MOTT MACDONALD

Bus Strategy Report

Outline Business Case - Appendix F

17 January 2020

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Contents

1 Introduction

This note reviews and summarises previous work undertaken to assess the potential for commercially viable High-Quality Public Transport services to operate on the A428 Cambourne to Cambridge corridor, using the new and improved public transport infrastructure proposed for delivery through the Cambourne to Cambridge Better Public Transport (C2C) project. An updated bus network proposition, informed by previous work, is presented.

The purpose of this report is to explore an “end to end” bus strategy, developing express services reaching key destinations. The strategy will be used to inform traffic modelling, which will be used to generate journey times.

The routes were developed from the Bus Operating Case draft report (Atkins, May 2017), a review of the current routes operated in the area, and assessment of future opportunities from a bus operational specialist. For more detail on the development process see section 3 and 4. The routes are based on realistic service numbers, and reflect existing service patterns and anticipated demand. The strategy assumes use of a segregated, off-road route running between Madingley Mulch Roundabout and Grange Road, in line with assessment to date (see Option Assessment Report 2 at https://www.greatercambridge.org.uk/transport/transport-projects/cambourne-to-cambridge/cambourne-to-cambridge-background/).

The C2C Bus Network Strategy is part of a wider network and will inform GCP’s City Access project. The project is developing a new city-wide local bus network as part of a package of measures to deliver a commitment to reduce traffic in Cambridge by 10-15% on 2011 levels by 2030. The Cambridgeshire and Peterborough Combined Authority has also classified the Cambourne to Cambridge route as an essential first phase of plans for a wider, regional Cambridgeshire Autonomous Metro network in the future. CAM would provide a segregated, public transport system to run both over and underground, served by low-floor ‘trackless metro’ vehicles.

The Bus Network Strategy discussed below would be deliverable as a standalone, but would also be compatible with other proposals such as the Cambridge South-East Transport Study (CSETS).

2 Summary

The proposed bus strategy is based around three direct express services as follows;

- Cambourne to Cambridge City Centre at 10-minute interval service (6 buses per hour)
- Cambourne to Biomedical Campus at 30-minute interval service (2 buses per hour)
- A428 Park and Ride site to Biomedical Campus at 30-minute interval service (2 buses per hour during peak periods)

In addition, passengers from Cambourne to Cambridge corridor services would also be able to interchange with the Universal service at West Cambridge which would serve Cambridge North Station and the Cambridge Science Park.

- Biomedical Campus to Eddington at 15-minute interval service (4 buses per hour)
- Biomedical Campus to Cambridge North Station & Cambridge Science Park 30-minute interval service (2 buses per hour)

The routes were developed using the Bus Operating Case draft report (Atkins, May 2017) and assessment from our public transport specialist.

For more detail on the development process see section 3 and 4.

The routes are based on realistic service numbers and anticipated demand. Although it should be noted that the routes are proposed routes only and have not been agreed with the route operators.

The final routes used within the traffic modelling can be found in Figures 5 & 6, and Appendix A.

This proposition is consistent with the findings of previous work that the level of service between Cambourne and Cambridge City Centre that can be delivered commercially is unlikely to exceed 8 buses per hour. It offers a holistic solution that retains a service at all existing bus stops, while providing a direct, limited stop service from Cambourne and the new A428 P&R site to the City Centre every 10 minutes in line with the level of service offered from the existing Cambridge P&R sites.

The desire for direct services from Cambourne and the new A428 P&R site to the Cambridge Biomedical Campus is also recognised alongside the findings of previous work that the viability of a direct service between Cambourne and the Biomedical Campus via the M11 operating every 20 minutes is likely to be marginal. The level of service between Cambourne and the Biomedical Campus is therefore proposed to be 2 buses per hour (every 30 minutes). This service would build on the recent launch of the “H” service by Stagecoach which connects Cambourne to CBC via the M11 and the Madingley Road Park and Ride.

Existing bus services would have the option of using the new public transport route, providing they comply with clean vehicle standards. For example, the X5 would be likely to use the new route. The Citi 4 has been assumed to continue to serve existing stops on the A1303.

3 Previous Work

3.1 Strategic Case (2016)

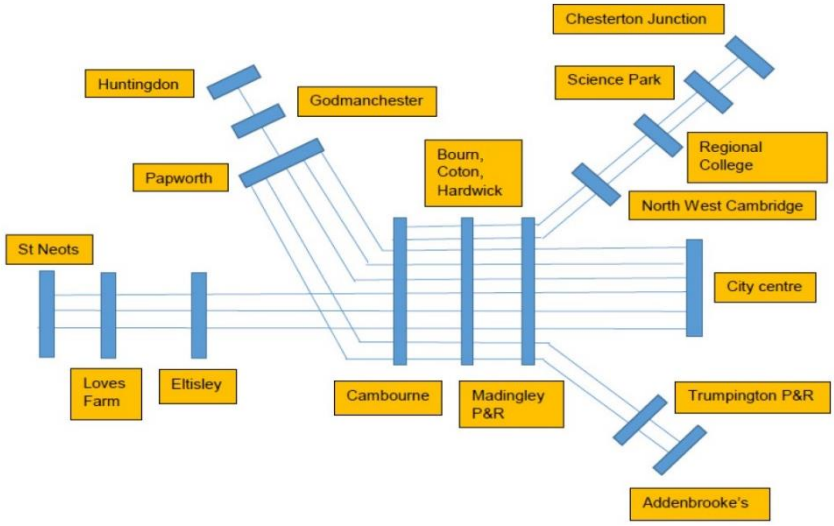
The Strategic Case for the C2C scheme (Atkins, July 2016) developed a bus network scenario (Figure 1). Each line in this figure represents one bus per hour. This scenario was intended as a basis for illustration and testing and was accompanied by a caveat that it did not represent a definitive statement of what could be delivered commercially or cost effectively.

This scenario envisaged that the core demand for bus services on the corridor would remain to destinations within Cambridge City Centre and was built around a 10-minute interval service (6 buses per hour) between Cambourne and central Cambridge, with 3 of these buses operating from St Neots, 3 from Papworth and one Papworth bus per hour starting from Huntingdon.

The service to central Cambridge was supplemented by services between Papworth, Cambourne and Addenbrooke's Hospital, and between Cambourne, Cambridge Science Park and Chesterton, each operating every 30 minutes.

In this scenario Cambourne would be served by a total of 10 buses per hour, all operating via the new A428 Park and Ride site proposed as part of the C2C scheme.

Figure 1: Strategic Case Bus Network Scenario



Source: Better Bus Journeys: Bus Operating Case, Draft Report (Atkins, May 2017)

3.2 Outline Business Case (2017)

Work undertaken by Atkins that was intended for the Outline Business Case (OBC) for the C2C scheme considered three alternative scenarios for the provision of bus services between Cambourne and Cambridge. These are summarised in Table 1. In contrast to the Strategic Case scenario, none of these scenarios considered or included services originating from points beyond Cambourne. This work assumed both a new Park and Ride (P&R) site and the retention of the existing Madingley Road P&R site.

All OBC scenarios retained the existing Stagecoach Citi 4 service between Cambourne and Cambridge operating every 20 minutes (3 buses per hour). In two cases a further 6 buses per hour were overlaid on top of this to central Cambridge, with 3 buses per hour to Addenbrooke's via the M11 and 3 buses per hour to Cambridge Science Park and Chesterton. In the third scenario, the Cambourne to Addenbrooke's service is provided at 6 buses per hour by extension of the city centre services in place of a direct service via the M11.

Table 1: Outline Business Case Bus Network Scenarios

Scenario	Route	Via	Headway (mins)
Do Minimum	Cambourne – City Centre (Citi 4)	Hardwick	20
1	Cambourne – City Centre	Hardwick	20
	Proposed P&R – City Centre	Madingley Road P&R	10
	Proposed P&R – Chesterton	Madingley Road P&R, Science Park	20
	Proposed P&R – Addenbrooke's	M11, Trumpington P&R	20
2	Cambourne – City Centre	Hardwick	20
	Cambourne – City Centre	Proposed P&R, Madingley Road P&R	10
	Cambourne – Chesterton	Proposed P&R, Madingley Road P&R, Science Park	20
	Cambourne – Addenbrooke's	Proposed P&R, Trumpington P&R	20
3	Cambourne – City Centre	Hardwick	20
	Cambourne – Chesterton	Proposed P&R, Madingley Road P&R, Science Park	20
	Cambourne – Addenbrooke's	Proposed P&R, City Centre	10

Source: Better Bus Journeys: Bus Operating Case, Draft Report (Atkins, May 2017)

Atkins assessed the commercial viability of the services proposed under each of these scenarios by comparing revenue estimates derived from Cambridge Sub-Regional Model (CSRM1) demand modelling transit line results with estimated operating costs. The results indicated that:

- The new services to the city centre are expected to be viable under all scenarios;
- In Scenarios 2 and 3, the provision of an additional 6 buses per hour between Cambourne and Cambridge City Centre would undermine the viability of the existing Citi 4 service;
- The viability of a direct service between Cambourne and Addenbrooke's via the M11 operating every 20 minutes (Scenario 2) is likely to be marginal;
- The viability of a Cambourne to Addenbrooke's service is improved in Scenario 3, where this is provided via a less direct route, but operating every 10 minutes, by extension of the city centre services; and
- A new service between Cambourne or the Proposed P&R and Chesterton via Cambridge Science Park is unlikely to be viable under any of the scenarios considered.

A key learning point from this work is the need to explicitly consider the impact of new public transport services proposed to operate on the Cambourne to Cambridge corridor on the viability of the existing bus services operating on this corridor. A holistic approach that seeks to integrate existing services within a new bus network strategy rather than simply overlaying new services will reduce the risk of the viability of existing services being compromised.

3.3 Bus Operating Case (2017)

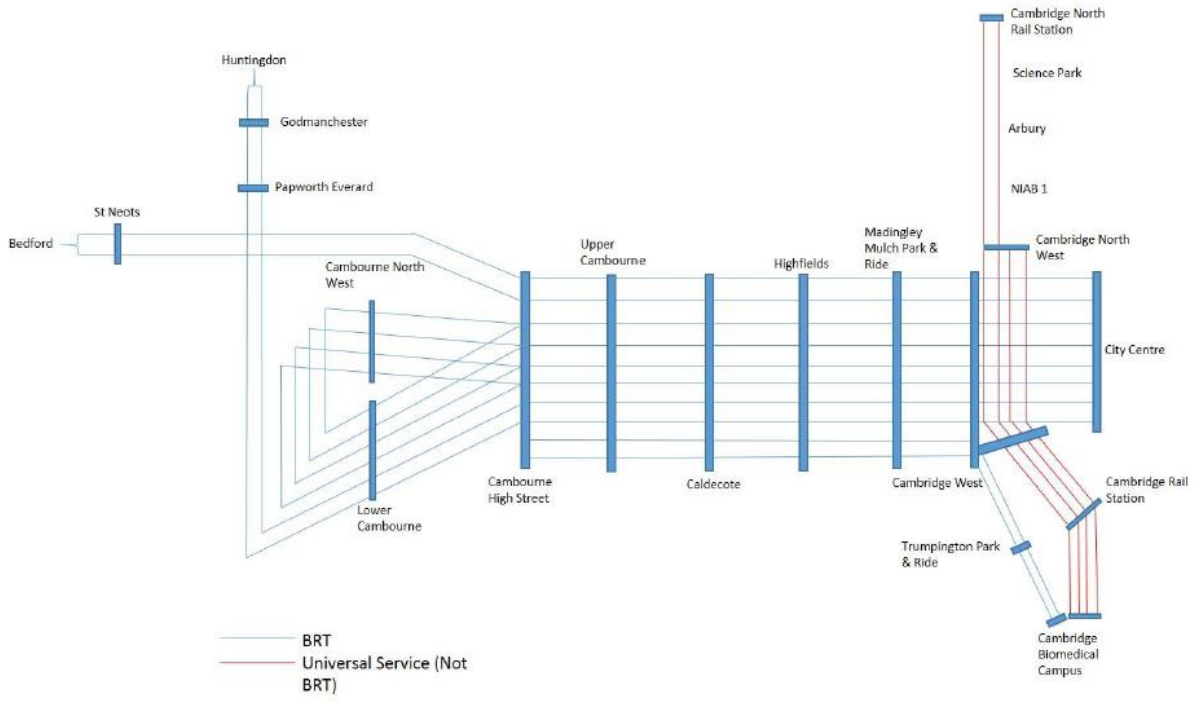
This work by Atkins, documented in a draft report dated May 2017, developed and tested a bus network proposition for both the Cambourne to Cambridge and former Western Orbital projects.

This was informed by, but not intended to be consistent with, previous work. However, in line with the original Strategic Case scenario, it considered the scope for the new public transport infrastructure on the Cambourne to Cambridge corridor to be utilised by services operating from beyond Cambourne.

The Bus Operating Case network proposition is shown schematically in Figure 2. Each line in this figure represents one bus per hour. The proposed services comprise:

- A 7/8-minute interval service (8 buses per hour) between Cambourne and central Cambridge via Bourn Airfield and the new A428 P&R site, with 2 of these buses operating from St Neots and 2 from Huntingdon via Papworth and Lower Cambourne. The remaining 4 buses per hour operate in a loop to serve Lower Cambourne and Cambourne West.
- A 30-minute interval service (2 buses per hour) between Cambourne and the Cambridge Biomedical Campus, via the new P&R site, West Cambridge and a western orbital route.
- Extension of the existing Universal bus service from its current northern terminus at Eddington through the Darwin Green development site (located between Huntington Road and Histon Road) and King's Hedges to Cambridge North Station, with interchange to/from Cambourne to Cambridge corridor services available at West Cambridge. Buses would continue to operate between Eddington and the Cambridge Biomedical Campus at 15-minute intervals (4 buses per hour), with a 30-minute interval service (2 buses per hour) on the new section of route between Eddington and Cambridge North Station.

Figure 2: Bus Operating Case Network Proposition



Source: Better Bus Journeys: Bus Operating Case, Draft Report (Atkins, May 2017)

3.4 Options Assessment Report 2 (2018)

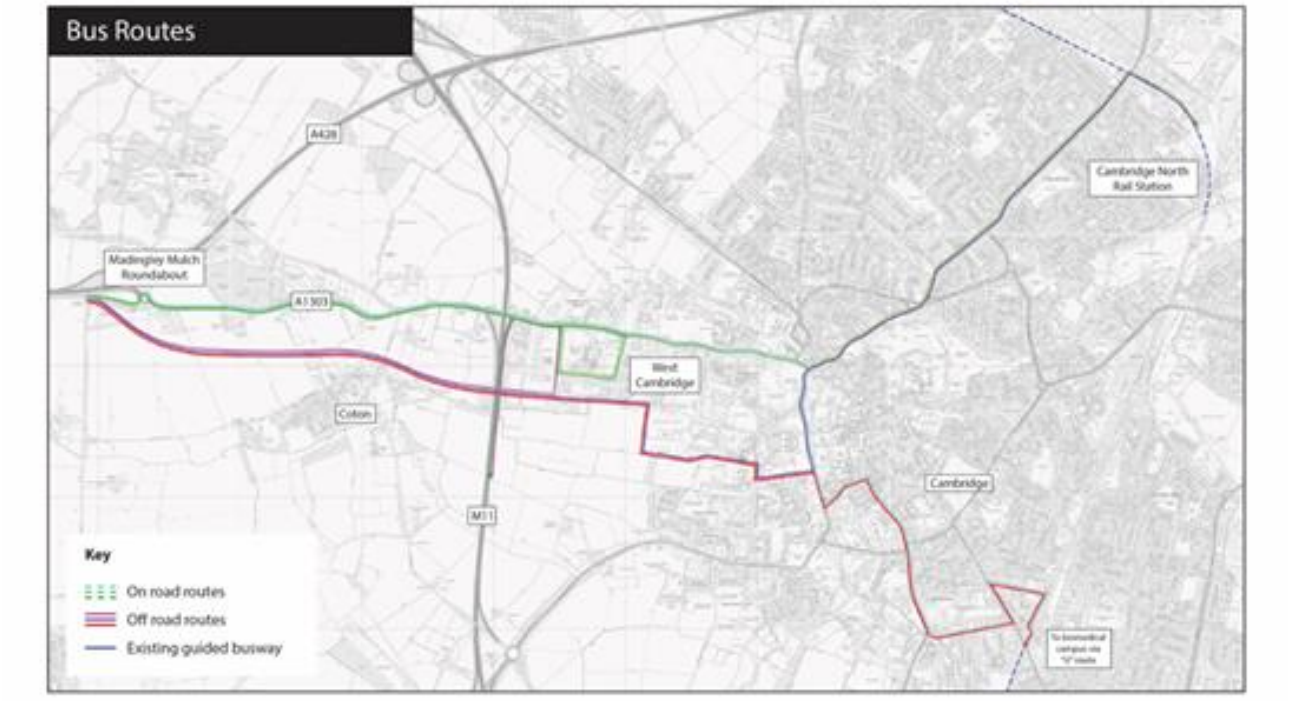
Options Assessment Report Part 2 (OAR2) was produced by Mott MacDonald in 2018, to assess the proposed off-road scheme against the proposed on-road scheme, as part of an update to the GCP Executive Board on progress towards a final recommended option for the C2C scheme. The core considerations related to Phase 1 of the project between Madingley Mulch roundabout and Grange Road.

OAR2 assumed the provision of a new P&R site on the Cambourne to Cambridge corridor at either Scotland Farm or Waterworks, with new bus services from this site to a range of destinations within Cambridge as shown in Figure 3.

It was assumed, based on a reasonable headway of 6/7 minutes per bus, that a total of 9 bus services per hour1 would be provided from the new P&R site, with 20-minute interval direct express services (3 buses per hour) travelling to Cambridge North Station, to Cambridge Biomedical Campus via the M11 and to Cambridge Biomedical Campus via the City Centre (Silver Street and Trumpington Street) and Cambridge Station, following the existing Universal bus route between Grange Road and the Biomedical Campus.

The existing Cambridge Park & Ride bus service from the Madingley Road P&R site was assumed to be removed with the closure of this site. At that stage, existing buses travelling along the A1303 route were assumed to use the new bus lane provision in all options, but with no changes to existing service levels.

Figure 3: Interim Outline Business Case – Park and Ride Bus Routes



Source: Mott MacDonald (© Crown Copyright. All Rights Reserved. OS License Number 100023205.2018)

The range of destinations served from the new P&R site reflected the destinations identified as priorities during consultation. However, this proposal offers no route penetrating central Cambridge as fully as the existing Madingley Road P&R bus route (Figure 4). The closest bus stop to the City Centre retail area would be on Trumpington Street at Pembroke Street and this would be served by only 3 buses per hour compared with the existing 6 buses per hour from Madingley Road P&R to the City Centre.

Figure 4: Existing Madingley Road P&R Bus Route

Source: www.cambridgeparkandride.info

3.5 Findings from Previous Work

The key findings from the previous work reviewed above that have influenced the development of an updated bus network proposition are:

- The core demand for bus services on the corridor is expected to remain to destinations within Cambridge City Centre.
- The scenarios presented in previous work have provided 6 buses per hour between Cambourne and Cambridge City Centre, and 10 in total serving Cambourne.
- Atkins found that the provision of an additional 6 buses per hour between Cambourne and Cambridge City Centre would undermine the viability of the existing Citi 4 service (3 buses per hour). This suggests that the level of service between Cambourne and Cambridge City Centre that can be delivered commercially is unlikely to exceed 8 buses per hour.
- The scenarios presented in previous work have provided a maximum of 10 buses per hour from the new A428 P&R site, with a maximum of 8 buses per hour from this site to Cambridge City Centre.
- Early studies identified a desire for direct services from Cambourne and the new A428 P&R site to destinations other than Cambridge City Centre, notably Cambridge Biomedical Campus. The opening of the new Royal Papworth Hospital on the Biomedical Campus site has strengthened the case for a direct service from Cambourne.
- Atkins tested the viability of direct services between Cambourne and Cambridge Biomedical Campus via the M11 and between Cambourne and Chesterton (Cambridge North Station) via Cambridge Science

Park, each operating every 20 minutes. The viability of this level of service to the Biomedical Campus was found to be marginal, while the service to Chesterton was considered unlikely to be viable.

- A bus service should be maintained for the peripheral areas of Cambourne and existing intermediate stops between Cambourne and Cambridge not served by the new High Quality Public Transport (HQPT) routes.
- The development of direct services from Cambourne and the new A428 P&R site to destinations other than Cambridge City Centre should not be at the expense of providing services to meet the core demand to destinations within central Cambridge. The P&R bus service from the new A428 P&R site to the City Centre should operate at least every 10 minutes in line with the level of service offered from the existing Cambridge P&R sites.

4 Updated Bus Network Proposition

An updated bus network proposition, informed by previous work, is presented below. The proposed express routes and service levels have been developed to inform the traffic modelling, which will be used to generate journey times.

The network is presented schematically and in a similar style to previous proposals in Figure 5. Each line in this figure represents one bus per hour. The service levels on each individual route and combined headways on common sections of route are summarised in Table 2. Detailed route maps are appended.

Table 2: Updated Bus Network Proposition

Route	Via	Headway (minutes between buses)	
		Route	Combined
Great Cambourne – Upper Cambourne – Lower Cambourne – Hardwick – City Centre (Citi 4)	All existing stops	30	
Huntingdon – Papworth – Cambourne – New A428 P&R – City Centre	Bourn Airfield, Hardwick, West Cambridge	30	10
St Neots – Cambourne – New A428 P&R – City Centre		30	
Lower Cambourne – Cambourne – New A428 P&R – City Centre		30	
Cambourne – New A428 P&R – Cambridge Biomedical Campus (Based on H service)	Bourn Airfield, Hardwick, West Cambridge, M11	30	15
New A428 P&R – Cambridge Biomedical Campus (peak only)	West Cambridge, M11	30	
Cambridge North Station – Cambridge Biomedical Campus (Universal)	Science Park, Darwin Green, Eddington, West Cambridge, City Centre, Cambridge Station, Busway	20	10
Eddington – Cambridge Biomedical Campus (Universal)	West Cambridge, City Centre, Cambridge Station, Busway	20	

4.1 Services to Cambridge City Centre

A new 10-minute interval direct express service (6 buses per hour) between Cambourne High Street and central Cambridge, via the new A428 P&R site and using the new off-road public transport route.

2 of these 6 buses per hour to operate from St Neots and 2 from Huntingdon via Papworth. The remaining 2 buses to commence from Cambourne, operating in a one-way loop from the High Street serving Lower Cambourne and returning to the High Street via Cambourne West. The final route through Cambourne is still being determined and will be driven by demand and the bus operators. We have assumed this route for the purposes of this assessment.

The existing Citi 4 service is retained running along the A1303, but at a reduced frequency of 2 buses per hour. This maintains a bus service for the peripheral areas of Cambourne and existing intermediate stops between Cambourne and Cambridge not served by the new HQPT express routes, while reflecting the findings from previous work that the new HQPT services are likely to attract passengers from Citi 4 to the extent that the current service level of 3 buses per hour would no longer be commercially viable. This assessment is to provide what is considered to be the most realistic scenario for modelling purposes. It is based on expert knowledge of the sector and it is neither a requirement nor proposal of the C2C scheme to reduce the Citi 4 service. If the current levels of demand are maintained then the current Citi 4 service pattern is likely to be maintained.

The combined level of service between Cambourne and central Cambridge would be 8 buses per hour.

This proposition offers the potential for the existing services between St Neots and Cambridge (Stagecoach X5) and Huntingdon and Cambridge (Whippet Coaches X3) to be integrated into the new HQPT routes.

4.2 Service to Cambridge Biomedical Campus

A 30-minute interval direct express service (2 buses per hour) between Cambourne and Cambridge Biomedical Campus, via the new A428 P&R site and using the new off-road public transport route to West Cambridge. This service is assumed to operate in a one-way loop from the High Street serving Lower Cambourne and returning to the High Street via Cambourne West. The final route through Cambourne is still being determined and will be driven by demand and the bus operators. We have assumed this route for the purposes of this assessment. A further 2 direct express buses per hour would run between the new A428 P&R site and the Biomedical Campus during peak periods, with timetabling coordinated with the services from Cambourne to provide a 15-minute interval service on this section of route.

It is proposed that this express service operates between West Cambridge and the Biomedical Campus via the M11 as the new Stagecoach H service does. The route uses the new bridge over the M11 connecting into Charles Babbage Road, then using High Cross road to connect to Madingley Road and then using the southbound slip road to access the M11. Using High Cross road would also provide an interchange between the Universal services.

4.3 Service to Cambridge North Station & Cambridge Science Park

The proposition for an express service linking Cambourne with Cambridge North is to extend the existing Universal bus service between the Cambridge Biomedical Campus and Eddington northwards through the Darwin Green development site (located between Huntington Road and Histon Road) and then via King's Hedges and Cambridge Science Park to Cambridge North Station.

Passengers from Cambourne to Cambridge corridor services would be able to interchange with the Universal service at West Cambridge. It is recognised that this arrangement would be less attractive than a direct service to northern Cambridge, but it reflects the conclusion based upon data provided from previous work by Atkins that a direct express service from Cambourne to northern Cambridge was considered unlikely to be viable due to their not being enough demand to cover the cost of the service. Through ticketing between the Cambourne to Cambridge and Universal services would be required to enable seamless interchange. Dependent on the future operators of these services, this may involve multi-operator ticketing arrangements.

Based on current service provision, the Universal service would continue to operate between Eddington and the Cambridge Biomedical Campus at 15-minute intervals (4 buses per hour), with a 30-minute interval service (2 buses per hour) on the new section of route between Eddington and Cambridge North Station. However, it is understood that there are committed plans to increase the frequency of the Universal service from 4 to 6 buses per hour. The proposition for testing assumes that this enhancement is implemented in advance of the delivery of the C2C project, such that there will be a 10-minute interval service (6 buses per

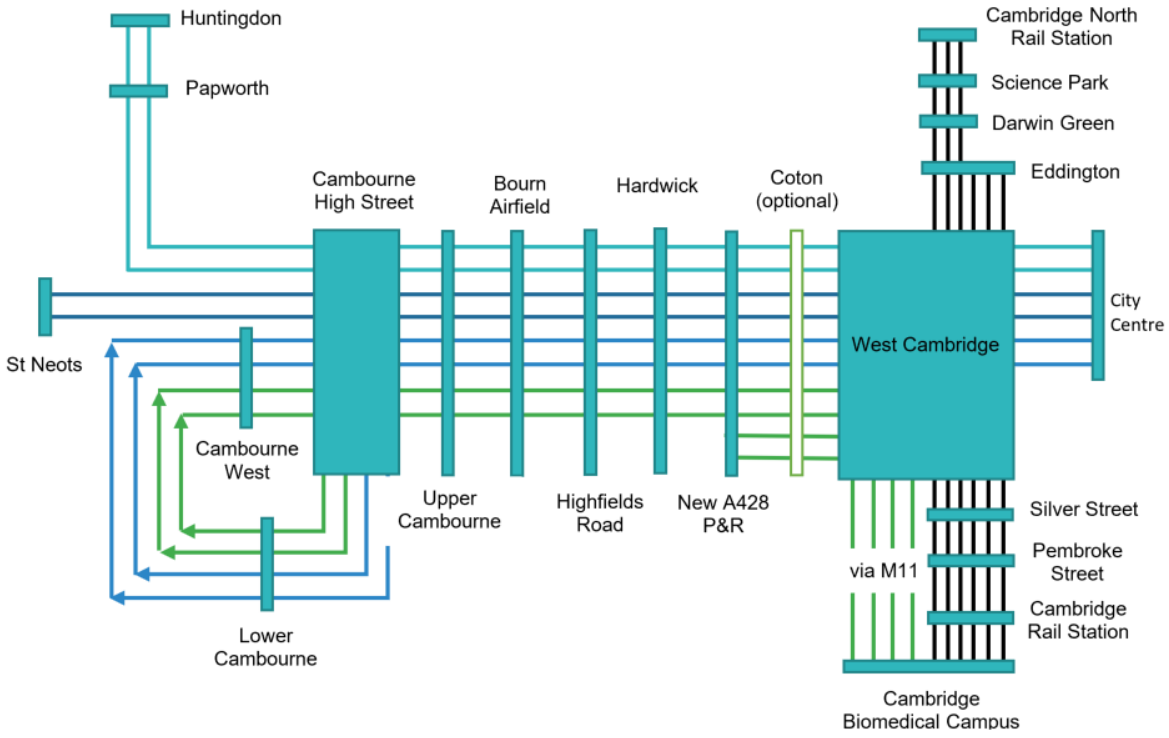
hour) between Eddington and the Cambridge Biomedical Campus, with a 20-minute interval service (3 buses per hour) on the new section of route between Eddington and Cambridge North Station.

4.4 Summary

This proposition is consistent with the findings of previous work that the level of service between Cambourne and Cambridge City Centre that can be delivered commercially is unlikely to exceed 8 buses per hour. It offers a holistic solution that retains a service at all existing bus stops, while providing a direct, limited stop service from Cambourne and the new A428 P&R site to the City Centre every 10 minutes in line with the level of service offered from the existing Cambridge P&R sites.

The desire for direct services from Cambourne and the new A428 P&R site to the Cambridge Biomedical Campus is also recognised alongside the findings of previous work that the viability of a direct service between Cambourne and the Biomedical Campus via the M11 operating every 20 minutes is likely to be marginal. The level of direct service between Cambourne and the Biomedical Campus is therefore proposed to be 2 buses per hour (every 30 minutes).

Figure 5: Updated Bus Network Proposition (Option A – Waterworks P&R)



Key

Huntingdon – Papworth – Cambourne – Cambridge City Centre (2 buses per hour)

St Neots – Cambourne – Cambridge City Centre (2 buses per hour)

Cambourne – Cambridge City Centre (2 buses per hour)

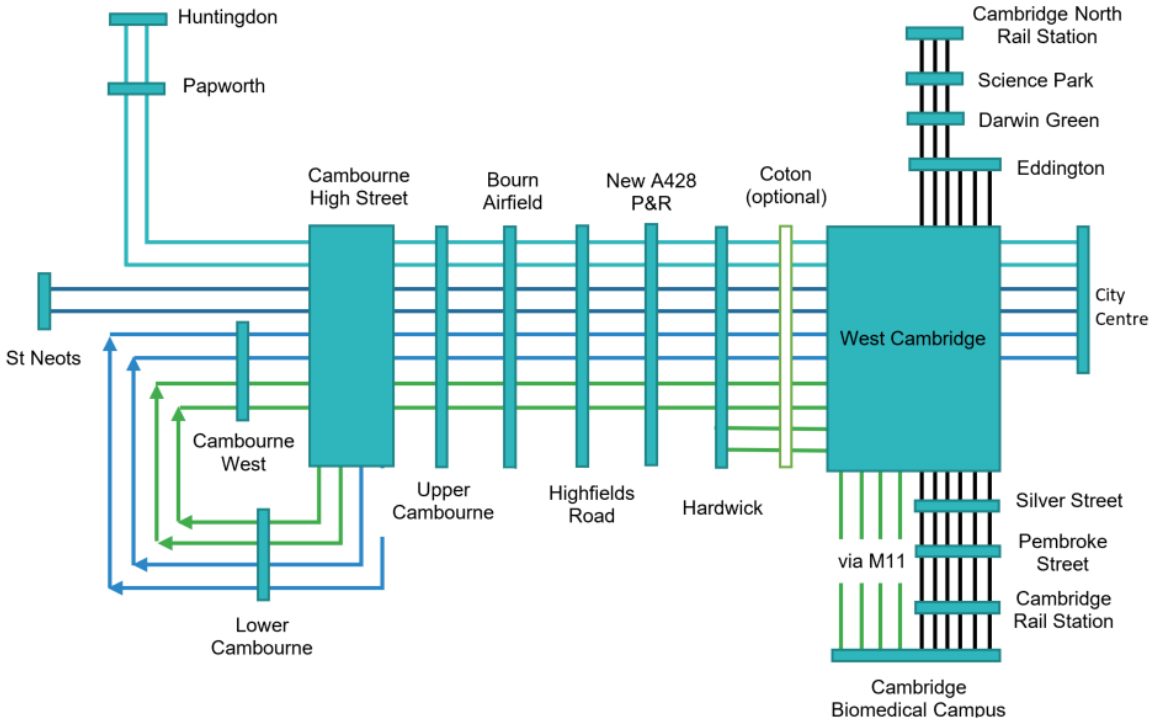
The above routes combine to provide 6 buses per hour (10-minute headway) between Cambourne High Street and Cambridge City Centre

Cambourne – Cambridge Biomedical Campus (2 buses per hour between Cambourne and CBC, 4 buses per hour between new P&R and CBC)

Planned enhancement of existing "Universal" route Cambridge Biomedical Campus – Eddington (6 buses per hour) with extension to Darwin Green, Cambridge Science Park and Cambridge North Rail Station (3 buses per hour)

Figure 6 below shows the routes from Madingley Mulch Roundabout into and around the City Centre. Details of the extended routes to Cambourne and beyond can be found in Appendix A.

Figure 6: Updated Bus Network Proposition (Option B Scotland Farm P&R)



Key

Huntingdon – Papworth – Cambourne – Cambridge City Centre (2 buses per hour)

St Neots – Cambourne – Cambridge City Centre (2 buses per hour)

Cambourne – Cambridge City Centre (2 buses per hour)

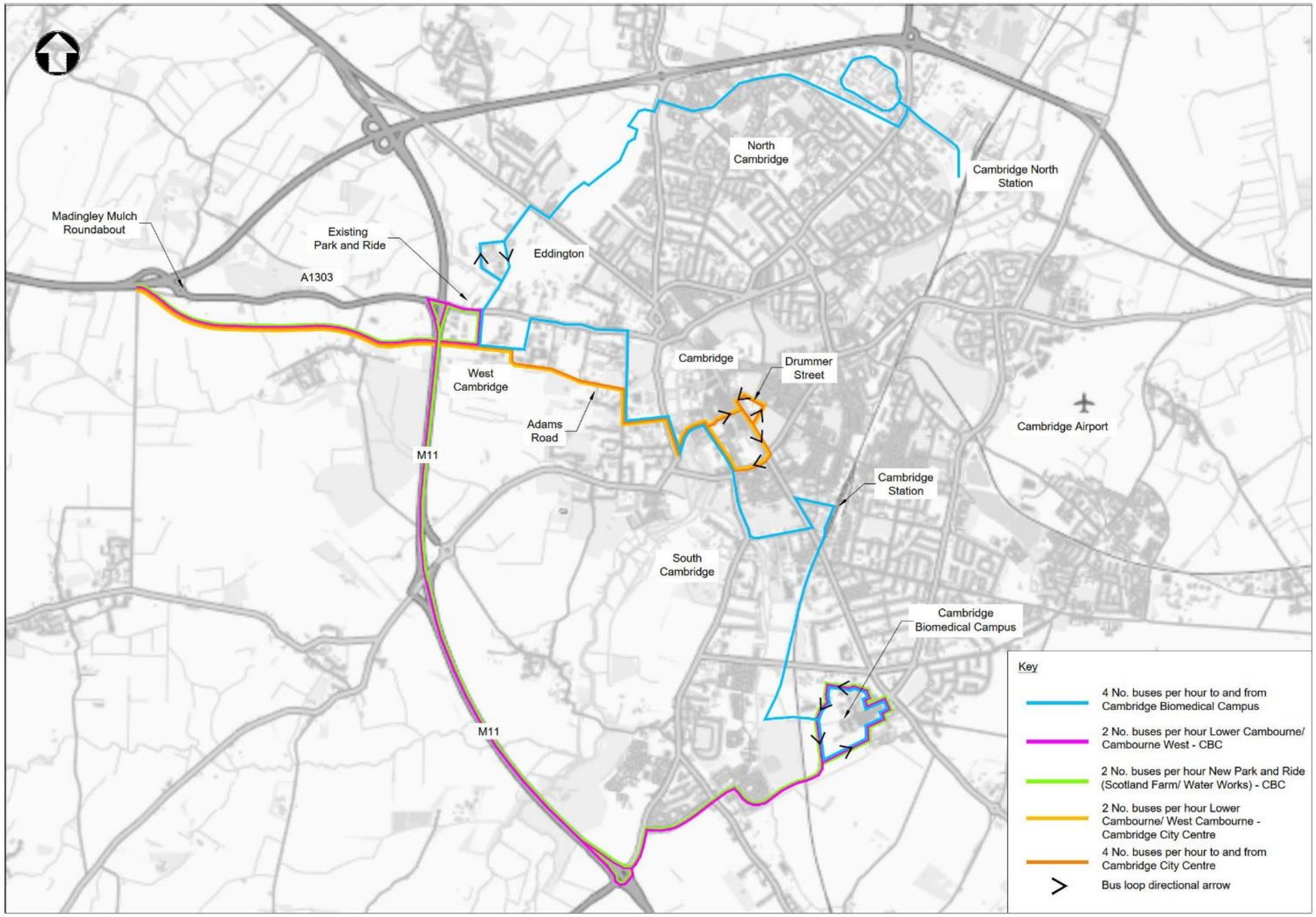
The above routes combine to provide 6 buses per hour (10-minute headway) between Cambourne High Street and Cambridge City Centre

Cambourne – Cambridge Biomedical Campus (2 buses per hour between Cambourne and CBC, 4 buses per hour between new P&R and CBC)

Planned enhancement of existing "Universal" route Cambridge Biomedical Campus – Eddington (6 buses per hour) with extension to Darwin Green, Cambridge Science Park and Cambridge North Rail Station (3 buses per hour)

Figure 7 below shows the routes from Madingley Mulch Roundabout into and around the City Centre. Details of the extended routes to Cambourne and beyond can be found in Appendix A.

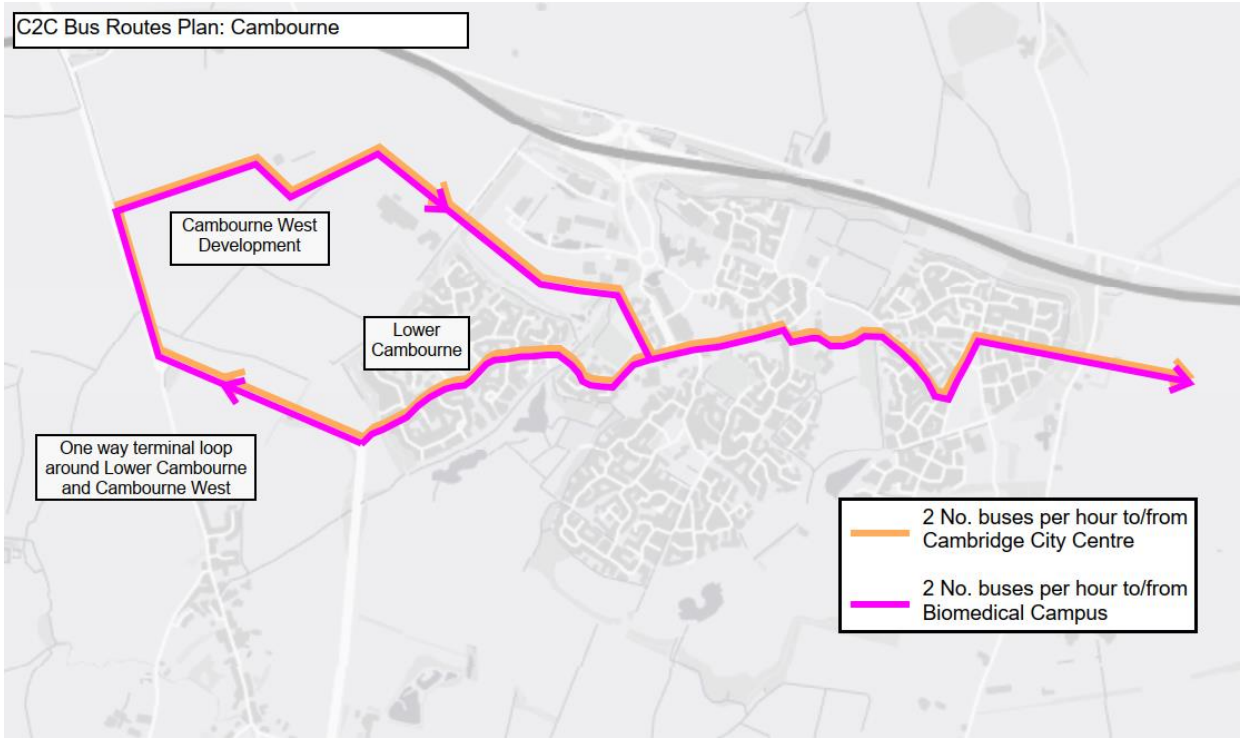
Figure 7: City Centre Route Summary



Source: Mott MacDonald

5 Appendix A

5.1 Route Plan 1



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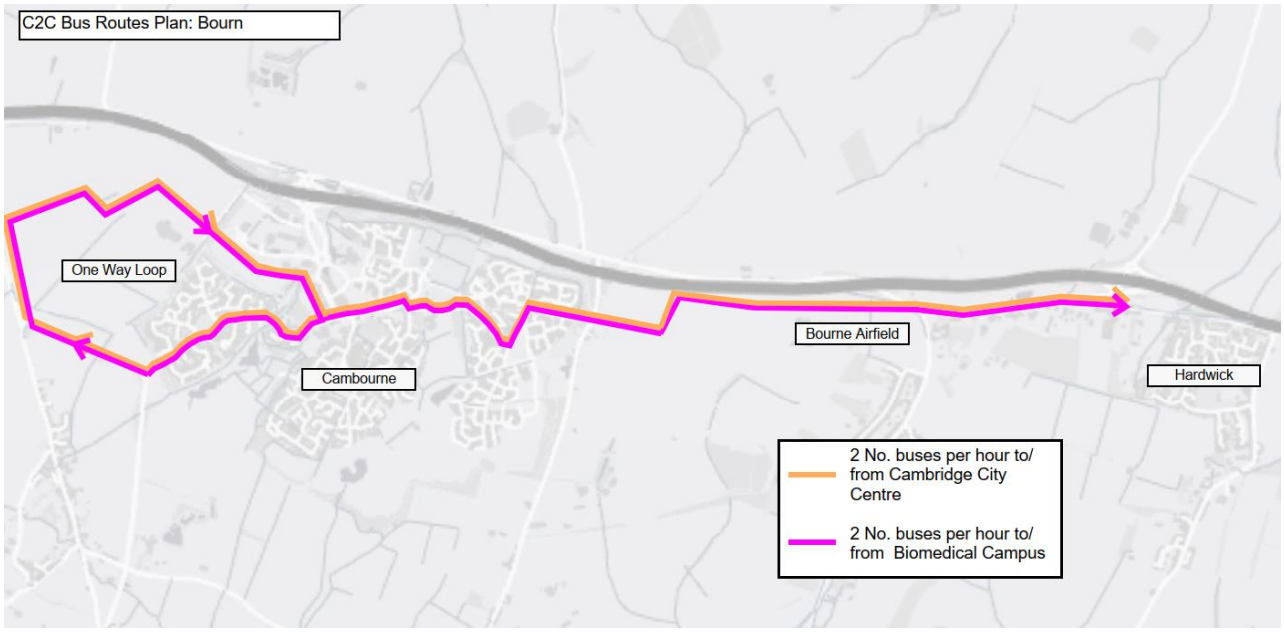

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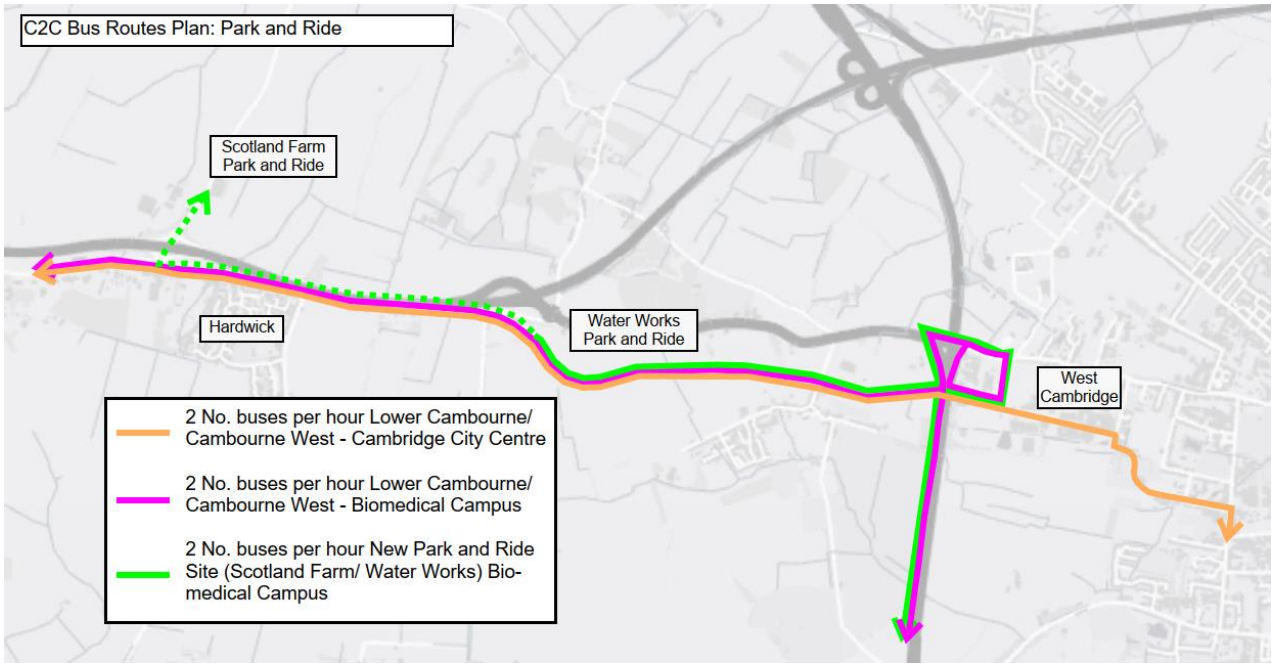

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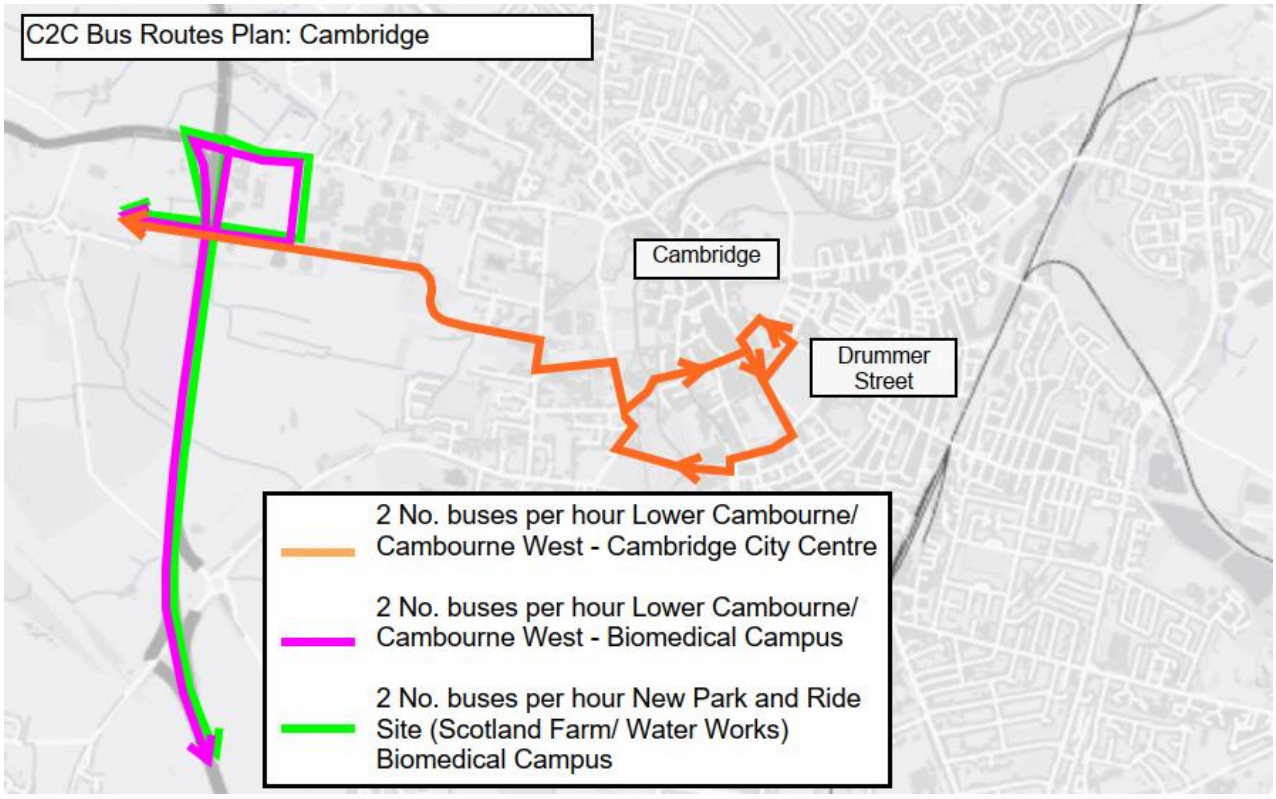

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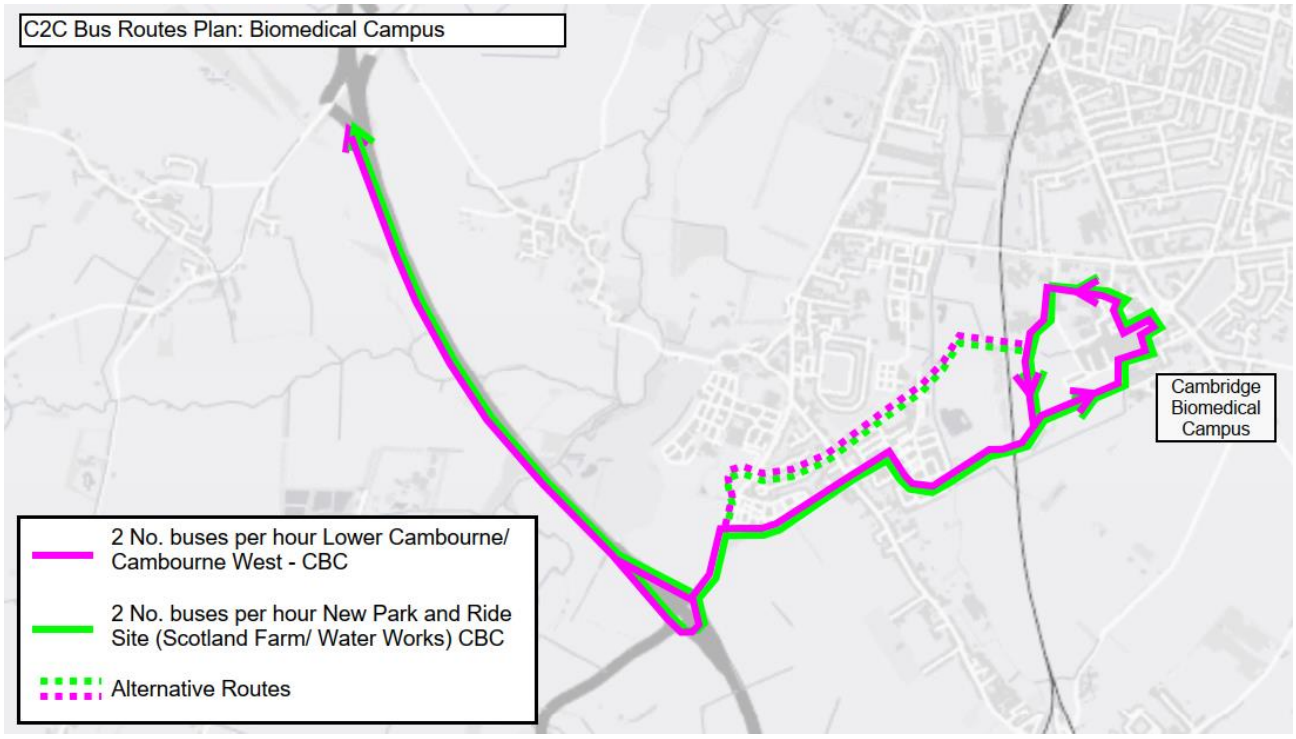
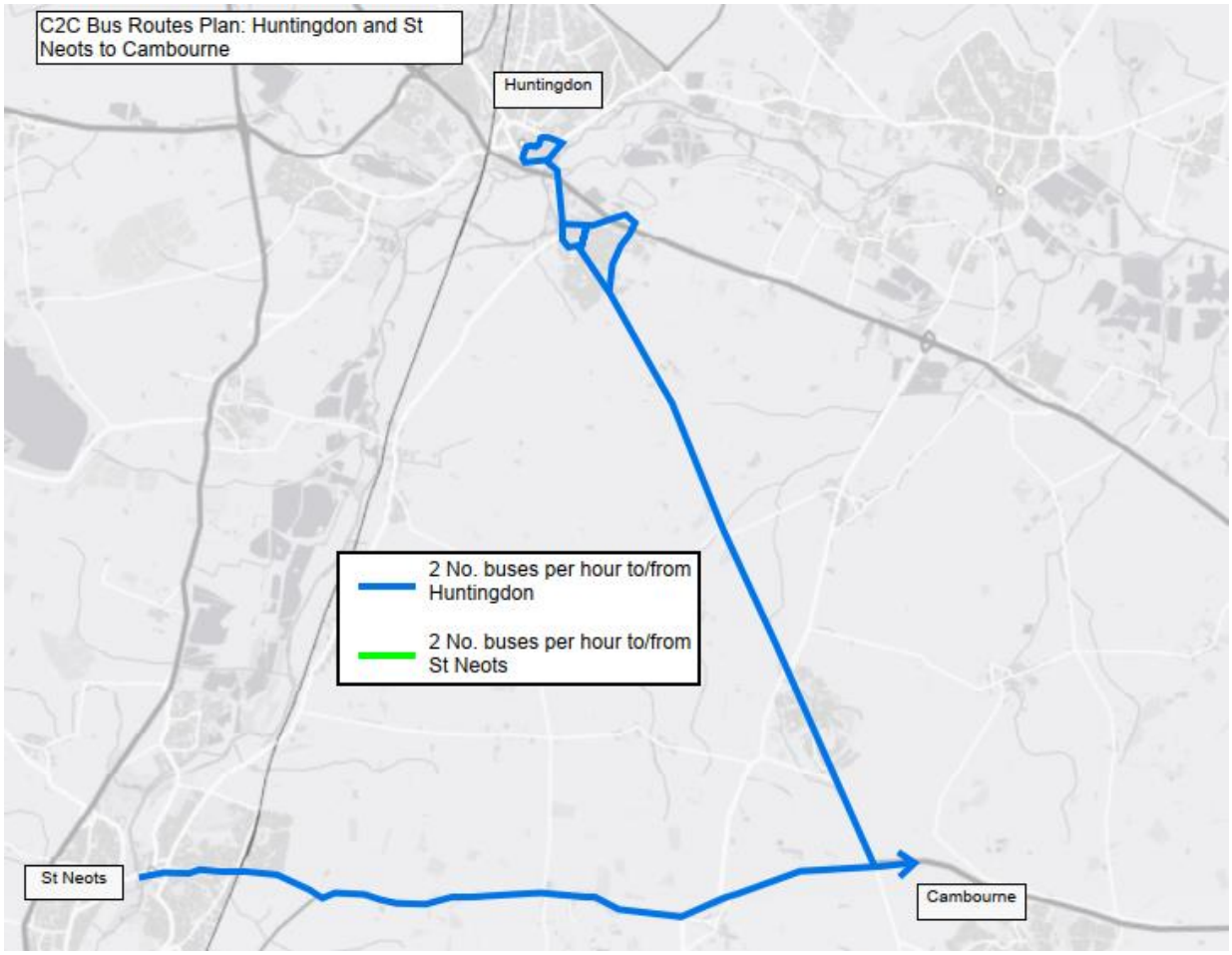


Source: Mott MacDonald

5.2 Route Plan 2



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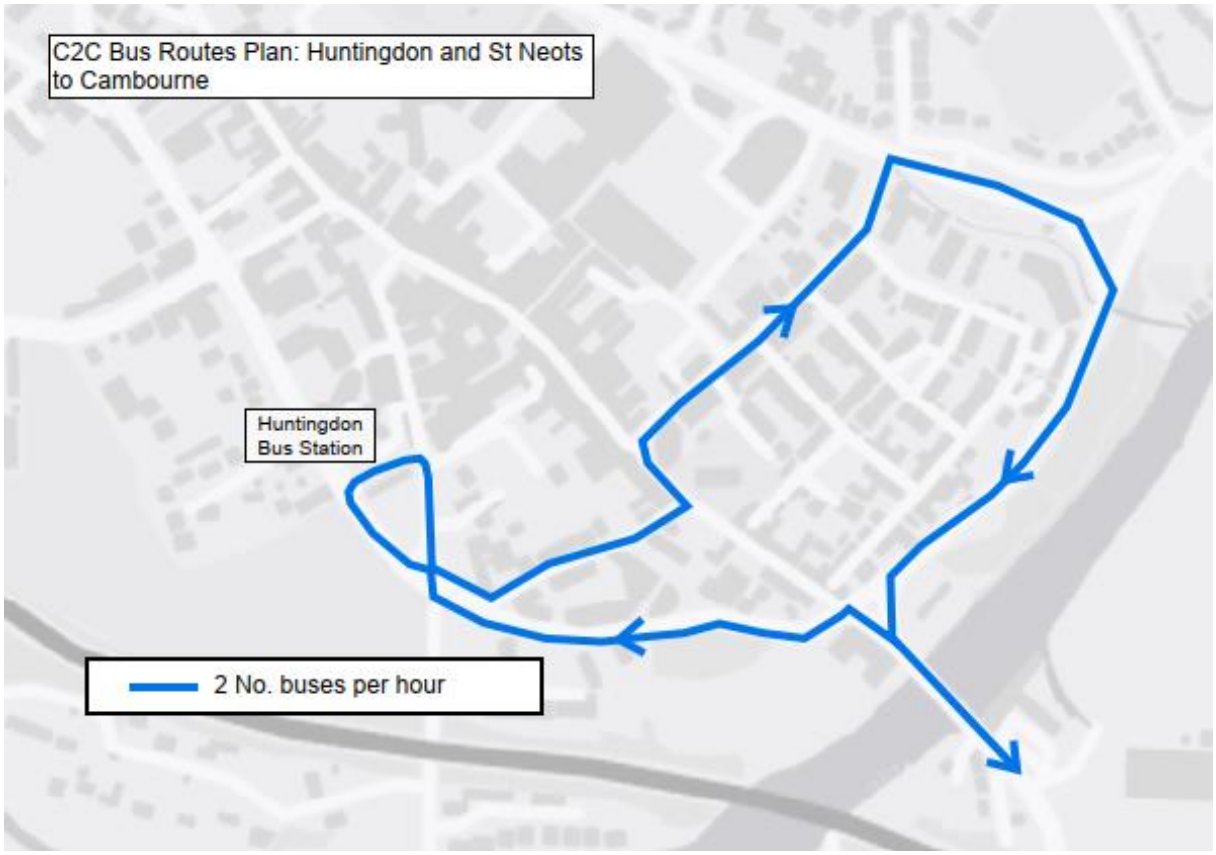

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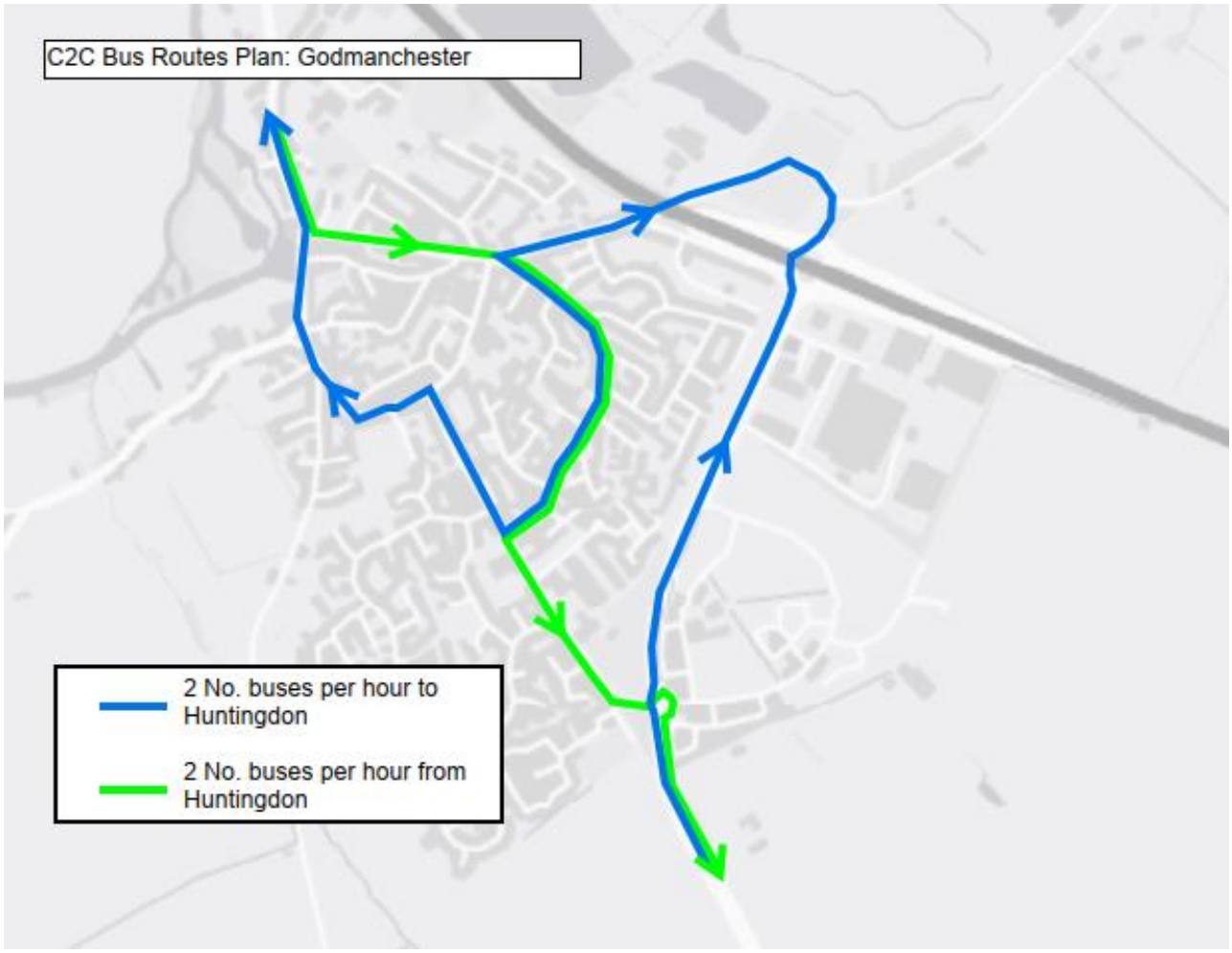

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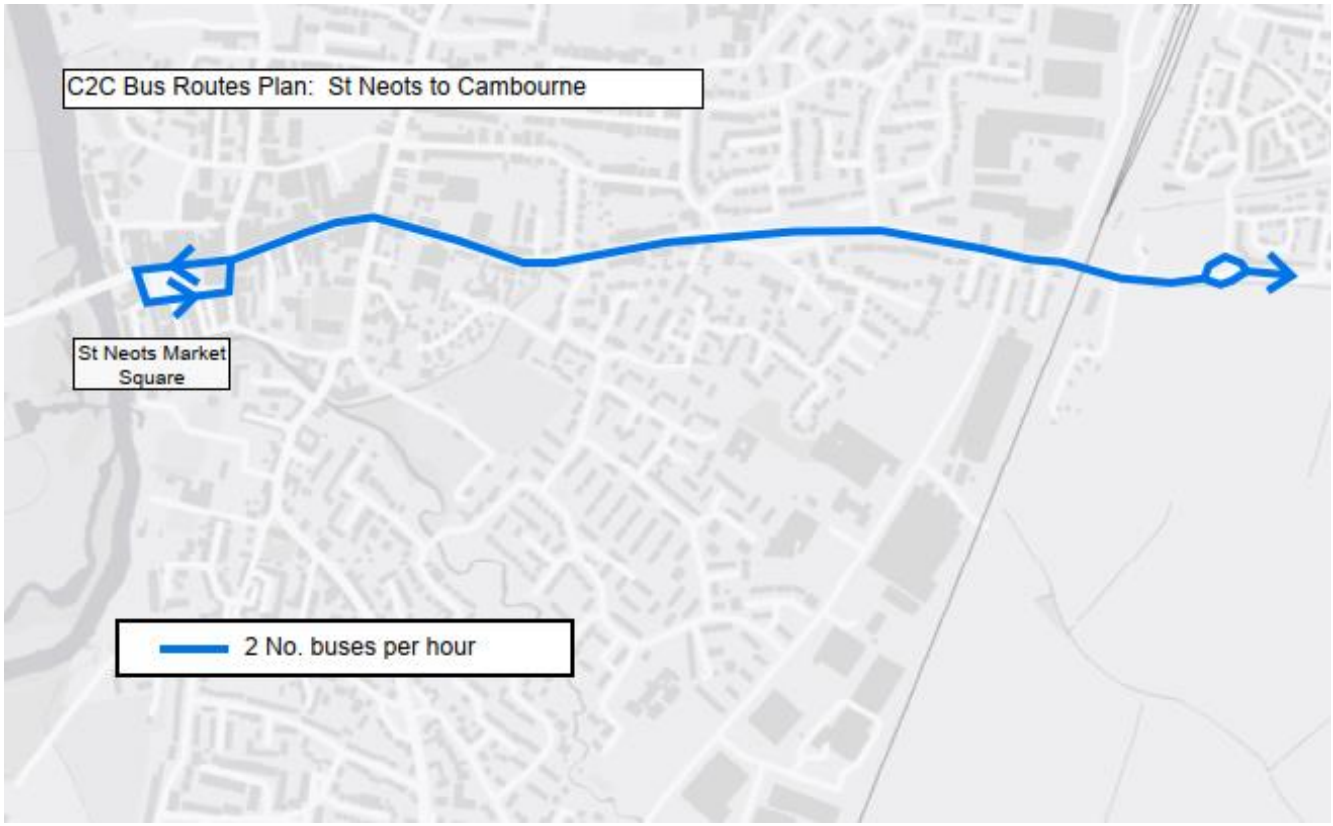

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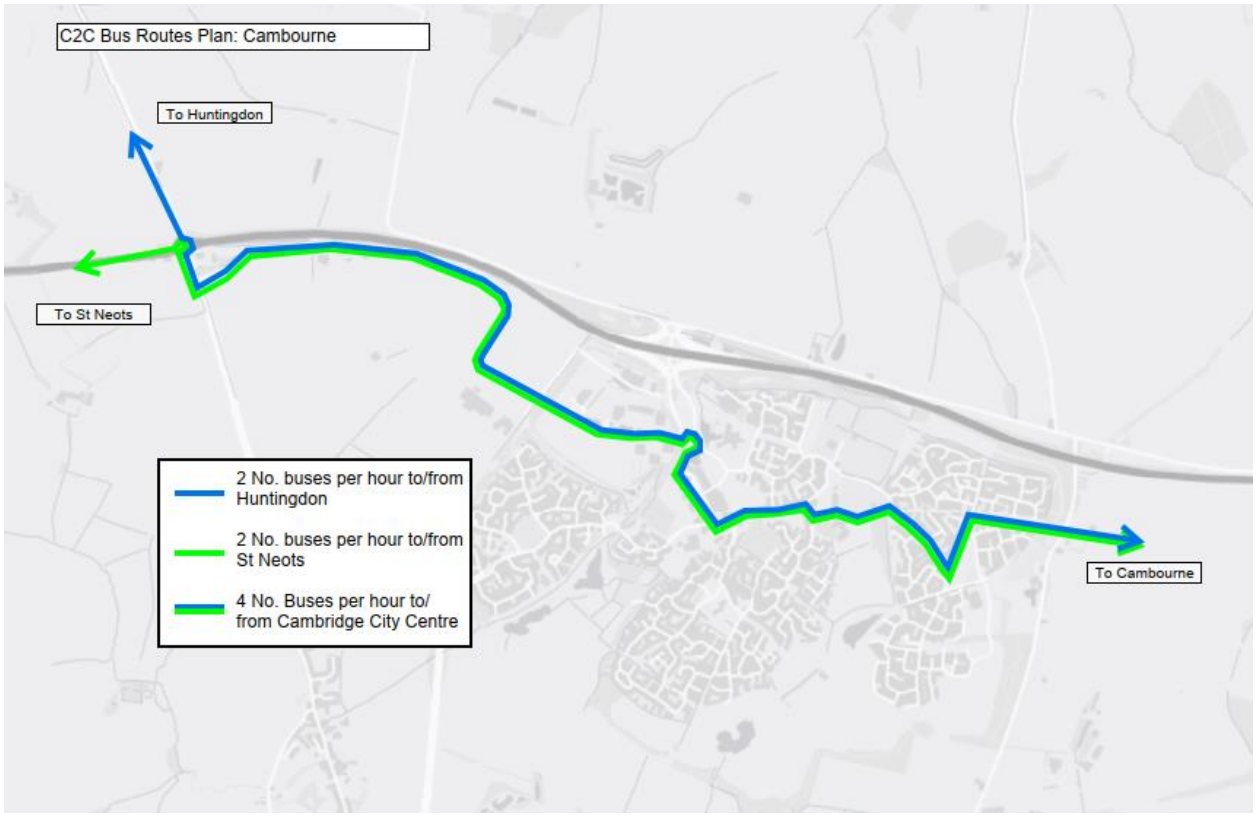

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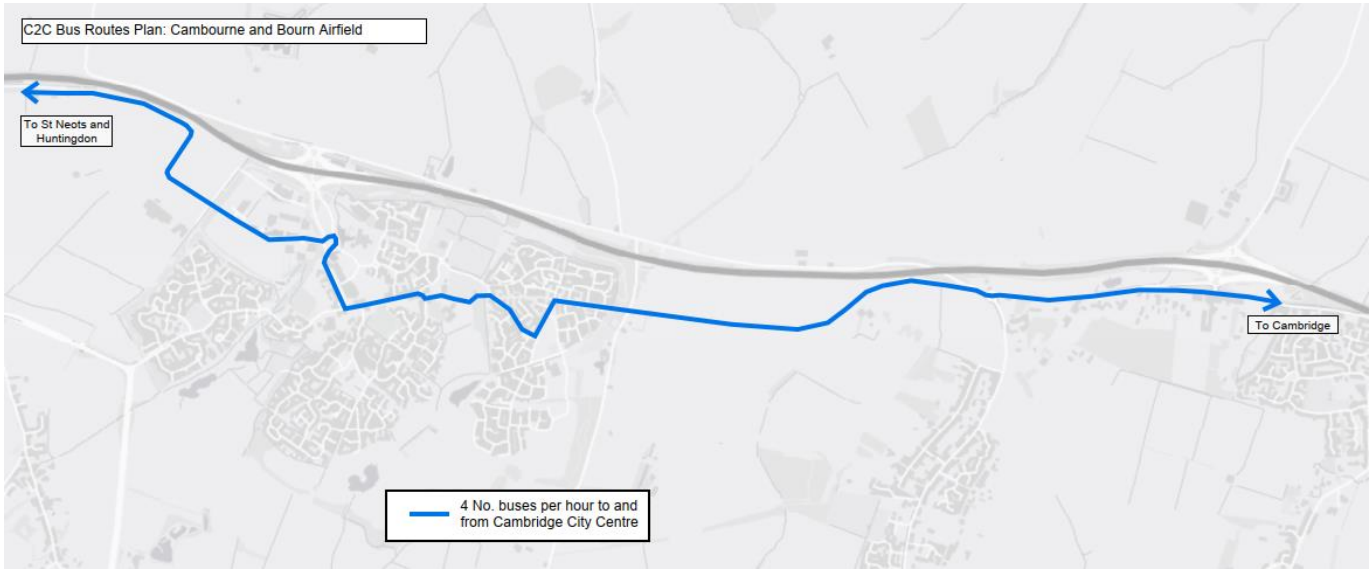
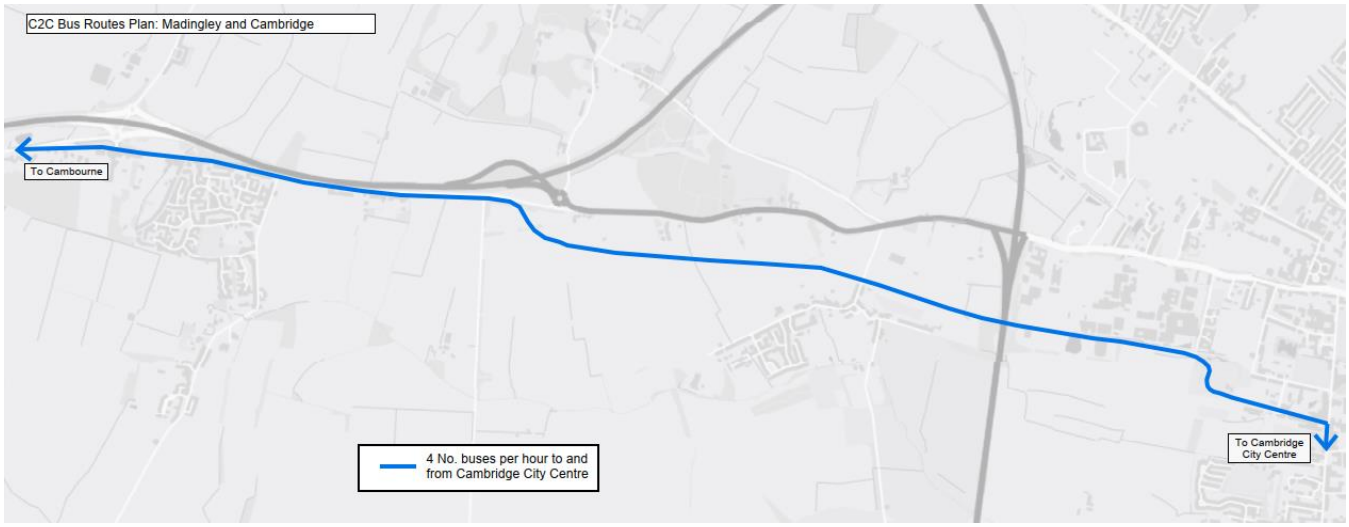


Source: Mott MacDonald



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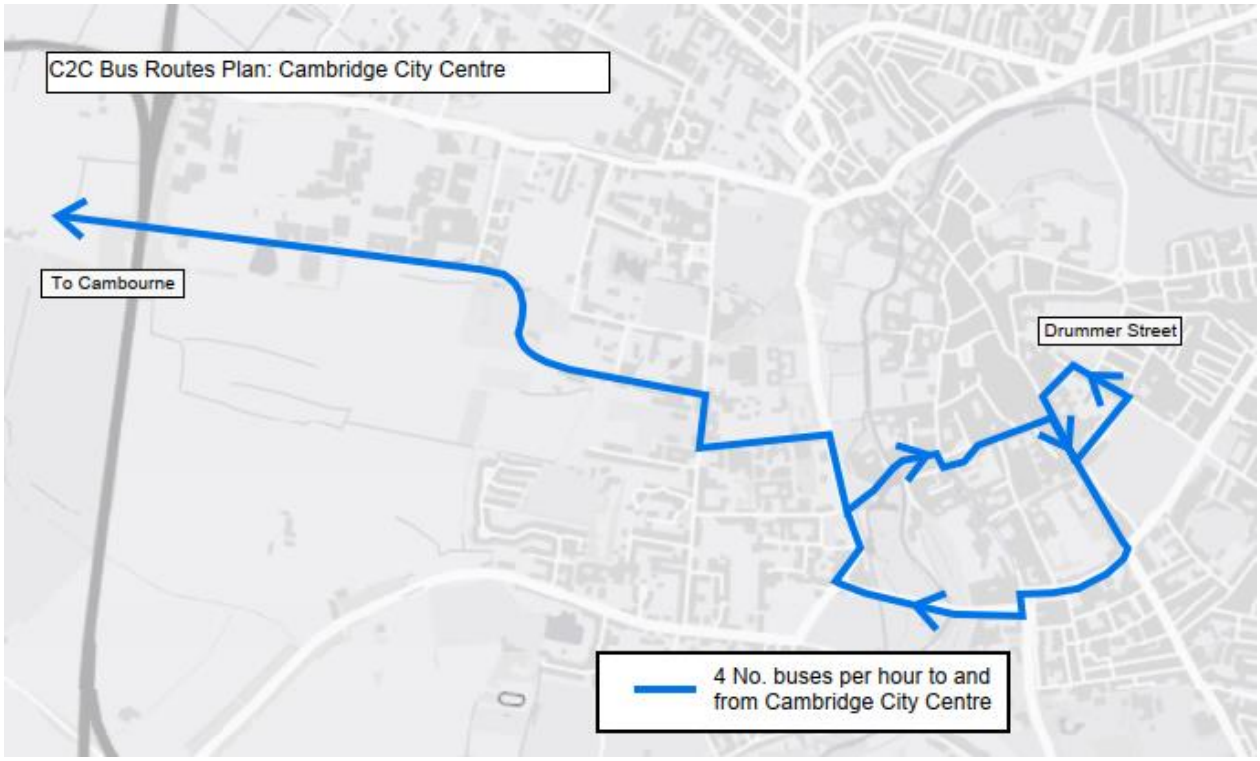
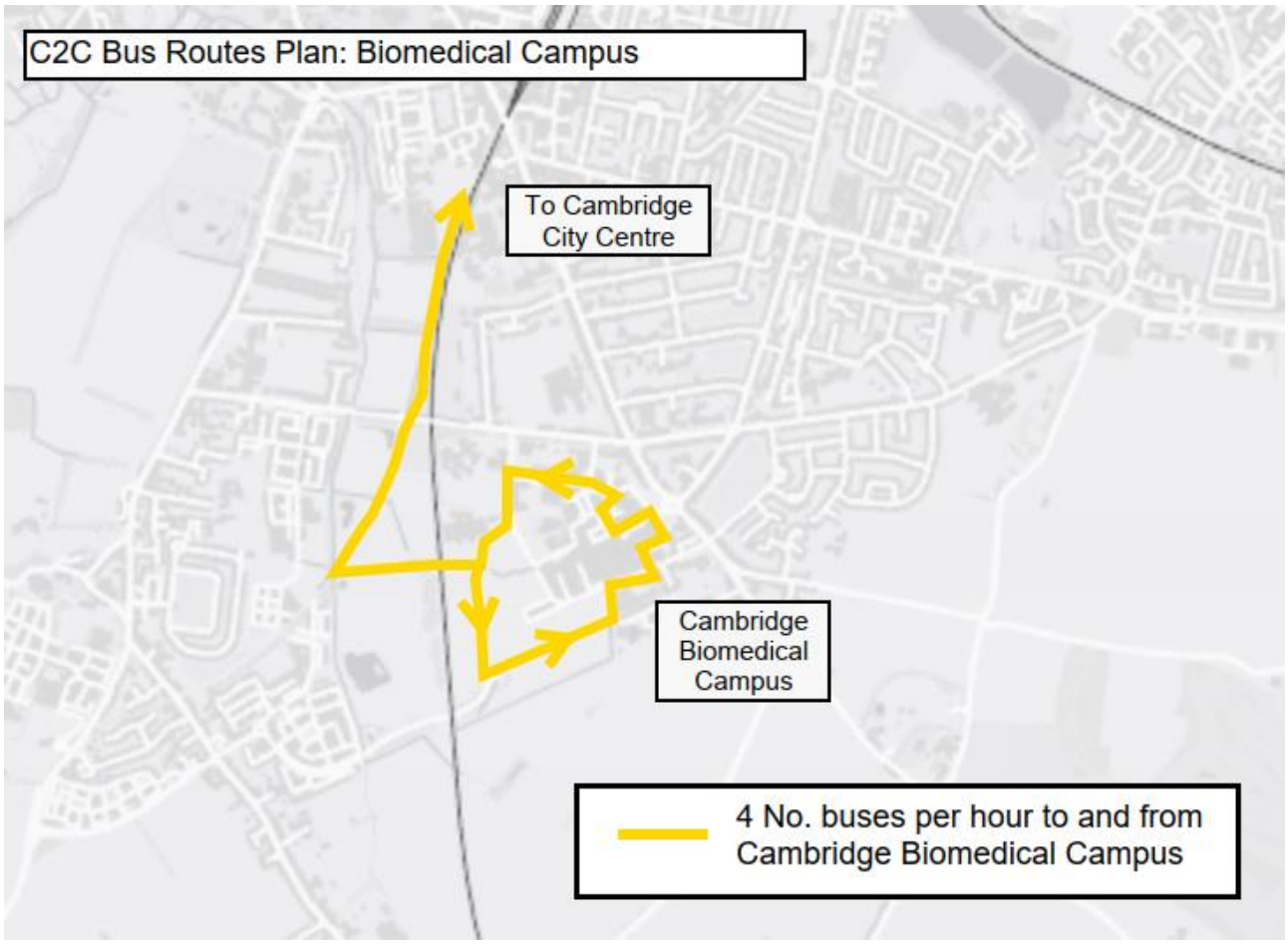


Source: Mott MacDonald

5.3 Route Plan 3



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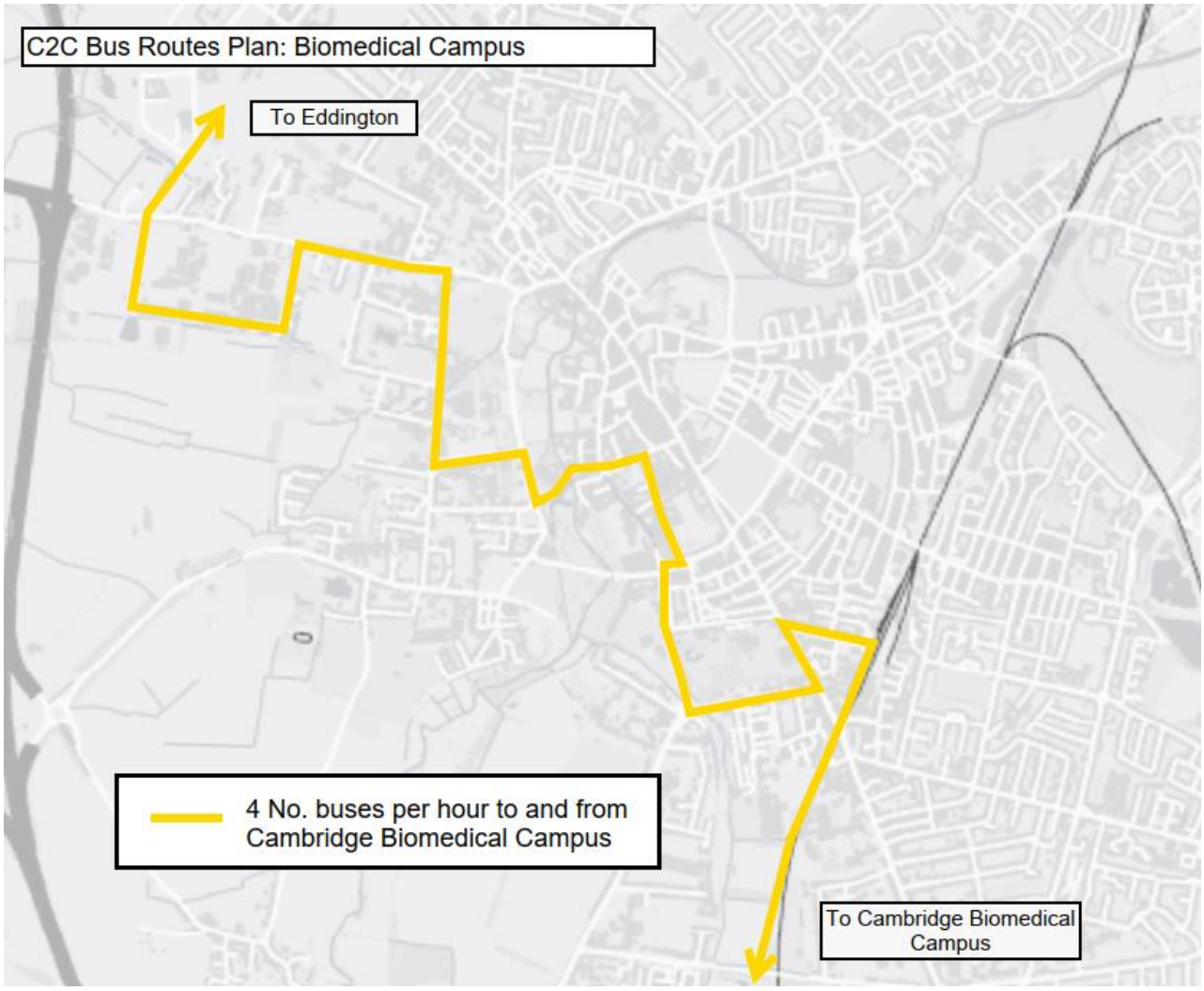

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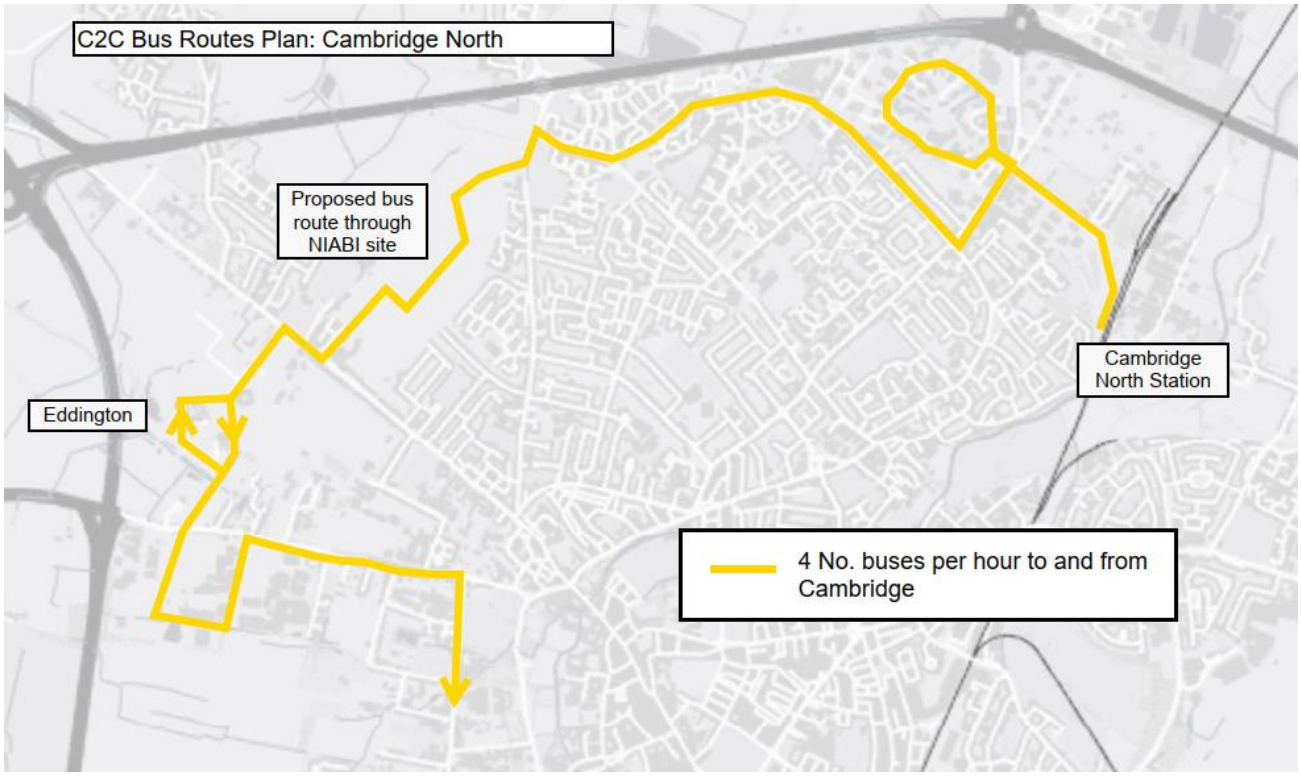

Source: Mott MacDonald

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