How to win air travellers to rail

A report by Greengauge 21 Commissioned by High Speed Rail Group

May 2022

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RAIL GROUP

CONTENTS

High Speed Rail Group

Representing companies with relevant experience and an interest in high speed rail, the High Speed Rail Group (HSRG) is committed to supporting the successful delivery of a world-class high speed rail network in Britain. Our members have helped deliver major infrastructure projects in the UK and around the world, including creating entirely new high speed networks and improving the UK's existing rail network. This gives us a unique insight into both the shortcomings of the current network and the transformative capacity, connectivity, economic and environmental benefits that high speed rail brings. Members support a national high speed rail network including the delivery of HS2, its extension to Scotland and integration with other rail investments such as Northern Powerhouse Rail and Midlands Engine Rail. This should go hand in hand with wider ambition to maximise the released capacity benefits HS2 brings and to catalyse change through the supply chain. A full list of our membership can be found at www.rail-leaders.com.

This report was commissioned from Greengauge 21.

Greengauge 21 was conceived as an umbrella under which all those with an interest in a high speed rail network could come together and openly and publicly debate the merits of alternative routes, priorities and technologies, alternative implementation strategies and the economic and environmental benefits for Britain. With no vested interest, Greengauge 21 seeks to act in the national and the public interest, by carrying out research and bringing forward evidence so that a full and open debate on high speed rail can take place alongside research into the wider benefits of the nation's public transport system.

Research by Dick Dunmore.

EXECUTIVE SUMMARY

1. Modal shift is essential if the UK is to achieve its 2050 net zero ambitions.

Across Britain

2. Across mainland Great Britain, there are 16,700 air passengers on an average day (in the most recent pre-COVID year, 2019). These passengers fly over a highly concentrated geography (unlike the pattern of flights across continental Europe) with 57% of GB domestic passengers travelling between London and Scottish airports. Year by year, rail is gradually winning market share as aviation journey times get extended.

3. But could we accelerate this trend towards rail from air? The answer is yes. In Britain, we need to offer high levels of journey comfort at competitive prices. We need to examine more long-distance, non-stop, point to point rail operations similar to those recently launched on the London-Edinburgh route, which is the nation's busiest in terms of daily flight volumes, carrying over 3 million air passengers annually (2019, pre-COVID).

4. But more—and faster—rail services to and from London cannot realistically be accommodated until HS2 is in operation. The existing network is limited to 125 mile/h operation (whereas HS2 trains will run at 225 mile/h) and is, in effect, full. HS2 will cut London-Glasgow/Edinburgh journey times from 4 hours 20 minutes to 3 hours 38 minutes. Further time savings north of Crewe could allow rail to grow its share of the Anglo-Scottish rail plus air market from 30% to 75%.

5. High speed rail, therefore, has an important role ahead. In conjunction with an improved West Coast Main Line, HS2 will speed up journeys like Birmingham–Glasgow from today's 4 hours 45 minutes to 3 hours 20 minutes. And the retained part of HS2's Eastern Leg could also be used to radically accelerate the nation's main cross country route, taking 1½ hours off the journey time from York to Birmingham, at the heart of the key north east-south west axis.

6. If all domestic mainland Great Britain airline passengers transferred to train, they would fill around 20 trains per day each way, and save a huge amount of carbon emissions, and free up scarce runway capacity at London's main airports.

Between Britain and continental Europe

7. This is where high speed rail has already succeeded, now dominating London–Paris and London–Brussels travel markets.

8. The new London-Amsterdam Eurostar service is already doing just as well. It takes only 3h52 minutes, and there are 10.5 million air passenger journeys from Britain (nearly half of them from London) to go for. HS1 across Kent and the channel tunnels has capacity for mor.

9. Using the continent's high speed network, a train can go from London St Pancras direct to Marseille, 1000km away, and back, in a single operating day, making for efficient fleet utilisation. London rail services can be extended to other cities within the same distance band for single-day travel—Berlin, Vienna, Hamburg, Frankfurt, Zurich, Geneva, Bordeaux, Nice, Barcelona. Services to these additional city destinations could address a market of 26 million airline passengers annually, providing a sustainable travel alternative for a total of 44 million airline passengers between Great Britain and the area within one day's rail travel of London.

A four-point plan to win air travellers to rail

Step 1 Winning today's domestic air travellers to rail

- London–Scotland accounts for 57% of domestic air travellers

- To compete with air, rail needs to offer point-to-point services with competitive prices

- Lumo is now testing this proposition on the nation's busiest single air route: London–Edinburgh. Its secret? No train stops between Newcastle and Stevenage and advance fares from as low as £19.90

- It is not too soon to think of expanding this concept. London–Glasgow is an obvious next step, along with London–Dundee and Aberdeen

- Cross country rail services operate today on a north east–south west axis, but end-to-end journeys are lengthy and slow. Here too a Lumo-style concept could work, connecting, say, Cardiff and Bristol with Darlington, Newcastle and Edinburgh, avoiding intermediate stations on congested parts of the rail network to speed up journey times

- But rail can only go so far operating on today's rail network.

Step 2 Modal Share transformation with HS2

- To make a deeper impact, rail needs to offer quicker journeys and provide capacity for additional limited-stop services. This is just what HS2 provides

- When HS2 is operational, travel between London and Scotland by train will be nearly an hour faster, with trains running at 225 miles/hour rather than 125 miles/hour

- Government should back the findings of its *Union Connectivity Review* which showed how HS2 plus complementary investment—upgrading today's railways across the border—could allow rail to win 75% of Anglo-Scottish passengers

- And the new plan to extend HS2 from Birmingham to Nottingham should be used to improve connectivity along the north east—south west axis, speeding up journeys by 1hour 30 minutes, levelling up cities outside the south east.

Step 3 Maximise HS1 to move international travellers to rail

- While Eurostar services have succeeded in their chosen markets, HS1 across Kent and through the channel tunnel has capacity for more. And Europe's high speed rail network is still expanding with new cities coming into reach all the time. As Eurostar becomes part of Europe's Railteam network, connections and new services will stretch across the Netherlands, Germany and Austria, through Switzerland to Italy and France to Spain. There is huge scope for longer distance rail travel from the UK, and for new entrants to compete strongly on shorter routes too.

Step 4 Properly connect Britain's two high speed rail networks

- HS2 can also extend European travel benefits across Britain, providing zero carbon connectivity across the nation.

- There are two ways HS2 can help achieve this:

  - When HS2 is built, fresh capacity will be created on today's busy West Coast Main Line (WCML), meaning new services can be added. For travellers from Manchester and Birmingham, we have identified a way to access cross channel rail services, using a new Javelin-style service that avoids the off-putting gap between Euston and St Pancras stations and instead delivers travellers directly to border controls at HS1 stations. The airline market Manchester/Birmingham-Amsterdam alone is 2.1 million passengers (per annum) or 2,900 each day.

  - By getting travellers faster from the Midlands and North to Euston. The gap to St Pancras is only ¾ mile, and should be provided with a proper passenger transfer facility Euston-St Pancras (HS2–HS1), one that provides a seamless 'between two terminals' connection suitable for all travellers, including those with impaired mobility.

Conclusion

10. Our report demonstrates that there is significant scope to attract many more passengers to rail from short haul flights. Expanding and integrating the national high speed rail network, accessing an ever increasing number of international high speed routes, will be key to facilitating this shift. By doing so, we can make major progress on net zero, and help deliver the 'levelling up' aim by strengthening the connectivity of major cities across the regions.

1

INTRODUCTION

1.1 The European Green Deal for 2019–2024 led to an Action Plan in December 2021 to boost passenger rail across the EU. It was based on analysis of the scope for rail to compete with air on intra-European routes, using pre-pandemic data from 2019.[1] Could the same approach be applied in the UK? And should it?

1.2 In this report, we examine the pattern of use of air travel within Great Britain and between Great Britain and continental Europe to assess the potential for rail—and especially high speed rail—to provide an attractive and lower carbon alternative to flying.

1.3 On average, air travel within Europe emits five to six times more CO_2 per passenger-kilometre than travel by train, according to the European Federation for Transport and Environment.

1.4 Data from the European Environmental Agency (EEA) shows that air traffic accounts for 14% of emissions while handling 8% of passenger-kilometres. Rail accounts for just 1% of emissions while handling 6 percent of passenger-kilometres.

1.5 An approach that reflected the EU Green Deal that seeks to discourage air travel where there is a low carbon surface rail alternative could help the rail sector recover revenue lost during the COVID-19 period in the UK. But it must be judged unlikely to be adopted as a policy in the UK, where instead a reduction in Air Passenger Duty is planned.

1.6 So while the Green Deal is an important reference point, the approach we adopt here is not so much concerned with arguing the case for an equivalent policy shift for the UK, desirable though that may be. Instead we concentrate on the practical ways by which rail might attract and accommodate demand that, pre-COVID, was met by short-haul air travel.

1.7 We take two timescales and two geographies for our analysis. The timescales are pre-HS2 and post-HS2 (so broadly the next 10–12 years and thereafter) and the geographies are within-Britain and between Britain and the continent of Europe.

1.8 We have investigated the data on air markets in depth, and we hope that the material presented here will be of ongoing value to the rail sector and other businesses seeking to offer an alternative to flights at a time of heightened public concern over the effects of global warming and its principal cause—carbon emissions.

1.9 It is also hoped that by looking across the longer distances that rail can compete with air travel—we believe this is for journeys up to 1000km long—we can help those planning rail network capabilities and utilisation more locally.

1.10 We recognise that the changes in travel behaviour experienced in 2020 and 2021 create a high level of uncertainty ahead. Much of our analysis draws on 2019 travel data, and we simply note that—at the time of writing—travel markets in total are recovering back towards 2019 levels quite rapidly.

1.11 We take two bites at the subject matter, looking in turn at the British domestic market (chapter 2) and near-European air markets (chapter 3) to establish the broad parameters of the rail opportunity. Then we examine each of these markets in more depth (chapters 4 and 5, respectively). We conclude in chapter 6 with specific propositions for new rail services that would attract travellers to switch from air to rail.

1.12 Our questions have thus evolved to the following:

- Is there scope to attract more rail travel from air both before HS2 is open and afterwards?

- How can the capability of HS1 and the Channel Tunnel be best exploited to offer a viable and attractive alternative to flying?

1. Long-distance cross-border passenger rail services, Steer and KCW, for European Commission, October 2021.

2

UNDERSTANDING DOMESTIC AIR TRAFFIC FLOWS IN GREAT BRITAIN

2.1 Greenpeace commissioned and published an analysis of the scope for air to rail modal shift in 2021. It focused on intra-EU air routes carrying over 500,000 passengers that link cities with rail journey times below six hours to assess the prospects for a European 'Green Deal'. Their work provides an informative benchmark against which to assess the prospects ahead in Great Britain (see a summary of this work in Annex A).

2.2 Great Britain has only five pairs of cities linked by domestic air routes carrying around 500,000 scheduled airline passengers a year, and they are in a much more concentrated pattern than is evident across continental Europe. In one respect at least this is helpful: it means that a focused effort to provide an alternative to air travel could work well within Great Britain.

2.3 The five routes are all to/from London: to Edinburgh, Glasgow, Aberdeen, Manchester and Newcastle. These are also the five main domestic routes to London Heathrow, where a large proportion of passengers may be connecting to other flights rather than travelling to or from London and Heathrow's wider catchment (for instance, along the Thames Valley).

2.4 London may dominate the high volume routes, but there are important regional routes to consider too. More than half the UK domestic flights outside London were once provided by Flybe, which was the largest independent regional airline in Europe, but which ceased all operations in March 2020.

2.5 For passengers who are no longer able to make domestic journeys by air, or who wish to find a lower carbon alternative, rail is likely to be able to offer the next-fastest mode of travel. But it is not yet clear what domestic air services will be offered in future, particularly if a portion of pre-pandemic business travel is replaced by video-conferencing.

2.6 Compared to the EU, Great Britain's air services and its rail network have a number of distinctive features:

- The rail network is self-contained, with only one external link

- Domestic air travel is dominated by routes between Scotland and South East England

- The UK has a unique six-airport system serving London (and the home counties). In 2019, Edinburgh and Glasgow had flights from all six airports, affecting the scope for rail to compete effectively

- The comparatively small numbers of air passengers on routes other than to London.

Figure 1: Overview and busiest routes, within UK and GB, 2019

Source: CAA airport statistics.
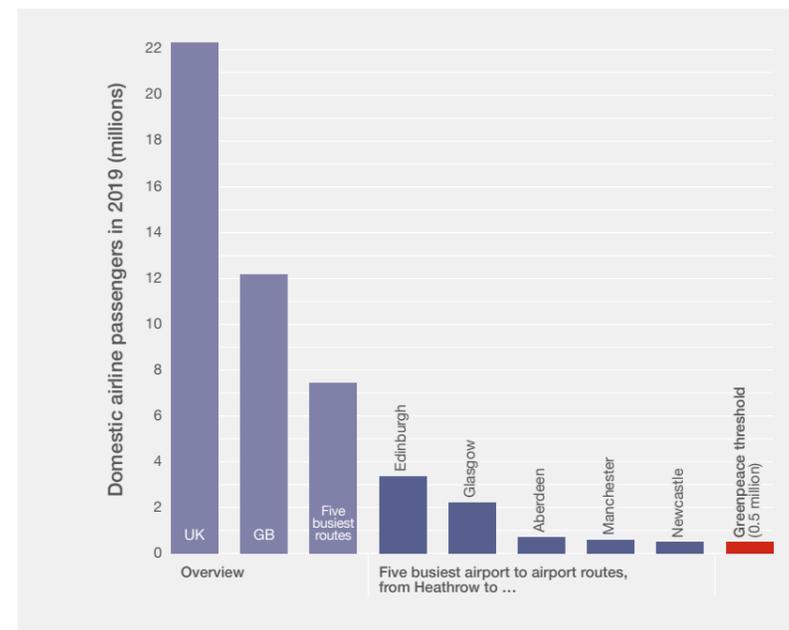
Domestic air demand trends: London routes

2.7 The charts summarise an analysis of Civil Aviation Authority (CAA) data from 2004 to 2019, and overall we find that:

- Passenger numbers between London and Manchester and Newcastle have declined, and are now largely limited to Heathrow.

- Passenger numbers between London and Aberdeen are more stable, but are also increasingly dominated by Heathrow.

- Passenger numbers between London and Edinburgh and Glasgow are stable or growing, but the proportion using Heathrow has fallen, with growing shares using Gatwick (an easyJet hub) and Stansted (Ryanair's largest base in Europe).
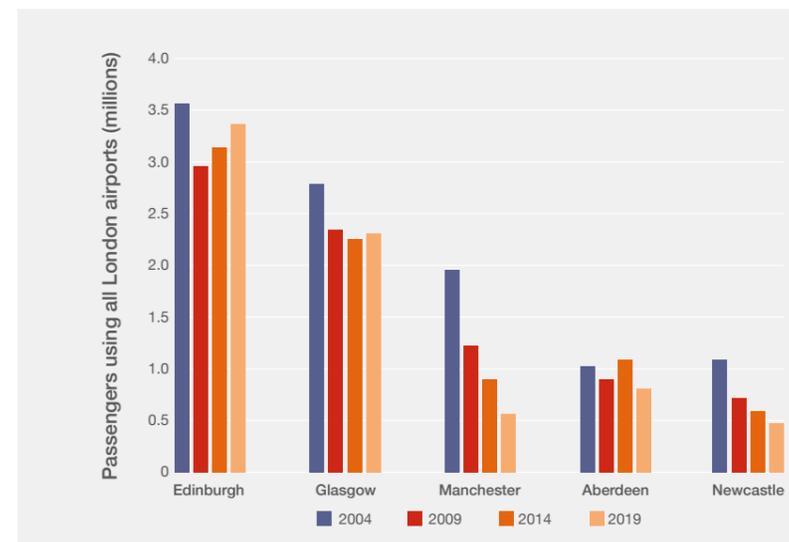
2.8 Currently, the new **Lumo** service, operating between Kings Cross/Stevenage and Newcastle/Edinburgh, is perhaps the strongest rail candidate to compete with domestic air travel. This, or a similar service, could in principle be extended to Glasgow and Aberdeen, paralleling 10,000 airline passengers per day each way.

2.9 To judge the scale of the potential transfer to rail, we can note that, **in extremis**, if all domestic aviation ended, with all airline passengers transferring to train, they would fill around 20 trains per day each way, sufficient to justify two trains per hour to/from London, at least at peak times.

2.10 Leaving aside London, the strongest candidate rail route appears to be Bristol and Birmingham to Glasgow and Edinburgh, paralleling around 1,600 air passengers per day each way.

Figure 2: Time series for passengers, five busiest routes, for all London airports, 2004 to 2019

Source: CAA airport statistics, Greengauge 21 analysis.

2.11 One way to create a stronger rail alternative in this corridor would be to strip out all but the most important intermediate stops, so that end-to-end journey times are reduced, making them more competitive to air services. This commercial logic might apply even if the pre-COVID pattern of inter-regional domestic air services is not re-established, and such development could contribute to the Government's 'levelling up' agenda, allowing cities which would not otherwise benefit from the faster rail connections that London enjoys, to be much better interconnected.

2.12 The value of improving the 'cross-country' (i.e. non-London) flows to the Government's levelling up aims should not be ignored. To compete with London as a business location, cities in the regions have to overcome a string of advantages that London enjoys. One of these is the ability to service pretty much almost the whole of Britain from a single base. Improved connections within regions (for instance, within the North of England) can provide one step towards counter-acting the draw of London locations. But within-region measures on their own can still leave a situation in which reaching other regions (or devolved nations)—London/ SE aside—remains a problem. As the more detailed analysis in Chapter 4 makes clear, pre-COVID there was a substantial 'cross-country' air service. So a key question is this: can rail play a stronger role in addressing the market opportunity on non-London, **inter-regional** flows as well as to and from the capital?

Initial Conclusions

2.13 The most likely service we have identified in Great Britain, in 2022, to provide an effective alternative to short haul domestic flights is an open access operator (Lumo). It offers advance fares for London–Edinburgh trains from £19.90….[2]

2.14 It is worth noting that it is for the Regulator (ORR) to decide whether to grant track rights to open access operators such as Lumo, and the criteria that used do not embrace the value of attracting passengers from air services and so reducing carbon emissions. With a move ahead to a new regime under Great British Railways (GBR) oversight to develop the national rail timetable, it will be important that any such criteria that embrace track allocation choices take into account carbon reduction potentially, and specifically by a modal switch from air to rail. This should be part of GBR's—as well as ORR's—remit.

2.15 Expanding such services and reducing their journey times (Lumo Edinburgh-London timings are around 4h20–4h30) is difficult, even with minimised intermediate stops, because of the need to fit Lumo trains in between the intensive East Coast Main Line (ECML) intercity service operated by LNER as well as the trains of other operating companies. It may be that some reductions in service levels (for instance, because of reduced levels of commuting to offices) will in the near-term free up some valuable peak network capacity. But the need for fast end-to-end timings if rail is to attract market share from air highlights both the potential role that HS2 can play and the prospect of some important policy choices ahead.

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2. Lumo website check made 20th March 2022.

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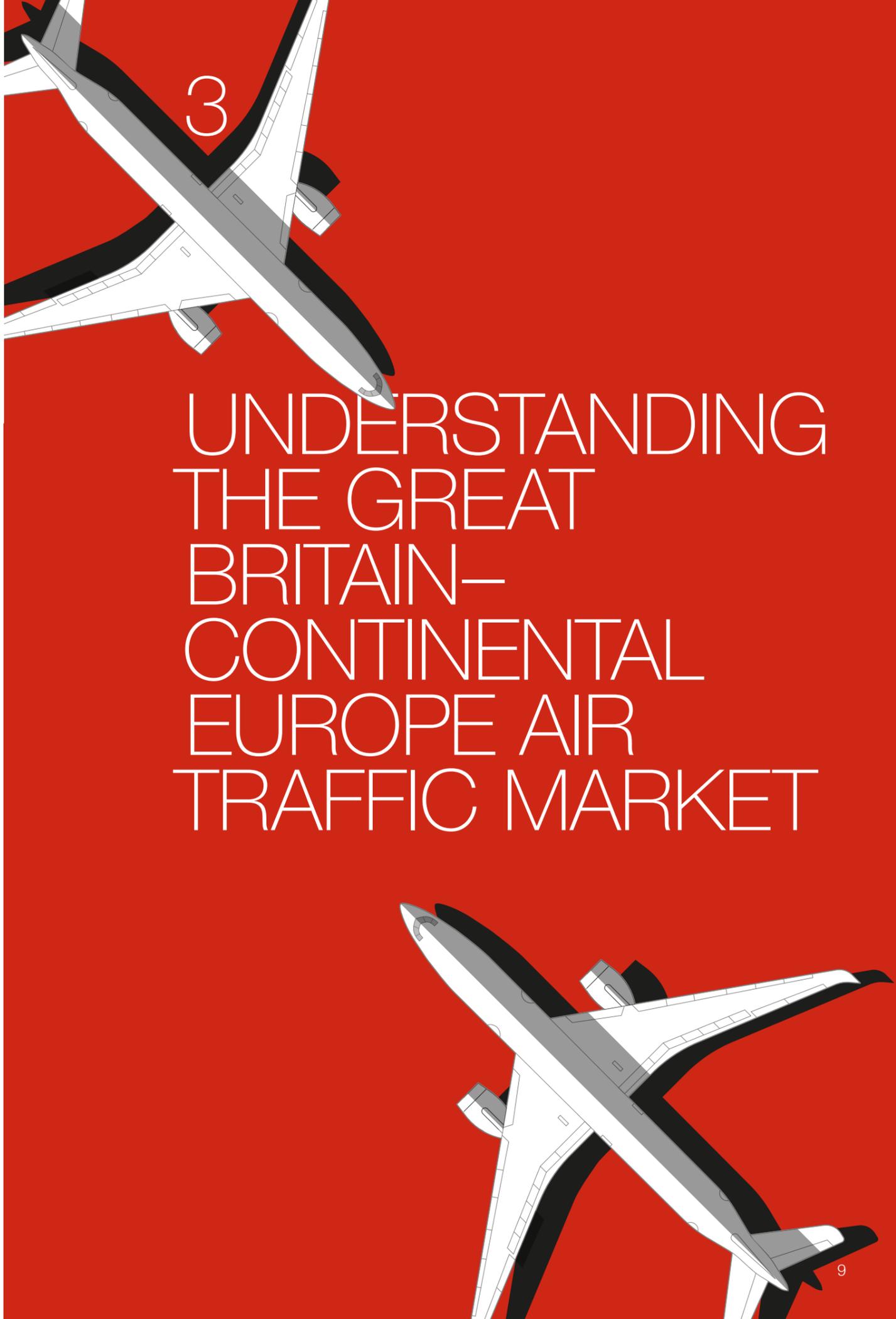
UNDERSTANDING THE GREAT BRITAIN– CONTINENTAL EUROPE AIR TRAFFIC MARKET

3.1 In 2019, the United Kingdom had over 3,400 international airline routes carrying over 240 million passengers. These were dominated by passengers between Great Britain and continental Europe, some of whom could make their journeys by train.

3.2 Eurostar currently serves eight continental cities served by airline routes to and from Great Britain that carried over 18 million airline passengers in 2019. Besides Eurostar, these cities were also served by 36 air routes from London airports, each carrying an average of 260,000 passengers; and 84 routes from other airports, that carried a lower average of fewer than 110,000 passengers, reflecting a mix of lower frequency, smaller aircraft (and services only operating at some times of the year).

3.3 **Over half of the 18 million air passengers on existing 'Eurostar routes' were flying to and from a single destination: Amsterdam**, comprising around 5 million using London area airports and 5.5 million using airports elsewhere in Great Britain. Amsterdam Schiphol acts as an airline hub, a major connecting point from airports in the UK which do not have direct services to London Heathrow, as well as a destination in its own right. Schiphol Airport has a high speed train station served by London trains.

3.4 Passengers travelling to island states, such as Ireland, Cyprus and Malta, or islands, such as Tenerife, Majorca or the Greek islands, are not in scope for travel by rail. And many other European air journeys are too long, to places too remote for rail travel to be realistic as an alternative to flying.

3.5 In practice, the number of air passengers that could credibly transfer to rail would depend on many factors including future policies on aviation taxation and pricing, rail capacity allocation, timetable design and pricing, and public attitudes.

3.6 In contrast to domestic trains, international rail services must operate on a number of networks, each with distinct systems, rules, timetable and charging systems and, in most cases, operating languages. International trains often stop at borders to change locomotives and crew to comply with the requirements for equipment, training and languages for each network[3]. Potential barriers to operating international services include the need to deal not only with multiple networks, but also issues such as:

- Network Rail's loading gauge[4], which is smaller than those on HS1, in the Channel Tunnel and on the European continent

- security and safety arrangements of the Channel Tunnel

- passport checks for movement into and out of the Schengen Area

- checks associated with entering and leaving the Single Market and Customs Union, and

- for some networks in European networks, different track gauges.

3. Eurostar trains between London and Brussels are driven by a single driver over four different rail networks, but this is a rare exception.

4. The maximum cross-section of rolling stock which can be operated on the network, taking into account clearances necessary for tunnels, bridges, platforms and other trackside infrastructure.

3.7 Eurostar's existing international services operate over five infrastructures: HS1, the Channel Tunnel, and the continental networks of France, Belgium and the Netherlands. Services between London and Amsterdam travel 600 kilometres, across all five networks, in 3 hours 52 minutes. However, Eurostar's newest e320 train fleet (Class 374 in Great Britain) has too large a loading gauge for it to operate over Network Rail infrastructure.

New international services further into continental Europe

3.8 Eurostar operates a service over a 1,000 kilometre route between London and Marseille in France, with each train making an outbound and return journey in a single day. It would in principle be possible to operate even longer out-and-back services which travelled outbound on one day and returned on the next. Given current rail infrastructure, these services could reach most of the major airline destinations in Luxembourg, Germany, Switzerland and Austria, including Vienna, and the north of Italy[5], and potentially Barcelona in Spain.

3.9 From the perspective of expanding international services to new networks, this suggests that there could be successful direct rail services from London to the rail networks of:

- France, Belgium and the Netherlands; as at present, and

- Luxembourg, Germany, Switzerland, Italy, Austria (and NE Spain in the future).

5. Serving Italy (or Spain) would also add another language to English, French, Dutch and German, which are sufficient for all the other networks listed.

3.10 In addition to the 18 million airline passengers per year to and from destinations already served by Eurostar, **key city destinations across these 8 (possibly 9) nations would add a further 26 million airline passengers, creating a total market of 44 million airline passengers between Great Britain and the area within one day of London by rail**. The chart below shows the number of airline passengers between Great Britain and cities in this area either already served by Eurostar or whose airports deal with more than 500,000 passengers per year to and from Great Britain.
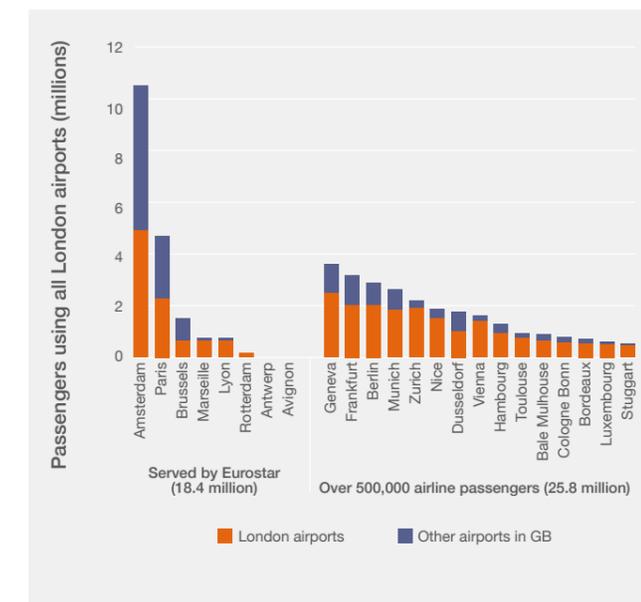

Figure 3: Principal GB-Europe air passenger markets
Source: CAA airport statistics, Greengauge 21 analysis.

3.11 Candidates for additional direct rail services from London in the first instance might be:

- within France: Nice, Toulouse and Bordeaux, and

- on more widely-drawn continental networks:

  › Geneva in Switzerland, and Frankfurt and Dusseldorf in Germany, which could probably be operated out and back in a single day; or

  › Berlin and Munich in Germany, and Zurich in Switzerland, which would require trains to travel out on one day and return on the next.

3.12 Note that services between London and these cities could make additional stops en route and hence serve yet more passenger markets. This would likely be crucial to achieving commercial viability.[6]

New international services further into Great Britain

3.13 Provided that they had stock compatible with the loading gauge available on Network Rail, international services could in principle also be extended northwards and westwards beyond London over the existing main railway line network.[7]

3.14 Four continental cities—from the list of existing and readily reached noted above: Amsterdam, Paris, Frankfurt and Geneva— had more than 1 million passengers per year to and from airports in Great Britain outside London. The busiest airline routes to these cities are from Birmingham and Manchester, both of which could in principle be reached on international services using the West Coast Main Line (WCML).

3.15 HS1 was built with a connection to the WCML which could be used to introduce services between European destinations to reach (say) Manchester and Birmingham. From Manchester, it would be possible to reach Amsterdam and Paris in around 6½ hours and Frankfurt and Geneva in around 8½ hours with this approach (with 30 minutes allowed for interchange and customs/border clearance at a selected HS1 station).

3.16 While the WCML is operating very close to capacity, making it difficult to find paths suitable for additional services at present, this will change upon HS2's completion, when a major timetable restructuring is expected, designed to make use of capacity freed up as today's Pendolino intercity services are replaced by HS2 trains. A limited number of North of England/Midland— Europe connecting services could then make use of some of this capacity released by HS2.

3.17 A rail service from Manchester/Birmingham with timed connections into Brussels, Antwerp, Rotterdam, and Amsterdam services would parallel airline routes that carried 2.1 million passengers in 2019. This equates to 2,900 passengers each way per day, enough to fill four 700-seat trains each way per day. Allowing for the (adverse) one-hour time difference, southbound departures from Manchester at, say, 06:00, 09:00, 11:00 and 14:00 would correspond to Amsterdam arrivals at 13:30, 16:30, 18:30 and 21:30.[8]

3.18 Cross-London connecting services would operate between Manchester/Birmingham and existing international stations on HS1, equipped with border control and customs facilities. These services could be readily used by domestic passengers to and from Kent and Stratford, as well as international passengers. So their economics are not solely dependent on international travel. The trains needed for such services would most likely be similar to the 225km/h Javelin trains that today provide high speed commuter services over HS1. Such services could be provided as an extension of the high speed southeastern Javelin service, or perhaps as an extension of the Lumo set of services. Either way, an attractive fares regime as in today's Lumo operation would be near-essential to build the international market.

Improvements to existing and connecting rail services

3.19 Air passengers could be attracted to rail by new international feeder services as described above, but several other steps could be taken to improve the attractiveness of rail relative to air, particularly for international travel. These are:

- Better connections
- Better ticketing
- More attractive fares.

Better connections

3.20 European Timetables could be designed with simple and reliable connections, focused on a number of hub stations. These could include Lille, Brussels and Cologne—and also Marne-la-Vallée (on the eastern side of Paris) as an alternative to changing stations in Paris and, as discussed above, a station on HS1 as an alternative to changing between stations in London.

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6. Originally mooted in September 2019, but delayed owing to the pandemic, the merger between Eurostar and Thalys (which includes services from Paris and Brussels to Cologne, Dusseldorf and Dortmund in Germany) has now been approved by the European Commission. The combined service network will be branded Eurostar.

7. Through operation onto HS2 from the continent is, however, not possible because there will be no physical link.

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8. If instead a through service was operated it could take 30 minutes off the journey times quoted here, but would require high speed rolling stock, built to the loading gauge on the WCML (Eurostar's original Class 373 stock meets this criterion, but is nearly 30 years old.) However, the HS2 train fleet is being designed for use on Network Rail as well as over the new high speed line (including northern sections of the WCML). This fleet might provide the basis of a suitable design (although compatibility with Channel Tunnel operating obligations and other train control systems would also be required).

4

3.21 Passengers will be most willing to accept connections if they are confident that they will be simple and reliable. Simplicity can be improved by careful timetable and station design, to offer connections which are cross-platform, or even to the next train on the same platform. Reliability can be more difficult to ensure. Unless the entire railway has the resilience to operate punctually, increased planned connection times will be needed. Passengers can be given rights to refunds, compensation, or alternative services if they miss connections, but these may not be consistent across a journey involving different networks or operators. Of course, what passengers really want is a dependable service and easy connections. Providing these in London (making easy the transfer between HS2 and HS1) would be great way to expand European rail travel to/from northern England and Scotland.

Better ticketing

3.22 In comparison with air, it may be harder to buy rail tickets far in advance, or to buy all the tickets needed for a journey or itinerary. Rail operators' systems do not always allow third parties to offer an intending passenger a complete itinerary and price as a single transaction.

More attractive fares

3.23 Rail fares are often high compared to air fares for the equivalent journeys. This partly reflects the different cost structures of the modes (airport charges can be expensive, but airline costs rise only slowly with distance). Rail faces differing rail infrastructure charges in EU member states and an expectation of cross-subsidy between profitable and unprofitable rail services. There are also practical issues in setting competitive rail fares for connecting services, or in markets too small to allow or justify targeted fares.

Conclusions

3.24 Eurostar currently serves key cities in France, Belgium and the Netherlands. There are 18m passengers each year (mppa), flying between airports in Britain and the cities Eurostar addresses in these three countries.[9] Over half of this prospective market comprises air journeys to/from Amsterdam (10.5 mppa), where the Eurostar service is still in the early stages of market development. A new cross-London rail service with managed connections from Manchester and Birmingham into an Amsterdam service could attract significant numbers of additional air travellers to rail.

3.25 Journeys from London as long as 1000km across Europe can be made within a day by train, and this means that additional destinations in France (such as Nice, Bordeaux and Toulouse) could be added and so too could destinations in other countries: Luxembourg, Germany, Switzerland, Italy, Austria and north east Spain (Catalonia). The air market here is even larger: a further 26m air passengers annually from Great Britain, creating a total target air market of 44m passengers.

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9. For comparison, Eurostar carried 11m passengers in 2019 on its London services (primarily to Paris, Brussels and Amsterdam).

DOMESTIC AIR TRAVEL IN GREAT BRITAIN: A DETAILED ANALYSIS
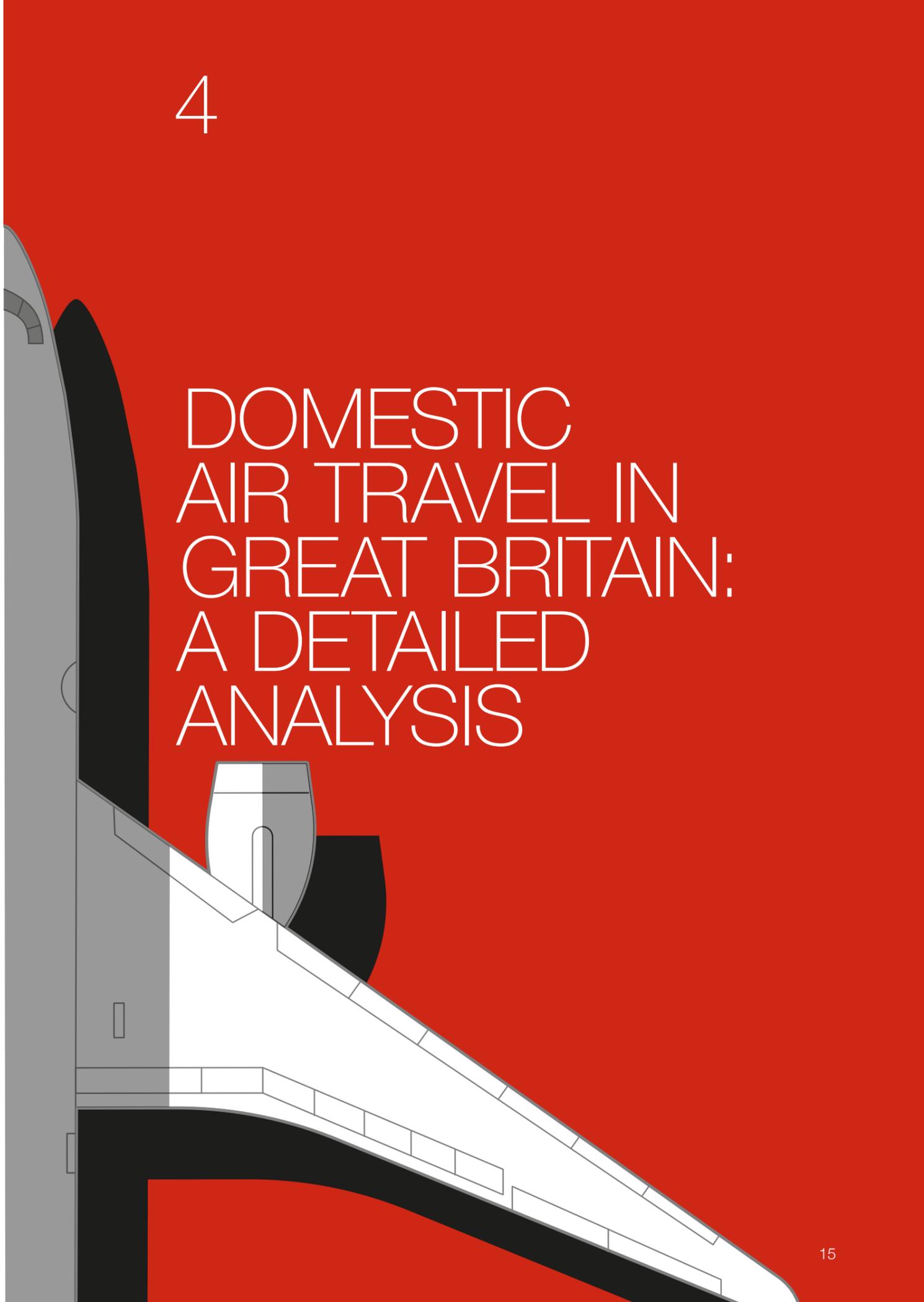
Domestic passenger numbers in 2019

4.1 More than half the UK domestic flights outside London were once provided by Flybe, which was the largest independent regional airline in Europe. However, following the start of the COVID-19 pandemic, Flybe ceased all operations in March 2020. A successor airline has announced that it will begin services from a Birmingham base during 2022, and details of its routes and schedules were published in March 2022[10].

4.2 The remainder of this analysis is therefore based on travel patterns in 2019, the last year before the COVID-19 pandemic. There is, however, no guarantee that either domestic airline services or domestic airline passenger numbers will return to pre-COVID levels, or when this will occur. If domestic air routes operating during 2019 do not return, some former airline passengers may find that rail has now become the fastest or most convenient alternative.

4.3 The following charts summarise CAA data in 2019, expressing passenger numbers as an average daily number in each direction.

Total UK domestic air passengers, 2019

4.4 CAA recorded nearly 450 domestic airline routes in 2019 carrying 22.3 million domestic passengers. These can be subdivided as shown on the chart below.
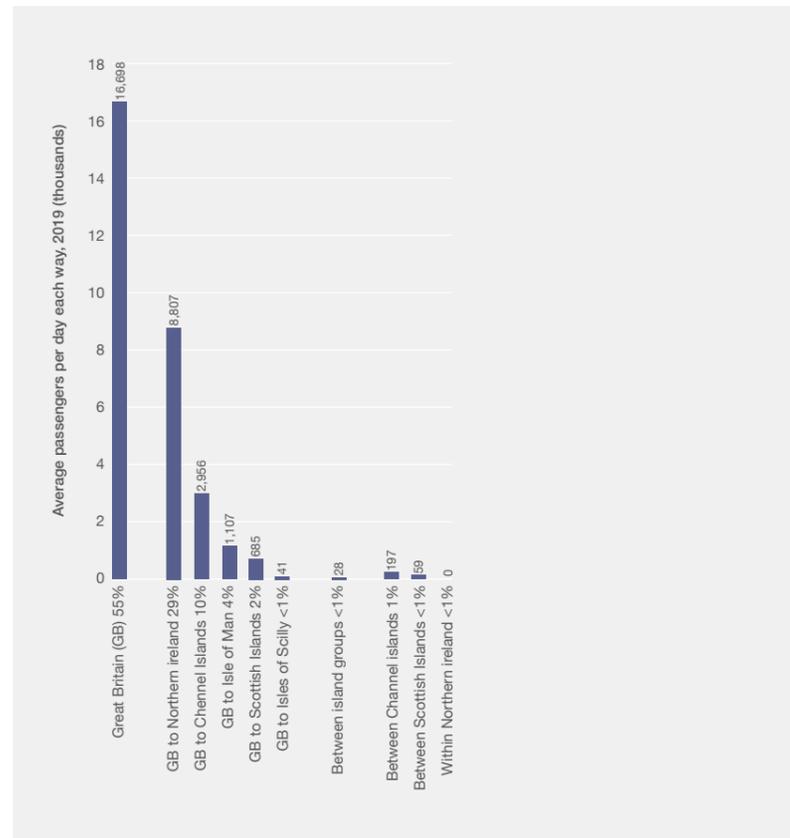
Figure 4: UK domestic airline passenger numbers by type of route
Source: CAA airport statistics, Greengauge 21 analysis.

4.5 In summary:

- 55% of UK domestic passengers were flying between airports within Great Britain

- 29% of UK domestic passengers were flying over water to or from Northern Ireland

- 16% of UK domestic passengers were flying over water to or from other islands

- 1% of UK domestic passengers were flying between islands or within Northern Ireland.

4.6 Only the first group, 55% of the total, are likely to be of direct relevance to the rail (and future high speed rail) network.

Great Britain domestic routes 2019 passenger volumes

4.7 The figure below shows the number of passengers on the 35 airport-to-airport routes within Great Britain that meet a low threshold (of just 100 passengers per day each way).
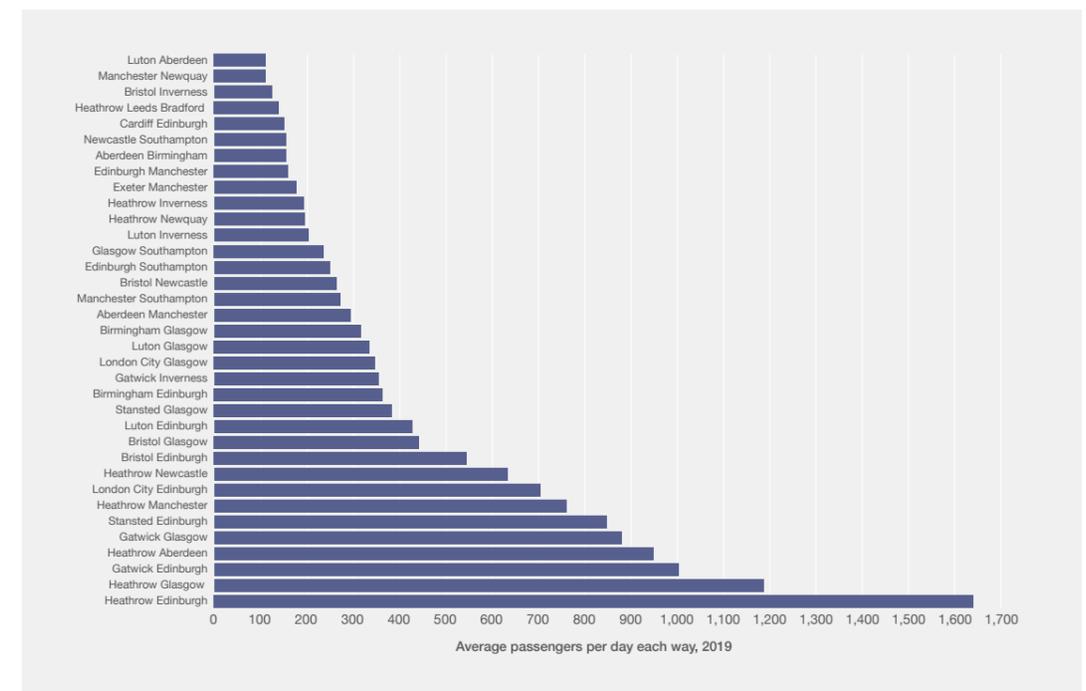
Figure 5: Domestic airline passengers in GB on routes averaging over 100 passengers per day each way, 2019 (55% of all UK domestic passengers are intra-GB, 50% of all UK domestic passengers are on this chart)

Source: CAA airport statistics, Greengauge 21 analysis.

4.8 Note that only 8 routes carried more than the 700 passengers per day each way, equivalent to the threshold used by Greenpeace. **By far the densest of these routes is between Heathrow and Edinburgh.**

4.9 Thin airline routes can be served with small aircraft, but could not possibly justify dedicated rail services. However, this would not preclude offering competing end-to-end rail services carrying other passengers over shorter distances.

4.10 In 2021, 26 of the 35 busiest GB airline routes had direct rail services between the cities they connect, meaning that all airline routes with over 300 passengers per day each way had at least one direct train. However, the existence of direct rail services does not mean that rail service timetables have been framed to compete with air services, such as by limiting stops to shorten end-to-end journey times.

Main domestic passenger airline routes, 2019

4.11 The figure below shows the busiest city-to-city airline routes in Great Britain in 2019, grouped by city.
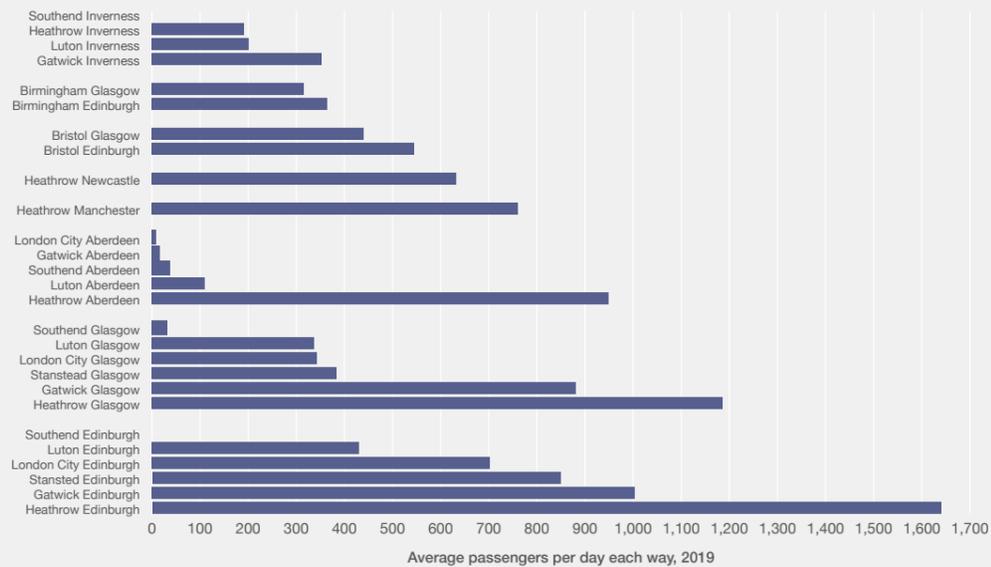

Figure 6: Busiest city-to-city airline routes in GB, 2019 (many passengers will be connecting)
(55% of all UK domestic passengers are intra-GB, 42% of all UK domestic passengers are on this chart)

Source: CAA airport statistics, Greengauge 21 analysis.
Note: Percentages on vertical axis are cumulative percentage of total UK domestic passengers.

Routes between Scotland and London and the South East

4.12 A large proportion of domestic air passengers fly between **London area airports and Scottish airports serving Edinburgh, Glasgow, Aberdeen and Inverness. These routes account for 31% of total passengers in the United Kingdom, or fully 57% of total passengers in Great Britain**. It is a highly concentrated market. Shorter distance air services within England to/from London have been cut back over the decades while intercity rail services have improved.

4.13 If routes from the London area airports are combined, only four carried more than the 700 passengers per day level required to be among the busiest 150 intra-EU routes. These are London to Edinburgh, Glasgow, Aberdeen and Manchester, although the fifth busiest route, from London to Newcastle, is close to the threshold. These are also the only five domestic routes which have retained services from British Airways' (BA) hub at London Heathrow.

Routes between Scotland and Birmingham, Bristol and the South West

4.14 The next busiest routes were (in 2019) from Bristol to Edinburgh and Glasgow, providing connectivity between the South West and the Scottish central belt. These routes are analogous to the two busiest routes from London and the South East, but with longer rail journey times. Combining these two routes gives a potential market of 1,000 passengers per day each way. A call at Birmingham would increase this to nearly 1,700 passengers per day each way.

London's airports

4.15 London's six-airport system is unique in Europe, and arguably in the world[11], and reflects several factors:

- London and the South East comprises one of the largest and wealthiest populations in Europe

- Great Britain is an island, with limited Eurostar, Eurotunnel shuttle and ferry services to destinations in continental Europe and, as noted above, considerable inter-island travel within the UK and the British Isles

- Great Britain has wide historic connections with the English-speaking world

- London is a major international finance centre

- There has been a policy of encouraging inter-airport competition and competitive entry into the airline market

- Partly as a result of all the above, and London's location in northwest Europe, the resulting density of intra-Great Britain, domestic, Irish and intra-European air services makes London a strong hub for travel between Europe and North America.

11. London's airports handle more passengers than all the airports in Australia combined.

4.16 The size of the airport system also means that several of the airports act as hubs for one or more carriers:

- Heathrow for British Airways and its oneworld partners, including long-haul services;

- Gatwick for easyJet;

- Stansted, for Ryanair (Stansted is its largest base in Europe); and

- London City for British Airways, on a smaller scale, focusing on short-haul business routes.

The effect of airport congestion

4.17 Measured by aircraft movements, London Heathrow is the busiest two-runway airport in the world, and London Gatwick is the busiest one-airport runway in the world. It is difficult to obtain take-off and landing slots at either airport, and rising congestion over time has two relevant effects.

4.18 The first effect of airport congestion is that it leads to longer overall flight times, partly due to the increasing need to queue, whether to take off or to land. The figures to the right compare BA's published timetables between Edinburgh and London in 1999 and 2022[12].

4.19 Flying from Heathrow to Edinburgh (below), scheduled flight times have risen, apparently because of the increased need to queue to take off. In 1999, BA operated a "clockface" timetable for much of the day at hourly or two-hourly intervals, with all but one of the flights scheduled to take 75 minutes. In 2022, most flights are scheduled to take at least 85 minutes, and some 95 minutes.
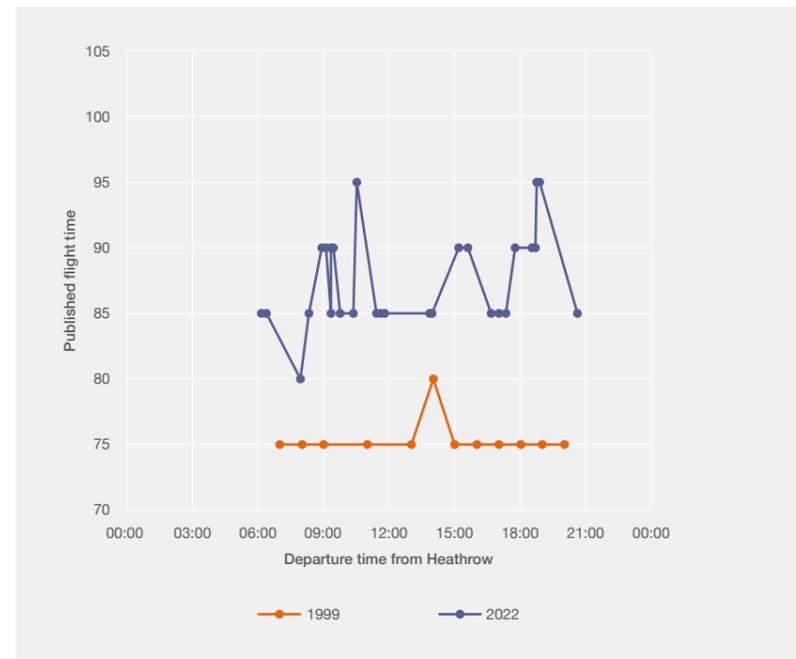
Source: OAG (1999), British Airways (2022).

4.20 A further complication is the relatively unpredictable arrival times at Heathrow of many overnight long-haul flights. Variations in the arrivals times in the early morning can mean that many arriving aircraft need to "stack"[13] and wait before landing. Short-haul and domestic flights, including those from Edinburgh, may either also stack or, more efficiently, be held at departure to ensure that they arrive at a less busy period. This effect was already visible in 1999, when scheduled flight times of 75 or 80 minutes rose to 90 minutes on the first two departures of the day, at 06:40 and 07:40. In 2022, in contrast, all except the last flight of the day have scheduled flight times of 85 minutes or more, and all southbound departures before 10:00 have scheduled flight times of 95 or 100 minutes.

4.21 The overall effect is that **flying between Edinburgh and Heathrow with BA at a given time of day is now scheduled to take around 10 minutes—and as much as 20 minutes—longer than it did 20 years ago**.

4.22 In 2016, NATS, the provider of air traffic control services at Heathrow, estimated that a 1-minute saving in the average holding time in stacks at Heathrow saved 11,000 tonnes of fuel and 35,000 tonnes of CO_2 per year[14]. After implementing initiatives to minimise holding times, they remained at an average of around 7.5 minutes for each arriving aircraft. This suggests that, before the COVID-19 pandemic, **the total annual effect of holding times at Heathrow for all flights was around 80,000 tonnes of extra fuel and 260,000 tonnes of CO_2**.

Source: OAG (1999), British Airways (2022).

4.23 Another effect of airport congestion is that the scarcity (and hence value) of slots at congested airports means that airlines use them for routes which can generate the greatest profit. This typically favours flying large aircraft on long-haul routes rather than small aircraft on short-haul or domestic routes. For a long time, both BA and British Midland International (BMI) operated domestic services, but when they merged in 2012, an attempt to establish a new second operator failed[15]. BA's own domestic services may only be viable because of the revenue contribution from passengers making connections, particularly to and from long-haul flights, rather than travelling point-to-point within Great Britain.

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12. January 2022 timetable, in which the timing and number of flights varies by day of the week. Note that during this period Heathrow was less busy than it had been prior to the COVID-19 pandemic.
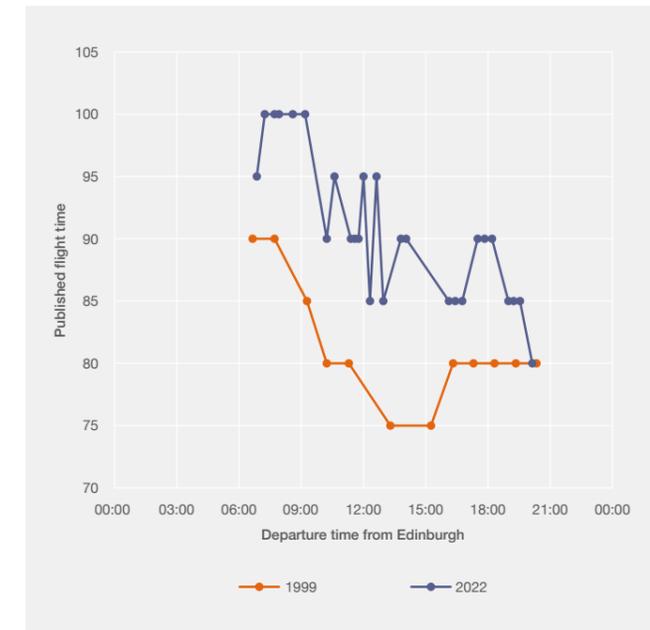
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13. Arriving aircraft fly in a holding pattern in one of four "stacks" associated with Heathrow. Each aircraft joins the top of the stack and then gradually descends to the bottom as aircraft which arrived earlier leave the stack to land.

14. "Heathrow holding times on the decline thanks to new technology", NATS, 23 November 2016.

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15. Virgin Atlantic Little Red introduced services between Heathrow and Aberdeen, Edinburgh, and Manchester in 2012 but withdrew in 2015.

4.24 This combination of congestion at Heathrow and Gatwick and the need to prioritise capacity at them for the most profitable services means that domestic flights have gradually been dispersed between a total of six airports serving the London area[16]. There are multiple 'London' air services to some destinations, particularly in Scotland. In 2019, as shown above:

- 6 London area airports had services to Edinburgh and Glasgow

- 5 London area airports had services to Aberdeen

- 4 London area airports had services to Inverness.

4.25 The size and complexity of the London area, and its resulting airport system, are unique. The question of how to assess the prospects for rail alternatives to air travel cannot be assumed likely to follow the same approach as has been used for other major European cities which typically have a single dominant airport. The unique London airport pattern raises a number of specific questions:

- How have services dispersed over time from once-dominant Heathrow and Gatwick?

- To what extent does each London area airport serve passengers connecting there, passengers to or from central or inner London, or passengers to or from points near the airport?

- How could Anglo-Scottish rail services, either with or without HS2, whether to central London or to one more airports, compete for these passengers?

- What, if anything, does this suggest about the role of the Old Oak Common interchange between HS2 and Crossrail? Could other investments produce greater air to rail connectivity or mode shift?

London's six-airport system

4.26 The figure below summarises the passenger data on the five busiest routes at five-year intervals from 2004 to 2019. Note that the airline market is dynamic, and this analysis conceals the effect of services only operated for part of the period such as British Midland International (to 2012) and Virgin Atlantic Little Red (2012–2015).
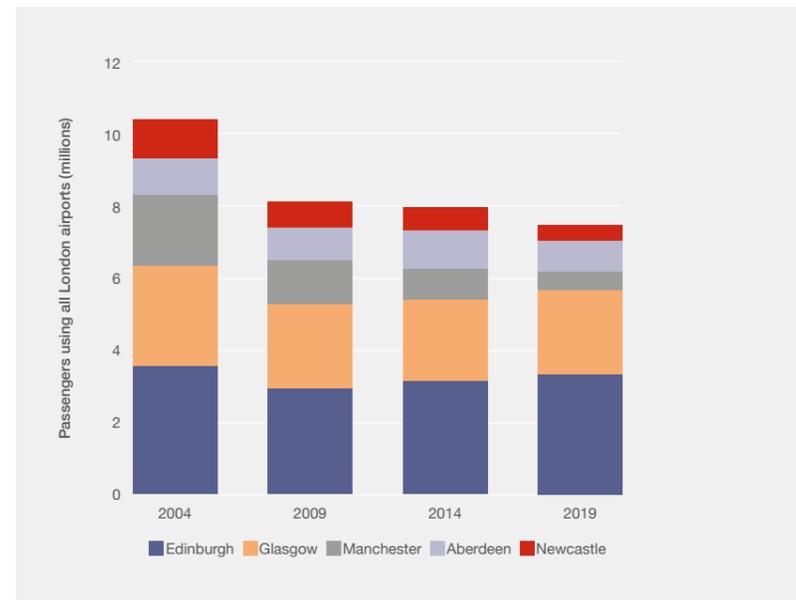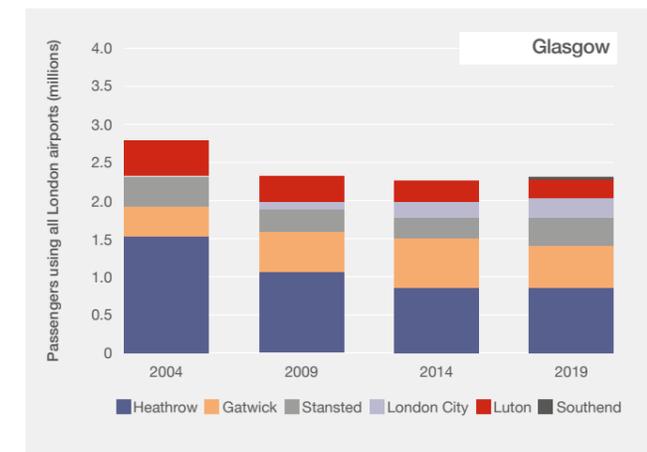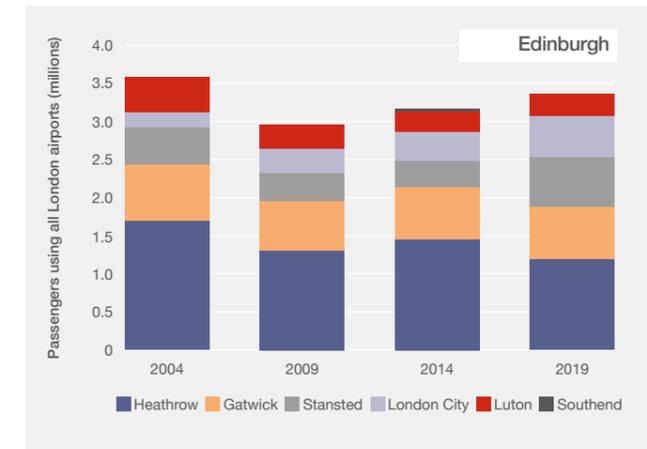

Source: CAA statistics, Greengauge 21 analysis.

4.27 The chart shows that, since a decline after 2004, passenger numbers to Edinburgh and Glasgow have recovered slightly, but those to Manchester, Aberdeen and Newcastle have continued to decline.

4.28 The next five charts examine the number of passengers between all of the London area airports and each of the key destination airports in turn.

4.29 Edinburgh and Glasgow are big markets, four to five hours from London by rail. Passenger numbers are stable or growing, but Heathrow has lost share to Gatwick, Stansted and London City, which are also hubs for at least one operator (easyJet at Gatwick, Ryanair at Stansted, British Airways at London City) and may also carry significant connecting traffic.
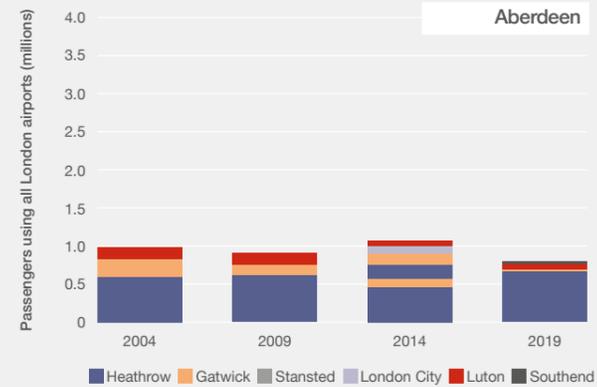

Source: CAA airport statistics, Greengauge 21 analysis.

4.30 Manchester and Newcastle are smaller markets, under three hours from London by rail. Faster and more frequent rail services have contributed to the decline in air passengers over the years, and by 2019 air services had contracted to the point where only a Heathrow route remained. It seems likely that most of the passengers on this route were connecting to other flights at Heathrow.
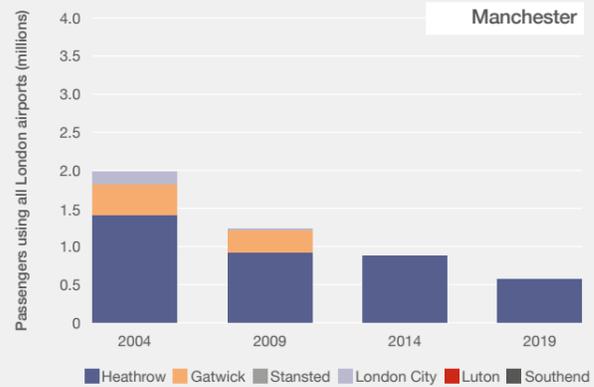
4.31 Aberdeen is around 7 hours by rail from London, too slow for rail to take a large share. Routes to Gatwick, London City and Luton still operated in 2019, but passenger numbers were low. Compared to the other routes, it seems likely that a larger share of passengers are point-to-point, although a proportion of the passengers to Heathrow are likely to have onward flight connections.

Source: CAA airport statistics, Greengauge 21 analysis.
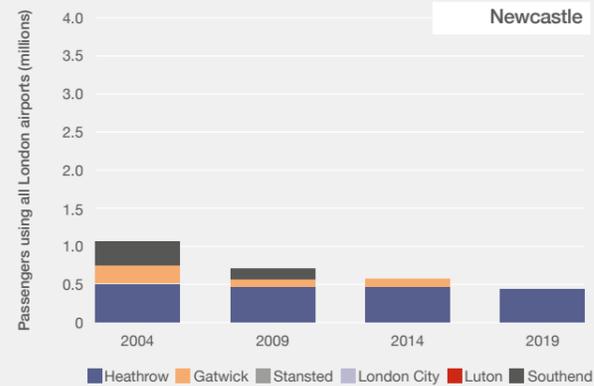
If there were no domestic flights within Great Britain

4.32 One hypothetical test is to estimate the effect on rail demand if all domestic air travel switched to rail, such as through an effective ban on domestic flights. The practical details would be complex, as some airline passengers could use more than one route through the rail network, and the rail timetable might in any case need to be adjusted to deal with the overall changes in demand. However, we have made two illustrative calculations for the potentially densest corridors.

Routes between Scotland and London and the South East

4.33 As noted above, passengers flying between London area airports and Scottish airports serving Edinburgh, Glasgow, Aberdeen and Inverness account for 31% of total passengers within the United Kingdom, or 57% of total passengers within Great Britain.

4.34 These routes carry a total of nearly 7 million passenger per year or nearly 10,000 passengers each way per day, sufficient to fill an hourly pair of 5-car IEP trainsets[17] throughout a 16-hour day[18]. In practice, yield management techniques could probably not achieve satisfactory day-long load factor management, and there would likely be a need for at least two additional train paths per hour in at least some hours.

Routes between Scotland and Bristol and the South West

4.35 The next most promising route would be for services from Bristol and Birmingham to Edinburgh and Glasgow.

4.36 These routes carried a total of nearly 1.2 million airline passengers per year or nearly 1,700 passengers each way per day, broadly equally balanced between Edinburgh and Glasgow. These airline passengers alone would be sufficient to fill a pair of 300-seat sets three times per day each way, assuming both Scottish central belt cities were served. A service at two-hour intervals, with a 6-hour journey time, could correspond to departures from 06:00 to 16:00 and arrivals from 12:00 to 22:00. And with HS2, Glasgow-Birmingham journey times would be sped up by 1 hour 25 minutes.

17. Capacity 302 seats per set or 604 per coupled pair.

18. Between London and Edinburgh, equivalent to departures from 05:00 to 20:00 and arrivals from 09:00 to 00:00.
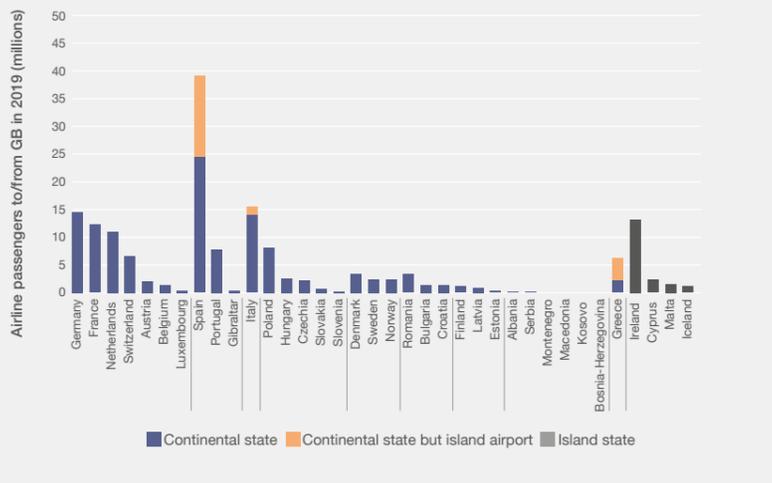
5

THE PROSPECTS FOR MORE INTERNATIONAL RAIL SERVICES FROM BRITAIN

5.1 We can categorise the near continent by nation (state) and as a function of the border and technical complexities that need to be overcome when operating direct through services.[19] The figure to the right summarises the number of airline passengers between airports in Great Britain and each group and each state in 2019.
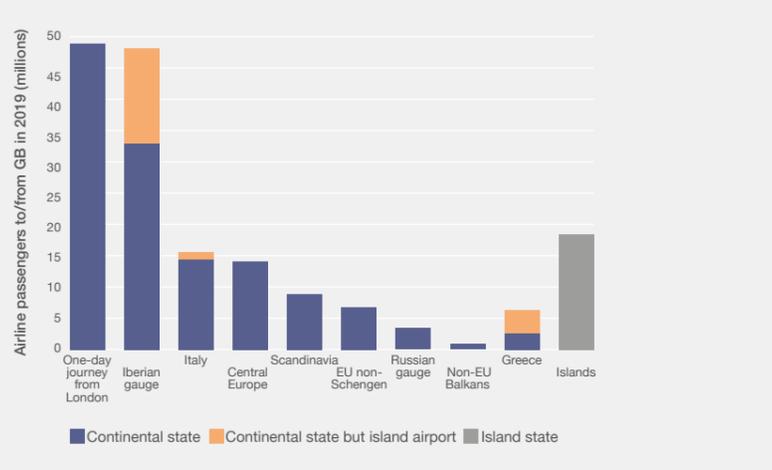
5.2 Destinations which could be reached within a one-day journey to or from London account for 49 million air passengers. **This is more than four times the number of airline passengers travelling between points in Great Britain.** Despite the challenges arising from crossing international borders and operating over the infrastructures owned by differing organisations, the potential for (high speed) rail is clearly very substantial, as is the scope to reduce carbon emissions.

5.3 The figure to the right disaggregates the airline travel data above to identify airline passenger numbers between Great Britain and each nation.

5.4 In the following analysis we distinguish:

- nations already served by Eurostar; and

- nations which could be reached within a one-day journey from London.

Source: CAA airport statistics, Greengauge 21 analysis.

Routes with the greatest potential to/from nations already served by Eurostar

5.5 International rail services to and from London currently serve 14 continental stations, of which 8 serve cities with airline services from Great Britain: Amsterdam, Rotterdam, Paris (Charles de Gaulle and Orly), Marseille, Lyon, Avignon, Brussels (and Charleroi) and Antwerp.

5.6 The chart below shows the number of airline passengers on these routes in 2019, distinguishing London airports from other airports in Great Britain.
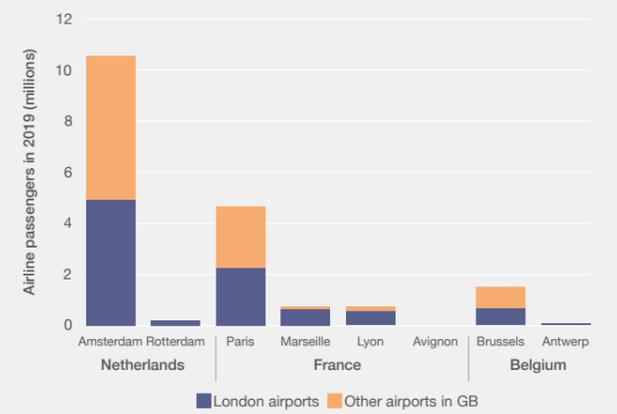
Source: CAA airport statistics, Greengauge 21 analysis.

5.7 Airline passenger numbers are divided almost equally between London airports (51%) and others (49%), but while 36 London airport routes carried an average of 260,000 passengers, the 84 'other airport' routes carry an average of fewer than 110,000 passengers.

5.8 The air passenger numbers are also dominated by Eurostar's three principal destinations, Amsterdam (57%), Paris (25%) and Brussels (7%), with only 11% to airports at other Eurostar destinations. Note also that Amsterdam and Paris Charles de Gaulle (which is used by 99% of the passengers to Paris airports) are hubs for Air France-KLM. A proportion of passengers on airline routes to Amsterdam and Paris are likely to be connecting at these airports. This is particularly the case for passengers flying between London airports and Paris, where Eurostar provides centre-to-centre travel in as little as 2¼ hours[20], and air is likely to attract few point-to-point passengers.

5.9 There may be scope for Eurostar to capture more passengers from air on the routes it already serves, and particularly from Amsterdam, which it has served only since 2018.[21] These could be either:

- from London, by some or all of more frequent services, shorter journey times, and more attractive pricing relative to air; or, in principle

- from cities beyond London which support dense air services to Amsterdam.

19. See Annex A for the rationale for the groupings presented here.

20. This is little more than the rail journey time between London and Manchester, where it is generally assumed that almost all airline passengers are connecting between flights at one or both ends of the route.

21. And only benefitted from juxtaposed border controls in Amsterdam and Rotterdam since October 2020.
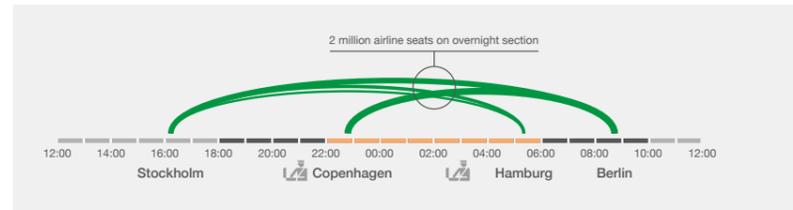
Air services from London dominate

5.10 In practice, and as discussed above, typically half the passengers between Great Britain and continental airports use London airports. In other words, a rail service between the continent and London will typically be able to serve as many airline passengers as rail services to all other airports in Great Britain combined. A service from the continent only as far as London avoids the need to use Network Rail tracks and hence can use stock designed for the larger gauge available on HS1.

5.11 However, as shown above, Eurostar routes have only four end points (Amsterdam, Paris, Bourg St Maurice and Marseille) but stop at a total of 14 continental stations, an average of four in each direction. Rail services in other corridors could also call at intermediate points, whether served by air or not, and the number of potential combinations of stopping points, at least assuming no operational constraints, is very large, particularly for day trains which can reasonably call, and make local connections, at intermediate stations at any time between around 06:00 and 22:00, a 16-hour day.

Night Trains

5.12 Night trains are expanding across Europe, offering an alternative to flying on many routes.[22] The night trains rarely run non-stop end-to-end, but still avoid stops in the small hours. Snälltåget night trains on the route of the Stockholm/Copenhagen to Hamburg/ Berlin sleeper, for example, do not stop for around seven hours between Copenhagen and Hamburg[23] (a journey segment which by 2030 will be possible in 2½ hours by day).

Source: Steer *op cit* (Figure G.16). Width of green lines is proportional to the number of airline seats in 2019.

Rail services beyond the current Eurostar network

5.13 In addition to the current Eurostar network, more than 500,000 passengers a year fly between Great Britain and a number of airports in Luxembourg, Germany, Switzerland and Austria. The chart below shows the number of airline passengers on these routes in 2019, distinguishing London airports from other airports in Great Britain.

5.14 The schematic map below shows the Railteam network of services[24] and the location of most of these destinations within them.
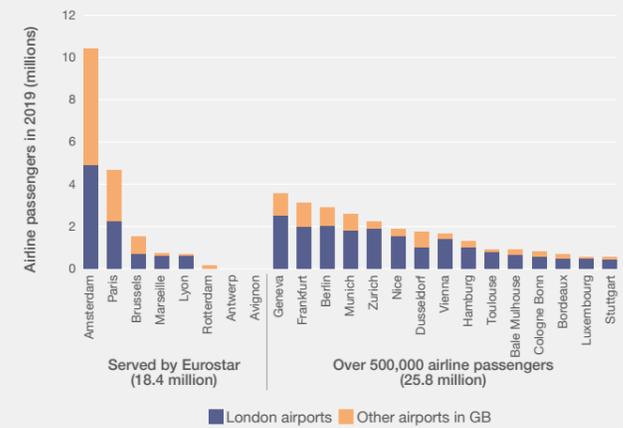
5.15 Of the potential rail destinations from Britain not shown on the map:

- Nice is approximately 2 hours 40 minutes by rail from Marseille

- Toulouse is approximately 2 hours by rail from Bordeaux, but from 2030 the LGV Bordeaux–Toulouse is expected to bring Toulouse within just 3 hours of Paris

- Bonn is close to Cologne (Köln on the map), and Cologne Bonn airport has a station on the Cologne to Frankfurt high speed line

- Barcelona is just 1 hour 21 minutes from Perpignan in south west France.

5.16 International rail services to and from London could be successfully extended beyond either Brussels or Paris, subject to a number of pre-conditions:

- Security and border arrangements for the Channel Tunnel could be met

- Trains carried all the technical systems required to operate the entire route

- Train crewing could be arranged to cover all local language and operational knowledge

- Suitable train paths could be found either among, or by combining with, existing services

- In competition with existing services, the new services could attract a reasonable load factor by being either:

  - sufficiently fast, and ideally not overtaken by other trains; or

  - sufficiently cheap, with lower fares to compensate for a slower journey.

22. See, for example, New destinations for GreenCityTrip sleeper trains | RailTech.com.

23. The Fehmarn Belt crossing, opening in 2029, should allow a day journey time of 2½ hours. It might not be attractive to use it to shorten journey times if this meant serving Copenhagen or Hamburg (or both) in the middle of the night.
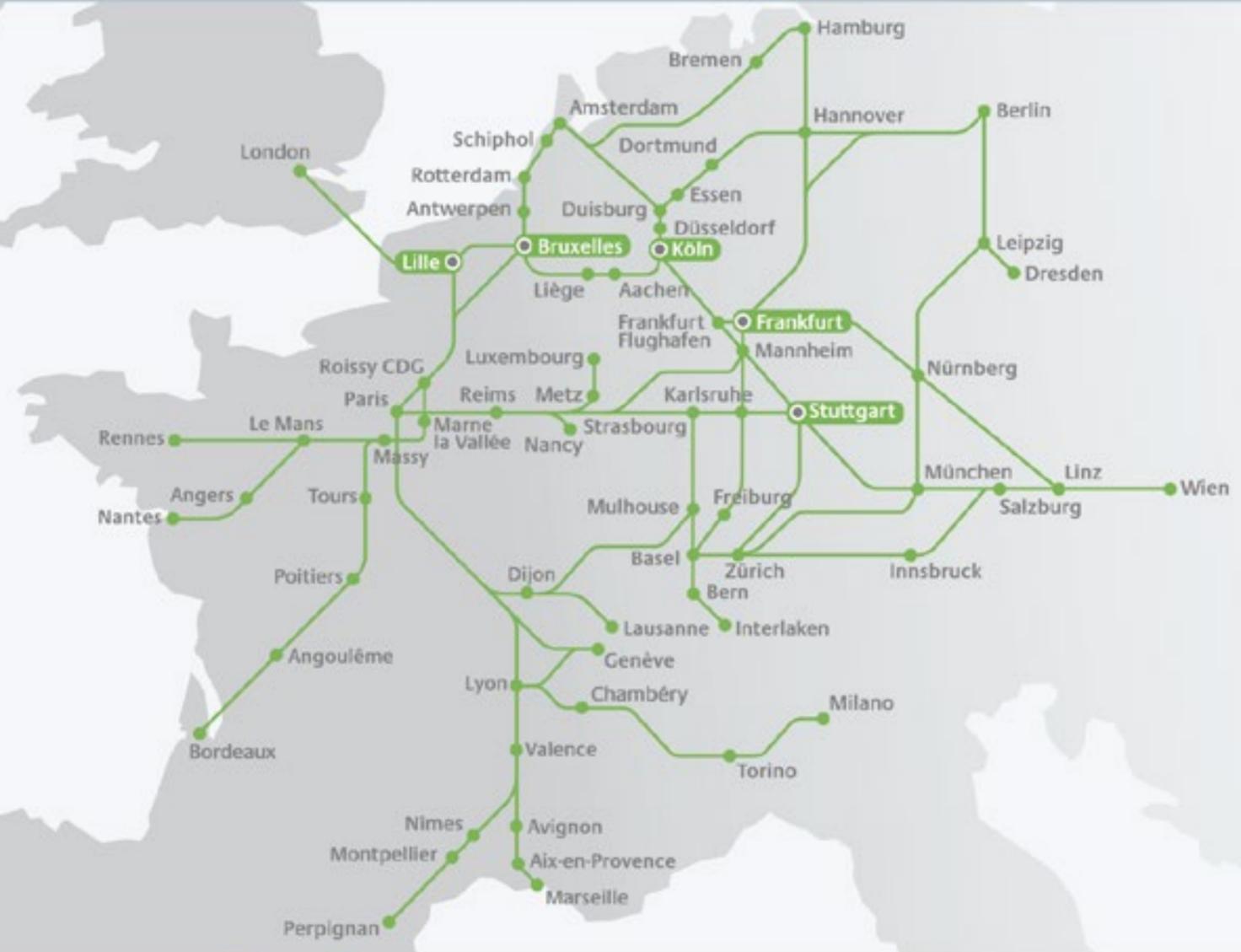
24. Railteam is an alliance of railway operators. The eight full members, Deutsche Bahn, SNCF, SNCB, Eurostar, NS International, ÖBB, SBB and Thalys, and the associated member TGV Lyria, have joined forces to offer all their passengers comprehensive service and comfort."

Source: Railteam. Stations highlighted in green are identified as hubs.

Possible extensions of rail services beyond Amsterdam, Brussels and Paris

5.17 Existing (daytime) trains could be extended, for instance:

- Beyond Amsterdam, possibly to Bremen and Hamburg

- Beyond Brussels, whence possible extensions would include:

  › Luxembourg
  › Liege-Cologne-Dusseldorf-Hannover-Berlin; and
  › Liege-Cologne-Frankfurt-Munich-Vienna.

- Beyond Paris, whence possible extensions would include:

  › Bordeaux-Toulouse; and
  › Marseille-Nice.

5.18 Geneva and Frankfurt, potentially the two most important new destinations, could probably both be served with an out-and-back train completing a return trip within a working day, as is currently achieved between London and Marseille.

Possible extensions of rail services beyond London

5.19 The analysis above shows that four continental airports within the 1,000-kilometre circle from London have more than a million passengers from airports in Great Britain outside the London area[25]. These are:

- Amsterdam and Paris, already served by Eurostar

- Frankfurt in Germany

- Geneva in Switzerland, and

- when the recently announced high speed line between Montpellier and Perpignan is completed, it would be realistically possible to operate high speed services between London and Barcelona in Spain too.
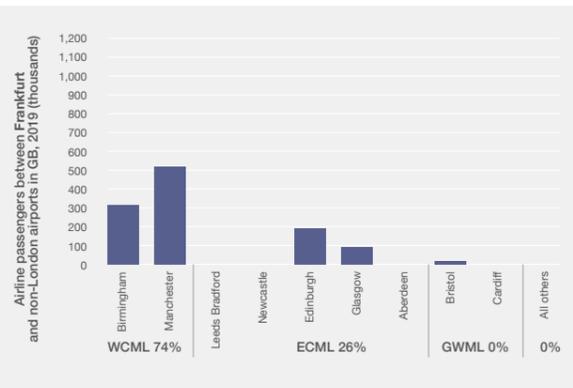
5.20 The charts to the right show the 2019 airline passengers to these cities from non-London airports. As noted in chapter 3 above, it is technically possible that such services could operate over the connection provided between HS1 and the WCML, a route where capacity will be made available following the implementation of HS2. Connecting services to international stations on HS1 are much more likely to be feasible than though services, (as noted in paragraph 3.18, above). Journey times shown here presume that these additional connecting services can be accommodated (post-HS2, using released capacity) with smartly timed interchanges at HS1 stations.

5.21 With current journey times, Amsterdam and Paris could be reached in around 6½ hours from Birmingham, Manchester, Leeds, Bristol and Cardiff. The busiest single air route is to/from Manchester.
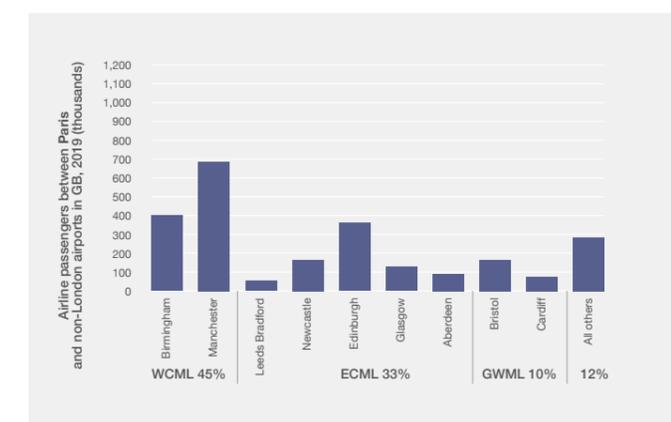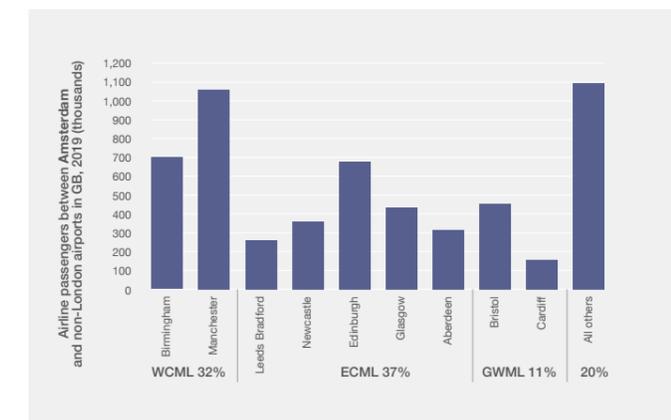
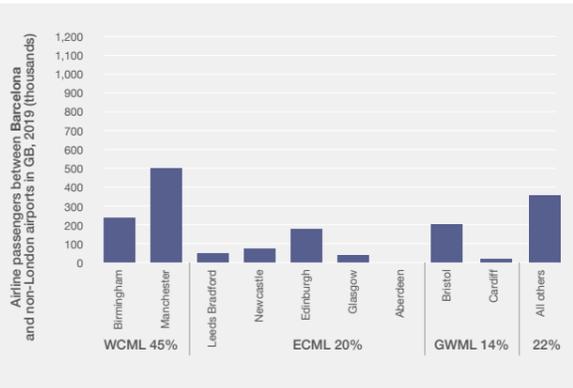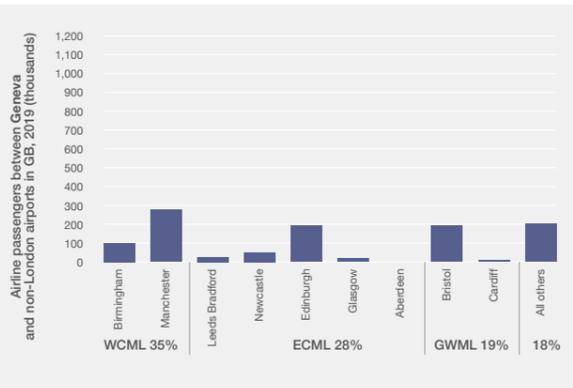Source: CAA airport statistics, Greengauge 21 analysis.

25. There were also 700,000 passengers between Copenhagen and airports in Great Britain outside London.

Airline passengers between Frankfurt and non-London airports in GB, 2019 (thousands)

WCML 74%   ECML 26%   GWML 0%   0%

Airline passengers between Geneva and non-London airports in GB, 2019 (thousands)

WCML 35%   ECML 28%   GWML 19%   18%

Airline passengers between Barcelona and non-London airports in GB, 2019 (thousands)

WCML 45%   ECML 20%   GWML 14%   22%

Source: CAA airport statistics, Greengauge 21 analysis.

5.22 With current journey times, Frankfurt and Geneva could be reached in around 8½ hours from Birmingham and Manchester. Again, the busiest single air route is to/from Manchester, and the same is true with Barcelona (see diagrams to the left).

5.23 Assuming operating services between the continent and locations in Great Britain north of London was possible[26], the corridor extending north of London with the greatest number of airline passengers seems likely to be from Manchester to Amsterdam, calling at Brussels–Antwerp–Rotterdam–Schiphol en route.

5.24 It would parallel airline routes carrying 2.1 million passengers in 2019, which equates to 2,900 passengers each way per day, enough to fill four 700-seat trains each way per daily.

26. As noted in paragraph 3.18 above, there would be substantial border control and hence service economics challenges to overcome, but good feeder services—able also to accommodate cross-London travellers to/from East London/Kent—could well be viable.

Service improvements centred on meeting traveller needs

5.25 The European Commission's Rail Market Monitoring (RMMS)[27] identified that the proportion of EU27 long-distance and high speed passenger services arriving less than five minutes late fell from 84.9% in 2015 to 78.7% in 2018. Many passengers may not wish to book connections if there is a significant risk that they will miss the second train. Tight connections are unlikely to be reliable at current levels of punctuality. Infrastructure managers and operators must therefore decide whether to create and offer rapid connections, with the associated risk that they fail, or to plan, or to allow passengers to specify, longer margins between connections, with the associated effect of a longer effective journey time.

5.26 If connections between trains cannot be guaranteed, an alternative approach is to offer passengers rights of compensation and/or travel on a later train. The rights created in European law on rail passenger rights, Regulation (EC) No. 1371/2007, are being expanded by Regulation (EU) 2021/782, which will apply from 7 June 2023. It is not clear whether any elements of the new regulation will be adopted in Great Britain, but passenger rights can also be specified in national, regional or local conditions of carriage or by contracts for rail services. There may be further complexities when the passenger's rights change over the course of their journey.

27. https://transport.ec.europa.eu/transport-modes/rail/market/rail-market-monitoring-rmms_en.

5.27 Much will depend on which parties bear responsibility for passengers suffering from connections which are broken (that is, when the railways fail to provide the minimum connecting time) and/or missed (the passengers fail to make the connection):

- If infrastructure managers or operators are liable for broken or missed connections, they may only plan or advertise long connecting times, and

- If ticket vendors are liable for broken or missed connections, they may withdraw from selling tickets for connecting services.

5.28 A single operator offering a passenger an end-to-end journey, or a connection between its own services, may balance the design of its timetable in the way that it calculates will deliver the best service to the greatest number of passengers, but this may not necessarily prioritise attracting relatively small numbers of long-distance of international passengers from air. Where a journey involves connections between the services of two or more operators, the outcome for the passenger may depend on constraints and priorities which vary between the operators.

Making best use of HS1

5.29 Notwithstanding the above practical issues, many passengers making international rail journeys to and from Great Britain may connect between services in Great Britain, including in London to join or leave services at St Pancras International. This offers connections to stations on the East Coast Main Line (ECML) from the adjoining Kings Cross station, Midland Main Line (MML) and, through Thameslink Southern Great Northern (TSGN) and Southeastern services, to stations on the Southern and Southeastern networks.

5.30 St Pancras International was planned on the assumption that each of its six international platforms could deal with one arrival and departure per hour but, in practice, it has rarely operated more than two international departures per hour.

5.31 For more departures to be possible, it would also be necessary to secure train paths on, as a minimum, the infrastructure of HS1 in Great Britain, Getlink and RFF in France, all of which we understand are constrained during at least some periods. In principle, however, capacity could be reallocated to the point where St Pancras itself became the constraint, in which case there would be a need to use another terminal in Great Britain.

5.32 HS1 was built with four international stations at St Pancras International, Stratford International, Ebbsfleet International and Ashford International. International services have only ever operated from three of these stations:

- St Pancras International from passengers from central London and beyond;

- Ebbsfleet International, intended for passengers accessing HS1 by road, particularly the M25; and

- Ashford International, for passengers to/from Kent.

5.33 The location of these stations was planned before the decision to operate domestic services on HS1, which now offer a high speed service linking all four stations in less than 40 minutes.

5.34 HS1 was built with a connection to the WCML, as already noted in the discussion of providing direct services between north of London locations and the continent.[28] Connecting services via this existing link between HS1 and the North London Line (and thence the WCML) would allow passengers to transfer from there to European services at one of the HS1 stations (most likely Stratford or Ebbsfleet) with security and frontier checks carried out at the interchange point, avoiding the need to traipse along Euston Road.

5.35 Such feeder services would be especially helpful if, in future, additional European services using HS1 start and finish from Stratford or Ebbsfleet. But for international services to/from St Pancras like today's Eurostar arrangement, a transit shuttle between Euston and St Pancras would be a better solution and a great contribution to the Government's levelling up agenda, making it easy to access London's European train services from the North and the Midlands.

5.36 Connecting international services to and from London could in principle be improved at Lille, Marne-la-Vallée[29], Brussels and Amsterdam, all of which have a single station, although this would be more difficult in Paris, which shares with London a pattern of multiple mainline stations serving different radial corridors.

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28. This extends from the portals of HS1's London Tunnels to the WCML slow lines at Primrose Hill Tunnels, a distance of around 2¾ kilometres, passing through Camden Road station, and has overhead electrification throughout.

29. Marne-la-Vallée is a station on the high speed line that bypasses Paris, running north-south to the east of the Capital and serving Disneyland® .

5.37 The practicalities of providing such connections would depend on the station layout and the availability of sufficient capacity to allow good connections for international passengers.

Booking and reservation systems

5.38 Airlines often publish their timetables, and allow reservations, up to a year in advance. Railways, in contrast, may not finalise engineering works and timetables until a few weeks in advance, making it impossible for passengers to plan a future trip.

5.39 One issue that may be important to many passengers is that it is easy to specify an origin and destination and be provided with a list of travel options and fares. This is often much simpler for air travel than for rail travel, and rail passengers often find that they can only book a journey as a series of transactions through different sales channels.

5.40 The rail industry is developing a standard, "Open Sales and Distribution Model (OSDM)"[30], to make it easier for vendors to sell several tickets as a single transaction. It remains to be seen, however, how successful OSDM is in practice.

Air fares and Rail fares

5.41 Passengers and passenger representatives often argue that rail fares are too high and that they need to be reduced to be attractive relative to air.

5.42 In practice, commercial rail operators must normally set fares high enough to cover their costs, including infrastructure charges, which vary widely within and between networks and are often higher than the marginal cost of infrastructure use. In Great Britain, long-distance operators have been incentivised to maximise net revenue to allow them to pay premia to the Department for Transport. Lower infrastructure charges, and fares designed to encourage use of available capacity, could make rail more attractive relative to air.

5.43 However, rail fares are constrained by factors which do not apply to air. For example, airlines can charge more to travel from London to Brussels than from London to Amsterdam, but rail operators cannot. It is also difficult to agree an end-to-end fare for a rail journey involving two or more operators, particularly when the potential market is small.

5.44 This is where it may be possible for open access operators, targetting specific point to point flows, airline-style, to create a commercially viable, attractively priced, alternative to both flying and to conventionally priced rail. Such developments are perhaps most likely on the busiest routes (such as London-Paris, Madrid-Barcelona) where there may be scope for on-track train service provider competition.[31] In some ways, this would be to mimic low-cost airline philosophy and SNCF is already set on this course across its TGV network, providing a lower cost 'no-frills' high speed service ('Ouigo') alongside its premium product.

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30. https://unioninternationalcheminsdefer. github.io/OSDM/.

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31. This already happens in Britain along the ECML.

6

RAIL SERVICES DESIGNED TO ATTRACT AIR PASSENGERS

Conclusions

5.45 We have presented in this chapter a comprehensive overview of air services between GB and Europe and the scope for rail to meet the existing (pre-COVID) pattern of air demand.

5.46 European destinations, reachable within a day from London, currently have four times the volume of air passengers traveling within GB.

5.47 Of existing Eurostar destinations, Amsterdam offers the biggest growth prospect. The existing service pattern could also be extended for within-a-single-day rail travel for GB to cities such as Berlin, Bordeaux, Frankfurt, Luxembourg and Munich.

5.48 There are also substantial new rail market opportunities. These are most easily represented by the map generated by Railteam (of which Eurostar is a member). Repeated above, it shows the very wide scope of within-day rail travel.

5.49 The competitive offer of rail need not be restricted within Britain to London. We have shown how customer-friendly connecting rail services from the West Midlands and North West could be provided—subject to capacity becoming available on the WCML.

5.50 Indeed, improved connections with appropriate disrupted travel compensation is seen as an important factor in rail providing a better alternative to air travel.

5.51 And, lastly, a key factor that will determine just how successful rail competition can be: pricing. With regard to fare levels, we found that there are already models for high speed rail emerging across Europe that could make a very significant difference to the ability for rail to attract custom from air services and reduce the level of carbon emissions accordingly.

6.1 Capturing more passengers from air could mean focusing on designing rail timetables with service end points and frequencies designed to target air markets, adding stops only where necessary to obtain reasonable passenger loads. If necessary, this might mean that slightly longer journey times on other services between intermediate points which do not have air connections[32].

6.2 We examined nearly 450 domestic airline routes in the United Kingdom, and eliminated from further consideration both those which are not wholly within mainland Great Britain and those which carry too few passengers either to justify a rail service or to provide the primary rationale for one. This left five routes that meet the (arbitrary) Greenpeace threshold of 500,000 passengers per year. **Four of these five air routes could be paralleled by one rail route, operating on the ECML corridor**.

Opportunities within GB prior to HS2 opening

6.3 The ECML, linking London with Newcastle, Edinburgh and both Glasgow and Aberdeen service with appealing fares—such as those set by Lumo—would be very well placed to address this market, although journey times would still likely leave air with the largest part of the travel market.

6.4 The WCML is better placed to address the London–Glasgow market, but the constraints of semi-regulated fare levels over a very busy multi-stop route may preclude offering the simpler and more appealing pricing that Lumo can offer. Rail already competes very strongly in the London-Manchester market where a large part of the remaining airline flows will be inter-lining.

6.5 Euston is fine as a destination for central London travel, but the current Avanti intercity service provides no stops near the M25 at Watford Junction, and the terminus at Euston (unlike the ECML at Kings Cross) has an awkward gap to Thameslink which provides a good onward connection across central London to south of the Thames destinations.

6.6 Speeding up longer distance ECML and WCML London services by removing intermediate stops could offer faster journeys, but as rail builds back services after the period of COVID travel restrictions, capacity constraints are likely to return to the network and make service enhancements and additions hard to achieve.

6.7 For non-London cross-country journeys the market on offer is smaller and network capacity constraints are—if anything—harder to overcome. We identified the Bristol–Birmingham–Newcastle–Scotland axis as being a strong candidate for rail to compete with air services. This might be served with a frequency more like an airline would offer—perhaps three times/day, rather than the hourly service levels that rail favours. Birmingham–Glasgow is already a very fast growing rail market via the WCML, to which Edinburgh could be added as a destination.

6.8 New rail services could bypass Birmingham which will be gaining flights to Aberdeen, Edinburgh and Glasgow from new services provided by the successor Flybe airline[33]. Possible limited stop services might run, for example:

- Cardiff-Bristol Parkway–Derby–Sheffield–York–Newcastle–Edinburgh

- Bristol Temple Meads–(Shrewsbury)–Crewe–Preston–Carlisle–Glasgow.

6.9 The aim would be significantly faster end-to-end journeys than today's Cross Country service offers, avoiding some major cities (Birmingham, Leeds) that, while offering good revenue potential, are also rail network congestion hot-spots.

Prospects improve with HS2

To and from London

6.10 When HS2 comes into service, London-Glasgow/Edinburgh services are planned to be much faster (3h38, compared with typically over 4h20 today) and the speed up of the London-Manchester route may end that route's air competition. HS2 will allow rail passengers to reach Heathrow terminals via a transfer to direct fast connections into Terminals 2/3 and Terminal 5.[34] Old Oak Common is much more convenient than Euston/King's Cross for these onward connections to Heathrow (and its surrounding catchment, including along the Thames Valley).

6.11 If improvements are also made north of Crewe, as the Union Connectivity Review suggested, the shift from air to rail could be transformational, with Anglo-Scottish mode share increasing from around 30% to over 70% (see diagram below). [35]
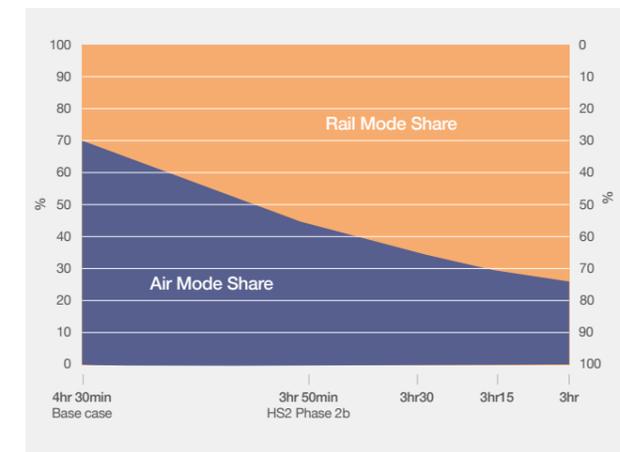
Source: Union Connectivity Review, p40.

6.12 In addition, the southern part of the WCML will be relieved of its longer distance intercity trains, potentially freeing up route capacity to make possible the operation of services connecting directly to HS1 as outlined in Chapter 3, extending the value of HS1 to the West Midlands and North West.[36]

6.13 As and when demand picks up, it might be possible to switch peak load services to through trains (for example between Manchester and Amsterdam direct) with a time saving of around 30 minutes and the removal of the need to interchange en route.[37] But there remains a key gap to fill: a transit shuttle facility is needed between Euston (HS2) and St Pancras (HS1). If this presents as an easy transfer (airport style, between terminals) then zero carbon rail will be able to replace many more air journeys.
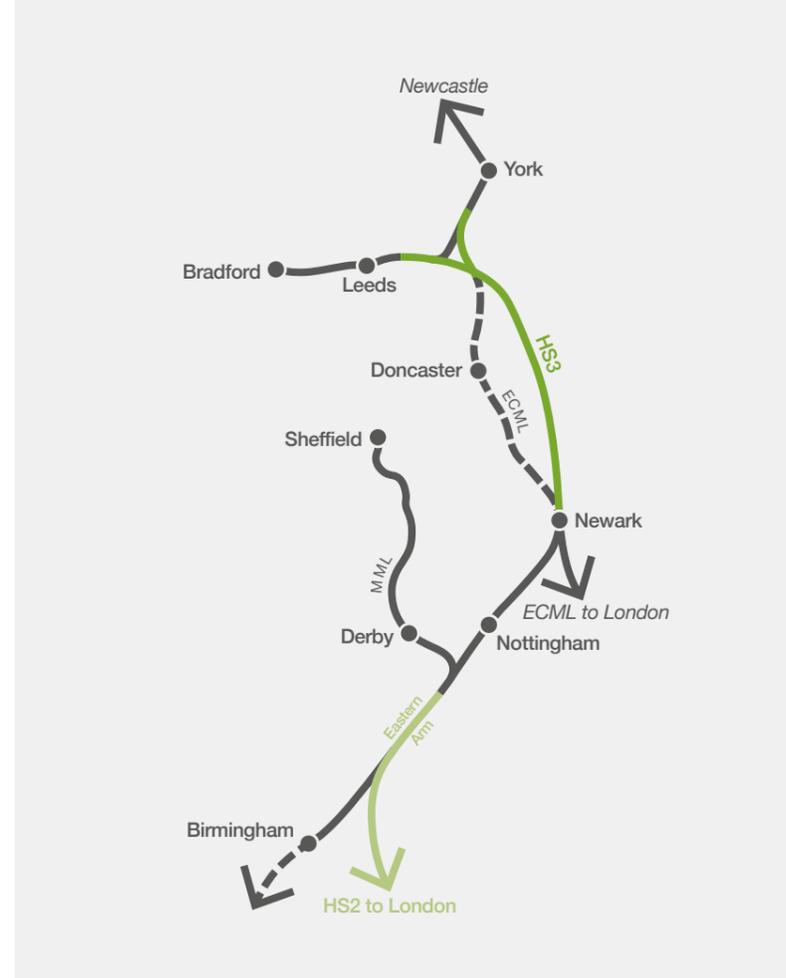
6.14 The Union Connectivity Review pointed to the desirability of further infrastructure work northwards from HS2's current limit, to bring down Anglo-Scottish journey times yet further. While this is projected to increase rail market share significantly, the awkward gap between Euston and St Pancras stations will to some extent reduce the advantage for travel onwards to continental Europe. An approach that shortens journey times over the ECML into Kings Cross might therefore be of greater value for international travellers. Meanwhile, the value of an easy-to-use passenger transfer facility between Euston and St Pancras, suitable for long-distance travellers, remains an obvious network gap to be filled. It is needed but not as much as a project to benefit London, as one that is needed for the Midlands and North to share in the European connectivity that HS1 offers to London.

Cross Country

6.15 A cross country opportunity once HS2 is in operation has been identified by Greengauge 21. It arises from the Integrated Rail Plan, which did not include the previously planned Eastern Leg of HS2 between the East Midlands and Leeds. It proposed instead that the cross-Midlands section of this line should proceed and be connected into the existing rail network in a way that allowed it to provide HS2 services to Nottingham and Derby, both of which were bypassed in earlier HS2 plans.

6.16 Greengauge 21 suggests that this could—and should—lead to a new and potentially better opportunity for the national high speed rail network on the eastern side of Britain. As illustrated above, the remaining (green coloured) Eastern arm part of HS2 across the Midlands would be complemented by a further section of high speed rail in the East Coast corridor (also coloured green, between Newark and York), relieving the ECML through the complex junctions at Doncaster and allowing a speed up of all ECML services.

6.17 This arrangement also allows a major speed-up of the core York–Birmingham section of the nation's primary (NE-SW) cross-country route. A faster rail service between Bristol (and Cardiff) via Birmingham and Nottingham to York, Newcastle and Edinburgh could meet some of the largest non-London air flows and make a significant difference to the all-round connectivity of a series of major provincial cities. This is levelling up at a strategic level. Even without any time savings from future investment in the East Coast corridor as shown in the map above, by using the retained southern party of HS2's Eastern arm, the primary (NE–SW) cross-country route would be speeded up by 1½ hours, with rail providing a much better alternative to flying.

International Opportunities

6.18 In the last chapter, we concluded that:

- The scope to attract passengers to switch from air to rail on routes between Great Britain and Europe is four times as high as over within domestic Great Britain routes

- There is a 1000km travel range from London to European destinations that can be reached by (high speed) rail—and the scope for new services via the Channel Tunnel to reduce air travel is substantial

- Quality of connections (and compensation arrangements if they are missed) will be important, and

- At least on some routes, rail fares set in the style of the new Lumo rail service in Britain and provided by SNCF through its high speed Ouigo brand, would be appropriate.

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36. The East Midlands, Yorkshire and North East England have the advantage today of main line connections into the St Pancras/Kings Cross complex from which Eurostar services depart.

37. Subject to the provision of border control facilities at non-HS1 stations and the availability of a UK-gauge train compatible with non-UK train control systems.

ANNEX A

EUROPEAN AIR-RAIL POLICIES AND PRACTICALITIES

Overall Conclusions

6.19 Four of the five busiest airline routes in Britain can be served by train services on the ECML. In light of the change of plans for HS2 build-out following the Government's Integrated Rail Plan, we have shown that there is scope to both:

- speed up the longer distance services using this line that compete with air services (London-Newcastle/Edinburgh/Aberdeen) and

- provide the capacity to accommodate additional rail services that prioritise quicker end-to-end journeys.

6.20 The huge opportunity for expanded high speed rail services from London across mainland Europe via the Channel Tunnel to compete with air services realistically extends to places 1000km distant. This report sets out where these opportunities lie.

6.21 The opportunities can be stretched to include European travel to/from major cities in the North and Midlands when HS2 is built. This would use capacity HS2 will free up on the WCML. This would be used to provide new cross-London services that feed into stations on HS1 where border control functions can be performed and where connections with an expanded set of European services can be provided. In turn, as the rail market for such connecting services builds up, the potential for direct services over the WCML to the continent should not be ruled out. But a transit shuttle link between Euston and St Pancras is needed to help 'level up' the North's access to fast European rail connections.

6.22 Within Great Britain, there is scope, following the publication of the Integrated Rail Plan, to progress an option that combines the shortened HS2 'Eastern Leg' with high speed rail in the East Coast corridor. Besides speeding up London–North East England–Scotland rail services and winning market share from air, this will create a much faster cross country route, linking South West England and South Wales with Birmingham, Nottingham, Yorkshire, North East England and Scotland. This offers a further levelling up boost for regional cities looking for a 360° improvement in connectivity.

6.23 The analysis here summarises recent initiatives across Europe designed to encourage surface rather than air travel where appropriate. It points towards several key issues that will arise if an expansion of international rail services to and from Great Britain is to be realised. The challenges increase as a function of the number of networks and languages used and, in some cases, by additional security, safety, passport, customs and phytosanitary requirements. The decision to introduce new services, and their potential commercial viability, would also of course depend on the number of airline passengers that they could attract.

The European Green Deal

A1. The European Green Deal has a goal of making Europe the first climate neutral continent in the world. This had led to interest in mode shift to boost passenger rail, on which the European Commission produced an Action Plan on 14 December 2021[1].

A2. Published alongside the action plan was a study by Steer and KCW[2]. Steer examined the operating cost drivers of air, rail and long-distance coach services. They noted that long-distance night trains cannot attractively call at stations in the middle of the route, and as a consequence mainly serve end-to-end traffic. They identified potential future night train routes based on airline seats and rail journey times between pairs of cities. They noted, however, that long-distance day trains can serve many intermediate stations, and that end-to-end passengers, including those attracted from air, may contribute only a small part of their total revenue.

A3. There have already been some national initiatives to restrict short-haul, or at least domestic, flights within Europe. During 2021, the French national assembly voted to ban domestic flights on routes that could be travelled by train in under two and a half hours. This was expected to close 12% of French domestic flights. In 2022, the Danish Prime Minister announced in her New Year speech proposals for all domestic flights to be fossil fuel free by 2030[3].

A4. Greenpeace has since published a briefing "Train alternatives to short-haul flights in Europe"[4] based on research carried out for them by OBC Transeuropa[5], which identified dense air routes linking cities that are also connected by rail services taking less than 4, 6, 8 or 16 hours. Greenpeace then published an analysis focusing on those intra-EU air routes that carry over 500,000 passengers and link cities with rail journey times below six hours.

A5. The following diagram shows Greenpeace's "Map of flight routes among the top 150 intra EU routes for which train alternatives under 6 hours exist". It excludes the UK, which is not part of the EU. But it usefully identifies a set of airline flows for which a plausible surface rail alternative exists. Many routes are within individual countries, although there are also a significant number of cross border services, especially between France and Germany.

1. https://transport.ec.europa.eu/news/action-plan-boost-passenger-rail-2021-12-14_en.

2. Long-distance cross-border passenger rail services, Final Report, Study Contract, MOVE/2020/OP/0013.
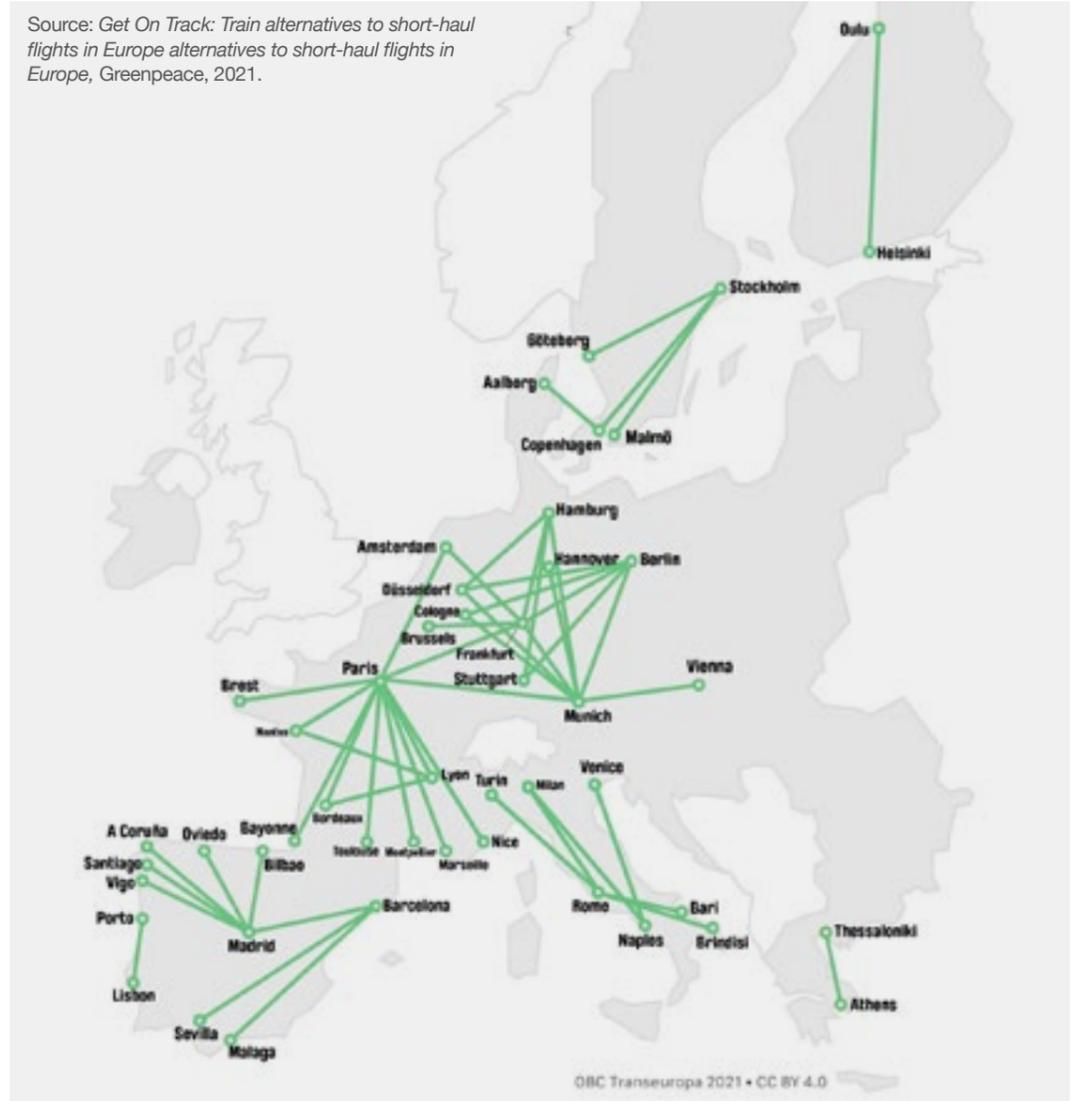
3. https://www.stm.dk/statsministeren/nytaarstaler-siden-1940/mette-frederiksens-nytaarstale-1-januar-2022/.

4. https://www.greenpeace.org/static/planet4-eu-unit-stateless/2021/10/135ec803-getontrack-gp-briefing-en-final.pdf.

5. https://www.balcanicaucaso.org/eng/Occasional-papers/Train-alternatives-to-short-haul-flights-in-Europe.

A6. Greenpeace did not comment in detail on the routes identified, but examination of the map suggests that:

• Either or both ends of many routes are hub airports where many passengers connect to other flights, whether domestic, intra-European or intercontinental

Source: *Get On Track: Train alternatives to short-haul flights in Europe alternatives to short-haul flights in Europe,* Greenpeace, 2021.

- In particular, many of the routes are domestic services to or from a national hub airport, and may carry a large number of passengers connecting with the services of the national carrier or other airlines

- Six hours by rail is an artificial threshold, longer than the point at which air normally dominates air/rail mode share, and a lower or higher threshold would have resulted in a different list and mix of airline routes.

A7. The following tables set out further analysis on this basis. It is clear that there are many fewer air routes that don't connect into hub airports – these are routes where there is less likely to be feeder air travel into longer haul flights which would be harder to attract to a surface travel option because of the convenience of 'one mode/booking' travel.

Indicative classification of air routes identified by Greenpeace: routes involving hub airports (Europe)

Type	State(s)		Origin	Destination	Rail time
Hub-to-hub international	Austria	Germany	Vienna	Munich	4:11
	Belgium	Germany	Brussels	Frankfurt	3:08
	Denmark	Sweden	Copenhagen	Stockholm	5:09
	France	Netherlands	Paris	Amsterdam	3:23
	France	Germany	Paris	Frankfurt	3:39
				Munich	5:47
	Germany	Netherlands	Frankfurt	Amsterdam	4:05
Hub-to-hub domestic	Germany		Frankfurt	Munich	3:14
Hub-to-spoke domestic	Denmark		Copenhagen	Aalborg	4:51
	Finland		Helsinki	Oulu	5:30
	France		Paris	Bayonne	4:08
				Bordeaux	2:09
				Brest	4:00
				Lyon	2:03
				Marseille	4:05
				Montpelier	3:29
				Nantes	2:10
				Nice	5:39
				Toulouse	4:56
	Greece		Athens	Thessaloniki	4:23
	Italy		Rome	Bari	3:59
				Brindisi	4:59
				Milan	2:59
				Turin	4:36

Type	State(s)	Origin	Destination	Rail time
Hub-to-spoke domestic	Germany	Frankfurt	Berlin	3:46
			Hamburg	3:58
		Munich	Berlin	3:59
			Cologne	4:37
			Dusseldorf	5:05
			Hamburg	5:48
			Hannover	4:35
	Portugal	Lisbon	Porto	2:50
	Spain	Madrid	A Coruña	5:12
			Barcelona	2:30
			Bilbao	5:04
			Oviedo	4:39
			Santiago	5:35
			Vigo	5:40
	Sweden	Stockholm	Göteborg	3:02
			Malmö	4:32

Indicative classification of air routes identified by Greenpeace: routes not involving hub airports

| Type	State(s)	Origin	Destination	Real-time
Non-hub domestic	France	Lyon	Bordeaux	4:52
			Nantes	5:03
	Italy	Naples	Milan	4:28
			Venice	5:06
	Germany	Berlin	Cologne	4:20
			Dusseldorf	4:17
			Stuggart	5:40
		Stuggart	Hamburg	5:34
	Spain	Barcelona	Malaga	5:22
			Sevilla	5:25

Attracting airline passengers between Great Britain and continental Europe to rail

A8. Existing and new international rail services between Great Britain and continental Europe need to operate on a number of networks including, as a minimum, HS1 in Great Britain; Getlink[6] and the RFF network in France.

A9. Eurostar currently operates services between London and France, Belgium and the Netherlands, serving a total of 14 continental locations. Many of them have airports with services to Great Britain, as listed below.

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6. Getlink, formerly Eurotunnel, is unusual in that its infrastructure, operations, rules and charges cross an international border, but under EU law it must be regulated separately in France and the United Kingdom.

Continental airports served by Eurostar with services to Great Britain in 2019 or 2018
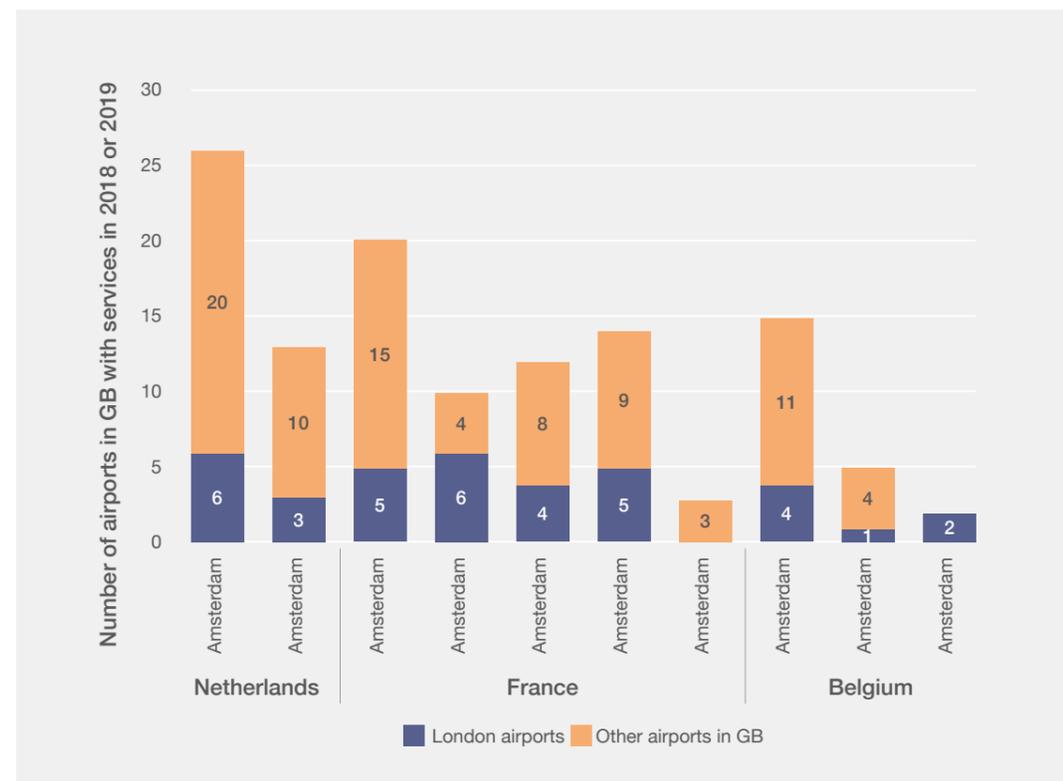
Source: CAA airport statistics, Greengauge 21 analysis. Note that the choice of airports is subjective.

A10. In 2019, there were 24.8 million airline passengers between Great Britain and continental airports[7] in these three countries.

A11. In Belgium and the Netherlands, Brussels, Rotterdam and Amsterdam provide relatively good and frequent connections between Eurostar and other stations in the national network.

A12. In France, in contrast, Eurostar currently only serves one radial corridor beyond Paris to Lyon, Avignon, Marseille and the ski resorts, terminating in Bourg-St-Maurice. We discuss further below the scope for international rail services to compete with other dense airline routes between Great Britain and France.

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7. Excluding French airports in Corsica.

Extending international services into new networks

A13. The potential rail journey time of new services may be important to prospective customers, but the first issue that has to be faced is the feasibility of operations over multiple infrastructure owners/ jurisdictions and, the efficiency of rolling stock diagrams – both of which are factors that will affect the economics of a competing rail service offer.

A14. In this analysis we therefore focus first on:

- the number of networks on which a new rail service would need to operate; and

- whether a single trainset, within a working day of around 16-18 hours, could complete either an out-and-back journey, returning the same day, or an end-to-end journey, returning the next day.

A15. Services between London and Amsterdam cover a distance of just over 600 kilometres in just over three hours, using five networks in succession, with a single driver for four of the networks[8]. All except the Getlink infrastructure are high speed lines, and all were planned, designed and built to be used by cross-border services. We understand that the infrastructure managers cooperate to be able to offer attractive end-to-end journey times.

A16. But each additional network penetrated by an international train will have its own licensing system, technical standards, processes for applying for and allocating capacity, and charges for its use[9]. Many networks within the EU also involve a different working language.

A17. The European Commission's "Action plan to boost long distance and cross-border passenger rail"[10] is informed by studies of the barriers to operating international services, and identifies a number of actions to remove or eliminate the obstacles to operating cross-border services. Successful extension of international services from Great Britain to more distant European destinations will depend on the success of the Commission's efforts.

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8. Since 1994, when services were introduced, Eurostar has used drivers trained and qualified to drive from London to Brussels. Initially at least, services to Amsterdam involved a change of driver to operate on the SNCB and ProRail networks beyond Brussels.

9. Much of this information is summarised in the infrastructure manager's Network Statement, the minimum contents of which are specified in Annex IV to Directive 2012/34/EU.

10. https://transport.ec.europa.eu/news/action-plan-boost-passenger-rail-2021-12-14_en.

Efficient use of rolling stock and crew

A18. The second issue to be faced is that efficient railway services must make efficient use of the hours during which passengers are willing to travel, which may extend from around 05:00 to 01:00, but with many passengers preferring to travel between 07:00 and around 23:00, a 16-hour day.[11] Efficient use of rolling stock means operating it through most if not all of this period, ideally with multiple journeys per day, but on longer journeys completing either:

- two journeys per day, returning to their starting point; or, alternatively

- one journey per day, with an outbound journey on one day and a return the next day.[12]

A19. The map below shows Eurostar's existing network using HS1, Getlink and the networks of France, Belgium and the Netherlands.

A20.   The network extends as far as Marseille, almost exactly 1,000 kilometres from London. When last operated in 2019, trains completed a round trip in a single working day, departing from London at 07:19 and arriving at 14:45, returning at 15:22 and arriving at 22:12. Once a service operates to a point from which it cannot return the same day, it will in any case need to spend a night away from base before returning the next day. This means that no additional rolling stock would be required to reach a destination which took all day.

A21. The example of Marseille suggests that rail might be able to support services, from London at least, on other routes up to a similar distance, which are shown in the figure below.

A22.   The circle includes France, Belgium, Luxembourg, the Netherlands, Germany, Switzerland, Austria and Denmark, which collectively approximate to points on the continent within 1,000 kilometres from London. In practice, journey times between London and many points within this circle would be too long to complete a return rolling stock diagram within a single day. But in such cases—such as Vienna (Austria)—all locations could be reached within one day from London.

A23. To reflect the commercial concerns of avoiding cross-boundary complexities and avoiding inefficient stock diagrams, our focus is on national networks and minimising border/jurisdiction crossings rather than simply distances and journey times. The map below shows a Europe subdivided by black lines, which distinguish (groups of) national rail networks by EU membership, Schengen membership and track gauge compatibility.

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11. This paper has not considered the possibility of international night trains to and from Great Britain. One major practical issue with such trains would be the need for them to comply with the safety requirements of the Channel Tunnel and to be able to operate on high speed lines.

12. Night trains can only make one loaded journey every 24 hours. Clearly the prospect of convertible trains (with lower density night-time sleeping/snoozing convertible to daytime, higher density seating) could possibly be a way of bridging the inefficiency thus creates.
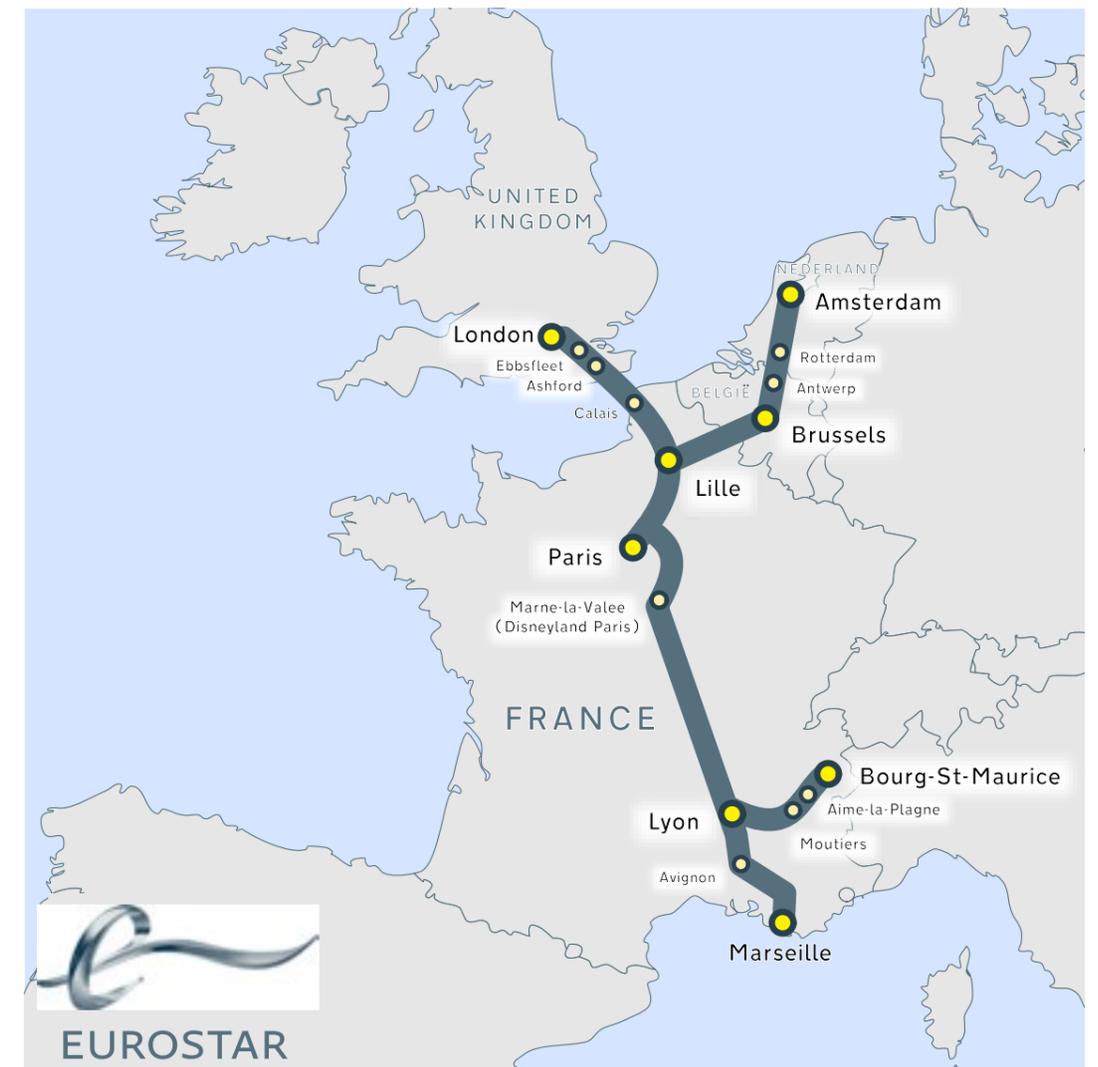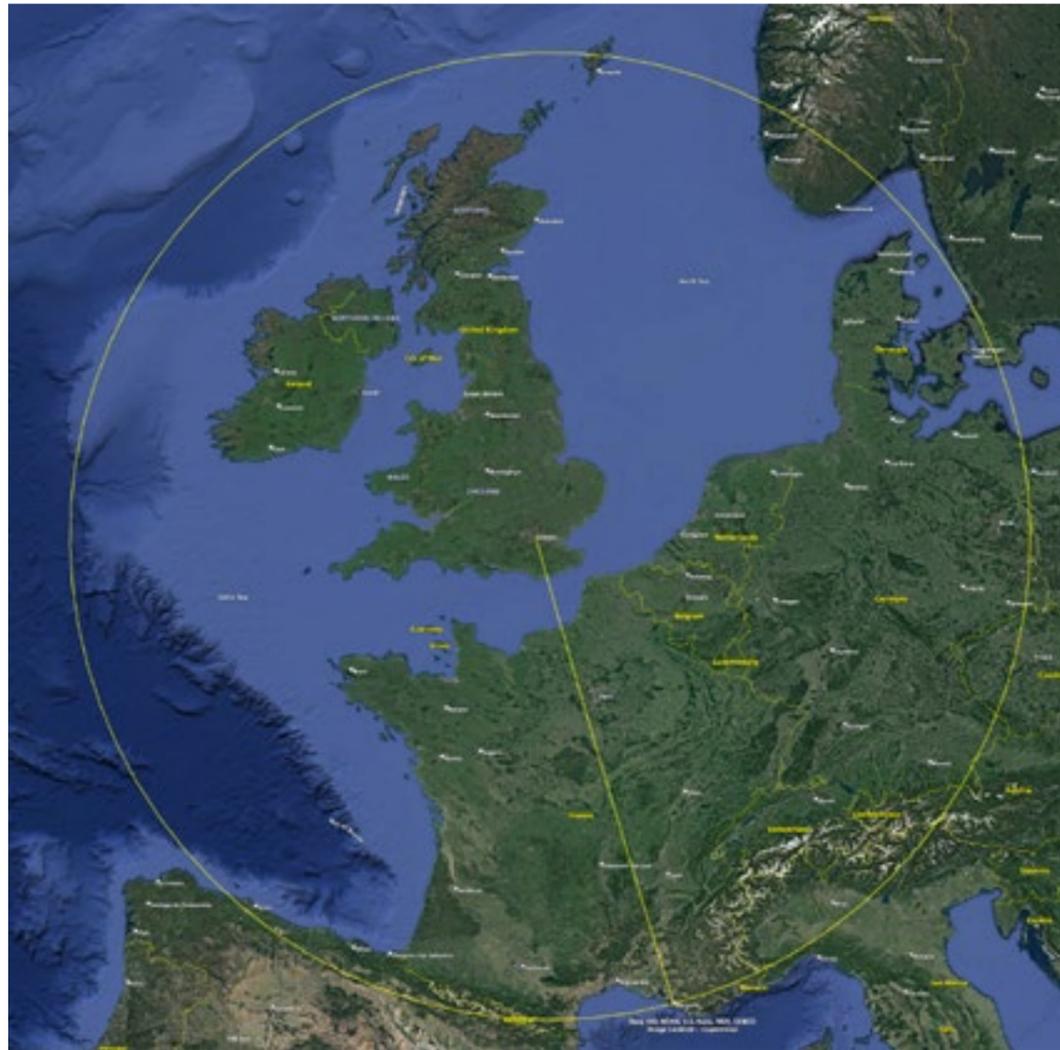
Source: Google Earth. The radius links London to Marseille, served by Eurostar.

Source: https://www.schengenvisainfo.com/schengen-visa-countries-list/, Greengauge 21 annotations (see text).

How to win air travellers to rail

How to win air travellers to rail

Group	Rationale	Networks
Existing international services	Eurostar is already working in these networks	Belgium France Netherlands
One-day journey to/from London	Indicative upper limit of what can be operated efficient with one round trip every two days	Austria Germany Italy Luxembourg Switzerland
Italy	EU Member State within Schengen Area but often more than a one-day journey to/from London by any route	Italy
Iberian gauge	EU Member States within Schengen area but with networks with 1668 millimetre gauge track	Gibraltar Portugal Spain
Scandinavia	EU Member States within Schengen Area but more than a one-day journey to/from London, via Hamburg	Denmark Norway Sweden
Central Europe	EU Member States within Schengen Area but more than a one-day journey to/from London, via other nodes in Germany or Austria	Czechia Hungary Poland Slovakia Slovenia
EU non-Schengen	EU Member States which are not in the Schengen Area and require passport controls	Bulgaria Croatia Romania
Russian gauge	EU Member States within Schengen area but with networks with 1520 millimetre gauge track (Finland can only be reached via the Russian Federation)	Estonia Finland Latvia Lithuania
Non-EU Balkans	Outside the Schengen Area and the EU and require passport controls and customs checks	Albania Bosnia-Herzegovina Kosovo Macedonia Montenegro Serbia
Greece	Only accessible via EU non-Schengen or Non-EU Balkans	Greece

A24. Having already covered the first destination category in this table ('Existing international services') we can move on to discuss each of the identified groups in turn.

European routes, group by group

One-day journey to/from London

A25. We noted about that the networks within 1,000 kilometres great circle distance from London also correspond closely to those in which most or all major cities can be reached within one day from London, as summarised in the table below.[13]

Group	State	Example city	Southbound		Northbound	
			Depart	Arrive	Depart	Arrive
Already served	Belgium	Brussels	08:55	12:05	08:52	09:57
	The Netherlands	Amsterdam	11:04	16:11	13:47	17:00
	France	Marseille	07:19	14:45	15:22	22:12
Can be reached within one day	Luxembourg	Luxembourg	08:55	15:50	05:46	12:30
	Germany	Munich	07:55	19:27	06:46	16:37
	Switzerland	Zurich	07:01	16:26	05:59	14:39
	Austria	Vienna	08:55	23:05	06:51	19:57
Cannot be reached within one day	Spain	Barcelona			08:15	19:57
	Denmark	Copenhagen			07:26	22:00
	Italy	Rome	07:01	23:49		

A26. The most distant major cities of Luxembourg, Germany, Switzerland and Austria, including Vienna, can all be reached from London in a single day. In 2019, there were 24 million airline passengers between Great Britain and these four countries.

A27. In contrast:

• In Italy, the northern cities of Turin, Milan and Bologna are within a day of London, but Florence, Rome and other cities further south are not

• In Spain, travel to London within a day is possible from Barcelona, but not from cities further away

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13. Based on searches for midweek travel in March 2022 on Deutsche Bahn https://www.bahn.com/en, except Marseille which is based on 2019 timings from "The Main in Seat 61". Longer journeys may have been possible before service reductions associated with the COVID-19 pandemic.

- In Denmark, travel from London to the capital and largest city, Copenhagen, is not possible within a day. Only the westbound journey to London can currently be completed in a day, and it takes 15½ hours and requires three changes[14].

A28. It would in principle be possible to connect more remote destinations with London within a working day if either:

- international services to and from St Pancras International included earlier departures and later arrivals, as has happened in the past or

- the timetabling approach adopted by the many infrastructure managers involved prioritising international services to and from London and allowed them to minimise their overall journey time, if necessary at the expense of other domestic and international services.

A29. On this basis, we identified an inner 'target' search area for potential international routes extending beyond the networks of France, Belgium and the Netherlands to those of Luxembourg, Germany, Switzerland and Austria. This search area also corresponds closely to the Railteam[15] network in Chapter 5. Around 48.8 million airline passengers currently fly between airports in Great Britain and continental airports these states.

Italy

A30. Italy has a well-used north-south high speed line, shown opposite, from Turin to Salerno, but as yet no high speed connection to the French TGV network at Lyon. At present, it is only just possible to travel between London and Rome by rail within a day, and only in the southbound direction. Reintroduction of services following the pandemic may make longer journeys possible, but at least parts of southern Italy are unlikely to be accessible within a single day.[16]

A31. Around 14.4 million airline passengers a year travel between Great Britain and Italy, excluding the relatively small number of passengers flying to Sardinia and Sicily.

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14. However, the Fehmarn Belt crossing, opening in 2029, should permit a 2-hour time saving, potentially enabling a one-day journey in both directions.

15. Railteam is an alliance of railway operators. The eight full members Deutsche Bahn, SNCF, SNCB, Eurostar, NS International, ÖBB, SBB and Thalys, and the associated member TGV Lyria, have joined forces to offer all their passengers comprehensive service and comfort.

16. This also applies to destinations in Sicily served by overnight trains carried on ferries.

The Iberian gauge area

A32. Around 48 million airline passengers currently fly between airports in Great Britain and in Spain, Portugal and Gibraltar, and northbound travel from Barcelona to London is possible within a single day.

Source: HrAd - Own work, CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=16363008

A33. Few passengers use Eurostar between London and Spain or Portugal, for a number of reasons:

- Nearly one third of these passengers are flying to islands including the Canary and Balearic islands, which could not be reached by rail. Only 32.8 million passengers fly to and from continental airports

- Spain and Portugal's main railway networks are built to the Iberian track gauge of 1668 millimetres. Standard gauge trains from Great Britain and France would be restricted to, and need to operate on, the Spanish high speed network, connected to the French high speed network at only one point, and consisting of lines radiating from Madrid, as shown above

- Trains could be constructed to change between the standard and the Iberian gauge, but would still be restricted by the lower speeds possible on the Iberian gauge network. Rail journey times to southern Spain and Portugal are much longer than those to Barcelona: requests to travel between London and Algeciras, the nearest station to Gibraltar, return results for journeys taking around 48 hours.

A34. Thus, while Spain and Portugal represent a large market, it may be operationally difficult for rail to capture many passengers from air, primarily due to long journey times and limited connectivity on the standard gauge high speed rail network. Barcelona/Catalonia, however, is within reach and looks to be the exception.

Central Europe

A35. The next group of states considered are Poland, Hungary, Czechia[17], Slovakia and Slovenia. All are EU Member States and part of the Schengen Area. With 14 million airline passengers in 2019, they collectively form a market almost as large as that of Italy.

Scandinavia

A36. In 2019, 8.8 million airline passengers travelled between Great Britain and Denmark, Sweden and Norway, all of which are within the Schengen Area. However, while London can just be reached from Copenhagen within one day, journey times to Stockholm and Oslo, the principal other destinations, are much longer.[18] Here, infrastructure schemes will shorten journey times – between northern Germany and Copenhagen, and as Sweden's high speed rail plans progress, onwards to Malmö and Stockholm.[19]

EU non-Schengen

A37. In 2019, 6.7 million airline passengers travelled between Great Britain and Romania, Bulgaria and Croatia. All are EU Member States but not part of the Schengen Area. This means that rail travel between Great Britain and these states would require a second passport check on leaving Slovenia or Hungary.

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17. Also known as the Czech Republic.

18. Flights between Aberdeen and Stavanger take as little as an hour, but surface travel would take around 48 hours, with only one part of the journey possible overnight, between Aberdeen and London on the Caledonian Sleeper.

19. See https://www.trafikverket.se/en/startpage/planning/high speed-railway/.

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Russian gauge

A38. In 2019, 3.5 million airline passengers travelled between Great Britain and Finland, Lithuania, Latvia and Estonia. All are EU Member States, but all have railways constructed to the Russian gauge of 1520 millimetres. As with rail travel to the Iberian Peninsula, through rail services would need to change gauge (in this case, upon leaving Poland). In addition, Finland can only be reached by rail by travelling through the Russian Federation.[20]

Non-EU Balkans

A39. In 2019, 0.6 million airline passengers travelled between Great Britain and the Balkan states of Albania, Serbia, Montenegro, Macedonia, Kosovo and Bosnia-Herzegovina which are not EU Member States. Rail travel to them requires not only passport checks but also custom checks, in principle at the border with Croatia or Hungary. This market is therefore both small and complex to serve.

Greece

A40. Greece represents a large market for air travel from Great Britain, with over 6.2 million airline passengers in 2019. However, all but 2.3 million of them were flying direct to Greek islands which could not be reached by rail. In addition, any rail services to Greece, unless operated as sealed trains would, as a minimum, need to leave the Schengen area while in Romania and Bulgaria, or use potentially shorter and faster routes through the non-EU Balkans which would also mean customs checks.

Islands

A41. Finally, around 18.4 million airline passengers in 2019 flew between Great Britain and the island states of Ireland, Cyprus, Malta and Iceland. None can be reached by rail, and only Ireland has a railway.

The scope for further international rail services

A42. Greengauge 21's analysis suggests that operating international rail services to and from Great Britain involves dealing with a number of issues, which increase with the number of networks and languages used and, in some cases, by additional security, safety, passport, customs and phytosanitary requirements. The decision to introduce new services, and their potential commercial viability, would also depend on the number of airline passengers that they could attract.

A43. The figure below summarises the number of airline passengers between airports in Great Britain and each group and each state in 2019.

20. Alternatively, central Helsinki can be reached from central Tallinn by ferry in as little as two hours, without leaving the Schengen Area or the EU.
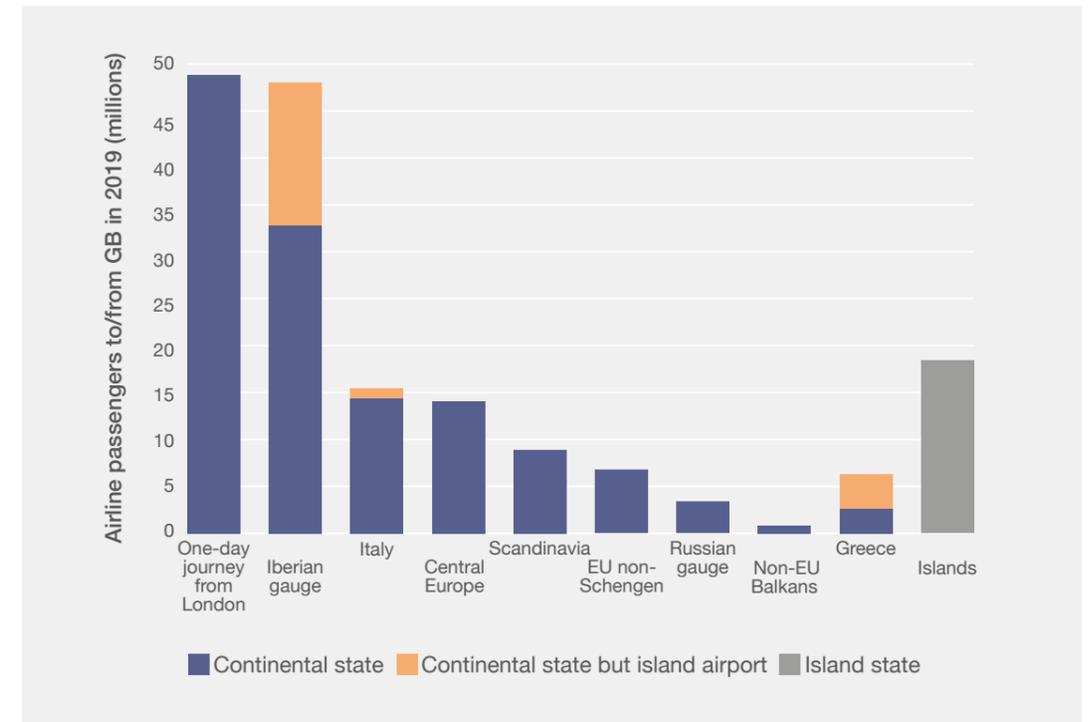
Source: CAA airport statistics, Greengauge 21 analysis.

A44. To recap, of the groups of networks set out earlier, the largest market, with nearly 49 million passengers, includes all the destinations which could be reached within a one-day journey to or from London. This is more than four times the number of airline passengers travelling between points in Great Britain, most of whom could be served by rail services on the Network Rail network.

A45. The figure below disaggregates the figure above to identify airlines passengers between Great Britain and each state.
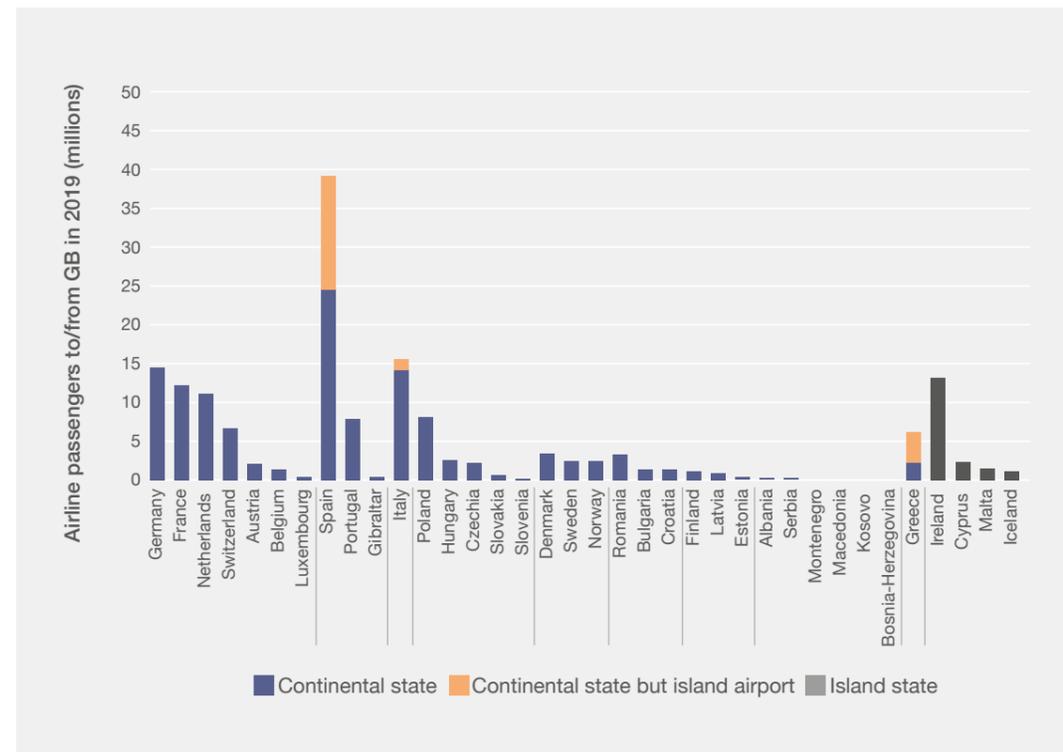
Source: CAA airport statistics, Greengauge 21 analysis.

The Existing Eurostar Catchment

A46. International rail services to and from London currently serve 14 continental stations, of which 8 serve cities with airline services from Great Britain: Amsterdam, Rotterdam, Paris (Charles de Gaulle and Orly), Marseille, Lyon, Avignon, Brussels (and Charleroi) and Antwerp. The chart below shows the number of airline passengers on these routes in 2019, distinguishing London airports and other airports in Great Britain.
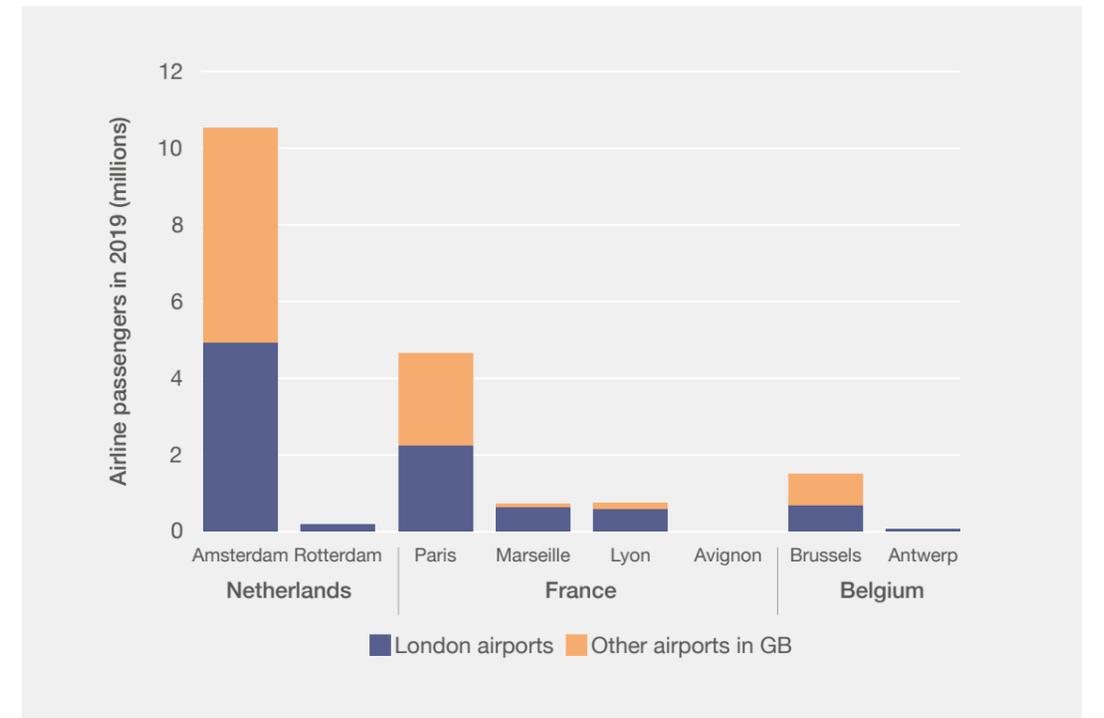
Source: CAA airport statistics, Greengauge 21 analysis.

A47. Airline passenger numbers were divided almost equally between London airports (51%) and others (49%), but while 36 London airport routes carried an average of 260,000 passengers, 84 other airport routes carried an average of fewer than 110,000 passengers, suggesting some combination of lower frequency, smaller aircraft and services only operating on some days or at some times of the year.

A48. The airline passenger numbers were also dominated by Eurostar's three principal destinations, Amsterdam (57%), Paris (25%) and Brussels (7%), with only 11% to airports at other Eurostar destinations. Note also that Amsterdam and Paris Charles de Gaulle (used by 99% of the passengers to Paris airports) are hubs for Air France-KLM. A proportion of passengers on airline routes to Amsterdam and Paris are likely to be connecting at these airports. This is particularly the case for passengers flying between London airports and Paris, where Eurostar provides centre-to-centre travel in as little as 2¼ hours[21], and air is likely to attract few point-to-point passengers.

A49. There may be scope for Eurostar to capture more passengers from air on the routes it already serves, and particularly from Amsterdam, services to which only began in 2018 and only benefitted from juxtaposed border controls in Amsterdam and Rotterdam in October 2020. These could be either:

- from London, by some or all of more frequent services, shorter journey times, and more attractive pricing relative to air; or, in principle

- from cities beyond London which support dense air services to Amsterdam.

A50. In practice, there is no unique definition of a hub airport where a large proportion of passengers are connecting between flights. Clearly those such as Frankfurt, Paris CDG, Schiphol qualify and it could be argued that Lyon in France, Milan in Italy, or Barcelona in Spain, are second national hubs, at least for intra-European travel.

A51. However, our analysis suggests that most of the European routes identified above have a hub airport at either or both ends, and at least a proportion of passengers between those two airports may be connecting at one of them, meaning that the airport, rather than the city, is the effective destination. While it is possible that rail could replace the shorter (feeder) flight component, unless air-rail connections are guaranteed and competitively priced, through travellers may be denied some practical advantages in terms of pricing and customer service. The European high speed rail network already includes stations at hub airports such as Paris, Amsterdam, and Frankfurt. In principle, wider use of links to these stations could reduce the reliance of passengers on domestic or short-haul air flights to connect with other flights.

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21. This is little more than the rail journey time between London and Manchester, where it is generally assumed that almost all airline passengers are connecting between flights at one or both ends of the route.

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