

BUS VIABILITY ON A CONGESTED NETWORK – CAMBRIDGE AHEAD RESEARCH

Cambridge Ahead produces research related to the sustainable and inclusive growth of the Cambridge city region, in order to inform the statutory role of policymakers. Infrastructure for, and provision of, public transport services are critical for the good growth of our economy.

RESEARCH PURPOSE

The following report provides a high-level review of bus viability within the Greater Cambridge region, highlighting the impacts of congestion and the financial implications for those who are responsible for funding public and private bus services.

Following a desk study into the impact of bus services and congestion on society, interviews were conducted with Whippet Coaches and Stagecoach East, both of whom operate services in the Greater Cambridge region.

The findings of this study are presented below and the impacts of congestion on bus viability are showcased within 2 case studies.

- Case Study 1- If there was a Free-Flowing Network, Whippet Coaches.
- Case Study 2 – Increasing Punctuality to 90%, Stagecoach East.

Details of the methodology are provided in Appendix 1.

RESEARCH QUESTION

“What is the impact of road congestion on the viability of bus services in Cambridge, and therefore the implications for those organisations (public and private) that commission these services?”

BUS VIABILITY ON A CONGESTED NETWORK

The Wider Value

The value of public transport to society and our economy is well documented (Begg, 2016; Goodwin, P., 2004 et al.) and the recent report by the Confederation of Passenger Transport (CPT) (CPT, 2024) identifies the wider benefits for both passengers and local communities across the UK.

- access to jobs, education and training = £8.7bn,
- health benefits = £2.8bn,
- support for volunteer work = over £1bn, and
- a reduction in congestion = £600m per year

The report also goes on to identify the value to the Cambridgeshire and Peterborough Combined Authority area from bus passengers and others involved in the provision of bus services to the economy annually.

- Economic activities of those involved in the provision of bus services = £35m
- Economic and social activities of bus passengers = £140m
- Economic impact of bus passengers interacting with local economies = £290m

Bus Journeys and Congestion Levels

17.3 million bus journeys were made in Cambridgeshire in 2023 (25.5 journeys per head of population) (DfT, 2024) a number that has been steadily declining year on year since 2010¹ when there were 22.7 million bus journeys (37.5 journeys per head of population). During the same period, traffic levels in the region have risen steadily on key strategic routes (Cambridge Insights, 2023 and DfT, 2023²) as have population levels (Cambridgeshire and Peterborough Insights, 2022).

Traffic congestion is not a new issue and since the late 1950s there have been a number of studies to calculate the cost to the UK economy and individual households. In 2013 it was reported that congestion in 2030 would cost the UK over £20bn per year and the cost to households would be approximately £2,000 per year (INRIX, 2013). But what does this mean from the perspective of those in our region who fund the local bus services?

How Are Services Funded – Who Pays The Bill?

In Greater Cambridge, the bus network is the responsibility of the CPCA. However, the funding is provided by a number of organisations including local authorities and central government as well as more recently from households through the mayoral precept³ which in 2024/2025 will raise £11m to support improvements to local bus services.

According to the CPCA around 90% of bus services in the region are commercially operated with no subsidy⁴ from the combined authority, with only 10% requiring some form of subsidy (partial or full). Some routes only require funding to support additional services during the off-peak period. In 2023/24 the CPCA funded approximately £14.14m⁵ worth of services.

The 90% of services that are deemed commercial are funded by the operator, mainly through bus fares, but some operators also receive funding from other sources including:

¹ As identified in the DfT, 2024 bus journey table BUS01f, except 2021 and 2022 due to the Covid-19 pandemic. These years should be excluded.

² <https://roadtraffic.dft.gov.uk/local-authorities/97>

³ *Mayoral Precept – A payment made to the mayoral authority by households through their council tax.*

⁴ *Does not include for the government funded £2 fare cap which operators can claim for as part of the cv-19 recover and is due to end in Dec 2024.*

⁵ *This includes the concessionary fare scheme*

- Organisations subsidising employee travel (discounted tickets)
- Organisations directly contributing to a service (the Universal)
- Third-party advertising.

In Greater Cambridge, there are also a number of bus services funded directly by schools and other organisations, although the majority of these are not available for the public to access, however, they will also be impacted by congestion levels.

So What Impacts Public Bus Service Viability?

The viability of running a service relies on funding, whether from the passenger directly or someone else such as the CPCA or another organisation. In order for an organisation to fund a service it still requires to be an attractive proposition to the user (the passenger). Whilst the specific metric of value will vary for each passenger, the results of the CPCA's bus survey, market research and other studies (CPCA 2021 Bus Strategy; Begg, 2016; Transport Focus, 2023) identified the key areas valued by passengers and non-passengers, these include;

- Services going to the places people want them (Convenience)
- Length of time waiting for a bus (Frequency)
- Bus arriving on time (Punctuality)
- Time to travel the journey (Journey Time)
- Confidence in the bus service running (Reliability)

Change to any of these factors will erode passenger satisfaction and therefore the viability for the end users, who may seek other solutions. This could be a different mode of travel, adjustment to their reason for travelling i.e. change job/education location, purchasing items elsewhere, or simply not travelling and missing out on opportunities.

How Does Congestion Impact Bus Service Viability?

Congestion is caused when there are too many vehicles for the amount of space available and in general terms causes traffic speeds to slow or become stationary for longer. In Cambridge during peak times traffic speeds can be reduced by up to 50% (Cambridge Insights, 2024) the challenge is not just traffic speeds but the unpredictability that this creates making it particularly challenging for operators to provide a reliable level of bus service (Begg, 2016 and Cameron, E. 2024)

This slowing of speeds impacts bus services by increasing the length of time to travel the route (Journey Time), the ability for the bus to arrive on time (punctuality) and the length of time passengers have to wait for a bus (frequency), and creates uncertainty to the service (reliability and predictability). These are all things that passengers value from their bus services.

Bus operators are unable to control traffic levels or congestion, therefore the options available to overcome some of these challenges include:

- Option 1 - Increasing the number of buses serving a route
- Option 2 - Reducing the frequency of the service (remove buses)

Both options impact the viability of bus services but in different ways.

Option 1 – cost to the operator/funding organisation an additional £219k (diesel bus) or £300k (electric bus)⁶ per bus added, this would require an additional 108k – 147k passengers to become cost neutral⁷.

Option 2 – does not increase operating costs but will impact passenger numbers and therefore revenue generated. The passenger attrition rate varies based on a number of factors and is known as ridership elasticity. Low-frequency routes are more sensitive to frequency adjustments and as an indication, for every percentage reduction in frequency, the operator could expect up to the same level of passenger attrition⁸ (Thornhill, C. 2024).

The Implications For Those Who Commission Bus Services

The evidence presented in this report shows that congestion has a demonstrable impact on the viability of bus services, which in turn harms service punctuality, reliability, journey time and frequency. This is a cyclical relationship which can lead to reduced passenger numbers over time, further contributing to congestion as people turn to other modes of transport.

Unless bus services are removed from the impacts of congestion either partially or fully, the costs of maintaining the existing level of bus service provision will continue to increase year on year and the quality of services will continue to be eroded, therefore passenger numbers are likely to also continue to reduce.

⁶ All bus types (diesel and electric) and includes for average capital and revenue cost.

⁷ Costs provided by Stagecoach £2.85m(diesel) or £3.9m(electric) for 13 extra buses and would require between 1.4m - 1.9m new passengers to fund.

⁸ Passenger attrition rates are the number of passengers lost.

CASE STUDIES

The following case studies show examples of how congestion in 2024 is impacting bus services in Greater Cambridge.

Case Study 1 – If there was a Free-Flowing Network (Whippet Coaches and the University of Cambridge)

Interview and email correspondence with Ed Cameron, Interim General Manager, Whippet Coaches.

The University of Cambridge in Partnership with Whippet Coaches operates the Universal Bus service between Girton, Eddington and Cambridge West, the City Centre, Cambridge Station and the Cambridge Biomedical Campus. A distance of approximately 8 miles with a journey time of between 32 and 69 minutes depending on the time of day. It currently takes 8/9 electric buses to maintain this service along with a route manager.

If all journeys could be completed in a shorter time – i.e. on a completely free-flowing⁹ network only 5 buses would be required, this would reduce the costs of operating the service by approximately 40%.

If the current 8 buses were utilised on a free-flowing road network, it could be possible to operate up to 12 buses an hour, a bus every 7-8 minutes.

The journey time from Eddington to the station/CBC could change as follows:

	Current slowest journey time	Potential journey time	Time savings	% Time savings
Girton to Cambridge rail station (6 miles)	00:47	00:20	00:27	57%

Table 1.1 Time savings for the Universal Bus services on a free-flowing route network.

To demonstrate the positive impact that the Busway track has on Universal in providing a consistent journey time, the following data is a sample from May 2024 for both U1 (via the Busway) and U2 (via Hills Road). It indicates the percentage of ‘On Time’¹⁰ journeys.

- U1 – 80.9% on time
- U2 – 74.8% on time

On average the U1 service which uses the Busway has greater reliability. This clearly shows the benefit of segregated bus routes, even if only for a short section, on bus viability.

⁹ The general assumptions made for the case study were:

- ‘Free-flowing’ road network was interpreted as the state of the road network off-peak, i.e. the very first or last departures.
- Allowances are still made for passenger boarding time, stopping at traffic signals and ‘real world’ driving.
- There was no allowance for additional boarding time that might be required if passenger numbers increase as a result of the faster journeys and more reliable service

¹⁰ On Time – the ‘On Time’ window is measured as departing 1 minute early or up to 5 minutes and 59 seconds late (DfT, 2024).

Case Study 2 - Increasing Punctuality to 90% (Stagecoach East)

Interview and email correspondence with Charlton Thornhill, Head of Commercial, and Darren Roe, Managing Director. Stagecoach East

Stagecoach East operate a number of Citi bus services within the urban area of Greater Cambridge and these services are those most impacted by congestion and punctuality levels vary across the routes. Modelling software to assess the costs associated with improving current punctuality (On Time¹¹) to 90% shows it would require an investment of 13 additional vehicles into the route cycles at a cost of £2.85m for diesel buses or £3.9m for electric buses per year. To pay for these improvements through additional fares would require an additional 1.4m – 1.9m passengers per year. This makes the assumption that congestion levels do not worsen, if they do, the cost of maintaining a 90% level of punctuality would continue to increase.

Route	Change in previous 12 months	Currently Punctuality	Additional Vehicles to reach 90% punctuality
1. Citi 1	Reduced Frequency	71.54%	4
2. Citi 2	Additional Bus	83.33%	2
3. Citi 3	Additional Bus	79.24%	1
4. Citi 4	Reduced frequency from 20 mins – 30 mins (1 less bus).	74.08%	2
6. Citi 7	Reduced frequency during afternoon peak time	72.63%	3
7. Citi 8	Reduced frequency	77.81%	1
	Total		13

Table 1.2 Summary of changes to key bus routes in Cambridge and number of additional buses required to reach 90% punctuality based on current traffic level (Aug 2024). NB. The additional buses required to increase punctuality rates to 90% will not increase the frequency of these services, they will simply maintain the status quo.

For context, some of the greatest levels of punctuality in England have been achieved in areas such as Greater Manchester (92%), Tyne and Wear (88%) and Nottingham (92%) (DfT, 2024). Both Greater Manchester and Tyne and Wear operate as an Integrated Transport Authority (ITA) who are investing significantly in bus improvements (infrastructure and services) and Nottingham has introduced demand management measures.

All three areas also offer forms of mass rapid transit, either as light rail or tram services as well as a comprehensive integrated local bus network.

¹¹ On Time – the ‘On Time’ window is measured as departing 1 minute early or up to 5 minutes and 59 seconds late (DfT, 2024).

APPENDIX 1

METHODOLOGY AND OUTPUTS

The following summarises the methodology of the study and key outputs.

Desk Study

The desk study considered the following areas.

- The impact of bus services and congestion on society, considering the quality of life (access to work, education, family and leisure activities) as well as the impact of public transport on the national and regional economy.
- A review of consultation responses from both the Cambridge and Peterborough Combined Authority (CPCA) and the Greater Cambridge Partnership (GCP) consultations on the public transport strategy, projects and services in the region.

Interviews

- Interviews/discussions were undertaken with representatives from Stagecoach East and Whippet Coaches to explore the ways in which congestion impacts bus operations in the Greater Cambridge area and how these may vary across services (rural and urban) and the different areas of the business.
- The interviews were undertaken using Microsoft Teams during June and August 2024.

Review/Analysis of Secondary Data

Both Stagecoach and Whippet coaches provided information regarding the impact of congestion on the running times of their services. This included data on the number of buses required to operate particular routes, journey time differences between on and off-peak services and how these have changed over time. The data has not been presented within the report due to commercial sensitivities, however, the results of the analysis are presented in the appendix as Case Studies.

Study Outputs

The study outputs included a 3-4 page report (below) and 2 case studies to showcase the impact of congestion on a number of urban bus routes within the Greater Cambridge region.

Author: **Jess Cunningham, Transport Planning Specialist**

References

- Begg, P.D., 2016. The Impact Of Congestion On Bus Passengers. Greener Journeys. Available at: https://greener-vision.com/wp-content/uploads/2016/09/TTBusReport_Digital-FINAL-With-Changes-1.pdf
- Berrebi, S.J., Joshi, S. and Watkins, K.E., 2021. On bus ridership and frequency. Transportation Research. Part A, Policy and Practice, [online] 148, p.140. <https://doi.org/10.1016/j.tra.2021.03.005>.
- Cambridgeshire County Council. 2024. Data Story Series: On the Buses, GCP Our Big Conversation Survey Data: Part Two | Cambridgeshire Insight Open Data. [online] Available at: <https://data.cambridgeshireinsight.org.uk/story/data-story-series-buses-gcp-our-big-conversation-survey-data-part-two>
- Cambridgeshire insights June 2024 - <https://cambridgeshireinsight.org.uk/wp-content/uploads/2024/08/TWG-June-2024-C1-v0.1.pdf>
- Cambridgeshire and Peterborough Insights, 2022. Census 2021 – First Results. Available at: <https://cambridgeshireinsight.org.uk/population/census-2021/first-results/#:~:text=The%20total%20usual%20resident%20population,usual%20resident%20population%20was%20621%2C200.>
- Cambridgeshire and Peterborough Combined Authority. Bus Support. Cambridgeshire & Peterborough Combined Authority. Available at: <https://cambridgeshirepeterborough-ca.gov.uk/what-we-deliver/transport/buses/bus-support>
- Cambridgeshire and Peterborough Combined Authority, 2023. CPCA Bus Strategy. Available at: https://cambridgeshirepeterborough-ca.gov.uk/wp-content/uploads/Bus-Strategy_v4-FINAL.pdf
- Cameron, Edward. (2024) 'Bus Viability on a Congested Network'. Interviewed by Jess Cunningham, 7th June.
- Confederation of Passenger Transport. (2024) The Economic Impact of Local Bus Services. Available at: <https://www.cpt-uk.org/news/economic-impacts-of-bus/>
- Department for Transport, "Bus Statistics Data Tables." GOV.UK, 12 Sept. 2024. Available at: <https://www.gov.uk/government/statistical-data-sets/bus-statistics-data-tables#localbus-passenger-journeys-bus01>
- Goodwin, P., 2004. The Economic Cost of Road Traffic Congestion. University College London. Available at: https://discovery.ucl.ac.uk/id/eprint/1259/1/2004_25.pdf
- Halford, P., 2024. CPT research highlights contribution of bus to UK economy. routeone. Available at: <https://www.route-one.net/news/cpt-research-highlights-contribution-of-bus-to-uk-economy>
- INRIX, 2024. Traffic Congestion to Cost the UK Economy More Than £300 Billion Over the Next 16 Years. [online] Inrix. Available at: <https://inrix.com/press-releases/traffic-congestion-to-cost-the-uk-economy-more-than-300-billion-over-the-next-16-years>
- Paaswell, R., 2003. Impact of congestion on bus operations and costs. [online] Available at: https://www.academia.edu/51045794/Impact_of_congestion_on_bus_operations_and_costs
- Thornhill, C. (2024) 'Bus Viability on a Congested Network'. Interviewed by Jess Cunningham, 23rd August.
- Transport Focus, Sept 2023. The Independent Bus User Survey. Available at: <https://d3cez36w5wymxj.cloudfront.net/wp-content/uploads/2023/09/27092232/EMBARGOED-YOUR-BUS-JOURNEY-INTERIM-REPORT-SEPT-2023-FINAL.pdf>