Technical Note

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Author:	Charlie Watson		
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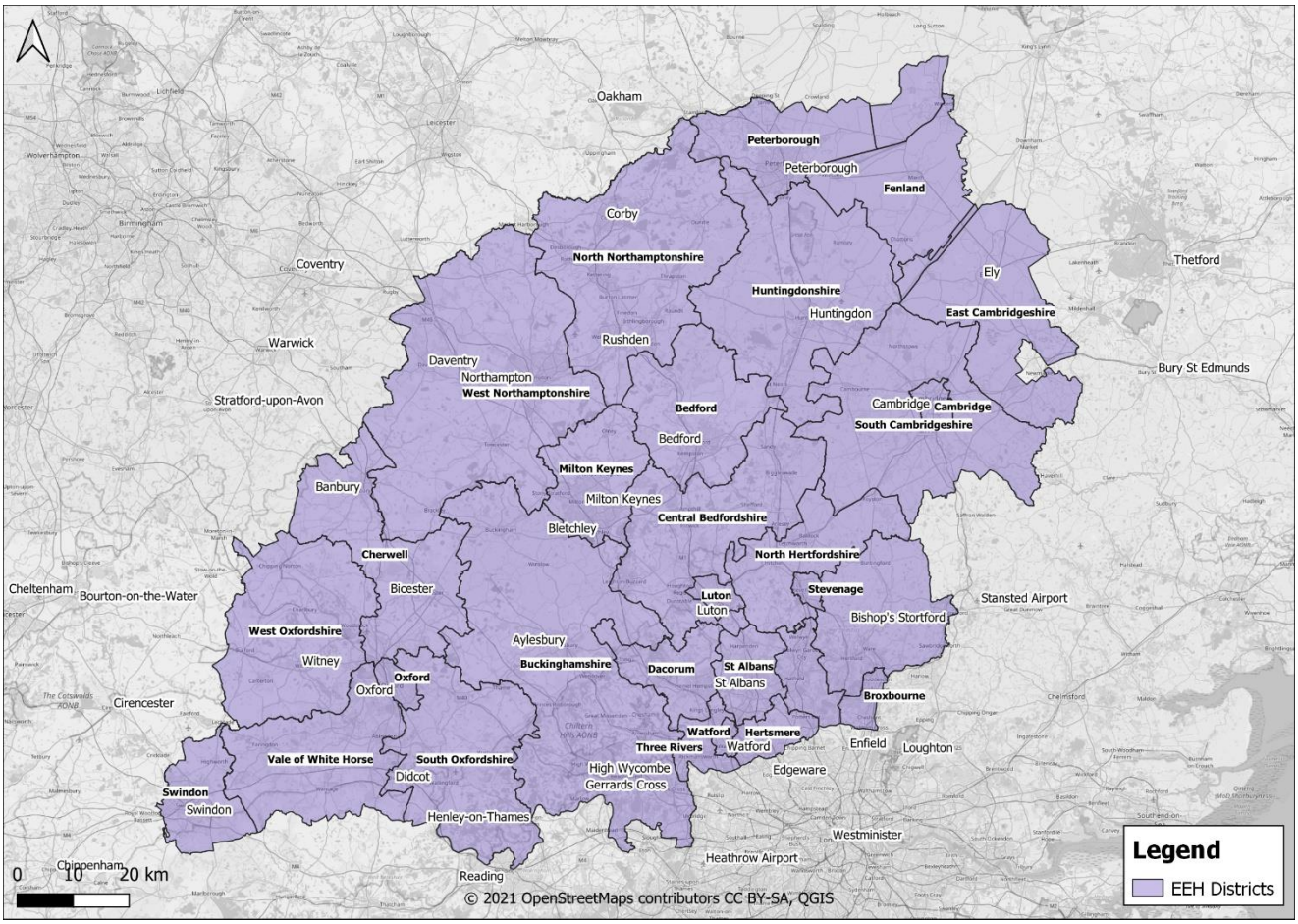
1. Introduction

England's Economic Heartland (EEH) is a sub-national transport body, bringing together the region's Local Transport Authorities in a strategic partnership that works with the region's local enterprise partnerships. Jointly funded through local contributions and the Department for Transport (DfT), EEH provides leadership on transport issues of strategic interest.

The EEH area stretches from Swindon and Oxfordshire in the south-west to Cambridgeshire and Peterborough in the north-east (Figure 1-1). The region is a net contributor to the Treasury, and it encompasses the entirety of the Oxford-Cambridge Arc – a national economic priority for the Government.

Figure 1-1 - The EEH Area



Atkins have been commissioned by England's Economic Heartland to undertake a Regional Bus Study, which aims to:

- Identify gaps in the region's strategically important bus/coach network coverage
- Set out a supporting vision and strategy for regional bus services in the EEH region
- Support the individual Bus Service Improvement Plans being developed by individual Local Transport Authorities

The study has been designed to review available data regarding regional travel patterns and identify where the bus network may not fully be meeting these, the overarching aims of the research is to:

- Encourage modal shift and support initiatives to reduce traffic emissions for intra-regional journeys

- Build on the work already being undertaken by each authority on their Bus Service Improvement Plan
- Identify potential bus priority improvements (services and infrastructure) of regional interest
- In parallel, we will develop a high-level Regional Bus Strategy to complement the implementation of BSIPs and support funding bids

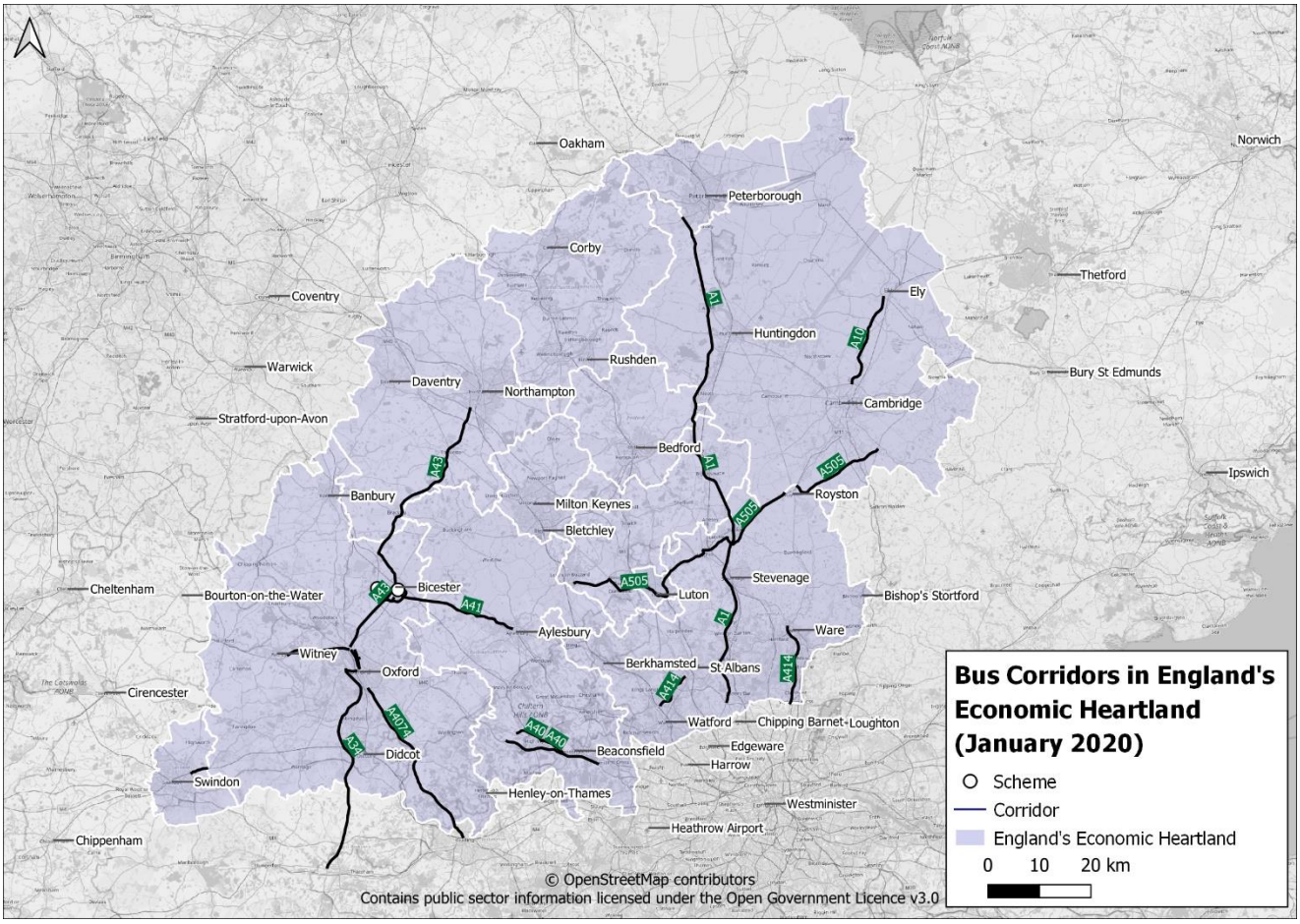
The study does not intend to consider significant movements within a local authority's area, instead it is aiming to improve the understanding of transboundary movements and coordination of bus services to meet these demands within the EEH area.

This note aims to outline the data collection, processing and analysis method used to identify gaps in the regions strategically important bus and coach network.

1.1. Previous work

Figure 1-2 outlines connectivity studies which have been conducted or are being conducted by the constituent local authorities which make up the EEH area. Those connectivity studies which are being undertaken by EEH are not included within Figure 1-2.

Figure 1-2 - EEH connectivity studies corridors



2. Methodology

2.1. Data Sources

Initial data collection for the project consisted of obtaining data relating to bus routes within the EEH area alongside journey data from National Highways.

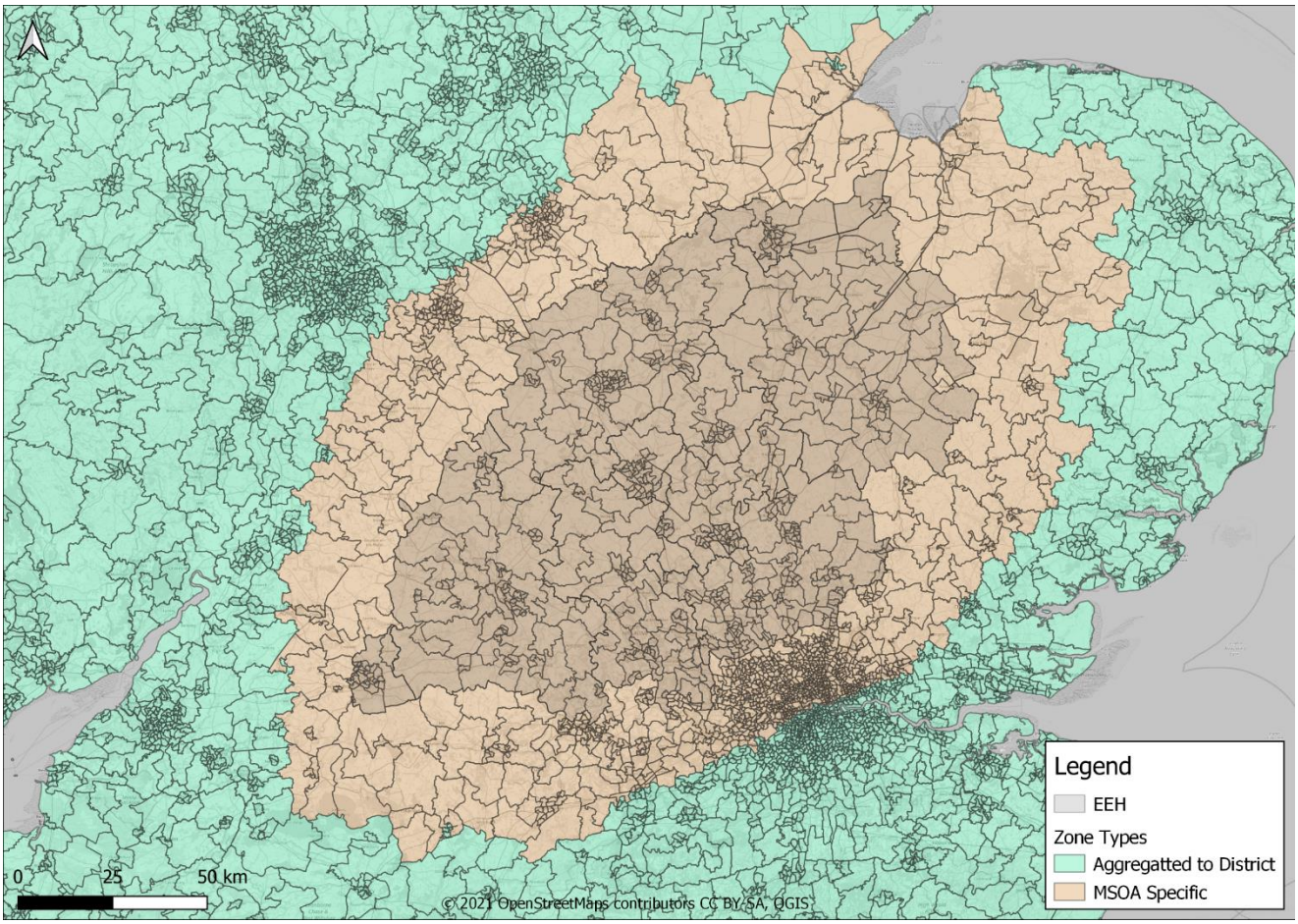
Bus route data was collected from Basemap's repository of the National Public Transport Data Repository for Q1 2022.

National Highway Trip Information System (TIS) data was collected for 2019 as a way of identifying trips between local authorities and specific areas. This database can provide a detailed breakdown of trips between Middle Super Output Areas (MSOAs) as well as aggregated flows between districts collected from GPS movements of O2 mobile phone customers, who account for roughly 25% of the UK population. This data is scaled up by the provider to account for the remaining proportion of the population who are not O2 customers.

2.2. Study Area

As previously discussed, this report covers the EEH area and the local authorities which are within. Figure 2-1 displays the EEH area alongside the level of detail collected from the TIS database. Detailed data was collected at the MSOA level for all local authorities within the EEH area, alongside all or part of adjacent local authorities – these areas are outlined in orange in Figure 2-1. Beyond these areas outlined in orange below, the journey data is aggregated to the district level and covered all of the UK.

Figure 2-1 - TIS data collection area



2.3. Process

The overall methodology utilised to conduct this assessment is summarised within Figure 2-2.

The bus route data has been utilised to allow for a visual representation of the bus services in operation in the EEH area, including filtering to display services which operate at least once per hour during ant weekday period. This data has also been utilised as an input for the Google Maps analysis comparing current public transport and private vehicle journey times.

National Highway TIS data has been used to develop an understanding of flows within the EEH at two scales. Initially TIS data was used to understand and map aggregated flows between the local authority areas to highlight the most common movements within the EEH area. Secondly, the aggregated flow data alongside local knowledge from EEH and local authority officers was used to identify key settlements and trip attracting areas to allow for a detailed MSOA level analysis of daily flows between the identified areas. This MSOA level analysis consisted of a GIS exercise to review the given MSOAs and identify where there were large flows of people travelling to other settlements or specific MSOAs. An example of the GIS outputs which were studied as part of this process is given in Figure 2-3. The number of MSOAs aggregated together was variable based on the number covering the settlements or trip generating areas in question.

On completion of a comprehensive review of the key settlements and trip attracting MSOAs, Google Maps was used to compare the journey time between the origin and destination points. These journey times were calculated to and from the central points of the given area as defined on Google Maps and represents the total journey time, including time to access public transport and interchange times. A ratio between the two was calculated to highlight the greatest difference in journey times between public and private modes of transport.

Figure 2-2 - Methodology chart

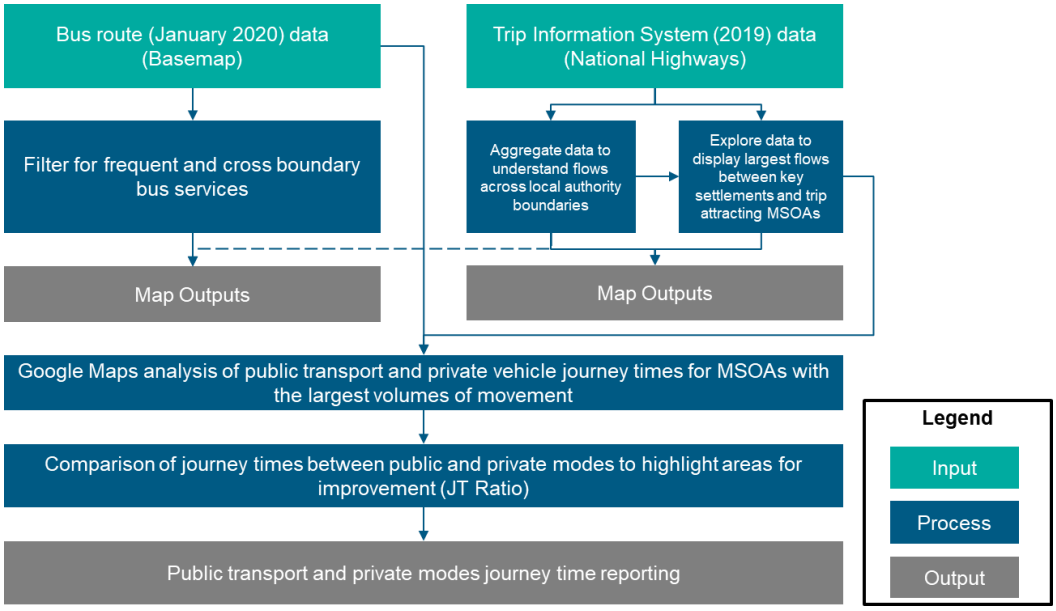
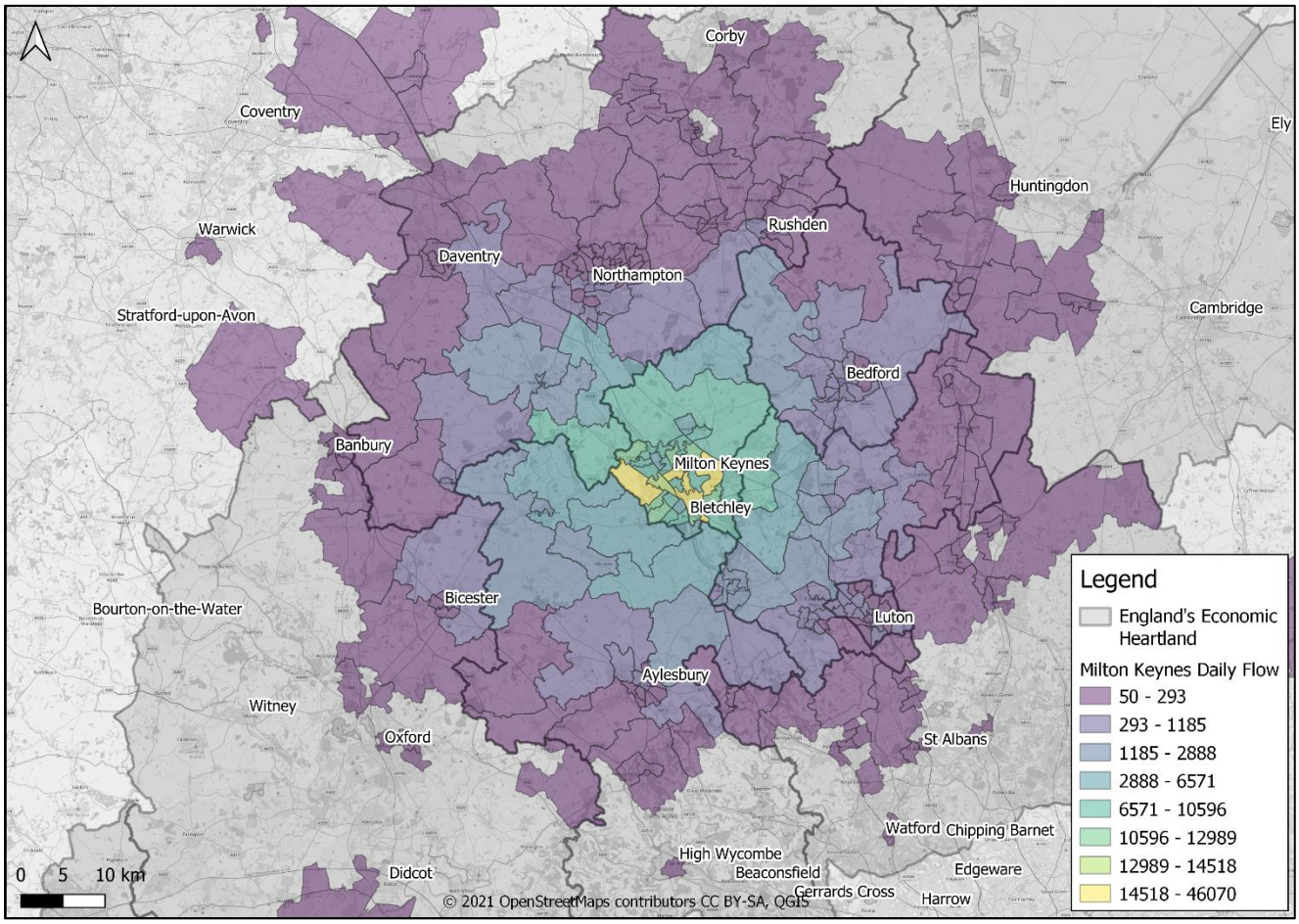


Figure 2-3 - One-way flow leaving Milton Keynes

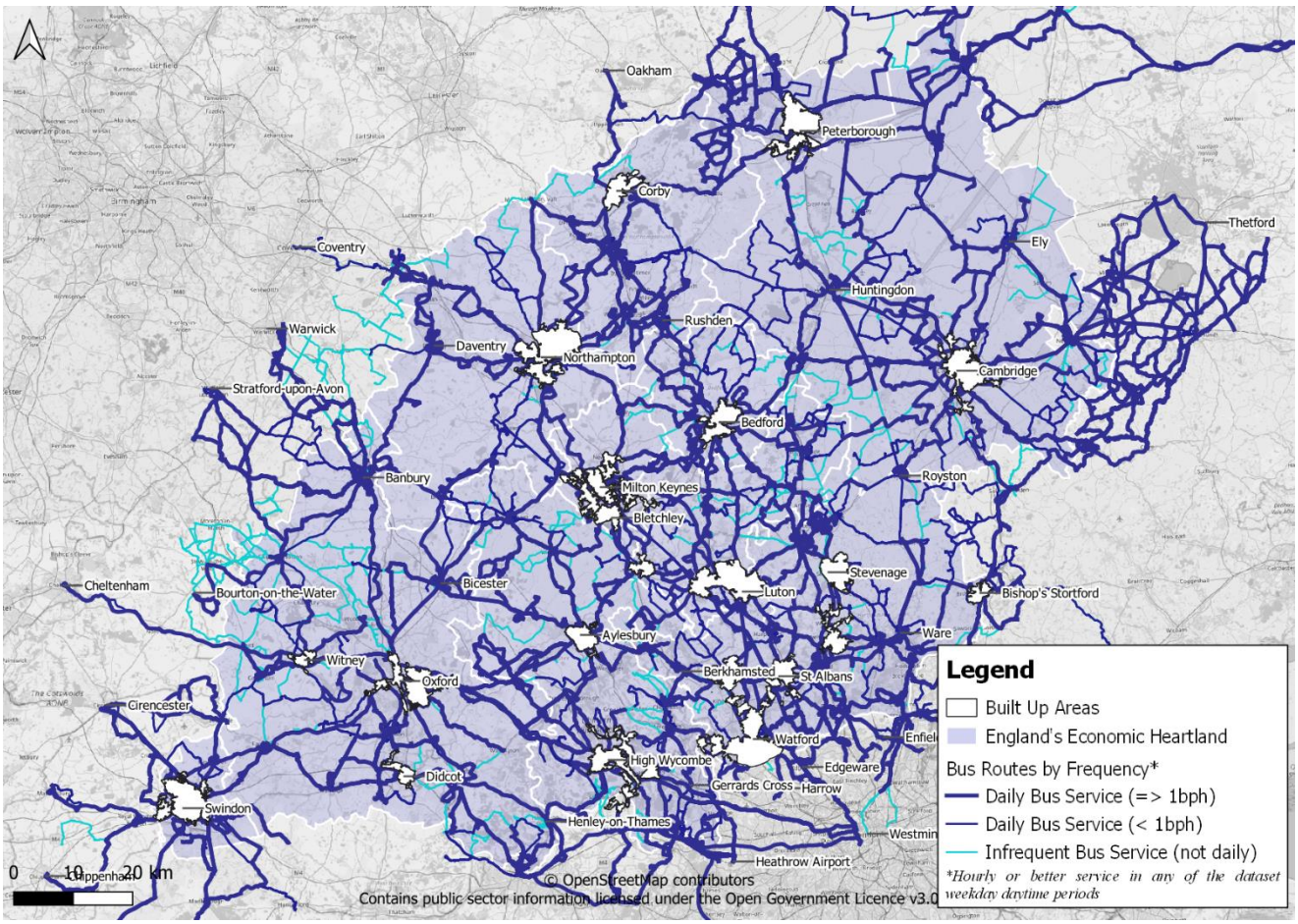


3. Results and Discussion

3.1. Bus Routes

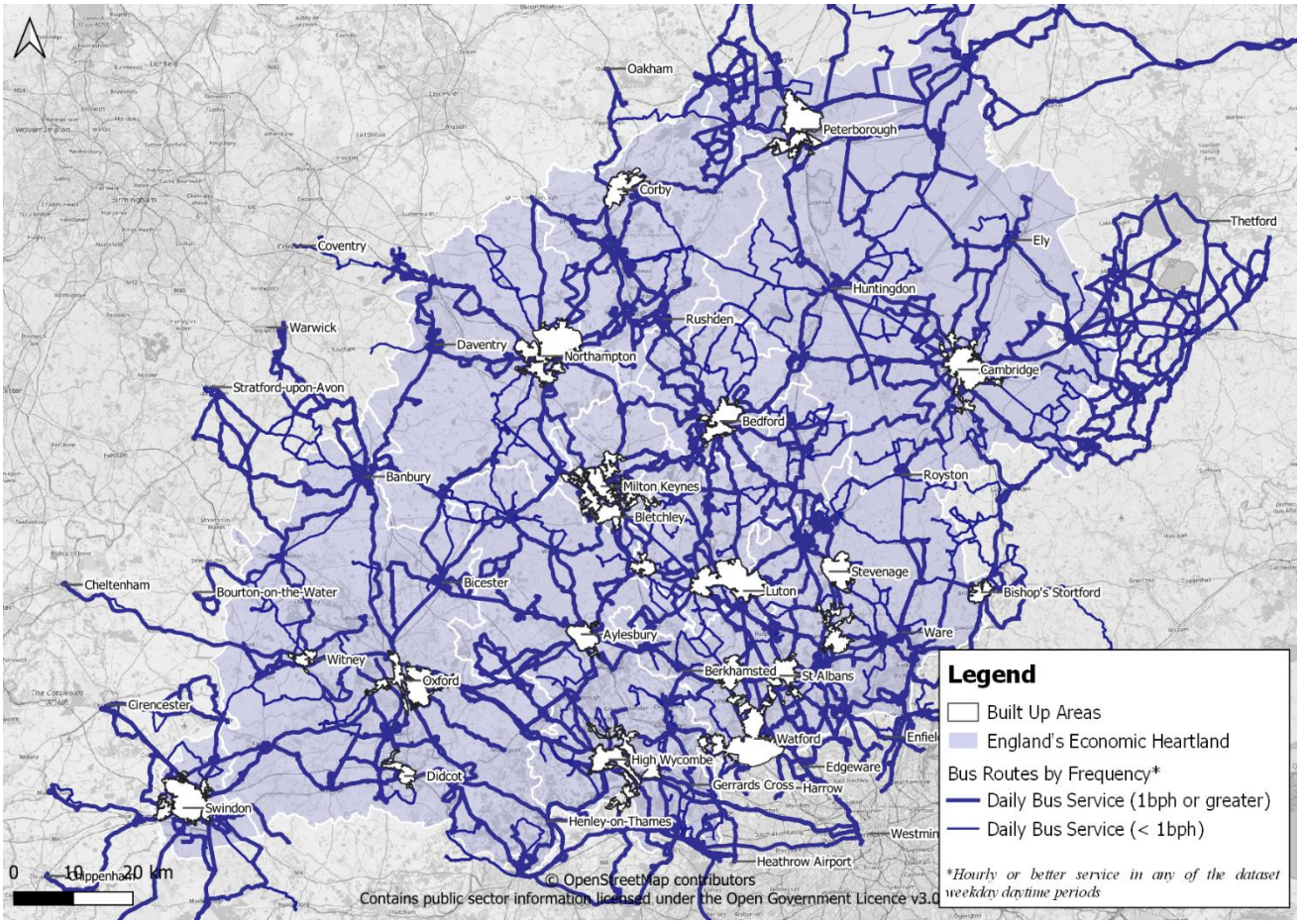
Figure 3-1 outlines all bus routes within the EEH area as of Q1 2022 according to the National Public Transport Data Repository (NPTDR), from the data it is evident that most of the bus routes within the EEH area emerge from the larger settlements within each of respective authorities, with the largest concentration of routes seen in the central Bedfordshire and Milton Keynes area and south into Luton, Hertfordshire and parts of Buckinghamshire.

Figure 3-1 - Bus routes in the EEH area (Q1 2022)



When filtering this data to include only bus services which run at least once per hour during any weekday period (Figure 3-2), it is clear that the density of the network reduces slightly, with some of the areas beyond the primary urban areas in the EEH no longer eliciting connectivity by bus. This said, it is clear that there are still dense and regular services in and around the large settlements.

Figure 3-2 - Bus routes in the EEH area with over 1 bus per hour (Q1 2022)



3.2. Local authority movements

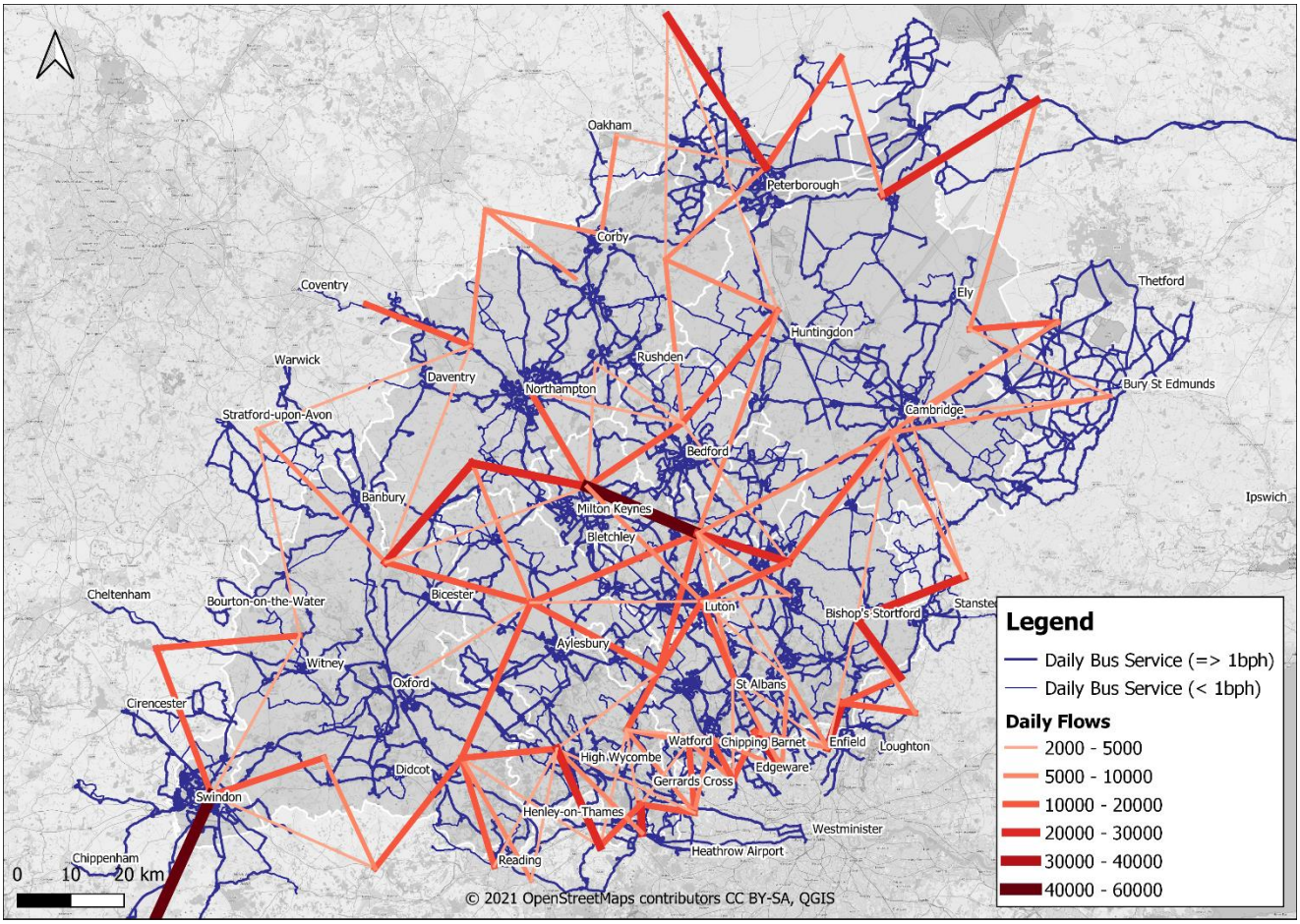
Flows across ceremonial county boundaries and individual authorities were considered to highlight the largest movements across the authority boundaries. The analysis highlighted that the greatest flows were between Hertfordshire and Bedfordshire where between 90,000 and 120,000 people were identified as travelling between each day - a similar movement of people was identified in the opposite direction. Furthering this, flows of between 70,000 and 90,000 people were seen between Buckinghamshire and Bedfordshire.

Figure 3-3 outlines the district level flows and the bus network within the EEH area. The figure outlines that the greatest one directional flows are seen between Swindon and Wiltshire and Milton Keynes and Central Bedfordshire where between 40,000 and 60,000 people travel between each local authority in one direction per day. The former pair has limited bus services crossing the boundary, whereas the latter has a denser bus network linking the two districts which is also complemented by the rail network. There are also large flows between the Cherwell District and South Northamptonshire although there are more limited regular bus services connecting the districts.

Overall, Figure 3-3 outlines that there are large numbers of people crossing the local authority boundaries each day and in some cases, particularly in the south of the EEH and central areas such as Milton Keynes, Luton and Bedford bus connectivity appears to be more readily available. This connectivity however is not replicated beyond these areas, with less regular cross boundary services less present in more rural areas and counties such as Oxfordshire, Cambridgeshire and Northamptonshire.

Granular flow maps for each of the districts is displayed in 4.Appendix A.

Figure 3-3 - Flows between districts and bus routes (=>1bph) in the EEH area



3.3. Local area movements

3.3.1. Flows of people

From investigating the major settlements and key trip attracting areas within the EEH area around 70 MSOA pairings were identified where there were at least 1,000 people travelling between the given areas per day in one direction, these values have been scaled up to represent the overall two-way flow (initial value x2). The top 30 pairings are identified in Figure 3-4.

The greatest cross boundary flow is between Luton and Dunstable where approximately 61,000 people travel between the two areas, this is followed by Milton Keynes to Leighton Buzzard where it is estimated that the daily flow is around 20,000 people per day.

When considering high trip generating sites as identified by local officers, a number of the OD pairings covering areas such as Cranfield, Daventry International Rail Freight Terminal (DIRFT) and Millbrook Technology Park, appear in the top 30 of OD pairs. Although the data has indicated large flows between the identified ODs, it is important to appreciate that MSOAs cover a wide area and therefore movements do not directly represent the actual sites which are contained within the MSOA, instead they offer an indication that there may be a large number of people travelling here – as such caution must be exercised when extrapolating between the flows into MSOAs and the factors contributing to this.

The complete list of the OD pairs with more than 1,000 daily movement is displayed in 4.Appendix B.

Figure 3-4 - Greatest identified daily cross boundary flows between MSOA area pairings in the EEH area

3.3.2. Journey time analysis

A summary of the journey time ratios for trips between the identified areas with flows of 1,000 or more individuals is outlined in Table 3-1. This table outlines that for the most part public transport journey times are longer than travelling by private vehicle by up to 2.5 times, potentially accounting for a total daily flow of 232,000 people.

There are also 16 OD pairs identified that account for approximately 99,000 people whose journey time using public transport would be at least 2.5 times greater than if they were to use private transport to travel between the MSOAs covering the respective areas. Some examples of these trips are highlighted in Table 3-2. It is clear that relatively short journeys when using a private vehicle can take substantially longer when using public transport which is likely to mean that the desirability of public transport is limited.

Four of the OD pairs with the greatest one-way daily flows were found to have particularly long journey times which consisted of multi-modal trips with long walk times of over 20 minutes; it is likely that using public transport for these journeys is deemed impractical by many. This accounted for around 26,000 people to or from the MSOA containing Millbrook Technology Park to Milton Keynes, Luton, Dunstable and Bedford. Poor connectivity is a multifaceted barrier, giving the potential for transport related social exclusion from opportunities within this MSOA, alongside forcing the use of the private vehicle which is less environmentally sustainable.

Table 3-1 – Summary of journey time ratios between OD pairs

Journey Time Ratio	Number of OD Pairs	One-way Daily Flow	Approx. Daily Flow (All-users and modes)
Less than 1	11	55,000	111,000
1 to 2.5	40	118,000	232,000
Greater than 2.5	16	49,000	99,000

Table 3-2 - Sample OD pairs with a JT ratio greater than 2.5

OD Pair	One-way daily flow (all users and modes)	Approx daily flow (all-users and modes)	Public Transport Journey Time (minutes, including interchange wait times)	Private Vehicle Journey Time	Ratio
Cranfield and Milton Keynes	8,000	16,000	40	13	3.1
Pinewood Studio and Slough	4,000	9,000	53	14	3.8
Milton Keynes and Towcester	4,000	8,000	55	19	2.9
Dunstable and Hemel Hempstead	3,000	5,000	58	20	2.9
Borehamwood and Chipping Barnet	2,000	4,000	50	12	4.2
Millbrook Technology Park and Dunstable	1,100	2,000	128	37	3.5

Table 3-3 provides a summary of the number of interchanges required for the public transport journeys previously discussed. It is clear that the majority of journeys are able to be completed using one mode of transport with 18 of the OD pairs required one interchange and only two OD pairs requiring two interchanges. As such Table 3-3 suggests that for the most part the longer journey times seen in the identified OD pairs are a result of slow public transport journeys or time taken to access the bus service due to limited network coverage.

Table 3-3 - Summary of the number of interchanges between OD pairs

Interchanges	Number of OD Pairs	One-way Daily Flow	Approx. Daily Flow (All-users and modes)
0	43	165,000	329,000
1	19	45,000	89,000
2	4	11,000	22,000
3	1	1,000	2,000

4. Conclusion

This note has aimed to outline the methodology and results of the research into cross boundary bus services and trips within the EEH area. The note has identified that there is a relatively dense network of bus services within the EEH area, however when filtered down to show only services which cross local authority boundaries, this thins down considerably.

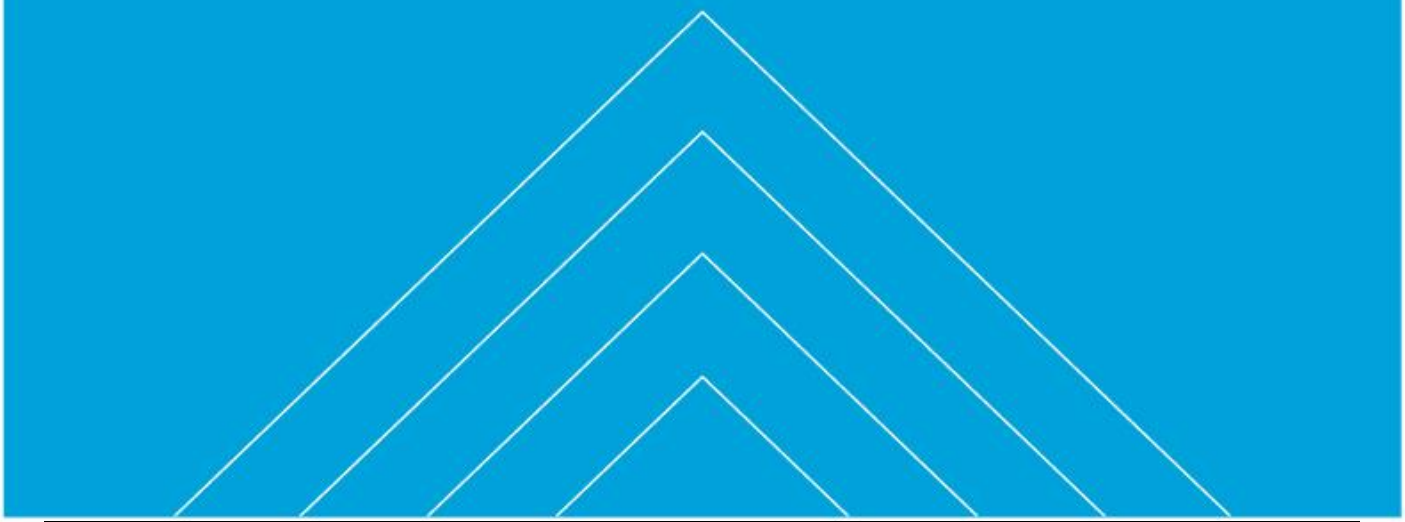
The TIS data has highlighted that there are a large number of trips which cross the local authority boundaries each day. The collected bus network data also suggests that there are variable levels of bus connectivity serving these flows, with bus connectivity appearing to be more readily available in the south and central areas of the EEH such as Milton Keynes, Luton and Bedford. This connectivity however is not replicated beyond these areas, with less regular cross boundary services less present in more rural areas and counties such as Oxfordshire, Cambridgeshire and Northamptonshire.

When considering the journey analysis for the local area movements between the identified highest trip generating MSOAs, the data suggests that the current bus network for the most part offers worse journey time outcomes than when travelling by private modes. Up to 232,000 people have a journey time up to 2.5 times greater than private transport if travelling by public transport with a further 99,000 people having a journey time over 2.5 times longer if using public transport. When considering the number of interchanges required for the public transport journeys identified, these tend to be limited, with most journeys between ODs pairs complete using one public transport service. Although some of the longest journey times will be a result of interchanges and the subsequent penalty, the data suggests that the current journey times on direct services are long when compared to travelling by car which subsequently impacts the attractiveness of these services to non-users.

It was identified that a key trip attracting MSOA containing Millbrook Technology Park had no viable connectivity to areas such as Milton Keynes and Dunstable despite the high number of journeys between the MSOA pairs indicated in the TIS data, suggesting there is scope to improve connectivity to out of town employment opportunities.

Overall, this report has outlined the methodology and findings of the analysis of National Highways TIS data alongside NPTDR bus data to highlight movements between districts and MSOAs within the EEH area and compare the present bus network against such data.

Appendices



Appendix A. County level flow data

Figure A-1 - Daily cross-boundary flows from Northamptonshire

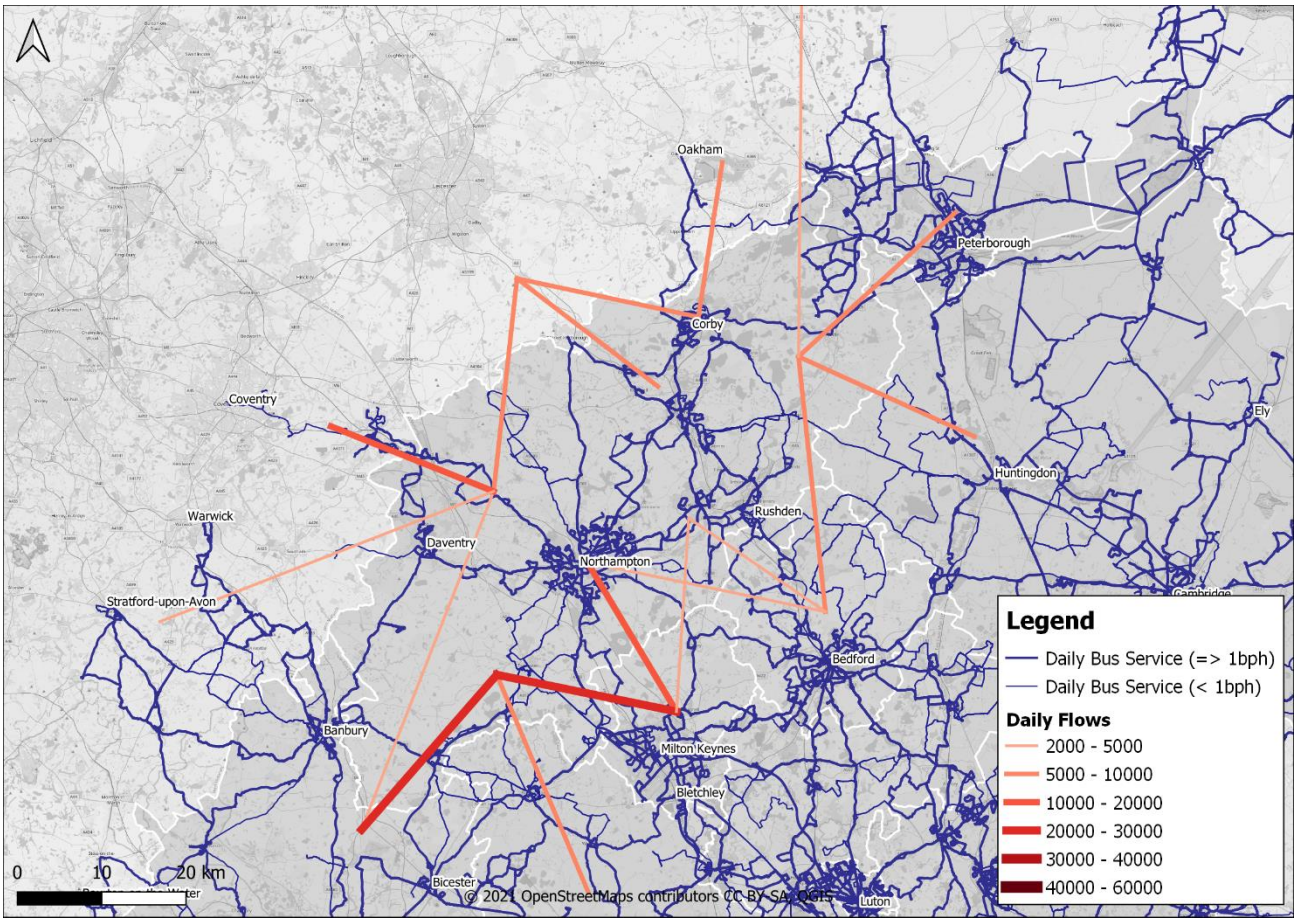


Figure A-2 - Daily cross-boundary flows from Oxfordshire

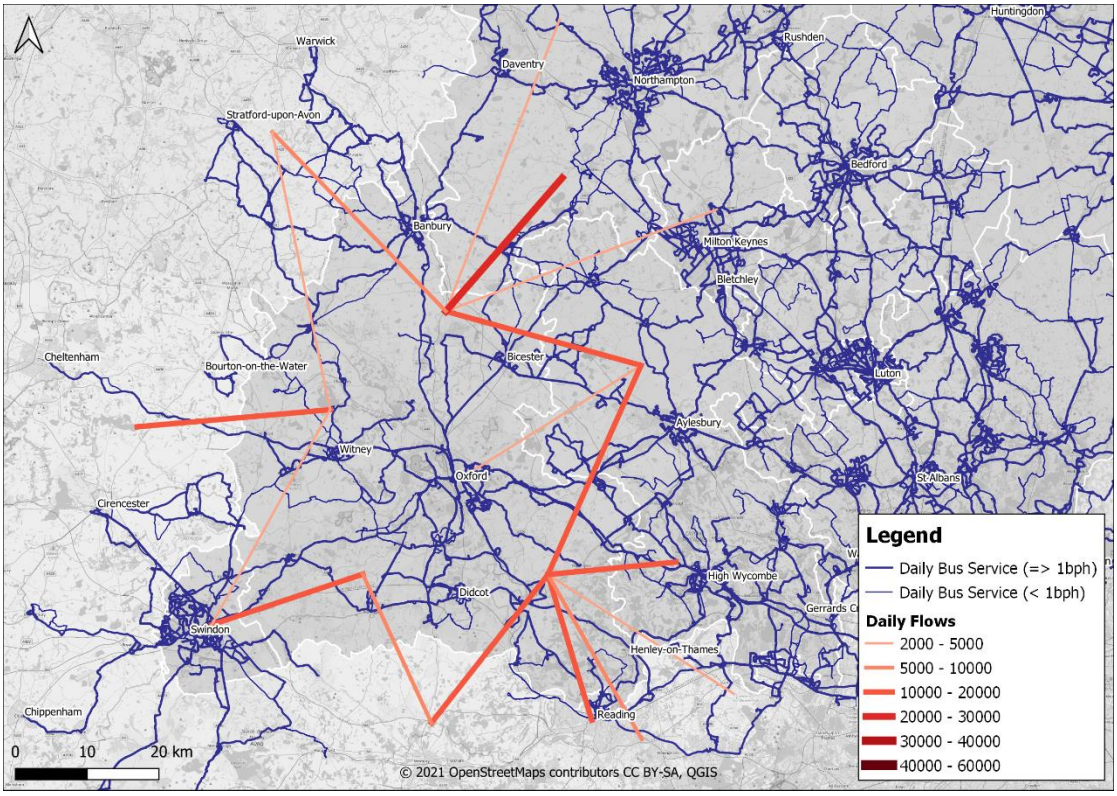


Figure A-3 - Daily cross-boundary flows from Swindon

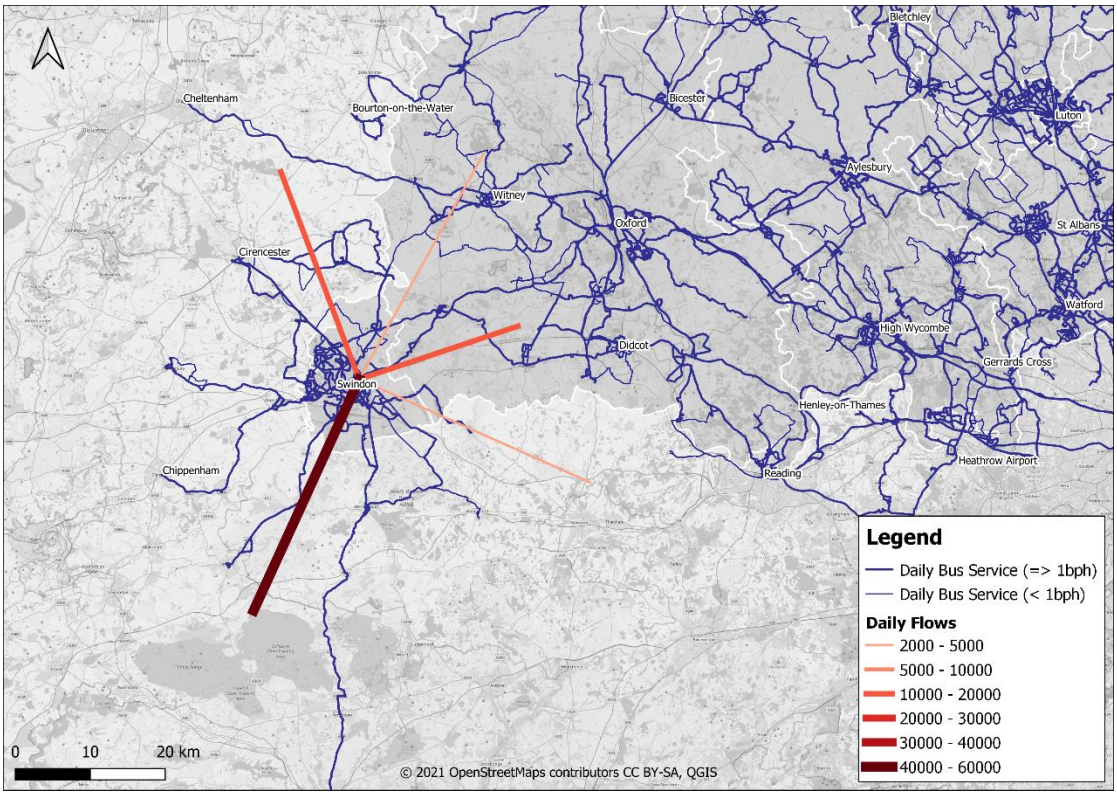


Figure A-4 - Daily cross-boundary flows from Bedfordshire

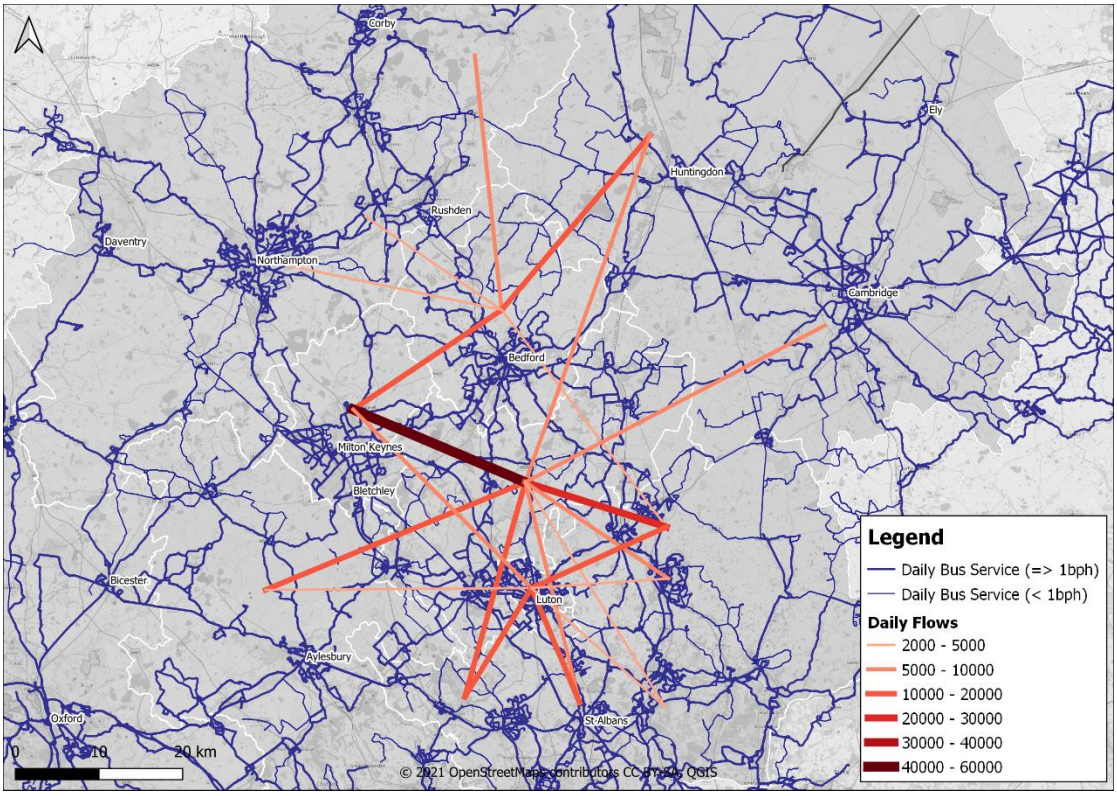


Figure A-5 - Daily cross-boundary flows from Buckinghamshire and Milton Keynes

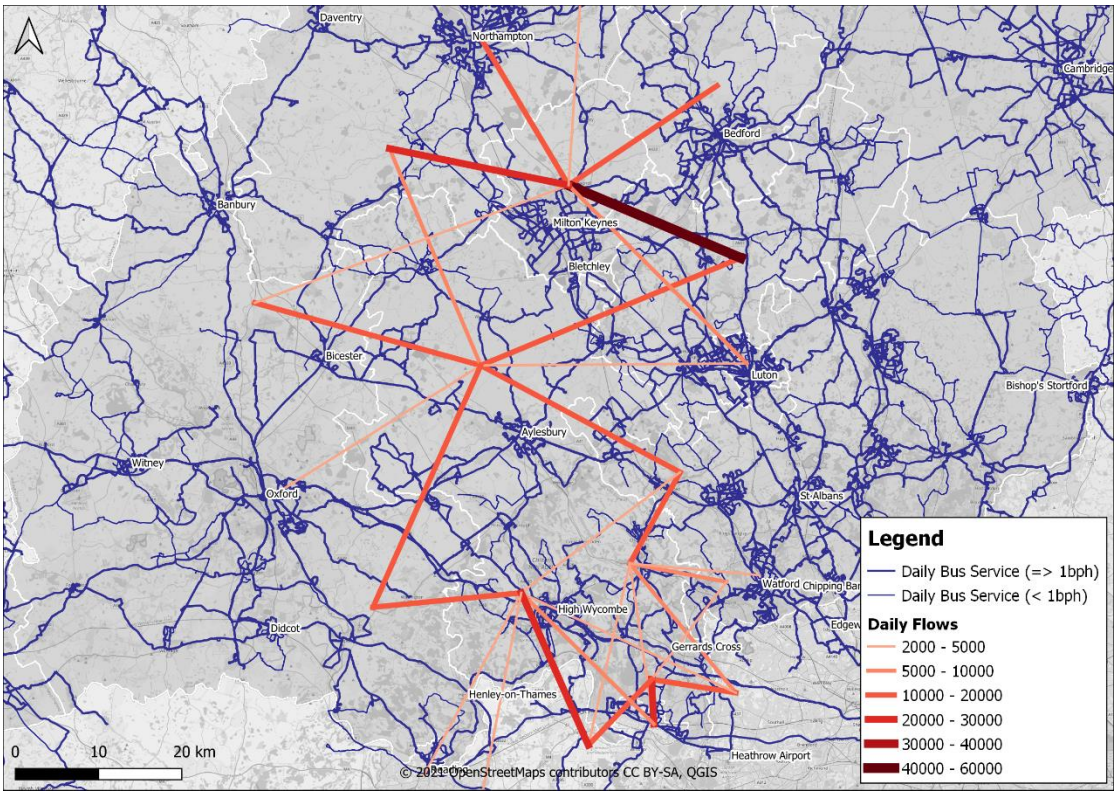


Figure A-6 - Daily cross-boundary flows from Cambridgeshire

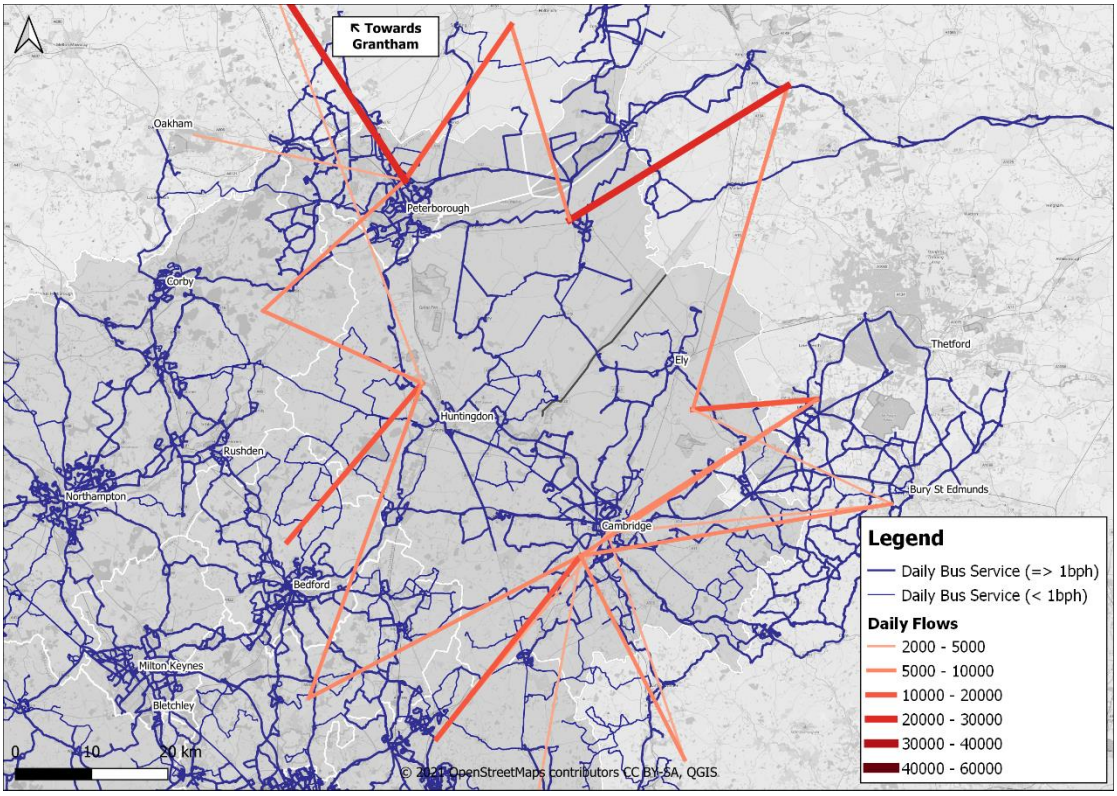
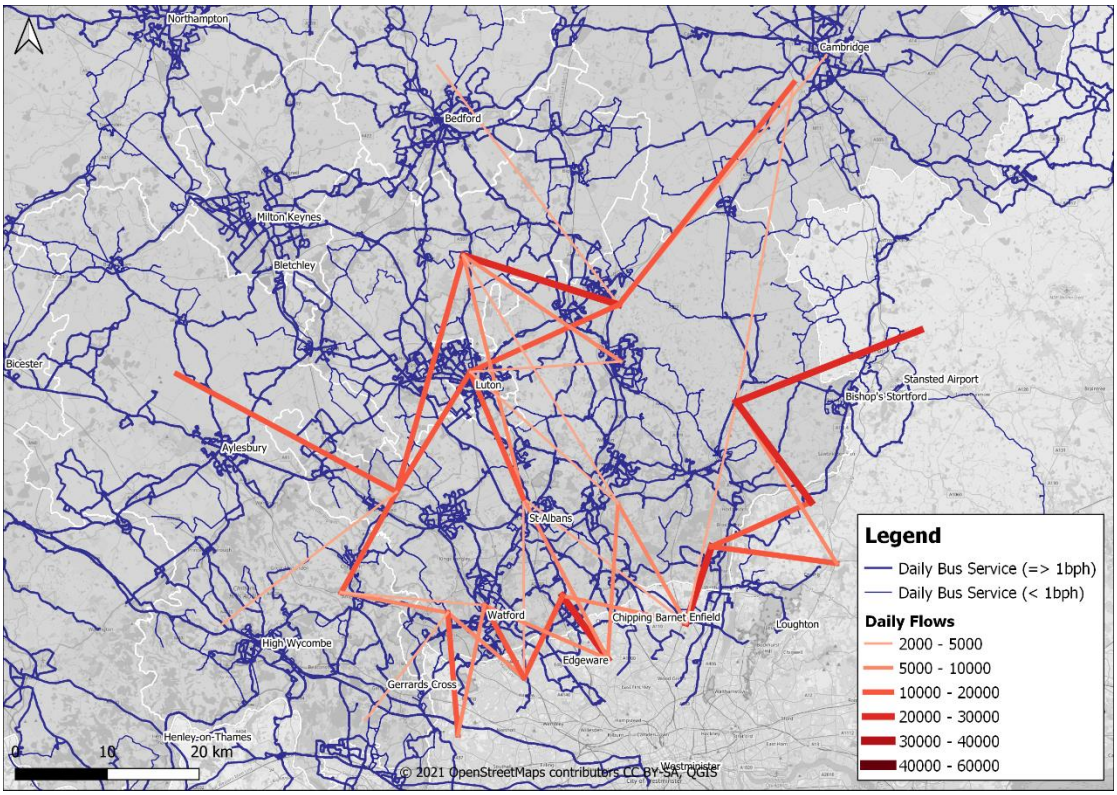


Figure A-7 - Daily cross-boundary flows from Herefordshire



Appendix B. OD Pairs

Table B-1 - Identified cross-boundary OD Pairs with over 1,000 one-way daily flows

					PT journey			Highway Assessment	Ratio
Origin Area (Principal town / attractor)	Destination Area	Daily Flow Between	One-way daily flow (all users and modes)	Approx. daily flow (all-users and modes)	Mode	PT Journey Time	Interchanges	Private Vehicle Journey Time	PT / Car
Luton	Dunstable	Luton and Dunstable	30,323	61,000	Bus	9	0	13	0.7
Milton Keynes	Leighton Buzzard	Milton Keynes and Leighton Buzzard	10,179	20,000	Train	46	0	21	2.2
Cranfield	Milton Keynes	Cranfield and Milton Keynes	8,199	16,000	Bus	40	0	13	3.1
Luton	Hemel Hempstead	Luton and Hemel Hempstead	7,884	16,000	Multi-modal	40	1	18	2.2
Milton Keynes	Buckingham	Milton Keynes and Buckingham	7,151	14,000	Bus	43	0	19	2.3
Harpenden	Luton	Harpenden and Luton	6,468	13,000	Train	8	0	15	0.5
Millbrook Technology Park	Milton Keynes	Millbrook Technology Park and Milton Keynes	6,322	13,000	Multi-modal	92	2	21	4.4
Luton	Hitchin	Luton and Hitchin	5,675	11,000	Bus	38	0	16	2.4
Swindon	Royal Wootton Bassett	Swindon and Royal Wootton Bassett	5,184	10,000	Bus	27	0	15	1.8

Daventry	Rugby	Daventry and Rugby	5,048	10,000	Bus	54	0	20	2.7
DIRFT	Rugby	DIRFT and Rugby	4,609	9,000	Bus	29	0	13	2.2
Pinewood Studio	Slough	Pinewood Studio and Slough	4,391	9,000	Bus	53	1	14	3.8
Aylesbury	Thame	Aylesbury and Thame	4,300	9,000	Bus	33	0	17	1.9
Borehamwood	Edgeware	Borehamwood and Edgware	4,248	8,000	Bus	20	0	10	2.0
Milton Keynes	Towcester (wide MSOA area)	Milton Keynes and Towcester (wide MSOA area)	3,988	8,000	Bus	55	0	19	2.9
Millbrook Technology Park	Bedford	Millbrook Technology Park and Bedford	3,961	8,000	Multi-modal	61	1	19	3.2
Luton	Leighton Buzzard	Luton and Leighton Buzzard	3,766	8,000	Bus	40	0	26	1.5
Rothamstead Research Campus	Luton	Rothamstead Research Campus to Luton	3,229	6,000	Train	23	0	14	1.6
Stevenage	Luton	Stevenage and Luton	3,156	6,000	Bus	64	0	26	2.5
Chesham	Hemel Hempstead	Chesham and Hemel Hempstead	3,095	6,000	Multi-modal	42	1	17	2.5
Leighton Buzzard	Aylesbury	Leighton Buzzard and Aylesbury	3,089	6,000	Bus	41	0	20	2.1
Banbury	Brackley	Banbury and Brackley	3,083	6,000	Bus	40	0	20	2.0

St Neots	Bedford	St Neots and Bedford	2,993	6,000	Bus	42	1	22	1.9
Peterborough	Spalding	Peterborough and Spalding	2,921	6,000	Train	20	0	34	0.6
Bedford	Sandy	Bedford and Sandy	2,809	6,000	Bus	32	0	19	1.7
Bedford	Ampthill	Bedford and Ampthill	2,758	6,000	Bus	33	0	18	1.8
Ware	Harlow	Ware and Harlow	2,648	5,000	Bus	14	0	15	0.9
Swindon	Marlborough	Swindon and Marlborough	2,579	5,000	Bus	38	0	22	1.7
Wisbech	King's Lynn	Wisbech and King's Lynn	2,555	5,000	Bus	30	0	20	1.5
Dunstable	Hemel Hempstead	Dunstable and Hemel Hempstead	2,537	5,000	Multi-modal	58	1	20	2.9
Dunstable	Milton Keynes	Dunstable and Milton Keynes	2,517	5,000	Multi-modal	49	1	27	1.8
Peterborough	Huntingdon	Peterborough and Huntingdon	2,492	5,000	Train	20	0	29	0.7
Cranfield	Bedford	Cranfield and Bedford	2,462	5,000	Bus	52	0	19	2.7
Haverhill	Cambridge	Haverhill and Cambridge	2,457	5,000	Bus	58	0	36	1.6
Bedford	Flitwick	Bedford and Flitwick	2,368	5,000	Train	11	0	24	0.5
March	Peterborough	March and Peterborough	2,295	5,000	Train	16	0	36	0.4
Bedford	Biggleswade	Bedford and Biggleswade	2,154	4,000	Bus	54	0	23	2.3

Wescott	Bicester	Wescott and Bicester	2,148	4,000	Bus	24	0	17	1.4
Biggleswade	Bedford	Biggleswade and Bedford	2,070	4,000	Bus	46	0	24	1.9
Borehamwood	Chipping Barnet	Borehamwood and Chipping Barnet	2,043	4,000	Multi-modal	50	1	12	4.2
St Neots	Sandy	St Neots and Sandy	2,024	4,000	Train	25	0	15	1.7
Watford	Luton	Watford and Luton	2,006	4,000	Multi-modal	62	2	25	2.5
Swindon	Calne	Swindon and Calne	1,894	4,000	Bus	49	0	30	1.6
Cambridge	Royston	Cambridge and Royston	1,873	4,000	Train	24	0	29	0.8
Aylesbury	Dunstable	Aylesbury and Dunstable	1,870	4,000	Bus	80	1	31	2.6
Rushden	Bedford	Rushden and Bedford	1,841	4,000	Bus	54	0	21	2.6
Northampton	Bedford	Northampton and Bedford	1,711	3,000	Multi-modal	76	1	37	2.1
Corby	Market Harborough	Corby and Market Harborough	1,683	3,000	Train	25	1	20	1.3
Chesham	Berkhamsted	Chesham and Berkhamsted	1,576	3,000	Bus	28	0	10	2.8
Harpenden	Dunstable	Harpenden and Dunstable	1,570	3,000	Multi-modal	44	1	18	2.4
Peterborough	Wisbech	Peterborough and Wisbech	1,522	3,000	Bus	42	0	42	1.0
Swindon	Devizes	Swindon and Devizes	1,503	3,000	Bus	55	0	33	1.7

Colworth Park	Rushden	Colworth Park and Rushden	1,421	3,000	Bus	35	0	13	2.7
Bicester	Brackley	Bicester and Brackley	1,404	3,000	Bus	37	0	16	2.3
South Cambridge Research Parks	Royston	South Cambridge Research Parks and Royston	1,398	3,000	Multi-modal	35	1	24	1.5
Millbrook Technology Park	Luton	Millbrook Technology Park and Luton	1,372	3,000	Multi-modal	90	2	28	3.2
Princes Risborough	Thame	Princes Risborough and Thame	1,331	3,000	Multi-modal	24	1	15	1.6
Hemel Hempstead	Aylesbury	Hemel Hempstead and Aylesbury	1,284	3,000	Multi-modal	54	1	25	2.2
Kettering	Market Harborough	Kettering and Market Harborough	1,265	3,000	Train	15	0	20	0.8
Swindon	Oxford	Swindon and Oxford	1,242	2,000	Train	48	1	54	0.9
Welwyn Garden City	Luton	Welwyn Garden City and Luton	1,230	2,000	Multi-modal	80	1	28	2.9
Hatfield	Luton	Hatfield and Luton	1,221	2,000	Multi-modal	41	1	26	1.6
Buckingham	Milton Keynes	Buckingham and Milton Keynes	1,210	2,000	Bus	25	0	26	1.0
Luton	Letchworth	Luton and Letchworth	1,147	2,000	Multi-modal	85	2	37	2.3
Millbrook Technology Park	Dunstable	Millbrook Technology Park and Dunstable	1,146	2,000	Multi-modal	128	3	37	3.5

Aylesbury	Bicester	Aylesbury and Bicester	1,119	2,000	Bus	50	1	35	1.4
Wisbech	Peterborough	Wisbech and Peterborough	1,090	2,000	Bus	42	0	42	1.0