the Site.

To determine whether the Planned Schemes and Potential Interventions identified in the Part 1 and Part 2 report have the potential to meet the Targets, the impact of the interventions needs to be assessed in the context of CBC. The following Section outlines the methodology used to conduct this assessment.

2.3. Methodology

A spreadsheet model has been developed to assess the impact of Planned Schemes, Cambridge South Station, other Potential Interventions and parking restrictions on the number of highway trips to CBC. The model includes the following steps:

- **Step 1: Growth Forecasts** – Uses staff and patient headcount data to generate percentage growth for each user category for each year. This takes hospital patient growth rates as a proxy for overall CBC patient and visitor growth rates. This is considered reasonable as the growth in visitor numbers will be determined by the growth in patient numbers;

- **Step 2: On-Campus Car Parking Supply** – Uses the existing on-site car parking supply and the proposed new car parks to build up a picture of available car park supply each year;
- **Step 3: Do-Minimum Car Parking Demand** - Applies the growth factors from Step 1 to baseline car parking demand numbers, including off-street parking on residential streets. The do-minimum scenario takes into account staff and patient growth and increases in parking supply but no other transport interventions;
- **Step 4: Patient and Visitor Parking is prioritised**[6] – Identifies what parking is available for staff if parking is prioritised for patients and visitors. It is assumed that staff will be offered parking that remains;
- **Step 5: Impact of On-street Parking Controls** – Assumes that staff will no longer be able to park on-street following implementation of on-street parking controls proposed as part of the City Access Strategy. The staff displaced from the on-street spaces are assumed be distributed between on-campus parking and Park and Ride sites depending on their eligibility to park on-campus;
- **Step 6: Impact of Planned Schemes** – Sets out the assumed impact of Planned Schemes in terms of the number of highway trips removed from the network as a result. These figures represent only an estimated impact on CBC demand as the impact of each scheme has not yet been fully assessed. This does not represent any other impact of these schemes (e.g. mode shift to/from the City Centre);
- **Step 7: Impact of Cambridge South Station and its supporting measures** – Two methodologies have been used to assess the impact of Cambridge South Station:
  - A) Basic Station Demand – this step used Station demand forecasting originally undertaken by John Laing to forecast the impact of the Station on CBC. This method assumes that there are no changes to CBC access other than the Station;
  - B) Maximum Station Demand - this step assumes that the Station will be able to contribute to the mode shift target by enabling most staff, and some patients and visitors, who live within a rail catchment to use rail to CBC. With the Station and supporting measures to further enable rail use, it is assumed that staff parking restrictions can be further tightened. Adjustments are made to account for trips that must be made by car such as blue-badge holders, on-call / out of hours doctors and nurses, as well as trips that would continue to be made by sustainable modes; and
- **Step 8: Impact of Other Potential Interventions** – Predicts the impact of all remaining Potential Interventions from Table 9 in the Part 2 Report, not included within the steps above, on the demand for highway person-trips to CBC. Adjustments have been made to reduce the risk of double counting trips already accommodated by rail and the Planned Schemes in Steps 6 and 7 respectively.

The model outputs consist of the total highway demand and parking demand to CBC each year. The year-on-year results will determine the phasing requirements of Planned Schemes and Other Potential Interventions to manage highway demand to the Site and provide alternative parking facilities (such as Park and Ride sites) when other provision (parking on residential streets) becomes unavailable.

The following Chapters of this Report detail the inputs and outputs of each step of the model in more detail to build up the picture of highway demand to CBC as growth happens between 2017 and 2031.

[6] Patient and Visitor demand is already prioritised on-site. This step simply ensures that this continues through the model and enables a calculation of supply that is left available for staff.

3. Parking

This Chapter sets out the context for parking supply and demand on the CBC Site, as covered by Steps 2, 3 and 4 of the spreadsheet model. Parking supply and demand is looked at across the Campus as a whole rather than through specific occupiers. Demand presented within this Chapter does not include Park and Ride as these are regarded as public transport journeys to the Site instead for the purposes of this Study.

3.1. Context

Parking supply on the CBC Site is critical in determining the volume of highway trips that will access the Site. Restricting parking on-site is key to getting people out of their cars and therefore reducing the number of highway trips to CBC. It is critical that any restrictions to car parking on-site is linked to the provision of other sustainable travel alternatives to ensure that parking is not displaced to other locations, such as on-street.

3.2. Parking Supply

Section 3.2.1 in the Part 2 Report shows that 3,671 additional spaces on top of the existing provision of 4,950 spaces are proposed to be provided on-site by 2025, bringing total parking provision to 8,621 spaces.

3.3. Do Minimum Car Parking Demand

Table 6 in the Part 2 Report shows that 2017 parking demand on-site equates to 4,649 (4,451 formal car parking and 198 informal car parking). In addition to this, there are 1,106 vehicles that are known to park off-site, resulting in a total parking demand of 5,755 in 2017. By 2031, if left unchecked, this is expected to rise to 9,381, leading to a deficit of 760 spaces (8,621 spaces minus 9,381 demand, Table 6 in the Part 2 Report).

3.4. Planned On-street Parking Controls

As part of the City Access Strategy, it is proposed to extend the On-street Parking Controls, already in place in the City Centre to areas around CBC, amongst others. This could mean that the existing on-street parking demand is displaced. Displaced vehicles could choose to park on-site, further afield or at a Park and Ride site. For the purposes of this Study it is assumed that that the next logical parking choice would be on-campus for those that are eligible to do so under the staff eligibility criteria. The impact of the Planned On-street Parking Controls is assessed in Chapter 4.

3.5. Can Demand for Parking be Met on Campus?

It is assumed that patient and visitor trips will be prioritised in terms of parking on-site, along with those staff for whom parking is deemed to be essential such as on-call / out of hours doctors and nurses. Table 2 shows the split for staff and patient parking demand and determines whether supply can accommodate demand generated by patients and visitors.

Table 2 - Do-Minimum Car Parking On-Campus[7] Demand vs Supply (Peak Demand)

	2017	2022	2031
Staff Demand	4,546	5,947	7,288
Patients Demand	1,209	1,471	2,093
Total Demand	**5,755**	**7,418**	**9,381**
On-Campus Supply	4,950	5,922	8,621
Can Patient demand be met?	Yes	Yes	Yes
Remaining parking available for staff parking	3,741	4,451	6,528
Can Staff demand be met?	No	No	No
Staff surplus / deficit	-805	-1,496	-760

Table 2 shows that in 2017 on-campus parking supply exceeds demand, with 805 vehicles unable to be accommodated within on-campus car parks (this accounts for the fact that an existing 1,106 vehicles are parked off-site). By 2031, with the construction of two new multi-storey car parks at CBC, the deficit is predicted to reduce slightly to 760.

Providing more car park capacity to accommodate demand will encourage additional trips to the Campus by car. This is against the aim of the GCP and CBC to reduce the level of highway trips to the Site in line with the Targets set out in Section 2.2. Therefore, to discourage highway trips to CBC, it is important to consider whether planned car parks meet the overall transport needs of CBC and the wider south Cambridge area. It is critical to consider implementing further restrictions on on-campus car parking to manage and discourage growth in highway trips to the Site to essential highway trips only. By implementing sustainable alternatives prior to 2025, demand may be as such that the planned car parks are no longer required.

Through placing restrictions on car park supply, a significant number of highway trips will be displaced and will have to be accommodated elsewhere or by an alternative mode. How and where these trips are displaced is discussed in Chapter 7.

[7] Includes those vehicles likely to be displaced by the On-street Parking Controls.

4. Planned Schemes

This Chapter outlines the predicted impact of the Planned Schemes on access to CBC (Steps 5 and 6). For the purposes of this Study it has been agreed that the following schemes are likely to have a direct or significant impact on access to CBC and have therefore been included within this Chapter:

- On-street Parking Controls;
- Cambridge South East Transport Study;
- Greenways (particularly Linton, Fulbourn, Sawston and Melbourn);
- Chisholm Trail;
- West of Cambridge Package, including:
  - Cambridge South West Park and Ride;
  - Expansion of Trumpington Park and Ride;
- Cambourne to Cambridge; and
- Cambridge Autonomous Metro (CAM).

The following Sections predict the impact of the schemes on access to CBC, based on information provided by the GCP Project Managers. Phasing of the schemes is considered within Chapter 9.

4.1. Impact on Access to CBC

Table 3 outlines the predicted impact of Planned Schemes on access to CBC including how this has been calculated. Impacts are presented in terms of the number of one-way highway trips that are added or removed from the network to CBC as a result of the scheme. This approach enables the impact of the schemes on the Targets identified in Section 2.2 to be ascertained. Data has been gathered from various sources including:

- GCP project teams;
- Case studies of similar schemes;
- Demand information;
- Mode split data; and
- Census data.

The demand caused by on-street parking is included within Table 2. However, this has been revisited as part of this Section in order to predict the impact of the On-street Parking Controls on CBC and is therefore also included within the Table 3. It is important to recognise that the impacts predicted in Table 3 are on access to CBC by highway only and do not reflect the total impact of scheme. Table 3 summarises the methodology used to calculate the impact of the Planned Schemes. Appendix C provides a detailed methodology.

Table 3 - Impact of GCP Schemes on Access to CBC

Schemes	Method of Calculating Impact	Impact on highway trips accessing CBC
On-street Parking Controls	A total of 1,106[8] people (assumed to be staff) park on-street in 2017. Data from CBC shows that 250 of these are assumed to Park and Cycle and are therefore assumed to come from further afield than the areas covered by the On-street Parking Controls. This therefore means that parking demand caused by those who Park and Cycle is unlikely to be affected by the On-street Parking Controls. Should they be affected by the On-street Parking Controls it is assumed that they would choose to Park and Cycle from a Park and Ride site instead, especially as they would be able to park free of charge. This leaves 856 people parked on-street within the areas proposed to be covered by the On-street Parking Controls who will be required to park elsewhere, whether that be on-site, depending on eligibility, or at Park and Ride Sites.	856 highway trips that need to be accommodated elsewhere or by alternative modes.
Cambridge South East Transport Study	Staff postcode data shows that a total of 1,757 staff are currently residing within the Cambridge South East Transport Study Catchment Area. By 2031 this is predicted to rise to 2,653, of which 1,565 are forecast to drive based on existing mode share data (59%). Information provided by the GCP project team predicts that the Strategy 1 scheme could reduce car travel to CBC by 40% from the Cambridge South East Study Area. Therefore, 626 staff trips are forecast to be taken off the highway network daily. The same methodology has been applied to patients residing in the Cambridge South East Study Area and leads to a further reduction in highway trips of 667, bringing the total reduction to 1,293 highway trips (626 + 667). Phase 2 of the Cambridge South East Transport Study is anticipated to form the first phase of CAM. Therefore, the impact of the South East Transport Study is transferred to CAM when the latter is predicted to become operational in the mid-late 2020's.	-1,293 highway trips.

[8] Part 2 Report – Table 6

Schemes	Method of Calculating Impact	Impact on highway trips accessing CBC
Greenways and Chisholm Trail (grouped together as methodology based on the same inputs)	The impact of the 'Cycling City and Town's' Scheme in Cambridge was a 9%[9] increase in cycling. This is lower than other schemes within the same programme due to the high baseline for cycling in Cambridge. The scheme included improvements to infrastructure and long-distance cycling from outlying villages, increases in cycle parking and speed reduction measures. This is assumed to be an appropriate proxy on which to base the impact of the Greenways and Chisholm Trail. There are 7,800 cycle trips predicted to access CBC in 2031. A 9% increase in cycling would lead to 702 new cycle trips. Based on a weighted mode shift (see note below Table) it is predicted that 370 of these would be mode shift from car.	-370 highway trips.
Cambourne to Cambridge	Census Data from 2011 has been interrogated to determine the number of people travelling for work from the Middle Super Output Area's (MSOA) associated with Cambourne and Papworth. Also taken into account are new housing developments at Cambourne West and Bourn Airfield that would not have been captured by the 2011 Census Data. The population of the developments and the number of staff likely to work at CBC has been based on the levels within the existing Cambourne settlement. The relocation of Royal Papworth Hospital has also been taken into account. This is likely to lead to additional trips from the corridor to CBC. However, as a result of some staff relocating closer to the Campus to areas such as Waterbeach Barracks. The impact of a new Park and Ride site was calculated based on a number of case studies[10] which show that a new Park and Ride Site leads to a 14% mode shift to Park and Ride. Based on a weighted mode shift (Cambourne and Papworth) the result of a new Park and Ride site is predicted to lead to a decrease in car usage of 12%. This equates to 254 fewer car trips accessing CBC. A new shuttle bus is proposed by CBC to start in April 2019 to support the relocation of Royal Papworth Hospital to CBC. This is assumed to provide an interim measure until the Cambourne to Cambridge bus service becomes operational in 2024 and will therefore include some of the demand for this service. Therefore, the impact of the bus service, (totalling 74 highway trips) has been moved forward to 2019 to reflect the introduction of this service.	-206 highway trips. (Cambourne to Cambridge Bus Service) -254 highway trips (Park and Ride) -460 trips (Total)

[9] https://www.sustrans.org.uk/sites/default/files/file_content_type/cycling_city_and_towns_cambridge.pdf (page 7)
[10] Canterbury Park and Ride and Oxford Park and Ride (calculated using an average impact on mode shift)

Schemes	Method of Calculating Impact	Impact on highway trips accessing CBC
West of Cambridge Package – bus service only	Census Data from 2011 has been interrogated to determine the number of people travelling to CBC for work from MSOA's in the north west of Cambridge (987) and the mode by which they travel. Based on a location which already has a direct bus service to CBC (Haverhill) a revised bus mode share of 31% has been applied, resulting in 143 new bus trips. Based on a weighted mode shift, it is predicted that 55 of these would be mode shift from car.	-55 highway trips.
Cambridge South West Park and Ride	The impact of a new Park and Ride site as part of the scheme has been calculated based on several case studies which indicate that a new Park and Ride site leads to a 14% mode shift to Park and Ride. By applying a weighted mode shift based on existing mode shares (see note for information), it is predicted that 6,740 trips could transfer from car and use this site. However, based on the catchment of Trumpington Park and Ride, obtained from Road-Side Interview (RSI) data, only 48% of these trips (3,235) originate in the catchment area. Vehicle occupancy data shows that vehicle trips to CBC have an occupancy factor of 1.48. Therefore, it is predicted that 1,932 vehicle trips could be removed from highway network as a result. This calculation, also takes into account that the new Park and Ride proposed by the Cambourne to Cambridge Scheme is also within the catchment for Trumpington Park and Ride. Therefore, an adjustment has been made to account for this and avoid double counting.	-1,932 highway trips.
Expansion of Trumpington Park and Ride by 279 spaces.	The impact of a new Park and Ride site calculated based on a number of case studies which show that a new Park and Ride site leads to a 14% mode shift to Park and Ride. As this is not a new Park and Ride site, but an extension, it has been assumed that there will be a 14% increase in Park and Ride usage at Trumpington Park and Ride as a result. RSI data has shown that 688 trips to Trumpington Park and Ride each day have an end destination at CBC. Therefore, this demand increases to 785 as a result of the expansion. Using a weighted mode shift percentage, this is predicted to include 66 trips that were previously made by car to CBC.	-66 highway trips.

Schemes	Method of Calculating Impact	Impact on highway trips accessing CBC
Cambridge Autonomous Metro	The Greater Cambridge Mass Transit Options Assessment Report predicts that CAM could lead to an increase in total public transport demand of 35%. 7,000 bus trips are predicted to CBC in 2031 of which a 35% increase is 2,540 trips. Of these it is considered that 2,097 will be abstracted from the highway and the remainder are abstracted from cycle. Vehicle occupancy data shows that vehicle trips to CBC have an occupancy factor of 1.48. Therefore, it is predicted that 1,418 vehicle trips could be removed from the highway network as a result of CAM. Demand forecasting for the CAM scheme represents the total potential volume of public transport demand across Cambridge based on housing and employment growth, total travel demand and mode share. The demand forecasts do not represent only the level of demand of a mass transit scheme. Therefore, the reduction in highway trips accessing CBC of 1,418 is based on the impact of all public transport schemes, including existing services and those proposed by the GCP alongside the CAM Scheme. For this reason, the reduction in highway trips of 1,480 is the uppermost reduction caused by improvements to public transport services in Cambridge. To avoid double counting, the impact of the GCP Schemes identified in Table 3, which includes public transport improvements, are assumed to be included within the impact identified the CAM Report. It is recognised that the demand impact of CAM is relatively modest which reflects the public transport improvements already assumed to be in place due to GCP schemes and other Potential Interventions.	-1,418 highway trips.

Note: *Many of the calculations summarised within Table 3 are applied based on a weighted mode shift. For example, for the Greenways and Chisholm Trail assessment, the number of new cycle trips that previously used car to access CBC has been calculated using a weighted mode shift approach. The predicted mode share for cycling to CBC in 2031 was 12% based on Table 4 in the Part 2 report. With the addition of the Greenways and Chisholm Trail this mode share becomes 21% meaning that 9% needs to be taken off the other modes. A weighted split has been applied to the 9% based on the 2031 mode shares which means that the car mode share is reduced by 7%. This equates to a reduction of 548 highway trips. All highway trips to CBC have a vehicle occupancy of 1.48, which when applied to the 548 highway person trips, leads to a predicted reduction of* ***370*** *highway vehicle trips to CBC in 2031. This methodology has been applied in the same way to each intervention where noted.*

The total impact of the Planned Schemes on highway trips to CBC is a reduction of **3,720 (CAM, Greenways, Chisholm Trail and Cambridge South West Park and Ride)**. It is considered that the peak hours would see the most impact in terms of highway trip reduction. However, the impact would be felt across the day as trips are made by shift-workers, out of hours staff and patients and visitors at all hours of the day.

4.1.1. What would access to CBC look like?

Figure 6 shows the impact of the Planned Schemes on access to CBC. Impacts have been factored to 2031, using the patient and staff growth figures, to present the highway demand picture for 2031.

Figure 6 - Impact of Planned Schemes on Daily One-way Highway Trips to CBC

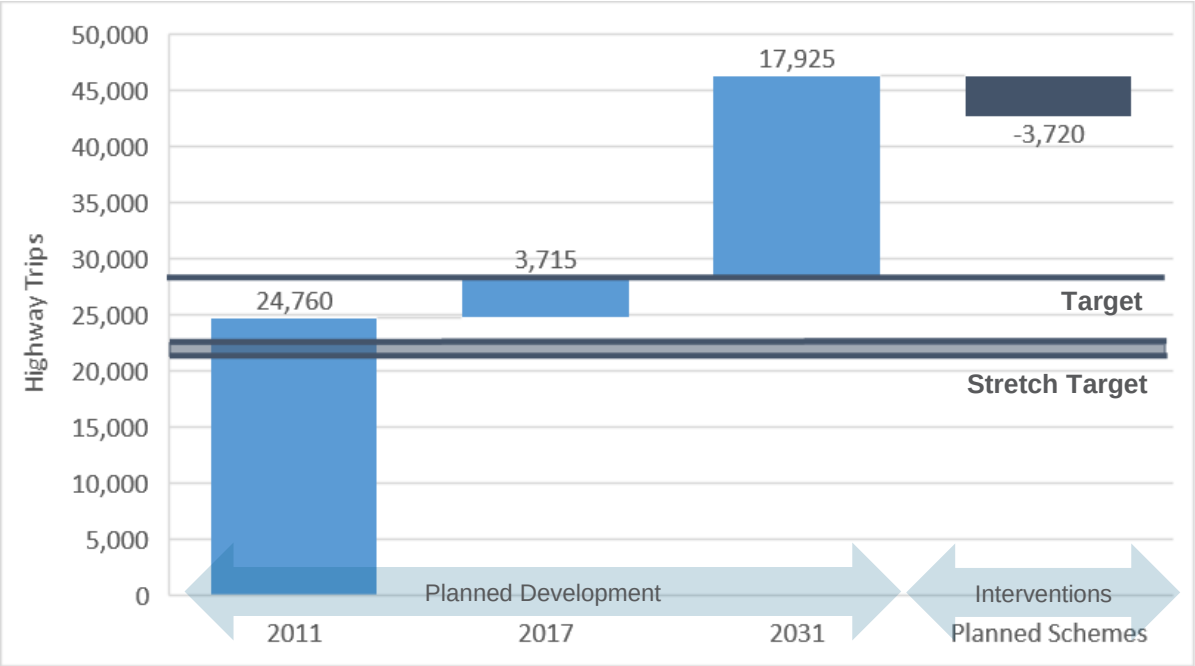


Figure 6 shows that, cumulatively Planned Schemes lead to a reduction of 3,720 highway trips to CBC. A further reduction of 14,205 is necessary to meet the 2017 Target. Therefore, as a combination of measures, the Planned Schemes alone are not predicted to meet the Target and therefore additional interventions are required.

The following Chapter builds on the Planned Schemes and assesses the potential impact of Cambridge South Station.

5. Cambridge South Station

This Chapter assesses the impact of Cambridge South Station in relation to access to CBC using demand forecasting previously undertaken by John Laing.

The Strategic fit of Cambridge South Station is outlined in Section 5.1 of the Part 2 Report.

5.1. Demand Forecasts

Demand forecasting for a new Cambridge South Station has previously been undertaken by John Laing, the results of which will form the basis of our demand assumptions when considering the wider transport network impacts of Cambridge South Station. A Technical Note outlining the assumptions and methodology is included within Appendix D. Demand presented within this Chapter is based on an assumption of eight trains per hour (tph) stopping at the Station in each direction. This is different to the John Laing work, which assumed four tph.

The rail trips generated by Cambridge South Station will be a combination of abstraction from other stations, (in this case Cambridge Station or Shelford Station), modal shift from alternative modes and entirely new trip making. The modelling work undertaken by John Laing to date has not included mode choice modelling. Therefore, highway abstraction estimations have been based on application of standard WebTAG guidance, with 26%[11] of new trips to rail assumed to have transferred from the highway. Considering the spread of CBC travel demand in comparison to the rail network, this is not an unreasonable assumption, with the opportunities for highway mode shift focussed on specific locations served by rail stations such as Royston, Ely, Kings Lynn and North Cambridge.

Table 4 summarises the demand forecasts for Cambridge South Station as well as demand to and from CBC by rail in 2031.

Table 4 - Impact of Cambridge South Station (2031 Return Trips)

Scenario	Destination Demand	Origin Demand
Demand to Cambridge South Station	4,700	1,100
Of which is Demand to CBC	3,142	539
CBC Demand Abstracted from Other Rail	1,000	172
New to Rail	2,142	367
Of which are abstracted from highway	557	189

Table 4 shows that 5,800 return trips are predicted to use Cambridge South Station daily. This is broadly equivalent to the total demand for Ely and Royston Stations combined.[12]

Table 4 also shows that 3,142 of 4,700 return trips to Cambridge South Station have ultimate destinations within the CBC MSOA. This equates to 68% of the total destination demand to the Station. Of these, 1,000 return trips are abstracted from other rail stations and 2,142 are new to rail. This equates to 557 return trips being abstracted from the highway network, based on a WebTAG figure of 26% abstraction.

[11] WebTAG (2015) TAG Unit A5.4: Marginal External Costs. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/625444/TAG_unit_a5.4_meccs_dec15.pdf (Section 2.2.3) [Accessed: 11.12.2018]

[12] 5,800 return trips daily in 2016/2017 – calculated using Office of Rail and Road Estimates of Station Usage 2016-2017 http://orr.gov.uk/__data/assets/excel_doc/0012/26130/estimates-of-station-usage-2016-17.xlsx

Of the 1,100 trips originating at the Station, 539 originate from within the CBC MSOA. Of these, 367 are new to rail, whilst 189 are predicted to be abstracted from other rail stations, based on a WebTAG figure of 26% abstraction.

Section 5.2 shows the predicted impact of Cambridge South Station on highway trips to CBC.

5.2. What would access to CBC look like?

Cambridge South Station is predicted to lead to a decrease of 746 one-way highway trips per day; 557[13] destination trips and 189 origin trips. Figure 7 shows the impact of the Station on the total volume of highway trips accessing the Site in 2031.

Figure 7 - Impact of Cambridge South Station on Daily one-way Highway Trips to CBC

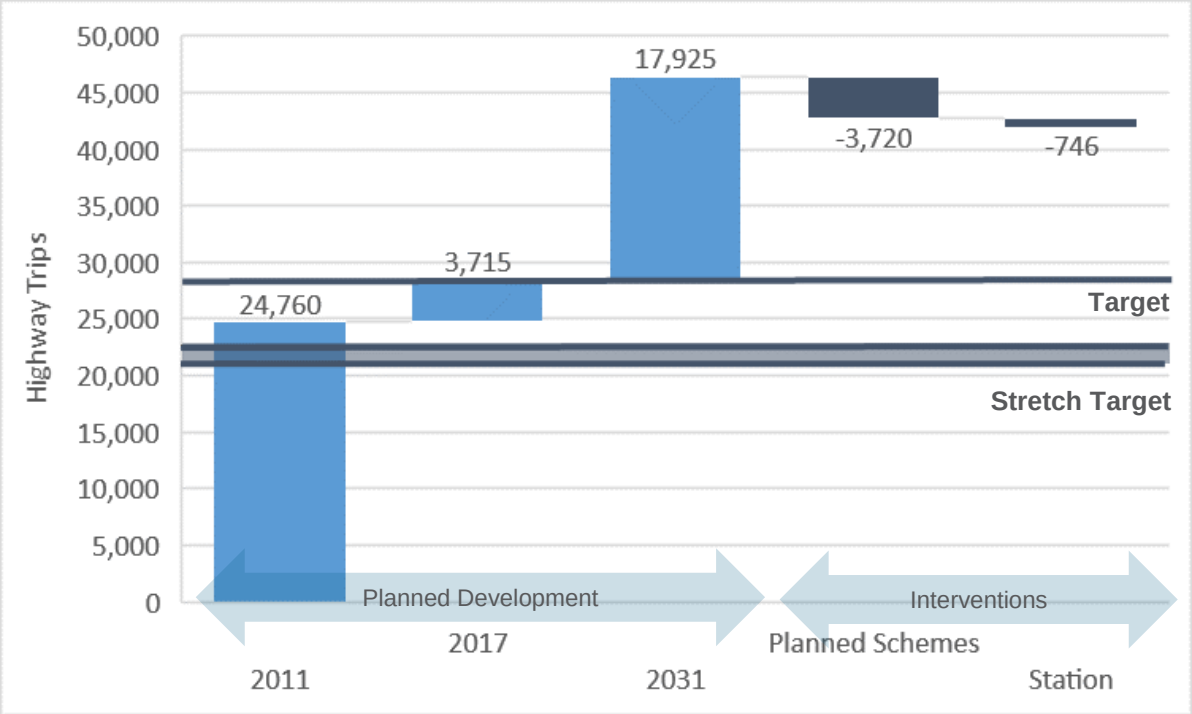


Figure 7 shows that Cambridge South Station combined with the Planned Schemes is predicted to lead to a total reduction in highway trips to CBC of 4,466. It is considered that the peak hours would see the most impact in terms of highway trip reduction. However, the impact would also be felt across the day as trips are made by shift-workers, out of hours staff and patients and visitors at all hours of the day (subject to the available hours of service).

Although the Station goes some way to meeting the Target, further significant intervention is required to achieve the 2017 highway traffic levels. A further reduction of 13,459 is required to meet the 2017 Target of 28,475 highway trips. Chapter 6 predicts the impact of the Potential Interventions identified in the Part 1 and Part 2 Reports and assesses their contribution to meeting the Target.

6. Other Potential Interventions

6.1. Impact of Potential Interventions

The impacts of Potential Interventions identified in the Part 1 and Part 2 Reports have been predicted based on known impacts of similar schemes, analysis of available demand and mode share data and known changes in demand due to new developments. Table 5 shows the method of calculating the impact of each intervention and the overall predicted impact in terms of reduction of highway trips accessing CBC.

Some Potential interventions are considered to have minimal or no impact on access to CBC as they are not directly related to reducing highway trips. However, this is not to say that they will not contribute to improving access to or around CBC for other modes and support the interventions that are considered to have a substantial impact. For example, providing priority access for bus services to the Cambridge South West Park and Ride would help improve bus journey times and reliability, which may in turn encourage more people to use the service, however this measure is considered a supporting measure for the Park and Ride itself. Therefore, any impact on highway trips will be included within the assessment shown in Table 3 for Planned Schemes rather than allocating them to the Potential Intervention.

Table 5 contains only those Potential Interventions that are predicted to have a direct impact on the number of highway trips accessing CBC. Table 5 summarises the methodology and impact of each Potential Intervention. A detailed methodology and the calculations involved are included within a Technical Note held within Appendix E.

Table 5 - Impact of Other Potential Interventions

Potential Intervention	Description	Data Source	Methodology for calculating impact	Impact on highway trips
Royston to Cambridge Bus Service Redirected to CBC	Rerouting of the Stagecoach 26 service from Royston to Cambridge to call at CBC. This initiative was implemented in Autumn 2018 as an extension to the Busway A service.	Staff and Visitor Postcode Data. 2011 Census Data (WU03EW – Location of usual residence and place of work by method of travel to work).	2011 Census data has been analysed for key towns[14] around Cambridge where a direct bus service is not available, to determine the existing bus mode share to CBC. The number of existing bus trips to CBC has been calculated based on 2011 bus mode shares and the 2017 CBC survey for patients and visitors.	-164 highway trips to CBC.
Direct Bus Services to CBC	Engage with bus operators to identify potential additional direct services to CBC. There are large gaps in direct services to the east, north east, and west of Cambridge which may deter users and reduce patronage. Gaps to address would include: a. Papworth, especially after the relocation of the Royal Papworth Hospital to CBC[15]; b. Ely and Newmarket; c. New developments such as Cambourne West, Bourn, Northstowe and Waterbeach.	Staff and Visitor Postcode Data. 2011 Census Data (WU03EW – Location of usual residence and place of work by method of travel to work).	Future bus mode share, as a result of a direct service, has been assumed at 31% for staff. This is based on the existing bus mode share from Haverhill to CBC, which has a direct bus service. A weighted mode share has then been used to calculate the impact on highway trips to CBC. Vehicle occupancy data shows that vehicle trips to CBC have an occupancy factor of 1.48 which has been applied to represent those who car share. Although Cambridge South Station could offer direct rail access to CBC it is considered that there will always be demand for a direct bus service as some users will want a more 'door-to-door' service that bus travel can provide; and	-435 highway trips to CBC.

[14] Royston, Ely, Newmarket – where significant numbers of staff reside.
[15] This service is due to start in April 2019

Potential Intervention	Description	Data Source	Methodology for calculating impact	Impact on highway trips
Free Bus Pass for New / Relocated Staff	New / relocated staff to receive free bus passes that cover the first month of their employment to instil positive travel habits from the outset.	Case Study – Beaulieu, Essex[16]. Table 5-8 and 8-1 in the Part 1 Report.	The Beaulieu development in Essex offered residents a free bus season ticket upon occupation. This resulted in a 58% of residents requesting the bus pass, and 22% converting to bus travel. Of the 5,231 new staff, 3,034 (58%) would be likely to request a bus ticket. Based on existing mode shares (28% bus) 1,465 staff would have already been likely to take the bus, irrespective of the free ticket. In line with the 22% increase in bus travel as a result of the bus pass a total of 1,787 bus trips could access CBC (1,465 multiplied by 1.22). This equates to an additional **322** bus trips (1,787 – 1,465) and therefore a proportionate decrease in highway trips. It is considered that all of these trips would be abstracted from car as those who walk or cycle would be likely to continue to walk or cycle irrespective of the free ticket.	-322 highway trips to CBC.
Encourage Home Working	Encourage and enable employees to work from home if possible.	Case Study – Advisory, Conciliation and Arbitration Service (ACAS)[17]. Table 5-1 in the Part 1 Report.	Case Study: ACAS is an organisation that provides advice to employers on a variety of aspects. ACAS state 'more than one in every ten staff are designated as homeworkers, but many more work from home occasionally'. From information presented in the Part 2 Report, it is considered that up to 4,578 staff (Admin/Clerical Staff) could be eligible for homeworking, therefore based on the ACAS data, 10% of these (**458 trips**) would be likely to take up home working.	-458 highway trips to CBC.

[16] http://planning.chelmsford.gov.uk/Planning/StreamDocPage/obj?DocNo=5684312&content=obj.pdf
[17] http://www.acas.org.uk/media/pdf/7/r/Homeworking-a-guide-for-employers-and-employees.pdf

Potential Intervention	Description	Data Source	Methodology for calculating impact	Impact on highway trips
Travel Planning Package	Travel Planning Package including: • Creation of an online travel portal; • Personalised journey planning; • Car share initiatives; • Car Club / Pool Cars; and • Travel Advice Centre.	Sloman et al, The Effects of Smarter Choices Programmes in Sustainable Travel Towns[18]. Impact of the Local Sustainable Transport Fund – Summary Report.[19] Meta-analysis of Outcomes of Investment in the 12 Local Sustainable Transport Fund Large Projects.[20]	Overall Travel Planning Package Measures could result in a mode shift of -2.3% points (average of 4 case studies) away from car. A total of 46,400 highway trips are predicted in 2031 without the implementation of any travel planning measures. This equates to 68.74% car mode share, which as a result of travel planning measures is predicted to be reduced to 66.44%. When applied to the total demand to CBC (67,500) this equates to 44,848 highway trips, a reduction of 1,553 highway person trips (46,400 – 44,848). When taking into account a vehicle occupancy factor of 1.48 this equates to **1,049 vehicles** being abstracted from the highway network as a result of a travel planning package. .	-1,049 highway trips to CBC.
Total reduction in highway trips as a result of 'Other' Potential Interventions				**-2,428**

[18] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/4408/chap1.pdf
[19] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/648822/local-sustainable-transport-fund-impact-summary-report.pdf
[20] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/738267/meta-analysis-of-lstf-large-projects-final-report.pdf

6.2. Impact on Access to CBC

Figure 8 shows the impact of the Planned Schemes, Cambridge South Station and Other Potential Interventions on access to CBC by Highway.

Figure 8 - Impact of Other Potential Interventions on Daily One-way Highway Trips to CBC

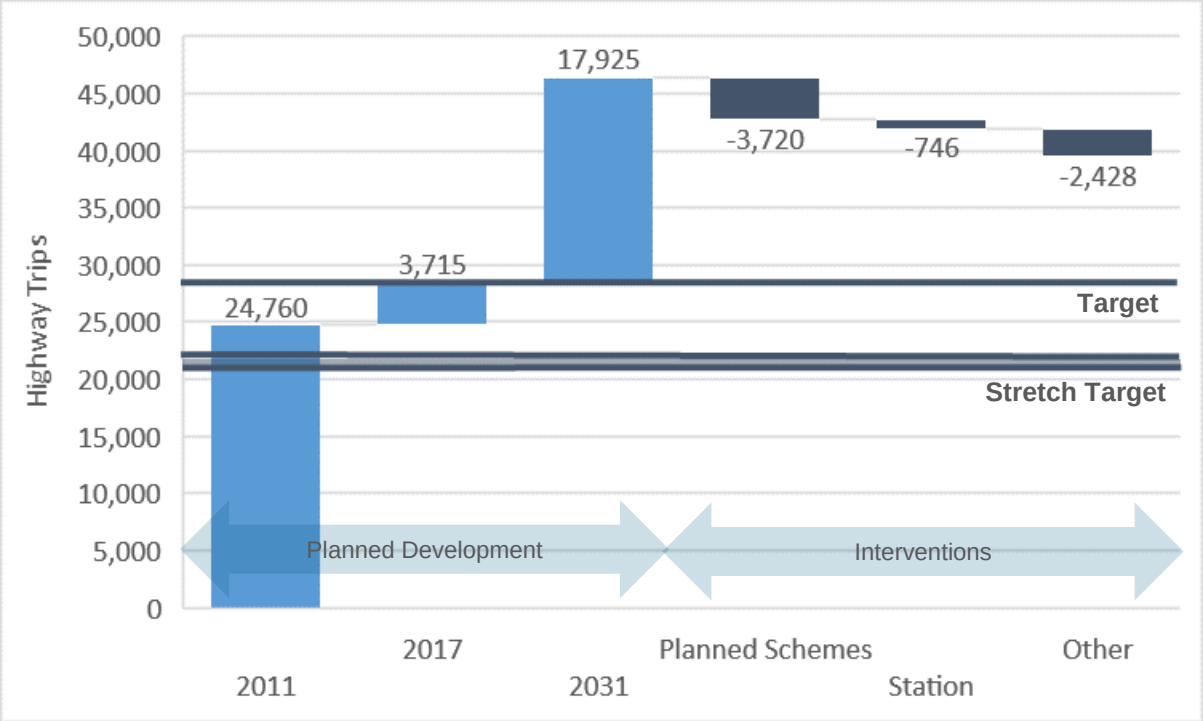


Figure 8 shows that in 2031, the other Potential Interventions, in combination with the Planned Schemes and Cambridge South Station, are predicted to lead to a total reduction in highway trips to CBC of 6,894. Although the interventions go some way to meeting the Target, further significant intervention is required to achieve the 2017 highway traffic levels. A further reduction of 11,031 is required to meet the 2017 Target of 28,475. It is considered that significant demand management measures would be required alongside the interventions, in terms of parking restrictions, to further encourage users out of their cars.

Analysis of information presented in Section 5 also suggests that Cambridge South Station could have a bigger role to play, when coupled with demand management measures, in helping to achieve the Target.

The impact of demand management measures and Cambridge South Station are further discussed in Chapter 7.

7. Demand Management Measures and Impacts

Chapter 6 showed that the Planned Schemes, Cambridge South Station and Other Potential Interventions are predicted to lead to a reduction in highway trips to CBC of 6,894 in 2031, which is 11,031 short of the Target. To meet the Target, significant demand management measures will also be required. This Chapter assesses the impact of restricting car park growth on Campus and considers where these displaced trips can be accommodated elsewhere on the transport network.

7.1. Restricting Car Park Growth

As identified in Section 3.4, expansion of car parks on-campus is not in line with the aims of the GCP and CBC in encouraging access to CBC by sustainable modes. Therefore, to further encourage people out of their cars, it is recommended that restrictions are applied to car park growth in the form of reconsidering the construction of two proposed multi-storey car parks consisting of 1,894 spaces on the Site.

Car park space turnover data has been obtained from CBC. This indicated that one parking space can accommodate more than one patient and visitor highway trip per day. Turnover factors for both staff and patients and visitors are shown in Table 6.

Table 6 - Car Park Space Turnover Factors

User Group	Car Park Turnover Factor
Staff	1.14
Patient and Visitor	2.73[21]

Restricting car park growth by 1,894 spaces (not constructing any of the planned car parks) would displace 3,663 vehicles when applying a vehicle turnover rate for staff of 1.14 and visitors of 2.73. Coupled with the 856 spaces removed from residential streets (see Table 3), this equates to 4,519 vehicles that are required to be accommodated elsewhere on the transport network as they are no longer able to park on-street or on-campus.

Some of these trips could be accommodated by transferring to rail and using Cambridge South Station. Chapter 5 presents the Station demand estimates as if a Station was constructed with the CBC access arrangements as they are today. The impact of the Station on mode choice for travel to CBC has the potential to be much higher if restrictions, such as reduced car park capacity, further encourage users to consider other modes. Therefore, Section 7.2 presents an additional Cambridge South Station forecast which assumes that:

- Congestion and restriction of car park growth (as described above) is likely to be a significant deterrent to driving, particularly in the future as demand for travel to CBC increases; and
- Measures included within Section 5.3 in the Part 2 report to support the Station and encourage its use are implemented.

7.2. Rail Demand – First Principles Approach

A first principles approach has been used to forecast maximum possible demand for Cambridge South Station to allow for a more CBC focussed approach than the John Laing work. This takes into account the level of growth outlined in Section 2.1, the demand management measures identified in Section 7.1 and the measures recommended within the Part 2 report to facilitate effective access to the Station. This uses a top-down approach to determine the maximum possible rail demand and then uses a set of assumptions to predict how much of this demand will use rail to access CBC. The methodology for this approach is as follows:

[21] Example – one car parking space accommodates 2.73 Patient / Visitor vehicles across a day

- **Step A** Identifying rail catchments through analysis of existing railway stations and the geographical area from which these are likely to capture trips to/from CBC. This step has focussed on key stations as follows:
  - King's Lynn;
  - Peterborough;
  - March;
  - Ely;
  - Downham Market;
  - Waterbeach;
  - Newmarket;
  - Bury St Edmunds;
  - Great Chesterford;
  - Royston;
  - Meldreth;
  - Shepreth;
  - Foxton;
  - Stevenage;
  - Whittlesford;
  - Bishop's Stortford;
  - London King's Cross / St Pancras; and
  - London Liverpool Street.

  (Cambridge Station and Cambridge North Station have not been considered within this analysis as they are unlikely to capture a significant number of trips to / from CBC as other modes are likely to be more favourable for such shorter distance trips).
- **Step B:** Determine if there is any reason why these catchments may change due to proposed large development sites which may lead to additional rail demand;
- **Step C:** Determine the number of staff and patients that currently reside within the rail catchments and the numbers likely to reside there in the future. This is the total maximum rail demand to CBC; and
- **Step D:** Adjustments are required to forecast a more realistic rail demand:
  - Reduction in demand due to those for who it is essential to use car such as blue badge holders;
  - Reduction in demand due to those who are already travelling to CBC by non-car modes, for example some bus users will continue to use the bus when there is a rail option available to them, whereas others may shift to rail; and
  - Reduction to remove risk of double counting with other schemes.

The following Sections provide more narrative and discussion around the steps identified above. Detailed methodology and calculations are included in a Technical Note held within Appendix F.

7.2.1. Step A: Rail Catchments

Figure 9 shows the rail catchments used to determine which trips to CBC could be captured by the introduction of rail. This has been determined based on staff and patient postcode data to identify areas of significant demand where an existing rail station could potentially be connected to CBC via a direct service to Cambridge South Station. Stations have been identified based on the number of staff residing in the catchment. A lower limit of 50 has been set to highlight key origins, except for Stevenage, where 45 staff reside. Stevenage, and London Stations, have been included within the assessment as it is considered a key Station on the Cambridge – London Kings Cross line. It is recognised that there are other relevant stations, in addition to those included within Figure 9, however it is considered that the majority of demand will be captured by the stations included within this assessment.

Details of the catchments and the staff and patients within are shown in Figure 9.

Figure 9 - Key Station Catchment Areas likely to generate Rail Demand to CBC

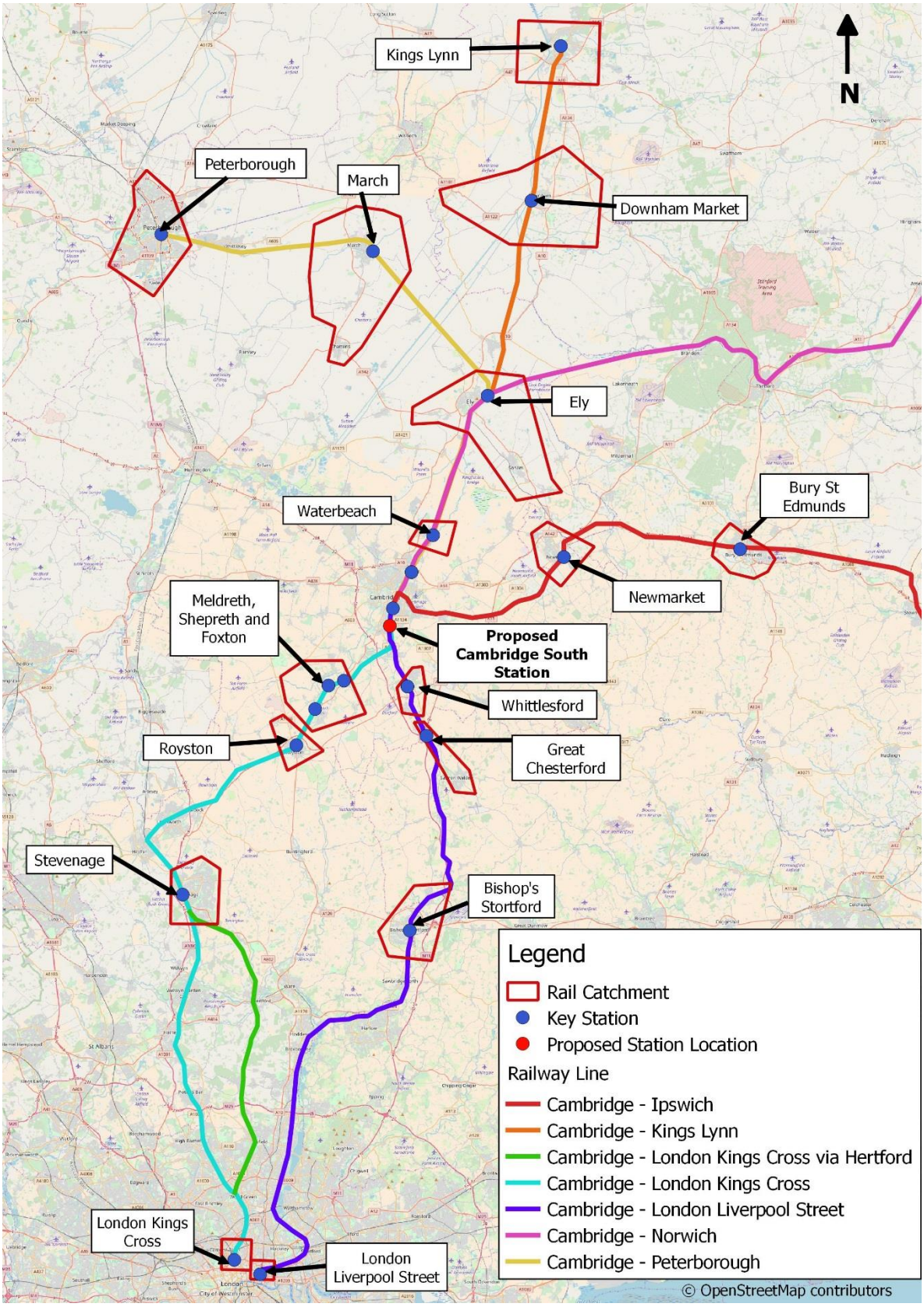


Table 7 shows the total number of staff and patients residing with the rail catchments shown in Figure 9 in 2017 and a forecast for 2031.

Table 7 - Staff and Patients Residing in Rail Catchments

Existing Staff (based on total staff numbers) (2017)	Staff 2031[22]	Existing Patients (based on daily patient trips) (2017)	Patients 2031[23]
3,303	4,988	2,383	4,123

7.2.2. Step B: Change in Rail Catchments due to development

Local Plans covering Hertfordshire, Cambridgeshire, Norfolk and Suffolk have been analysed to identify major allocated planned developments that could have an impact on the future rail demand to CBC. These consist of up to 35,000 new homes within the rail catchments identified in Figure 9 up to 2031. The number of additional trips likely to be made to CBC as a result of these developments has been calculated using the percentage of the existing population of the closest settlement that work at CBC as a proxy. Therefore, it is predicted that 1,002 additional staff, patient and visitor trips could be generated to CBC by rail as a result of the development of Cambridge South Station.

7.2.3. Step C: Total Maximum Rail Demand to CBC

Table 8 shows the total number of staff and patients that reside within the catchments identified in Section 7.2.1, any increases due to new developments, and the total forecast numbers in 2031.

Table 8 - Total Daily Maximum Rail Demand to CBC

2017 Demand		2031 demand (51% uplift for staff and 73% uplift for patients)		New demand as a result of developments		Total 2031 Demand	
Staff	Patients and Visitors	Staff	Patients and Visitors	Staff	Patients and Visitors	Staff	Patients and Visitors
3,303	2,383	4,988	4,123	993	9	5,981	4,132

Table 8 shows that that the maximum rail demand that could be generated by CBC trips to Cambridge South Station in 2031 is 10,113. Section 7.2.4 discusses adjustments that have been made to this total demand to reflect a realistic daily demand.

7.2.4. Step D: Adjusted Demand

It is not likely or feasible for all of the demand identified in Table 8 to use rail to access CBC. Therefore, adjustments are required to reduce the demand to take this into account.

Adjustment to Daily Headcount[24]

Of the 17,250 staff working at CBC in 2017, 13,552 are known to travel to CBC daily, equating to 79% of total staff. Therefore, total staff rail demand has been factored down by 21% (1,256) to account for those trips that are not made every day. This leads to 8,857 daily staff trips could be made to CBC by rail in 2031.

Adjustment for Essential Car Users

For some people it is not possible to use rail to access CBC. These groups of people consist mainly of blue-badge holders and on-call or out of hours staff where alternative sustainable travel options are not available.

8% of parking spaces on-site are allocated to blue-badge holders, therefore it is assumed that 8% of drivers are essential drivers and would therefore not take the train (calculated by 8% of total parking supply and adjusted by turnover factor). It is unknown how many staff are likely to be on-call each day, therefore rail demand has been reduced by 1% to take this into account. When applying

[22] 2017 staff multiplied by 51% growth in staff numbers from 2017 to 2031
[23] 2017 patients multiplied by 73% growth in staff numbers from 2017 to 2031
[24] Patient demand already adjusted to daily headcount

a turnover factor for staff of 1.14 and visitors of 2.73, the total number of essential car drivers as a result of blue-badges is **1,334**.

Information provided by CBC indicates that in 2017, 1,465 staff start their shifts out of hours and 900 finish their shift out of hours. This data includes only CUH staff who sign in and out, so this may underestimate the total. Based on this data we have assumed that:

- Individual staff will generally either start or finish their shifts out of core hours (but not both) therefore 2,365 staff are considered to work out of hours;
- An additional 2% (345) of staff will work out of hours as contractors, for example external cleaners and caterers (2% of 17,250 staff);
- Therefore, the total number of out of hours staff is considered to be 2,710 (2,365 + 345);
- Approximately 18% of staff reside within the Station catchment, which equates to 476 out of hours staff;
- It is also known that approximately 79% of staff travel daily to CBC, therefore 374 of the 476 in-catchment out of hours staff are assumed to travel daily;
- Factoring to 2031 (using the 51% growth in Table 1 from the Part 2 Report) equates to **565** staff.

Overall it is therefore considered that 565 staff in 2031 will be considered out of hours staff and therefore essential car users despite being within the station catchment.

This equates to a reduction in rail trips of 1,899 (1,334 + 565) in 2031 to adjust for essential car users.

Adjustment for those who already travel by non-car modes

Some staff, patients and visitors who reside within the rail catchments already use sustainable modes to access CBC. For the purposes of this assessment it is assumed that those already travelling by train continue to do so but alight at Cambridge South instead of Cambridge Rail Station. For those who already travel by bus, it is assumed that 50% of these will continue to travel by bus and 50% will transfer to rail, due to the attractiveness of the mode in terms of journey times. It is assumed that those that travel by foot and cycle will continue to do so.

Census analysis has shown that the above process equates to 165 trips continuing to use bus, foot or cycle to access CBC. When factored to 2031 this equates to a reduction in rail trips of 334 in 2031.

Resultant Maximum Rail Demand

Following the adjustments outlined in the above sections, Figure 10 shows the total maximum rail demand that could access CBC in 2031. The total maximum rail demand is 6,624 one-way trips per day in 2031.

Figure 10 - Maximum Rail Demand

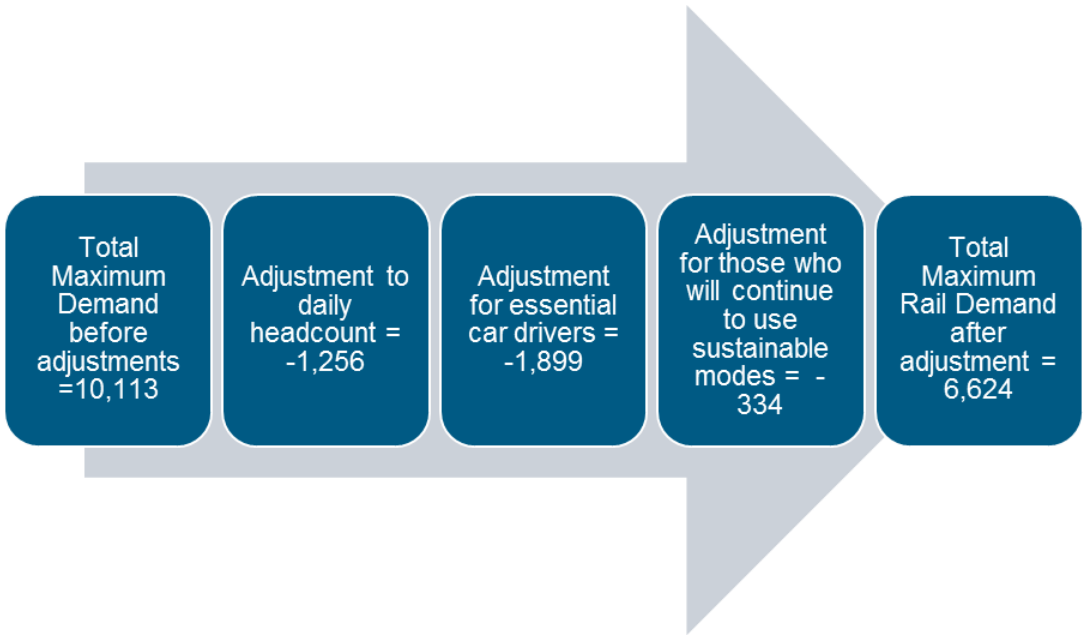


Figure 10 shows that the Total Maximum Rail Demand for Cambridge South Station could remove 6,624 highway trips from the network to CBC. To achieve this maximum demand, it would be critical that station supporting measures outlined in the Part 2 Report and demand management measures detailed in Section 7.1 above, are implemented to further encourage rail use. Depending on the extent of demand management the impact of Cambridge South Station on highway trips could between 746 (the basic demand identified in Chapter 5) and 6,624. This is considered to be a spectrum of potential demand.

The maximum impact of Cambridge South Station is not only dependent on supporting measures implemented at CBC itself, but also on the ability of the wider network to support that level of ridership. Early engagement with the rail industry around train capacity and the potential contribution of East-West Rail are fundamental to maximising the impact of Cambridge South Station on highway trips to the Site. This should include timetabling and routes, ensuring that these meet the needs for users of the CBC Site.

Furthermore, access to Cambridge South Station from 'origin' stations on the network should be reviewed to ensure that these stations do not become blockers to increasing demand at Cambridge South Station through issues such as car parking or cycle parking capacity.

7.3. Impact on Access to CBC

Figure 11 shows the impact of the Planned Schemes, Other Potential Interventions and Cambridge South Station on access to CBC by Highway using the methodology outlined in Section 5.2. The maximum station demand is shown as the 6,624 one-way trips outlined in Section 7.2, minus the natural Station demand predicted using the John Laing work in Chapter 5 (746). This shows that the Station could accommodate the trips displaced by the proposed car park restrictions and On-street Parking Controls (4,769) if rail is a suitable alternative mode for these trips.

Figure 11 - Impact of Cambridge South Station on daily One-way Highway Trips to CBC

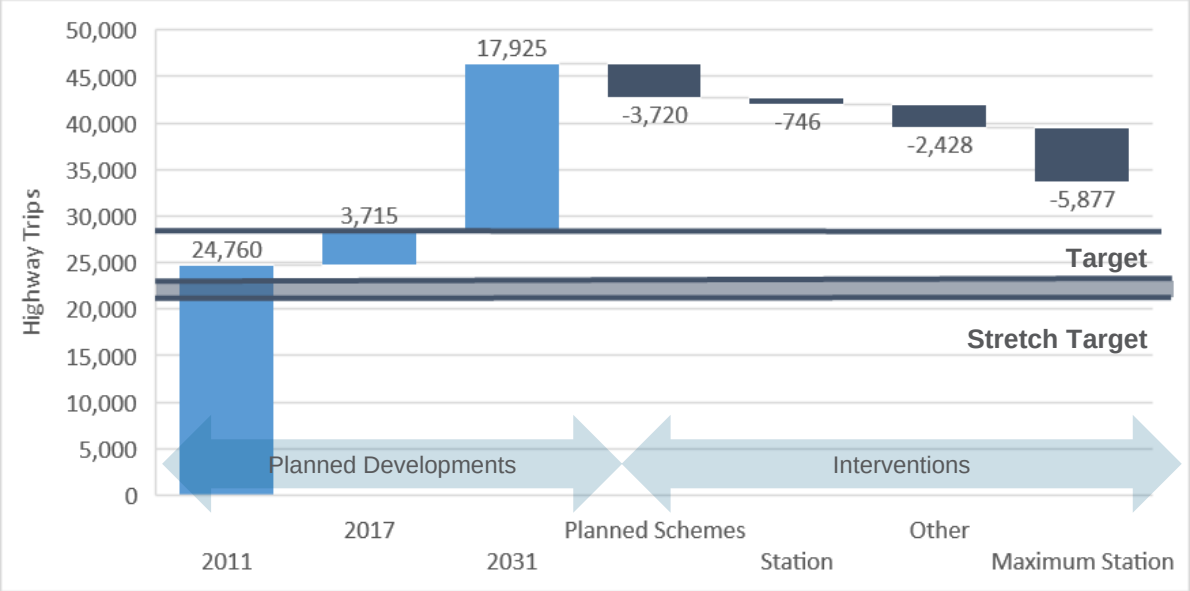


Figure 11 shows that Cambridge South Station, coupled with Planned Schemes and Other Potential Interventions has the potential to lead to a maximum reduction in highway traffic of 12,771 trips. A further reduction of 5,154 highway trips is required to meet the 2017 Target.

Those staff, patients and visitors that are displaced by the proposed car park restrictions and On-street Parking Controls, that live within rail catchments, should be targeted by travel planning measures in terms of switching to rail. This could be implemented through changes to the staff parking eligibility criteria whereby staff that reside in a rail catchment area and are not essential drivers are not eligible for a car parking space. The remaining displaced trips, for whom it is not feasible to use rail, are likely to be accommodated by CAM or Park and Ride provision. For this, phasing of schemes is vital to ensure that growth is managed in a sustainable way. For example, if the On-street Parking Controls are implemented before any GCP schemes or additional Park and

Ride capacity is provided, then all the displaced vehicle trips are likely to attempt to park on-campus.

Chapter 8 assesses the impact of the Planned Schemes, Cambridge South Station and Other Potential Interventions on parking demand at CBC.

8. What does this mean for Parking?

Reducing the highway demand for the Site is likely to have an impact on the number of parking spaces required to meet demand. This Chapter considers the demand for parking following the reduction in highway trips outlined in Chapters 4, 5 ,6 and 7, and highlights some opportunities that could be created regarding the supply of parking at CBC.

Section 3.3 of this Report outlines the do minimum Campus car parking demand and supply. The information presented in that Section reflects the situation if growth, of both highway trips and car parking supply, was to increase as planned, without any intervention. Table 2 showed that although patient and visitor demand could be met on-campus, there is predicted to be a shortfall in staff parking spaces across the Campus in 2031 without any intervention.

8.1. Impact on the Demand for Car Parking

To determine the demand for car parking following implementation of Planned Schemes, Cambridge South Station and Other Potential Interventions, car park space turnover data has been obtained from CBC as shown in Table 6. This has been used to factor the impact of the Interventions, which are currently presented in the form of highway trips, into demand for car parking spaces.

The turnover factors for staff (1.14) and patients and visitors (2.73) have been applied to the total reduction in highway trips as a result of each intervention to determine the total reduction in car park space demand as a result. Table 9 shows the impacts of the interventions on both highway trips and parking demand.

Table 9 - Impact of Interventions on Car Park Space Demand

Intervention	Impact on Daily Highway Trips			Impact on Daily Demand for Car Park Spaces (Impact on daily highway trips divided by turnover factor)		
	Staff	Patients	Total	Staff	Patients	Total
Planned Schemes	-2,849	-871	-3,720	-2,501	-319	-2,820
Cambridge South Station Maximum Impact	-2,492	-4,132	-6,623	-2,187	-1,514	-3,701
Other Potential Interventions	-2,050	-378	-2,428	-1,799	-139	-1,938
Total	-7,391	-5,381	-12,771	-6,487	-1,972	-8,460

Table 9 shows that all the interventions outlined in this Report could lead to a reduction in car park demand of 8,460 spaces per day in 2031. This value is only slightly less than the total number of parking spaces proposed in 2031 which is 8,621 spaces as shown in Table 2[25]. Highway trips to CBC include all vehicles travelling through the Site, taken from the CBC 2017 Travel Survey. Therefore, this includes through trips and drop-offs that do not contribute to parking demand on Campus, meaning that the total reduction will be less than the 8,460 shown in Table 9. To take this into account, it is considered that the minimum demand for car parking on-campus is equivalent to the **1,899** essential car users identified in Section 7.2.4.

[25] It is generally recognised that around 90% occupancy can give the perception of feeling full and therefore can discourage use. Advice from CBC has suggested that at CBC car parks would have to be at 95%-100% capacity to feel full as staff shift patterns and patients needs mean that the easiest option is to park on Campus, even at high occupancy levels. CBC also actively manage parking to direct people to available spaces in other locations.

The impact of Cambridge South Station on demand for car park spaces shown in Table 9 (-3,701) is considered to be the maximum possible demand. Rail modelling using the John Laing Station work showed that the Station had the potential to reduce highway trips to CBC by 746. This equates to a reduction in demand for car park spaces of 386 in 2031. In reality, the impact of Cambridge South Station on demand for car parking is likely to be somewhere between -386 and -3,701.

Figure 12 shows the predicted future car park demand and supply based on the reductions shown in Table 9 with a residual minimum parking demand (1,899) as described above. A sensitivity has also been applied which takes into account the lower Station impact outlined above.

Figure 12 - Impact on Car Park Demand

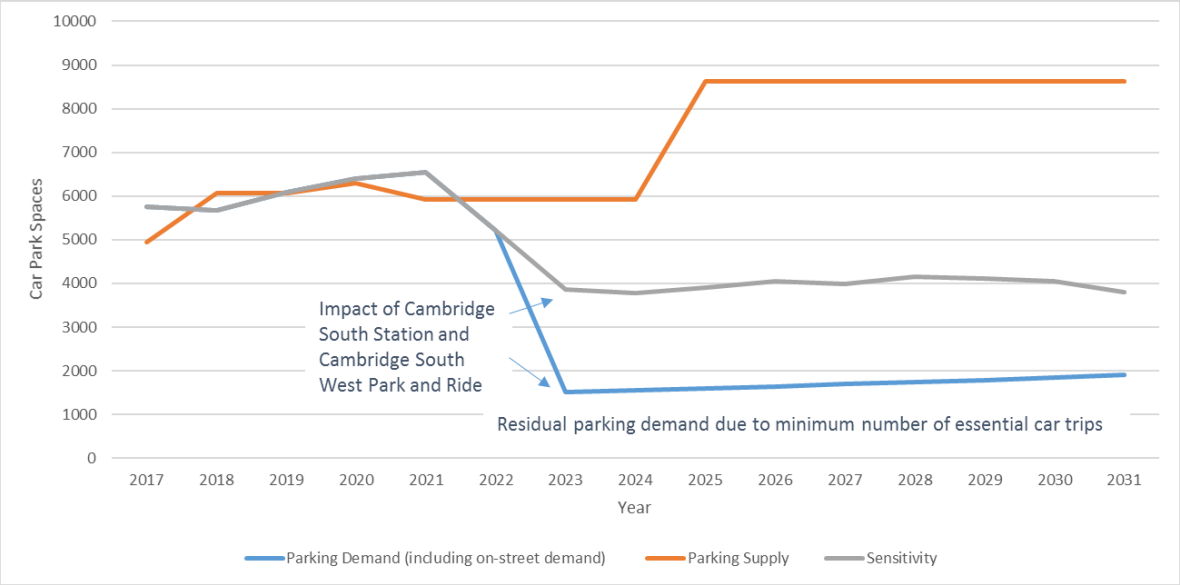


Figure 12 shows that parking demand is predicted to exceed supply between 2019 and 2022. Cambridge South Station and the Cambridge South West Park and Ride are predicted to have the largest impact on car park demand in 2023, whether taking the maximum Station impact or the sensitivity scenario. In reality, the impact is likely to be between these two figures.

Figure 12 also suggests that the impact of all interventions have the potential to negate the need for the additional car parking proposed on-site in 2025, whether this be through retiring surface level car parks or not building the multi-storey car parks associated with the Phase 2 development.

In the period between 2019 and 2022 it is likely that additional pressure will be put on on-street parking and Park and Ride sites to absorb the surplus demand for parking on-site.

Chapter 9 assesses the phasing requirements of the Planned Schemes, Cambridge South Station and Other Potential Interventions to recommend the most effective way to manage growth at CBC.

8.2. Opportunities Created

As noted above, success in meeting the highway trip targets would translate into reduced parking demand. Figure 12 showed the potential for 'headroom' of supply over demand after 2022 and the additional parking proposed in 2025 would create further headroom. Reducing the headroom of supply over demand across the site would provide opportunities for supporting further campus growth, improving other modes of transport, and/or improving the public realm. This could be through:

- Allowing the sites currently earmarked for the two new multi-story car parks to be re-designated for employment-generating development instead;
- Allowing current large surface car parks to be re-designated for development or other infrastructure requirements such as an expanded bus interchange. This would be through transferring surface car park demand into available spaces in other existing parking areas or one/both of the new multi-storey car parks; and
- Allowing existing on-street parking areas and other small pockets of parking to be used for public realm enhancements, improved pedestrian and cycling provision, improved bus stop

facilities, or additional cycle parking, as appropriate to the location. This could further reduce the level of motor traffic in key parts of CBC, such as Main Drive, which would further improve the environment of the campus.

The two existing CBC multi-storey car parks operate under long-term commercial arrangements with private operators. It is assumed that any changes to take advantage of the headroom would be focused on other parking areas and not adversely affect those arrangements.

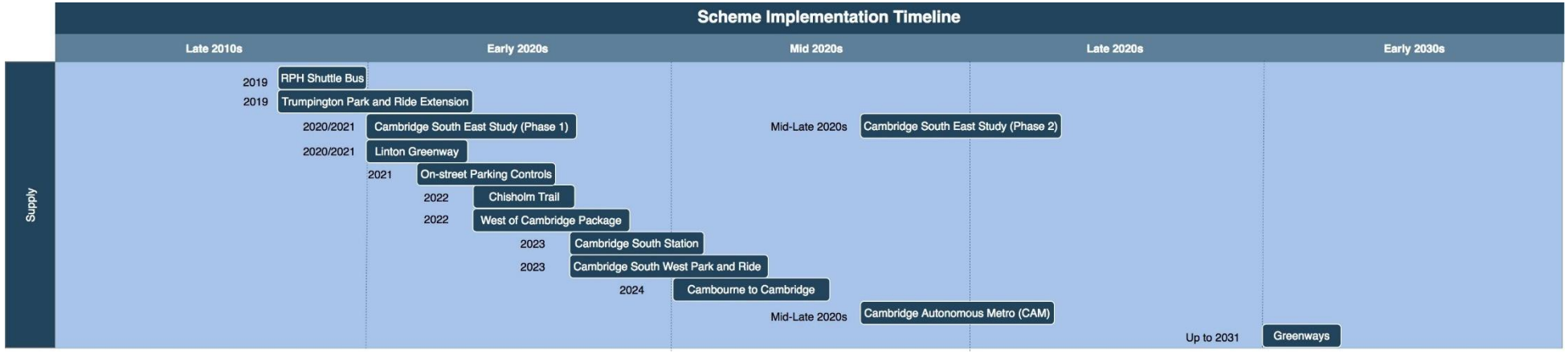
9. Phasing Requirements

Figure 11 indicates that by 2031 highway trips to CBC will still be 5,154 trips short of the Target of returning to 2017 levels. Considerable growth is anticipated at CBC and schemes, including Planned Schemes, Potential Interventions, Demand Management (in the form of reduced parking supply) and Cambridge South Station must be in place at the appropriate time to prevent an increase in highway trips. This Chapter assesses whether the phasing of the Planned Schemes and Cambridge South Station is in line with the growth of CBC between 2018 and 2031.

9.1. Existing Phasing

Figure 13 shows the existing phasing for the Planned Schemes and Cambridge South Station.

Figure 13 - Scheme Phasing Timeline



As discussed in Section 2.4 of the Part 2 Report, the majority of the schemes are anticipated to be constructed towards the early-mid 2020's. With significant growth planned at CBC over the next 12 to 24 months, significant pressure will be put on the transport network in the short term.

9.1.1. Will existing phasing accommodate growth at CBC?

Figure 14 shows the number of highway trips anticipated to access CBC each year, with the Planned Schemes, Cambridge South Station and Other Potential Interventions. The phasing of the Planned Schemes is based on the dates shown in Figure 13.

Figure 14 - Existing Phasing - Impact on Highway Trips to CBC

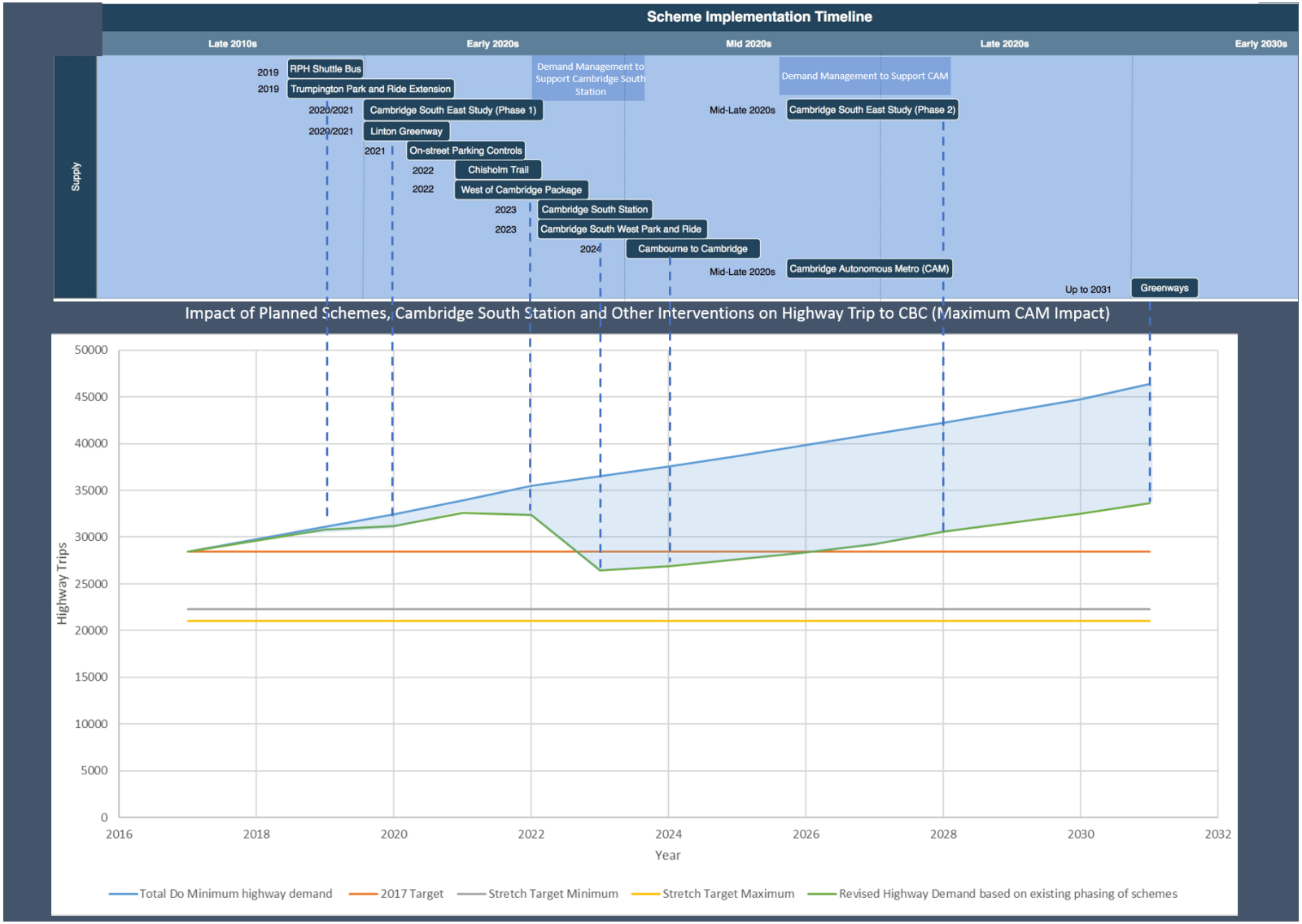


Figure 14 shows that with existing phasing of Planned Schemes, highway trips to CBC are likely rise slowly until 2022, when a number of Planned Schemes and Cambridge South Station are scheduled to be implemented. Once implemented these schemes are predicted to reduce the demand for highway trips to CBC to below 2017 levels up until 2026. From 2024 onwards, highway trips are predicted to rise gradually until 2031 (and by 2026 are predicted to exceed the Target).

The timing of any demand management measures (at CBC or citywide) is critical to ensuring the greatest impact of Cambridge South Station and CAM. Demand management should be in place at the time of scheme opening to encourage use of the new infrastructure.

It is recognised that the demand impact of CAM in Figure 14 is relatively modest which reflects the public transport improvements already assumed to be in place due to GCP schemes and other Potential Interventions. As noted in Section 4.1, the demand assumption for CAM is based on a 35% increase in public transport demand with no dis-incentives to car travel. By 2028, it is considered that demand management measures implemented at CBC in terms of restricting car park growth and wider GCP measures could lead to significant dis-incentives to car travel. Therefore, Figure 3 shows the impact of CAM based on the alternative scenario that CAM will lead to a 40% decrease in highway traffic in 2031. It should be noted that this is the maximum impact predicted for the CAM scheme which is very early in its development stages and further work is required to fully understand the impact. It is assumed that this CAM scenario is likely to require associated demand management measures in Cambridge City Centre.

Figure 15 - Impact of Phasing with maximum CAM Impact

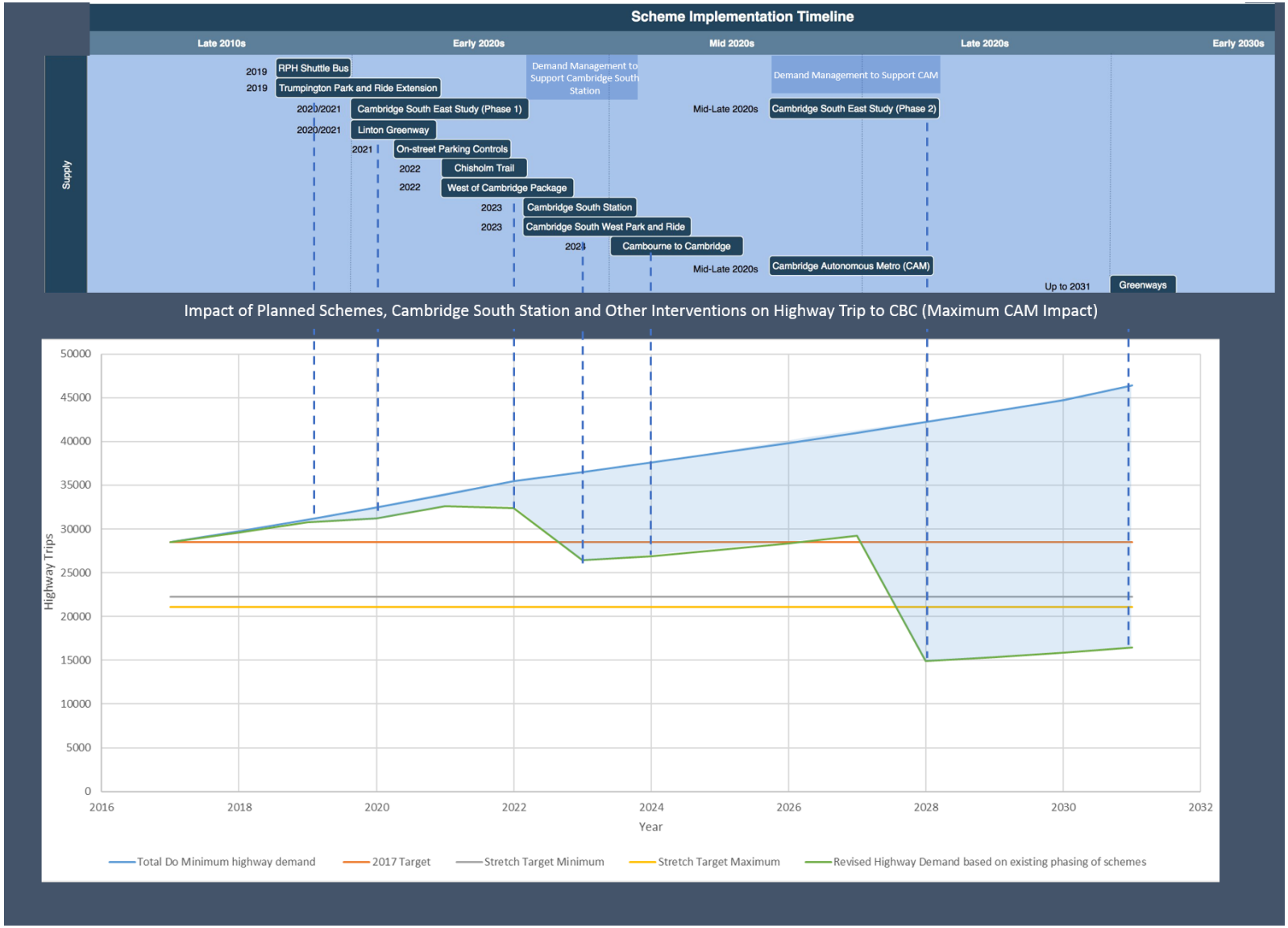


Figure 15 shows that CAM, coupled with demand management measures, has the potential to exceed the Targets for reducing highway trips to CBC. The phasing plan is critical for meeting the Targets, to ensure that sustainable alternatives are in place when demand management measures are implemented. Schemes are likely to have the maximum impact if phased effectively. Maintaining the programme for the Planned Schemes is also critical for enabling growth, avoiding abortive expenditure on those Schemes, and in avoiding a negative impact on the Campus operation, such as increased congestion within CBC. This will also help manage demand for car parking on-site. The earlier that significant sustainable transport options are available the easier highway trips are to manage as some growth at CBC will be yet to occur and there is a window of opportunity to provide sustainable alternatives before car-based travel patterns are established.

10. Conclusions

Atkins has been commissioned by Cambridgeshire County Council (CCC) to undertake a Transport Needs Review of Cambridge Biomedical Campus (CBC) on behalf of the Greater Cambridge Partnership (GCP). Part 1 of the Study assessed the existing transport situation and made recommendations on Potential Interventions to accommodate growth at CBC to 2022. Part 2 of the Study reviewed forecast demand data and transport supply for all modes up to 2031. It recommended measures to accommodate growth both with, and without Cambridge South Station. This Report is Part 3 of the Study and assesses the impact of Planned Schemes (GCP and CAM), Cambridge South Station and Potential Interventions identified in the Part 1 and 2 Reports on highway trips to CBC.

10.1. Accommodating Growth

Planned growth at CBC is predicted to generate an additional 17,925 highway trips each day by 2031 if mode share remains as existing. This is predicted to put significant pressure on the highway network and on-street parking surrounding CBC as well as transport infrastructure and car parks within the Campus. The Part 2 Report showed that to accommodate the extensive growth planned at CBC, significant interventions are required to manage access to the Campus, alongside the provision of Cambridge South Station. These measures are needed to achieve sustainable growth and reduce the number of highway trips to the Site. Targets to reduce the number of vehicles accessing CBC are as follows:

- **Target:** Maintaining traffic at 2017 levels up to 2031; and
- **Stretch Target:** A 10% to 15% reduction in peak highway trips from 2011 levels, which is aligned with the Target of the GCP City Access Strategy.

To maintain traffic at 2017 levels up to 2031, a reduction of **17,925 daily person-trips** to 28,475 will be required. To achieve a Stretch Target of a reduction to 10% below the 2011 traffic levels by 2031, a reduction of **24,116 daily person-trips** to 22,284 daily person trips will be required. This figure is equivalent to 81% of the 2017 traffic levels accessing the Site. To achieve a reduction of 15% below the 2011 traffic levels by 2031, the more ambitious end of the Stretch Target, a reduction of **25,354 daily person-trips** to 21,046 daily person-trips will be required; equivalent to 85% of the existing 2017 traffic levels accessing the Site.

It is important to recognise that although this level of reduction is significant, a lot of the growth included within the 2022 and 2031 scenarios is yet to happen. If actions are taken now to mitigate traffic growth before it happens (i.e. to capture growth using sustainable modes), the 10%-15% Stretch Target for reduction could involve fewer established car trips.

10.2. Impact of Planned Schemes, Cambridge South Station and Potential Interventions

To determine whether the Planned Schemes, Cambridge South Station and Potential Interventions have the potential to meet the Targets for reducing highway trips to CBC, a spreadsheet model has been developed. Year-on year results determine the phasing requirements to meet demand as CBC grows. Table 10 summarises the impact of all schemes and interventions on access to CBC by highway.

Table 10 - Summary of Impact of Planned Schemes, Cambridge South Station and Potential Interventions

Scheme	Impact on highway trips in 2031
Planned Schemes (includes GCP Schemes and CAM)	3,720
Cambridge South Station – Maximum Potential	6,623 (746 basic demand and 5,877 additional for maximum demand)
Other Potential Interventions (identified in the Part 1 and Part 2 Reports)	2,428
CAM – Maximum Potential	17,142
Total	**29,913**

Figure 16 shows the impact of all schemes and interventions on access to CBC by highway at the 2031 horizon.

Figure 16 - Impact of Schemes and Interventions on Highway Trips to CBC

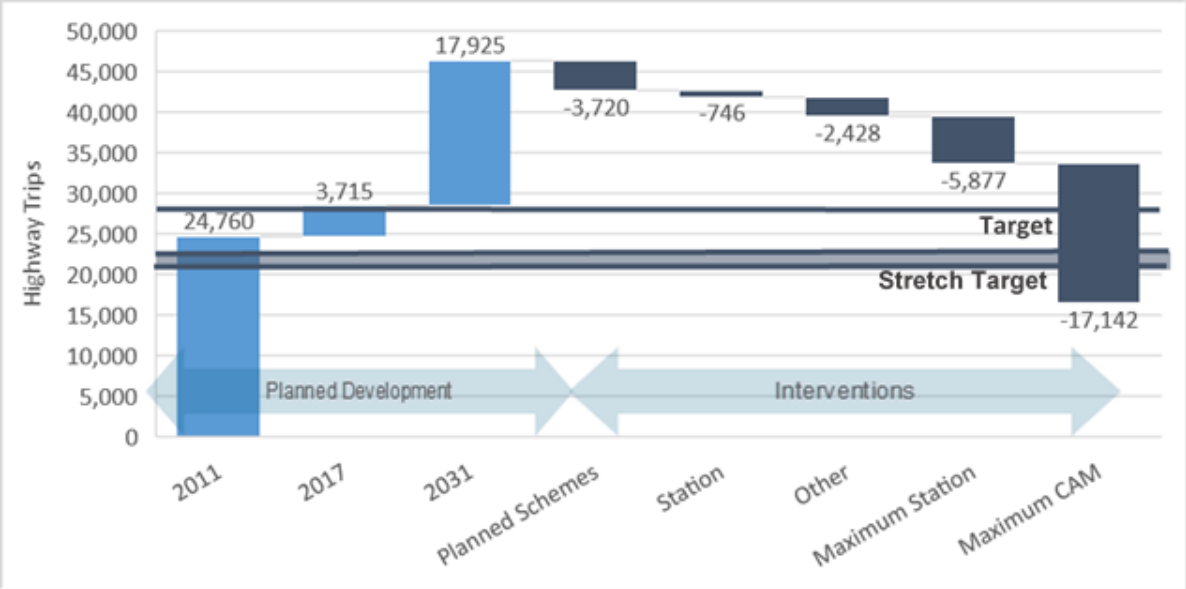


Figure 16 shows that, together, the Planned Schemes, Cambridge South Station and other Potential Interventions have the potential to lead to a reduction in highway trips accessing CBC each day of 29,913 in 2031. The Maximum Station and Maximum CAM scenario are required to meet the Target and Stretch Target.

10.3. Phasing Requirements

Phasing of Planned Schemes has been assessed against growth at CBC on a yearly basis to determine whether the transport network around CBC may be able to accommodate demand in the period between 2017 and 2031.

With existing phasing of Planned Schemes, highway trips to CBC will rise slowly until 2022, when a number of Planned Schemes and Cambridge South Station are scheduled to be implemented. These are predicted to reduce the demand for highway trips to CBC to below 2017 levels up until 2026. From 2024 onwards, highway trips are predicted to rise gradually until 2031.

This shows that existing phasing does not meet requirements for managing highway trip reductions, however there is scope to remain close to Target highway trip levels up until 2026.

The impact of CAM has been revised based on the alternative scenario, that CAM will lead to a 40% decrease in highway traffic in 2031. The results indicate that bringing these schemes forward

could manage highway demand accessing CBC to meet the Target between 2023 and 2031 (see Figure 16).

The phasing plan is critical for meeting the Targets, to ensure that sustainable alternatives are in place when demand management measures are implemented. Schemes are likely to have the maximum impact if phased effectively. Maintaining the programme for the Planned Schemes is also critical for enabling growth, avoiding abortive expenditure on those Schemes, and in avoiding a negative impact on the Campus operation, such as increased congestion within CBC.

10.4. What does this mean for CBC Parking?

In order to determine the demand for car parking following implementation of the Planned Schemes, Cambridge South Station and Other Potential Interventions car park space turnover data has been obtained from CBC. This has been used to factor the impact of the Interventions, which are currently presented in the form of highway trips, into demand for car parking spaces. Overall, the impact of all the Interventions lead to a reduction in staff, patient and visitor car park demand of 8,460 spaces per day in 2031. It is considered that the minimum demand for car parking on-campus is equivalent to the 1,899 essential car users[26] identified in Section 7.2.4.

Analysis of the period between 2018 and 2031 shows that parking demand is predicted to exceed supply from 2019 to 2022. Cambridge South Station is predicted to have the largest impact on car park demand in 2023. Overall, the impact of all the interventions has (-8,460 spaces) the potential to negate the need for additional car park spaces to be provided in 2025 as currently proposed, whether this be through retiring surface level car parks or not building the multi-storey car parks associated with the Phase 2 development.

10.5. Conclusions and Recommendations

Overall, Part 3 of the CBC Transport Needs Review has shown that Planned Schemes, Cambridge South Station and Other Potential Interventions have the potential to have a significant positive impact on access to CBC, including encouraging more trips by sustainable modes and abstracting trips from the highway. Together, if phased effectively, the measures have the potential to exceed the Targets for highway trip reduction by 2031. Phasing is critical to managing highway demand, in line with growth, between now (2018) and 2031 to maintain demand broadly in line with 2017 levels.

Effective phasing will also help manage demand for car parking on-site. The earlier that significant sustainable transport options are available the easier highway trips become to manage as some growth at CBC will be yet to occur and positive travel habits will be encouraged for new trips from the start.

Conclusions

- Highway trips are expected to continue to grow between 2017 and 2031;
- Although some imminent developments at CBC (Royal Papworth Hospital and AstraZeneca) have been delayed, these are still expected become operational before most of the planned major transport schemes are implemented;
- GCP Schemes that are planned to come forward between 2022 and 2024, and Cambridge South Station, could have a significant impact on highway demand to CBC, bringing total highway demand to below 2017 levels in 2023. The ‘Maximum Station’ impact is required to meet this Target and therefore supporting measures and demand management are critical to doing so. The availability and management of car parking at CBC is critical to achieving the Target;
- Post-2023, CAM has the potential for the greatest impact. The level of impact depends on supporting demand management measures to encourage the transition from private car to sustainable transport;
- For the Station and CAM to have maximum impact, citywide demand management needs to be in place;

[26] Disabled users, on-call staff and out of hours workers with little options for sustainable alternatives (staff, patients and visitors).

- Achieving the Target for highway trip reduction opens up headroom in the parking supply and creates opportunities to avoid planned parking construction, retire existing car parks and release space to enhance public realm, and/or provide additional development sites; and
- The maximum impact of Cambridge South Station is not only dependant on supporting measures implemented at CBC itself, but also on the ability of the wider network to support that level of ridership. For example, early engagement with the Rail Industry around train capacity and the potential contribution of East-West Rail are important to provide the most effective assess to the Station.

Recommendations

- It is critical that GCP schemes are kept to programme (as identified in this Report) to address short-term continued highway traffic growth, mitigating negative impacts on Campus operation and quality of life;
- Key stakeholders should collaborate to coordinate phasing of planned schemes, growth and any demand management measures, in order to have the maximum impact in the identified timescales. These players include CBC, Cambridgeshire County Council, GCP, University of Cambridge, the Cambridge and Peterborough Combined Authority and the rail industry;
- Carry out further scheme development work on the measures identified for securing the transport and public realm goals relating to Cambridge South Station;
- Further work to understand the increase in footfall at rail stations at the other end of the rail journey, to determine if they need any infrastructure improvements to support the new rail trips to CBC via Cambridge South Station; and
- Further development of Potential Interventions identified in this Study, including possible 'quick wins' to help address the initial highway growth is recommended. This should commence as soon as possible.

It will be essential to bring these workstreams forward swiftly to ensure that measures are in place to promote the required mode shift to accommodate growth at CBC.

Appendices



Appendix A. Part 1 Report Potential Interventions

These are high level solutions and should be treated as a recommendation for further development and assessment of benefits and costs from Part 1 of the Study.

Within each of the categories below, the Potential Interventions have been listed in a broad priority order (1 being the highest priority). Nevertheless, all Potential Interventions are seen as providing benefit within the next five years, irrespective of their ranking. The rankings are indicative and would need to be reviewed in the light of further development and assessment

A.1. Potential Walking Interventions

The potential walking interventions are as follows:

1. An audit of existing pedestrian and cycling routes and connectivity requirements within CBC, leading to a strategy for improving the consistency, continuity and quality of these routes. On-site observations found that these routes are currently inconsistent and at times difficult to navigate. Observations also found some footways on site are narrow and uneven in places;
2. Review pedestrian and cycle wayfinding in the light of current routes and those proposed in the strategy described above. This should include the potential for 'best in class' solutions and tying in with current wayfinding strategy elsewhere in Cambridge;
3. Not all junctions have pedestrian crossings, such as the eastern side of the Long Road/Hills Road junction. Ensuring all crossings with pedestrian desire lines have pedestrian crossing provision would help to accommodate future pedestrian trips; and
4. Reviewing lighting levels and perceived security on pedestrian routes within and around CBC. This is because stakeholders expressed concerns about inconsistent lighting levels.

A.2. Potential Cycling Interventions

The potential cycling interventions are as follows:

1. An audit of the pedestrian and cycling routes, and subsequent strategy, as described above;
2. Providing an extensive cycle network to encourage cycling to CBC. The GCP Greenways cycleway scheme will connect local villages to the site and provide cyclists with a safer route into the site;
3. Develop a scheme to provide an attractive cycling route to CBC from the east (Cherry Hinton, Fulbourn and nearby villages), via Nightingale Avenue and the recently-upgraded cycle entrance at Red Cross Lane. For those originating from Fulbourn, access to CBC from the Fulbourn Greenway would involve cycling to Cambridge Railway Station and then along the recently improved cycling facilities on Hills Road or leaving the Greenway early and travelling down Wulfstan Way and Nightingale Avenue. Neither of these routes have dedicated cycle provision at present. Cycle improvements along these routes have the potential to improve access to CBC by cycle from the east;
4. Keep the capacity and condition of cycle lanes under review, to ensure they are in adequate condition to accommodate the additional demand;
5. Enhancements to the existing cycle/pedestrian cut-through via Car Park H and its linkage to Puddicombe Way and onwards to Main Drive. Building on the recently-implemented Hills Road cycling scheme which leads to this cut-through, it could become a high-quality and highly visible pedestrian/cycle access with good links into the rest of the campus;
6. Provide for cyclists to turn right out of Adrian Way into Long Road (an intervention previously identified by the Cambridge Cycling Campaign); and
7. Review the scope for cycle access directly between cycle routes and adjoining buildings, such as future developments between Dame Mary Archer Way and the cycle route to Shelford, and incorporate this into site design briefs.

A.3. Potential Public Transport Interventions

The potential public transport interventions are as follows:

1. Engage with bus operators to identify potential additional direct services to CBC. There are large gaps in direct services to the east, north east and west Cambridgeshire, which may deter users and reduce patronage. Gaps to address would include:
    a. Papworth, especially after the relocation of the Royal Papworth Hospital to CBC;
    b. Ely and Newmarket; and
    c. New developments such as Cambourne West, Bourn, Northstowe and Waterbeach;
2. Consider the potential for dedicated staff shuttle buses to support key specific flows (e.g. Waterbeach Barracks, Eddington and Northstowe) if commercial bus services cannot provide adequately for these;
3. Engage with bus operators to identify improved off-peak services. Consider extending the duration of high frequency service periods to cover more of the pre-AM peak and post-PM peak periods which are particularly used by shift workers. This was one of the key issues identified by stakeholders. If not viable on a purely commercial basis, these may require a degree of financial support;
4. Review the impact of visiting hours and consider interventions to either increase bus capacity at relevant times or encourage visiting at off-peak times;
5. Consider fare promotions for staff, to further increase the attractiveness of public transport;
6. Further promotion of the existing patient courtesy bus through media campaigns and on-site promotional activities. Stakeholders commented that this is a useful service but under-used and under-promoted;
7. Measures to improve the attractiveness and awareness of existing bus services, including additional Real Time Passenger Information displays, amendment of timetables in line with actual journey times, off-bus ticket purchasing opportunities, further promotion and publicity such as face-to-face engagement on-site, and maintaining the condition of the buses and bus stops. These were identified by stakeholders as potentially valuable. This should include additional 'where to catch your bus' information, both to assist bus users and to promote the range of services available, given the complexity of existing bus stopping arrangements;
8. Carry out further work to understand the most desirable medium-term strategy for bus stop location and bus routing within CBC. This should consider and balance the goals of:
    a. Offering passengers convenient access to all parts of CBC, from all bus routes;
    b. Making the service offer comprehensible and 'marketable' as part of encouraging bus use;
    c. Minimising bus journey times and mileage; and
    d. Maximising connectivity to/from a future Cambridge South station;
9. This may ultimately point to a central bus station at the heart of CBC, a central bus spine route through CBC, or another solution, and might require a frequent campus shuttle bus to provide very local connectivity and reduce walking journey times; and
10. Use of EURO6 buses and provision of rapid charge electric vehicle points for use by Taxi's only in order to contribute to improving air quality in the area.

A.4. Potential Parking Interventions

The potential car parking interventions are as follows:

1. CCC are considering the extension of on-street parking controls. Although this may put additional pressure on parking within CBC, it could encourage individuals to take more sustainable forms of transport;
2. Identify the range of reasons why staff park in nearby residential areas and relevant policy responses (considering potential extensions of the on-street parking controls being considered by CCC);
3. Review existing small pockets of parking, particularly those at the heart of the campus, to identify those where users could be relocated to vacate space for pedestrian, cycling or public realm enhancements, as well as potentially reducing traffic volumes and conflicts in those areas; and
4. Review the management of staff parking demand for existing and future occupiers across CBC, including potential adjustments to pricing structures or eligibility criteria, with the aim of:
5. Maintaining the correct level of parking demand within the available supply, bearing in mind that growing patient and visitor demand will need to get priority; and
6. Evening-out the issues with some parking areas being over-popular and others not fully used.

The potential cycle parking interventions are as follows:

1. Continuation/formalisation of the cycle clearing scheme which removes abandoned cycles, with a potential need to increase frequency if required. On-site observations found significant numbers of cycles that appeared to be abandoned;
2. Work closely with CBC to provide the additional cycle spaces recommended in the 2015 Access to Addenbrooke's Modal Choice Document and identify further areas where cycle parking on-site can be increased an intensified Stakeholders also highlighted the closure of an area, including cycle parking, near the Frank Lee Centre which could be re-opened to provide additional parking quickly;
3. Work with CBC Partners to identify possible funding sources for cycle parking improvements; and
4. Consider whether, as part of a sustainable transport focus, existing car parking spaces could be converted into cycle parking spaces (especially as one car parking space converts into multiple cycle parking spaces). See also recommendation above concerning existing small pockets of car parking that could be converted into cycle parking.

A.5. Potential Park and Ride/Park and Cycle Interventions

The potential Park and Ride/Park and Cycle Interventions are as follows:

1. Increase nearby Park and Ride capacity to encourage those who use/visit CBC to use this as a mode as opposed to parking on-site or on nearby residential streets. Possible interventions include:
   a. Investigate the possibility of increasing the capacity at Trumpington Park and Ride in the immediate short term (by the end of 2018) to help provide capacity for the staff from Papworth travelling on to the site. Any proposals should also investigate if additional bus capacity from the Park and Ride sites is required;
   b. Increased Park and Ride capacity to the south-west of Cambridge, such as that proposed by the GCP, is recommended for years 1-5, to help provide capacity for sustainable mode choice for those using CBC;
   c. Investigate the possibility of increasing the parking capacity at Babraham Park and Ride in years 1-5. Any proposals should also investigate if additional bus capacity from the Park and Ride sites is required; and
   d. Investigate the possibility of having dedicated CBC parking spaces at Park and Ride sites; and
   e. Explore the possibility of moving a proportion of the contractor parking to Babraham Park and Ride, where evidence suggests that there is some available capacity whilst also complimenting this by providing a dedicated shuttle into the development sites as a short-term measure.
2. Provision of a Park and Cycle site outside CBC, to reduce congestion near the site and promote sustainable transport. Cambridge has a very large propensity to travel by cycle, as evidenced by mode share figures. Park and Cycle capacity may also come in the form of a bike hire scheme to and from Trumpington Park and Ride and Babraham Park and Ride, or a bike share scheme throughout the city (such as the existing Ofo scheme), as suggested by stakeholders. This could include formalisation of facilities at the existing Park and Ride sites, including measures such as dedicated areas for parking adjacent to cycle storage locations, with greater numbers and quality of storage facilities for cycles and associated equipment;
3. It is suggested that a Park and Ride for CBC only could be investigated closer to the site to relieve pressure from Trumpington and Babraham Park and Ride whilst providing a prioritised service for those using the site; and
4. Investigate the possibility of provision for dedicated/formalised Park and Cycle facilities from Park and Ride sites. This should include dedicating specific areas of the sites for 'Park and Cycle only', with accompanying facilities such as lockers, cycle parking stands and links to the nearby cycle network.

A.6. Potential Local Highway Interventions

The potential local highway interventions are as follows:

1. Stakeholders suggested improved traffic signals on Addenbrooke's Road could reduce the chance of traffic queues reaching the M11 Junction 11 bridge, which has been observed to be congested due to right turning on traffic on the northbound side of Hauxton Road;

2. Continue to support sustainable travel to reduce dependence on private car modes;
3. Stakeholders suggested the need to review signal timings at the Hills Road access to optimise traffic flow within the immediate vicinity of CBC. This is being monitored by CCC; and
4. Provision of additional electric vehicle charging points on Campus to encourage us of these vehicles to access the Campus.

A.7. Other Potential Interventions

Other Potential Interventions are as follows:

1. Reviewing the attractiveness and promotion of existing car-share options (including the Camshare county-wide platform and the specific arrangements at Cambridge University Hospitals, which include a dedicated parking area for car-sharers). It may be possible to enhance the range of benefits available for car-sharing, such as extending a dedicated/priority parking offer across CBC;
2. Set up mechanisms for staff of new occupiers, such as relocated Royal Papworth Hospital staff, to receive travel planning advice and support prior to relocation, to promote knowledge of their options when accessing CBC and ensure that sustainable travel patterns are established from the start. This could be in the form of an online travel plan through which the business provides incentives for employees to undertake. Through this, employees could request face-to-face guidance if required;
3. Annual surveys should continue for monitoring purposes, with a view to implementing new strategies should the existing proposals be ineffective;
5. Control of HGV's entering the Campus through an off-site freight consolidation point. This would reduce the number of HGV's accessing the site and contribute to improving air quality in the area; and
6. Inclusion of rapid electric charging points for taxis to encourage taxi fleets to include these vehicles and help improve air quality in the area.

Appendix B. Part 2 Report Potential Interventions

These are high level solutions and should be treated as a recommendation for further development and assessment of benefits and costs from Part 2 of the Study.

B.1. Potential Bus Interventions

- CBC Bus Strategy – a coordinated bus strategy for CBC developed by all stakeholders and bus operators;
- Season Ticket Loans for Staff - Providing a loan to employees to buy bus season tickets;
- Subsidised Ticketing for Staff - A contribution toward bus tickets provided to staff;
- Free Bus Pass for New / Relocated Staff - New / relocated staff to receive free bus passes that cover the first month of their employment in order to instil positive travel habits from the outset;
- Inter-operator Ticketing - Ability to buy tickets that are useable on all bus services;
- Bus Hub / Interchange at the West of CBC - A bus interchange located to the west of the Site to be served by CGB buses, buses accessing the Site via Addenbrooke's Road and Robinson Way;
- Reconfiguration of Addenbrooke's Bus Station - An opportunity to expand and rework the existing Addenbrooke's Bus Station, potentially by using the Car Park H land to the north of the existing Site or Car Park A adjacent to the existing Site;
- Permitted right turn for buses and cycles from Adrian Way - Allow all movements for buses and cycles at the Adrian Way junction with Long Road to enable different routing patterns;
- Bus service pattern review to accommodate off-peak working hours - Engagement with bus operators to provide off-peak hour services for CBC staff whose shift pattern includes late or early working;
- Safer Routes to Bus Stops - Based on the outcomes of the pedestrian audit recommended in Part 1, provide suitable lighting and visibility at, and on routes to, bus stops;
- Royston to Cambridge Bus Service redirected to CBC - Rerouting of the Stagecoach 26 service from Royston to Cambridge to call at CBC. Could involve routing via the CGB or via Addenbrooke's Road and Long Road;
- Bus Service from Papworth Everard and Cambourne - Providing a temporary bus service from / to Papworth Everard / Cambourne in advance of the West of Cambridge Package;
- Additional bus priority measures on Addenbrooke's Road to provide segregated or enhanced access to CBC;
- Enhanced CGB Capacity - Provide increased capacity on the CGB to the east of Trumpington Park and Ride, which currently has a single track of approximately 700m;
- Bus Priority signals in the vicinity of CBC - Allow buses an extended green phase at traffic signals in the vicinity of the CBC Site;
- Central Spine Road for Buses - Provision of a bus-only route through the centre of the Campus; and
- Demand Responsive Bus Service around CBC - Demand responsive bus service, which could be in the form of autonomous pods, around the CBC Site. To be developed in accordance with CBC Bus Strategy.

B.2. Potential Park and Ride Interventions

- Expanding Parking Capacity at Existing Park and Ride Sites to Accommodate Growth - Provide additional parking capacity at Trumpington and Babraham Road Park and Ride sites, as well as at the Cambridge South West Park and Ride to help manage demand for travel to the CBC Site. Table 6 of the Part 2 report indicates a requirement for approximately 1,500 spaces for CBC users only across all Park and Ride sites;

- Direct Bus Service from a New Cambridge South West Park and Ride to CBC - Provide a direct bus service from a new Cambridge South West Park and Ride to CBC without calling at Trumpington Park and Ride, to encourage use of the new Park and Ride;
- Extend Existing Patient Courtesy Bus to Babraham Park and Ride - Extension of the existing Patient Courtesy Bus to Babraham Park and Ride, to encourage use of this site by patients who would otherwise drive to CBC;
- Service Directly from Milton, Newmarket and Madingley Park and Rides to Serve CBC - Provide a direct bus service from other Park and Ride sites around the City to CBC;
- Park and Ride Capacity to the East - Provision of a Park and Ride and Park and Cycle, in addition to Babraham Road Park and Ride, to accommodate demand from the east. This could come in the form of the Park and Ride associated with the Cambridge South East Transport Study depending on exact location, which could provide some eastern Park and Ride Capacity;
- Allocated Spaces at Park and Ride for CBC - Allocated spaces for CBC staff and visitors at Park and Ride sites to encourage use by providing convenient and dedicated spaces to lessen the requirement to search for a space;
- Bus (or Autonomous Pods) to/from CBC/ Park and Rides Before and After Main Park and Ride Service Ends - Engagement with bus operators to provide services to/from Park and Ride sites before and after the core City Centre service has finished, to accommodate early/late shift working. This could consist of a dedicated service (e.g. use of the patient shuttle bus when it is not in use) or an extension of existing services;
- Priority Access for Buses to/from Cambridge South West Park and Ride - Bus priority measures across the M11 and into the new Park and Ride site, segregated from other Road users;
- Effective Access for Vehicles to/from Cambridge South West Park and Ride - Explore potential for Park and Ride lane or segregated access from M11 Junction 11 for the proposed new Park and Ride. Real-time information about space availability at Trumpington Park and Ride and a new Cambridge South West Park and Ride, as well as journey time to Trumpington Park and Ride, could help manage demand; and
- Further restrictions on Car Access - Restrictions on the majority of vehicles entering the Campus, with exceptions for emergency vehicles, A&E and Rosie emergency access, blue badge holders, staff access required due to limited alternative options and specific Site needs, servicing (off-peak), buses, taxis and perhaps some car sharers.

B.3. Potential Parking Interventions

- Extension of the On-street Parking Controls to streets surrounding CBC, focussing on the short-term management of on-street parking impacts and aligning the implementation of any further controls with the phasing of potential interventions over the medium to long term;
- Bring Cycle Parking Expansion Forward - Implement planned cycle parking sooner than predicted to accommodate demand and encourage further use. This could also include provision and parking for hire or pool cycles and provision for charging electric cycles;
- Restrictions on Car Park Growth - Restrict the level of car park growth on-site. Consider whether those car parks planned/approved will be beneficial to the overall transport picture; and
- Needs Based Prioritisation of Parking Allocation - Allocation of parking on-site based on a hierarchy of need with priority given (as now) to patients and visitors followed by staff on a basis of need.

B.4. Potential Peak-Hour Spreading Interventions

- Review Staggering Shift Patterns of Workers - Varying the start and finish times of staff to stagger arrival and departure to CBC;
- Review Potential to Change Visiting Hours - Restrict all non-essential deliveries to arrive at CBC outside of the peak hours; and
- Restrict Non-Essential Deliveries During Peak Hours - Restrict all non-essential deliveries to arrive at CBC outside of the peak hours.

B.5. Potential Walking and Cycling Interventions

- Local Connections to the West - Review and improvement of connections for pedestrians and cyclists to the west of the Campus via Alpha Terrace and Anstey Way towards Grantchester;
- Greenways Project Implementation and Connection with CBC - Creation of a link between the Fulbourn Greenway and CBC for those travelling from the east, routing via High Street, Queen Edith's Way, Nightingale Avenue and Red Cross Lane;
- Audit of Pedestrian and Cycle Routes and Connectivity Requirements within CBC - Audit of pedestrian and cycle wayfinding and infrastructure;
- Segregated Cycle Routes On-site - Where possible, cycle routes should be segregated from traffic and pedestrians; and
- Monitoring the Cycle Demand on an Annual Basis - Annual monitoring of cycle parking capacity and condition, as well as an audit on cycle infrastructure and connections across the Site.

B.6. Potential 'Other' Interventions

- Integrated Online Journey Planning Tool - Creation of an online travel portal on CBC and CUH websites for use by staff, patients and visitors;
- Personalised Travel Planning for Staff (and visitors if requested) - Personalised journey planning for Site occupants / staff. Those that register for a personal travel plan could receive a free bus ticket or equivalent;
- Car Sharing Initiatives - Car sharing initiatives including guaranteed ride home (whereby car sharers are provided with a return journey in an emergency or unforeseen circumstance), dedicated or priority parking spaces and discounts on parking;
- Staff Car Share Database - Dedicated CBC Staff Car Share Database that is coordinated between all Campus Stakeholders. Each organisation currently offers their own closed system, which limits the effectiveness of the scheme;
- Pool Cars/Car Club - A car club or pool cars for use by staff travelling for work or as a guaranteed ride home;
- Travel Advice Centre - Creation of a Travel Advice Centre at CBC for staff and visitors. To provide marketing information, timetables, advice etc; and
- Encourage Home-Working - Encourage and enable staff to work from home if possible.

Appendix C. Impact of Planned Schemes Technical Note

Technical Note

Project:	Cambridge Biomedical Campus Transport Needs Review		
Subject:	Calculating the Impact of Planned Schemes		
Author:	Atkins	Atkins No.:	N/A
Date:	19/12/2018	Icepac No.:	N/A
		Project No.:	5161508
Distribution:	N/A	Representing:	N/A

This Technical Note should be read alongside the Cambridge Biomedical Campus Transport Needs Review Part 3 Report.

This Technical Note documents the methodology, calculations and workings used to predict the impact of planned schemes on highway demand to CBC.

Impacts are presented in terms of the number of one-way highway trips that are removed from the network to CBC as a result of the schemes. This approach allows the impacts of the schemes to be determined in comparison to the Targets identified in Section 2.2 of the Part 3 Report. Data has been gathered from various sources including:

- Greater Cambridge Partnership Project Managers;
- Case studies of similar schemes;
- Demand information;
- Mode split data; and
- Census data.

Note: in the spreadsheet model all impacts have been scaled up or down to reflect the year of opening and the impact for each year of the Study. In this note, the impacts are expressed in terms of the number of one-way highway trips that are removed from the network to CBC as a result of the schemes in 2031.

1.1. Impact of GCP City Access Strategy On-street Parking Controls

The 2017 CBC Travel Survey showed that 1,106[1] people (assumed to be staff) park on-street on a daily basis. Of these, 250 people park further afield and cycle to CBC and are therefore assumed to be unaffected by the On-street Parking Controls. Should they be affected by the On-street Parking Controls, it is assumed that they would choose to Park and Cycle from a Park and Ride site instead, especially as they would be able to park free of charge.

This leaves 856 people assumed to be parked on-street within areas proposed to be covered by the On-street Parking Controls and therefore required to access CBC by other means once the On-street Parking Controls are implemented. They may choose to park on-site, depending on

[1] Part 2 Report – Table 6

availability, at a Park and Ride site, or switch modes entirely. If they choose to park on-site, this would put additional pressure on the already constrained parking supply on-Campus.

The overall impact of the On-street Parking Controls is therefore predicted to be **856 vehicles** that are displaced and therefore require an alternative option to access CBC. How these trips are accommodated is addressed in Chapter 7 of the Part 3 Report. Key assumptions used in this calculation are as follows:

- All those parked on-street are assumed to be staff and single-occupancy vehicles; and
- The 250 people that park and cycle to CBC are likely to park further away than the area proposed for the On-street Parking Controls and therefore will be unaffected by its introduction or are likely to relocate to a Park and Ride site as the next most suitable location.

1.2. Impact of Cambridge South East Transport Study

To predict the impact of the Cambridge South East Transport Study, information has been obtained from the GCP Project Manager.

In summer 2017 transport modelling was undertaken using the Cambridge Sub-Regional Model 2 (CSRM2). The results indicated that the Strategy 1 Scheme mass transit route to CBC could reduce car travel to CBC by 40% from the Cambridge South East Study Area (broadly defined by the A1307/A1301 corridors south east of CBC). The modelling results show demand as a whole, rather than being split by patients and visitors. Therefore, the 40% reduction in car travel has been applied to both patient and visitor trips for the purposes of this assessment. This is considered to be reasonable due to the large volume of patients and visitors residing in the South East Transport Study Catchment (Figure 5-2 and Figure 5-3 in the Part 1 Report).

The Cambridge South East Study Area has been mapped in **Figure *1***. For the purposes of this Study it is considered that the catchment for the Strategy 1 Scheme is greater than that defined by the GCP i.e. staff and patients from Haverhill are likely to benefit from a mass transit scheme on the A1307 corridor. Therefore, to predict the impact of the Strategy 1 Scheme on highway trips to CBC, an extended Study area, also shown in **Figure *1*** has been used. This Study area has been defined based on the extent of the route proposed for the Cambridge South East Transport Study, between CBC and Haverhill and the origin of CBC users likely to be affected by the Scheme.

Figure 1 - Cambridge South East Transport Study Catchment Area

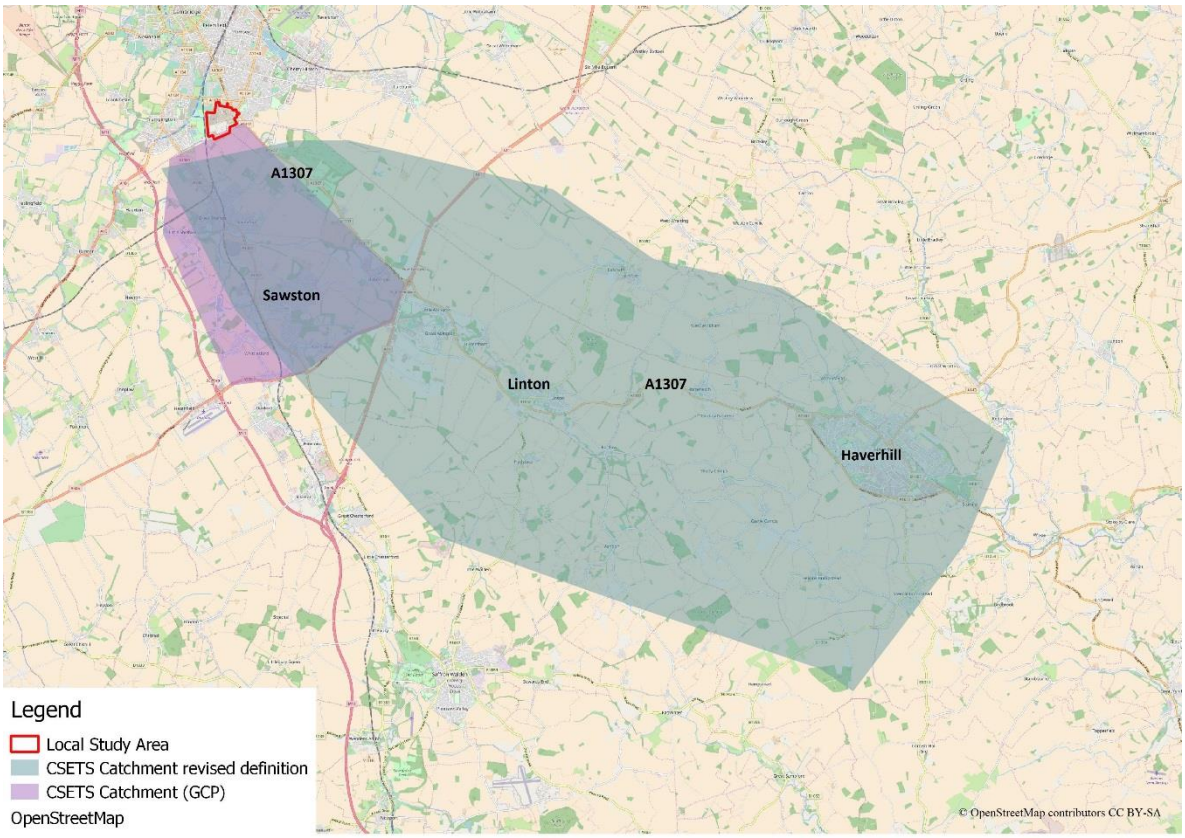


Table *1* shows the methodology and calculations to determine the number of highway trips to CBC removed from the highway as a result of the Cambridge South East Transport Strategy based on the revised catchment. Reference numbers for each step of the calculation are used throughout to aid understanding of the process.

Table 1 - Calculating the Impact of Cambridge South East Transport Study

Ref	Methodology / Source	Figures
	Staff	
a	Number of staff residing in the revised study area – taken from staff postcode data supplied by CBC (2017)	1,757
b	Number of staff residing in the revised study area in 2031	2,653 51%[2] growth applied to a
c	Number of staff who will drive in 2031	1,565 (b multiplied by 59%) Based on a 59% car mode share for staff from Haverhill to CBC from the 2011 Census
d	Reduction in highway trips to CBC by staff in 2031	626 (c multiplied by 40% taken from CSRM2 modelling as described above)

[2] Part 2 Report Table 1

	Patients	
e	Number of patients residing in the revised study area – taken from patient postcode data supplied by CBC	47,561 (annual)
f	% of patients residing in the revised study area	11.3% Total patient numbers predicted at CBC (422,461[3]) divided by e
g	Number of daily patient trips	1,632 daily patient trips in 2017 (14,500) multiplied by f
h	Number of daily patient trips from the revised study area in 2031	2,826 daily patient trips in 2031 (25,100[4]) multiplied by f
i	Number of patients who will drive in 2031	1,667 59% car mode share for patients from Haverhill to CBC from the 2011 Census multiplied by h
j	Reduction in highway trips to CBC by patients in 2031	667 (i multiplied by 40% taken from CSRM2 modelling as described above)
	Total reduction in highway trips to CBC as a result of the Cambridge South East Transport Study	
	1,293*	

*Numbers may not add due to rounding throughout the calculation

Table *1* shows that the Cambridge South East Transport Study is predicted to lead to a reduction in daily highway trips to CBC of **1,293** in 2031. Phase 2 of the Cambridge South East Transport Study is anticipated to form the first phase of CAM. Therefore, the impact of the South East Transport Study is transferred to CAM when the latter is predicted to become operational in the mid-late 2020's.

Key assumptions used in this calculation are as follows:

- The study area for the Scheme covers the area shown in **Figure *1***;
- A 59% car mode share for the Study area – this has been taken from 2011 Census data for Haverhill. A sensitivity test has been conducted for Sawston and Shelford which showed a 54% car mode share. As the largest settlement in the Study area it is considered representative to base car mode share on Haverhill;
- 40% reduction in highway trips as a result of the Cambridge South East Transport Study;
- 40% reduction in highway trips has been applied to both staff and patients trips;
- The percentage of patients residing in the Study area will remain constant over time; and
- The percentage of staff residing in the Study area will remain constant over time.

1.3. Impact of Greenways and Chisholm Trail

The impact of the Greenways and Chisholm Trail have been assessed simultaneously as the schemes both aim to provide enhanced cycle connections to and within Cambridge. The Chisholm

[3] 2017 postcode survey
[4] Part 2 Report Table 3

Trail is programmed to be constructed by 2023 and the Greenways by 2031[5], with the exception of the Linton Greenway, which is aligned to the Cambridge South East Transport Study Programme.

The Greenways considered to have most impact on access to CBC are the Melbourn, Linton, Sawston and Fulbourn routes. To assess the impact of the Greenways and Chisholm Trail on access to CBC by highway, we have used existing information in the form of a Case Study as evidence.

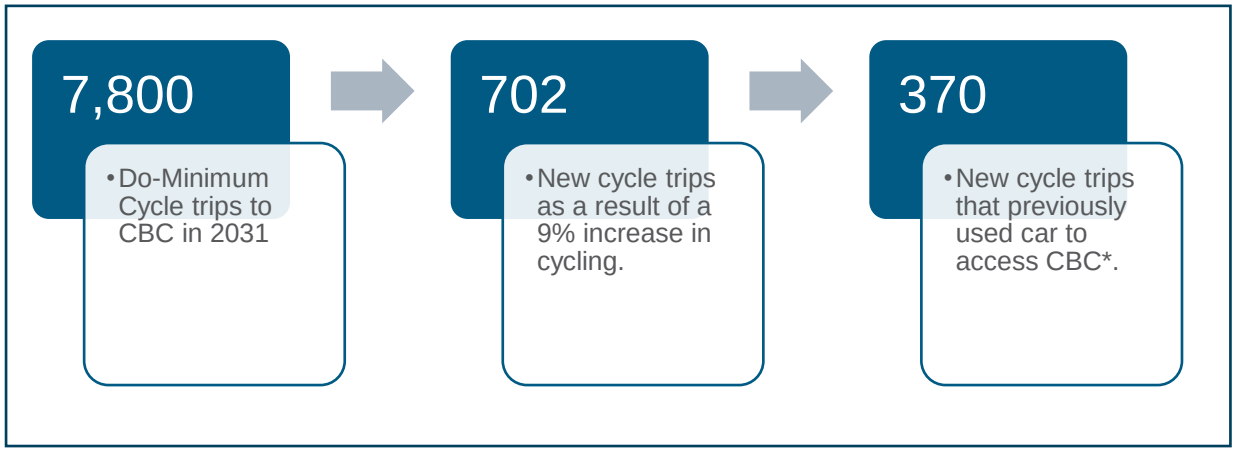
The 'Cycling City and Towns Scheme'[6] was implemented in Cambridge from 2008 with the focus of encouraging cycling in the villages surrounding the city and to spread the cycling culture in Cambridge to these areas. Measures included:

- New surfacing;
- Advanced stop boxes;
- Constructing or improving 16 cycle routes;
- Speed reductions for motorists;
- Increased cycle parking at key locations; and
- Travel Plan Programmes such as Bikeability training with local businesses.

The impact of the scheme by 2011 equated to an increase in cycling of 9% across the City[7]. This increase is lower than for other Cities due to the already high baseline for cycling in Cambridge. This scheme is considered to be an appropriate comparator for the impact of the Chisholm Trail and Greenways, as it includes providing new links between villages and Cambridge by cycle as well as cycle improvements within Cambridge itself.

Figure *2* shows how the impact of the Chisholm Trail and Greenways Schemes on highway trips to CBC in 2031 have been calculated based on a 9% increase in cycling. Impacts are assumed to be on staff trips only due to the nature of the schemes as patients and visitors are less likely to walk or cycle.

Figure 2 - Calculating the Impact of Greenways and Chisholm Trail



*The number of new cycle trips that previously used car to access CBC has been calculated using a weighted mode shift approach. The predicted mode share for cycling to CBC in 2031 was 12% based on Table 4 in the Part 2 report. With the addition of the Greenways and Chisholm Trail this mode share becomes 21% meaning that 9% needs to be taken off the other modes. A weighted

[5] There is potential for the delivery of the Greenways to come before 2031 however this is dependent on funding.

[6] https://www.sustrans.org.uk/sites/default/files/file_content_type/cycling_city_and_towns_cambridge.pdf

[7] Cycling City and Towns Cambridge – Page 9

split has been applied to the 9% based on the 2031 mode shares which means that the car mode share is reduced by 7%. This equates to a reduction of 548 highway trips. All highway trips to CBC have a vehicle occupancy of 1.48, which when applied to the 548 highway person trips, leads to a predicted reduction of **370** highway vehicle trips to CBC in 2031.

Key assumptions used in this calculation are as follows:

- Cycle schemes will predominantly impact staff rather than patients and visitors;
- Chisholm Trail and Greenways would have a similar impact of the 'Cycling City and Towns Scheme'.

1.4. Impact of the Cambourne to Cambridge Scheme

The impact of the Cambourne to Cambridge Scheme has been calculated using existing data and separated into four components:

- Bus Service between Cambourne, Cambridge City Centre and CBC;
- A Park and Ride off the A428/A1303;
- Consideration of the relocation of Royal Papworth Hospital and the impact on trips; and
- Consideration of the development of Bourn Airfield and Cambourne West and their impact on trips along the corridor.

Each of these is assessed in turn below.

Bus Service

To calculate the impact of a new direct bus service from Cambourne to CBC staff and patient postcode data and Census Data has been analysed. **Table *2*** shows the process for calculating the impact of this Bus service on highway trips to CBC.

Table 2 - Calculating the Impact of a Cambourne to Cambridge Bus Service (numbers may not add due to rounding)

Ref	Methodology	Figures
	Staff	
a	2017 - % of CBC staff that reside in Cambourne / Papworth	0.24%
b	Daily number of staff trips to CBC in 2017 based on a total trip number of 13,552 (Part 2 Report Table 1)	33 (13,552 multiplied by a)
c	2011 Census Journey to Work (Census Table WU03EW) bus mode share from Cambourne / Papworth to CBC	10%
d	2017 Staff Bus Trips to CBC	3 (b multiplied by c)
e	2031 Staff trips to CBC based on a total number of trips of 20,400 (Part 2 Report Table 1)	49 (20,400 multiplied by a)
f	2031 Staff Bus Trips to CBC	5 (e multiplied by c)
g	New assumed bus mode share – based on the existing bus mode share from Haverhill where there is already a direct service to CBC (Census 2011 Table WU03EW)	31%
h	2031 Staff Bus Trips to CBC with a new bus service	15 (e multiplied by g)

i	Total reduction in highway trips to CBC as a result of the West of Cambridge Package Bus Service	10 (h minus f)

Table 2 shows that the West of Cambridge Bus service is predicted to remove 10 highway trips per day from highway demand to CBC.

A Park and Ride Site off the A428 / A1303

A new Park and Ride is proposed to be located off the A428 or A1303. Various Case Studies have been collected which show the impact of Park and Ride schemes including Canterbury Park and Ride and Oxford Park and Ride . Based on the Case Studies, the overall impact of the Park and Ride is predicted to be a 14% mode shift to Park and Ride (based on an average of all Case Studies used).

The process used to calculate the impact of a new Park and Ride on highway trips from Cambourne / Bourn / Papworth is shown in Table 3.

Table 3 - Calculating the Impact of a Park and Ride off the A428 / A1303 (numbers may not add due to rounding)

Ref	Methodology	Figures
a	Total Population of Cambourne, Papworth, Cambourne West and Bourn Airfield likely to work at CBC	2,183 (see Table for calculations 352 + 1,096 + 736)
b	Existing Car Mode Share (Census 2011 Cambourne)	83%
c	Existing Car Trips to CBC	1,812 trips (a multiplied by b)
d	New Park and Ride Mode Share	14% (Table 3)
e	New Car Mode Share	71% (1,558 trips) Calculated using a weighted mode shift approach as outlined in Figure 2 for the Chisholm Trail and Greenways.
f	New Car Trips to CBC	1,558 (a multiplied by e)
f	Reduction in car trips as a result of the Cambourne to Cambridge Park and Ride	254 (c minus f)

Table 3 shows that a total of 254 highway trips are predicted to be removed from the highway network to CBC as a result of a new Park and Ride off the A428 / A1303.

New Bus Trips as a Result of the Relocation of Papworth Hospital

With the relocation of Papworth Hospital to CBC in 2019, it is likely that there will be an increase in trips to CBC from Papworth / Cambourne. To predict the likely transfer of trips, 2011 Census data has been analysed for trips originating within the Papworth and Cambourne MSOAs with their destination within the MSOA that Papworth sits in.

Table shows the process for calculating the impact of the Cambourne to Cambridge scheme on trips that were previously made to Royal Papworth Hospital that would be made to CBC following the relocation.

Table 4 - Calculating the Impact of the Relocation of Royal Papworth Hospital on the Cambourne to Cambridge Scheme (numbers may not add due to rounding)

Ref	Methodology	Figures
a	Number of Royal Papworth Hospital Staff residing in Papworth / Cambourne (2011 Census)	690
b	Number who travel by foot from within the Papworth MSOA. These are assumed to be staff who live on-site or with the same village.	283 (42% mode share from 2011 Census) (a multiplied by 42%)
c	Number of staff who are assumed to transfer to Waterbeach Barracks – based on the number of dwellings at Waterbeach Barracks dedicated to relocated Papworth staff	235 These have been removed from future calculations as they will no longer make trips along the A428 corridor to access CBC.
d	Existing Bus Mode Share to Papworth (MSOA) (2011 Census Data)	1% (6 trips)
e	Existing Car Mode Share to Papworth (MSOA) (2011 Census Data)	48% (328 trips)
f	New assumed bus mode share – based on the existing bus mode share from Haverhill where there is already a direct service to CBC	31%
g	New car mode share – this mode share has gone up when compared to before the Cambourne to Cambridge Scheme and the Royal Papworth Relocation due to the removal of 235 (c) walking trips as a result of Waterbeach Barracks. Actual number of car trips has reduced.	58% (264 trips) Calculated using a weighted mode shift approach as outlined in **Figure *2*** for the Chisholm Trail and Greenways.
j	Reduction in car trips, of those that have transferred as part of the Royal Papworth Relocation, as a result of the Cambourne to Cambridge Scheme.	64 (e minus g)

Table 4 shows that as a result of the Cambourne to Cambridge Scheme, there is predicted to be a reduction in car trips, of those who drive to CBC as a result of the Royal Papworth Relocation, of 64 trips.

New developments at Cambourne West and Bourn Airfield

Two new developments are planned to the west of Cambridge, at Bourn Airfield (3,500 homes) and at Cambourne West (2,350 homes). This volume of new homes has the potential to change travel patterns and traffic volumes in the area considerably and is therefore likely to have an impact on travel to CBC. **Table** 5 shows the process for calculating the impact of the Cambourne to Cambridge Scheme on trips to CBC from Bourn Airfield and Cambourne West. Both developments are programmed to commence construction by 2021 and therefore will be some part built out by the time the Cambourne to Cambridge Scheme is opened in 2024. Therefore, the impact of the scheme on the new developments is scheduled to be felt in 2024.

Table 5 - Calculating the Impact of New Developments on demand for the Cambourne to Cambridge Scheme (numbers may not add due to rounding)

Ref	Methodology	Figures
	Cambourne – used as a basis for calculations	
a	Total workers in Cambourne / Papworth (2011 Census)	3,280
b	…of which work at CBC	352
c	…as a %	11% (b divided by a)
d	Existing Cambourne Homes (South Cambridgeshire Annual Monitoring Report 2018[8])	4,114
e	Existing Cambourne Population (Cambourne Parish Council	12,000
f	Cambourne Dwelling Occupancy Ratio	2.92 (e divided by d)
	Bourn Airfield	
g	Allocated Bourn Airfield Homes	3,500
h	Population (based on Cambourne Occupancy Ratio)	10,209 (g multiplied by f)
i	Staff in Bourn likely to work at CBC (11% based on Cambourne)	1,096 (h multiplied by 11%)
j	We already know that 93 less highway trips will be caused by a bus service from Papworth / Cambourne (calculated using the same methodology presented in Appendix E Section 1.1). Based on a Cambourne population of 12,000 this equates to….	0.78% (93 divided by 12,000)
k	Reduction in car trips as a result of the Bourn Airfield Development	79 (h multiplied by j)
	Cambourne West	
l	Cambourne West Homes	2,350
m	Population (based on Cambourne Occupancy Ratio)	6,855
n	Staff in Cambourne West likely to work at CBC (11% based on Cambourne)	736
o	We already know that 91 less highway trips will be caused by a bus service from Papworth / Cambourne. Based on a Cambourne population of 12,000 this equates to….	0.78% (91 divided by 12,000)
p	Reduction in car trips as a result of the Cambourne West Development	53 (m multiplied by o)
q	Total reduction in highway trips from Bourn Airfield and Cambourne West as a result of the Cambourne to Cambridge Scheme	132 (k plus p)

[8] https://www.scambs.gov.uk/media/2428/south_cambs_amr_2016-2017_final.pdf

*numbers may not add due rounding

Total Impact of the Cambourne to Cambridge Scheme on Highway trips to CBC
Table 6 shows the total impact of the Cambourne to Cambridge Scheme on highway trips to CBC, consisting of a total of all the elements outlined above.

Table 6 - Total Impact of the Cambourne to Cambridge Scheme on Highway Trips to CBC

Component	Total impact on highway trips to CBC
Bus Service	10
Park and Ride	254
Papworth Hospital	64
Cambourne West and Bourn Airfield	132
Total	**460**

The total number of highway trips predicted to be abstracted from highway as a result of the Cambourne to Cambridge Scheme is **460**.

A new shuttle bus is proposed by CBC to start in April 2019 to support the relocation of Royal Papworth Hospital to CBC. This is predicted to provide an interim measure until the Cambourne to Cambridge bus service becomes operational in 2024 and will therefore include some of the demand for this service. Therefore, the impact of the bus service, and relocation of Royal Papworth Hospital (totalling 74 highway trips) have been moved forward to 2019 to reflect the introduction of this service.

Key assumptions used in this calculation are as follows:

- The proportion of staff residing in Cambourne will remain constant over time;
- Bus mode share will increase as a result of a new direct service;
- 14% modal shift to Park and Ride as a result of a new Park and Ride site;
- Number of dwellings being constructed for Royal Papworth Hospital staff at Waterbeach Barracks is equivalent to the number of staff who will relocate to Waterbeach; and
- The occupancy ratio of Cambourne West and Bourn Airfield will be comparable to the existing Cambourne settlement.

1.5. Impact of the West of Cambridge Package

The impact of the West of Cambridge Package has been calculated using existing data and separated into three components:

- A direct bus service from north-west Cambridge to CBC;
- A new Park and Ride at M11 Junction 11; and
- An extension to Trumpington Park and Ride of 279 spaces.

Each of these is assessed in turn below.

Bus Service

The bus service associated with the West of Cambridge Package is assumed to connect with the Cambourne to Cambridge bus service. Therefore, demand for the West of Cambridge Service that originates to the west of the City, i.e. Cambourne, is included within the demand for the Cambourne to Cambridge Scheme.

To calculate the impact of a new bus service between north-west Cambridge and CBC, Census Journey to Work data has been obtained for the MSOAs shown in **Figure *3*** which are considered to form the catchment of the West of Cambridge bus service within Cambridge.

Figure 3 - MSOA Catchment of the West of Cambridge Bus Service

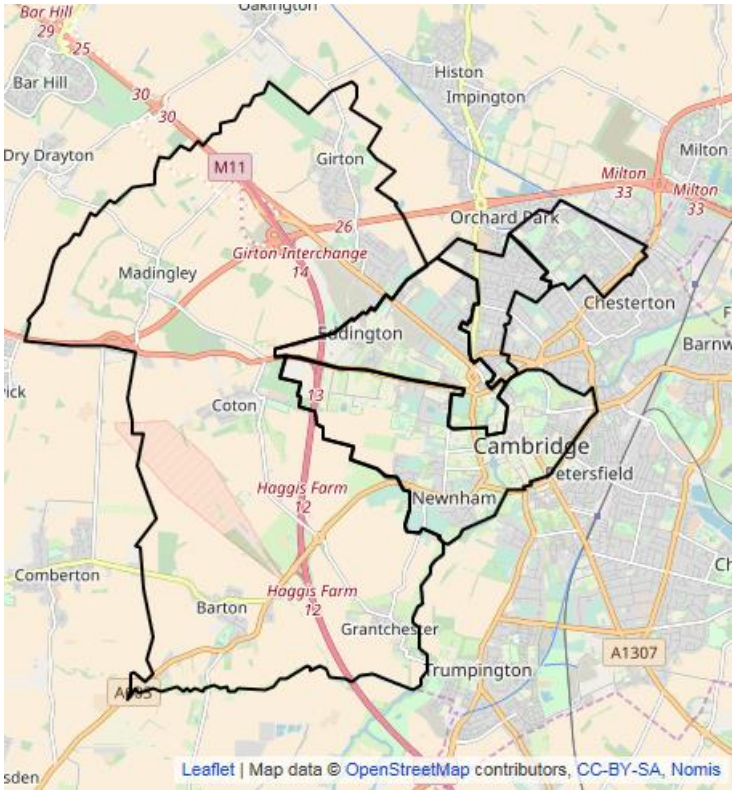


Table 7 shows the process for calculating the impact of the West of Cambridge Bus service on highway trips to CBC.

Table 7 - Calculating the Impact of the West of Cambridge Bus Service

Ref	Methodology	Figures
a	Total trips to CBC from within the West of Cambridge Bus Service Catchment Area – taken from 2011 Census Journey to Work Data (WU03EW)	987
b	Number of car trips to CBC – taken from 2011 Census Journey to Work Data (WU03EW)	351
c	Existing bus mode share to CBC from within the West of Cambridge Bus Service Catchment Area – taken from 2011 Census Journey to Work Data (WU03EW)	17%
d	Existing car driver mode share to CBC from within the West of Cambridge Bus Service Catchment Area – taken from 2011 Census Journey to Work Data (WU03EW)	36%
e	New Bus Mode Share – based on the existing bus mode share from Haverhill where there is already a direct service to CBC	31% This equates to a 14% increase in bus mode share.
f	New Car Mode Share	30% Calculated using a weighted mode shift approach as outlined

		in **Figure *2*** for the Chisholm Trail and Greenways.
g	Number of car trips to CBC with the West of Cambridge Bus Service in place	296 (a multiplied by f)
h	Total reduction in highway trips to CBC as a result of the West of Cambridge Package Bus Service	55 (b minus g)

Table 7 shows that the West of Cambridge Package Bus Service is predicted to lead to a reduction in daily highway trips to CBC of **55**.

Park and Ride at M11 Junction 11

Table 8 shows the process and calculations for forecasting the impact of a new Park and Ride at M11 Junction 11.

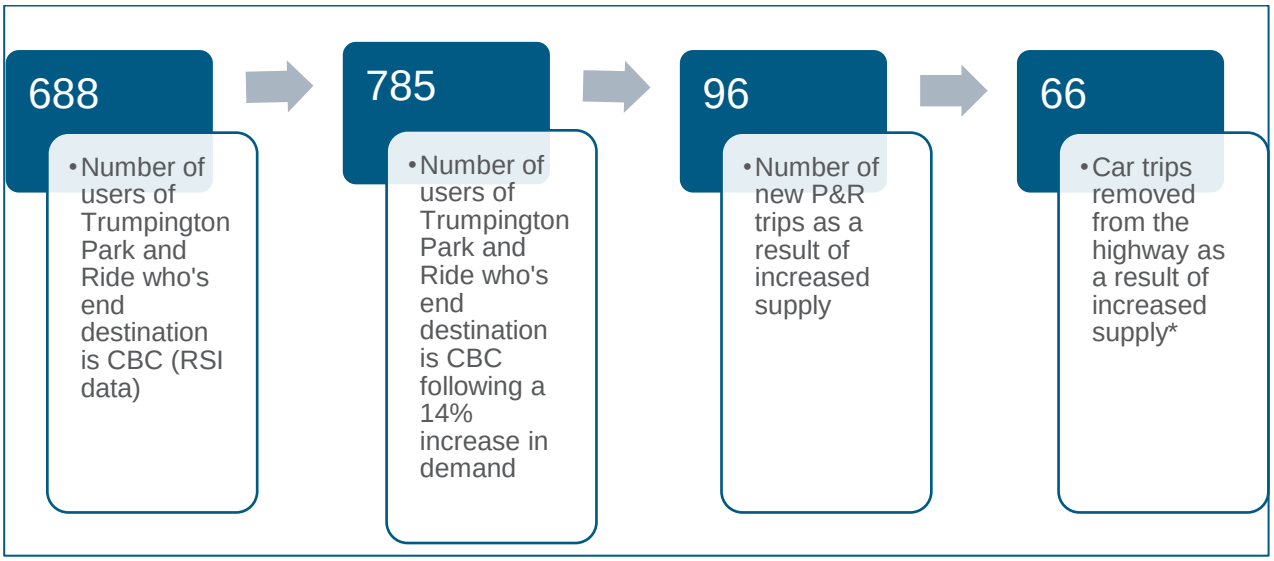
Table 8 - Calculating the Impact of the West of Cambridge Park and Ride Site

Ref	Methodology	Figures
a	New Park and Ride Mode Share as a result of a new Park and Ride at M11 Junction 11	14% (Table 3)
b	Existing Car Mode Share to CBC – taken from Table 4 in the Part 2 Report	69%
c	Total trips to CBC in 2031 – taken from Table 4 in Part 2 report	67,400
d	Total car trips to CBC in 2031 - taken from Table 4 in the Part 2 Report	46,400
e	Revised Car Mode Share as a result of a shift to Park and Ride	59% Calculated using a weighted mode shift approach as outlined in **Figure *2*** for the Chisholm Trail and Greenways.
f	Revised total car trips to CBC in 2031	39,660 (e multiplied by c)
g	New Car trips as a result of new Park and Ride provision	6,740 (d minus f)
h	% of staff that reside within the Trumpington Park and Ride Catchment (catchment taken from 2013 Road-side Interview Data)	48% (48% of g is 3,235)
i	Application of a vehicle occupancy factor of 1.48	2,186 (h divided by 1.48)
j	Reduction to account for Park and Ride trips already accommodated by the Cambourne to Cambridge Park and Ride which is also in the catchment for Trumpington Park and Ride	1,932 (i minus 254 in Table 7)
k	Total reduction in highway trips to CBC as a result of a new Park and Ride at Junction 11	1,932

Table 8 shows that the M11 Junction 11 Park and Ride is predicted to lead to a reduction in daily highway trips to CBC of **1,932**.

Extension to Existing Trumpington Park and Ride
Figure *4* shows the process and calculations for forecasting the impact of the extension to the existing Trumpington Park and Ride.

Figure 4 - Calculating the Impact of the Extension to Trumpington Park and Ride



* Calculated using a weighted mode shift approach as outlined in **Figure *2*** for the Chisholm Trail and Greenways.

Figure *4* shows that the extension of Trumpington Park and Ride is predicted to lead to a reduction in daily highway trips to CBC of **66**. Therefore, the total impact of the West of Cambridge Package is predicted to be a reduction of **2,053** highway trips to CBC.

Key assumptions used in this calculation are as follows:

- The bus service associated with the West of Cambridge Package connects with the bus service associated with the Cambourne to Cambridge Scheme;
- Bus mode share will increase as a result of a new direct service; and
- 14% modal shift to Park and Ride as a result of a new Park and Ride site.

1.6. Impact of Cambridge Autonomous Metro

Cambridge Mass Transit Options Assessment Approach to Future Demand
The approach to calculating the impact of CAM on highway trips to CBC is based on the Greater Cambridge Mass Transit Options Assessment Report[9] (OAR) (January 2018) hereafter referred to as the CAM study. The Report did not forecast demand for CAM, or indeed for Cambridge public transport overall. However, it set out some scenarios to help assess the level of capacity for which the mass transit system would need to be planned. The scenarios involved assumptions about the level of mode shift to public transport and the amount of local growth, in various combinations. Chapter 5 of the CAM study set out two possibilities for the level of mode shift:

- **A 35% increase in public transport demand**, compared to 2015 levels. This represented a modal shift delivered by an improved transit system. It was informed by experience of other UK mass transit schemes including the Cambridgeshire Guided Busway. It was

[9] https://citydeal-live.storage.googleapis.com/upload/www.greatercambridge.org.uk/futureinvestmentstrategy/Cambridge%20Mass%20Transit%20Options%20Assessment%20Report%20Final%202.pdf

designed to represent likely public transport patronage, based on 2015 demand (including Park and Ride), plus mode shift, but without any disincentives to car travel (e.g. a workplace parking levy); and

- **A 40% capture of relevant highway demand**. This represented 40% of all existing highway trips to the Cambridge urban area being transferred to public transport. This was seen as reflecting the attractiveness of the new mass transit system or additional disincentives to driving into Cambridge, resulting in greater mode shift from car than the previous scenario. The CAM study noted that this level of mode shift "*would be unprecedented*" and represented "*the very upper end of what any scheme could realistically achieve*" (CAM study para 5.10).

note that these two levels of mode shift are not directly comparable, the first relating to public transport demand and the second to the highway demand that could be captured.

The CAM Study also set out two possibilities for growth:

- Local Plan growth to 2031; and
- 'Transformational Growth', represented as double the Local Plan growth.

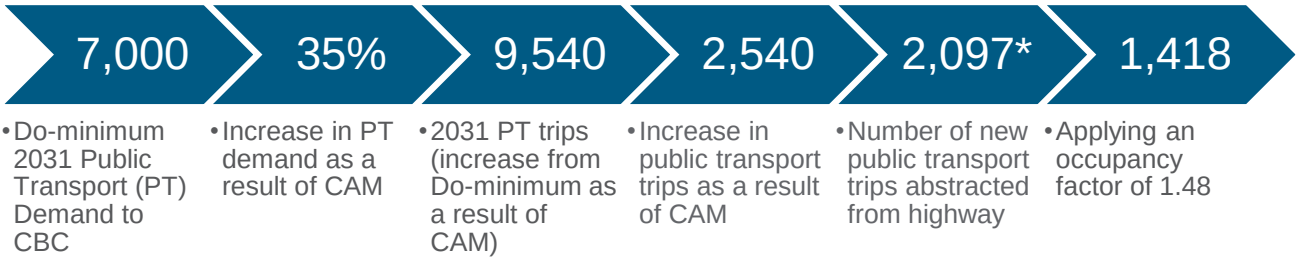
The CAM Study set out five scenarios, representing different combinations of these possibilities. For each scenario, the Study set out a potential volume of public transport demand along each of the key corridors into Cambridge for the busiest AM peak hour. It is important to note that these figures represent potential volumes for planning purposes (not demand forecasts) and covered all public transport demand along the corridor (not just the mass transit system). Based on those figures, the CAM Study recommended a planning capacity of 4,000 people per hour per corridor in each direction for the mass transit system.

Representing CAM in the CBC Study

The CAM Study does not provide a 'CAM Demand Forecast' which can be directly used to assess the impact of CAM on highway trips to CBC. However, the CAM study's two possibilities for the level of mode shift can act as starting points for such an assessment.

As noted by the CAM Study, the 40% capture of highway demand is a best-case assumption. This is likely to involve dis-incentives to car travel such as a workplace parking levy or similar. Without these disincentives in place the overall impact of CAM is more likely to be represented by the 35% increase in public transport use, the majority of which will still be mode shift from car however mode shift from other modes is also possible. This scenario has been used to forecast the impact of CAM on access to CBC. **Figure *5*** shows the process used to calculate the impact. The Do-minimum 2031 Public Transport Demand is taken from Table 4 in the Part 2 Report.

Figure 5 - Calculating the Impact of Cambridge Autonomous Metro



* Calculated using a weighted mode shift approach as outlined in Figure 2 for the Chisholm Trail and Greenways. This calculation assumes that no trips will be abstracted from walking to public transport as the catchment of these two modes is considered to be different.

Given that demand forecasts within the CAM Study are based on total public transport demand, to avoid double counting the total impact of planned schemes to input into the Part 3 Report is

equivalent to the CAM, Greenways and Chisholm Trail impacts. The total impact of a new Park and Ride site at Junction 11 is also included within this demand as it is considered to appeal to a different demand sector i.e. the total number of trips abstracted from highway as a result of CAM, Junction 11 Park and Ride, Chisholm Trail and Greenways is 3,720, broken down as follows:

- CAM Impact – 1,418;
- Junction 11 Park and Ride Impact – 1,932; and
- Greenways and Chisholm Trail Impact – 370.

Key assumptions used in this calculation are as follows:

- 35% increase in public transport use as a result of CAM;
- No impact on walking mode share as a result of CAM;
- Some impact on cycling mode share; and
- Majority impact on highway trips.

Appendix D. Impact of Cambridge South Station Technical Note

Technical Note

Project:	Cambridge Biomedical Campus Transport Needs Review		
Subject:	Cambridge South Station		
Author:	Atkins	Atkins No.:	N/A
Date:	14/12/2018	Icepac No.:	N/A
		Project No.:	5161508
Distribution:	N/A	Representing:	N/A

This Technical Note outlines the demand forecasting undertaken to predict the impact of Cambridge South Station on travel to and from CBC. This note should be read alongside Part 3 of the Cambridge Biomedical Campus Transport Needs Review.

1.1. Approach

Demand forecasting for a new Cambridge South Station has previously been undertaken by John Laing, the results of which will form the basis of our demand assumptions when considering the wider transport network impacts of Cambridge South Station.

In the context of this Study, the forecasts have been used to understand and shape the wider transportation needs of CBC as opposed to supporting a business case for the Station itself. For this purpose, it has been considered appropriate to apply off-model uplifts and sensitivity testing to the existing demand data provided by John Laing, to consider the range of possible rail demand a new Station may deliver and the impact it could have on access to CBC.

1.2. Demand Forecasts For 2031

Demand forecasts have been taken from a trip-rate spreadsheet model supplied by John Laing, the key assumptions of which are identified in Table 1. Following a review of the modelling assumptions, off-model uplifts have been identified to reflect more up to date knowledge of employment and housing developments in the CBC study area as defined in the Part 1 and Part 2 Reports. John Laing tested a core scenario of 4tph (trains per hour in each direction) and a sensitivity scenario of 8tph. For the purposes of the CBC Study and following discussions between CCC and Network Rail, 8tph is considered a credible realistic target. Therefore, this has been applied as the core scenario in this Study.

Table 1 – Modelling Assumptions

Modelling Assumption	Description (John Laing Definitions)	Updates / Changes Applied
Service Frequency	4tph comprising of: 1tph Kings Lynn – Kings Cross (fast); 1tph Cambridge – Kings Cross (All stations);	Core Scenario considered to be 8tph in each direction, which was undertaken by John Laing as a sensitivity test.

Modelling Assumption	Description (John Laing Definitions)	Updates / Changes Applied
	1tph Cambridge – Liverpool Street; and 1tph Cambridge – Stansted Airport.	
Population	Application of TEMPro 7.0[1].	While TEMPRO will capture housing growth across larger areas, the detail of localised development can be lost. Therefore, we have considered the significant development in the Southern Fringe region separately to apply a local demand generation uplift in line with the population increase being delivered within the Stations' catchment area (See Figure 1 and Figure 2 below)..
Employment	Application of TEMPro 7.0 with specific CBC employment figures included for the site (21,500 by 2020).	Uplifted demand figures to reflect latest employment figures for CBC of 26,000 by 2020.
Annualisation Factors	The original demand forecasts produced annual Station usage figures.	To consider the average daily rail demand de-annualisation factors have been derived based on the known staff/visitor split of travel to CBC.
Car Parking	No car parking available at the proposed Station.	No change.

Table 2 shows the resultant forecast demand for the Station in 2031 taken from the modelling outputs.

Table 2 - Rail Demand Forecast for 2031

	Total Station Demand (Return Trips)	Destination Demand (Return Trips)	Origin Demand (Return Trips)
Total Demand	5,800	4,700	1,100

The demand forecasting estimates an average weekday Station demand of around 5,800 return journeys by 2031. This is broadly equivalent to the total demand for Ely and Royston Stations combined[2]

Of all trips using Cambridge South Station, 81% of these would be destination trips travelling to the Station, while the remaining 19% would be origin trips starting their rail journeys at the Station. This is a result of the forecasting methods employed by John Laing, which assumed that no car parking

[1] TEMPro is software that allows users to extract growth forecasts from the National Trip End Model (NTEM). The NTEM model forecasts growth in trips up to 2051 for use in transport modelling. The forecasts take into account national projections of population, employment, housing, car ownership and trip rates. https://data.gov.uk/dataset/11bc7aaf-ddf6-4133-a91d-84e6f20a663e/national-trip-end-model-ntem

[2] 6,000 return trips daily in 2016/2017 – calculated using Office of Rail and Road Estimates of Station Usage 2016-2017 http://orr.gov.uk/__data/assets/excel_doc/0012/26130/estimates-of-station-usage-2016-17.xlsx

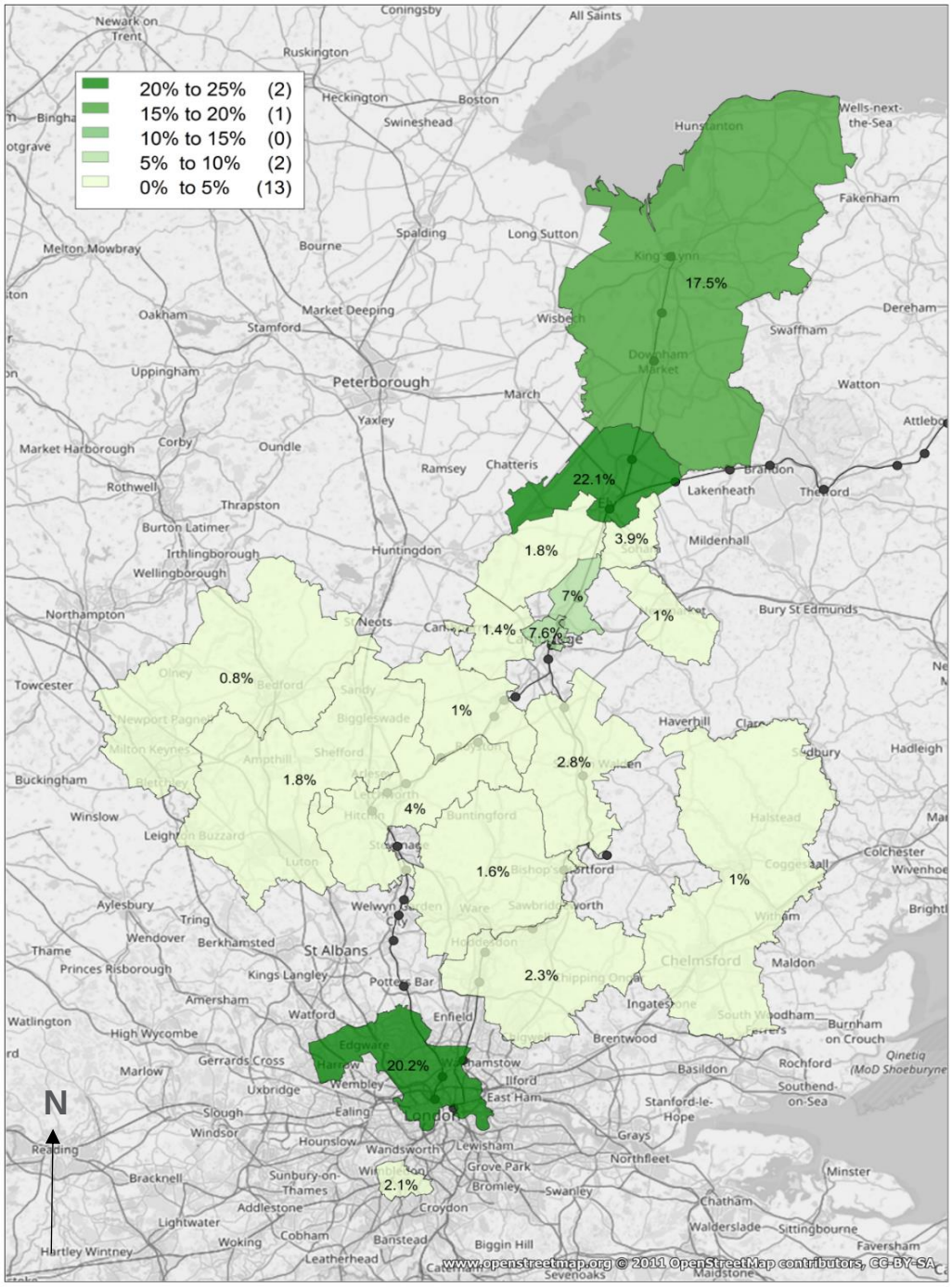
would be available at Cambridge South Station, reflecting current proposals for the design of the Station facilities.

Conversely, demand accessing the Station as an origin Station is expected to be more aligned to traditional daily profiles with a focus in the commuter peaks as people utilise services to commute into London, Cambridge and other locations. While the forecasts suggest this will be a smaller element of overall demand at the Station, (420 trips across the peak periods), this will be sensitive to parking availability at or near the Station and service level provision. Therefore, the differentiation in parking availability would be a critical factor in Station choice for those within the catchment of both Cambridge Station and Cambridge South Stations. Restricting parking at Cambridge South Station would prevent the Station from becoming a major origin for rail trips that could otherwise draw large volumes of highway trips to the CBC site. If such parking constraints were not to occur, highway trips accessing the Station would exacerbate existing highway congestion in the vicinity of CBC.

Direct access to a range of potential routes on the rail network would allow a rail Station at Cambridge South Station to provide a competitive travel choice that could generate significant mode shift for travel to and from CBC. The ability to serve the CBC market will reflect the rail network itself and its competitive position against other modes, which is reflected in the origin of passengers forecast to use Cambridge South Station.

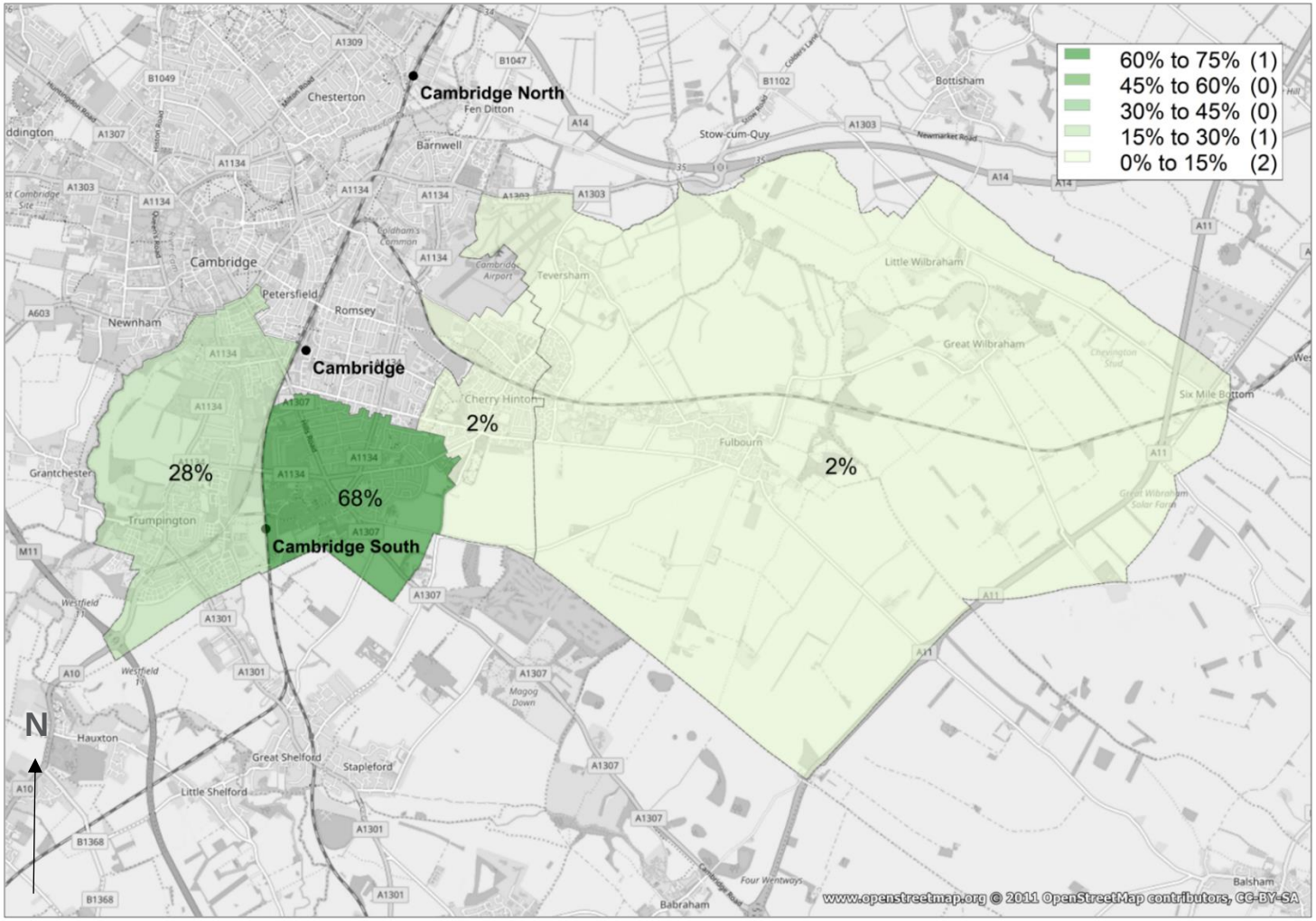
Figure 1 shows the geographical spread of origins (by MSOA) for rail demand forecasts to Cambridge South Station as a destination Station. This highlights Ely, Kings Lynn, North Cambridge and London as potentially being strong rail markets. Figure 2 shows the predicted ultimate destination of these trips (by Middle Super Output Area), to understand where these passengers are expected to travel onwards to after arriving at the Station. This suggests that passengers travelling to Cambridge South Station are likely to be focused mainly on reaching CBC and nearby locations (including Hills Road Sixth Form College and Long Road Sixth Form College), as well as the neighbouring Trumpington residential area.

Figure 1 - Predicted True[3] Origin of Trips to The Station as a Destination Station[4]



[3] True Origin: Where a trip starts, not where a user joins the train
[4] The numbers presented in brackets in the legend indicate how many records exist within that range

Figure 2 – Predicted True Destination[5] of Trips to The Station as a Destination Station[6]



[5] True Destination: Where a trip ends, not where a user departs the train
[6] The numbers presented in brackets in the legend indicate how many records exist within that range

1.3. Rail Abstraction and Mode Shift

The rail trips generated by Cambridge South Station will be a combination of abstraction from other Stations, (in this case Cambridge Station), modal shift from alternative modes and entirely new trip making. The modelling work undertaken by John Laing to date has not included mode choice modelling. Therefore, highway abstraction estimations have been based on application of standard WebTAG guidance, with 26% of new trips to rail assumed to have transferred from the highway. Considering the spread of CBC travel demand in comparison to the rail network, this is not an unreasonable assumption, with the opportunities for highway mode shift focussed on specific locations served by rail Stations such as Royston, Ely, Kings Lynn and North Cambridge.

Table 3 shows the abstraction and mode shift splits for trips with a destination within the CBC site.

Table 3 - Rail Abstraction and Mode Shift for CBC as a Destination (2031)

Scenario	Destination Demand (Return Trips)
Demand to Cambridge South Station	4,700
Of which is Demand to CBC	3,142
CBC Demand Abstracted From Other Rail	1,000
New to Rail	2,142
Of which are abstracted from highway	557

Table 3 shows that a total of 3,142 destination return trips are predicted to use Cambridge South Station daily to access the CBC site, which equates to 68% of destination trips to Cambridge South Station. Of these, 1,000 return trips are abstracted from other rail Stations and 2,142 are new to rail. This equates to 557 return trips being abstracted from the highway network, based on a WebTAG figure of 26% abstraction.

Table 4 shows the rail demand for trips originating at Cambridge South Station.

Table 4 - Rail Demand Forecast for CBC as an Origin (2031)

Scenario	Origin Demand (Return Trips)
Demand from Cambridge South Station	1,100
Of which is Demand from CBC	539
CBC Demand Abstracted From Other Rail	172
New to Rail	367
Of which are abstracted from highway	189

Table 4 shows that of the 1,100 trips originating at the Station, 539 originate from within the CBC MSOA. Of these, 367 are new to rail, whilst 189 are predicted to be abstracted from other rail Stations, based on a WebTAG figure of 26% abstraction.

Table 3 and Table 4 show that Cambridge South Station has be potential to lead to a significant abstraction of trips from the highway network as well as other rail Stations. The latter may also reduce highway trips as part of the trip previously made from Cambridge Station, for example, may have included a car leg which no longer occurs.

1.4. What Impact Does A Station Have On The CBC Transport Network?

Overview

Cambridge South Station would have a range of impacts across the wider transport network. These fall into three main categories:

1. Abstraction of previous highway trips to and from CBC that would now use rail to travel to CBC;

2. Generation of new rail trips (those now travelling to and from Cambridge South Station, adding trips to the local networks). This can have a range of possible impacts including:
    - Additional drop off and pick up movements at or near the Station;
    - Additional public transport use for local access/egress legs;
    - Additional walking and cycling trips for local access/egress legs; and
    - Increased demand for cycle parking at the Station;
    - Increased demand for motor vehicle parking at the Station, on-street or in existing CUH patient and visitor parking. This will be limited at CBC by the intention to provide no general car parking at the station and by the heavy existing usage and close management of parking within CBC.
3. Abstraction of rail demand from alternative Stations, which will impact the wider transport networks surrounding CBC through:
    - Reduced congestion on other sections of the highway network, as less people drive into Cambridge for rail access at Cambridge Station;
    - Reduced use of guided bus links between Cambridge Station and the CBC site; and
    - Reduced taxi trips between CBC and Cambridge Station.

Abstraction Of Highway Trips

Of the 3,142 rail passenger trips predicted to travel to Cambridge South Station to access CBC (Table 3), up to 557 return person-trips a day could be removed from the highway network (Table 3). Given the diverse spread of CBC staff and visitors in the Cambridgeshire area and further afield, rail travel could prove a viable option for many. Figure 5-3 in the Part 1 Report[7] shows the staff locations by postcode and highlights large markets of staff who are ideally located for convenient rail network access. This includes not just those living close to a Station, but also those with convenient public transport access to a Station, such as via the GCB to Cambridge North.

The nature of the rail Stations along the route will also have an impact on passenger's choice to utilise the rail network. For example, parking availability and accessibility at Stations such as Ely, Royston and Waterbeach will influence an individual's decision making in using rail over driving to CBC. A review of the access to and parking at these Stations would be necessary with the introduction of Cambridge South Station, to ensure that facilities at the origin end of destination trips to CBC is not preventing further take-up of rail travel. Availability of parking at origin Stations on the network may incentivise more people to take up rail travel to access CBC.

New Rail Network Trips

It is predicted that 1,100 return trips a day would use Cambridge South Station as an origin Station (Table 4). The modelling has assumed no car parking facilities at the Station, which is aligned to proposed Station design in accordance with encouraging sustainable access and egress from the Station itself. This means that these trips would access the Station via either walking, cycling, public transport or highway (as taxi or drop-off trips).

The distribution of passengers' true origins (by MSOA) is shown in Figure 3, with 49% coming from the MSOA in which CBC is located. The local nature of the Station catchment supports the ability to maximise sustainable access to the Station. However, it is inevitable that the Station will generate some levels of car drop-off and pick up, which would add multiple trips to the network. It will be essential that highway traffic generated by trips to the Station as an origin is minimised through:

- Excellent walking and cycling routes, including wayfinding; providing safe and convenient access to the Station; alongside high quality and sufficient levels of cycle parking facilities;
- Bus Connections: between the Station and local residential areas; particularly those towards the further end of the walking catchment such as Cherry Hinton and Fulbourn; and
- Managing Parking: the availability of parking, whether official Station car parking or nearby car parks / on-street parking, will influence how people utilise the Station. Without appropriate restrictions in place the ability to park would encourage car travel to the Station which could exacerbate congestion issues, as opposed to providing congestion relief. There is an expectation that no general car parking would be provided at Cambridge South Station. Further

[7] Cambridge Biomedical Campus Transport Needs Review (April 2018)

management measures would need to be in place to minimise the potential for Station users to park nearby instead.

These measures will also help support onward travel options for the 4,700 passengers travelling to Cambridge South Station as a destination, encouraging sustainable modes for the final leg of passengers' journeys.

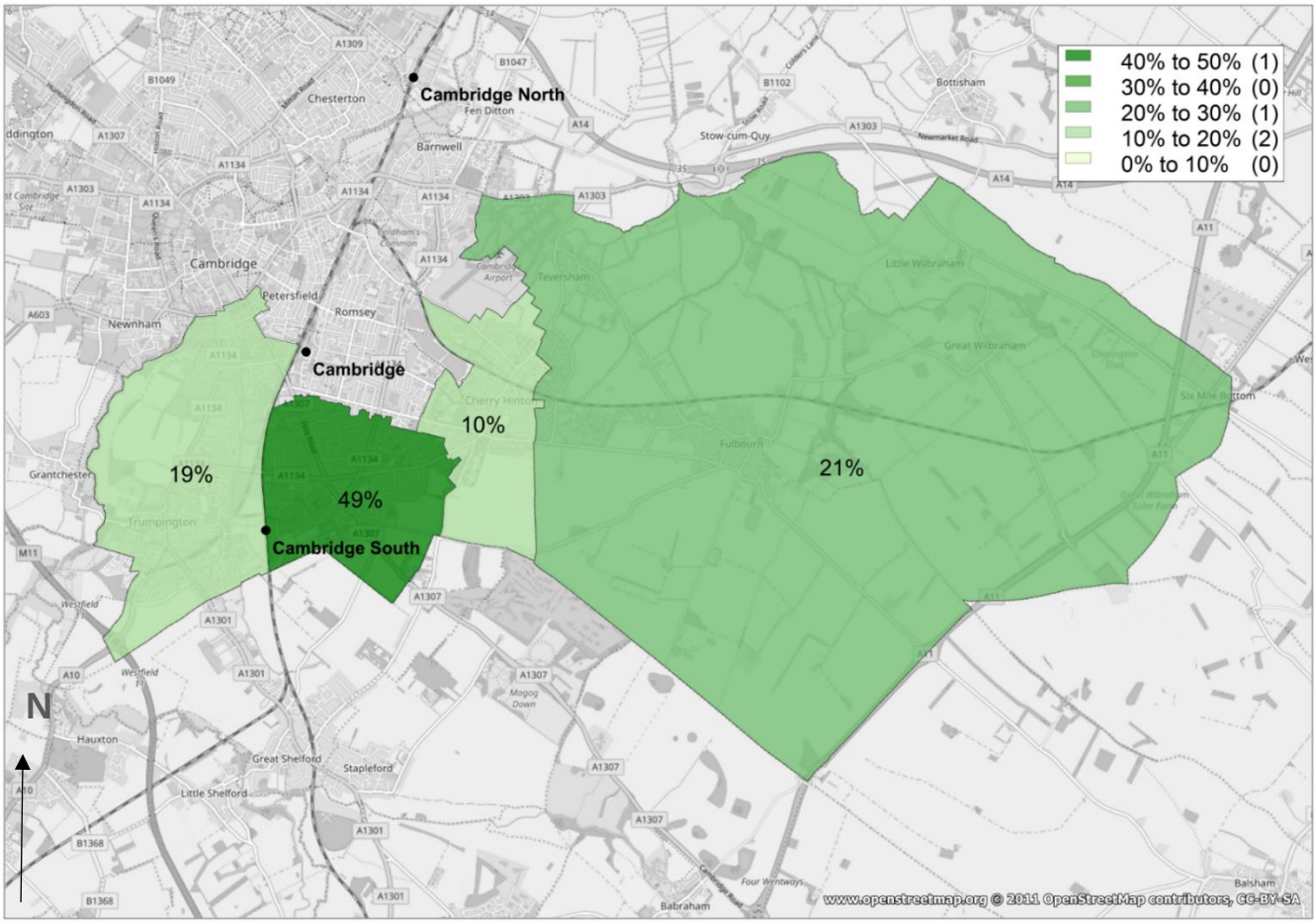
Abstraction Of Rail Demand From Alternative Stations

Of the total demand travelling to Cambridge South Station as a destination, it is forecast that 1,830 return journeys are passengers who would already travel via rail and hence the demand is abstracted from alternative rail Stations. Given the location of Cambridge South Station, it is anticipated that a high proportion of this is abstracted from Cambridge Station. Switching between destination Stations will be a result of Cambridge South Station being closer to passenger's ultimate destination and hence will ultimately decrease the need for onward travel on the wider transport network. The wider network implications of this will be a reduction in passengers needing to use alternative modes for their final leg between Cambridge Station and CBC. This is likely to result in a further reduction in highway trips to CBC through a reduction in taxi journeys and car pick up and drop offs between CBC and Cambridge Station, as well as potentially releasing capacity on sustainable modes, particularly the guided bus.

Of the 1,100 trips using Cambridge South Station as an origin, 539 are predicted to access from CBC, of which 189 are assumed to be modal shift from the highway (Table 4). These will incorporate trips to a range of destinations, which will provide a reduction to the wider highway network, although not necessarily to the main CBC access links. Similarly, 172 are abstracted from Cambridge Station and therefore will reduce the highway journeys into Cambridge City.

Figure 3 shows the true origin of rail demand using Cambridge South Station as an origin Station.

Figure 3 – Predicted True[8] Origin of Trips to The Station as an Origin Station[9]



[8] True Origin: Where a trip starts, not where a user boards the train
[9] The numbers presented in brackets in the legend indicate how many records exist within that range

Appendix E. Impact of Other Potential Interventions Technical Note

Technical Note

Project:	Cambridge Biomedical Campus Transport Needs Review		
Subject:	Impact of Other Potential Interventions		
Author:	Atkins	Atkins No.:	N/A
Date:	19/12/2018	Icepac No.:	N/A
		Project No.:	5161508
Distribution:	N/A	Representing:	N/A

This Technical Note should be read alongside the Cambridge Biomedical Campus Transport Needs Review Part 3 Report.

This Technical Note documents the methodology and calculations used to predict the impact of Potential Interventions on highway demand to CBC. Impacts are presented in terms of the number of one-way highway trips that are removed from the network to and around CBC as a result of the Potential Interventions. This approach enables us to ascertain the impact of the Potential Interventions on the Targets identified in Section 2.2 of the Part 3 Report.

Note: in the spreadsheet model all impacts have been scaled up or down to reflect the year of opening and the impact for each year of the Study. In this note, the impacts are expressed as the number of one-way highway trips that are removed from the network to and around CBC in 2031.

1.1. Direct Bus Services to CBC from Key Locations

The CBC Part 2 report identified a number of key locations, where a significant number of staff and patients reside, that could be targeted for a direct bus service. These locations are:

- Royston;
- Papworth;
- Cambourne;
- Waterbeach;
- Ely; and
- Newmarket.

A direct bus service from the Papworth / Cambourne area is proposed as part of the Cambourne to Cambridge Better Bus Journeys Scheme. Therefore, the impact of a direct bus service from this location has not been included within this analysis to avoid double counting.

A direct service from Royston to CBC, via the Busway A service, was introduced in Autumn 2018. As the impact of this change was not included within the 2017 cordon counts it is considered that the impact calculated as part of this Study should still be included but will be bought forward to 2018.

The impact of new direct services to CBC has been calculated using six steps, as follows:

1. Identification of the number of daily staff and patient trips to CBC;

2. Factoring of staff and patient trips to 2031;
3. Use of 2011 Census Data to identify the existing bus mode share from each location to CBC and therefore the existing number of trips by bus;
4. Application of a new bus mode share of 31% - based on the existing Haverhill to CBC bus mode share, where a direct service is already in place (2011 Census);
5. Calculation of the number of new bus trips abstracted from car based on a weighted mode share percentage, the methodology for which is explained within Appendix C; and
6. Factor by the 1.48 occupancy factor of vehicles travelling to CBC (taken from 2017 CBC Travel Survey).

The following sections summarise each step in the process.

Staff and Patient Numbers (Steps 1 and 2)

Table *1* shows the number of staff and patients residing in each location, factored to daily trips[1] and to 2031. Factoring to 2031 is based on the proportion of total staff and patients that live in these locations compared to the total staff and patient trips predicted for 2031. Proportions residing in each location are considered to remain constant over time.

Table 1 - Daily Staff and Patient Trips from Key Locations

Location	Existing Daily Trips (2017)		2031 Daily Trips	
	Staff	Patients	Staff	Patients
Royston	663	289	999	501
Waterbeach	27	182	41	314
Ely	1,006	195	1,515	338
Newmarket	545	775	821	1,341

Bus Mode Share (Steps 3 and 4)

Table *2* shows the existing bus mode share for trips to CBC from each of the locations as well as the application of a new bus mode share of 31% to reflect a potential direct service to that location in 2031. Patient mode shares are based on the existing CBC patient / visitor bus mode share of 12%. The patient mode share is considered to remain constant as a result of a new service as patients are more likely to have restrictions to travelling by public transport and are making the trips less frequently. This assumption is considered a worst-case assessment.

Table 2 - Bus Mode Share

Location	2011 Bus Mode Share (staff)	2031 Bus Trips		Revised Bus Mode Share (staff)	Revised 2031 Bus Trips		New Bus Trips as a result of direct services (2031)
		Staff	Patients		Staff	Patients	
Royston	2%	24	60	31%	310	60	286
Waterbeach	11%	5	38	31%	13	38	243[2]
Ely	2%	34	41	31%	470	41	436
Newmarket	5%	42	161	31%	254	161	212

[1] Factoring to daily trips has been conducted using the total known number of daily trips in 2017 (13,552) multiplied by the proportion of staff residing in that location.
[2] Also takes into account that up to 235 Royal Papworth Hospital Staff are likely to relocate to Waterbeach Barracks

Bus Trips Abstracted from Highway (Step 5 and 6)

Table *3* shows the methodology for calculating the number of bus trips abstracted from highway, based on a weighted mode share percentage. This process involves calculating the mode share, excluding bus, and applying the revised highway mode share to the total number of new bus trips in 2031. For example, when excluding bus trips from Royston to CBC, the highway mode share is 85% (previously 83%). The total number of new bus trips forecast in 2031 is 286 (see Table 2), which when multiplied by 85% shows that 243 of the new bus trips previously accessed CBC by highway. This process is further explained in Appendix C.

Table 3 - Bus Trips Abstracted from Highway

Location	Highway Mode Share % when bus is excluded	Trips abstracted from highway as a result of direct bus services[3]
Royston	85%	243
Waterbeach	74%	180
Ely	63%	276
Newmarket	89%	188
Total		887

Table *3* shows that 886 highway person trips could be removed from the network to CBC as a result of direct bus services being provided from Royston, Waterbeach, Ely and Newmarket. When taking into account a vehicle occupancy factor of 1.48 this equates to **599 vehicles** predicted to be abstracted from the highway network as a result of the direct services.

Key assumptions used in this calculation are as follows:

- The proportion of staff residing in each location will remain constant over time; and
- Bus mode share will increase as a result of a new, direct service.

1.2. Impact of a Free Bus Pass for New or Relocated Staff

To predict the impact of providing a free bus pass to new or relocated staff, a Case Study for a similar scheme has been sought. The Beaulieu development in Essex offered residents a free bus season ticket upon occupation. This resulted in a 58% of residents requesting the bus pass, and a 22% increase in bus use.

It is recognised that not all CBC staff will reside in areas accessible by bus and therefore bus travel to work will not be feasible for all. This is also the case with the Beaulieu Development; although residents live in a development served by a bus, not all are likely to work in locations where it is feasible to travel by bus. Therefore, this case study is considered appropriate to use to calculate the impact of offering staff at CBC a free bus pass.

Based on the Beaulieu Case Study example, of the 5,231 new staff predicted at CBC in 2031, 3,034 (58%) could request the bus ticket. Based on existing mode shares (28% bus[4]) 1,465 staff would have already been likely to take the bus, irrespective of the free ticket. In line with the 22% increase in bus travel predicted as a result of the bus pass a total of 1,787 bus trips could access CBC (1,465 multiplied by 1.22). This equates to an additional 322 bus trips.

It is considered that all of these trips would be abstracted from car as those who walk or cycle would be likely to continue to walk or cycle irrespective of the free ticket. Therefore, the total number of

[3] New bus trips multiplied by highway mode share, excluding bus
[4] Part 1 Report Figure 5-8

highway person trips predicted to be abstracted from the network as a result of the free bus ticket is **322**.

Key assumptions used in this calculation are as follows:

- Similar impacts are experience to the Beaulieu Case Study; and
- All trips would be abstracted from car.

1.3. Impact of Encouraging Home Working

To predict the impact of encouraging home working, a Case Study for a similar initiative has been used from the Advisory, Conciliation and Arbitration Service (ACAS). ACAS is an organisation that provides advice to employers on a variety of topics and states that more than one in every 10 of their staff are designated as home workers, with many more working from home occasionally.

From information presented in the Part 2 Report, it is considered that up to 4,578 staff (Admin/Clerical Staff) could be eligible for homeworking, therefore based on the ACAS data, 10% of these (**458 trips**) would be likely to take up home working.

Key assumptions used in this calculation are as follows:

- Of all staff at CBC, 5,391 staff could be eligible for home working.

1.4. Impact of Travel Planning Package

To predict the impact of the Travel Planning Interventions recommended, evidence was sought on the impact of travel planning packages, which are likely to have more impact than interventions implemented in isolation. The following sources have been identified, all of which suggest a 2-3% point mode shift (2.3% average) away from car as a result of Travel Planning Packages. Local Sustainable Transport Fund (LSTF) Schemes are not only implemented in locations with poor sustainable travel options but look to enhance options that already exist such as in Peterborough. For this reason, these case studies are considered appropriate to apply to Cambridge which has existing good sustainable transport options:

- Sloman et al, The Effects of Smarter Choices Programmes in Sustainable Travel Towns[5] (2%);
- Impact of the Local Sustainable Transport Fund – Summary Report[6] (2.3%); and
- Meta-analysis of Outcomes of Investment in the 12 Local Sustainable Transport Fund Large Projects[7] (2.6%).

A total of 46,400 highway trips are predicted in 2031 without the implementation of any travel planning measures. This equates to 68.74% car mode share, which as a result of travel planning measures is reduced to 66.44%. When applied to the total demand to CBC (67,500) this equates to 44,848 highway trips, a reduction of 1,553 highway person trips. When taking into account a vehicle occupancy factor of 1.48 this equates to **1,049 vehicles** predicted to be abstracted from the highway network as a result of a travel planning package.

5 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/4408/chap1.pdf

6 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/648822/local-sustainable-transport-fund-impact-summary-report.pdf

7 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/738267/meta-analysis-of-lstf-large-projects-final-report.pdf

Key assumptions used in this calculation are as follows:

- Travel Planning measures lead to a 2.3% point mode shift from highway.

1.5. Summary

The calculations outlined above show that the Other Potential Interventions have the potential to remove a total of 2,428 highway trips off the network to CBC in 2031. Within the spreadsheet model it is assumed that the impact of these schemes will be felt in 2023 as there are no hard proposals at this stage.

Appendix F. Maximum Impact of Cambridge South Station Technical Note

Technical Note

Project:	Cambridge Biomedical Campus Transport Needs Review		
Subject:	Maximum Station Demand		
Author:	Atkins	Atkins No.:	N/A
Date:	19/12/2018	Icepac No.:	N/A
		Project No.:	5161508
Distribution:	N/A	Representing:	N/A

This Technical Note should be read alongside the Cambridge Biomedical Campus Transport Needs Review Part 3 Report.

This Technical Note documents the methodology, calculations and workings used to predict the maximum impact that Cambridge South Station could have on access to CBC.

Station demand forecasts presented in Chapter 5 of the Part 3 Report are based on the CBC transport network as it is today (2018). Planned Schemes and Interventions presented in the Part 3 Report have the potential to change transport options for access to CBC considerably and growth is predicted to put further pressure on parking supply. Therefore, it is considered that Cambridge South Station could have a much greater role to play in providing sustainable access to CBC.

Station impacts are presented in terms of the number of one-way highway trips that are removed from the highway network to CBC. This approach allows the impacts of the schemes to be determined in comparison to the Targets identified in Section 2.2 of the Part 3 Report.

The methodology for this approach is as follows:

- **Step 1:** Identifying rail catchments through analysis of existing railway stations and the geographical area from which these are likely to capture trips to/from CBC. This step has focussed on key stations as follows:
  - King's Lynn;
  - Peterborough;
  - March;
  - Ely;
  - Downham Market;
  - Waterbeach;
  - Newmarket;
  - Bury St Edmunds;
  - Great Chesterford;
  - Royston;
  - Meldreth;
  - Shepreth;
  - Foxton;

- Stevenage;
- Whittlesford;
- Bishop's Stortford;
- London King's Cross / St Pancras; and
- London Liverpool Street.

(Cambridge Rail Station and Cambridge North Station have not been considered within this analysis as they are unlikely to capture a significant number of trips to / from CBC as other modes are likely to be more favourable for such shorter distance trips).

- **Step 2:** Determine if there is any reason why these catchments may change due to planned large development sites which may lead to additional rail demand;
- **Step 3:** Determine the number of staff and patients that currently reside within the rail catchments and the numbers likely to reside there in the future. This is the total maximum rail demand to CBC; and
- **Step 4:** Adjustments are required to forecast a more realistic rail demand:
  - Reduction in demand due to those for who it is essential to use car e.g. blue badge holders;
  - Reduction in demand due to those who are already travelling to CBC by non-car modes e.g. some bus users will continue to use the bus when there is a rail option available to them, whereas others may shift to rail;
  - Reduction to remove risk of double counting with other schemes

The following Sections provide more narrative and discussion around the steps identified above.

Step 1: Rail Demand

Figure 1 shows the rail catchments used to determine which trips to CBC could be captured by the introduction of rail. This has been determined based on staff and patient postcode data to identify areas of significant demand where an existing rail station could potentially be connected to CBC via a direct service to Cambridge South Station. Stations have been identified based on the number of staff residing in the catchment. A lower limit of 50 has been set to highlight key origins, except for Stevenage, where 45 staff reside. Stevenage, and London Stations, have been included within the assessment as it is considered a key Station on the Cambridge – London Kings Cross line. It is recognised that there are other relevant stations, in addition to those included within Figure 1, however it is considered that the majority of demand will be captured by the stations included within this assessment.

Figure 1 - Staff and Patients Residing in Rail Catchments

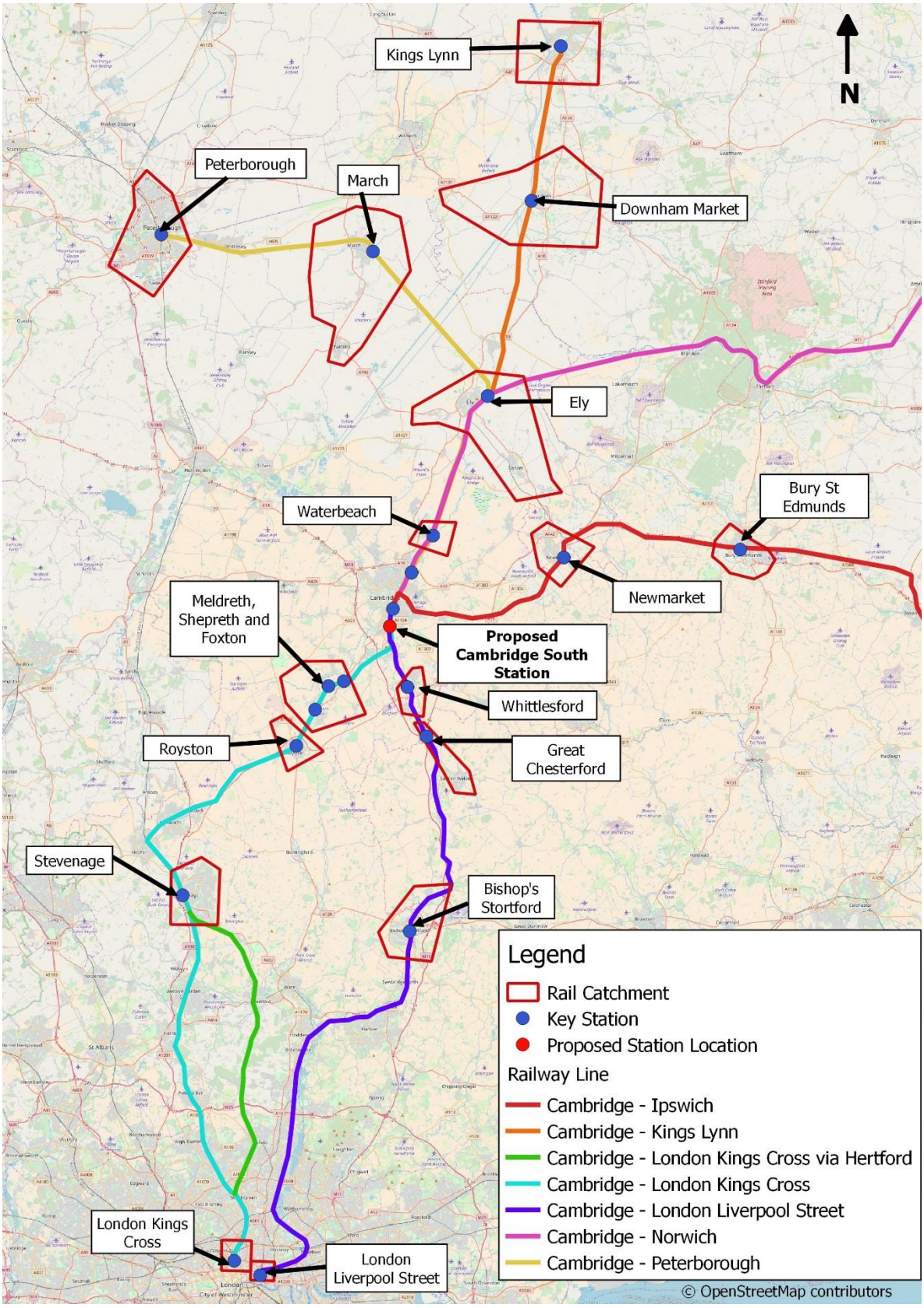


Table 1 shows the number of staff and patients that are currently residing in the rail catchments.

Table 1 Number of Staff and Patients Residing in Rail Catchments

Station Catchment	Existing Staff (based on total staff numbers)	Staff 2031[1]	Existing Patients (based on daily patient trips)	Patients 2031[2]
Downham Market	69	104	168	291
Kings Lynn	91	137	151	261
Peterborough	122	184	235	407
March	99	149	161	278
Ely	921	1,391	227	392
Waterbeach	25	38	96	155
Newmarket	499	753	410	709
Bury St Edmonds	167	252	147	254
Great Chesterford	427	645	335	580
Meldreth, Shepreth and Foxton	246	371	53	42
Royston	410	619	132	229
Stevenage	45	68	55	95
Kings Cross	11	17	3	5
Whittlesford	55	83	5	8
Bishops Stortford	114	172	233	404
London Liverpool Street	2	3	1	2
Total	3,303	4,988	2,383	4,123

Numbers may not add due to rounding

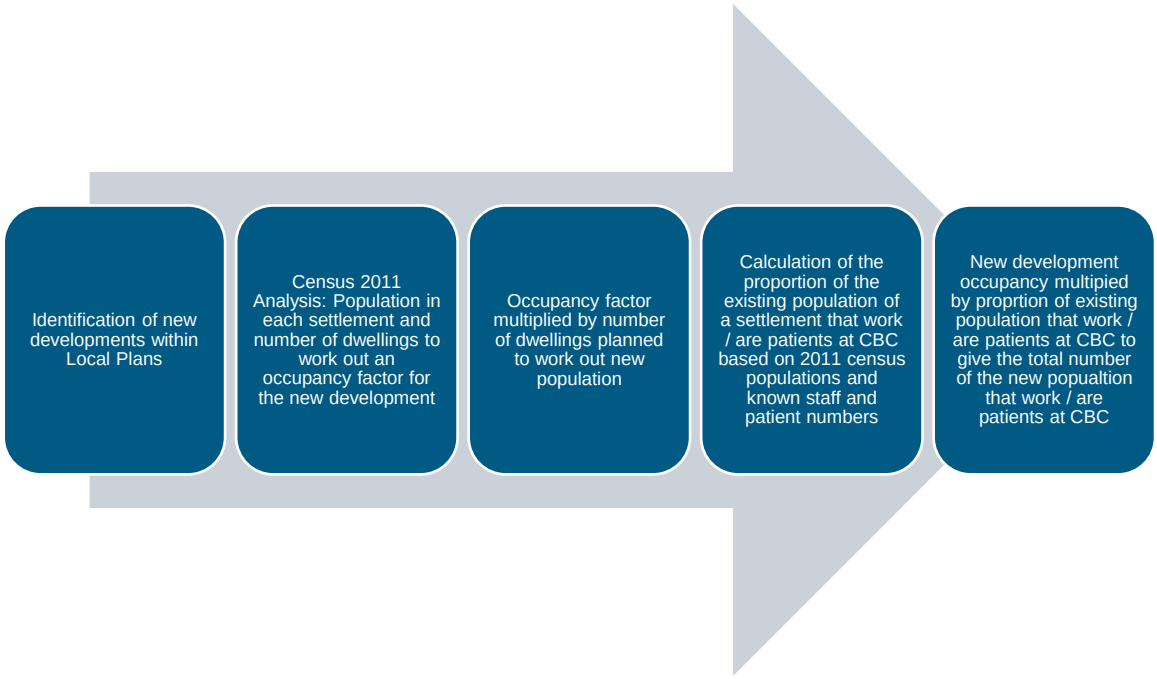
Step 2: Change in Rail Catchments

It is recognised that the number of staff and patients within the rail catchments may change as a result of planned developments.

Local Plans covering Hertfordshire, Cambridgeshire, Norfolk and Suffolk have been analysed to identify major allocated developments that could have an impact on the future rail demand to CBC. These consist of up to 35,000 new homes within the rail catchments identified in Figure 1 up to 2031. Figure 2 shows the process for calculating new rail trips to CBC that could be made as a result of planned developments.

[1] 2017 staff multiplied by 51% growth in staff numbers from 2017 to 2031 (Part 2 Report Table 1)
[2] 2017 patients multiplied by 73% growth in staff numbers from 2017 to 2031 (Part 2 Report Table 2)

Figure 2 - Process for defining new trips to CBC as a result of planned developments



The process identified in Figure 2 has been applied to both staff and patients resulting in an additional 1,002 daily trips as a result of new developments; 993 staff trips and 9 patient trips.

Step 3: Total Maximum Rail Demand to CBC

Table 2 shows the total number of staff and patients that reside within the catchments identified in Table 1, any increases due to planned developments, and the total forecast numbers in 2031.

Table 1 – Total Daily Maximum Rail Demand to CBC

2017 Demand		**2031 demand (51% uplift for staff and 73% uplift for patients)[3]**		**New demand as a result of planned developments**		**Total 2031 Demand**	
Staff	Patients and Visitors	Staff	Patients and Visitors	Staff	Patients and Visitors	Staff	Patients and Visitors
3,303	2,383	4,988	4,123	993	9	5,981	4,132

Table 2 shows that the maximum rail demand that could be generated by CBC trips to Cambridge South Station is 10,113. Step 4 discusses adjustments that have been made to this total demand to reflect a realistic daily demand.

[3] See Table 1

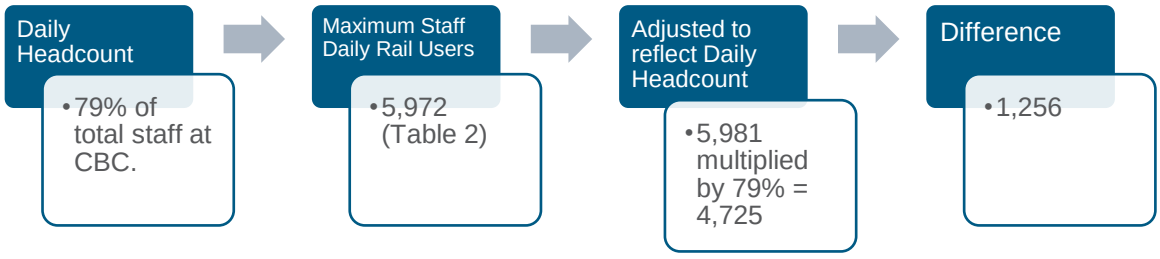
Step 4: Adjusted Demand

It is not likely or feasible for all of the demand identified in Table 2 to use rail to access CBC. Therefore, adjustments are required to reduce the demand to take this into account.

Adjustment to Daily Headcount[4]

Of the 17,250 staff working at CBC in 2017, 13,552 are known to travel to CBC daily, equating to 79% of total staff. Therefore, total staff rail demand has been factored down by 21% to account for those trips that are not made every day.

Figure 3 – Adjustment to Daily Headcount



Adjustment for Essential Car Users

For some people it is not possible to use rail to access CBC. These groups of people consist mainly of blue-badge holders and on-call or out of hours staff. These adjustments have been applied as follows:

- **Blue-badge holders**: 8% of parking spaces on-site are allocated to blue-badge holders, therefore it is assumed that 8% of those that park at CBC are essential car drivers and would therefore not take the train. Total parking supply at CBC in 2031 is 8,621 of which 8% is 690. When applying a turnover factor for staff of 1.14 and visitors of 2.73, the total number of essential car drivers is **1,334**[5];
- **Out of Hours Staff**[6]: information provided by CBC indicates that in 2017, 1,465 staff start their shifts out of hours and 900 finish their shift out of hours. This data includes only CUH staff who sign in and out, so this may underestimate the total. Based on this data we have assumed that:
    - Individual staff will generally either start or finish their shifts out of core hours (but not both) therefore a total of 2,365 staff are considered to work out of hours;
    - Out of hours staff origins are distributed in the same way as the total staff population meaning that 18% of staff are considered to reside in rail catchments shown in Figure 1; and
    - An additional 2% of staff will work out of hours as contractors e.g. external cleaners, caterers (2% of 17,250 staff).

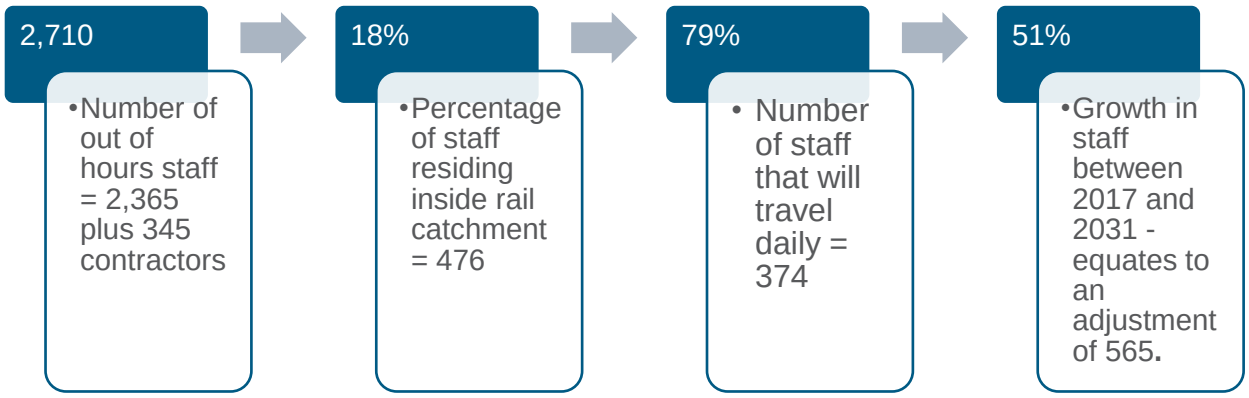
[4] Visitors already represented as daily headcount

[5] A sensitivity test has been undertaken using an alternative methodology based on 20% of patients and 5% of staff designated as blue-badge holders. This results in a total adjustment of 1,062 trips. In this case the methodology presented in Step 4 is considered to comparable and therefore robust for the purposed of this assessment.

[6] Considered to be unable to access sustainable modes of transport due to their shift starting or ending outside of the core operation of bus and/or rail services.

The figure below shows the process used to calculate the adjustment for out of hours staff based on the assumptions above.

Figure 4 – Adjustment for Out of Hours Staff



Therefore, the total number of essential car drivers as a result of being blue badge holders or working out of hours is **1,899**.

Adjustment for those who already travel by non-car modes

Some staff, patients and visitors who reside within the rail catchments already use sustainable modes to access CBC. For the purposes of this assessment it is assumed that those already travelling by train continue to do so but alight at Cambridge South instead of Cambridge Rail Station. For those who already travel by bus, it is assumed that 50% of these will continue to travel by bus and 50% will transfer to rail, due to the attractiveness of rail travel in terms of journey times. It is assumed that those that travel by foot and cycle will continue to do so.

Census analysis has shown that the above process equates to 165 trips continuing to use bus, foot or cycle to access CBC and 165 transferring to rail. When factored to 2031 this equates to **334 trips** transferring to rail.

Resultant Maximum Rail Demand

Following the adjustments outlined in the above sections, Figure 3 shows the total maximum rail demand that could access CBC in 2031.

Figure 4 - Maximum Rail Demand

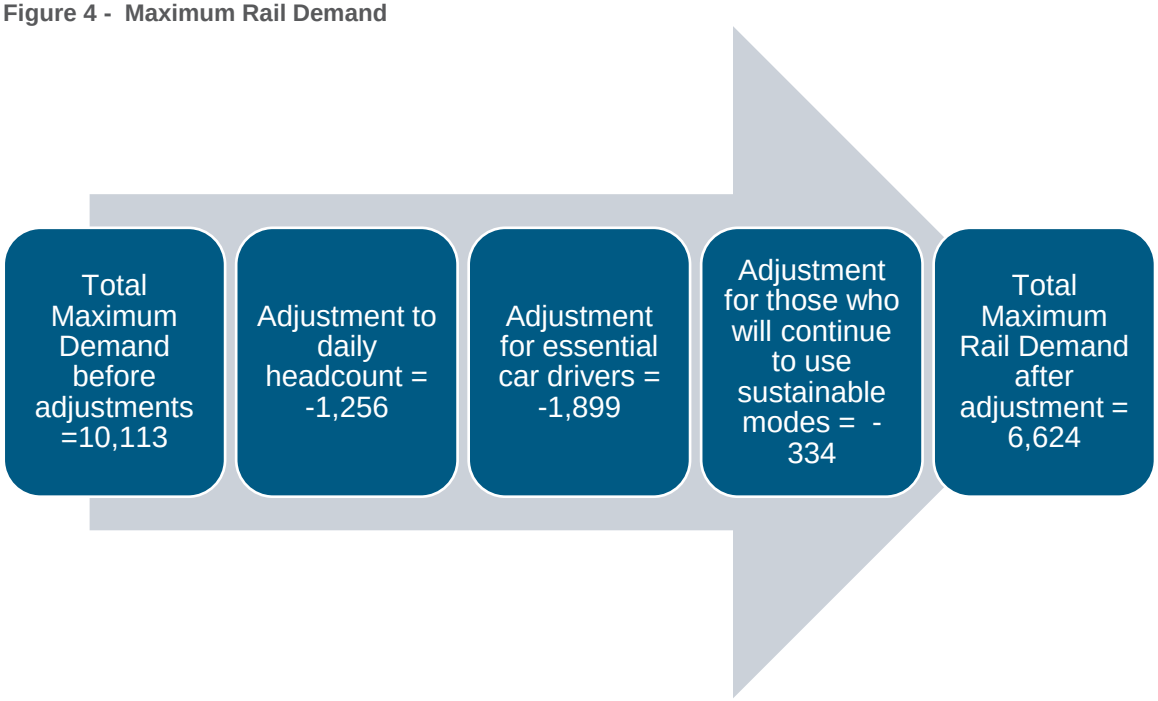


Figure 3 therefore shows that the total maximum rail demand to CBC, abstracted from highway is **6,624 trips**.

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