York Aviation

DEPARTMENT FOR TRANSPORT

REGIONAL CONNECTIVITY REVIEW

FINAL REPORT

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Contents

1   INTRODUCTION AND BACKGROUND

1.1   In summer 2017, York Aviation LLP (YAL) were commissioned by the Department for Transport (DfT) to provide technical consultancy services in relation to the on-going Consultation for the Airports National Policy Statement (NPS). In January 2018, as part of this framework of advice, DfT commissioned research to understand the current connectivity of the UK regions in the context of the role of London Heathrow as a hub for the UK.

1.2   In recent years, following the Airports Commission process, the issue of domestic air connectivity to Heathrow has become an increasingly important topic. It is well recognised that the size and strength of its local market, coupled with its hub function, means that Heathrow is able to support a level of connectivity that simply cannot be replicated at other airports in the UK. However, at the same time, domestic connections to the UK's hub have become significantly eroded, as capacity constraints have driven airlines towards more revenue intensive use of slots. The Airports Commission recommended that the Government consider the use of Public Service Obligations (PSOs) to secure domestic connectivity to Heathrow for regions that currently do not have access to the UK's hub, with the aim of making sure that regions do not miss out on trade-related economic activity and tourism.

1.3   This research is intended to provide a detailed evidence base to aid the Government's thinking in this area. The Government would like a clear understanding of the current picture of air connectivity across the UK. The Government is keen to ensure that a supported network of domestic routes at a potentially expanded Heathrow is targeted to maximise the benefit to the UK.

1.4   We have organised this report into the following sections:

⤫   **Section 2** outlines the approach and assumptions which underpin this review;

⤫   **Section 3** outlines the connectivity offered by UK regional airports;

⤫   **Section 4** considers the availability of connectivity to users at a local level across the UK;

⤫   **Section 5** considers what level of service from regional points provides the optimal return on investment in connectivity terms;

2   ASSUMPTIONS AND APPROACH

2.1   In this section we set out the key assumptions and definitions which underpin this analysis and outline the approach taken to the core connectivity elements of this work as presented in Sections 3 and 4. We consider the approach to other elements individually in Sections 5 and 6..

2.2   The scope of airports contained within the study has been defined by the DfT, and totals 42 UK airports along with Dublin, in recognition of the role it plays in supporting connectivity for Northern Ireland (we consider this in further detail below). A full list of the UK airports examined in this study is set out in **Appendix A**.

2.3   In developing the analysis, it was necessary to determine a number of key assumptions and definitions. In developing these, we recognise that the aviation market is constantly evolving and that there are ongoing developments in the sector which may change the connectivity picture of the UK's airports over the short to medium term. However, in order to produce an evidence base for consideration, it has been necessary to present a snapshot at a particular moment in time, and in this case we have chosen to focus on 2017. A key advantage to this approach is that we do not need to speculate over the future or the impact of emerging trends that may materialise over the next few years. However this does mean that, as consideration of the connectivity picture evolves over time, further consideration may need to be given to these issues.

2.4   In general, we have tried to be consistent with definitions already used by DfT. However, we have sought to use our industry experience to enhance these and add value to the study in some places.

2.5   Key areas for consideration of definitions and assumptions include:

- ✈   Definition of Connectivity;

- ✈   Major International and Emerging Destinations; and

- ✈   Definitions of Hubs and Identification of Key Hubs.

2.6   We have also considered a number of other issues that are pertinent to the analysis and discuss our methodology in relation to these below:

- ✈   the inclusion of Dublin in the connectivity data;

- ✈   treatment of 'stopping' services to Australia / New Zealand;

- ✈   what constitutes a possible connection between airlines at relevant hub airports.

2.7 At this time, it is beyond the scope of the study to consider the needs of communities in terms of connectivity (as opposed to what is available to them). Instead the report's key aims are to look at the breadth of connectivity offered and the differences between individual airports in this respect. As a result, we have not analysed available data to identify where there is demand that is unserved or underserved from a local airport, and therefore we have not sought to highlight specific network gaps which could be filled through direct connectivity or indeed through new hub connections, including through a potentially expanded Heathrow.

2.8 However, as a proxy measure to overcome this, the scope did require us to consider connectivity in terms of 'Major' destinations, which should be points with higher demand and thus represent the needs of users. This is considered further below.

Connectivity

2.9 There are a number of ways to define connectivity, but for consistency with DfT, we follow an approach based upon the number of destinations served from an airport, either directly or indirectly (via a hub), and the frequency of service.

2.10 The DfT define connectivity on the basis of routes served 'daily' and 'weekly', defining these as at least 360 departures per year and 51 departures per year respectively to reflect that some services may be cancelled or not scheduled on a limited number of occasions over each year, preventing these from reaching 365 and 52 departures per year respectively. However, there are some difficulties with this approach, particularly when considering that much of the CAA and DfT analysis is carried out on historic 'actual flown' data. These are discussed further in **Appendix B**. As a consequence, and to enable effective consideration of indirect connectivity, we have used OAG schedules data to undertake our analysis and adjusted these definitions slightly to present what we believe to be as accurate as possible a view of 'daily' and 'weekly' connections.

2.11 As we have used actual scheduled data, rather than flown data, we have used the following connectivity measures:

→ At Least Daily, determined by <u>at least</u> 360 planned services per annum; and

→ At Least Weekly, determined by <u>at least</u> 50 movements across the year.

2.12 These numbers vary slightly from those of DfT because, on a promulgated basis, we believe that most passengers would perceive these as daily or weekly. It should be noted that throughout this report we reported At Least Weekly services as including within the total those services that are served on an At Least Daily basis. In other words, the number of destinations served At Least Weekly is a cumulative total including those served at least daily.

2.13 In both cases we have also used aggregated data for the whole of 2017 and so to overcome the previously identified issue of flights being concentrated in a shorter period of the year we have applied a secondary check based on two example weeks of the year, one covering early summer and another mid-winter, applied as follows:

✈ For daily services the annual frequency must be a minimum of 360, and the service must also operate for a minimum of 7 days in each example week; and

✈ For weekly services, the annual frequency must be a minimum of 50, and the service must operate at least once per in each example week.

2.14 We have based the connectivity count on the number of destination cities served, rather than the number of airports served. In some cases, cities are served by more than one airport and in most cases it will not matter which airport a passenger chooses to use to reach their destination, so the important factor is that they can reach their destination city in some way.

2.15 The result is a 'simple' assessment of the number of destination cities served from each of the assessment airports, providing a general view of connectivity available from each. This approach recognises that both leisure and business destinations have a value to society. It is, however, essentially agnostic as to which destinations are of greater value (business or leisure). Whilst consideration was given to categorising destinations as either business, leisure or mixed, we believe this is not easily achievable on a consistent basis requiring a large number of subjective judgements to be made. Provision of the analysis based around 'Major' and 'Emerging Market' destinations goes some way to measuring the value of the destinations served and the definitions of these are discussed later in this section.

2.16 However, we do believe it remains appropriate to consider the connectivity offered by the UK's airports from the perspective of the value they offer to business users. To do this we have applied our own Business Connectivity Index (BCI) as an additional measure within the analysis. This uses research undertaken by the Globalisation and World Cities Network (GaWC) to value destinations cities in terms of their status as world cities. This value is then weighted by the level of frequency offered to these destinations. From the perspective of the business user, this then includes not only the destinations served but also the frequency of services, which is a key determinant of utility. Weighting is applied to the frequency to recognise that there is a point at which adding extra frequency on a route has a diminishing additional value. This weighting has been estimated using regression analysis comparing business usage with frequency.

2.17 The above sets out our approach and assumptions in terms of considering 'direct' connectivity from the UK's airports. Connections to hub airports, however, also play an important role in providing 'indirect' connectivity to the UK. To consider this we have used OAG schedules to enable us to consider both the number of destinations served (weekly and daily) and the BCI score for one-stop connections via the major hubs serving the UK market (the identity of these hubs is discussed below). To do this we have extracted all the scheduled flight times over a typical summer and winter week (consistent with those used in the direct frequency analysis) and matched flights arriving into hubs with flights departing from the same airport, limiting the analysis to what we have termed 'valid' connections:

✈ these are onward flights that depart within a specific time window following the arriving flight from the UK airport. This window reflects a minimum and maximum connecting time for each airport (the times are outlined with the hub definitions below);

✈ connections are only be allowed between the relevant hub airline, alliance members and their affiliates plus between Flybe and Virgin and Skyteam flights and between bmi regional and Star Alliance flights at relevant hubs. These latter adjustments reflect particular relationships between these specific airlines and the relevant alliances in serving the UK market;

✈ the routing taken by a passenger must be geographically rational. In other words, the onward flight from the hub airport must not involve significant backtracking or be involve significant deviation of the great circle path. For instance, while it would be rational for a passenger to choose a Middle East hub to travel to Asia, it would not be rational for that passenger to choose the same hub to reach North America.

2.18 For the purposes of BCI assessment, the connectivity offered by indirect services has been weighted by the journey time for the identified routings compared to a notional direct routing from the UK to the final destination[1]. This recognises that a direct frequency should be more attractive, all other things being equal, and therefore should receive a higher rating in terms of a connectivity score for business users.

2.19 These various indicators have been presented in our analysis in Section 3, providing rankings of UK airports in connectivity terms.

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[1] The average observed journey time (including wait times) via all indirect routings from OAG is divided by the estimated direct flight time to provide an adjustment factor, which is then used to deflate the number of indirect frequencies to the final destination. This has the effect of reducing the value of an indirect frequency in the BCI analysis.

Major International and Emerging Destinations

2.20   DfT does not currently have any definitions around 'Major' and 'Emerging' markets from the UK. It should be recognised that identifying either requires some level of subjective judgement to be made. However, we have attempted to do this in a defined way, which would provide a rationale for replicating the work, even if the destinations change over time as a result.

2.21   For the 'major' markets, we looked at the largest final destinations to/from the UK which cumulatively account for 80% of all air travel demand, taken from CAA survey data across all surveyed airports in 2016[2]. This is based on the end destination of passengers, so if they travel to a hub to then access their final destination, then it is the latter which is counted as this reflects the actual connectivity needs of passengers travelling to and from the UK.

2.22   A total of 141 airports (rather than city) destinations account for 80% of all air travel demand to/from and within the UK currently. Although prime facie this appears to be a large number of airports for our assessment, it represents only 8.5% of all destinations for which there is demand to/from the UK. In considering connectivity in relation to the potential new runway at Heathrow, it would be typical to consider international destinations and access to these as little domestic connectivity is offered by flights to/from the Airport. Therefore in defining the list of 'major' destinations, we have focused solely on international points. This varies from the overall counts of destinations served and the BCI scores, which include domestic destinations to reflect that these do still have some value to regional users, which may in some cases be higher than the value placed on many international destinations.

2.23   In establishing this approach to determining the 'major' destinations, we ruled out a number of other options which focused on a smaller number of destinations, including, among others:

✈   destinations that make up 50% of total demand;

✈   the top 50 or top 100 destinations; and

✈   splitting the definition between short haul and long haul destinations and considering the top 30 short haul or the top 20 long haul.

2.24   These options resulted in the omission of a number of destinations which in our view would also be considered as 'major'. Therefore, we believe that the 80% option reflects the best balance at present. The full list of 'major' destinations can be found in **Appendix C**.

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[2] Whilst the connectivity analysis was undertaken based on 2017 data, the corresponding final survey data was not available for determining 'Major' markets at the time of producing the work. However, it is not expected that there would be much change in this analysis from one year to the next, with any change likely to occur over longer periods of time.

2.25 It is harder to use existing statistical and survey information to determine emerging markets, which by their nature may have relatively low demand presently but which could be expected to have a greater influence in the future. However, there are a wide range of potential definitions of emerging markets in broader economic development publications and it should be noted that there is substantial crossover in these definitions.

2.26 As a result, we have chosen to use countries defined by the International Monetary Fund (IMF) as 'emerging', which presently covers 23 nations globally. We have therefore assumed all destinations within these countries count as 'emerging' within our analysis. It should be noted that we have not considered major international destinations and emerging markets on a mutually exclusive basis. In other words a destination could appear in both lists.

2.27 The 23 emerging markets are: Argentina, Bangladesh, Brazil, Bulgaria, Chile, China, Colombia, Hungary, India, Indonesia, Malaysia, Mexico, Pakistan, Peru, Philippines, Poland, Romania, Russia, South Africa, Thailand, Turkey, Ukraine and Venezuela.

Hubs

2.28 There are a significant number of airports which serve as hubs for passengers travelling to/from the UK, with some providing significant global reach, and others acting in a more niche way, serving specific smaller markets. However, whilst they all contribute to the connectivity value of the UK, it is not practical to run the analysis across all such airports given the huge range of schedules data that this would involve. Furthermore, the value of analysing the connectivity of all of these hubs diminishes when it is considered that many of them are actually only served from London Heathrow anyway and as a result the connectivity value, when considering regional airports, will be low from an extensive list of hubs.

2.29 DfT's own list of hubs is relatively short and is taken from its passenger forecasting model. Based on our experience, this list appears to miss some key hubs which provide significant connectivity benefits across the UK, particularly to regional airports. Therefore, we have sought to expand the list, but retain a manageable and definitive position. We reviewed all airports which act as hubs for passengers to/from the UK and, combining all passengers making onward connections through these, have established the top 10 short haul (though with onward passenger flying to short haul and long haul destinations) and top 10 long haul hubs. We have also included New York Newark alongside the New York JFK hub, so both major airports in New York feature in the analysis. In 2016, from surveyed airports in the UK, these airports represented 9.3% of all airports at which connections were made, but handled over 63% of onward connecting passenger, illustrating their dominance and importance in this study.

2.30 The hubs are Dubai, Doha, Abu Dhabi, Amsterdam, Istanbul, Hong Kong, Frankfurt, Singapore, Paris (CDG), London (LHR), Madrid, Chicago (ORD), New York (JFK+EWR), Atlanta, Johannesburg, Delhi, Munich, Dublin, Copenhagen and Keflavik.

2.31   A further consideration in determining the appropriate hubs is that if the core hubs across a variety of global regions are included then it could be assumed that they should provide excellent coverage of onward destinations.   Consequently, adding further hubs to the analysis would not necessarily show a greater breadth of possible onward destinations served via hubs, but would merely duplicate many of the points that can be reached. Furthermore in the BCI analysis for business connectivity, the results are moderated by frequency such that adding additional flight frequencies to reach a final destination has diminishing returns as previously explained.   For these reasons, we believe that this list of hubs represents a good picture of how well connected the UK's airports really are through hubs.

2.32   One of the changes occurring now in hub connectivity terms is the decision by low fares airlines to offer onward connectivity through key bases, either onto their own services or in partnership with other airlines (through interline agreements).   It is possible these activities could change the picture of hub connectivity very quickly from the UK's airports given the range and frequency of services offered by these airlines.   However, in choosing to use a definitive point of 2017 for our analysis, these services remained only in their infancy and therefore did not register on the top 10 lists for hubs, and therefore we have not attempted to define the conditions on which passengers may have used these airlines for global connectivity.

2.33   Whilst most regional airports of any size have some form of hub connection (provided by a hub carrier or an affiliate), there are a limited number of cases where there is no such service. In addition, some of the airports in the Scottish Highlands and Islands are reliant on the core Scottish airports as their hubs to access not only international points, but also other parts of the UK and Scotland.   We did consider the inclusion of Edinburgh and Glasgow as hubs in order to consider the connectivity benefits offered to these remote locations, but decided not to include these in order to treat all UK airports consistently and provide a comparative basis for the study.

2.34   This does, however, highlight the likely different connectivity needs of different regions of the UK, and we are able to highlight connectivity gaps in terms of network breadth through hubs, but this analysis may not reflect the underlying demand to use new services if further connections could be encouraged.

2.35   Our approach to measuring connectivity through hubs has been outlined earlier in this report, but **Table 2.1** illustrates the minimum and maximum connecting times defined for the hubs in our analysis.   In most cases these have been taken directly from airline information related to their hubs, though in a limited number of cases we have had to apply our own assumptions to these where information was not available, and hence set these down clearly overleaf.

Table 2.1: Minimum and Maximum Connecting Time Assumptions (Minutes)		
Hub	**Min. Connecting Time**	**Max. Connecting Time**
Abu Dhabi	60	275
Amsterdam	45	180
Atlanta	75	180
Chicago	75	180
Copenhagen	40	180
Delhi	75	240
Doha	45	300
Dubai	60	310
Dublin	90	240
Frankfurt	60	180
Hong Kong	60	240
Istanbul	60	240
Johannesburg	75	240
Keflavik	60	180
London Heathrow	60	180
Madrid	45	180
Munich	30	180
New York (EWR)	75	210
New York (JFK)	75	240
Paris (CDG)	60	180
Singapore	60	180
Source: Airline data, York Aviation		

Dublin Airport

2.36 Northern Ireland (NI) shares a land border with the Republic of Ireland, and surface access connections to Dublin, particularly with recent improvements to the motorway network, mean that a large number of passengers travelling to/from NI choose to do so through Dublin Airport. Therefore, we strongly believed that, as far as practicable, we should include Dublin Airport in all analysis covering connectivity. This is achievable easily from OAG data to cover direct and indirect connectivity, but the DfT's journey time data, which underpins the analysis in Section 4, is unable to provide a full indication of the proximity of the NI population to this Airport, therefore the later analysis has been based on proxies for journey times and a more qualitative assessment on this basis.

3   CONNECTIVITY ANALYSIS

3.1   In this section we consider the connectivity available across the 43 assessment airports (including Dublin) both by direct and indirect routings. Our analysis in this section is based on the approach and assumptions previously outlined.   However, before considering connectivity against the 'major' and 'emerging' markets, we first consider the overall connectivity picture from each airport. This is useful in setting the context against which we can measure the true value of each airport.

Connectivity to All Destination Cities

3.2   The total number of city destinations served directly varies significantly across all the UK airports included in the study. The number of destinations served by regular flights in 2017 is shown in **Table 3.1** overleaf. This list includes those operated for the summer or winter periods only, and as such does not meet the connectivity criteria outlined in Section 2. However, the results do usefully shows the scale of airports by comparison to each other. Whilst Heathrow is considered the key UK hub, it is interesting to note that over the course of 2017 it served fewer destinations than both Gatwick and Manchester and only a limited number more than Stansted.

3.3   There are a number of reasons for this:

✈   Heathrow is considered to be 'full' and as a consequence airlines have consolidated their activities onto core routes, favouring frequency over network breadth to maximise yields. Essentially, more marginal routes have been dropped;

✈   Manchester, Gatwick and Stansted all have higher proportions of leisure passengers and a greater leisure focus on their networks. This provides a larger pool of destinations than would be considered as 'core' to Heathrow's network;

✈   Manchester, Gatwick and Stansted all have large low fare airline bases, and these carriers have historically been driven more by passenger volumes than by fare yields, and thus have typically sought to offer a wider breadth of network so as to appeal to a greater array of passengers. Furthermore, by offering very low fares, these airlines have been able to stimulate markets and generate a new discretionary travel market which requires a greater number of destinations to keep passengers interested in their services.

3.4   At the lower end of the scale, many of the Scottish airports have a very limited number of destinations, covering the essential lifeline links back to the Central Belt airports of Glasgow or Edinburgh.

Table 3.1: Total Destinations Cities Served Directly in 2017		
Airport	**2017 Terminal Passengers (millions)**	**Number of Destination Cities**
London Gatwick	45.6	233
Manchester	27.8	212
London Heathrow	78.0	202
London Stansted	25.9	190
Dublin	29.6	171
Birmingham	13.0	152
London Luton	16.0	136
Edinburgh	13.4	126
Bristol	8.2	122
Glasgow	9.9	113
Newcastle	5.3	81
East Midlands	4.9	81
Leeds/Bradford	4.1	72
Liverpool	4.9	69
Belfast International	5.8	62
London City	4.5	53
Cardiff	1.5	50
Doncaster Sheffield	1.3	44
Aberdeen	3.1	42
Southampton	2.1	40
Exeter	0.9	35
London Southend	1.1	33
Bournemouth	0.7	24
Belfast City	2.6	23
Norwich	0.5	20
Newquay	0.5	19
Glasgow Prestwick	0.7	18
Inverness	0.9	13
Kirkwall	0.2	13
Humberside	0.2	11
Sumburgh	0.3	6
Durham Tees Valley	0.1	6
Stornoway	0.1	5
City of Derry	0.2	3
Tingwall	0.0	3
Tiree	0.0	3
Islay	0.0	3
Wick	0.0	2
Benbecula	0.0	2
Campbeltown	0.0	1
Dundee	0.0	1
Barra	0.0	1
Source: OAG, CAA Statistics, Dublin Airport Authority		

3.5 However, as outlined in Section 2, a simple count of all destinations served through the year at an airport provides a limited picture of the connectivity value offered by each Airport and therefore needs to be looked at in the context of our defined levels of connectivity:

✈ At Least Daily, determined by <u>at least</u> 360 planned services per annum;

✈ At Least Weekly, determined by <u>at least</u> 50 movements across the year; and

✈ BCI scores related to business connectivity.

3.6 The results of our analysis of the number of destination cities that can be reached At Least Daily and At Least Weekly from each assessed airport is set out in **Table 3.2**. Once again, it should be remembered that the At Least Weekly figures include destinations that are served on an At Least Daily basis.

3.7 Table 3.2 also presents the number of destination cities that can be reached via both direct services and indirect routings using the hub airports set in Section 2, even where these overlap with available direct destinations. Hence, although ranked by total, these are not strictly additive, and we consider the cumulative value of hubs over direct services later in this section. The analysis set out in Table 3.2 is helpful in understanding the total scale of connectivity offered by indirect services.

3.8 In terms of destinations that are served At Least Daily compared to all the destinations served, unsurprisingly Heathrow moves back up the list on a direct basis and also has the by far the largest number of destinations served indirectly on the same basis (62% of all direct destinations are served at least daily). More interesting is the rate at which destinations fall away from the regional airports on this metric. This can be seen at larger airports, such as Manchester and Gatwick, but particularly at airports in the middle of the passenger throughput range. Whilst Manchester and Gatwick see around 35% and 31% of their annual destinations served at least daily, this number falls significantly at airports such as Birmingham (21%), Edinburgh (18%), Bristol (16%) and Liverpool (10%). At the lower end of the scale, such as the Scottish regional airports, the difference is less dramatic, as the limited number of destinations served do tend to be served daily. Typically:

✈ airports serving over 15 million passengers per annum (mppa), excluding Dublin and Heathrow, have an average of 28% of their destinations served at least daily. As a capital city Airport, Dublin's rate is higher at 37%;

✈ for airports between 3mppa and 15mppa, the average falls to 21% of annual destinations served at least daily;

✈ airports serving between 0.5mppa and 3mppa (including Newquay) see an average of 17% of their destinations served at least daily; and

Table 3.2: Numbers of Destination Cities Served and Level of Service									
Destination Cities Served At Least Daily				Destination Cities Served At Least Weekly					Diff. in Rank
Rank	Airport	Direct	Indirect	Total	Rank	Airport	Direct	Indirect	Total	
1	Heathrow	126	432	558	1	Heathrow	164	549	713	0
2	Manchester	52	283	335	2	Manchester	115	397	512	0
3	Dublin	64	243	307	3	Dublin	100	366	466	0
4	Birmingham	32	218	250	4	Birmingham	71	354	425	0
5	Aberdeen	19	176	195	5	Edinburgh	67	287	354	1
6	Edinburgh	22	171	193	6	Gatwick	137	172	309	2
7	Glasgow	24	150	174	7	Glasgow	51	229	280	0
8	Gatwick	73	97	170	8	Aberdeen	26	228	254	-3
9	Newcastle	14	144	158	9	Newcastle	32	214	246	0
10	Bristol	20	107	127	10	Bristol	63	178	241	0
11	Leeds/Bradford	9	98	107	11	London City	29	159	188	1
12	London City	22	81	103	12	Southampton	21	147	168	1
13	Southampton	13	82	95	13	Leeds/Bradford	25	140	165	-2
14	Belfast City	10	81	91	14	Cardiff	20	133	153	1
15	Cardiff	8	75	83	15	Stansted	131	0	131	4
16	Humberside	2	69	71	16	Belfast City	15	107	122	-2
17	Durham Tees Valley	2	67	69	16	Norwich	8	114	122	2
18	Norwich	4	63	67	18	Humberside	3	109	112	-2
19	Stansted	57	0	57	19	Durham Tees Valley	3	108	111	-2
20	Inverness	5	35	40	20	London Luton	90	0	90	1
21	London Luton	35	0	35	21	Exeter	17	72	89	1
22	East Midlands	9	4	13	22	East Midlands	31	53	84	0
22	Exeter	2	11	13	23	Doncaster Sheffield	20	54	74	4
24	Belfast Int.	11	0	11	24	Inverness	9	49	58	-4
25	Liverpool	7	0	7	25	Liverpool	43	0	43	0
25	Kirkwall	7	0	7	26	Belfast Int.	23	0	23	-2
27	Doncaster Sheffield	1	4	5	27	Kirkwall	10	0	10	-2
28	Sumburgh	4	0	4	28	Prestwick	9	0	9	12
29	Southend	3	0	3	28	Southend	9	0	9	1
29	Newquay	3	0	3	30	Bournemouth	8	0	8	10
29	Stornoway	3	0	3	31	Newquay	5	0	5	-2
32	Benbecula	2	0	2	31	Stornoway	5	0	5	-2
33	Tingwall	1	0	1	33	Sumburgh	4	0	4	-5
33	Tiree	1	0	1	34	City of Derry	3	0	3	6
33	Islay	1	0	1	34	Tingwall	3	0	3	-1
33	Wick	1	0	1	34	Tiree	3	0	3	-1
33	Campbeltown	1	0	1	37	Benbecula	2	0	2	-5
33	Dundee	1	0	1	37	Wick	2	0	2	-4
33	Barra	1	0	1	39	Barra	1	0	1	-6
40	Bournemouth	0	0	0	39	Campbeltown	1	0	1	-6
40	Prestwick	0	0	0	39	Dundee	1	0	1	-6
40	City of Derry	0	0	0	39	Islay	1	0	1	-6
Note: Ranked by 'Total' though Direct and Indirect are not strictly additive as there may be overlap in destinations.									
Source: York Aviation analysis of OAG.									

✈   for airports with less than 0.5mppa, the rate rises rapidly back up to an average of 56% of all destinations served at least daily.

3.9   The importance of hub connections to regional airport also becomes clear. In many cases the number of indirect destinations served at least daily is higher than the total annual direct destinations available at all frequencies across the year from airports. The value of having multiple hub carriers serving an airport is also clear. For airports served by a single hub airline, the range of onward destinations available at least daily is typically around 60-70 (for example Humberside, Norwich and Durham Tees Valley, all served solely by KLM as a hub airline), whilst airports such as Edinburgh, Aberdeen and Bristol, with multiple hub airlines quickly see their destination counts rise.

3.10   If we consider the numbers of destinations served At Least Weekly, the pattern begins to change.

3.11   The number of destinations served At Least Weekly by Heathrow is of course higher than the number served At Least Daily (as the latter is a subset of the former) but the growth is relatively limited. Around 81% of destinations are served At Least Weekly. In other words the number of destinations that are served less than daily from Heathrow but more than weekly is relatively limited. This is for a number of reasons:

✈   the majority of its core destinations are served at least daily; and

✈   of the non-daily destinations, many are low frequency, summer-only destinations served by British Airways as they reduce capacity to business orientated destinations in the summer months.

3.12   On the whole the majority of UK regional airports have a higher percentage of destinations served at least weekly year-round than at least daily, and hence the total number of destinations served At Least Weekly grows substantially compared to the At Least Daily figures. However, there is evidence that the trend is reversed for smaller airports. Broadly:

✈   Airports serving over 15 million passengers per annum (mppa), excluding Dublin and Heathrow, have an average of 62% of their destinations served At Least Weekly;

✈   For airports between 3mppa and 15mppa, the average falls to 48% of annual destinations served At Least Weekly;

✈   Airports between 0.5mppa and 3mppa (including Newquay) see an average of 45% of their destinations served At Least Weekly; and

✈   Airports with less than 0.5mppa the rate falls to an average of 82% of all destinations served At Least Weekly, reflecting the focus of many on 'lifeline' type services, which are generally served At Least Daily.

3.13   For indirect connections served At Least Weekly, the increase from the number of destinations served At Least Daily is relatively limited in many cases. This is because most hubs are set up to maximise connections and therefore are reliant on higher frequencies across the week to offer the maximum level of coverage for travellers in order to offer a competitive product against competitor airlines and their hubs. For only a limited number of regional airports is this not the case, and on the whole these are the ones served by the lowest frequency of flights to hubs, including Exeter, East Midlands and Doncaster.

Major and Emerging Destination Connectivity

3.14   As highlighted above, the analysis of overall destinations and the frequency at which these are served is useful for providing an overview of the scale of activity offered by airports, but may not fully highlight the value of the networks provided. Based on the definitions outlined in Section 2, we have undertaken the same analysis for 'Major' and 'Emerging' destinations. We have analysed the major and emerging markets with some reference back to the overall number of destinations served from each airport, but it is important to recognise that the analysis below is based on international destinations only, and so airports with a greater reliance on domestic networks will see a noticeable change from those with much stronger international markets.

3.15   **Table 3.3** illustrates the scales of the networks based on the number of major destinations served At Least Daily and At Least Weekly throughout the year respectively. Again, the results may show duplication in destinations between the direct and indirect analysis, and we adjust for this later in the section, illustrating the net benefits of the indirect services.

3.16   Our analysis clear demonstrates the important role Heathrow plays in providing the greatest number of direct services to major destinations on an At Least Daily basis. Major destinations at Heathrow account for 63% of all destinations served at least daily. This is low compared to many other UK examples (Manchester at 79%, Gatwick at 81%, Bristol 75% etc.) and reflects two points:

✈   Heathrow's role, as the UK's gateway airport, can sustain higher frequencies to emerging or more niche destinations, such as Beirut and Tehran, which are not included in the major destination list; and

✈   Heathrow has eight domestic links. If these are deducted then major destinations make up 67% of Heathrow's daily (or greater) services.

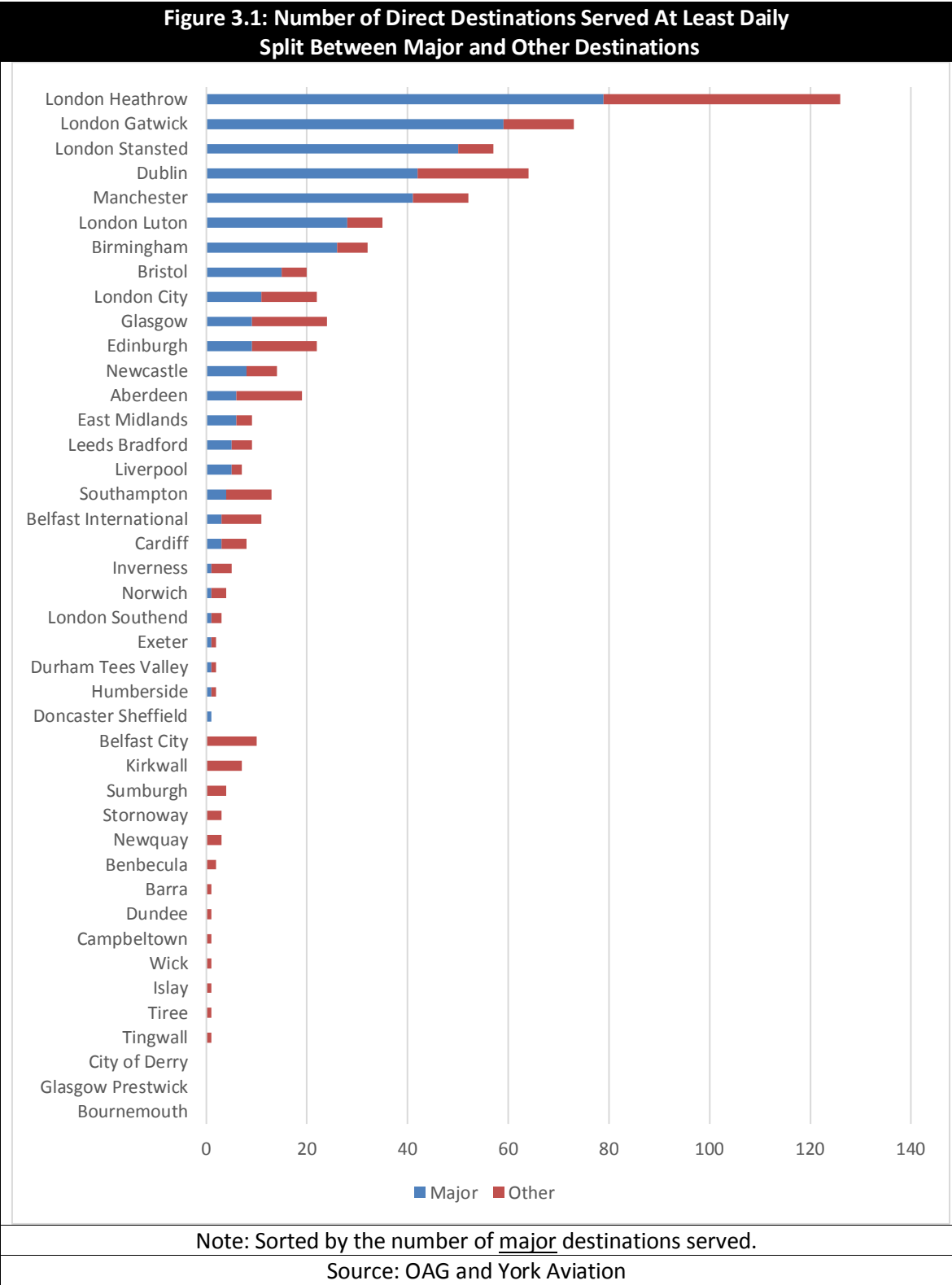| Table 3.3: Numbers of <u>Major</u> Destination Cities Served and Level of Service									
Destination Cities Served At Least Daily					Destination Cities Served At Least Weekly				Diff. in Rank
Rank	Airport	Direct	Indirect	Total	Rank	Airport	Direct	Indirect	Total	
1	Heathrow	79	106	185	1	Heathrow	85	110	195	0
2	Manchester	41	98	139	2	Manchester	83	105	188	0
3	Dublin	42	96	138	3	Dublin	67	112	179	0
4	Birmingham	26	92	118	4	Birmingham	56	104	160	0
5	Gatwick	59	43	102	5	Edinburgh	51	93	144	1
6	Edinburgh	9	86	95	6	Bristol	52	84	136	4
7	Glasgow	9	83	92	7	Gatwick	81	54	135	-2
8	Aberdeen	6	85	91	8	Glasgow	30	88	118	-1
9	Newcastle	8	75	83	9	Newcastle	24	87	111	0
10	Bristol	15	65	80	10	Aberdeen	11	97	108	-2
11	Leeds/Bradford	5	65	70	11	London City	16	80	96	1
12	London City	11	56	67	12	Leeds/Bradford	18	77	95	-1
13	Belfast City	0	65	65	13	Southampton	10	74	84	1
14	Southampton	4	57	61	14	Belfast City	1	76	77	-1
15	Cardiff	3	54	57	14	Cardiff	13	64	77	1
16	Stansted	50	0	50	16	Stansted	70	0	70	0
17	Norwich	1	48	49	17	East Midlands	23	42	65	6
18	Humberside	1	44	45	17	Norwich	4	61	65	0
19	Durham Tees Valley	1	43	44	19	Humberside	1	58	59	-1
20	Inverness	1	32	33	20	Durham Tees Valley	1	57	58	-1
21	London Luton	28	0	28	20	Exeter	8	50	58	2
22	Exeter	1	11	12	22	London Luton	54	0	54	-1
23	East Midlands	6	4	10	23	Doncaster Sheffield	16	27	43	2
24	Liverpool	5	0	5	23	Inverness	2	41	43	-3
25	Doncaster Sheffield	1	3	4	25	Liverpool	35	0	35	-1
26	Belfast Int.	3	0	3	26	Belfast Int.	15	0	15	0
27	Southend	1	0	1	27	Prestwick	9	0	9	1
28	Benbecula	0	0	0	28	Bournemouth	8	0	8	0
28	Bournemouth	0	0	0	29	Southend	7	0	7	-2
28	Barra	0	0	0	30	Newquay	1	0	1	-2
28	Campbeltown	0	0	0	31	Barra	0	0	0	-3
28	Dundee	0	0	0	31	Benbecula	0	0	0	-3
28	Islay	0	0	0	31	Campbeltown	0	0	0	-3
28	Kirkwall	0	0	0	31	City of Derry	0	0	0	-3
28	City of Derry	0	0	0	31	Dundee	0	0	0	-3
28	Sumburgh	0	0	0	31	Islay	0	0	0	-3
28	Tingwall	0	0	0	31	Kirkwall	0	0	0	-3
28	Newquay	0	0	0	31	Stornoway	0	0	0	-3
28	Prestwick	0	0	0	31	Sumburgh	0	0	0	-3
28	Stornoway	0	0	0	31	Tingwall	0	0	0	-3
28	Tiree	0	0	0	31	Tiree	0	0	0	-3
28	Wick	0	0	0	31	Wick	0	0	0	-3
Note: Ranked by 'Total' though Direct and Indirect are not strictly additive as there may be overlap in destinations.									
Source: York Aviation analysis of OAG.									

3.17 **Figure 3.1** overleaf shows the number of direct destinations served At Least Daily split between Major destinations and other destinations. The variance in this is significant across regional airports and a few key points are worth considering:

✈ whilst having strong domestic networks, Manchester, Birmingham and Bristol have heavy international focuses on their demand and networks, leading to a higher percentage of their 'at least daily' flights being to major destinations;

✈ for Manchester and Birmingham this also reflects their role as UK regional gateways for a number of full service airlines that tend to operate at higher frequencies to support business users and feed hubs;

✈ key Scottish airports such as Glasgow and Edinburgh do comparatively badly on this measure because a larger percentage of their 'at least daily' flights are actually to domestic points, which are excluded from the major destination list;

✈ whilst the breadth of major destinations served at least daily is broad from some airports, covering city, leisure and long haul points, from many it is leisure orientated destinations such as Alicante and Malaga, which underpin the higher frequencies;

✈ a large number of airports have no 'at least daily' service to any major destinations. This mainly covers the Scottish regional airports, but also Bournemouth, Glasgow Prestwick and City of Derry, from which there are no 'at least daily' services to any destinations at all, whether major or otherwise;

✈ Doncaster scores highest as a percentage of 'at least daily' flights serving major destinations, but this is the result of only having one destination at this frequency throughout 2017.
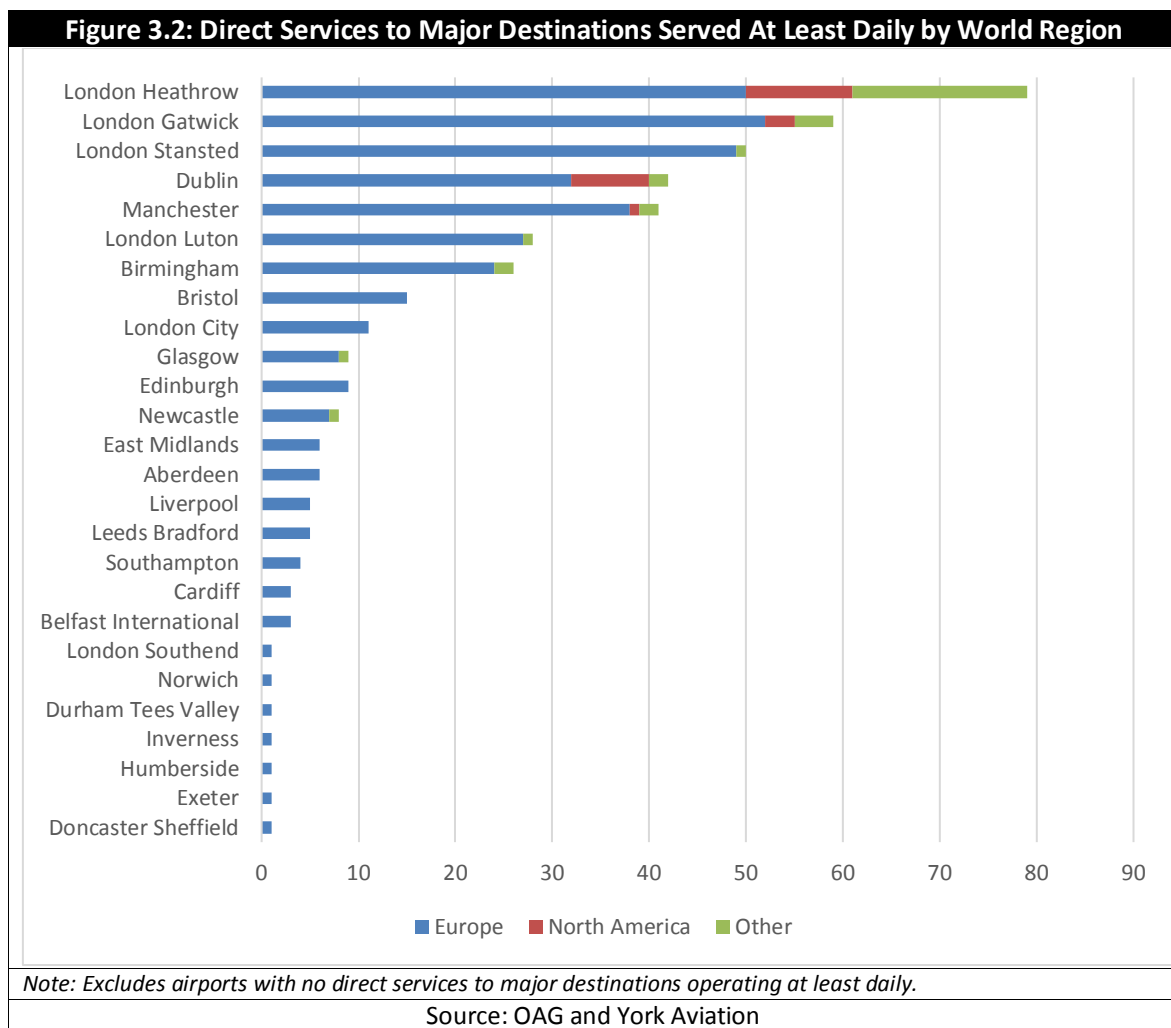
3.18 Across all airports, much of the 'at least daily' frequency to major destinations is driven by hub airlines and KLM plays a key role in this with its links to Amsterdam. Typically these services are operated between 3 and 5 times daily from smaller regional airports. Flybe's role is also important to recognise, in that its links with Skyteam carriers KLM and Air France has allowed a number of daily (often single-daily) services to be launched to either the Amsterdam or Paris hubs of these airlines. In combination, these carriers account for all 'at least daily' services to major destinations from Norwich, Inverness, Doncaster/Sheffield, Exeter, Humberside, Durham Tees Valley, and London Southend. Belfast City just misses out on this, with 6 weekly flights by KLM to their Amsterdam hub.

Figure 3.1: Number of Direct Destinations Served At Least Daily Split Between Major and Other Destinations

Note: Sorted by the number of _major_ destinations served.

Source: OAG and York Aviation

3.19   In terms of the number of major destinations which are directly served at least weekly (which includes those served at least daily), the patterns observed are very similar to those for all destinations. Heathrow does not at significantly to the number of destinations from its at least daily position because most of the major destinations from the airport are capable of sustaining at least daily flights. Similarly, due to the scale of the market available to Gatwick, it is able to sustain more services to major destinations at least daily than it does at least weekly (59 are at least daily, adding only 22 at least weekly).

3.20   Indirect connections also see only a limited increase in major destinations served at this frequency, largely because, as highlighted previously, most hub airlines seek to serve many of their destinations on at least a daily basis. In a limited number of cases, where hub connections from the UK are less frequent, such as from Exeter and Doncaster/Sheffield, the number of major points which can be reached at the lower 'at least weekly' frequency does increase, reflecting how slight flight time changes over the course of a week for the UK and onward flights, can impact on daily connectivity.

3.21   Beyond this, for direct services, most UK regional airports, in so far as they serve major destinations (i.e. many of the Scottish regional and other smaller UK airports do not serve any major destinations), see a significant increase in the number of destinations which can be reached year-round at least once weekly compared to at least daily.

3.22   For some, such as Manchester, the number of destinations served at least weekly approximately doubles from those served at least daily, reflecting relative strength in the at least daily network. For others the increase is more significant, for example Edinburgh jumps from 9 such destinations reached at least daily to 51 reached at least weekly. Examples, highlighting the pattern across most UK regional airports, include:

✈   Doncaster/Sheffield climbs from one major destination reached at least daily to 16 reached at least weekly;

✈   Bristol more than doubles, climbing from 15 major destination reached at least daily to 52 reached at least weekly;

✈   Belfast International rises from 3 destinations served at least daily to 15 served at least weekly.
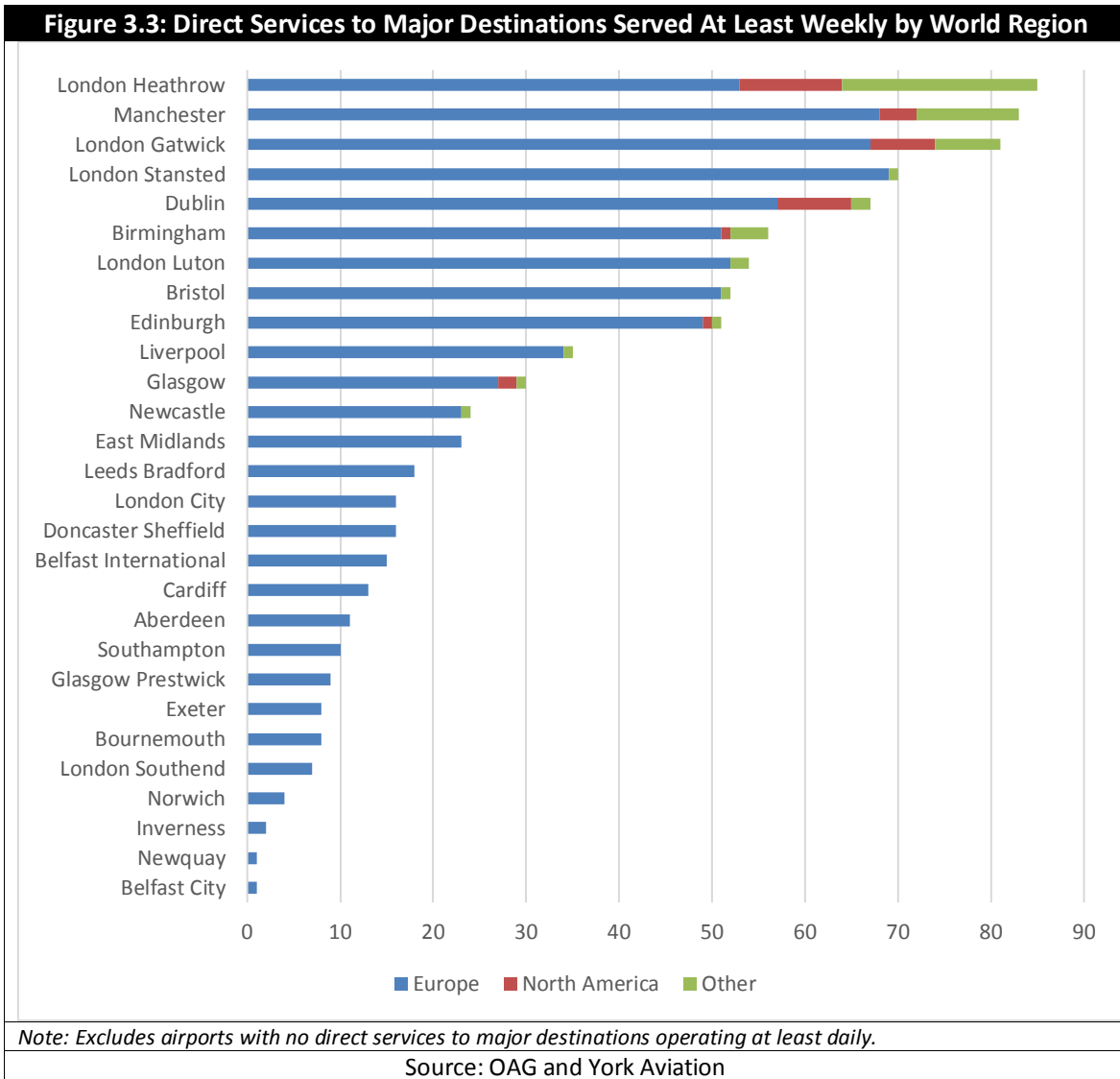
3.23 Whilst we explore the way in which airports gain their connectivity from different types of airlines later in this section, it is worth highlighting that in many cases, the increase in major points served at least weekly compared to at least daily perhaps reflects the nature of airlines serving these routes. Clearly, with a more limited underlying demand from regional points (than from larger cities such as London and Manchester), and the dominance of low fares airlines operating larger aircraft, the scope for more flights to major destinations at higher frequencies is limited. Whereas historically many airports may have seen 50-seat regional aircraft providing them with multiple weekly or even daily frequencies, the use of larger aircraft (3 to 4 times larger than regional aircraft), even with stimulation associated with low fares carriers, has seen an overall reduction in frequency to key points. For those wishing to reach major destinations at a higher frequency, this has perhaps pushed more emphasis onto hub connectivity.

3.24 **Figure 3.2** shows the number of major destinations served at least daily by broad world region.

Figure 3.2: Direct Services to Major Destinations Served At Least Daily by World Region

Note: Excludes airports with no direct services to major destinations operating at least daily.

Source: OAG and York Aviation

3.25 This clearly illustrates that, whilst Heathrow has a broad global network of major destinations, frequent services to major destinations from all UK airports are dominated by Europe. This is not surprising, although it is interesting to note that Heathrow actually has a limited offer to central/eastern Europe compared to other airports, with these services congregating more at other airports around London, notably Luton and Stansted. In its role serving Northern Ireland, Dublin provides a high level of service to major destination in Europe and North America, but a much more limited range of direct points throughout other world regions.

3.26 Manchester, as the third busiest airport in the country has a generally good breadth of network, but it is interesting to see that on a year-round basis, it only serves one North American destination at least daily. This is the result of minor service adjustments in the winter months which provide a virtually daily year-round frequency, but not quite sufficient to meet the criteria defined in Section 2.

3.27 **Figure 3.3** overleaf illustrates the same global analysis but for destinations which are directly served at least once per week year round.

3.28 Again, major European destinations dominate across all airports, although the picture shows generally a better mix of global destinations across more of the UK's airports, including at Manchester, Birmingham and Gatwick. In particular the long haul network at Manchester is better represented for 2017 on this basis.

3.29 At this lower connectivity frequency, further destinations start to stand out too, such as points in the Caribbean, serving the leisure markets.

3.30 However, it remains striking how many airports have no long haul presence on a year-round basis even at lower frequency, illustrating the importance of hubs or surface access to larger airports to meet the needs of those wishing to travel outside of Europe.

Figure 3.3: Direct Services to Major Destinations Served At Least Weekly by World Region

Note: Excludes airports with no direct services to major destinations operating at least daily.

Source: OAG and York Aviation

3.31 From this analysis, it is also clear that many regional airports have limited direct services to major European points on either frequency parameter. This explains why hub airlines feeding services out of the regions have a relatively high percentage of passengers connecting within Europe, as passengers seek frequencies and timings that meet their specific needs. Indeed in 2017[3]:

→ from 7 surveyed airports, on KLM marketed flights, 45% of passengers making onward connections through Amsterdam did so to a short haul point in Europe;

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[3] Source: 2017 CAA Final Passenger Survey

✈ on British Airways flights to Heathrow from the UK regions, 40% of passengers making onward connections did so to short haul points in Europe; and

✈ from 4 surveyed airports, on Air France marketed flights, 26% of passengers making onward connections through Paris did so to a short haul point in Europe;

3.32 This analysis around the major destinations is useful in understanding in pure terms how many points can be reached through direct and indirect services from each airport, but it is also important to understand the net benefits of hub services over and above any direct service provision. **Table 3.4** overleaf shows the net benefit of direct and indirect services to major destinations on the basis of services operated at least daily and at least weekly throughout the year. The net connectivity provided by indirect connections is assumed to be connections to destination cities that are not served by direct services from the relevant airport. In other words a destination city can only be counted once within this analysis, regardless of the route by which it is reached. For ease below, we refer to these net destinations as unique destinations.

3.33 By comparison to the 141 identified major destinations, Table 3.4 shows how close to serving all of these destinations each airport can get through a combination of direct and indirect connections. Based solely on direct services, it is the London airports of Heathrow, Gatwick and Stansted which are least reliant on hub connections to provide services to major destinations at least once per day throughout the year. Around 40% of the unique major destinations which can be reached from Manchester and Dublin at this frequency level can be accessed directly without the need to use a hub.

3.34 However, after this, most UK airports are more dependent on hub connections to reach the full breadth of major destinations at least once daily, including Birmingham, Edinburgh and Glasgow.

3.35 We also consider the number of unique major destinations which can be reached directly or indirectly at least once per week throughout the year. When ranked by total unique destinations available at least once weekly, there are a number of interesting changes in the patterns in the data:

✈ Heathrow drops down the rankings, reflecting its focus on higher frequencies as described previously. With lower frequency services included, it is in fact Manchester that the best overall coverage of major destinations;

✈ direct connections dominate lower frequency connectivity from many regional airport major destinations, with hub connections adding little extra value.

Table 3.4: Numbers of <u>Unique Major</u> Destination Cities Served and Level of Service									
Destination Cities Served At Least Daily					**Destination Cities Served At Least Weekly**					**Diff. in Rank**
Rank	Airport	Direct	Indirect	Total	Rank	Airport	Direct	Indirect	Total	
1	Heathrow	79	33	112	1	Manchester	83	37	120	1
2	Manchester	41	65	106	2	Dublin	67	52	119	1
3	Dublin	42	60	102	3	Birmingham	56	61	117	1
4	Birmingham	26	73	99	4	Heathrow	85	30	115	-3
5	Edinburgh	9	79	88	5	Edinburgh	51	55	106	0
6	Glasgow	9	78	87	5	Gatwick	81	25	106	1
6	Gatwick	59	28	87	7	Bristol	52	52	104	3
8	Aberdeen	6	79	85	8	Glasgow	30	71	101	-2
9	Newcastle	8	69	77	9	Aberdeen	11	86	97	-1
10	Bristol	15	57	72	9	Newcastle	24	73	97	0
11	Leeds/Bradford	5	63	68	11	Leeds/Bradford	18	71	89	0
12	Belfast City	0	65	65	12	London City	16	68	84	1
13	London City	11	49	60	13	Southampton	10	68	78	1
14	Southampton	4	55	59	14	Belfast City	1	75	76	-2
15	Cardiff	3	53	56	15	Cardiff	13	59	72	0
16	Stansted	50	0	50	16	Stansted	70	0	70	0
17	Norwich	1	48	49	17	Norwich	4	60	64	0
18	Humberside	1	45	46	18	Humberside	1	59	60	0
19	Durham Tees Valley	1	44	45	19	Durham Tees Valley	1	58	59	0
20	Inverness	1	31	32	20	East Midlands	23	34	57	3
21	London Luton	28	0	28	21	Exeter	8	48	56	1
22	Exeter	1	11	12	22	London Luton	54	0	54	-1
23	East Midlands	6	4	10	23	Inverness	2	39	41	-3
24	Liverpool	5	0	5	24	Doncaster Sheffield	16	24	40	1
25	Doncaster Sheffield	1	3	4	25	Liverpool	35	0	35	-1
26	Belfast Int.	3	0	3	26	Belfast Int.	15	0	15	0
27	Southend	1	0	1	27	Prestwick	9	0	9	1
28	Benbecula	0	0	0	28	Bournemouth	8	0	8	0
28	Bournemouth	0	0	0	29	Southend	7	0	7	-2
28	Barra	0	0	0	30	Newquay	1	2	3	-2
28	Campbeltown	0	0	0	31	Benbecula	0	0	0	-3
28	Dundee	0	0	0	31	Barra	0	0	0	-3
28	Islay	0	0	0	31	Campbeltown	0	0	0	-3
28	Kirkwall	0	0	0	31	Dundee	0	0	0	-3
28	City of Derry	0	0	0	31	Islay	0	0	0	-3
28	Sumburgh	0	0	0	31	Kirkwall	0	0	0	-3
28	Tingwall	0	0	0	31	City of Derry	0	0	0	-3
28	Newquay	0	0	0	31	Sumburgh	0	0	0	-3
28	Prestwick	0	0	0	31	Tingwall	0	0	0	-3
28	Stornoway	0	0	0	31	Stornoway	0	0	0	-3
28	Tiree	0	0	0	31	Tiree	0	0	0	-3
28	Wick	0	0	0	31	Wick	0	0	0	-3
Source: York Aviation analysis of OAG.									

3.36 We have not attempted to allocate the major destination frequencies above by individual airlines or airline types, because passengers will have the option to use multiple airlines if a single carrier is unable to meet all their requirements. For many regional airports it is likely that multiple carriers contribute to the frequencies identified above. **Figure 3.4** illustrates how reliant each airport is on different types of airlines to provide connections to major destinations, across the whole of 2017. It shows the number of frequencies to major destinations offered by full service airlines, low cost carriers and charter airlines[4].

Figure 3.4: Annual Departing Frequencies by Airline Types to Major Destinations
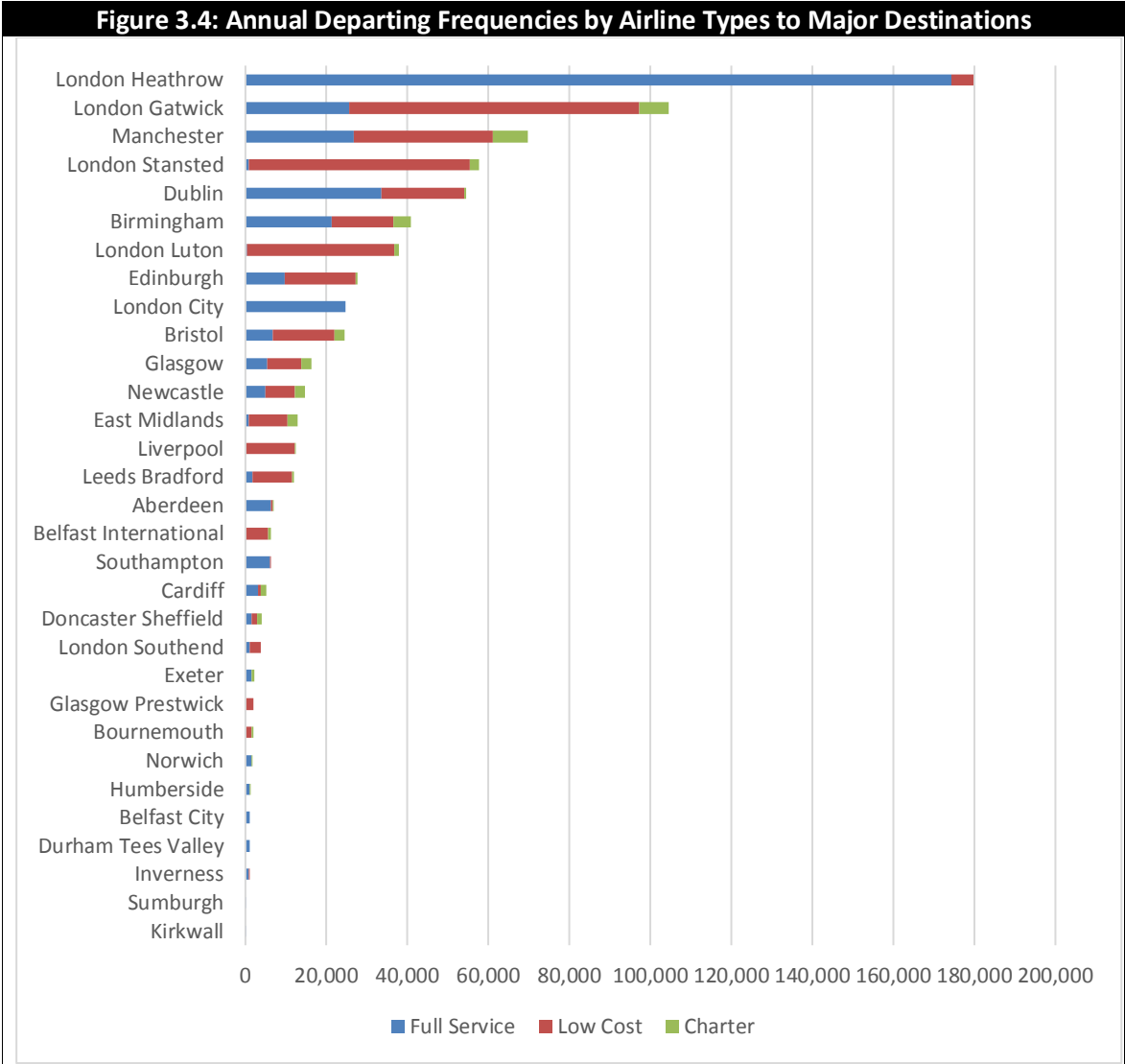
Note: Only includes airports with regular services to major destinations.

Source: OAG and York Aviation

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[4] In reality some airlines operate hybrid models between a number of these categories, but we have followed the OAG allocation of airline types between low cost carriers and full service, except where we have allocated carriers as primarily charter.

3.37 This analysis presents a fairly mixed picture, and this is interesting in its own right because it illustrates the role played by all airlines in providing connectivity, including the charter carriers (who do tend to sell 'seat-only' tickets). Airports such as Gatwick and Stansted see higher frequencies to single destinations by low cost carriers than is typically seen at smaller regional airports and this is reflected in the high percentage of frequencies to major destinations provided by these carriers. It is highly likely that these carriers are also responsible for offering at least daily services to a number of the major points from these airports. By comparison from the regional airports, the greater ratio of frequency provided by full service carriers reflects the fact that these airlines, typically operating smaller aircraft, will likely be operating at higher weekly frequencies than low cost carriers on the same routes.

3.38 It is hard to suggest that the available products of these airlines will not be meeting the needs of users in serving major destinations. Whilst the mainline airlines will often operate higher frequencies and offer more flexibility in terms of fares, the low cost airlines have been making progress on offering greater flexibility to attract a higher proportion of business passengers. Even charter airlines, selling on the basis of inclusive tour or seat-only, will likely be offering a product which is adequate for many passengers, particularly when considering they serve more leisure orientated services where fare flexibility and exact flight timings are less of an issue than attractive fares due to the price sensitivity of leisure travellers.

3.39 **Table 3.5** goes on to illustrate the picture in relation to 'Emerging' destinations, as defined in Section 2 of the report. There are some important elements to consider in relation to the emerging markets and the nature of services to these:

  ✈ in some cases the number of airports which are capable of handling international flights may be limited and therefore the scope for a wide range of destinations in these countries will be more limited;

  ✈ some international airports may not have the physical runway capabilities to sustain long haul services, and thus are likely to only be available to regional international flights. This may preclude direct long haul services from Europe, but may mean they can continue to be served via hubs which are closer to the destination;

  ✈ for those airports which are further afield, the scope for a wide range of services may also be limited as typically, even to developed countries, the number of entry points for long haul services tends to be more limited; and

  ✈ the overall demand to/from some of these countries may be lower due to lower GDP and lower propensities to fly. Therefore all services to a country of this nature may be more centred on a limited number of destinations, with passengers consolidated onto these.

Table 3.5: Numbers of <u>Emerging Market</u> Destination Cities Served and Level of Service									
Destination Cities Served At Least Daily					Destination Cities Served At Least Weekly				Diff. in
Rank	Airport	Direct	Indirect	Total	Rank	Airport	Direct	Indirect	Total	Rank
1	Heathrow	22	71	93	1	Heathrow	34	110	144	0
2	Manchester	2	54	56	2	Birmingham	15	81	96	1
3	Birmingham	2	49	51	3	Manchester	14	76	90	-1
4	Dublin	5	42	47	4	Dublin	17	60	77	0
5	Gatwick	7	29	36	5	Edinburgh	6	56	62	1
6	Edinburgh	0	34	34	6	Glasgow	8	45	53	2
7	Aberdeen	0	32	32	7	Gatwick	11	41	52	-2
8	Glasgow	0	27	27	8	Bristol	11	38	49	2
9	Newcastle	0	26	26	8	Newcastle	3	46	49	1
10	Bristol	1	18	19	10	Aberdeen	2	39	41	-3
11	London City	0	18	18	11	London City	0	37	37	0
12	Southampton	0	16	16	12	Southampton	0	33	33	0
12	Leeds/Bradford	0	16	16	13	London Luton	25	0	25	2
14	Belfast City	0	13	13	14	Leeds/Bradford	3	21	24	-2
15	London Luton	12	0	12	14	Norwich	0	24	24	6
16	Cardiff	0	11	11	16	Humberside	0	21	21	2
17	Stansted	10	0	10	17	Cardiff	0	20	20	-1
18	Humberside	0	9	9	18	Durham Tees Valley	0	19	19	0
18	Durham Tees Valley	0	9	9	18	Stansted	19	0	19	-1
20	Norwich	0	8	8	20	Doncaster Sheffield	9	8	17	2
21	Inverness	0	4	4	21	Belfast City	0	16	16	-7
22	Doncaster Sheffield	0	1	1	22	East Midlands	5	8	13	1
23	East Midlands	0	0	0	22	Liverpool	13	0	13	1
23	Liverpool	0	0	0	24	Exeter	0	8	8	-1
23	Exeter	0	0	0	25	Inverness	0	5	5	-4
23	Belfast Int.	0	0	0	26	Belfast Int.	4	0	4	-3
23	Bournemouth	0	0	0	27	Bournemouth	1	0	1	-4
23	Benbecula	0	0	0	28	Barra	0	0	0	-5
23	Barra	0	0	0	28	Benbecula	0	0	0	-5
23	Campbeltown	0	0	0	28	Campbeltown	0	0	0	-5
23	Dundee	0	0	0	28	City of Derry	0	0	0	-5
23	Islay	0	0	0	28	Dundee	0	0	0	-5
23	Kirkwall	0	0	0	28	Prestwick	0	0	0	-5
23	City of Derry	0	0	0	28	Islay	0	0	0	-5
23	Sumburgh	0	0	0	28	Kirkwall	0	0	0	-5
23	Tingwall	0	0	0	28	Southend	0	0	0	-5
23	Newquay	0	0	0	28	Newquay	0	0	0	-5
23	Prestwick	0	0	0	28	Stornoway	0	0	0	-5
23	Southend	0	0	0	28	Sumburgh	0	0	0	-5
23	Stornoway	0	0	0	28	Tingwall	0	0	0	-5
23	Tiree	0	0	0	28	Tiree	0	0	0	-5
23	Wick	0	0	0	28	Wick	0	0	0	-5
Source: York Aviation analysis of OAG.									

3.40 It is striking that in terms of emerging markets, most airports have very few direct services at least daily to destinations of this type, with Heathrow far above any others in the UK on direct services. As the IMF definition of emerging countries covers Hungary, Romania, Bulgaria and Poland, then it is these European points which contribute to most of the regional airports' links of this nature. In particular Luton, with its large Wizz Air operation, and Stansted with many of Ryanair's central European routes benefit from the inclusion of these EU countries within the IMF definition. In many cases, the demand on these routes is dominated by 'Visitng Friends and Relatives' (VFR) travel associated with EU citizens living in the UK.

3.41 Birmingham is the only airport, other than Heathrow, with a long haul service operated at least daily to an emerging market, with its Air India service to Delhi. Beyond this, all other airports are dominated by short haul points, including Dublin. Istanbul does also feature for Birmingham, Manchester, Stansted, Dublin and Gatwick, as well as Heathrow.

3.42 Only Heathrow has a significantly wider network, providing true connectivity directly from the UK to emerging markets at least daily. Of the 22 direct services from Heathrow, 15 are long haul, 2 are Russian and the remaining 5 are to European points, including Istanbul. This means that Heathrow actually serves fewer emerging points in Europe at this frequency level than a number of other UK airports.

3.43 It is also noticeable that for a number of UK airports, the contribution of hubs to emerging markets at least once per day year round is also relatively limited compared to major destinations. In part this can be explained by the issues identified in paragraph 3.39, meaning there may be more limited options to connect to. Essentially, given that most of the emerging markets are long haul destinations, the UK airports that gain most benefit are those with direct services to hubs in long haul locations, for example:

✈ the Middle Eastern hubs airlines, such as Emirates, Qatar Airways and Etihad tend to have well-developed networks to points in a number of emerging markets, such as India, Thailand and South Africa;

✈ direct links by airlines such as Cathay Pacific and Air China/China Eastern/China Southern from UK airports will provide connectivity to a significant number of points in China and other emerging markets in Asia;

✈ the direct LATAM and Avianca services from Heathrow to South America provide significant inward connectivity within that region, which is relatively underserved from the UK overall.

3.44 The dominance of long haul points in emerging markets means that access to these is therefore always likely to be highly reliant on hub connectivity, either through a long haul link from the UK airport or through connections to Heathrow. Given that many regional airports may struggle to attract adequate long haul connections, then it does indicate that there may be a significant role for hub services to Heathrow to support connectivity to these regions if demand requires it.

3.45 In terms of the equivalent analysis on the basis of 'at least weekly' services, and shows a more balanced picture between Heathrow and the other UK airports and Dublin on a direct basis. As with the 'at least daily' frequency, short haul points, particularly in Poland, dominate the services at this service level. Again this reflects the high levels of VFR travel associated with these services from the regions.

3.46 However, there is some increase in long haul connectivity from other larger airports too when lower frequencies are included, with 5 additional direct long haul services from Manchester, 3 from Gatwick and one from Birmingham. Heathrow has a further 10 long haul destinations served, and just further 2 European points. Once again, Dublin has no direct long haul presence into emerging markets at this frequency level, leaving Northern Irish passengers with no option to access a direct service from Ireland as a whole.

3.47 Overall, the increase in the number of emerging market points served at least weekly via hubs from all UK airports compared to the higher 'at least daily' frequency is limited, again reflecting the nature of hub airlines in offering maximum frequency.

3.48 As the above analysis is looking directly at the overall number of points which can be reached either directly or via hubs, it is again necessary to consider the net benefit added by hub services.

3.49 **Table 3.6** overleaf shows the unique destinations served at least daily and at least weekly from the UK airports. This shows that hubs are offering a significantly greater breadth of destinations to emerging markets than can be accessed directly from the UK, even from Heathrow, at whichever frequency level is considered.
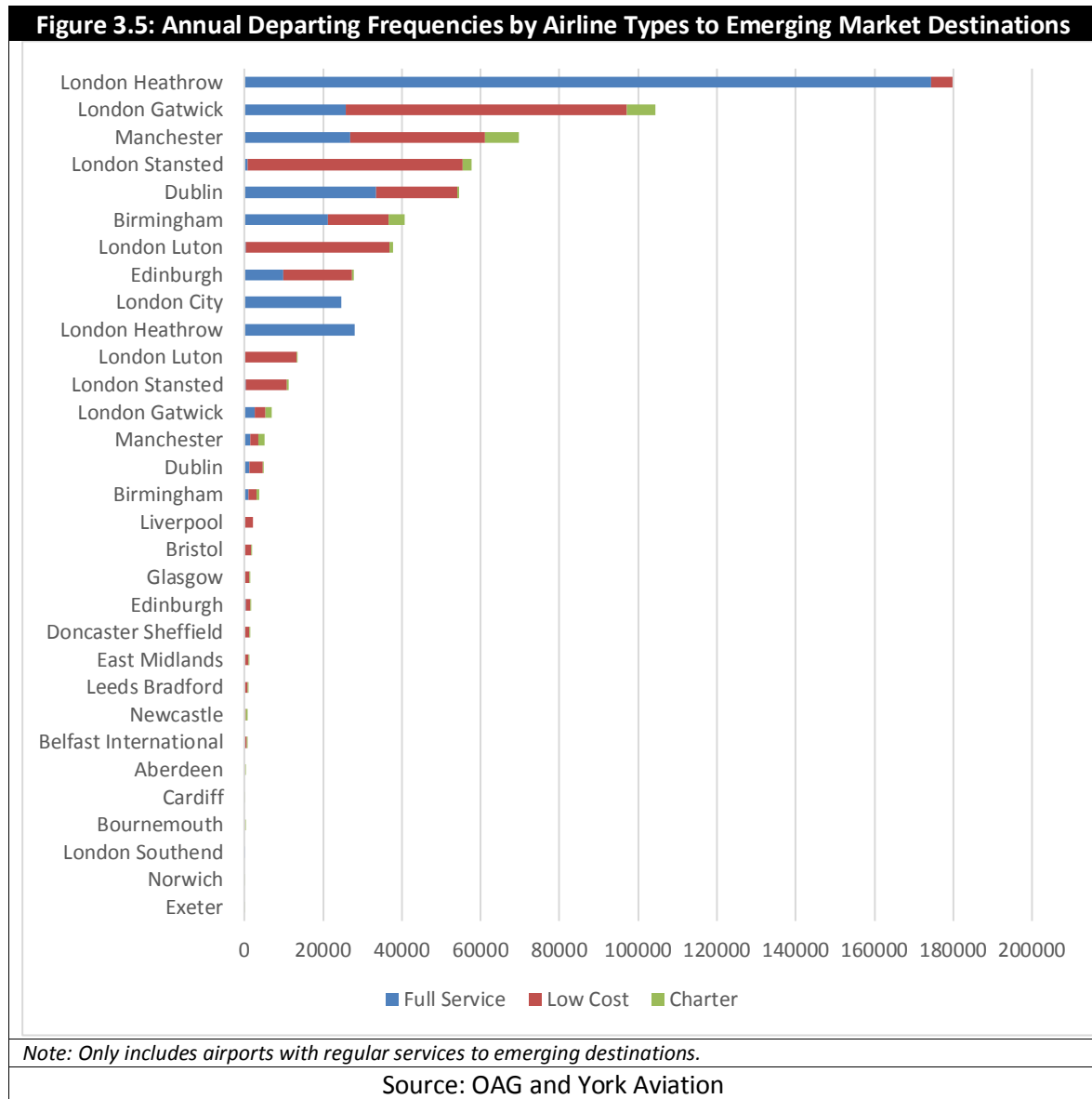
Table 3.6: Numbers of Unique Emerging Market Destination Cities Served and Level of Service									
Destination Cities Served At Least Daily					Destination Cities Served At Least Weekly				Diff. in Rank
Rank	Airport	Direct	Indirect	Total	Rank	Airport	Direct	Indirect	Total	
1	Heathrow	22	49	71	1	Heathrow	34	77	111	0
2	Manchester	2	52	54	2	Birmingham	15	67	82	1
3	Birmingham	2	47	49	3	Manchester	14	65	79	-1
4	Dublin	5	38	43	4	Dublin	17	49	66	0
5	Gatwick	7	29	36	5	Edinburgh	6	52	58	1
6	Edinburgh	0	34	34	6	Glasgow	8	42	50	2
7	Aberdeen	0	32	32	6	Gatwick	11	39	50	-1
8	Glasgow	0	27	27	8	Newcastle	3	45	48	1
9	Newcastle	0	26	26	9	Bristol	11	29	40	1
10	Bristol	1	17	18	10	Aberdeen	2	37	39	-3
10	London City	0	18	18	11	London City	0	37	37	0
12	Leeds/Bradford	0	16	16	12	Southampton	0	33	33	0
12	Southampton	0	16	16	13	London Luton	25	0	25	2
14	Belfast City	0	13	13	14	Norwich	0	24	24	6
15	London Luton	12	0	12	15	Leeds/Bradford	3	20	23	-3
16	Cardiff	0	11	11	16	Humberside	0	21	21	2
17	Stansted	10	0	10	17	Cardiff	0	20	20	-1
18	Humberside	0	9	9	18	Durham Tees Valley	0	19	19	0
18	Durham Tees Valley	0	9	9	18	Stansted	19	0	19	-1
20	Norwich	0	8	8	20	Belfast City	0	16	16	-6
21	Inverness	0	4	4	20	Doncaster Sheffield	9	7	16	2
22	Doncaster Sheffield	0	1	1	22	Liverpool	13	0	13	1
23	Benbecula	0	0	0	23	East Midlands	5	7	12	0
23	Belfast Int.	0	0	0	24	Exeter	0	8	8	-1
23	Bournemouth	0	0	0	25	Inverness	0	5	5	-4
23	Barra	0	0	0	26	Belfast Int.	4	0	4	-3
23	Campbeltown	0	0	0	27	Bournemouth	1	0	1	-4
23	Dundee	0	0	0	28	Benbecula	0	0	0	-5
23	East Midlands	0	0	0	28	Barra	0	0	0	-5
23	Exeter	0	0	0	28	Campbeltown	0	0	0	-5
23	Islay	0	0	0	28	Dundee	0	0	0	-5
23	Kirkwall	0	0	0	28	Islay	0	0	0	-5
23	City of Derry	0	0	0	28	Kirkwall	0	0	0	-5
23	Liverpool	0	0	0	28	City of Derry	0	0	0	-5
23	Sumburgh	0	0	0	28	Sumburgh	0	0	0	-5
23	Tingwall	0	0	0	28	Tingwall	0	0	0	-5
23	Newquay	0	0	0	28	Newquay	0	0	0	-5
23	Prestwick	0	0	0	28	Prestwick	0	0	0	-5
23	Southend	0	0	0	28	Southend	0	0	0	-5
23	Stornoway	0	0	0	28	Stornoway	0	0	0	-5
23	Tiree	0	0	0	28	Tiree	0	0	0	-5
23	Wick	0	0	0	28	Wick	0	0	0	-5
Source: York Aviation analysis of OAG.									

3.50 **Figure 3.5** shows the airline mix providing the direct connectivity throughout 2017 to emerging markets from the UK. Again, all airlines have a role in providing services to these destinations, but the importance of low cost serving central European points is clear across almost all airports. Away from the larger UK airports, full service carriers currently play almost no role in providing direct connectivity from the UK to emerging markets.

Figure 3.5: Annual Departing Frequencies by Airline Types to Emerging Market Destinations

Note: Only includes airports with regular services to emerging destinations.

Source: OAG and York Aviation

Business Connectivity Index

3.51 The BCI looks at connectivity specifically from the perspective of the business user. It seeks to consider the value of each destination city in an airport's route network in terms of the city's economic status, as defined by its ranking in the GaWC World Cities Network ranking of world cities, and the ease with which it can be reached in terms of frequency. The methodology has previously been described in Section 2. In this analysis we have considered the BCI in terms of both direct and indirect connections from airports, where indirect frequencies are weighted by the additional time it takes to travel via the indirect route compared to a direct routing. It should be noted that in this analysis the indirect BCI score represents the additional value added by indirect connections, either through providing access to destinations that cannot be reached directly or where it provides additional frequencies to destinations that are served directly.

3.52 **Table 3.7** shows the results of this analysis for the assessment airports. Unsurprisingly, Heathrow is by far the most important airport in the UK in terms of business focussed connectivity. Dublin and Manchester form a next step down, reflecting their size, the presence of significant numbers of more business focussed airlines and their extensive long haul networks. There is then a further step down to large regional airports such as Birmingham, Edinburgh and Glasgow. Broadly, BCI goes with airport size but there are notable exceptions:

✈ Aberdeen, Newcastle, London City, Belfast City and Southampton are perhaps punching above their weight, benefitting from their extensive hub connections;

✈ Gatwick and Stansted are some way below what might be expected given their size, perhaps reflecting their focus on leisure destinations and the generally lower levels of frequency on offer by the dominant low fares airlines.

3.53 What is also interesting to note is the balance between Direct and Indirect BCI scores. It is only really Heathrow of all the major airports with a recognised hub connection where the direct BCI outweighs the indirect BCI. All the other airports are heavily reliant on indirect connectivity to drive their overall BCI score. This again highlights the importance of hub services for UK regional airports, even major intercontinental gateways such as Manchester, in serving both UK business and overseas business seeking to trade with the UK. In this context, the potential for Heathrow connections in the future can be seen, especially given the overall power of Heathrow as a business focussed connector.
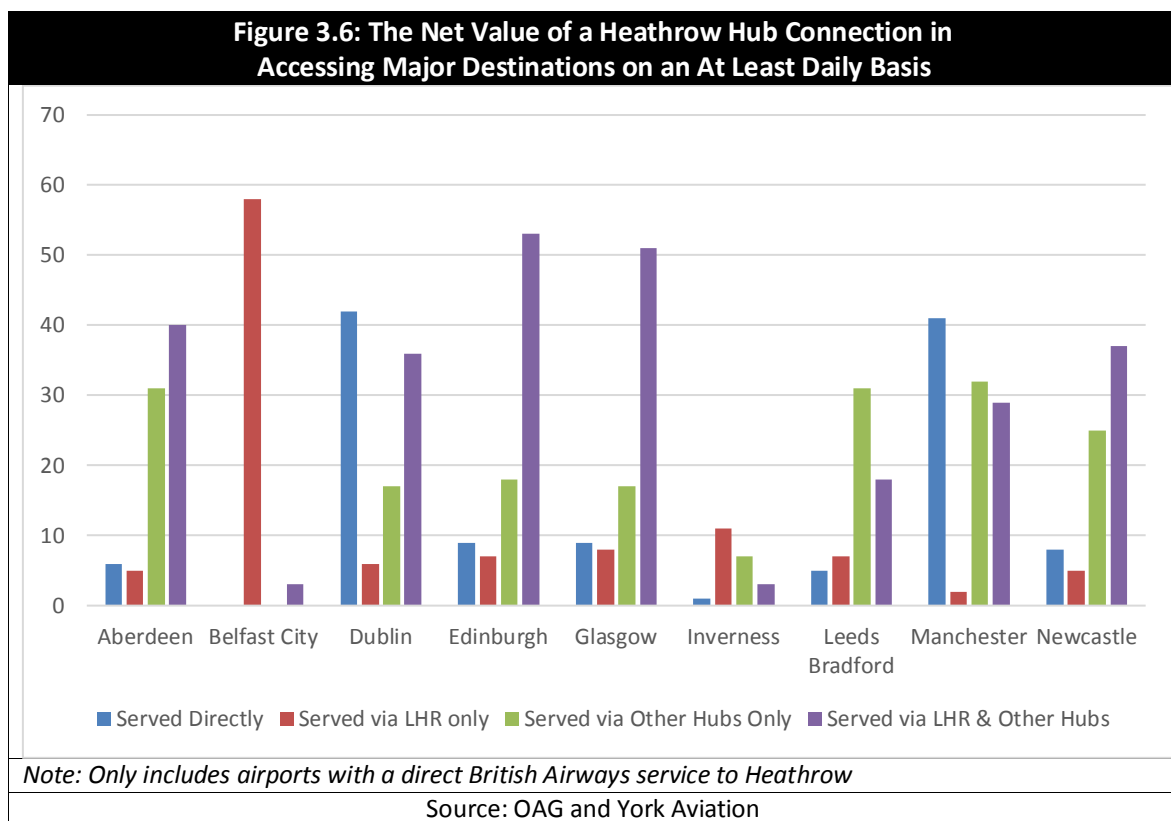
Table 3.7: Business Connectivity Index Scores for Assessment Airports			
Airport Name	Direct BCI Score	Indirect BCI Score	Total BCI Score
London Heathrow	636	462	1,098
Dublin	322	585	907
Manchester	266	626	892
Birmingham	164	591	756
Edinburgh	161	573	734
Glasgow	105	537	642
Aberdeen	57	541	598
Newcastle	67	500	567
London Gatwick	259	290	550
Bristol	104	353	456
London City	94	355	449
Belfast City	34	399	433
Southampton	44	370	414
Leeds/Bradford	51	357	407
Cardiff	43	295	338
Norwich	13	282	295
Humberside	7	264	271
Durham Tees Valley	7	251	258
Inverness	25	209	234
London Stansted	171	0	171
London Luton	142	0	142
Exeter	29	110	139
Doncaster Sheffield	26	98	124
East Midlands	44	66	111
Liverpool	63	0	63
Belfast International	50	0	50
London Southend	32	0	32
Newquay	19	8	27
City of Derry	8	0	8
Dundee	7	0	7
Sumburgh	6	0	6
Kirkwall	6	0	6
Stornoway	6	0	6
Glasgow Prestwick	5	0	5
Wick	3	0	3
Bournemouth	3	0	3
Islay	2	0	2
Barra	2	0	2
Tiree	2	0	2
Campbeltown	2	0	2
Benbecula	2	0	2
Tingwall	0	0	0
Source: York Aviation			

Heathrow's Hub Value

3.54 In considering the role of Heathrow in providing connectivity as a hub for the UK regions we have attempted to isolate the net connectivity offered by services to the London hub compared to direct connections and services via all other hubs. For this analysis we have focused on the eight UK regional airports that have British Airways connections to Heathrow, plus Dublin which also has such services. For each airport, we show the number of relevant direct destination cities served, the number that can only be reached via Heathrow, the number that can only be reached via another hub and the number which can be reached via Heathrow or another hub.

3.55 **Figure 3.6** shows this analysis for major destinations that are served on at least a daily basis, either directly or indirectly.

Figure 3.6: The Net Value of a Heathrow Hub Connection in Accessing Major Destinations on an At Least Daily Basis

Legend: ■ Served Directly   ■ Served via LHR only   ■ Served via Other Hubs Only   ■ Served via LHR & Other Hubs

Note: Only includes airports with a direct British Airways service to Heathrow

Source: OAG and York Aviation

3.56 The same analysis is presented in **Figure 3.7** for major destinations served on at least weekly basis.

Figure 3.7: The Net Value of a Heathrow Hub Connection in Accessing Major Destinations on an At Least Weekly Basis

Note: Only includes airports with a direct British Airways service to Heathrow

Source: OAG and York Aviation
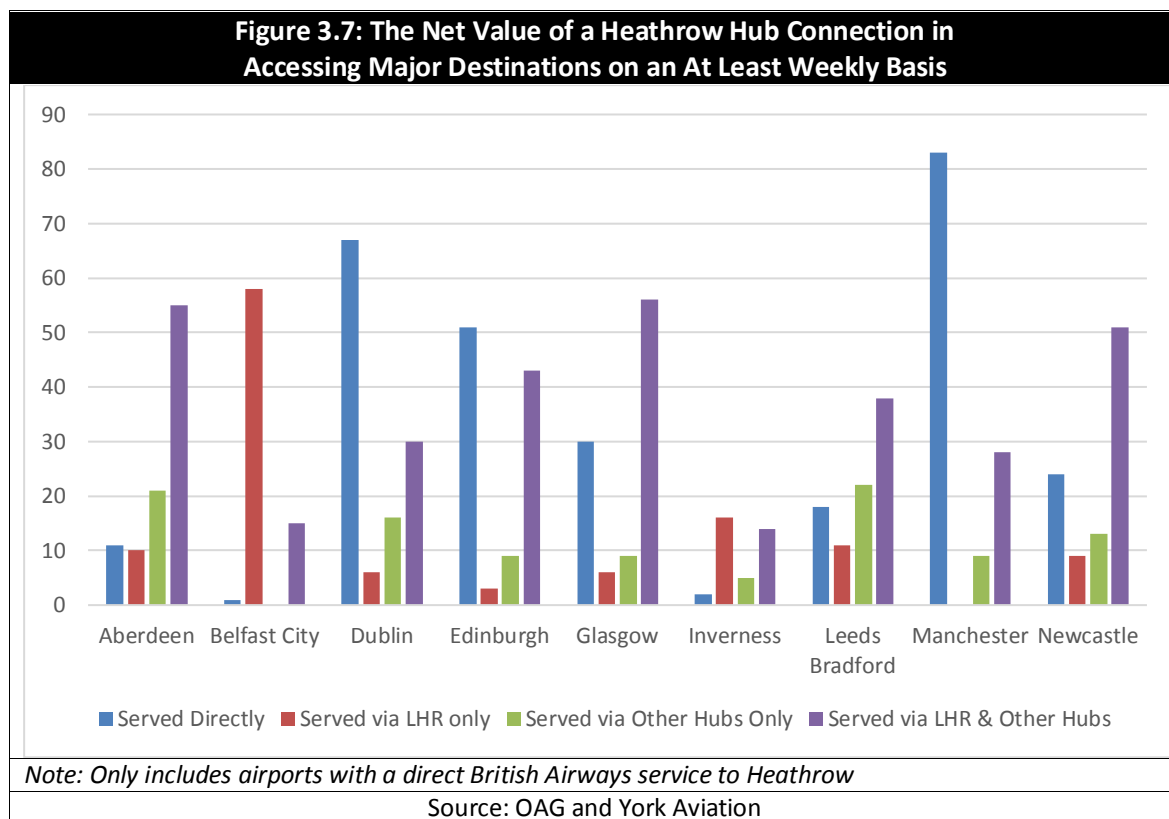
3.57 There are a number of points to be made about the role of Heathrow based on these results:

✈ in almost all cases Heathrow does add value in terms of the ability to access major city destinations. In other words, Heathrow offers connections that are not available directly or from other hubs;

✈ the number of unique destinations offered by other hubs is usually higher than offered by Heathrow. However, this is not surprising. There are more of the other hubs and long haul hubs will naturally offer access to local markets which will never be sensibly served from Heathrow or indeed other European hubs;

✈ where an airport has limited hub or no other hub access, for instance at Belfast City, the potential of opening access to Heathrow can be seen, with significant added value in terms of major destinations served. Where hub access is limited, the underpinning size of the London point to point market compared to that to alternate hubs may mean that Heathrow can play a role where others can't;

✈ it is also reasonable to suggest that Heathrow is likely offer higher frequencies to destinations that are of higher value to UK passengers, even within the definition of major destinations;

✈ it should also be recognized that this views Heathrow as it is now rather than in an enhanced capacity scenario. Hence, its network coverage is ultimately to some degree a reflection of its current capacity position. A larger Heathrow will potentially add more value over other hubs.

3.58 **Figure 3.8** presents the same analysis for emerging destinations served at least daily from each of the airports.

Figure 3.8: The Net Value of a Heathrow Hub Connection in Accessing Emerging Market Destinations on an At Least Daily Basis

Note: Only includes airports with a direct British Airways service to Heathrow

Source: OAG and York Aviation
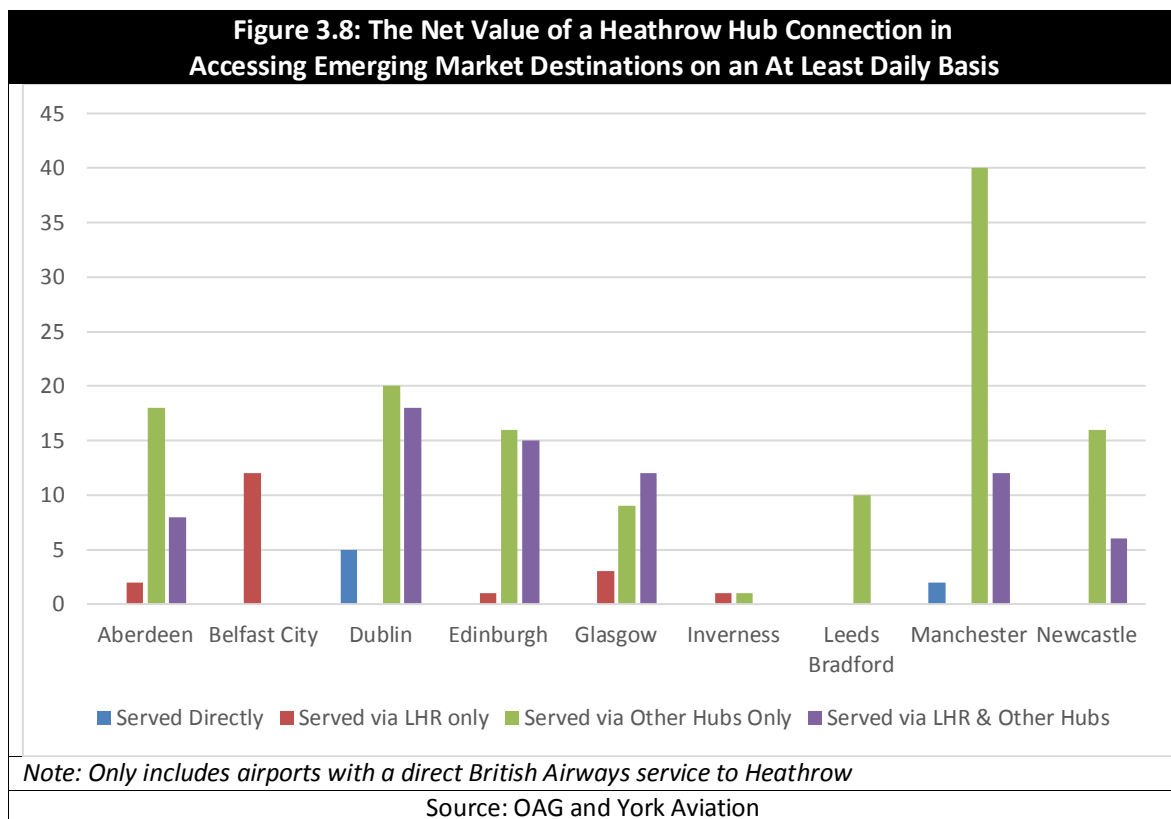
3.59 **Figure 3.9** presents the analysis for emerging destinations served at least weekly from each of the airports.

Figure 3.9: The Net Value of a Heathrow Hub Connection in Accessing Emerging Market Destinations on an At Least Weekly Basis

Note: Only includes airports with a direct British Airways service to Heathrow

Source: OAG and York Aviation
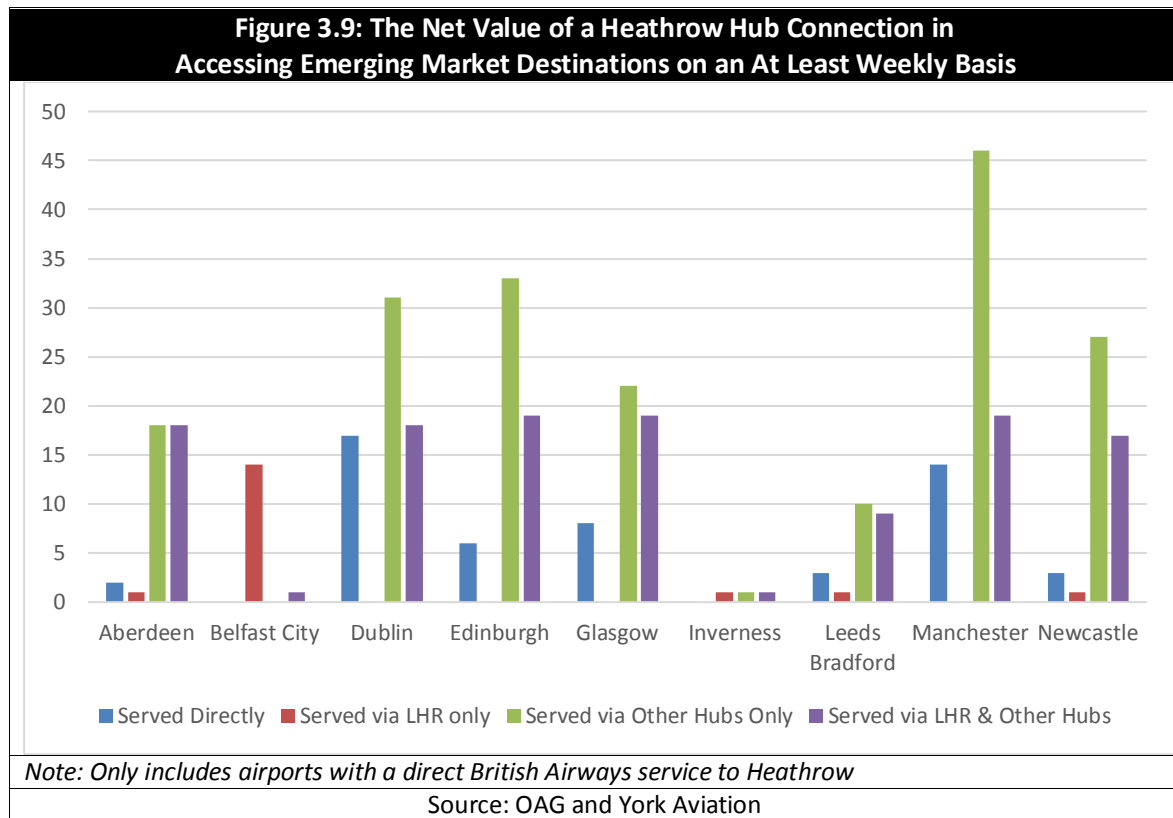
3.60 The pattern that emerges from the analysis of emerging market coverage is very similar to that for major destinations. Heathrow does often add value, serving destinations that are not accessible via other hubs and its true value can be seen for airports where access to other hubs is limited. Others hubs do, however, currently provide greater accessibility to emerging markets. Again, however, it should be remembered that the current 'snapshot' position at Heathrow is likely to have been distorted by the network dynamics created by its capacity constraints. With airlines focussing scarce slot resources on high value, proven, high volume markets, there is little incentive or ability to serve emerging markets from Heathrow. An expanded Heathrow would change this dynamic and the Airport's coverage of emerging markets may well change significantly.

3.61 Overall, it would seem reasonable to conclude that Heathrow is an important hub for the UK's regional airports and does add value in most cases. However, other hubs are also important in providing network breadth. The particular value of Heathrow to UK regional connectivity may come where there is limited hub connectivity available, and would cover airports including Liverpool, Newquay and City of Derry among others. The London point to point market could underpin Heathrow hub services, where other hub services cannot operate viably or cannot achieve sufficient frequency. In these cases, added value from Heathrow can be substantial.

4   CONNECTIVITY COVERAGE

4.1   In this Section, we set out to examine how accessible the connectivity offered by the UK's airports is to the UK population. This considers access from a number of perspectives:

✈   it considers the role that each of the assessed airports plays in covering the UK population;

✈   it examines accessibility to major international destinations and emerging markets, by examining the extent to which the UK population is within given time boundaries of an airport serving major international destinations;

✈   it examines the role that Heathrow and other hubs play in providing access to major international destinations via indirect services;

✈   it uses mapping software to provide a visual representation of accessibility from the across the UK to major international destinations, either directly or indirectly.

4.2   The analysis draws extensively on journey times data provided to us by the DfT. This provides the journey time between each Lower Super Output Area (LSOA) in the UK and each of the assessed airports (excluding Dublin). The data includes information for both car and public transport access. In the interests of simplicity, for each LSOA, we have assumed the lower of the two available journey times is the relevant minimum access time for this analysis. It should also be noted that this analysis does not consider the quality or volume of connectivity on offer (whereas the analysis in Section 3 focusses on this aspect). Where relevant, it only considers whether an airport offers connections to major international destinations. It does not consider the extent of this offer.

Catchment Areas of UK Airports

4.3   The usefulness of an airport to the UK in terms of its connectivity offer is a function of both its destination offer (considered above) and the extent to which this offer is accessible by the population. It should, of course, be remembered that the two are in reality inextricably linked. Access to a larger population base will, in general and all other things being equal, enable a more extensive route network to be offered.

4.4   Using the journey time data provided by the DfT, 60 minute, 90 minute and 120 minute catchment areas have been mapped for each of the assessed airports. These maps are set out in **Appendix D**. These catchments have then been combined with the latest available data on LSOA level resident population from the Office for National Statistics (ONS), the Scottish Government and the Northern Ireland Statistics and Research Agency (NISRA) to provide an assessment of the UK population falling within each catchment definition for each airport. The results of this analysis are set out in **Figure 4.1** and **Table 4.1**.

Figure 4.1: Catchment Coverage of the UK Population by Assessed Airports (% of UK Total Population)

Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.
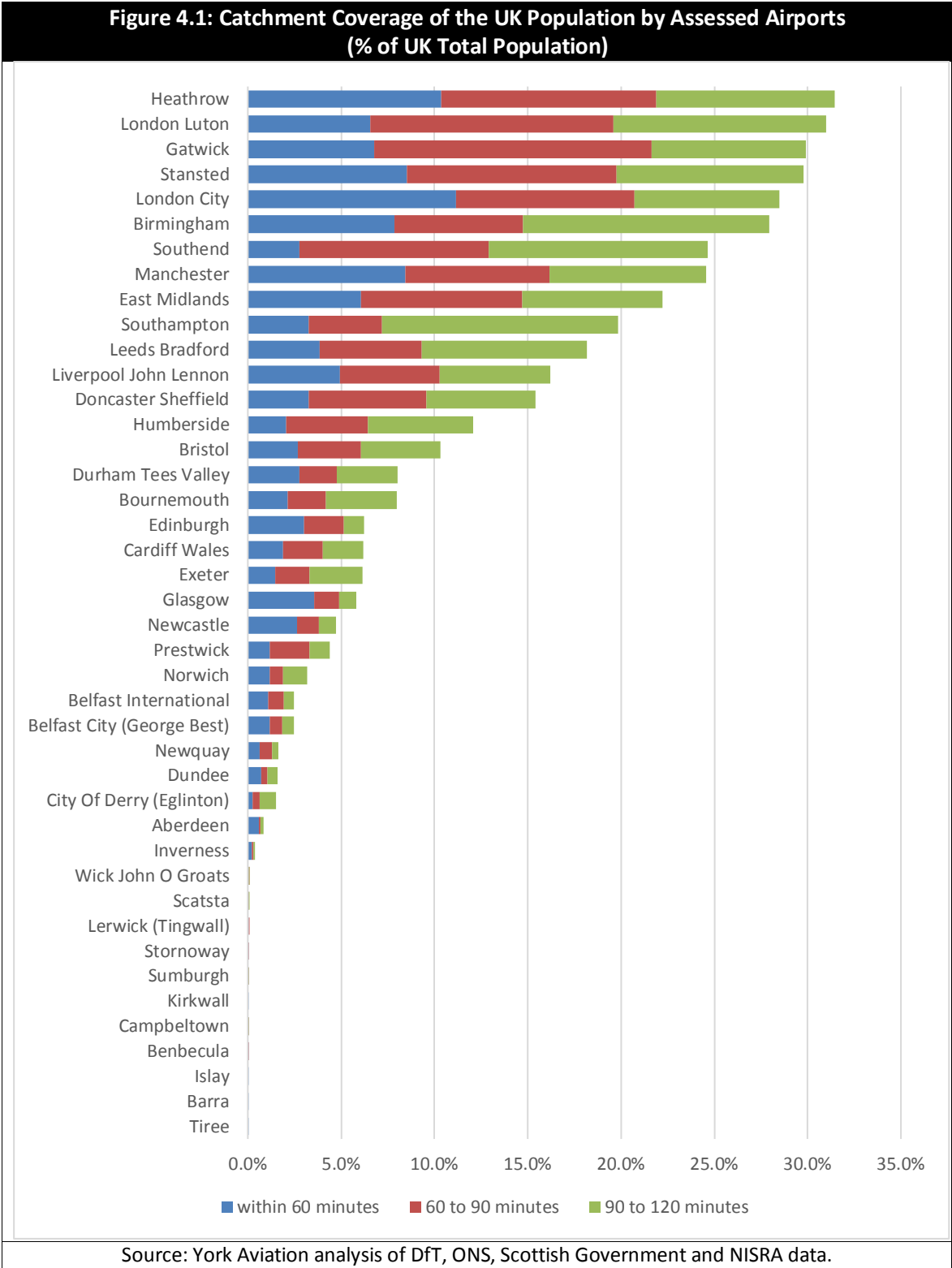
Table 4.1: Catchment Coverage of the UK Population by Assessed Airports (% of UK Total Population)			
Catchment	Within 60 minutes	Within 90 minutes	Within 120 minutes
Heathrow	10.4%	21.9%	31.5%
London Luton	6.6%	19.6%	31.0%
Gatwick	6.8%	21.6%	29.9%
Stansted	8.5%	19.8%	29.8%
London City	11.2%	20.7%	28.5%
Birmingham	7.9%	14.8%	27.9%
Southend	2.8%	12.9%	24.7%
Manchester	8.4%	16.1%	24.6%
East Midlands	6.1%	14.7%	22.2%
Southampton	3.2%	7.2%	19.8%
Leeds/Bradford	3.9%	9.3%	18.2%
Liverpool John Lennon	4.9%	10.3%	16.2%
Doncaster Sheffield	3.3%	9.6%	15.4%
Humberside	2.1%	6.4%	12.1%
Bristol	2.7%	6.1%	10.3%
Durham Tees Valley	2.7%	4.8%	8.0%
Bournemouth	2.1%	4.2%	8.0%
Edinburgh	3.0%	5.1%	6.2%
Cardiff Wales	1.9%	4.0%	6.2%
Exeter	1.5%	3.3%	6.1%
Glasgow	3.6%	4.9%	5.8%
Newcastle	2.6%	3.8%	4.7%
Prestwick	1.2%	3.3%	4.4%
Norwich	1.2%	1.9%	3.2%
Belfast International	1.1%	1.9%	2.5%
Belfast City (George Best)	1.2%	1.9%	2.5%
Newquay	0.6%	1.3%	1.6%
Dundee	0.7%	1.0%	1.6%
City Of Derry (Eglinton)	0.3%	0.6%	1.5%
Aberdeen	0.6%	0.7%	0.9%
Inverness	0.2%	0.3%	0.4%
Wick John O Groats	0.0%	0.0%	0.0%
Lerwick (Tingwall)	0.0%	0.0%	0.0%
Scatsta	0.0%	0.0%	0.0%
Stornoway	0.0%	0.0%	0.0%
Sumburgh	0.0%	0.0%	0.0%
Kirkwall	0.0%	0.0%	0.0%
Campbeltown	0.0%	0.0%	0.0%
Benbecula	0.0%	0.0%	0.0%
Islay	0.0%	0.0%	0.0%
Barra	0.0%	0.0%	0.0%
Tiree	0.0%	0.0%	0.0%
Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.			

4.5 In terms of total population coverage, unsurprisingly the list is dominated by the London airports. Their proximity to London, by far the largest city in the UK, and the city's broader environs drives this performance. It also helps to explain why this group includes many of the UK's largest airports, including, of course, the UK's global hub airport, Heathrow. Heathrow has the largest 90 minute and 120 minute catchment coverage of the group but it is in fact London City, with its central London location that has the largest 60 minute catchment coverage. At 90 minutes, Gatwick's population coverage is very similar to Heathrow, while at 120 minutes Luton is the closest competitor to Heathrow.

4.6 Away from London, the UK's largest regional airport, Manchester, has the highest population coverage at 60 minutes and 90 minutes. The nearest competitors in this regard are Birmingham and East Midlands, reflecting not only their 'local' catchments but their relative proximity to London and the South East, particularly in relation to the 120 minute catchment.

4.7 There does appear to be a relationship between airport size and connectivity but the extent of competition between individual airports is also clearly a factor. In many cases where there are a number of airports sharing the same catchment, there is a 'dominant' airport that has established first mover advantages and others in its sphere of influence may underperform in terms of their connectivity offer.

4.8 It is also worth noting the influence of peripherality. Airports in more isolated parts of the UK often have smaller population coverage but are able to generate greater volumes of demand, most likely reflecting a higher propensity to fly. Examples would include Aberdeen, Edinburgh, Glasgow and the Belfast airports. The levels of connectivity observed at some these airports are a reflection of the needs of their catchment areas to connect to distant centres for economic and social reasons and for which air connectivity is the only sensible option.

Access to Major Destinations & Emerging Markets

4.9 Building on the analysis above, **Figure 4.2** considers the proportion of the UK population that has access to an airport serving major international destinations on an at least daily and on an at least weekly basis, either directly or indirectly.

4.10 The results show that there is in reality very little difference between the coverage for at least daily and at least weekly services or for direct versus indirect. This ultimately reflects the fact that large parts of the UK population are close to at least one major airport which will offer some mixture of all of the above.

4.11 75% of the UK population is within 60 minutes of an airport offering at least daily services to major destinations, a further 17% are within 90 minutes and further 5% within 120 minutes. In total, 97% of the UK population is currently within 120 minutes of an airport offering direct connections to one or more major destinations on an at least daily basis. If services to major destinations that are served at least weekly are added, the percentage of the population within 60 minutes increases to 77%, while the proportions within 90 and 120 minutes remain the same. Total coverage increases to 99% of the population.
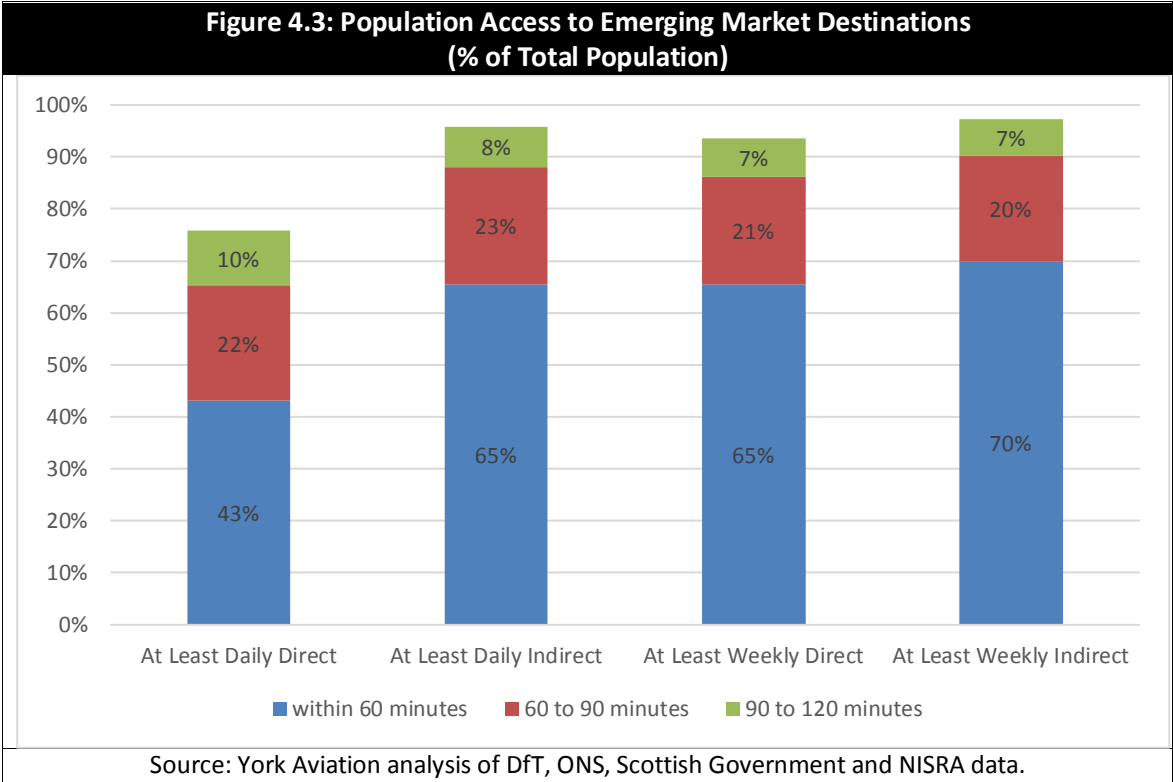
4.12   Access to indirect connections to major destinations requires access to an airport offering a valid hub connection, as described above in Section 2. Only a subset of UK airports offer such connections and as such the access to major destinations via indirect routings within 60 minutes is lower at 70% for at least daily services. However, this lower figure is ultimately compensated for in terms of accessibility within 90 minutes and 120 minutes, such that total remains at 97% for at least daily services. These figures remain identical for access to at least weekly indirect services, reflecting the point made previously that services to major hubs tend to be offered on an at least daily basis by airlines to maximise the opportunities for connections. Hence, adding it services that are only served at least weekly makes no difference to coverage.

Figure 4.2: Population Access to Major International Destinations (% of Total Population)

Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.
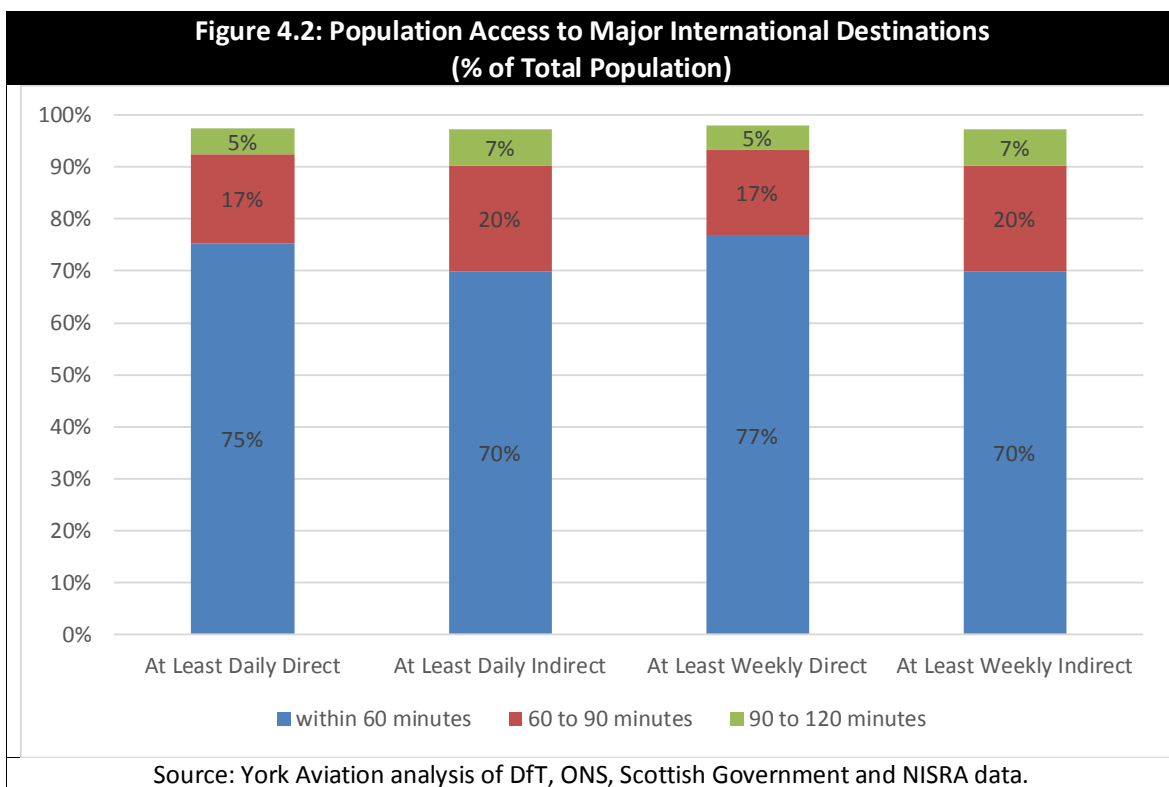
4.13   **Figure 4.3** reproduces the same analysis for emerging markets. The pattern of accessibility to emerging markets is somewhat different and reflects a number of the points made in earlier sections about coverage of these markets by UK airports.

4.14 A limited number of UK airports provide direct access to emerging markets, particularly on an at least daily basis, with Heathrow being by far the largest player in the market. This is reflected in the fact that only 75% of the UK population has direct access to emerging markets on an at least daily basis within 120 minutes and only 43% are within 60 minutes. As we have seen a number of regional airports offer access to emerging markets at lower frequencies and this is reflected in the direct coverage on at least weekly basis, where the percentage of the population within 120 minutes increases to 93% (65% within 60 minutes).

4.15 The analysis also highlights again the role that hub airports play in supporting connectivity to emerging markets. Indirect connections are available on an at least daily basis to 96% of the population within 120 minutes and to 65% within 60 minutes, a considerable jump up when compared to the direct service coverage. Again, the high frequency nature of hub services means that adding lower frequency services and examining coverage on at least weekly basis has a limited overall impact. Total coverage only increases by 1% to 97% of the UK population. The proportion of the population within 60 minutes increases to 70%.

Figure 4.3: Population Access to Emerging Market Destinations (% of Total Population)

Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.

The Role of Heathrow & Other Hubs in Connectivity

4.16 Heathrow is the only major global hub airport located in the UK and, as we have seen, provides access to a wide range of destinations, major and emerging, at a high level of frequency. However, UK regional airports also provide access to a wide range of overseas hub airports, offering indirect connectivity to major destinations and emerging markets. Below, we have sought to compare the role that Heathrow plays in offering connectivity to the UK with that played by connections to overseas hubs.

4.17 In **Figure 4.4** we have set out the proportions of the UK population that can either access major international destinations directly by being within 120 minutes surface travel time of Heathrow or indirectly using a regional airport hub service to Heathrow and compared this this to the proportions of the population that have access via other overseas hubs currently. This is, of course, not entirely a like for like comparison as it could be argued strongly that direct access to Heathrow is more valuable than a hub connection via either Heathrow or another hub. However, the analysis does provide an indication of Heathrow's role in providing connectivity to the UK's population.

Figure 4.4: Proportion of the UK Population that can access Major International Destinations At Least Daily Directly or Indirectly via Heathrow and Indirectly via Other Hubs (% of Total UK Population)

Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.
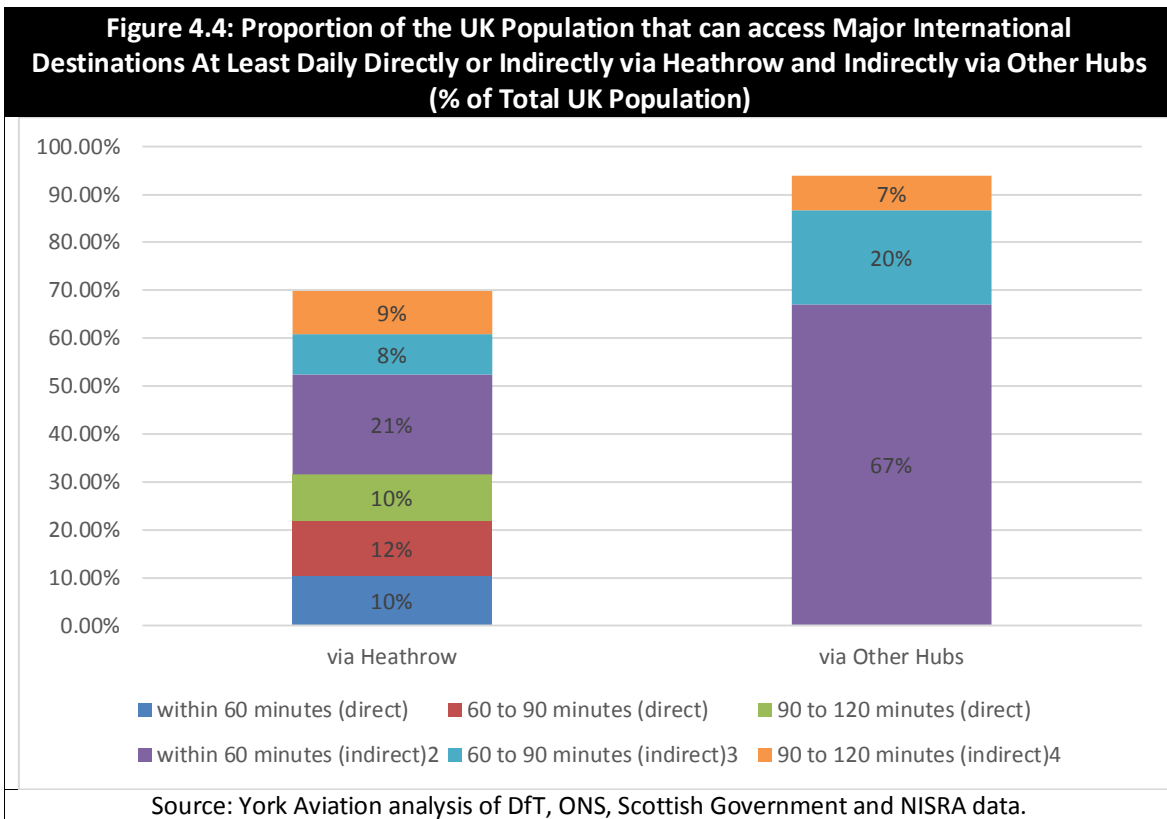
4.18 Currently, around 70% of the UK can access Heathrow's connectivity to major destinations served at least daily directly or indirectly within a 120 minute surface travel time. Over 30% can access this connectivity within a 60 minute travel time. A potentially expanded Heathrow, with an increased number of domestic connections, would push this coverage higher.

4.19 At present, overseas hubs providing access to major destinations on an at least daily basis actually have a higher coverage of the UK population. Around 94% of the UK population are with 120 minutes of a service to a relevant hub and around 67% are within 60 minutes. Given Heathrow's well documented current capacity constraints and the consequent erosion of the domestic network that has taken place this disparity is perhaps unsurprising. It should also be recognised that there are simply more overseas hubs and hence more airlines to potentially operate relevant hub services.

4.20 Overall, Heathrow is a significant provider of connectivity for a large proportion of the UK population and this role could be expanded with increased capacity.

Identifying Accessibility Gaps in the UK

4.21 Building on our analysis above, we have undertaken a mapping analysis that considers accessibility to daily services to major international destinations from individual LSOAs. Again, it should be remembered that this does not allow for the quality or volume of connectivity on offer, it merely says whether the population can access major international destinations or not.

4.22 **Figure 4.5, 4.6 and 4.7** map access to direct services to major destinations by time band by LSOA. It shows for each LSOA the maximum number of relevant destinations served by an airport within each access time. We have focussed here on destinations served at least daily.

4.23 In many ways the 60 minute analysis provides the most insight into connectivity patterns in the UK. It is clearly possible to see the influence of the UK's largest airports, particularly that of Heathrow and Gatwick in London and the South East, which comes out clearly as the best connected part of the UK. It is also possible to see areas of weakness and gaps quite clearly, notably with limited or no access in parts of the South West, Wales, the Midlands and Yorkshire & the Humber. Given the distribution of the UK population, it is perhaps areas of the near South West and Yorkshire & the Humber that represent the greatest areas for concern in terms of accessibility.

4.24 As the time bands increase in size, gaps and areas of weakness clearly reduce and it is possible to see the influence of Heathrow in the South East and Manchester in the North grow. By the time the 120 minute band is reached, it is perhaps reasonable to say the most of the UK's core populated areas have a reasonable level of service.
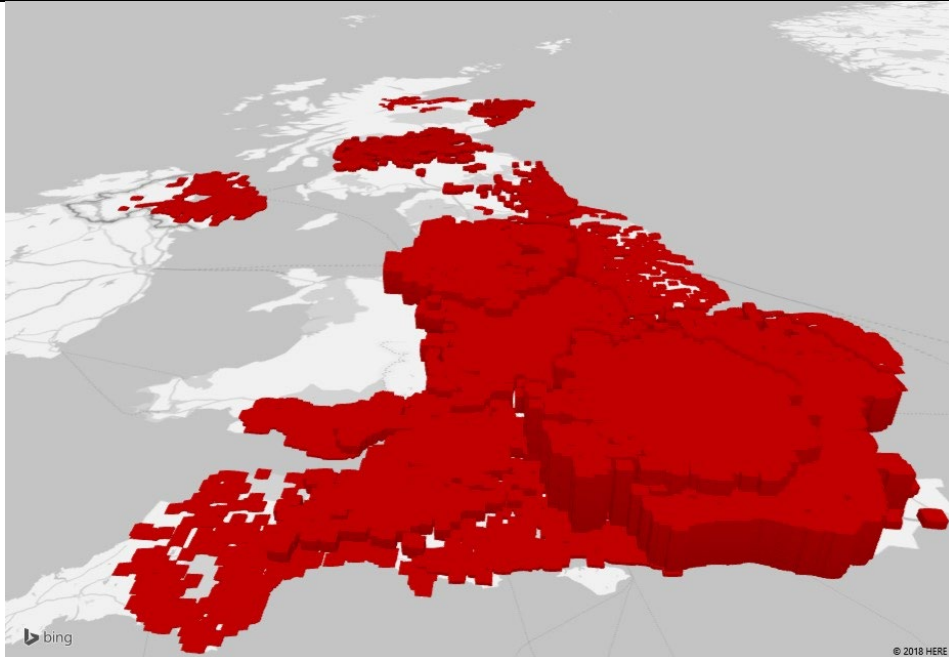
Figure 4.5: Largest Number of Daily Direct Services Offered by an Airport to Major International Destinations within 60 Minutes
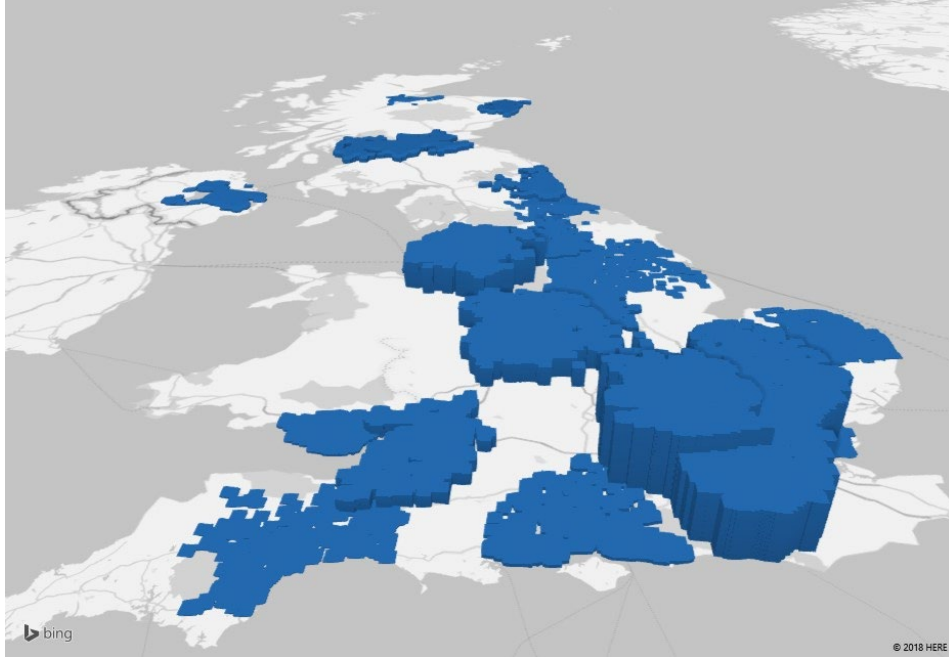
Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.

Figure 4.6: Largest Number of Daily Direct Services Offered by an Airport to Major International Destinations within 90 Minutes
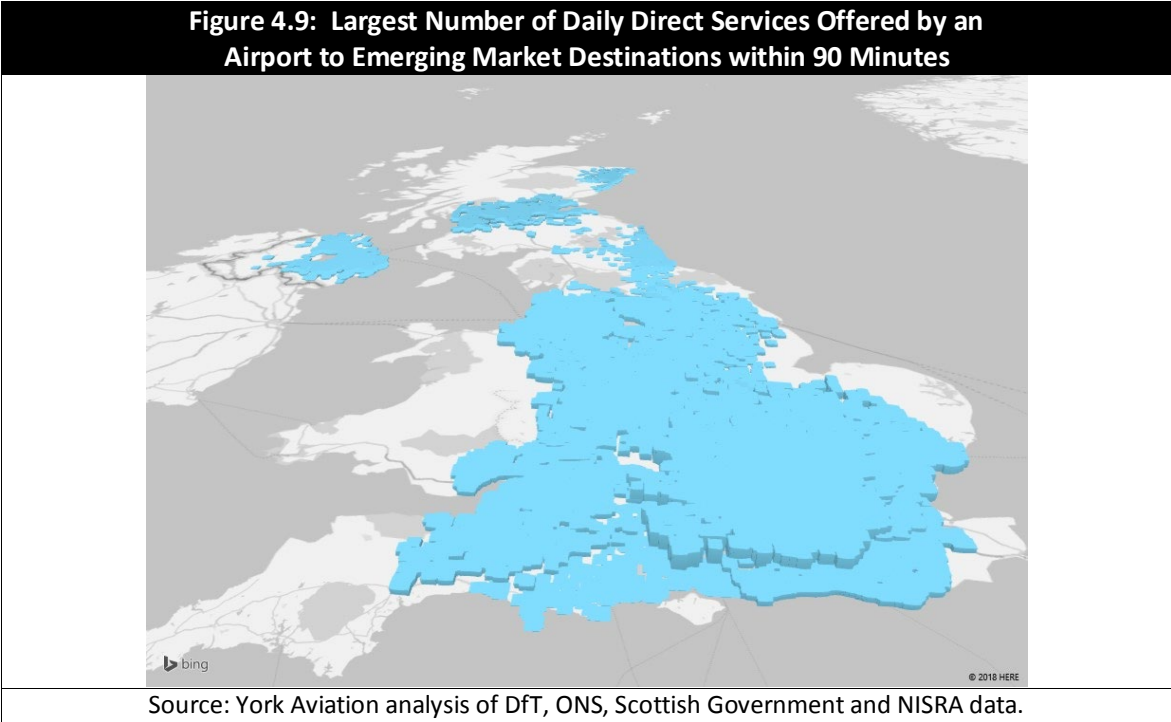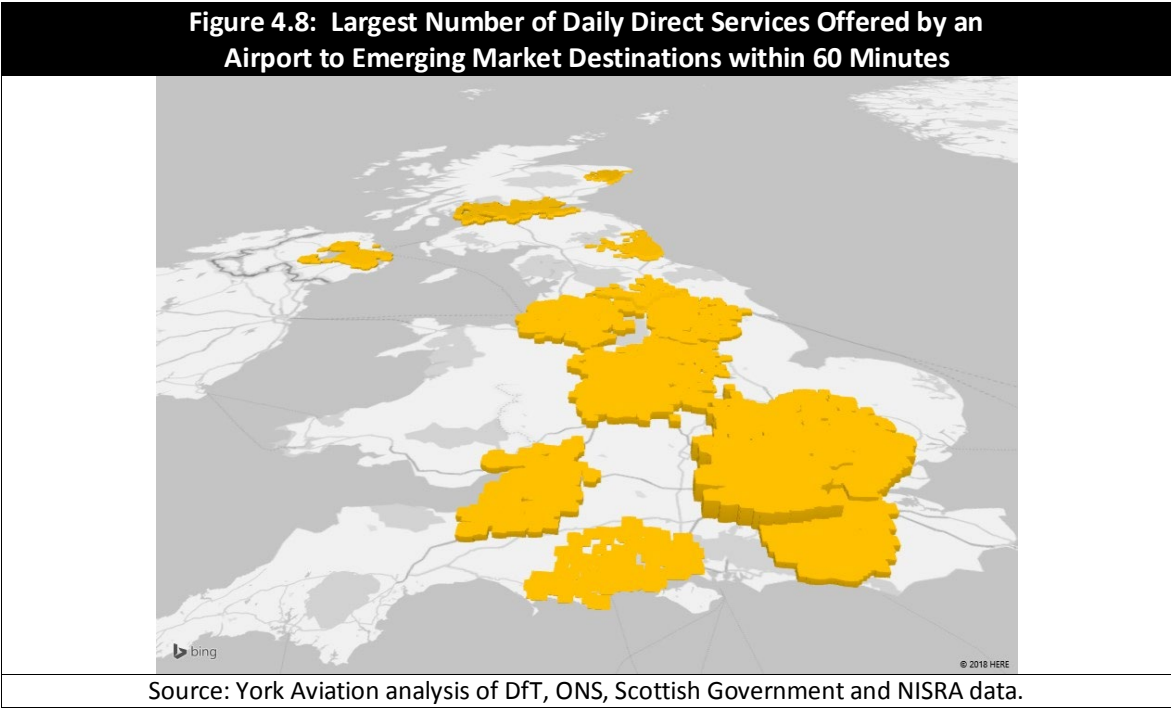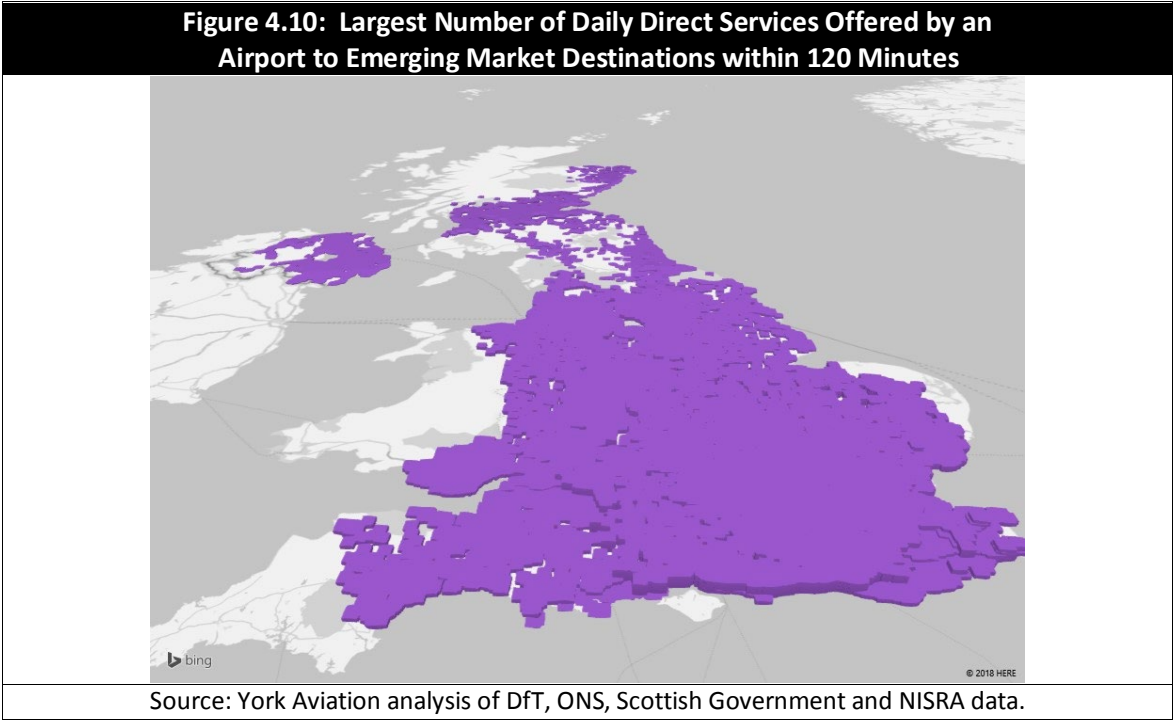

Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.

Figure 4.7: Largest Number of Daily Direct Services Offered by an Airport to Major International Destinations within 120 Minutes

Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.

4.25 **Figure 4.8, 4.9 and 4.10** map access to at least weekly direct services to emerging markets by time band by LSOA. It shows for each LSOA the maximum number of relevant destinations served by an airport within each access time. We have focussed here on at least weekly services given the nature of these markets and the fact that, particularly from the regions important services to emerging markets are served at this lower frequency level.

4.26 In many ways the pattern here is the same as that seen for major destinations. At 60 minutes the influence of the major UK airports can be seen clearly and there are obvious gaps and areas of weakness. The pattern is, however, more extreme with fewer airports serving emerging markets and Heathrow's core gateway role stronger. As the time bands expand the gaps reduce and the influence of the UK's large airports increases.

4.27 We have not presented here the same analysis for indirect connectivity as the strengths and weaknesses and geographic patterns that can be observed are essentially the same as those for direct services.

Figure 4.8: Largest Number of Daily Direct Services Offered by an Airport to Emerging Market Destinations within 60 Minutes

Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.

Figure 4.9: Largest Number of Daily Direct Services Offered by an Airport to Emerging Market Destinations within 90 Minutes

Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.

Figure 4.10: Largest Number of Daily Direct Services Offered by an Airport to Emerging Market Destinations within 120 Minutes

Source: York Aviation analysis of DfT, ONS, Scottish Government and NISRA data.

5 HUB SERVICE REQUIREMENTS

5.1 In this section we go on to consider what level of service should be provided from a regional airport to Heathrow in order to maximise the number of available connections. We seek to answer 3 key questions:

→ At what frequency might a service offer the optimal return on investment[5] by maximising connectivity against service frequency?

→ At what times of day would slots be required at Heathrow for such service to operate and maximise connectivity?

→ What share of annual slots would be needed to allow for this service level from an increased basket of regional points into a potentially expanded Heathrow?

5.2 Major hub airlines tend to adopt a 'wave' or 'bank' system at their hub airports whereby over the course of a day there are nominated periods of arrivals followed by nominated periods of departures which maximise the available connections whilst minimising the time required between flights. However due to long term capacity constraints, this system does not operate at Heathrow as British Airways has sought to use any available slots over the years to develop its network. As a result it is not possible to assume a set pattern of daily frequencies associated with a typical hub which would maximise connections. **Figure 5.1** shows a comparison of arrivals and departures at Heathrow for British Airways with the clear arrival and departure 'waves' operated by KLM at their Amsterdam hub and clearly illustrates the difficulty of maximising connections at the London hub as a result of an almost continuous arrival and departure flow of flights.

Figure 5.1: Hub Airline Movement Patterns (July Day 2017)

British Airways – London Heathrow   *KLM – Amsterdam*

Source: OAG

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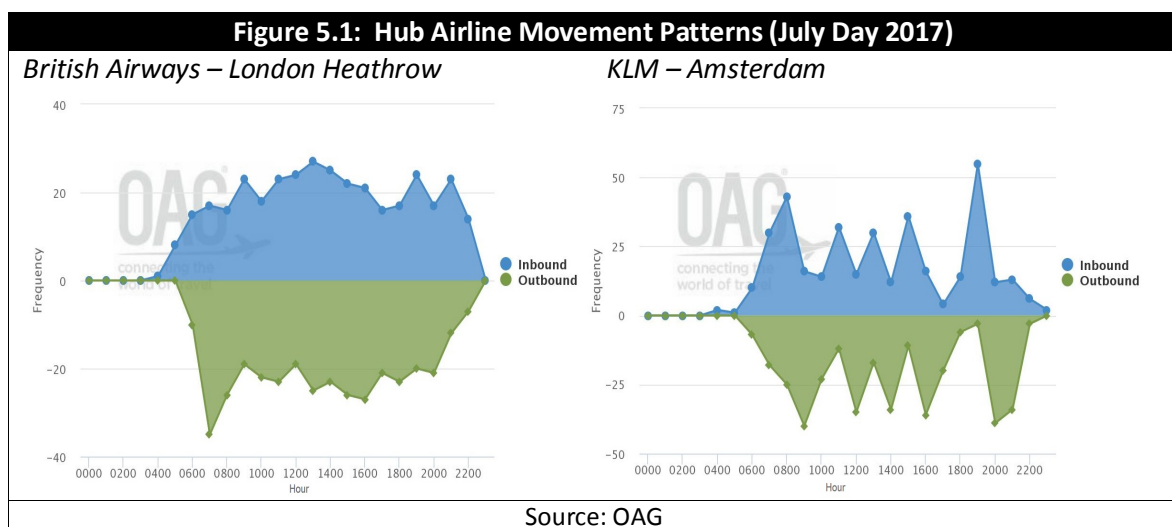
[5] To society, covering user benefits, possible government interventions and airline costs and benefits.

5.3 **Figure 5.2** goes on to illustrate the number of international connections available with British Airways between 60-180 minutes after an arrival at each hour or half hour period through the day. This clearly shows that for large parts of the day, the number of available connections is fairly even regardless of arrival time, with only a limited number of peaks.

Figure 5.2: Available British Airways Onward International Connections

Source: OAG

5.4 With little clear pattern in hub activity at Heathrow, our approach to considering the optimum frequency for maximising connections has been to test a number of frequency scenarios against the connectivity criteria previously identified in Section 3. These frequency scenarios range from 1 flight per day (each way) through to 12 flights per day (each way), the current lowest and highest levels operated by British Airways to / from UK regional airports. Given the structure of British Airways movements at Heathrow, as seen in Figures 5.1 and 5.2, it would be reasonable to assume that at each current level of frequency to regional airports, the airline has sought to maximise connectivity. However, it seems likely that at some point there will be diminishing returns on the extra connectivity added through additional flight frequencies and it is this we have sought to understand. Indeed higher frequencies on current domestic routes may reflect the strength of the underlying point to point demand as much as the need for maximising connectivity.

5.5 The purpose of the analysis is to establish a baseline 'optimum' frequency rather than attempt to estimate what any future impact would be if new runway capacity allowed British Airways to adjust schedules to a more structured 'wave' form or to add further onward destinations. Therefore, the analysis is based on current levels of connectivity for summer 2017, consistent with the earlier analysis[6].

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[6] In reality, there is some limited variation between the summer and winter schedules at Heathrow which may impact the year-round connectivity. However, on core routes, i.e. not the sun-routes served in peak summer, the average change in weekly frequency between summer and winter was only 2.6 flights per week and this applies primarily to European destinations served at high frequency. Most long haul routes operate consistently throughout the year.

5.6 The approach has been to develop flight schedules for each scenario and feed these into our indirect connectivity model. This is done on a one-way schedule (i.e. arriving from the regional point and connecting onward), and assumes that the return leg would offer a similar level of reciprocal connectivity. We have largely based these around the existing schedules but used the evidence in Figure 5.2 to make adjustments where necessary.

5.7 We have taken the same minimum (60 minutes) and maximum (180 minutes) connecting times from the earlier analysis. We recognise that for lower frequency routes passengers may be willing to make longer connections, but this approach allows a clear comparison to be made between frequencies.

5.8 The details of the flight timings are show in **Appendix E**, but the scenarios can be summarised as:

✈ Scenario 1: One flight per day, with timings matching the current single-daily flights to/from Inverness;

✈ Scenario 2: One flight per day, but with an earlier mid-morning arrival than seen from Inverness to meet the lunchtime departures;

✈ Scenario 3: Two daily flights into Heathrow, timed to suit business users seeking a day return point to point (morning and evening flights) with onward connectivity as a secondary benefit;

✈ Scenario 4: Three flights per day based on the current Leeds/Bradford schedule which appears to be more focused on onward connectivity, as flight timings are less suited to point to point business users;

✈ Scenario 5: Three flights per day but based more on a service which would allow day return point to point journeys as well as onward connectivity;

✈ Scenario 6: Four flights per day, suited to day return point to point passengers and with a greater spread through the day for improved onward connectivity;

✈ Scenario 7: Five flights per day, as above but with a further spread of timings through the day;

✈ Scenario 8: Six flights per day, based on the current flight timings to/from Belfast City;

✈ Scenario 9: Six flights per day, based on the current flight timings to/from Newcastle;

✈ Scenario 10: Six flights per day, but optmised around both Belfast City and Newcastle with some further spread of timings through the day;

✈   Scenario 11: Seven flights per day, based on the current flight timings to/from Aberdeen;

✈   Scenario 12: Seven flights per day, based on an amended Scenario 11 with a slightly more even spread of flights through the day;

✈   Scenario 13: Eight flights per day, based on the current flight timings to/from Manchester;

✈   Scenario 14: Nine flights per day, derived from Scenario 13, but with an additional early lunchtime flight for a greater spread of services;

✈   Scenario 15: Ten flights per day, based on the current flight timings to/from Glasgow;

✈   Scenario 16: Eleven flights per day, derived from Scenario 15, but with an extra early evening flight to fill a gap in the schedule;

✈   Scenario 17: Twelve flights per day, based on the current timings to/from Edinburgh.

5.9   **Table 5.1** overleaf sets out the results from our analysis. Based on Heathrow's 2017 schedules, it shows:

✈   the total number of destinations that can be reached on an at least daily and at least weekly basis for each scenario;

✈   the number of major destinations that can be reached on an at least daily and at least weekly basis for each scenario;

✈   the number of emerging market destinations that can be reached on an at least daily and at least weekly basis for each scenario.

Table 5.1: Numbers of Destinations Available via a Notional Heathrow Hub Service					
	All Destinations		Major International		Emerging Markets	
	At Least Daily	At Least Weekly	At Least Daily	At Least Weekly	At Least Daily	At Least Weekly
Scen 1	38	65	26	47	4	6
Scen 2	40	58	31	42	3	4
Scen 3	54	75	45	55	8	9
Scen 4	74	98	54	66	10	14
Scen 5	74	104	46	66	14	19
Scen 6	90	129	62	82	17	22
Scen 7	94	127	65	81	16	21
Scen 8	90	126	64	82	15	20
Scen 9	92	122	67	79	13	17
Scen 10	107	142	71	87	19	23
Scen 11	107	138	71	87	19	22
Scen 12	108	140	72	87	19	22
Scen 13	115	146	76	89	22	23
Scen 14	116	147	76	89	22	23
Scen 15	113	144	75	89	19	22
Scen 16	116	145	76	89	20	22
Scen 17	116	145	76	89	21	22
Source: York Aviation analysis of OAG.					

5.10 This same data is also shown in **Figure 5.3** but we have narrowed the focus in this chart to at least daily services in the interests of clarity. As we have described above, the great majority of Heathrow's core markets are served at least daily.

Figure 5.3: Numbers of Destinations Available via a Notional Heathrow Hub Service

Source: York Aviation analysis of OAG.
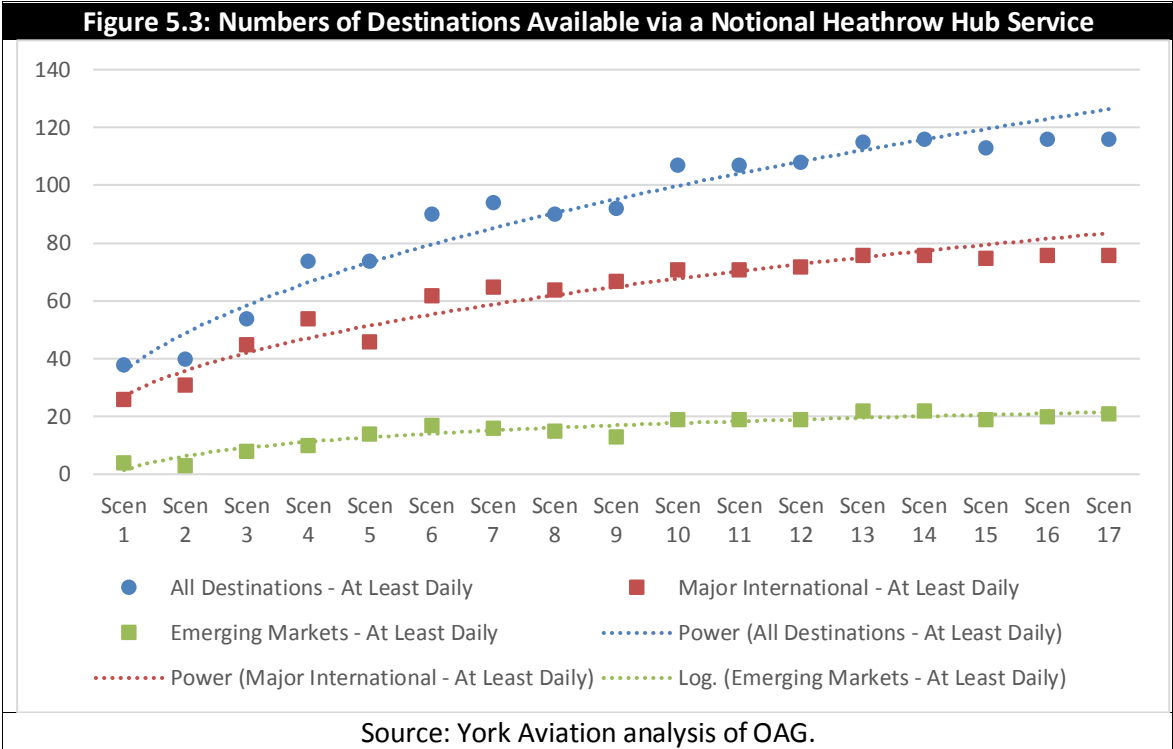
5.11 All three metrics shown here experience some volatility in the number indirect destinations served as the number of hub feeder frequencies rise, which suggests that even at relatively high levels of frequency there is optimisation required in terms of arrival timings at Heathrow to maximise the number of possible connections. However, all three do follow a similar pattern, with the number of connections that can be made steadily increasing at the lower end of the frequency range until around four to five frequencies per day, when diminishing returns on additional frequencies begin to set in. This is particularly true for connections to major destinations and emerging markets.

5.12 This suggests that in terms of new domestic connections to Heathrow or indeed expanding existing low frequency connections, around six services per day would provide the optimal return on investment in connectivity terms. Of the three scenarios tested at 6 flights per day, it is Scenario 10 (a hybrid between Belfast City and Newcastle with further spreading) which provides the greatest level of connectivity to major and emerging markets across all frequency measures. **Table 5.2** goes on to show the indicated schedule from this, and we have made approximations for the reciprocal departures based on typical operating patterns[7].

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[7] The reciprocal departure times will depend ultimately on the flying time to/from a destination, but these flight timings allow for flights of approximately 1 hour20 mins to 1 hour 30mins which will cover much of the UK.

Table 5.2: Indicative Optimal Schedule	
Departure Times from LHR	**Arrival Times to LHR**
	0815
0710	
	1020
0920	
	1245
1125	
	1455
1435	
	1745
1645	
	2020
2055*	
Note: *Would return next day as the 0815 arrival	
Source: York Aviation	

5.13 Whilst these are the tested times within the scenario, the slots for these could be broadly split into half hour periods as the reality is that passengers may be willing to wait slightly longer than the 180 minutes maximum connecting time tested. The broad slot requirement times are therefore shown in **Table 5.3**.

Table 5.3: Broad Slot Requirement	
Departure Slots at LHR	**Arrival Slots at LHR**
	0800-0830
0655-0725	
	1005-1035
0905-0935	
	1230-1300
1110-1140	
	1440-1510
1420-1450	
	1730-1800
1630-1700	
	2005-2035
2040-2110	
Source: York Aviation	

5.14 Determining how many slots would be required at an expanded Heathrow Airport in order to allow this level of service from an increased number of regional points is dependent on four key aspects:

+ **Existing frequencies:** We have assumed that domestic points currently operated at greater than 6 flights per day retain their existing frequency, but that destinations served below this level see an increase to 6 flights per day. This applies only to the hub carrier, British Airways (and Aer Lingus) and excludes the current Flybe domestic links;

+ **New regional points:** Clearly the number of slots required will depend on the number of new regional destinations which may be served. We have not attempted to estimate this, but instead have presented the results over a spread of new destinations:

+ **Assumed Heathrow Capacity:** We have assumed that an expanded Heathrow Airport would have 740,000 available annual slots each year as drawn out of the current consultation process;

+ **Frequency of new services:** We have assumed that new services are operated 6 times per day.

5.15 In 2017, domestic services used around 8.5% of all available slots at Heathrow. Clearly if this figure was a higher proportion of all available slots at a potentially expanded Heathrow then this could limit the new slots available for expanding international services. We have not attempted to project the nature of services at Heathrow in the future, but rather have measured the connectivity benefits against the current base, and therefore it seems likely that a greater use of slots for domestic services would be unlikely to lead to any reduction in connectivity from the present levels. In terms of further connectivity gained, there would continue to be a significant number of new slots available for international services, so it could be expected that connectivity would increase, albeit the extent of this could change depending on how many new domestic services/frequencies were actually delivered.

5.16 **Table 5.4** indicates the share of slots which would be used by domestic services at a potentially expanded Heathrow if new regional flights were launched and current services increased to a minimum of 6 flights per day. This shows that, combined with the increased existing network, two new regional points would use up to 7% of total annual slots at Heathrow[8], increasing through to around 15% if as many as 15 new points could be served.

5.17 In reality some domestic destinations would be unable to sustain 6 daily services and therefore the figures in the table may represent an upper bound of slots which would need to be retained to feed the hub. Furthermore, it is possible that in a free market, other airlines, not the main hub carrier or its partners, may wish to use slots for domestic services, and these could be over and above the figures shown in Table 5.4.

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[8] Out of the 740,000 total limit of a potentially expanded Heathrow.

Table 5.4: Estimated Domestic Slot Share of Expanded London Heathrow		
2017 Domestic Slots		
British Airways/Aer Lingus	37,000	
Adjustment for Lower Frequency Services	7,250	
Proxy 2017 Domestic Slots (Min 6 flights/day on all routes)	**44,250**	
New Regional Routes	***New Slots Required***	***Share of Expanded London Heathrow Slots (including 2017 Proxy)***
2	8,740	7%
3	13,110	8%
4	17,480	8%
5	21,850	9%
6	26,220	10%
7	30,590	10%
8	34,960	11%
9	39,330	11%
10	43,700	12%
11	48,070	12%
12	52,440	13%
13	56,810	14%
14	61,180	14%
15	65,550	15%
Source: OAG/York Aviation		

APPENDIX A

LIST OF UK AIRPORTS ASSESSED IN THIS REPORT

Table A1: UK Airports in Scope	
Aberdeen	Inverness
Barra	Islay
Belfast City (George Best)	Kirkwall
Belfast International	Leeds/Bradford
Benbecula	Lerwick (Tingwall)
Birmingham	Liverpool (John Lennon)
Bournemouth	London City
Bristol	London Luton
Campbeltown	Manchester
Cardiff Wales	Newcastle
City Of Derry (Eglinton)	Newquay
Doncaster Sheffield	Norwich
Dundee	Prestwick
Durham Tees Valley	Scatsta
East Midlands International	Southampton
Edinburgh	London Southend
Exeter	London Stansted
London Gatwick	Stornoway
Glasgow	Sumburgh
London Heathrow	Tiree
Humberside	Wick John O Groats
Source: DfT	

APPENDIX B

**DISCUSSION OF THE ISSUES AROUND THE USE OF CAA AND
DFT DATA FOR CONNECTIVITY ANALYSIS**

In Section 2 we set out our approach to the definition of connectivity and our position in relation to the DfT's existing definitions daily and weekly services and the use of CAA data on destinations served versus the use of schedules data, such as that provided by OAG. In our view there are a number of practical issues around the use of the CAA data that mean that the use of OAG data is more appropriate and this knocks on to exactly how daily and weekly services are defined. We discuss these issues further below.

The key difficulty with this is that airlines may not schedule services every single day of the year (for 'daily') and then may also suffer cancellations within the services that they do schedule, which means, in the historic data, their services may not meet the 'daily' criteria. One result of this is that in one year a route may feature in the analysis, but the following year may not because the airline may suffer an extra cancellation, meaning annual comparisons or analysis of connectivity may show quite different results for some airports despite the same level of service being intended by the airlines. Furthermore, passenger perceptions of a daily flight, and therefore the value of connectivity offered, is based on what flights are available to buy as any cancellations cannot be anticipated. Therefore, it is actually the promulgated schedule that defines connectivity value to society, not the historic activity, which could be significantly impacted by cancellations. The same is true for weekly frequencies.

A further issue, which relates particularly to the analysis of 'weekly' flights is that the figure of 51 departures may not reflect a year round service. If an airline operates 2 flights per week, but only for the peak summer season, then this will show in historic data as being 'weekly' if this data is on an aggregated annual basis, but may in reality only operate for half of the year, so may not reflect true connectivity benefits from air services.

We recognise that the DfT definitions are a proxy in order to draw a sensible conclusion from available data and that definitive markers need to be determined. However, there appear to be some further difficulties with using the CAA flown data to analyse the connectivity including:

✈ routes with refueling stopovers, such as to Australasia, are not apparent as only the next destination is shown;
✈ the two-way nature of the CAA data means that routes flown on a triangular basis (i.e. from the UK to destination A, then on to destination B and then back to the UK) are not properly picked up;
✈ there are inconsistencies in the way the data treats stopovers, for example in some cases the data records the London City to New York service as stopping in Shannon and in other cases it does not record the fuel stop in Ireland.

We have undertaken a comparative analysis of the CAA flown data and OAG scheduled data for 2016 (the last full year of CAA flown data at the time of the analysis) which showed that, when adjusting for some of the data problems above, OAG data shows an average of 0.3% more flights on comparative routes. On a schedule of 360-365 flights per annum, this suggests typically a couple of occasions each year when a service does not operate.

Based on the identified difficulties with the CAA's flown data, we have used OAG schedules data as the basis for the analysis as this shows the promulgated services which will better reflect the public perception of service frequency and therefore connectivity value.

The use of OAG also removes any inconsistency in our approach covering direct and indirect connectivity as it gives a common data source across the two. CAA flown data only aggregates data

to an annual level and therefore cannot be used to consider flight connection opportunities as it provides no information on flight timings at hub airports.

OAG data has also enabled us to include key destinations that are served by stopping services, notably Sydney, Melbourne and Auckland, within our analysis. This cannot be done using CAA data and given the size of these markets from the UK, this seem a major omission given the scale of demand to these destinations. Given that passengers can book services on these flights to both the final destination and the intermediary stop, we have included both of these in the analysis, so the intermediary stops also contribute to service frequencies. This only impacts on connectivity from London Heathrow, as these are no services to Australasia from any other airports in the UK presently. There are a limited number of triangular services operated by British Airways, mainly to the Caribbean. Given the low volumes of passengers on these (which will be considered in the definitions and assumptions around Major International destinations below), we have not sought to apply the same approach.

APPENDIX C

LIST OF MAJOR DESTINATIONS

CAA Survey Data (True Origin/Destination)

Destination Airport	Destination City	UK Demand Share	
		Share	Cumulative Share
DUB	Dublin, IE	4%	4%
AMS	Amsterdam-Schiphol, NL	3%	7%
AGP	Malaga, ES	3%	10%
ALC	Alicante, ES	2%	12%
PMI	Palma De Mallorca, ES	2%	14%
BCN	Barcelona, ES	2%	16%
TFS	Tenerife Sur Reina Sofia, ES	2%	18%
FAO	Faro Pt	2%	20%
GVA	Geneva (Cointrin), CH	2%	22%
MAD	Madrid (Barajas), ES	1%	23%
JFK	New York(Jf Kennedy), US	1%	24%
CDG	Paris - Charles De Gaulle, FR	1%	26%
CPH	Copenhagen (Kastrup), DK	1%	27%
ACE	Lanzarote Arecife, ES	1%	28%
DXB	Dubai, AE	1%	29%
FCO	Rome (Fiumicino), IT	1%	30%
MUC	Munich, DE	1%	31%
LIS	Lisbon, PT	1%	32%
BUD	Budapest, HU	1%	33%
SXF	Berlin (Schonefeld), DE	1%	34%
FRA	Frankfurt Main, DE	1%	35%
ZRH	Zurich Ch	1%	36%
NCE	Nice, FR	1%	37%
IBZ	Ibiza, ES	1%	37%
PRG	Prague, CZ	1%	38%
MCO	Orlando (International), US	1%	39%
MXP	Milan (Malpensa), IT	1%	40%
DLM	Dalaman, TR	1%	40%
LPA	Gran Canaria, ES	1%	41%
PFO	Paphos, CY	1%	42%
MLA	Malta Mt	1%	43%
ARN	Stockholm(Arlanda), SE	1%	43%
VCE	Venice (Marco Polo), IT	1%	44%
LCA	Larnaca, CY	1%	45%
FUE	Fuerteventura, ES	1%	45%
DUS	Dusseldorf, DE	1%	46%
OTP	Bucharest Otopeni, RO	1%	46%
KRK	Krakow, PL	1%	47%
YYZ	Toronto, CA	1%	48%
HKG	Hong Kong(Kai Tak), HK	1%	48%
HAM	Hamburg (Fuhlsbuttel), DE	1%	49%

BKK	Bangkok, TH	1%	49%
VIE	Vienna (Schwechat), AT	1%	50%
ORK	Cork, IE	1%	50%
ATH	Athens Gr	1%	51%
TLV	Tel Aviv, IL	1%	51%
OSL	Oslo (Fornebu), NO	1%	52%
LIN	Milan (Linate), IT	0%	52%
SYD	Sydney(Kingsford Smith), AU	0%	53%
PSA	Pisa, IT	0%	53%
NAP	Naples, IT	0%	54%
WAW	Warsaw, PL	0%	54%
CIA	Rome (Ciampino), IT	0%	55%
MAH	Mahon, Minorca, ES	0%	55%
HER	Heraklion, GR	0%	56%
LAX	Los Angeles International, US	0%	56%
EWR	New York(Newark), US	0%	56%
BSL	Basle (Mulhouse), CH	0%	57%
CFU	Corfu, GR	0%	57%
GDN	Gdansk, PL	0%	58%
MJV	Murcia San Javier, ES	0%	58%
KEF	Keflavik, IS	0%	59%
BOS	Boston(Logan Internationa, US	0%	59%
HEL	Helsinki, FI	0%	59%
PER	Perth, AU	0%	60%
CUN	Cancun, MX	0%	60%
BGY	Bergamo, IT	0%	61%
SOF	Sofia, BG	0%	61%
AYT	Antalya, TR	0%	61%
SIN	Singapore(Changi Internat, SG	0%	62%
SFO	San Francisco Internation, US	0%	62%
OPO	Porto (Pedras Rubras), PT	0%	62%
TXL	Berlin - Tegel, DE	0%	63%
IST	Istanbul, TR	0%	63%
WMI	Warsaw Modlin Mazovia, PL	0%	64%
CGN	Cologne (Bonn), DE	0%	64%
STR	Stuttgart De	0%	64%
RHO	Rhodes, GR	0%	65%
RIX	Riga, LV	0%	65%
BRU	Brussels (National), BE	0%	65%
RAK	Marrakesh(Menara), MA	0%	66%
KTW	Katowice (Pyrzowice), PL	0%	66%
MEL	Melbourne(Tullamarine Int, AU	0%	66%
JNB	Johannesburg(Jan Smuts), ZA	0%	67%
SNN	Shannon, IE	0%	67%
TLS	Toulouse (Blagnac), FR	0%	67%
LAS	Las Vegas (Mccarron Int), US	0%	68%

WRO	Wroclaw, PL	0%	68%
DEL	Delhi, IN	0%	68%
NOC	Connaught (Knock), IE	0%	69%
FNC	Funchal, PT	0%	69%
GOT	Gothenburg (Landvetter), SE	0%	69%
LYS	Lyon, FR	0%	69%
ISB	Islamabad (Rawalpindi), PK	0%	70%
BLQ	Bologna, IT	0%	70%
BGI	Bridgetown, BB	0%	70%
BOD	Bordeaux (Merignac), FR	0%	71%
MRS	Marseille, FR	0%	71%
VLC	Valencia, ES	0%	71%
VNO	Vilnius, LT	0%	72%
MIA	Miami International, US	0%	72%
ORD	Chicago(oHare), US	0%	72%
PEK	Beijing/Peking, CN	0%	72%
PVG	Shanghai, CN	0%	73%
POZ	Poznan Pl	0%	73%
VRN	Verona (Villafranca), IT	0%	73%
IAD	Washington Dulles Int, US	0%	73%
KUL	Kuala Lumpur Internationa, MY	0%	74%
GIB	Gibraltar, GI	0%	74%
ZTH	Zakinthos Is. Zante, GR	0%	74%
BNE	Brisbane, AU	0%	74%
BOM	Bombay, IN	0%	75%
BIO	Bilbao, ES	0%	75%
YVR	Vancouver, CA	0%	75%
TSF	Treviso (St Angelo), IT	0%	75%
AKL	Auckland International, NZ	0%	76%
CPT	Cape Town(Df Malan), ZA	0%	76%
BTS	Bratislava, SK	0%	76%
BJV	Bodrum Tr	0%	76%
DBV	Dubrovnik, HR	0%	76%
TRN	Turin (Caselle), IT	0%	77%
LOS	Lagos(Murtala Muhammed), NG	0%	77%
BLL	Billund, DK	0%	77%
LUX	Luxembourg (Findel), LU	0%	77%
SVQ	Seville, ES	0%	77%
HND	Tokyo(Haneda), JP	0%	78%
SVG	Stavanger (Sola), NO	0%	78%
BGO	Bergen (Flesland), NO	0%	78%
KGS	Kos, GR	0%	78%
EIN	Eindhoven (Rnethaf), NL	0%	78%
AUH	Abu Dhabi, AE	0%	79%
KUN	Kaunas Lt	0%	79%
ICN	Seoul (Incheon), KR	0%	79%

BOJ	Bourgas, BG	0%	79%
SZG	Salzburg, AT	0%	79%
ATL	Atlanta, US	0%	79%
HAJ	Hannover (Lagenhagen), DE	0%	80%
ORY	Paris-Orly, FR	0%	80%
MBJ	Montego Bay, JM	0%	80%
GRO	Gerona (Costa Brava), ES	0%	80%
CMB	Colombo(Katunayake), LK	0%	80%

APPENDIX D

ASSESSED AIRPORT CATCHMENT MAPS

Aberdeen Airport Catchment Map

Aberdeen

- 120 minutes
- 60 minutes
- 90 minutes

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Barra Airport Catchment Map

Barra

- 60 minutes

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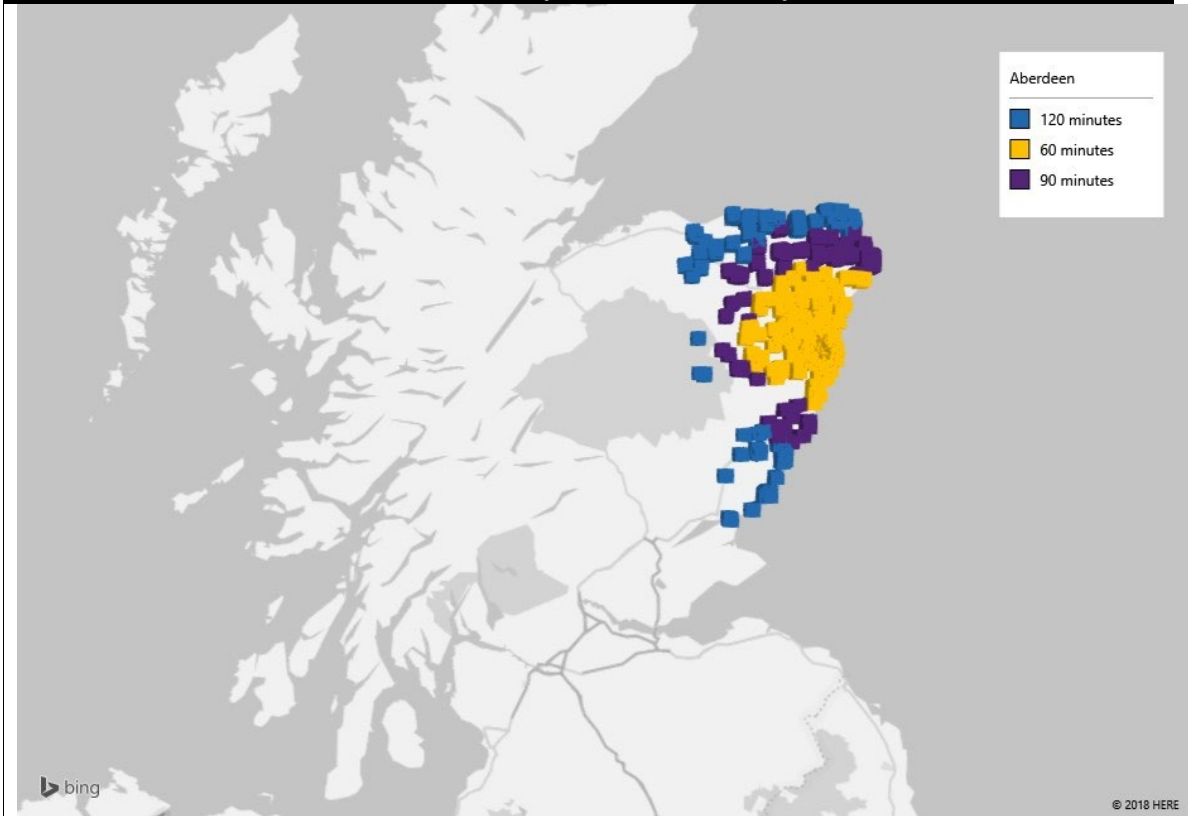
Belfast City Airport Catchment Map
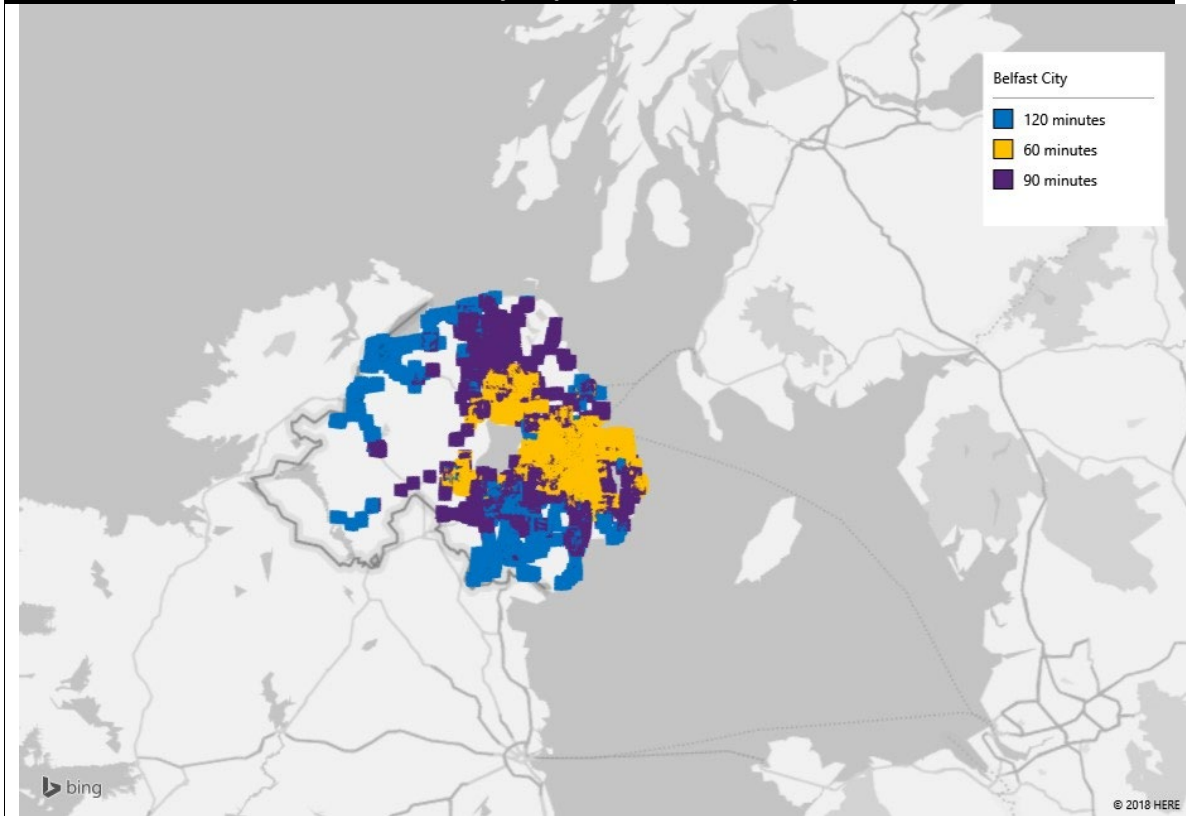
Belfast International Airport Catchment Map
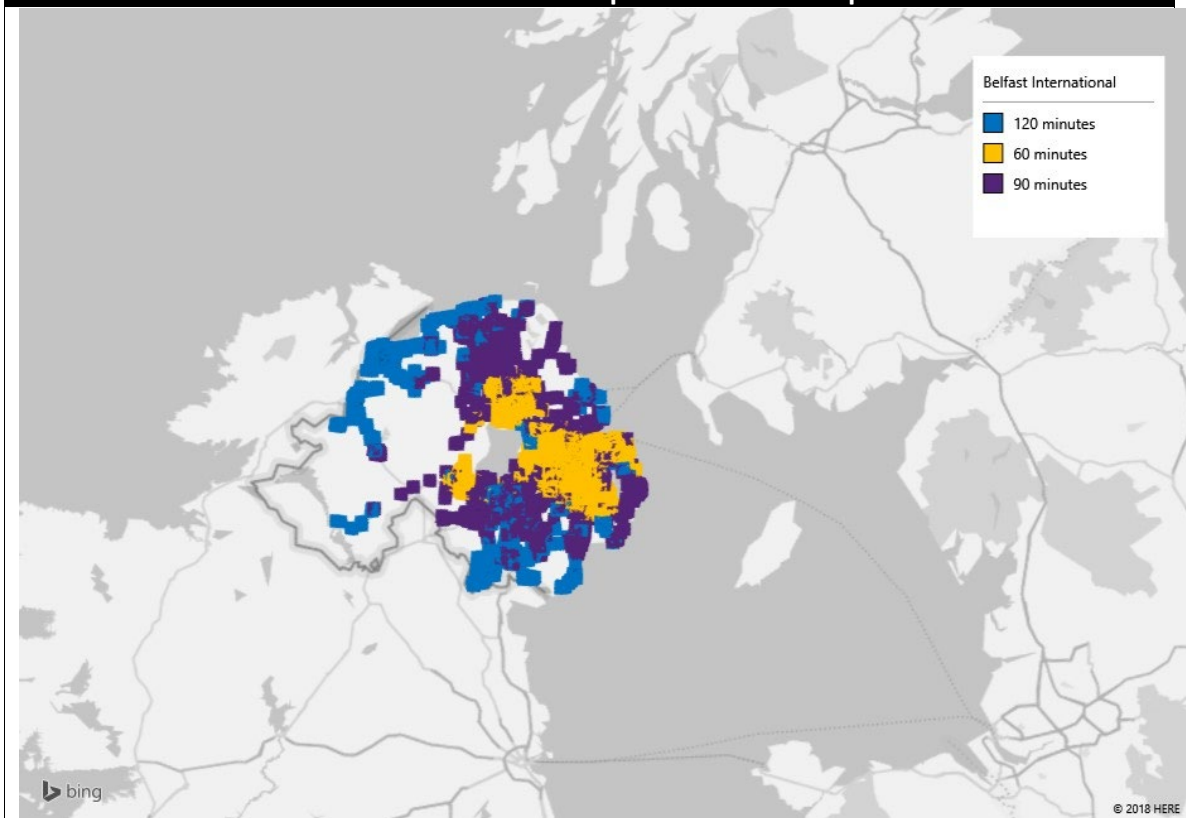
Benbecula Airport Catchment Map

Benbecula
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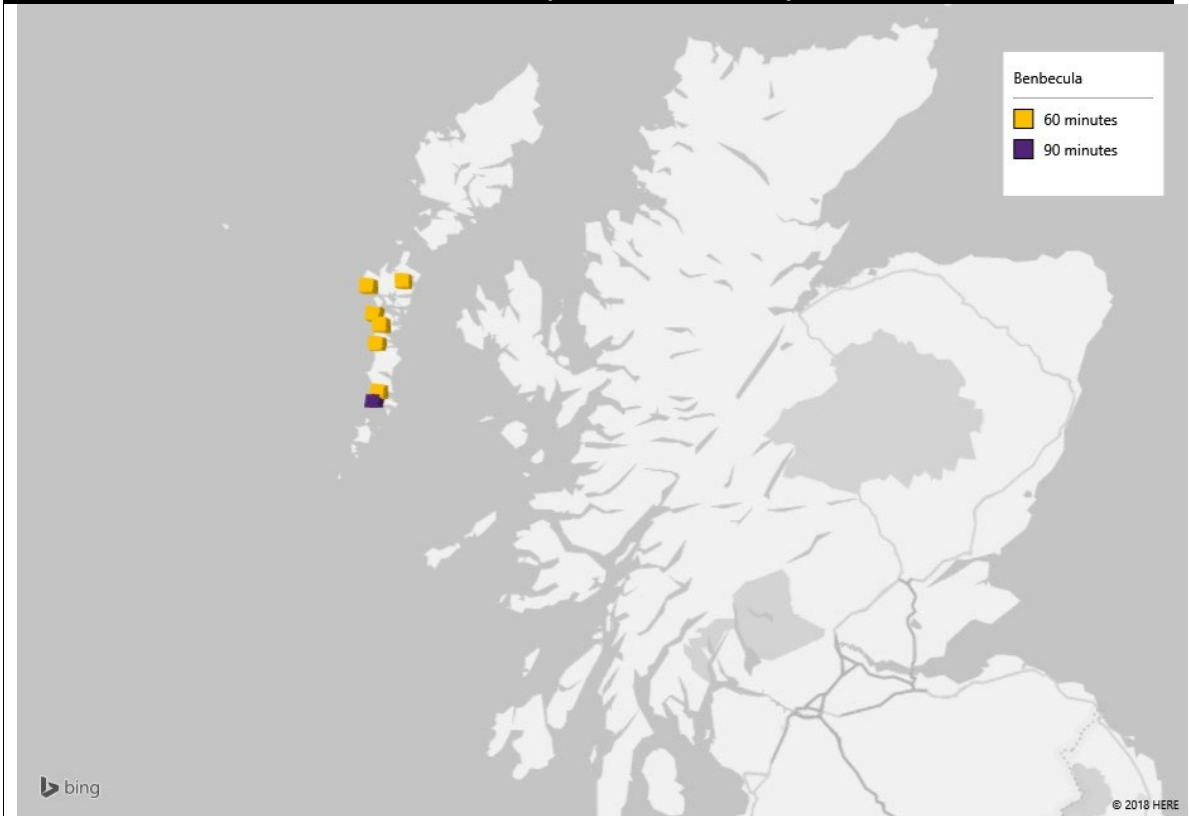
Birmingham Airport Catchment Map

Birmingham
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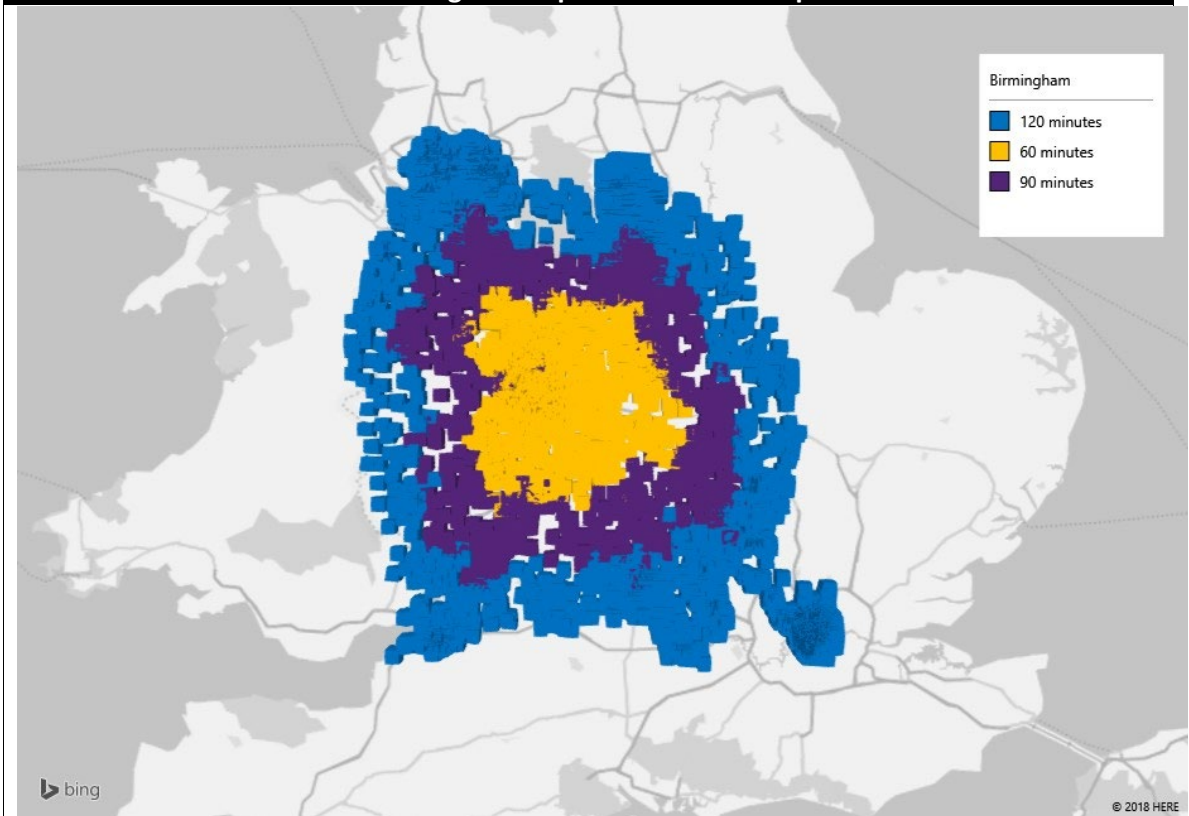
Bournemouth Airport Catchment Map

Bournemouth
- 120 minutes
- 60 minutes
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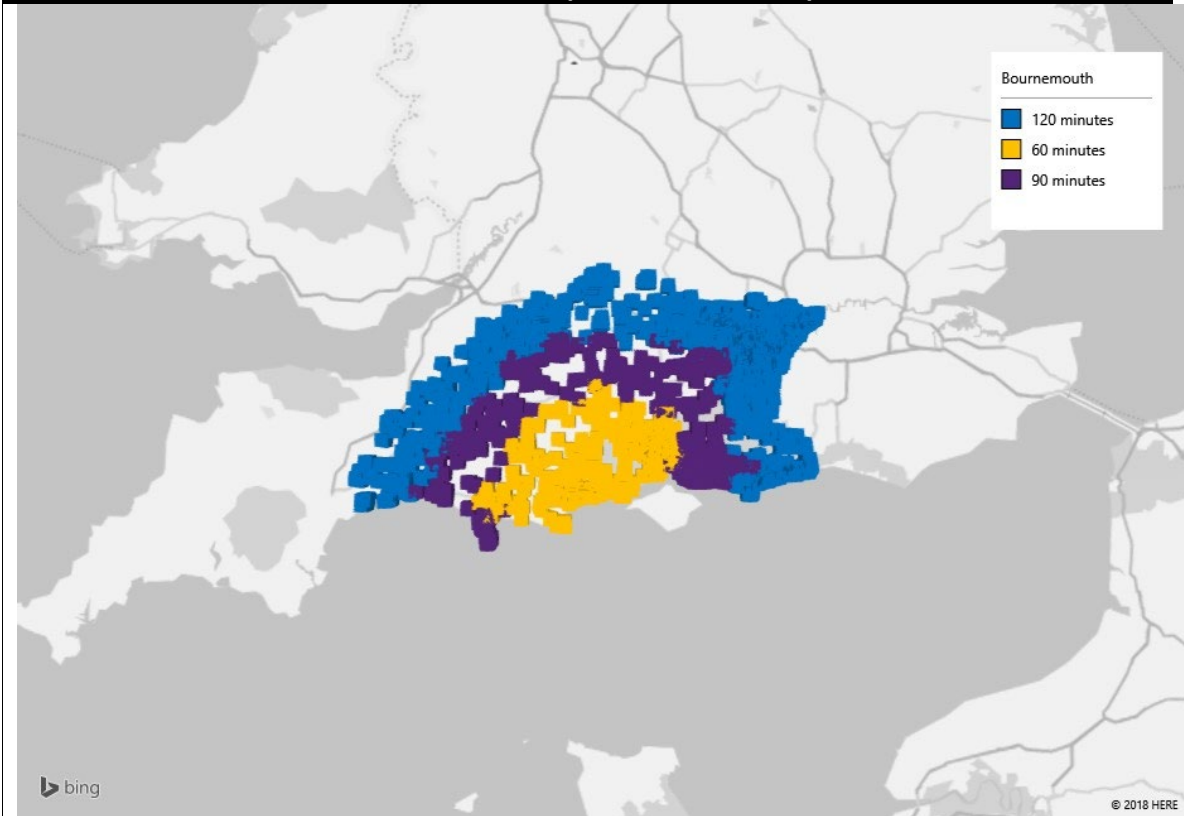
Bristol Airport Catchment Map

Bristol
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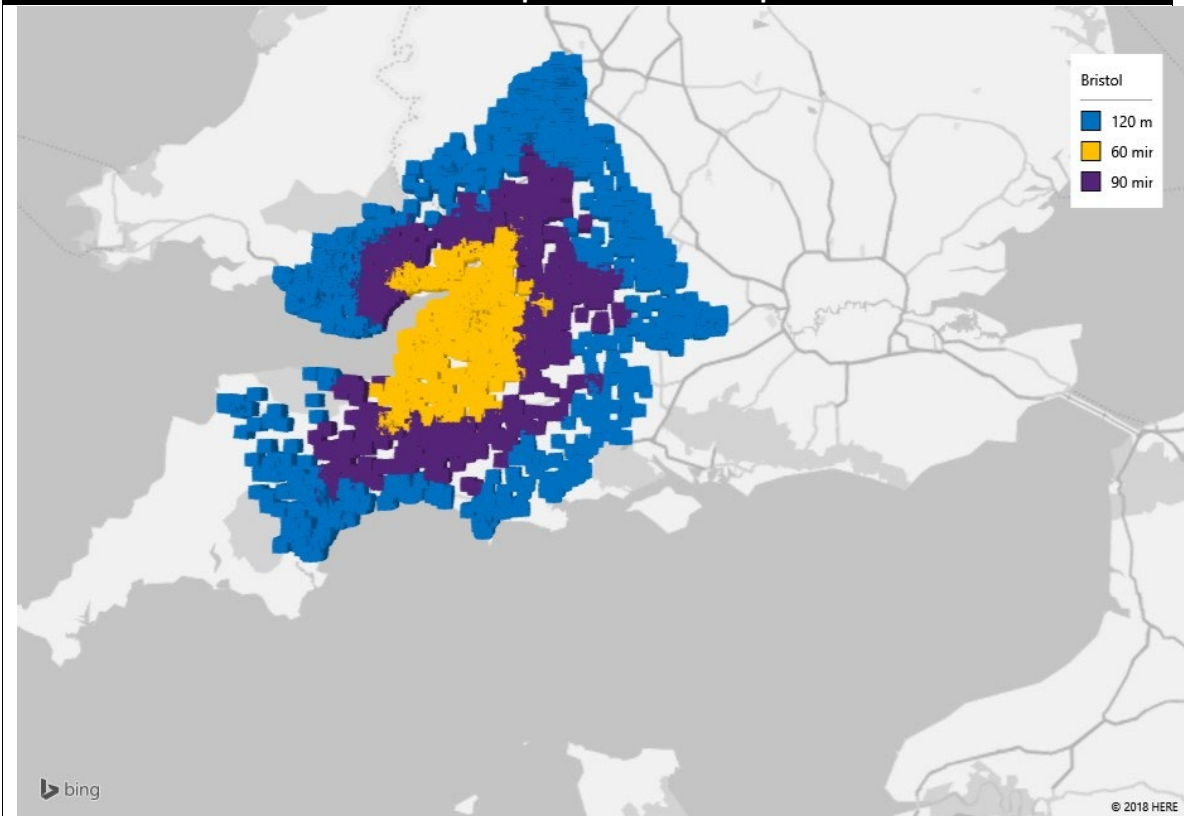
Campbeltown Airport Catchment Map

Campbeltown
- 120 minutes
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- 90 minutes

Cardiff Airport Catchment Map

Cardiff Wales
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- 90 minutes
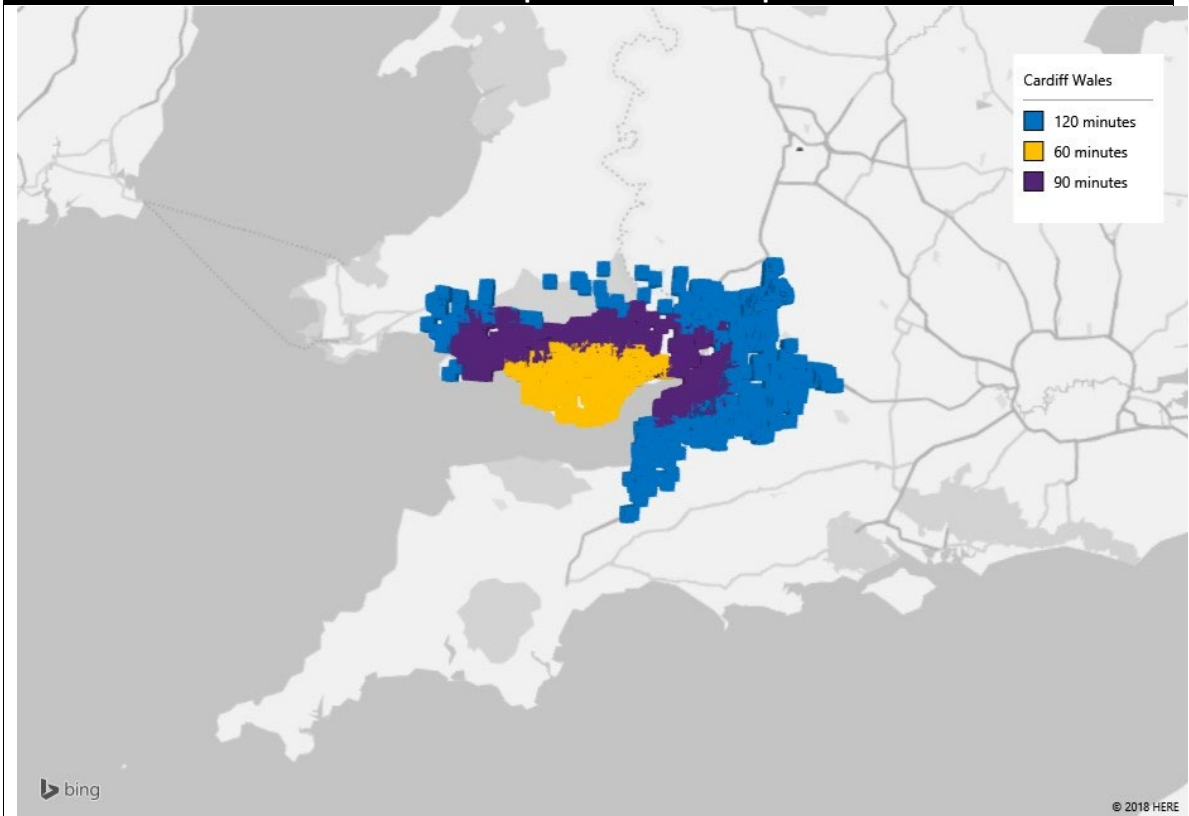
City of Derry Airport Catchment Map

City of Derry

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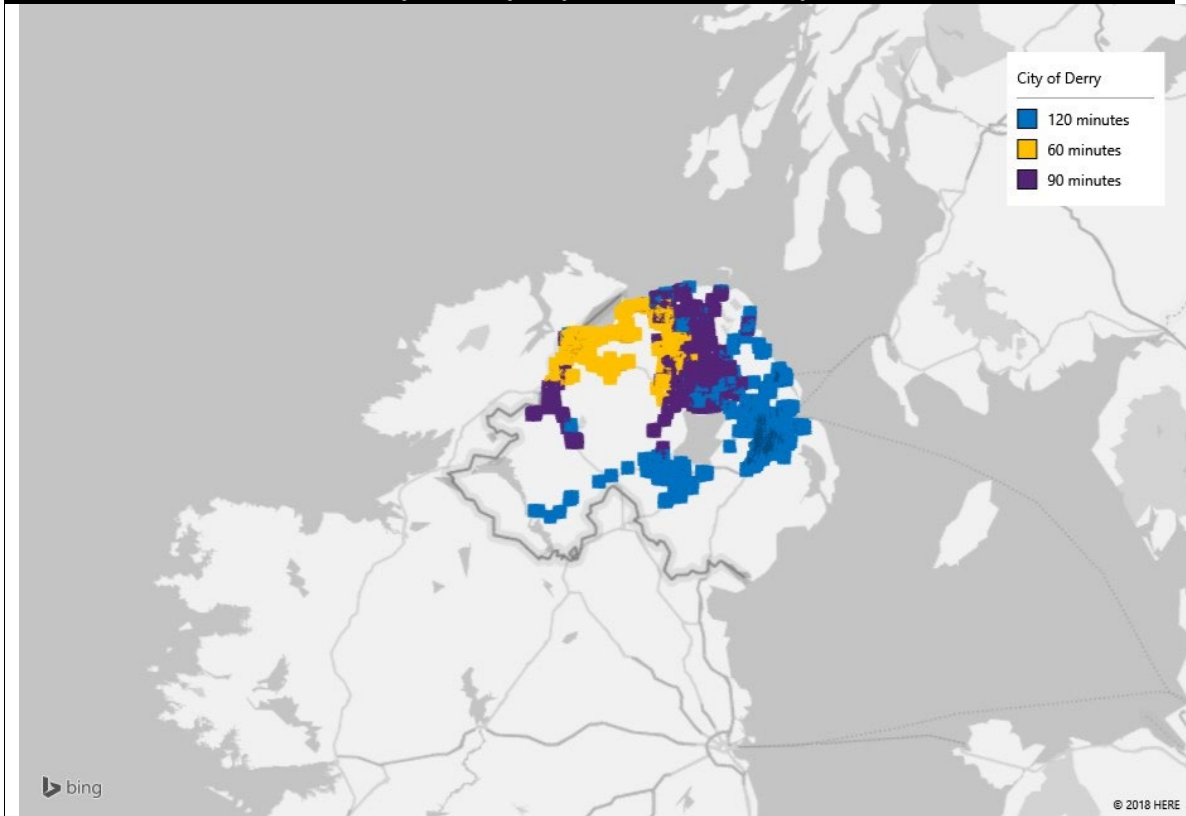
Doncaster Sheffield Airport Catchment Map

Doncaster Sheffield

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Dundee Airport Catchment Map

Dundee

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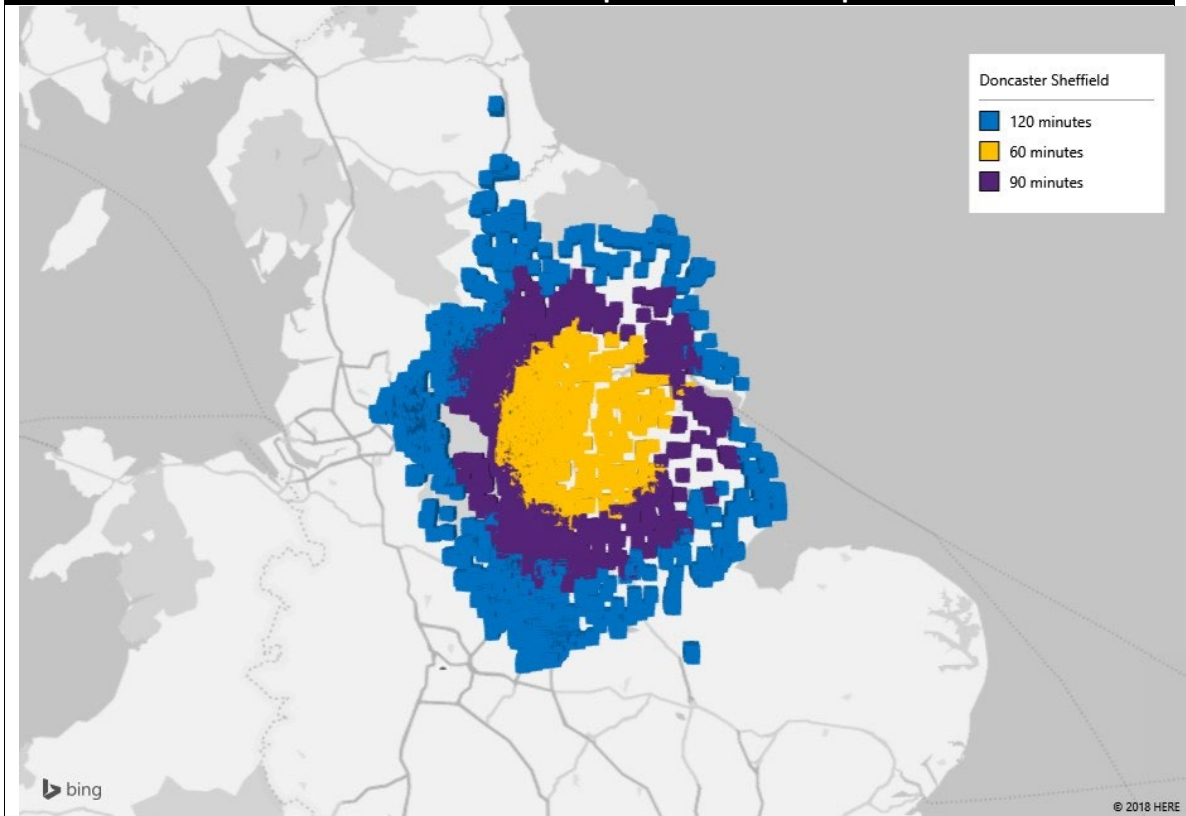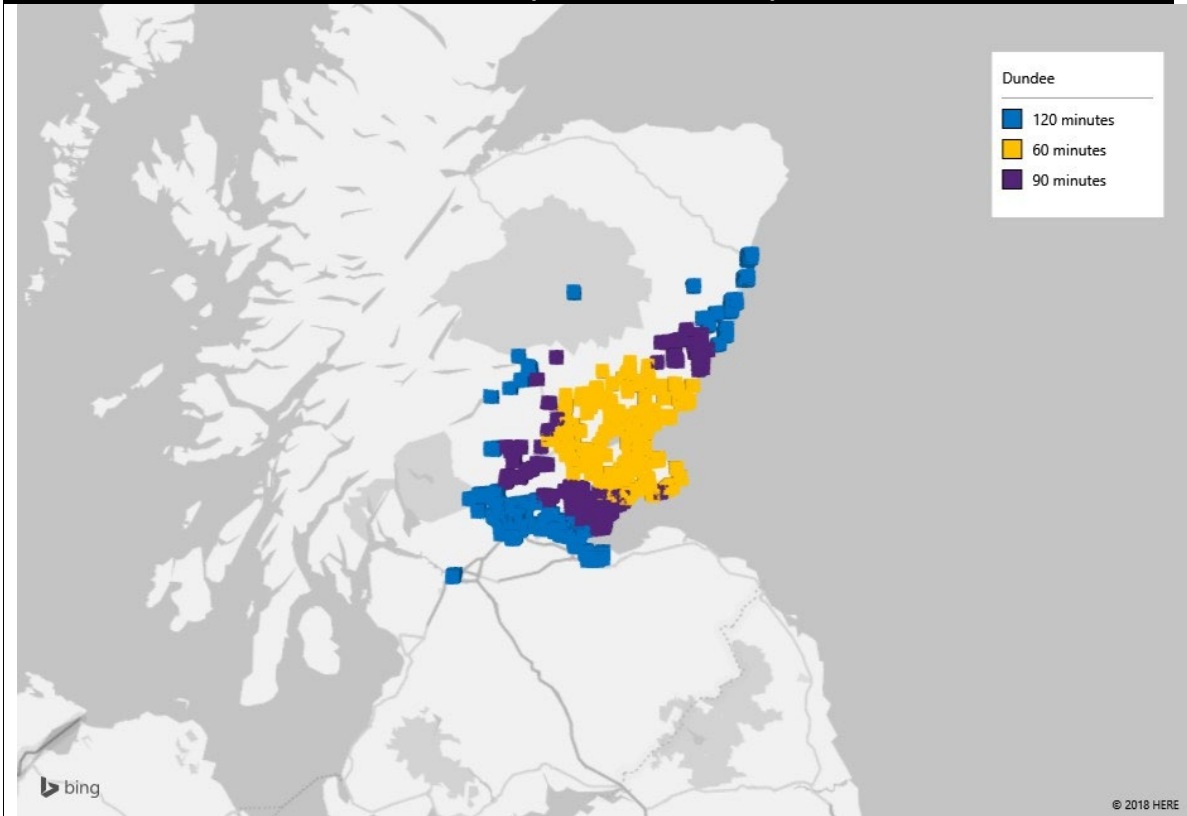
Durham Tees Valley Airport Catchment Map

Durham Tees Valley

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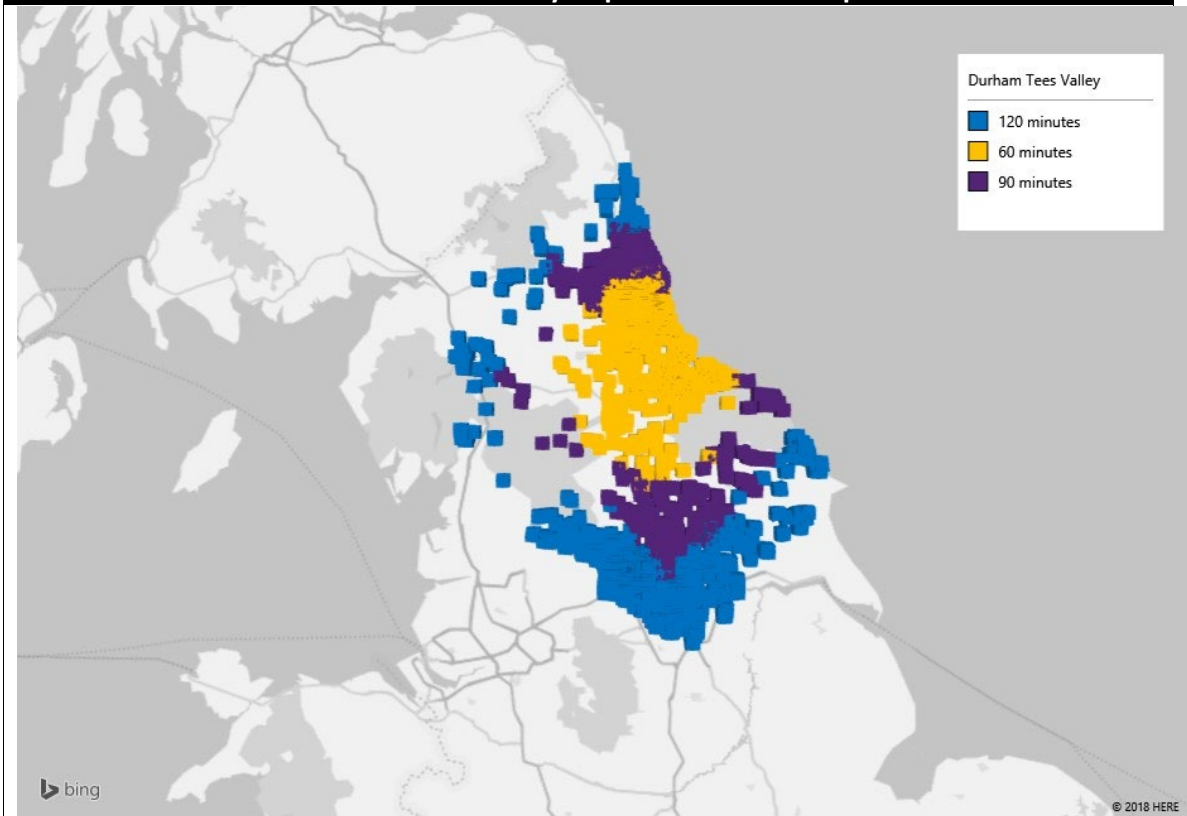
East Midlands Airport Catchment Map

East Midlands

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Edinburgh Airport Catchment Map

Edinburgh

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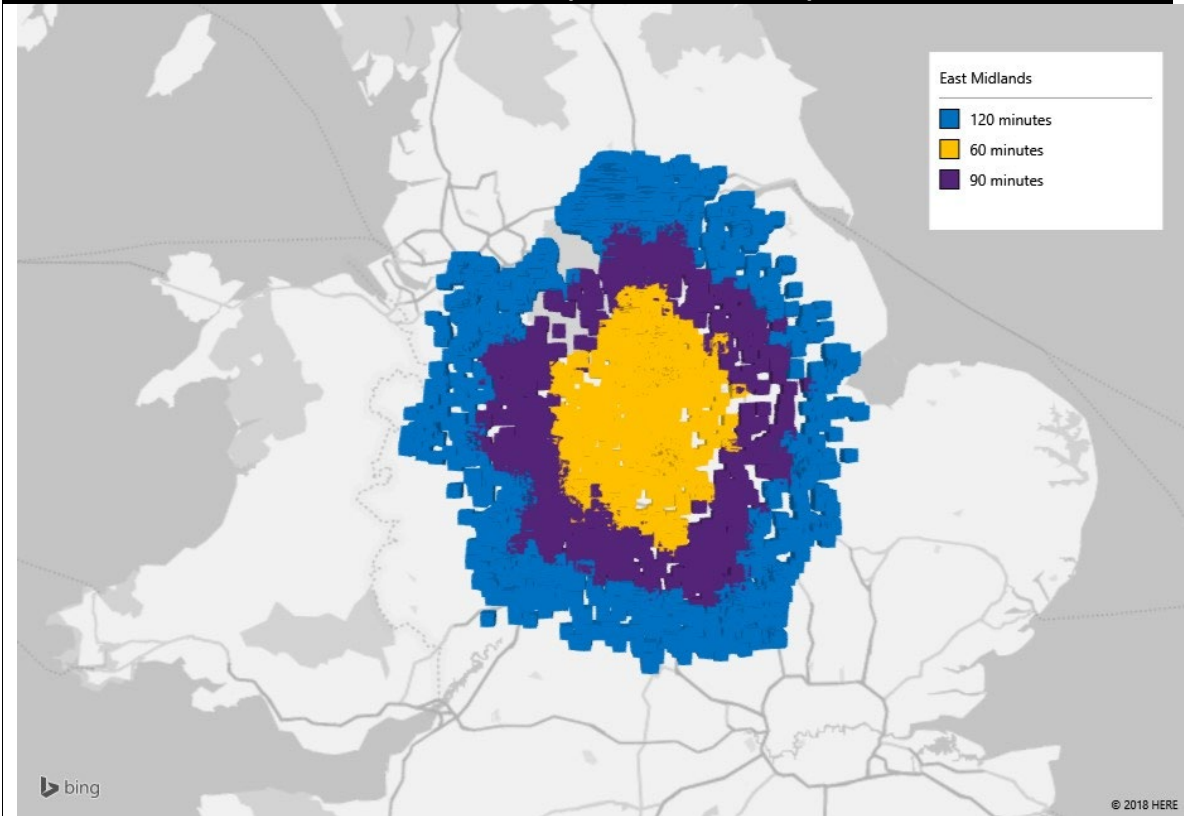
Exeter Airport Catchment Map

Exeter
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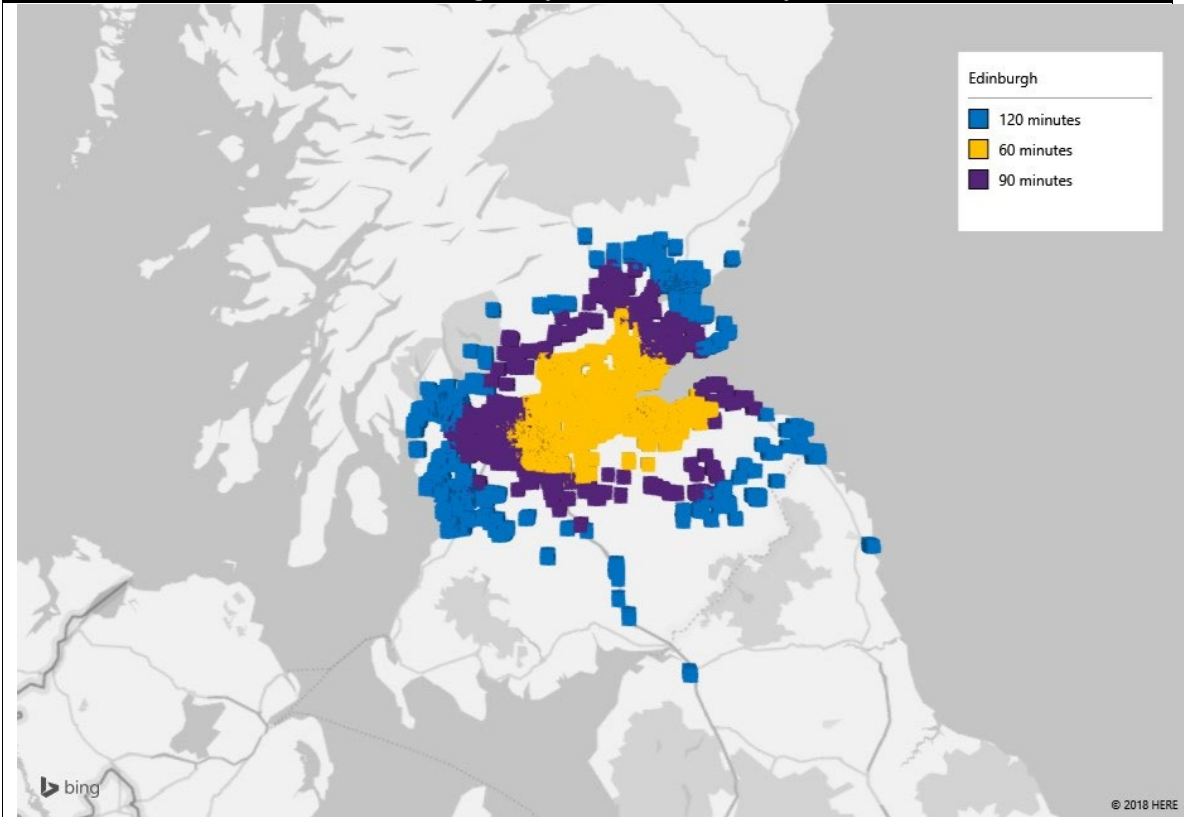
Gatwick Airport Catchment Map

Gatwick
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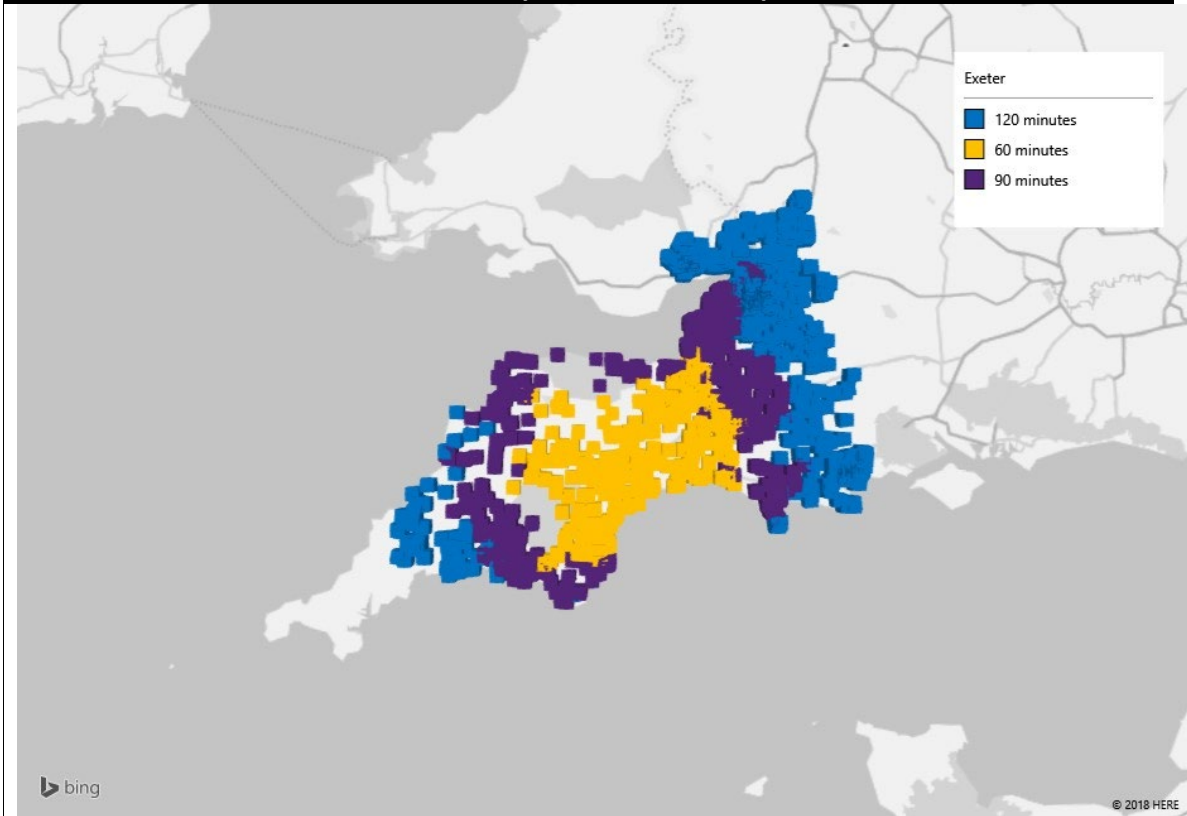
Glasgow Airport Catchment Map

Glasgow
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- 90 minutes

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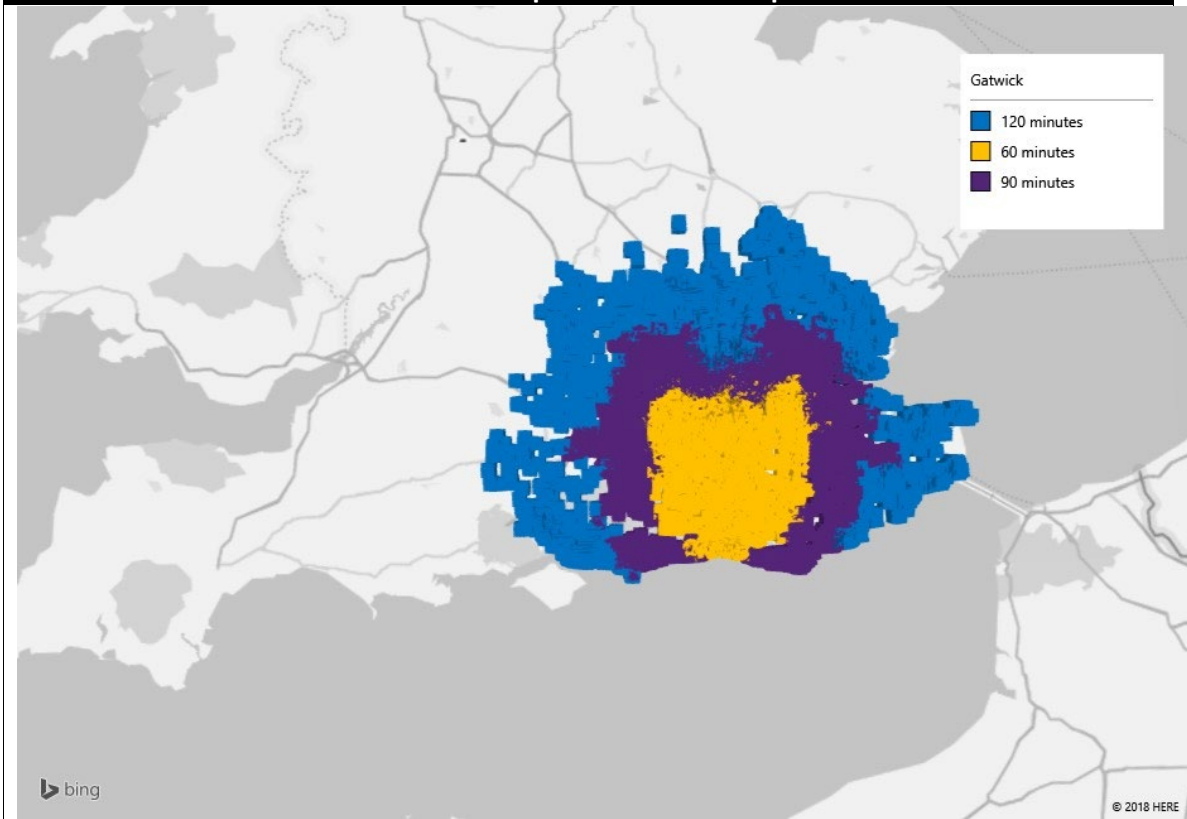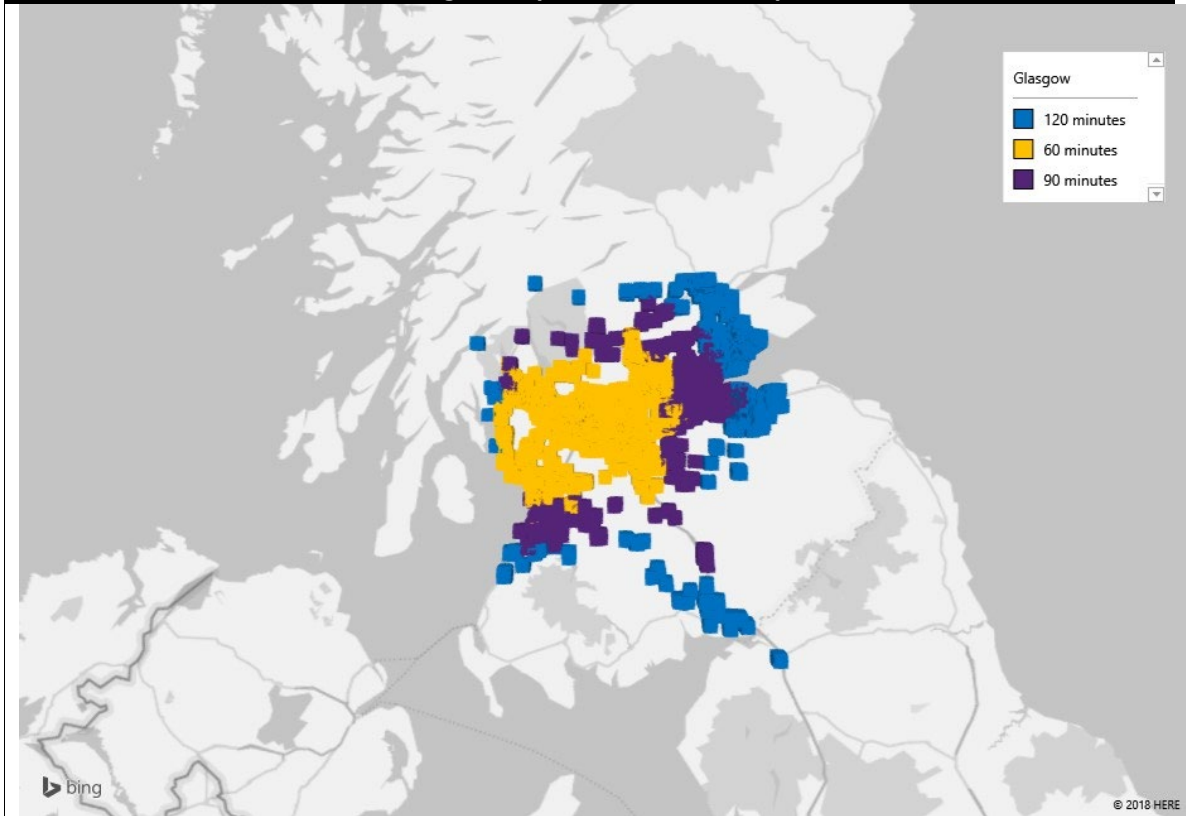
Heathrow Airport Catchment Map

Heathrow
- 120 minutes
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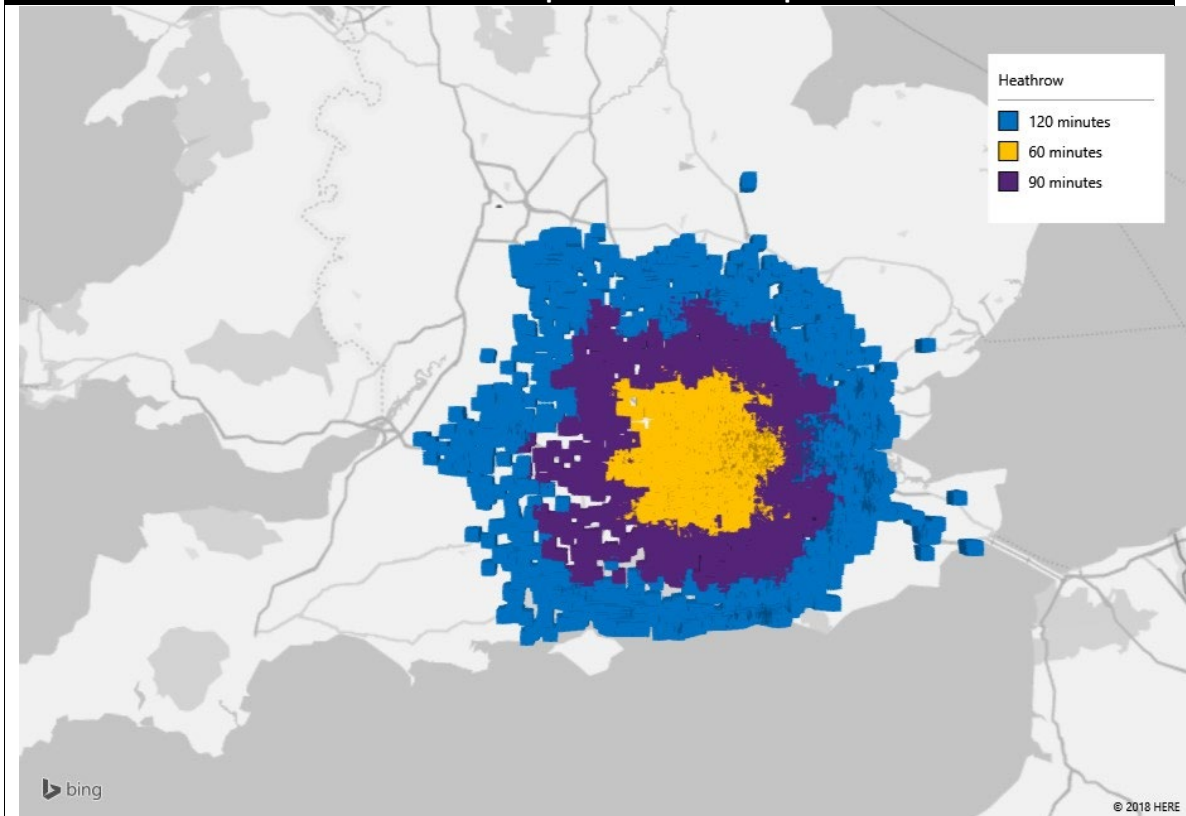
Humberside Airport Catchment Map

Humberside

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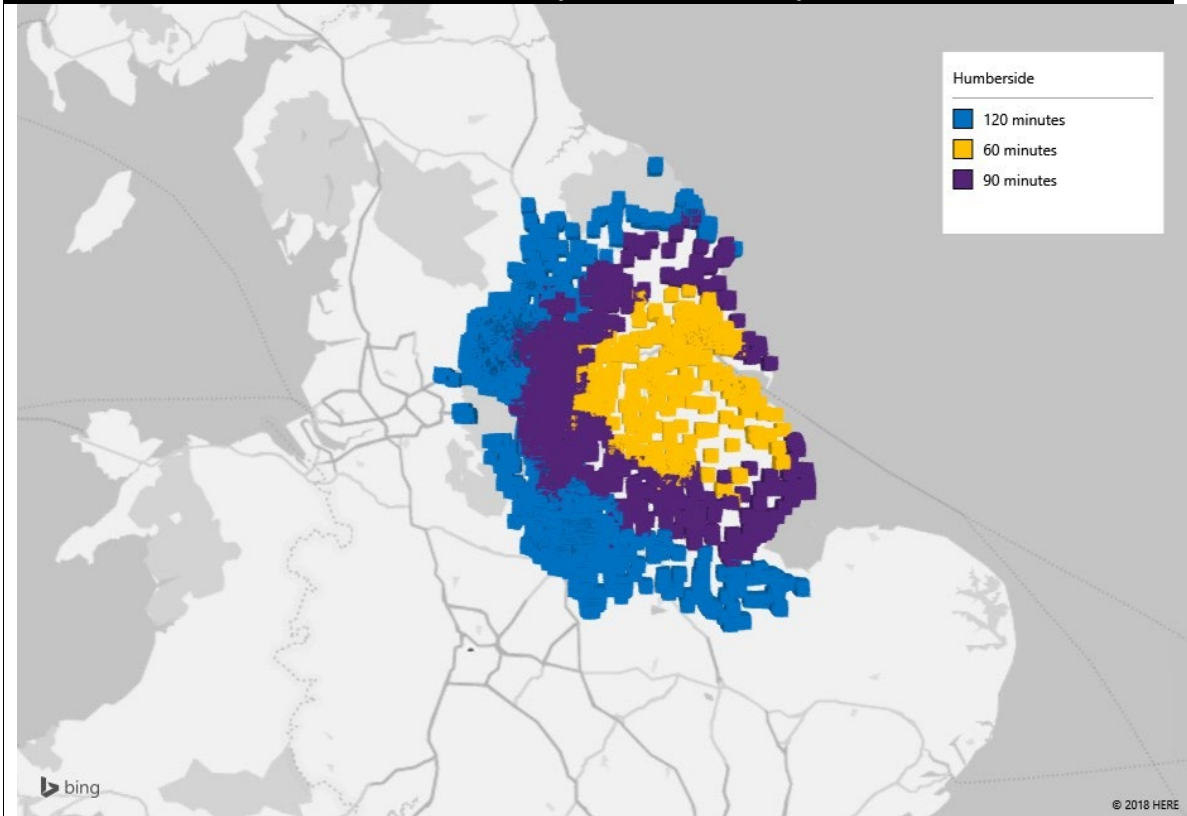
Inverness Airport Catchment Map

Inverness

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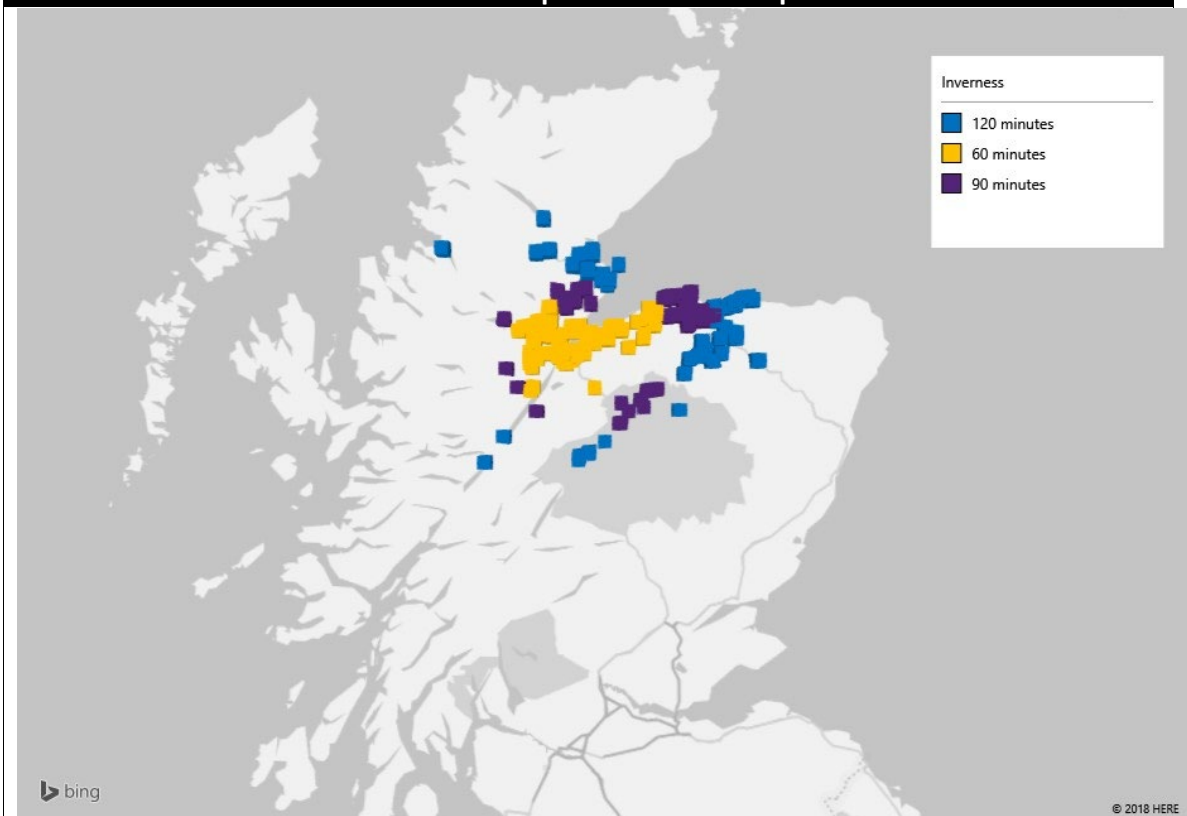
Islay Airport Catchment Map

Islay

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Kirkwall Airport Catchment Map

Kirkwall

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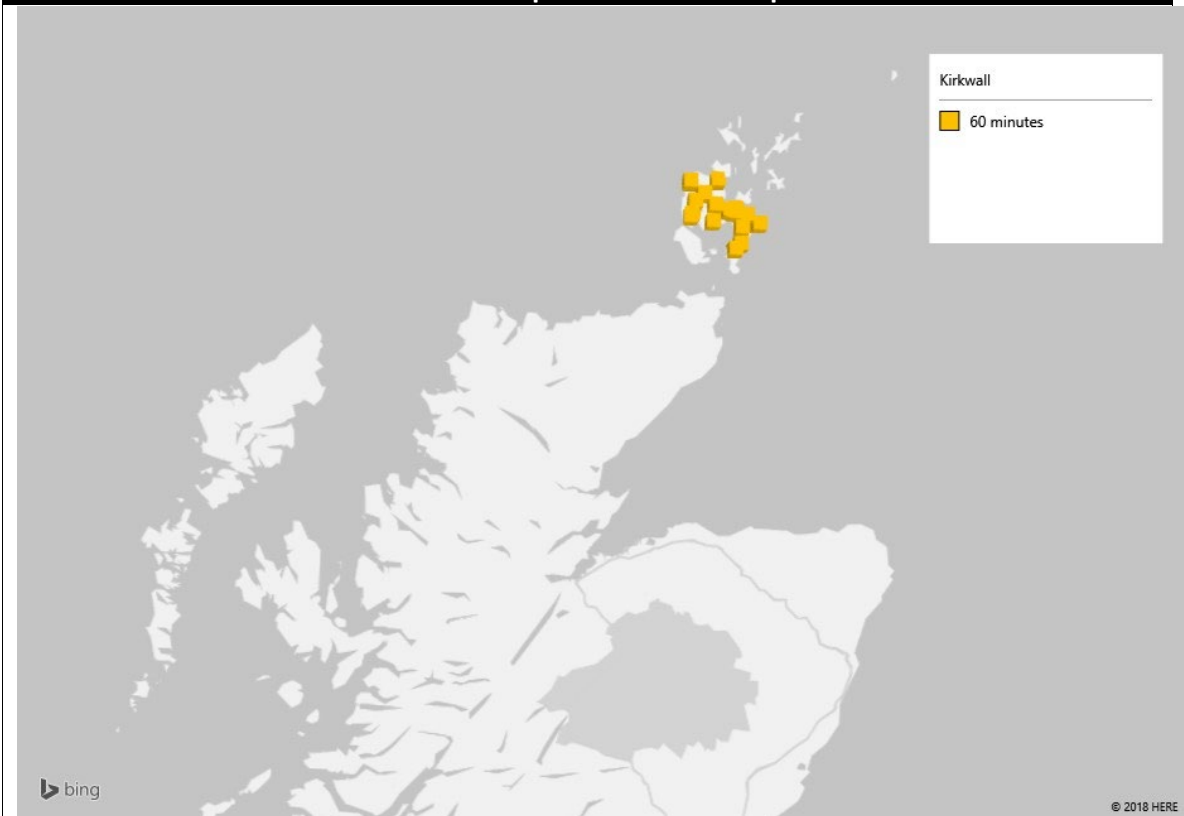
Leeds/Bradford Airport Catchment Map

Leeds Bradford
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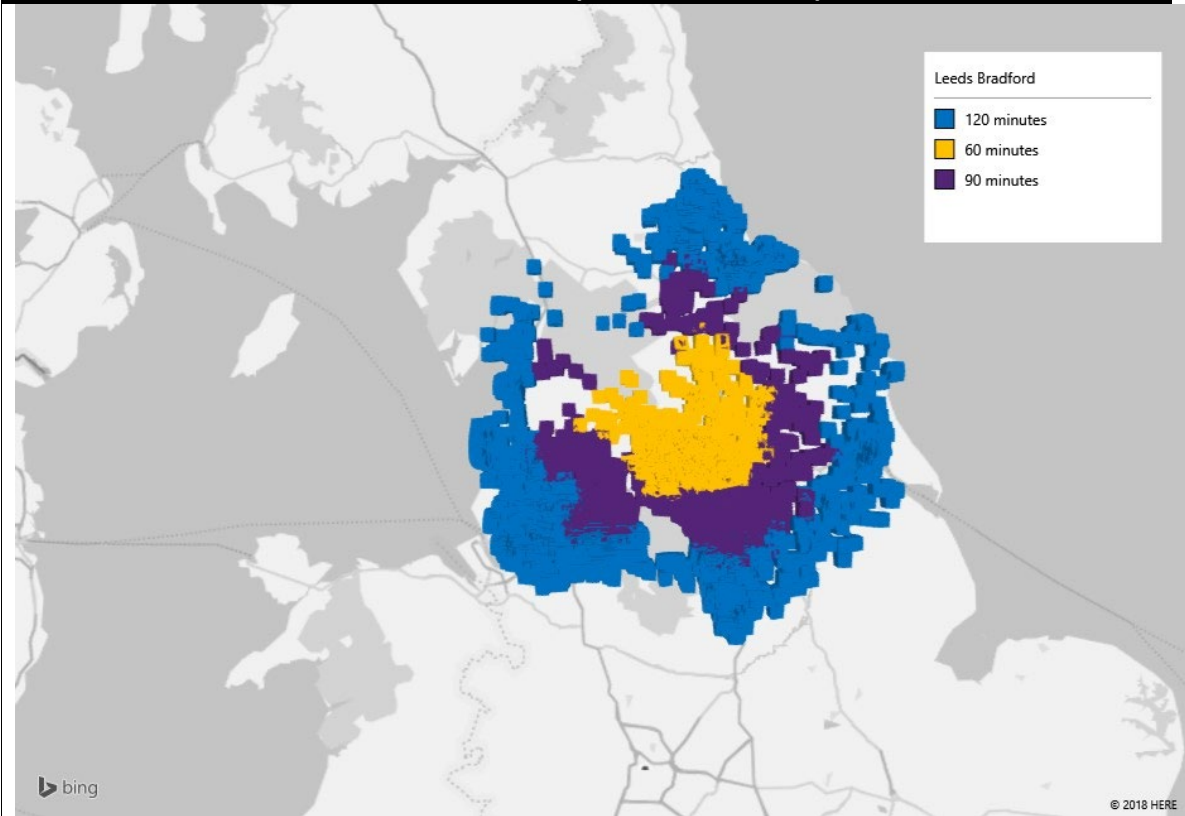
Lerwick (Tingwall) Airport Catchment Map

Lerwick (Tingwall)
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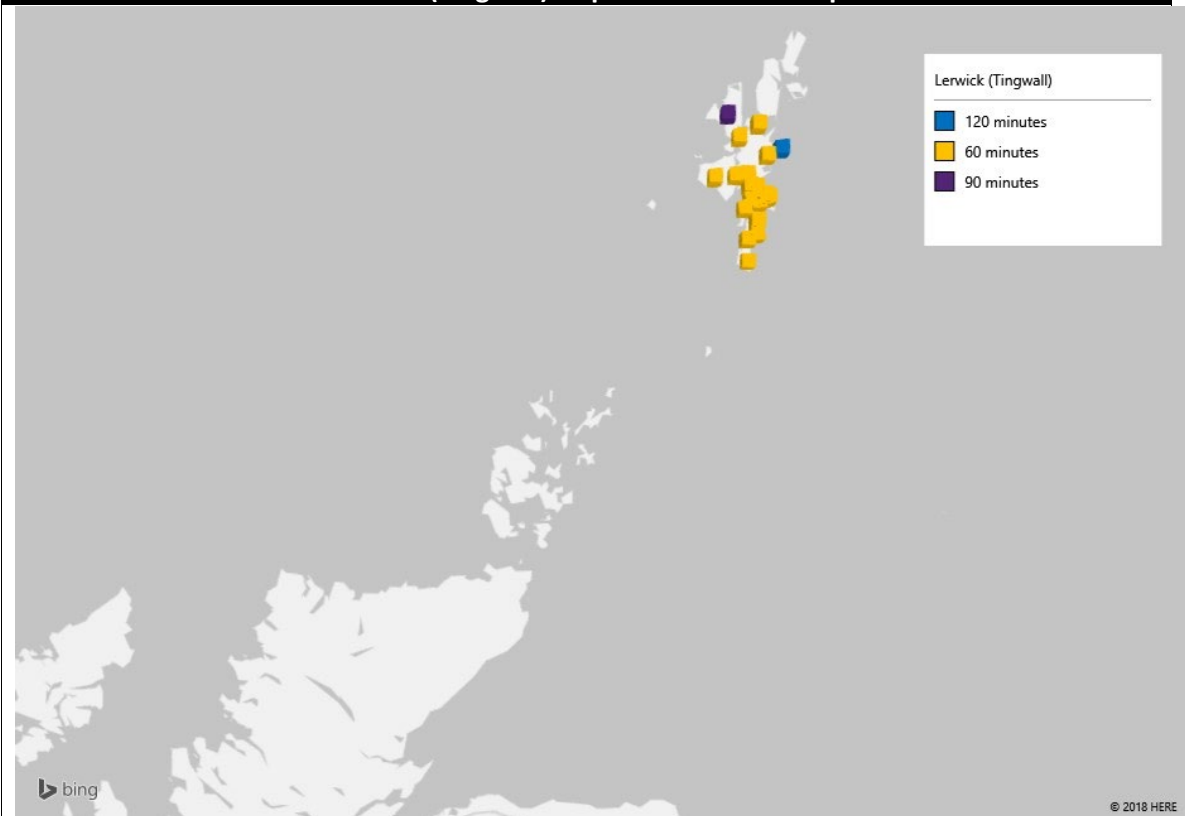
Liverpool John Lennon Airport Catchment Map

Liverpool John Lennon
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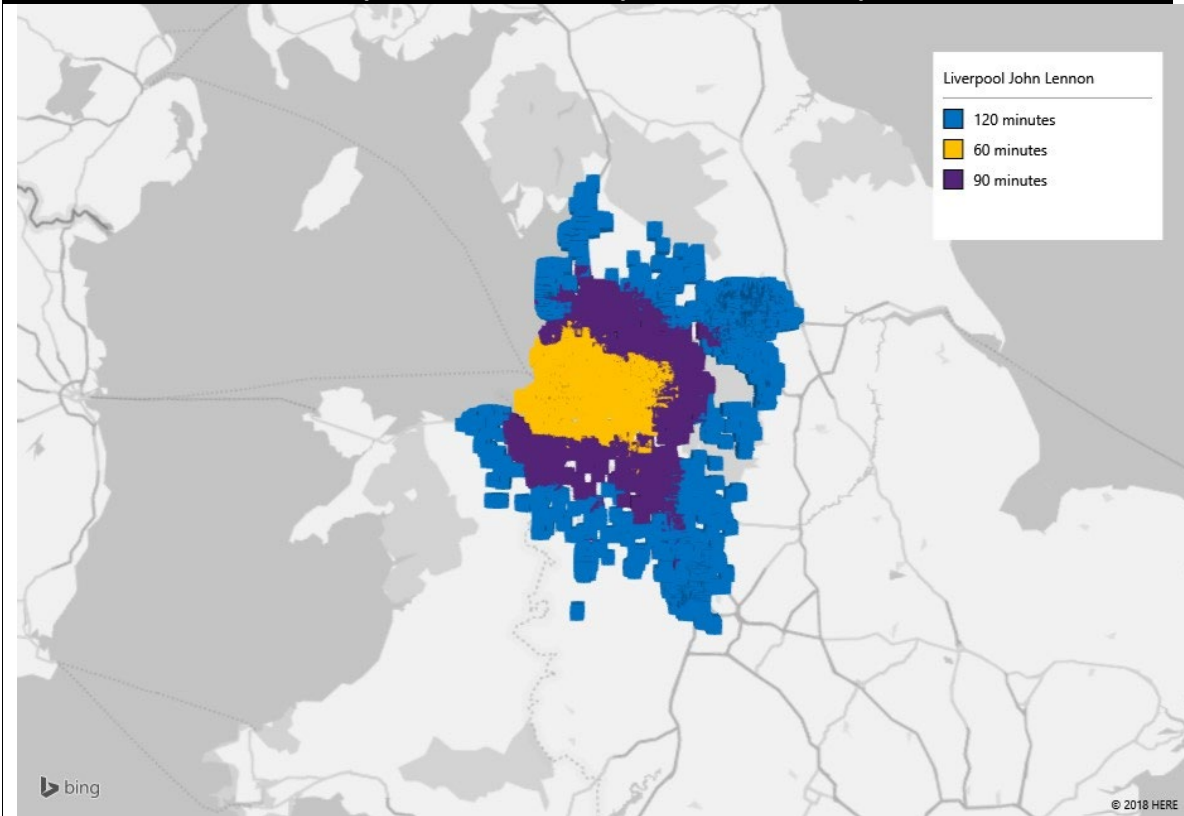
London City Airport Catchment Map

London City
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Luton Airport Catchment Map

London Luton
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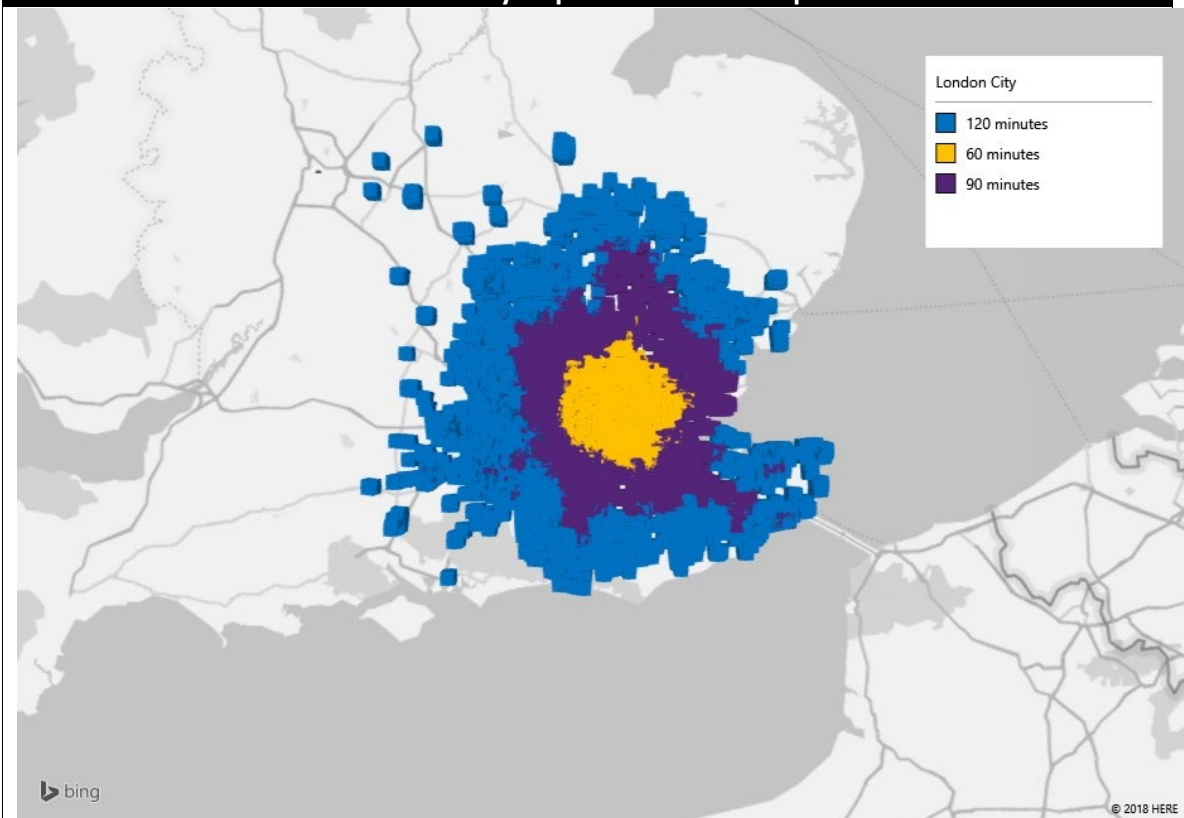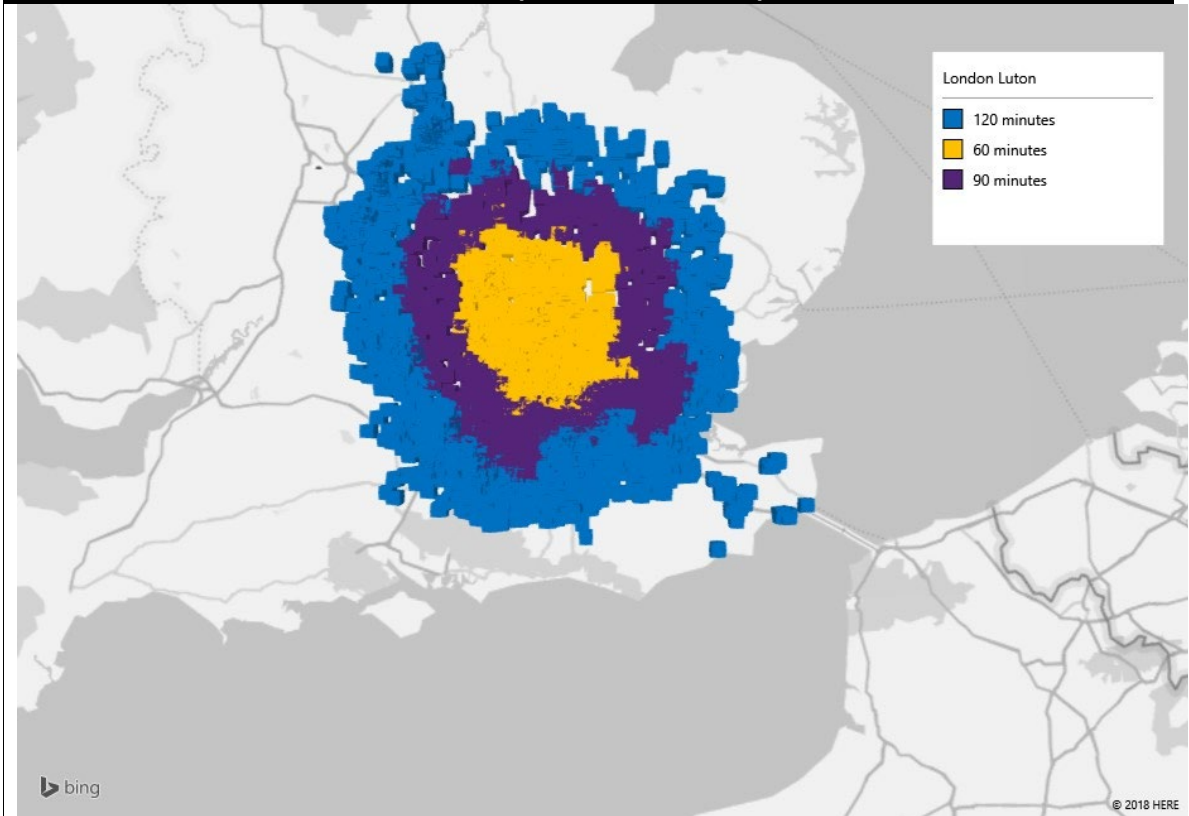
Manchester Airport Catchment Map

Manchester
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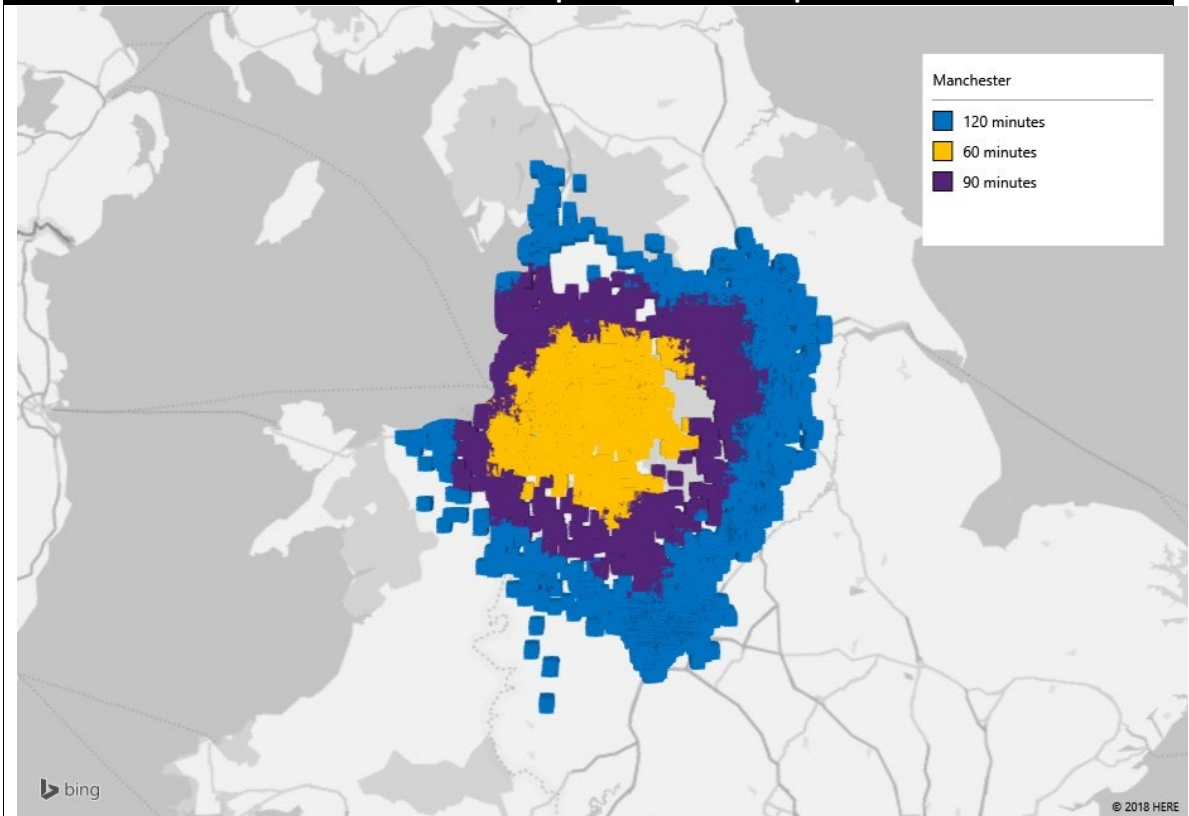
Newcastle Airport Catchment Map

Newcastle
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Newquay Airport Catchment Map

Newquay
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- 60 minutes
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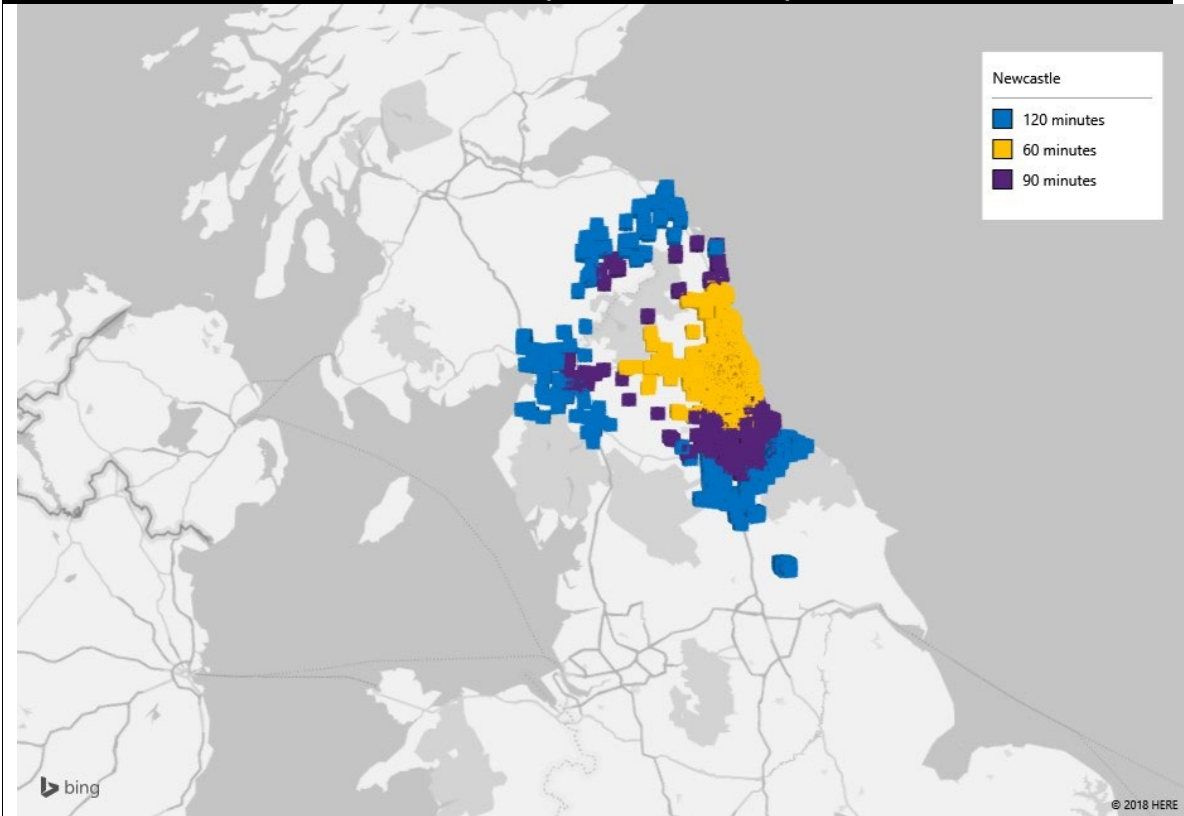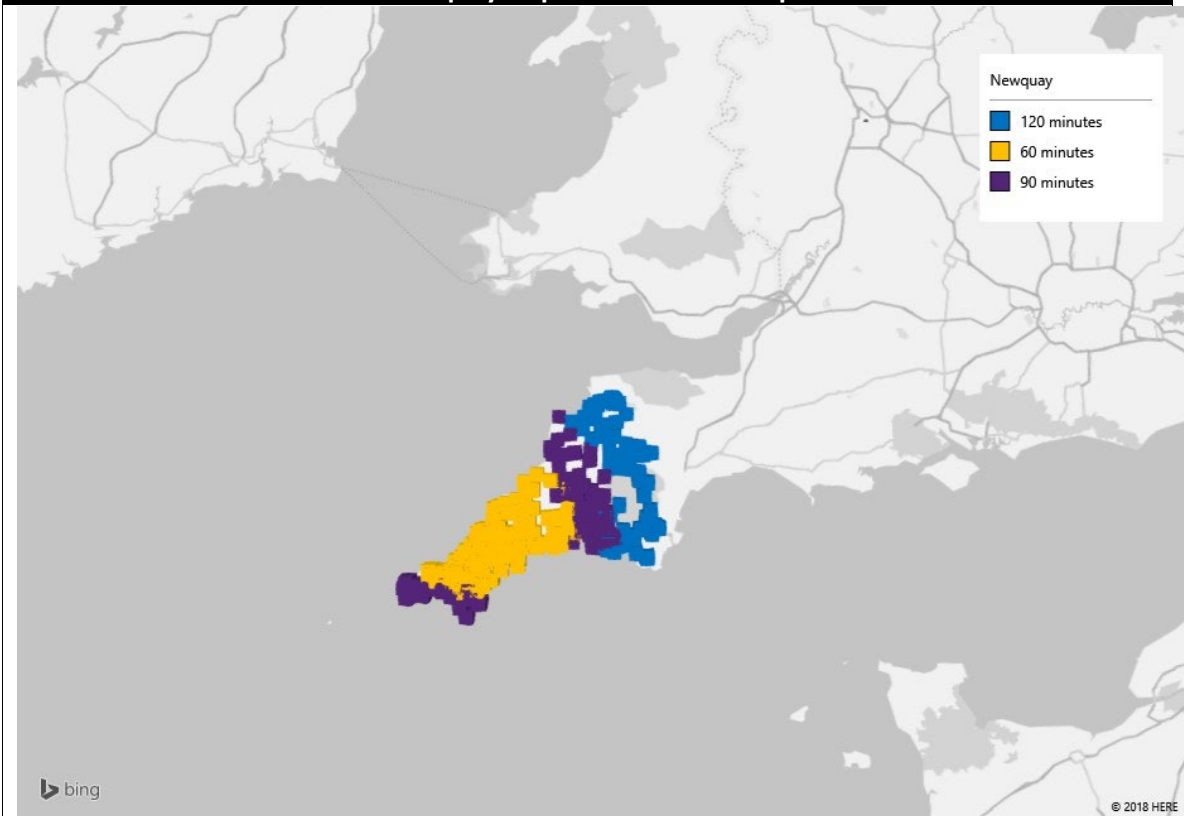
Norwich Airport Catchment Map

Norwich

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Prestwick Airport Catchment Map

Prestwick

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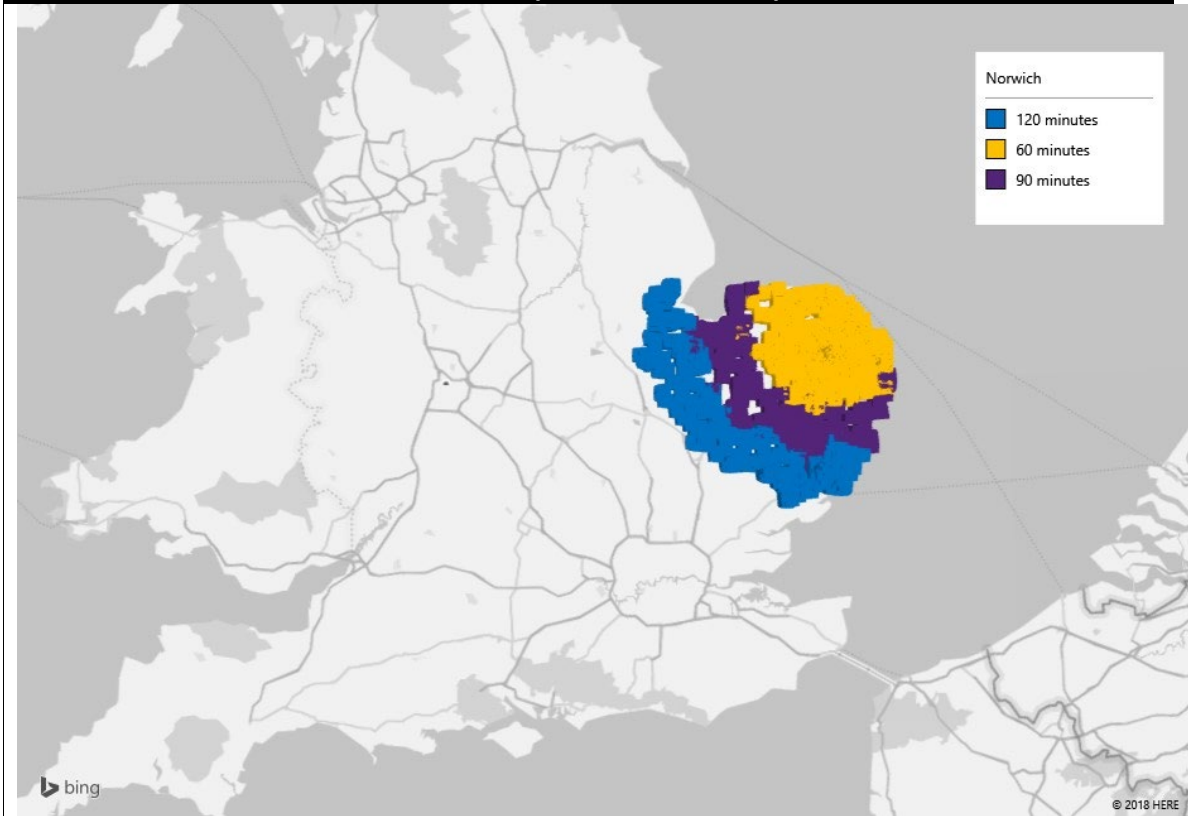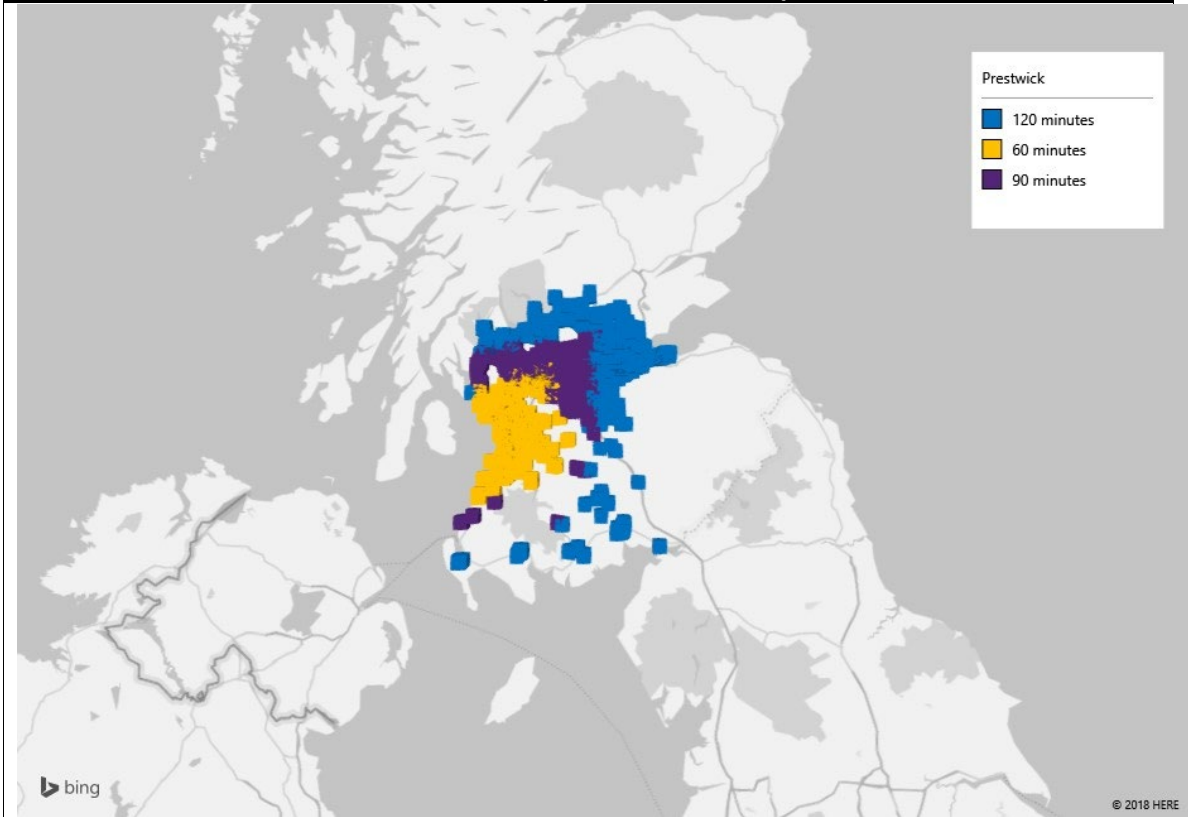
Scatsta Airport Catchment Map

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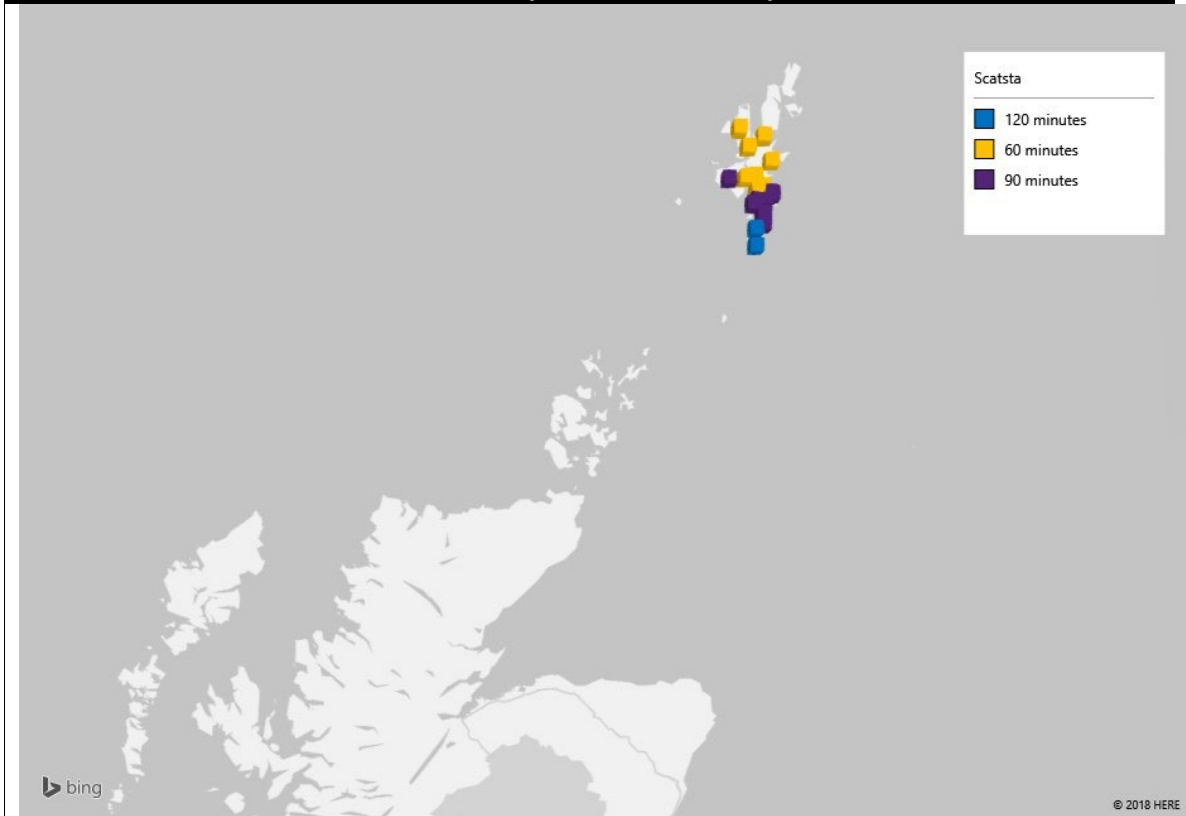
Southampton Airport Catchment Map

Southampton

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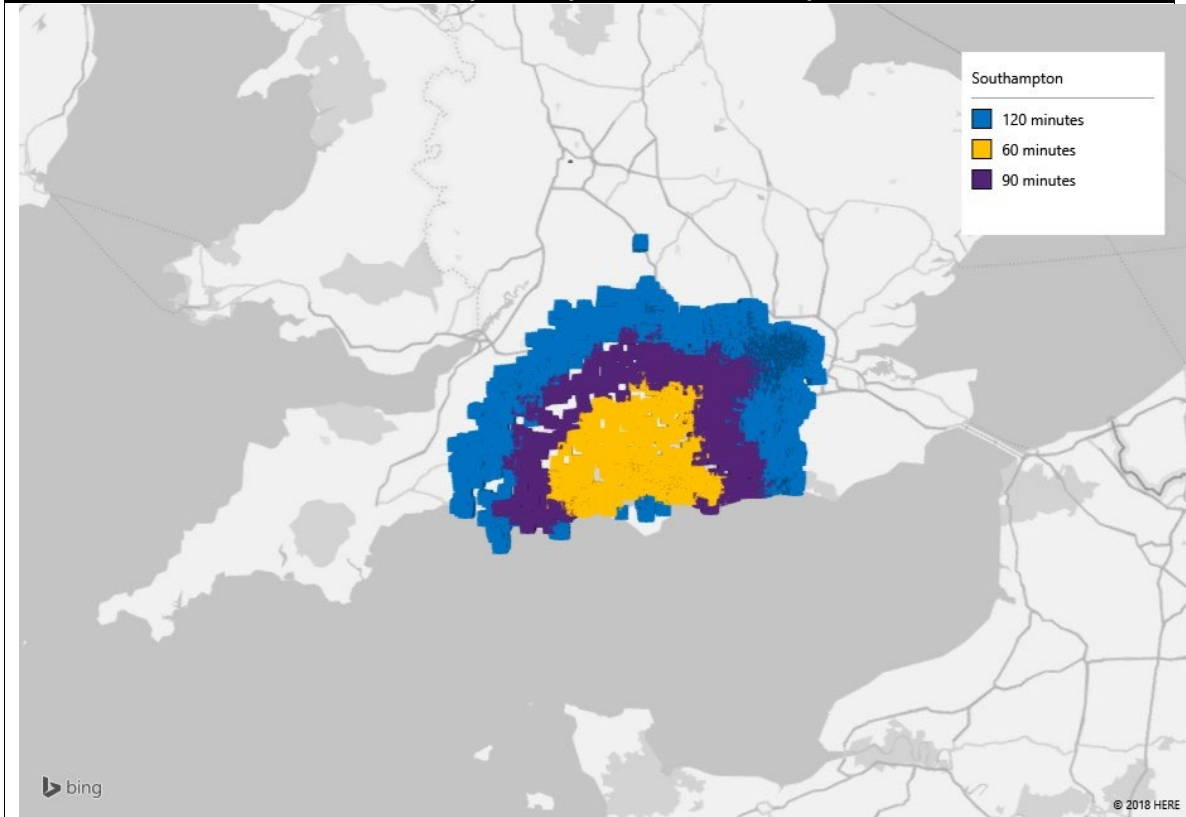
Southend Airport Catchment Map

Southend
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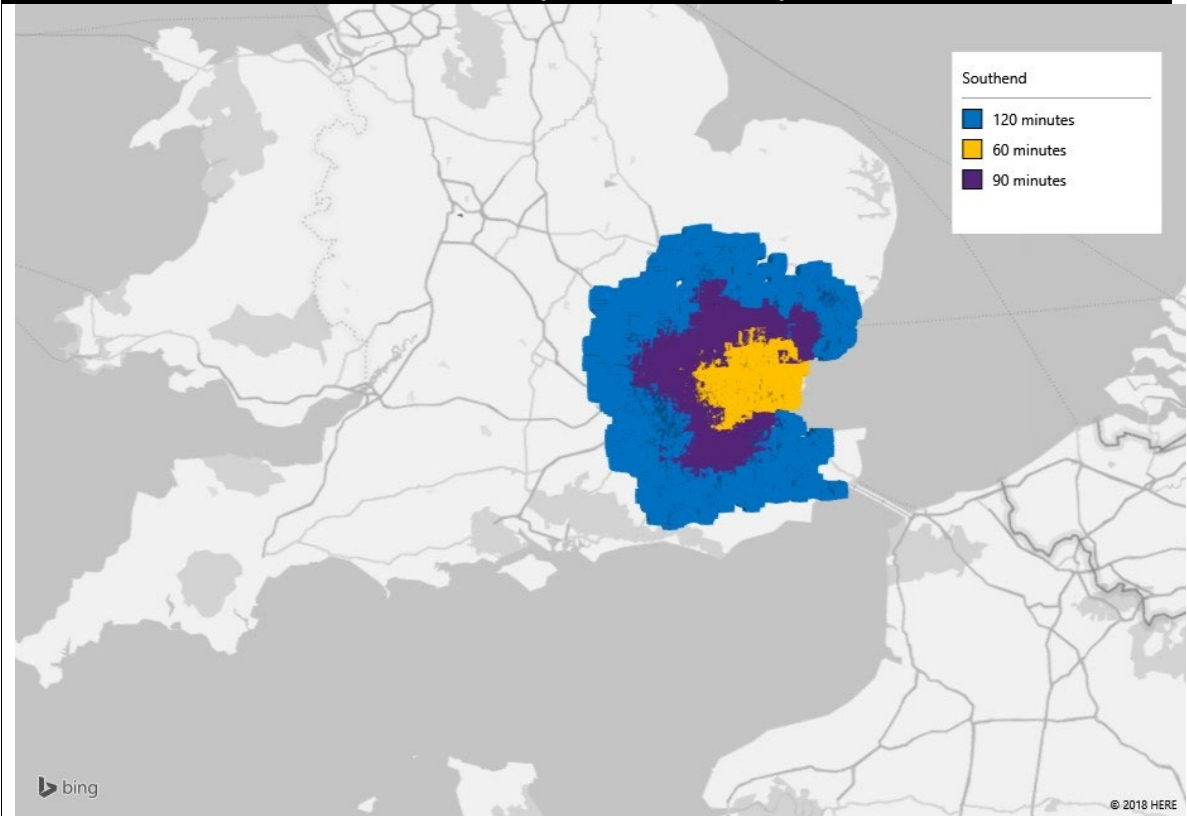
Stansted Airport Catchment Map

Stansted
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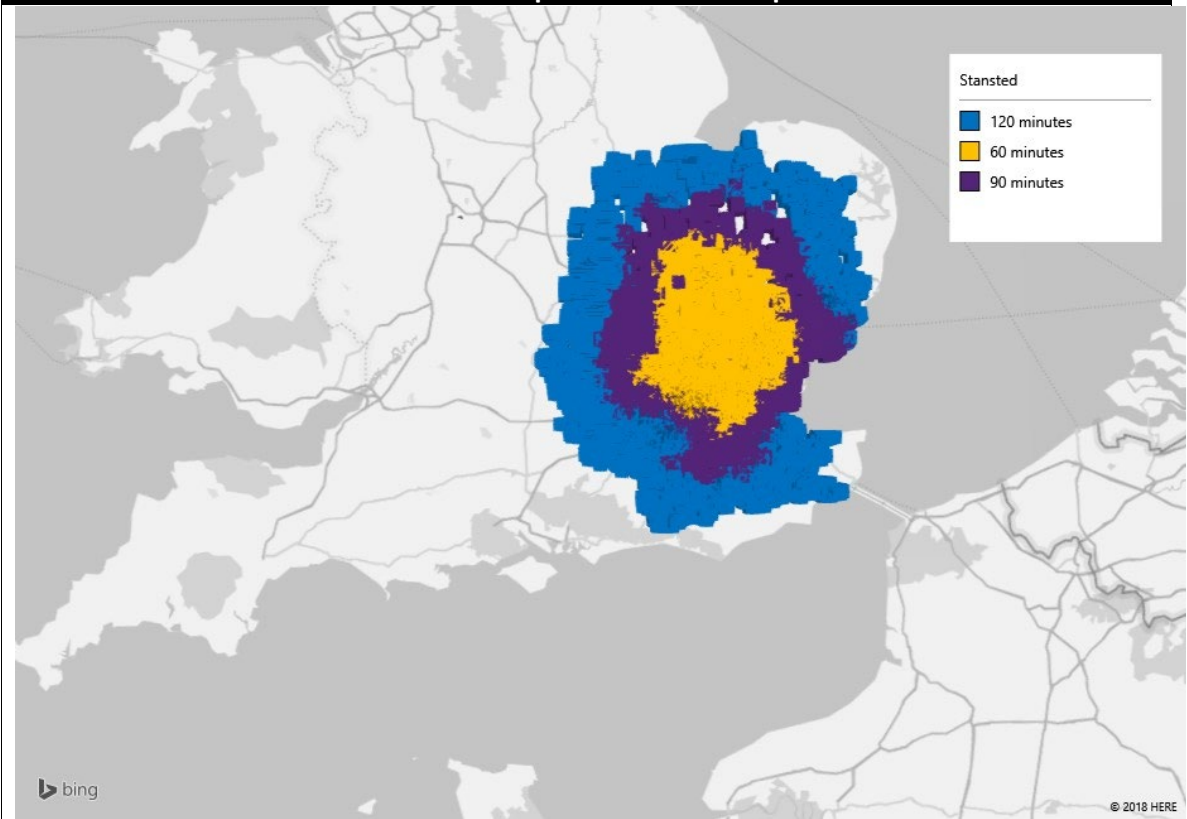
Stornoway Airport Catchment Map

Stornoway
- 60 minutes
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Sumburgh Airport Catchment Map

Sumburgh
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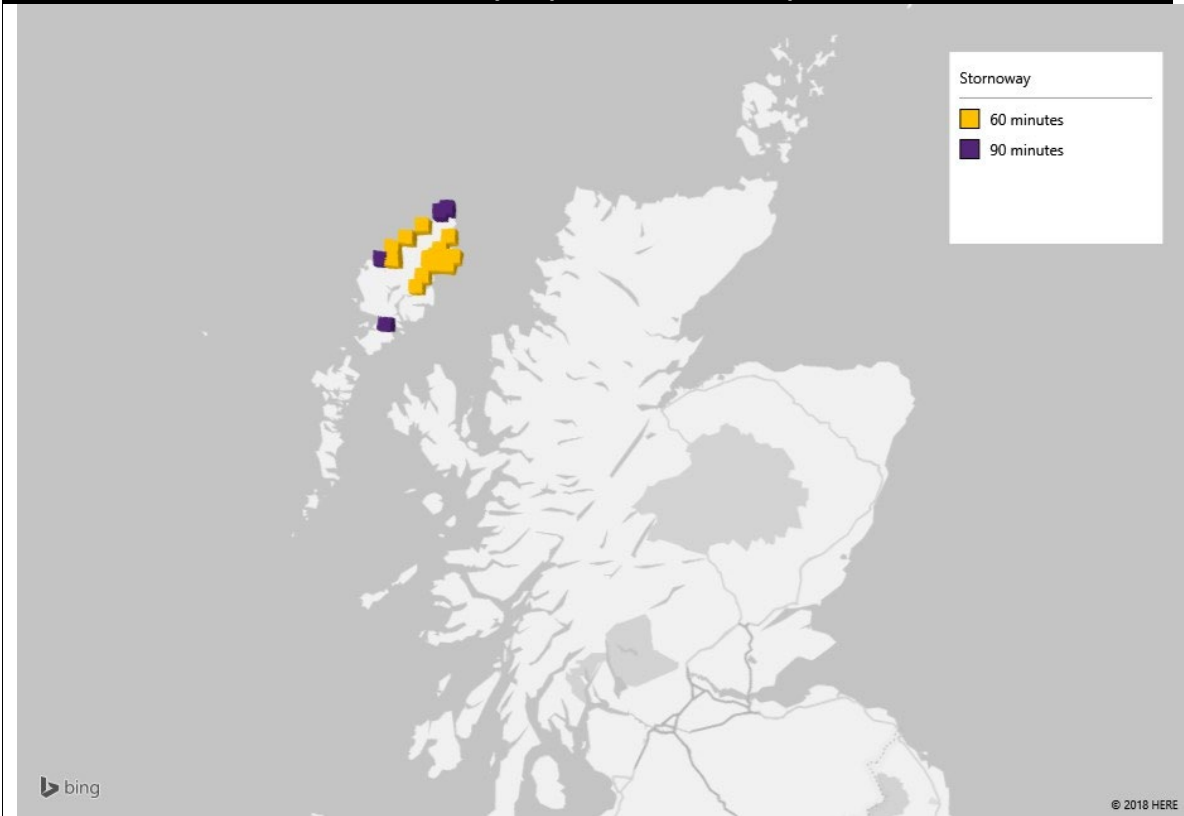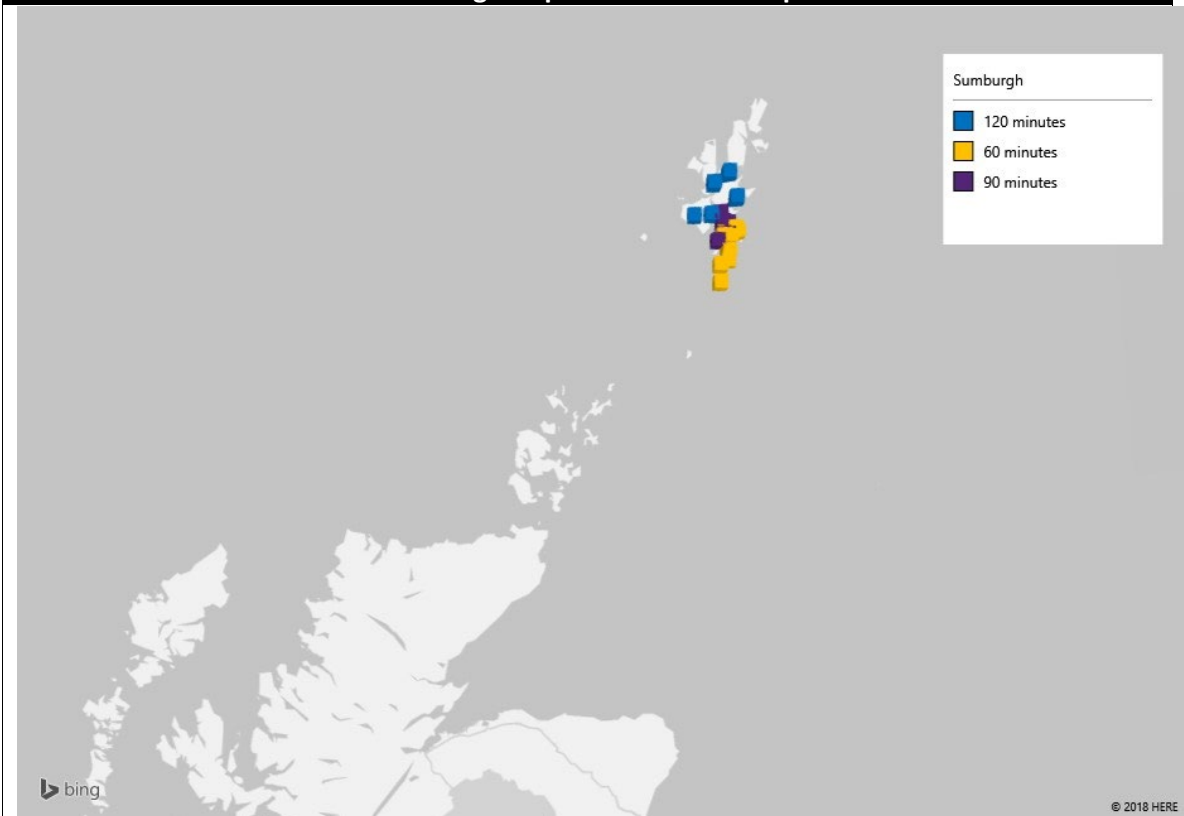
Tiree Airport Catchment Map

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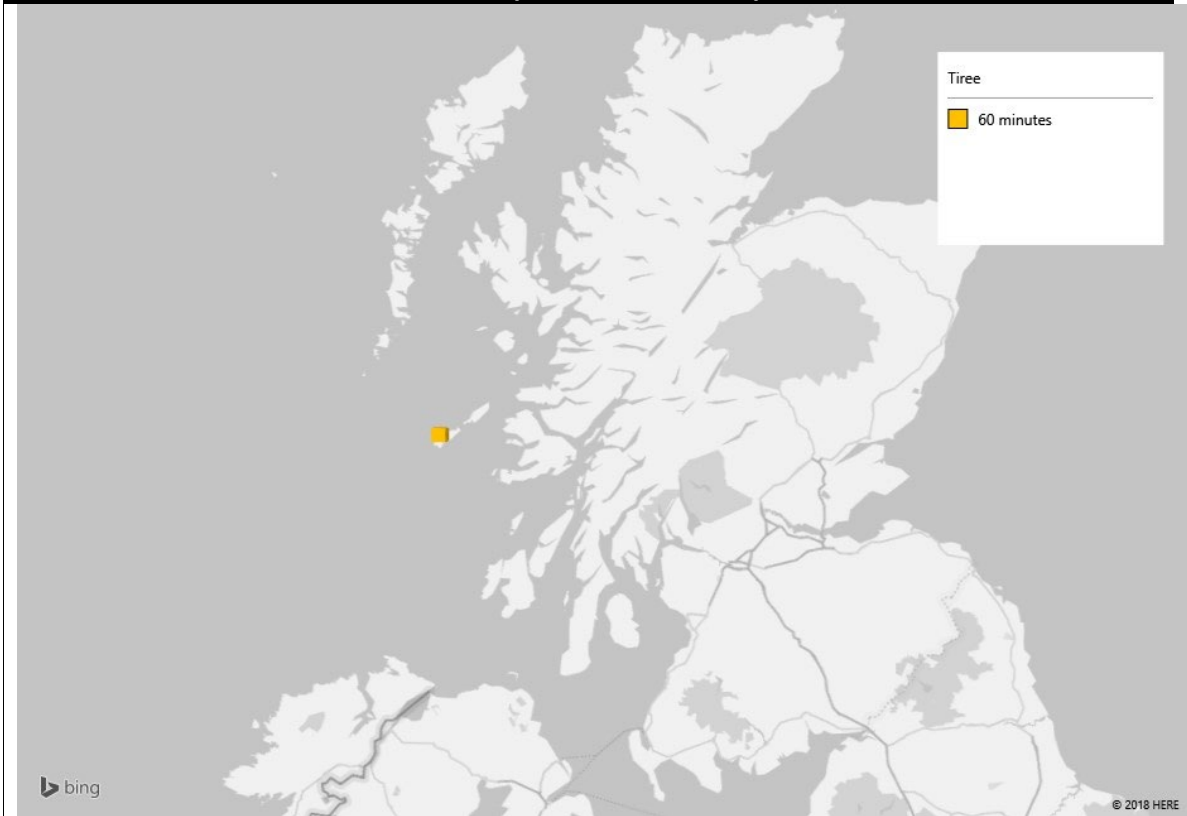
Wick John O'Groats Airport Catchment Map

Wick John O'Groats

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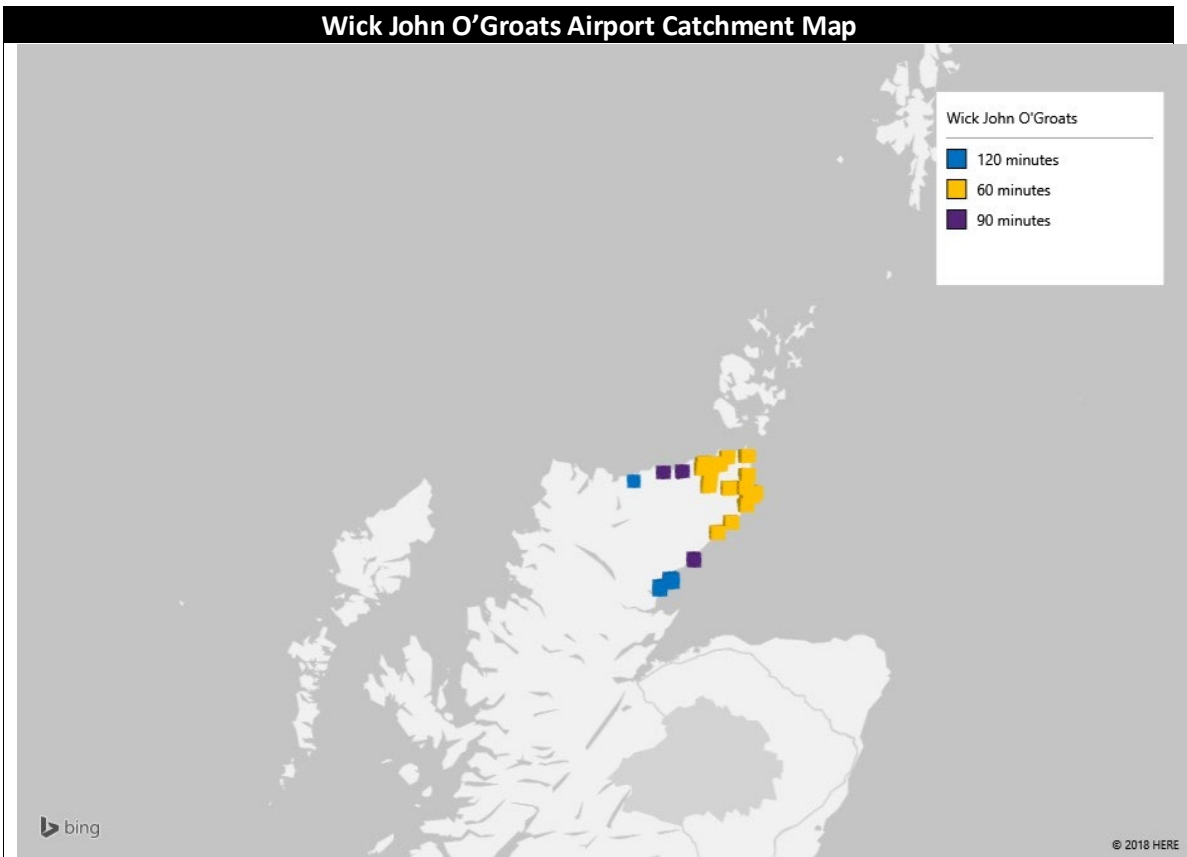
APPENDIX E

ASSESSED HUB FLIGHT TIMINGS

Tested Arrival Times Into Heathrow Hub								
Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9
1340	1045	0820	1045	0820	0820	0820	0815	0725
		1745	1535	1245	1104	1020	1035	1020
		2020	1935	1935	1410	1300	1455	1300
					1935	1745	1640	1645
						2020	2020	1745
							2125	2130

Scenario 10	Scenario 11	Scenario 12	Scenario 13	Scenario 14	Scenario 15	Scenario 16	Scenario 17
0815	0845	0835	0755	0755	0830	0830	0835
1020	1110	1110	0945	0945	0915	0915	0930
1245	1245	1245	1050	1050	1100	1100	1035
1455	1410	1410	1310	1200	1210	1210	1140
1745	1610	1610	1505	1310	1340	1340	1300
2020	2000	1845	1650	1505	1535	1535	1515
	2205	2055	1845	1650	1655	1655	1650
			2055	1845	2000	1855	1725
				2055	2150	2000	1855
					2225	2150	2010
						2225	2055
							2200