Airports, Cities and Infrastructures –
Post-war European Airport Models and their Impacts on Cities



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Abstract

This paper is a comparative analysis on major airport-related plannings and developments in Europe. Since the advancement of aviation technology in the 20th century, airports have become indispensable infrastructures and emerging urban city nodes. This thesis aims to look into how airport developments affect the transformations of their host cities and neighbouring infrastructures.

Aeiral images reflect that various airports relate with their host cities through different urban patterns and networks. To understand the reason behind such disparity, six case studies will be conducted and compared: Paris Orly Airport, Copenhagen Airport, Amsterdam Schiphol Airport, London Heathrow Airport, Frankfurt Airport and Stockholm Arlanda Airport. These airports are categorised into three types, namely urban, urban periphery and remote. Firstly, historical studies of each case will be done individually. Maps of each case are drawn to discover their developments throughout the century. These airport-related developments and their driving forces are then compared among airports of the same category as well as different categories.

Acknowledging the unique context of each city and airport, the driving forces and stakeholders behind the morphology of urban, urban periphery and remote airports are revealed towards the end of this paper. The findings conclude some decisive factors for the airport-related development and shed light on the debate of whether the type of airports is the quintessential factor or not.

1 Introduction

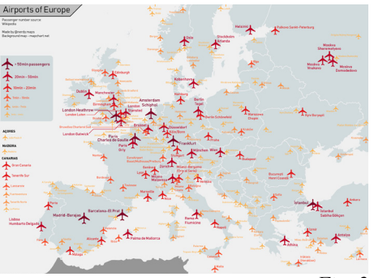


Fig. 2
Airports of Europe

Aviation expansion in the post-war era has made air transport an indispensable way of modern circulation and mobility. As of March 2022, the number of airport construction projects underway adds up to 650 with a total investment value of approximately USD $575 billion. (CAPA, 2022) In 2019, the number of passengers carried worldwide rose 3.6% to 4.5 billion in which Europe has taken up 26.8% of the total world traffic. (ICAO, 2019) The significance of air transport has put airport developments on top of their agendas for many cities. For many global cities, their tourism and trading economies depend heavily on international airports to flourish. These airports have become assets for the cities to secure their competitive positions. (Kasioumi, 2021) (Fig. 2)



Fig. 3
The Comet, world's first jet airliner

This period of rapid expansion of airports and the aviation industry started while European countries were recovering from the Second World War, leading to the advancement of aviation technology, economic growth, together with the increasing demand for civilian air travel. (Fig. 3) At the same time, city expansions began due to population growth. Post-war redevelopment and planning strategies were implemented so as to regulate urban growth and provide adequate transportation facilities. In the areas with an airport, the plannings of cities and transport infrastructures would most likely be influenced by the development of the airports, and they will be addressed as airport-related developments in this paper.

This thesis will investigate airport-related plannings and developments, in terms of urban forms and transport infrastructure. In order to answer the key question “Are the plannings of airport-related developments based only on their types, in other words, their relations with the urban centres?”, case studies will be carried out to investigate how these developments take place through time individually. Cases of the same type are then analysed based on multiple factors, such as the differences in main stakeholders, proximities to metropolitan areas and sometimes their relations with other airports or cities.

2 Airports, Cities, Infrastructures and their Relationships

Since the aviation expansion period, airports have been constantly evolving. Meanwhile, their surrounding urban fabric, together with the infrastructures in between, display different kinds of growths and developments. After understanding the larger picture of aviation and airport history in the previous chapter, we will look at some of the common causes and results of these developments.

Published in 2000, Edwards’ book *The Modern Terminal: New approaches to airport architecture* provides basic understanding and overview of the make-up of an airport. Spatial planning strategies and stakeholders behind the developments are studied in *Flexibility and commitment in planning: A Comparative Study Local Planning and development in the Netherlands and England*. Nonetheless, the books *The noise landscape: A spatial exploration of airports and cities* and *From Airport to Airport City* give much insight to the relationships between airport and cities by using case studies.

The components of an airport could be defined as causes and results of expansions. Airports can evolve differently because of a number of factors. To begin with, structures of each airport differ from state ownership to partnership between government and investors, to even total private ownership. Sources of income are also unique, and they can be from the airside (aeronautical income), or from the landside (non-aeronautical income). This is affected by how owners and operators decide on airport development strategies. Meanwhile, other possible factors include availability of land, investment incentive, airspace availability, the environment and spatial planning controls. Different combinations of factors lead to different developments of airports. These results commonly manifest themselves in terms of tangible facilities and capacities, which include mainly runways and terminals, but sometimes also air traffic control buildings and other supportive warehouses. Surface access is also a very relatable result, which usually means railway stations dedicated to the airports.

This paper will also examine the developments of cities and infrastructures. These developments are typically affected by spatial planning strategies, land availability and investment incentives. Factors related to the governments and administration systems, including the difference in planning ideologies and strategies, are especially evident in some, but not all cases. Urban developments commonly take place in the form of new towns and business districts, or rapid expansion of these. In the meantime, new construction of motorways and various railway systems found on map represent transportation developments, which are usually initiated by the governments or airport operators.

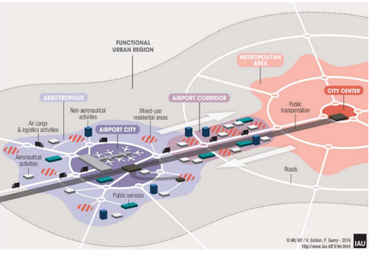


Fig. 4
Airport-centred urban development concepts

When cities and airports are considered together, different types of relationship and various ways of developing the airport, its surroundings, and the infrastructure between them can be observed. Since the late 1960s, there has been discussions on the integration of airports with metropolitan areas, and starting from the 1980s, settlement tendencies were observed in airport areas. (Kasioumi, 2021) In their 2002 publication "From Airport to Airport City", architecture firm Güller and Güller was the first to interpret "airport-driven" or "airport-related" development as urban models. More of these models were proposed in recent years to look at spatial and urban conditions in airport areas. (Fig. 4) (Boucsein et al., 2018)

Airports, cities and infrastructures, and their relationships were analysed thoroughly as individual elements in the precedent studies. Adding onto this field, this thesis will analyse if there are more important and determining factors for developments than the type of airports. Building on the existing studies and by categorizing airports according to their relationships with the cities, factors contributing to the developments in the three types of airports will be examined and compared.

3 Methodology

According to the relationships between airports and city centres, six case studies will be done in this paper and they will be categorised into three types: urban airports, urban periphery airports, remote airports and in one case. (Fig. 5) The context of this study is set in Northwest Europe so that the historic, economic, social, and political backgrounds of cities are kept similar for a fairer comparison. For airports, some of the largest hubs are chosen so as to examine the more substantial urban growths related to them. Within each category, two cases are selected based on both their similarities and differences.

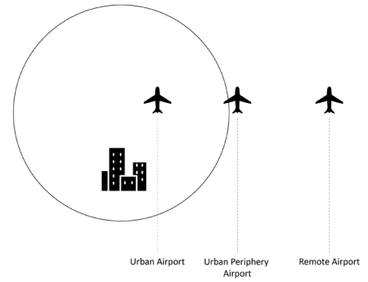


Fig. 5
Categorisation of airports

For urban airports, Paris Orly Airport and Copenhagen Airport were selected as examples. (Fig. 6-7) While Orly was established already as a military airfield in the late 1900s and is operating alongside with three other airports today, Copenhagen was opened in the 1920s as one of the first civil airports in the world, and the only airport in the city until now. This study will investigate the influence of airports on the urban fabric, in the sites of both an ancient city of Paris and a comparatively younger city of Copenhagen which is famous by its transport oriented development strategies. Relations between Copenhagen and Malmö will especially be studied.



(Left) Fig. 6
Aerial photo, Paris Orly Airport
(Right) Fig. 7
Aerial photo, Copenhagen Airport

For urban periphery airports, Amsterdam Schiphol Airport and London Heathrow Airport were the cases for study. (Fig. 8-9) While Schiphol operates as the major airport of the Netherlands and the only one in Amsterdam, Heathrow operates as the lead airport with five other airports in just the city of London. These two cases demonstrate very different city sizes and spatial planning strategies as well.



(Left) Fig. 8
Aerial photo, Amsterdam Schiphol Airport
(Right) Fig. 9
Aerial photo, London Heathrow Airport

For remote airports, Frankfurt Airport and Stockholm Arland Airport were studied. (Fig. 10-11) Frankfurt Airport was relocated and reconstructed during the interwar period by the Nazi Party and the country's history also played a larger role in the development of the airport and the city compared to other cases. On the other hand, Arlanda Airport was planned more recently in the post-war period. While both airports are situated remotely from the urban centre, they are relatively nearer to other cities around them. These studies will investigate how these remote airports' relations with their host cities and the other neighbouring cities.

In the previous chapter, we have discussed the causes and results of developments. Tangible causes and results will be demonstrated by mapping. To fully understand these transformations through time, 1:100 000 maps (A3) are drawn. In each case study, two to three maps are drawn to represent the developments and morphologies. Furthermore, some airport-related planning concepts can also be discovered from these maps.



(Left) Fig. 10
Aerial photo, Frankfurt Airport
(Right) Fig. 11
Aerial photo, Stockholm Arlanda Airport

There will be three recurrent themes among all the eighteen maps: airports, cities and infrastructures. Tangible components in this study are all be represented by these three main themes on maps. For the theme of airports, the extend of the aerodrome, runways and terminals are visible from maps of such scale. They manifest the most important facilities of airports and give hints on the airport capacities. The theme of cities is shown on a scale of buildings, which has the most accurate and universal definition across different countries and periods when compared with others like “plots” “blocks” or “neighbourhoods”. By drawing buildings, these sets of maps can clearly show the newly built urban parts, depicting developments new towns and business districts. Among the three, infrastructure is an equally, if not more, important theme. Represented in two colours, they are above-ground structures such as motorways, trunk roads and bridges; and underground railways like the metro and high-speed rail links.

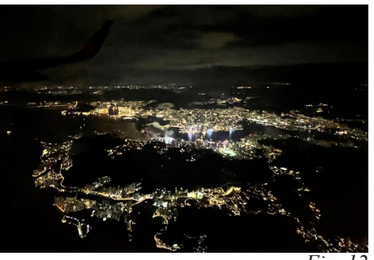


Fig. 12
Aerial photo taken from plane at night, Hong Kong

All the maps were drawn with the help of geographic information system (GIS) software and mostly open-source data was used for the research. Specifically for mapping, local archival maps, Open Street Map, Open Railway Map, Digimap, and Google Earth were used. The 2023 maps are drawn first to achieve the highest level of accuracy. The maps are presented in a dark background with the intention to render and immerse the readers into the night view of cities from a plane. (Fig. 12) For earlier maps, there have been minor difficulties as some maps do not contain all information and the extent needed. To overcome such challenges, multiple sources are used for most old maps. As there are multiple maps for each case, it is very important to understand that the mapped years are selected based on historical events and the availability of sources. In particular, the first map does not depict the situation of the year that the airport was built. Figures used, especially for the airports, are before 2019 so as to avoid any influences by different COVID-19-related measures which are not the main concern in this study.

Case Study: Paris Orly Airport







Legend

Urban - Airport
Urban - Buildings
Transport - Highway
Transport - Railway
Landscape - Water
Landscape - Contours

1:100 000 0 1 2 3 4km

N

Urban - Paris Orly Airport 1941

Fig. 13


Legend
Urban - Airport
Urban - Buildings
Transport - Highway
Transport - Railway
Landscape - Water
Landscape - Contours
0 1 2 3 4km
1:100 000
N
Urban - Paris Orly Airport 1975

Fig. 14

Legend

Urban - Airport
Urban - Buildings
Transport - Highway
Transport - Railway
Landscape - Water
Landscape - Contours

1:100 000 0 1 2 3 4km

N

Urban - Paris Orly Airport 2023

Fig. 15

4 Case Studies of Urban Airports

4.1 Paris Orly Airport (ORY)

4.1.1 Early Years of Orly (1909-1940)

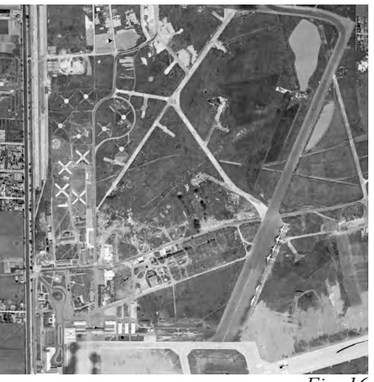


Fig. 16
Orly Air Base, 1949

Like most of the older airports, the first years of Orly was a military facility called the Orly Air Base. (Fig. 16)The military airfield was developed by the American Expeditionary Forces during the First World War when the US was engaged in the Western Front conflict. In order to obtain suitable combat aircrafts from France, Orly was developed so that French aircrafts manufactured in Paris could be received and tested. During the interwar period, it was turned into a civilian airport in 1932. After opening it up to the public, commercial operations started despite being a secondary airport to Le Bourget Airport. At that time, the change of use led to a very different airport layout than before.



Fig. 17
Paris urban fabric by Haussmann

In terms of transportation, Paris was left with the results of the "one of the most striking examples of rational urban planning" conducted by Haussmann and the French Napolean government in the mid-19th century. (Ball, 2022) (Fig. 17) It had a well-developed motorway system, together with metro and railway that was opened since 1900. On the map of 1941, Orly was already connected to the city by both motorway and railway with shuttle buses to reach the terminals. Planned by the national government and constructed in 1824, motorway N7 is a main motorway running north-south and connects Orly Airport on its northern boundary. As far as the city of Paris is concerned, the urban centre is also very densely built, with obvious signs of sprawl towards all directions. However, they had not yet reached to Orly at the time, leaving a gap between the city and the airport. Therefore, Orly Airport could also be defined as urban periphery airport back in 1941.

4.1.2 Post-war Growth of Orly (1941-1974)

After a short period of growth, the development of Orly Airport was hindered due to warfare during the Second World War. It was occupied and used by Nazi Germany and suffered much bomb damage. However, the post-war period saw some major expansions of Orly. In 1945, the company L'aéroport de Paris (later Groupe ADP) was founded as a public institution of an industrial and commercial nature, controlled by the national government. Under its management, 1950s was the period when Orly outgrew Le Bourget and became the busiest airport of Paris. Among the expansions, the runways are the most significant ones from the maps. The airport layout was changed as one of the four original runways were preserved and another one of them was extended. During the 1950s, Air France, the primary national flag carrier, moved its operations and engineering base to Orly's South Terminal. The South Terminal was then inaugurated in 1961 and it soon became a landmark and France's most visited monument during 1963-1965. (Fig. 18) This terminal was also described as the "airport city", even before such concept was invented. (Boucsein et al., 2018) In 1966, a new 2100m runway was built to the northwest of the airport as the third and last runway now. A few years later, West Terminal was also opened in 1971.



Fig. 18
Orly South Terminal, 1961

In terms of transportation, the 1960s-70s was two of the more important decades. There had been constructions of multiple motorways. On the 1975 map, a ring road around the city of Paris appeared. Completed in 1973, Boulevard Périphérique quickly became the busiest road in France and taking up a quarter of Paris' traffic movements. (Fig. 19) Meanwhile, there has also been a new motorway to the west of Orly Airport. It is motorway A6 which was constructed in sections and their openings began from 1960 until 1974, extended from Boulevard Périphérique. After its completion, Orly Airport was again connected to the centre of Paris by its main ring road. Slowly, the existing motorway N7 lost its importance in the 1970s.



Fig. 19
Boulevard Périphérique, 1974

By comparing the 1941 and 1975 maps, the surroundings of Orly were filled up with more buildings. By this time, Orly had already transformed into an urban airport. (Fig. 20) While it is observed that comparatively more developments took place in-between the airport and the city, there had been no signs showing that these neighbouring urban developments were airport-oriented. Nevertheless, it is worth mentioning that under the peak of the French "golden era" planning, a new Paris-Nord airport, or the Paris Charles de Gaulle Airport (CDG), was decided to be built with the national priority of airport infrastructures, aiming to secure the international competitiveness of the French civil aviation and aerospace industry. CDG was first proposed in the 1950s, construction started in mid-1960s and it was finally opened in 1974.



Fig. 20
Paris in 20 years, 1967

4.1.3 Long Halt of Orly (1975-2023)

The last construction of the West Terminal in 1971 was considered the last major act on Orly Airport. Since the opening of the new major airport of CDG in 1974, Orly had experienced a traffic decline. There had only been an extension in 1993 and a renovation of the South Terminal in the 2000s. From the map of 2023, there had been no change in the layout of the airport.



Fig. 21
Orlyval

While the airport itself did not expand much in this period, transportation network improved. During the mid-1980s, there had been an intensified discourse on the access problem of Orly. (Boucsein et al., 2018) Eventually, Orlyval, a rapid transit train system, was built in 1991 to connect the airport with Paris Metro, adding capacity to the existing public transport network with only consisted of a historic commuter train system. (Fig. 21) Other than this, there had been no improvements of transport infrastructure for Orly in the late 1990s and 2000s.

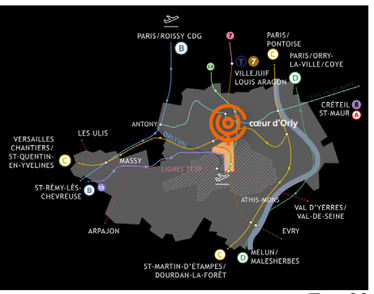


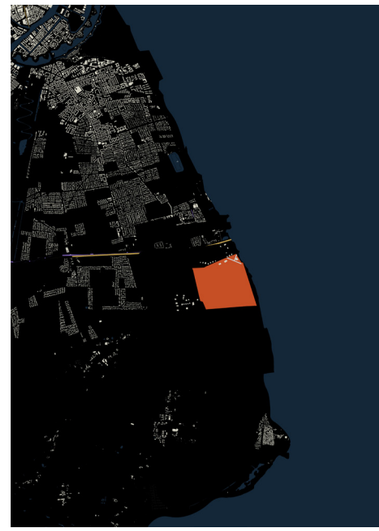
Fig. 22
Connections to Cœur d'Orly

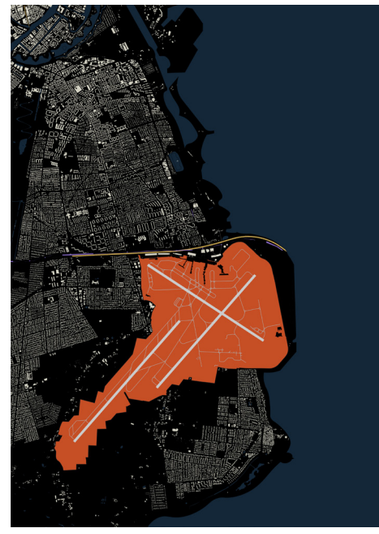
In 2005, Aéroports de Paris was privatised and turned into a public company. Even though it was also renamed Groupe ADP, the majority of its shares were still held by the French government. Groupe ADP continued developments and consolidations of its Parisian airports. After more than a decade of halt for Orly, it has been reoriented towards international flights. Meanwhile, to the north of the airport, a business park named Cœur d'Orly, meaning the heart of Orly, was developed in 2013 and is visible on the 2023 map. (Fig. 22) Led by Groupe ADP, this new economic hub combines three office buildings, hotels and retail programs. Together with two another small business parks Orlytech and Roméo, both located only 6 minutes to the airport and strategically oriented to Orly, they aimed at attracting international businessmen and investors. Prompted by this new urban development, a new tramway link to Paris metro line 7 was developed in 2013, linking up Orly, Cœur d'Orly and Paris city centre. Nonetheless, Grand Paris Express Metro was proposed in 2013. (Fig. 23) With a plan to open before the 2024 Summer Olympics in Paris, an extension of line 14 will be an additional link to Orly Airport.

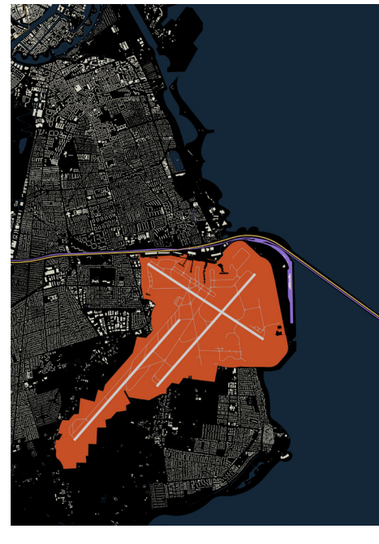


Fig. 23
Render of Grand Paris Express Metro, 2020

Case Study: Copenhagen Airport







Legend

Urban - Airport
Urban - Buildings
Transport - Highway
Transport - Railway
Landscape - Water
Landscape - Contours

1:100 000 0 1 2 3 4km

N

Urban - Copenhagen Airport 1945

Fig. 24

Legend

- Urban - Airport
- Urban - Buildings
- Transport - Highway
- Transport - Railway
- Landscape - Water
- Landscape - Contours

1:100 000 0 1 2 3 4km

N

Urban - Copenhagen Airport 1985

Fig. 25

Legend

- Urban - Airport
- Urban - Buildings
- Transport - Highway
- Transport - Railway
- Landscape - Water
- Landscape - Contours

0 1 2 3 4km

1:100 000

N

Urban - Copenhagen Airport 2023

Fig. 26

4.2 Copenhagen Airport (CPH)

4.2.1 Opening as a Civil Airport (1925-1943)

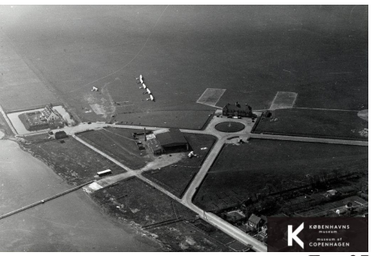


Fig. 27
Aerial view of Copenhagen Airport, 1931

Located in Kastrup, Amager Island, Copenhagen Airport was opened in 1925 as one of the world's first airports designed for civil air traffic. At the time of its opening, it has only a wooden barrack as its main terminal building. Meanwhile, Københavns Lufthavnsvæsen, a government enterprise was established by the government to operate the airport. A few years after the first terminal building designed by Vilhelm Lauritzen was constructed in 1939, the first paved runway of 1400 metres was opened in 1941. (Fig. 27) During the Second World War, Copenhagen Airport was closed for civil services except for periodic flights. Meanwhile, German occupation of Denmark in the 1940s suspended further developments. As seen from the 1944 map, during the first twenty years of the airport's operation, it occupied only a small plot of land near the coastline and on the edge of urban developments. Therefore, unlike the current relationship with the city, we could say that Copenhagen Airport started as an urban periphery airport for the first two decades.

Considering the rather undeveloped Tårnby Municipality, which is located to the south of the airport, there was no motorway nor railway connecting Copenhagen Airport with the city centre which is 8km to the northwest of the airport. Also, flying was not as common at the time, which is why the airport was built only for the few civilians who could afford flying and the transportation network was not very developed.

4.2.2 Large Scale Development of Copenhagen (1945-1984)

The 1985 map is very different from the previous one. As the airport was unscathed during the war, it became the most modern international airport in Europe during the post-war period. With the development of Scandinavian Airlines (SAS) in 1947, Copenhagen Airport became the main hub for the airline. In 1973, Copenhagen Airport had already gone through different phrases of expansions and developed into a much larger one with three new, and much longer runways, paved with asphalt and concrete.

While the airport of Copenhagen was undergoing large scale developments, the Amager Island also evolved in multiple ways. In 1947, planners from the Danish Town Planning Institute produced the Finger Plan (Egnsplan) which put forward the country's development in form of five fingers or corridors with Copenhagen's developed city centre as the palm. (Fig. 28) Transportation was an important element in the Finger Plan. In terms of motorway, there were two major improvements. In 1960-61, the Danish Road Directorate connected Copenhagen Airport to Kastrup by a motorway. This section of motorway is called the Øresundsmotorvej, which is a section of the E20, an international route running through Ireland, the United Kingdom, Denmark, Sweden, Estonia and Russia. In Zealand, the main island of Copenhagen Centre, E20 was also constructed in phrases. Until 1983, the motorway was extended to Avedøre Havnevej and further extension would be seen in the next map. Meanwhile E47, another important motorway that was developed in that period. Construction started in the 1950s and finished in 1974, linking up the south and north of Zealand and joining the E20 in Avedøre. Despite land transportation, a marine link from the airport to Malmö, implying the scope of Copenhagen Airport has already reached Sweden by the time. The marine link operated by SAS from 1984 but would be closed in 2000 with the opening of a new bridge.



Fig. 28
Finger Plan, 1947

In terms of built-up areas, there was a significant increase in number of buildings surrounding the airport in Amager, transforming Copenhagen Airport to an urban airport. (Fig. 29) Surprisingly, the development we see on the 1985 map in Kastrup was not a part of the 1947 Finger Plan. It is believed that the growth in residential areas was due to suburbanisation with Copenhagen's affluent families moving to the suburbs. (Knowles, 2012) Yet it would later lead to the development of an important "extra finger" of Copenhagen. On the other hand, the western part of the Amager Island, Kalvebod Fælled, only appeared in the 1985 map but not the 1944 map. Initiated by the Danish government, this piece of reclaimed land was done in the 1940s by damming and draining the seabed. Taking up approximately one fourth of the Amager Island, this piece of land was mainly for military purposes, which also explains the absence of built-up areas here.



Fig. 29
Amager poster for advertisment, 1948

4.2.3 The New Finger (1985-2023)

Since the addition of the third terminal in 1998, Copenhagen Airport itself had not changed much in terms of its architecture and runways. Instead, the differences in transportation infrastructure and built-up areas are very evident from the 2023 map. In the previously mentioned E20 motorway, two more sections, in-between the previous ones, were opened in 1987 and 1997 respectively by the Danish government. Since then, the airport, together with the urban areas of the New Finger, has been connected by the international motorway across Amager Island and Zealand.



Fig. 30
Øresund Fixed Road and Rail Link

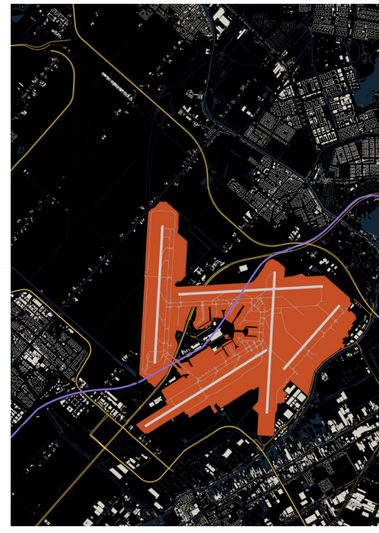
In the 1990s, the focus of the Danish economic development was shifted back to Copenhagen. (Knowles, 2012) Meanwhile, the city authorities have emphasised minimum travel time between the city centre and outskirts. (Vuk, 2005) One of the main projects would be the construction of Øresund Fixed Road and Rail Link to Malmö, which we can clearly see on the 2023 map to the east of Copenhagen Airport. (Fig. 30) In addition to the aim of connecting the two regional largest cities which were both, at that time, in economic difficulties, another reason for the Øresund Link Project would be to provide a quicker, more efficient alternative transport route to the airport. (Omega Centre, 2014) Since its opening in 2000, the project enabled travelling between the airport, Copenhagen and Malmö via both motorway and railway. In addition, there was a construction of a new railway infrastructure in Copenhagen following the Ørestad Act passed by the Danish Parliament in 1992. As the phase 3 of the project, the Copenhagen Metro system of 22 km has been connecting the airport since 2007.

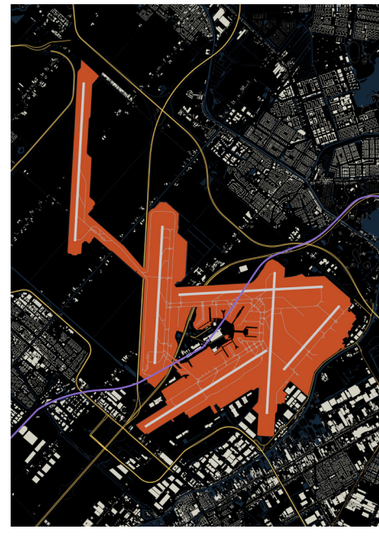


Fig. 31
Aeiral view of Ørestad New Town

Together with the abovementioned transport developments, there has also been another project approved by three major Danish political parties in 1992. The Ørestad New Town, the vertical strip of development to the west of the airport, is jointly owned by the city of Copenhagen (55%) and the Danish government (45%). Designed and directed by the Ørestad Development Corporation and financed by government backed loans. (Fig. 31) Its strategic location on the international rail and motorway route, that is linking Copenhagen, the Copenhagen Airport and Malmö by the Øresund Fixed Link has become the new town's feature and selling point. As an extension of Copenhagen's CBD, it is only 5 minutes away from the city centre, 10 minutes away from Scandinavia's main airport and 30 minutes away from the third largest Sweden city. Thus, the Ørestad New Town represents the major airport-related urban development around Copenhagen Airport.







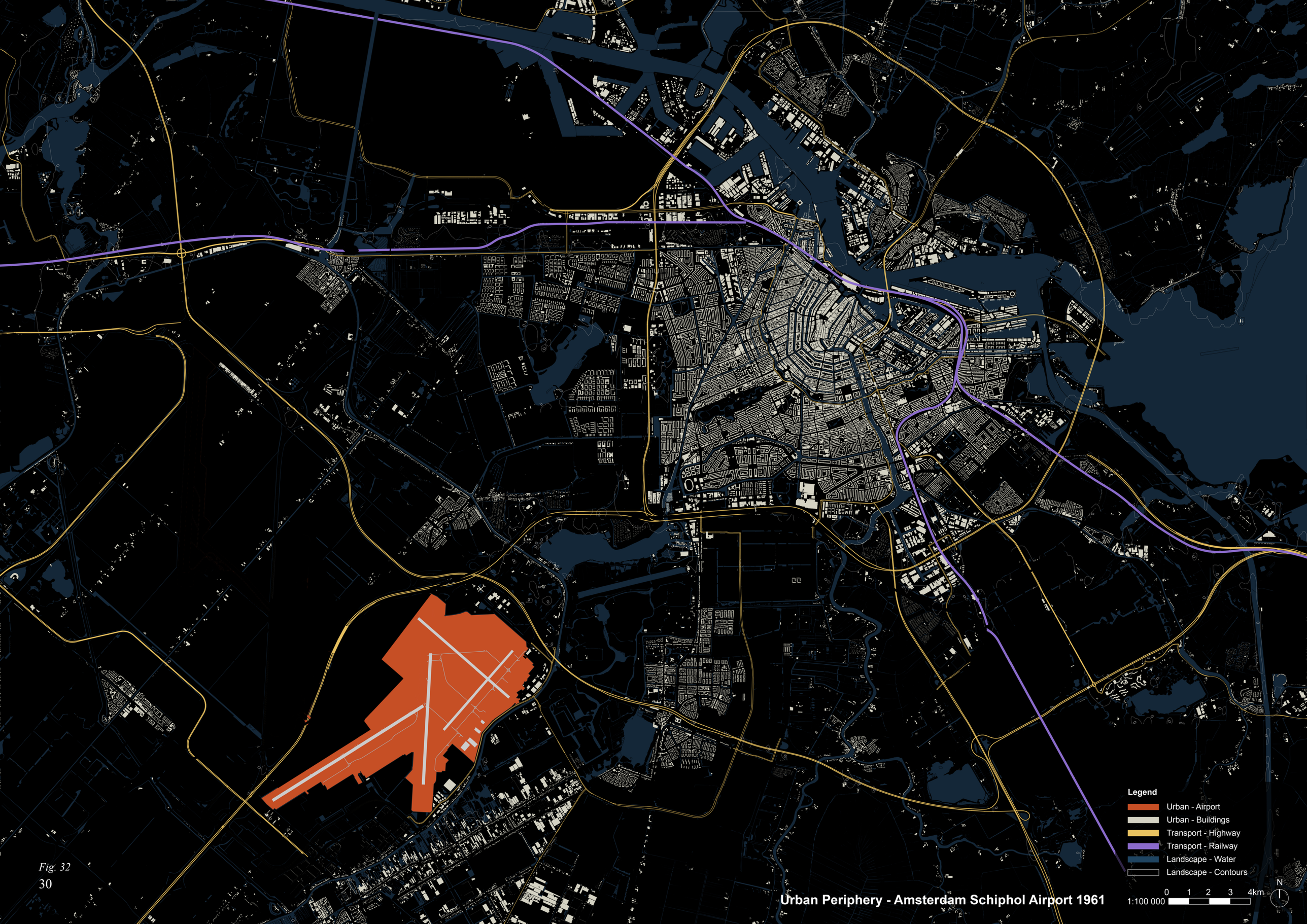


Fig. 32

30

Urban Periphery - Amsterdam Schiphol Airport 1961


Legend
Urban - Airport
Urban - Buildings
Transport - Highway
Transport - Railway
Landscape - Water
Landscape - Contours
0 1 2 3 4km
1:100 000
N
Urban Periphery - Amsterdam Schiphol Airport 1997

Fig. 33

Legend

Urban - Airport
Urban - Buildings
Transport - Highway
Transport - Railway
Landscape - Water
Landscape - Contours

0 1 2 3 4km
1:100 000

N

Urban Periphery - Amsterdam Schiphol Airport 2023

Fig. 34

5 Case Studies of Urban Periphery Airports

5.1 Amsterdam Schiphol Airport (AMS)

5.1.1 From a Military Airfield to a Civil Airport (1916-1950s)

As one of the world's leading airports, the history of Amsterdam Schiphol Airport dates back to 1916, when the first military aircraft landed on the field in Haarlemermeer. After the First World War, the 1920s was a period of growth for Schiphol. With the increase in civilian usage and diminished military operations, the airport was not a base for the Dutch air force anymore. The city of Amsterdam officially gained ownership the airport in 1926 and prepared it for the Olympics in 1928 by increasing the number of runways to 4, as seen from the 1961 map, and paving them with asphalt. After a short period of development before the Second World War, Schiphol suffered from repeated bombing and was captured by the German air force. One year after its complete destruction in 1944, the Netherlands managed to rebuild the airport in one year. (Fig. 35)



Fig. 35
Aerial view of Schiphol Airport, 1946

Since then, the 1950s saw the flourish of airport as Schiphol was an attraction for many who could not afford air travel. In addition to a new air traffic control tower and a concrete-paved runway, the first tax-free shops were also opened during that period, as day-trip tourism the main source of revenue for the airport. However, at that time, the only way of travelling from the city to the airport is by car through the A4 motorway, or Rijksweg 4, which is why only motorways are shown around Schiphol on the 1961 map. Unlike today, Schiphol was detached from the city of Amsterdam. The city's post-war urban planning strategy followed the General Expansion Plan of Amsterdam devised by Cornelis van Eesteren, chairman of CIAM, in 1934. (Fig. 36) There was no built-up residential nor commercial areas surrounding the airport, but only agricultural greenhouses that were located towards the south. Therefore, the 1961 Amsterdam Schiphol could be categorised as a remote airport.

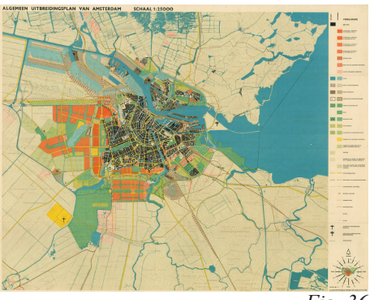


Fig. 36
General Expansion Plan of Amsterdam, 1934

5.1.2 Rebirth of Schiphol (1960s-1990s)

Schiphol is quite different on the map of 1997 than that in 1961. After the war, Jan Dellaert, the airport's first manager created a new plan for Schiphol. It was approved by the government in 1961 and subsequently, a new terminal building at the heart of the airport was inaugurated in 1967. Shortly two years after, it was planned that the terminal space should be doubled to accommodate the expected explosive growth of air passengers. The terminal extension was completed in 1975. In addition to the later completed Terminal-West and Schiphol Plaza, the third long runway (Buitenveldertbaan) was reconstructed and the fourth long runway (Zwanenburgbaan) was built, the airport was becoming what we see on 1997 map. (Fig 37)

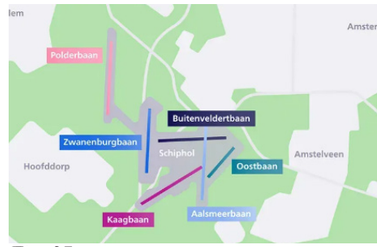


Fig. 37
Runways of Schiphol Airport

Meanwhile, planning approaches in the Netherlands aimed at integrating motorway infrastructure and other spatial planning sectors. (Heeres et al., 2012) As two new runways were added to the airport, road transport was also modified. In 1966, the Schiphol Tunnel was built at the same time with the construction of the Buitenveldertbaan, as it goes underneath the runway as a part of the A4 motorway. (Fig. 38) Soon after, the late 1970s and the early 1980s was another important period of infrastructure improvement. On the 1997 map, Schiphol was not only connected by the A4 motorway, but also by a railway. In 1978, Schiphol was linked to the railway network provided by the Netherlands Railways after years of planning and consultations with the government. Three years later, the direct rail link Amsterdam-Leiden-The Hague-Rotterdam was also completed. Together they became important means of public transportation to the airport.



Fig. 38
Consturction of Schiphol Tunnel, 1966

On the urban scale, two major developments are visible from the maps of 1961 and 1997. To the east of Schiphol, there was a significant increase in built-up areas forming the Southern Axis of Amsterdam. This development can be traced back to 1914, when architect Hendrik Petrus Berlage presented Plan Zuid, or the South Plan. Since the 1980s, the City of Amsterdam began to search for land to development business areas. (Fig. 39) Meanwhile, the national government published the fourth Memorandum on Spatial Planning in the Netherlands in 1988. The national "main ports", Schiphol airport and the port of Rotterdam, became one of the focal points of the report. (van der Wouden, 2017) These events all led to Zuidas establishing itself as an "airport corridor" in the area between Schinkel and Amstel. (Güller and Güller, 2003) Besides national spatial strategies which aimed to boost the Dutch economy, a rapid expansion of residential areas in Hoofddorp to the west of the airport is also seen from the map. Following the national spatial development policy in the 1960s to 1970s, suburbanisation was encouraged, creating such expansion of towns to accommodate housing needs near large cities like Amsterdam. (Bontje and Sleutjes, 2007) Considering the aforementioned urban expansions surrounding Schiphol throughout almost four decades until 1990s, the airport could be defined as an urban periphery airport.



Fig. 39
Aerial view of Zuidas Development

5.1.3 Strengthened Businesses around Schiphol (2000s-2023)



Fig. 40
Aerial view of the Fifth Runway

Schiphol has, again, a new addition of runway shown on the 2023 map. To the far northeast of the airport, the construction of the fifth and longest runway (Polderbaan) began in 2000 and opened in 2003. (Fig. 40) The new runway locates further away from the heart of the airport and diverted some flights from the existing runways. Such adjustments resulted in an increase in noise complaints in some neighbouring residential areas but a decrease in other parts. (Schiphol Group, 2003)

Meanwhile, the fifth Memorandum on Spatial Planning was published in 2001. Subsequently, 2009 saw the beginning of a new High Speed Line (HSL) rail connection between Antwerp and Schiphol. With significant reduction of travelling time, Schiphol's catchment area has increased to other European cities like Antwerp, Brussels and Paris. Inevitably, there have been doubts on the effectiveness of such plans in terms of usage, cost and operation organisations. (van der Wouden, 2017) Nevertheless, it shows Schiphol's potential and priority in the national government's spatial and infrastructural planning. A new motorway can be seen running parallel with the fourth and fifth long runway of Schiphol. This A5 motorway has been serving as a shortcut between A4 and A9. However, the it has no direct relation with the development of Schiphol.

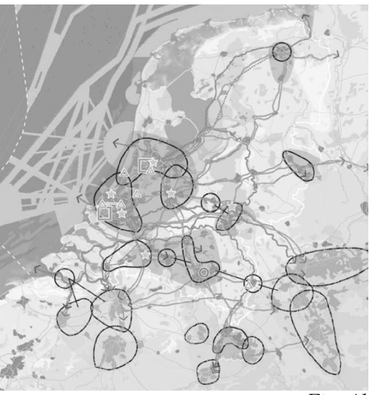


Fig. 41
National Spatial Structures: Economy, infrastructure, urbanisation

The Fifth National Spatial Strategy in 2001 again mentioned Schiphol as one of the nation's "main ports", with Amsterdam as one of the economic core areas. (Fig. 41) Moreover, the document proposed the "Northern Wing Programme" which involved the areas such as Haarlemmermeer, Amsterdam and Almere. Notably, Amsterdam Southern Axis, or Zuidas, was both one of the six elements forming the "Northern Wing Programme" and one of the six national city key projects. Currently, Zuidas and Schiphol shares synergy as the travel time between these two locations takes only six minutes via motorway or railway. Such collaborations and associations between the city and the airport imply active investment in the areas. (Bosma, 2013) For this reason, despite insignificant increase of built-up area can be seen from the 2023 map, there is no doubt that continuous development of Zuidas is under way.

Latest renovation of airports started to emphasize on the accommodation of extra business and commercial development due to the higher revenue brought by landside facilities than airside facilities. (Güller and Güller, 2003) In addition to Zuidas, there have also been multiple other new business developments surrounding Schiphol which created an "aerotropolis". (Kasarda & Lindsay, 2011) Since 2010, there have been long term development plans to develop a hub of Schiphol-related logistics business parks to the southwest of the airport. (Schiphol Group, 2010) On the 2023 map, five of such business parks can be found, with Schiphol Trade Park, Schiphol Logistics Park and Green Park Aalsmeer to the south of Schiphol and Polanen Park and Business Park Amsterdam Osdorp to the north of Schiphol. (SADC, 2018)







Case Study: London Heathrow Airport

Legend

- Urban - Airport
- Urban - Buildings
- Transport - Highway
- Transport - Railway
- Landscape - Water
- Landscape - Contours

1:100 000 0 1 2 3 4km

N

Urban Periphery - London Heathrow Airport 1960

Fig. 42

Legend

Urban - Airport

Urban - Buildings

Transport - Highway

Transport - Railway

Landscape - Water

Landscape - Contours

0 1 2 3 4km

1:100 000

N

Urban Periphery - London Heathrow Airport 1980

Fig. 43

Legend

Urban - Airport

Urban - Buildings

Transport - Highway

Transport - Railway

Landscape - Water

Landscape - Contours

0 1 2 3 4km

1:100 000

N

Urban Periphery - London Heathrow Airport 2023

Fig. 44

5.2 London Heathrow Airport (LHR)

5.2.1 Creating Heathrow (1929-1950s)



Fig. 45
Aerial view of Heathrow Airfield, 1955

Before becoming today's Heathrow, the plots of land had some years of aviation history under the names of Norholt Aerodrome and Hounslow Heath Aerodrome, being London's only airport handling international flights. In 1929, farmland was purchased by an aircraft builder, and the Fairey's Great West Aerodrome became a private airport with a grass runway used to assemble and test aircraft. During the Second World War, the British government decided to build the Royal Air Force (RAF) Heston and requisitioned the land of an agricultural village Heath Row, which included Fairey's Great West Aerodrome. As a result of the period serving as a military airfield, the runways seen on the 1960 map was laid in a "Star of David" shape. (Fig. 45)

After the war, the RAF did not need the airfield anymore. In 1946, the then state-owned airport began its service as a new civil airport of London under the Air Ministry. With the continuous rise of air passengers, there was a need for Heathrow to build permanent buildings. On the 1960 map, we can see the plan drawn by British architect Frederick Gibberd in 1951 with a passenger terminal (Europa Building) and an office block (Queens Building) that were opened in 1955.

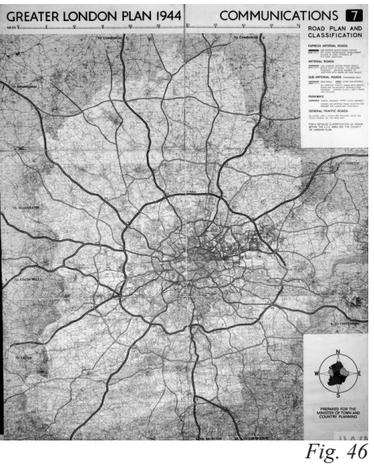


Fig. 46
Greater London Plan, 1944

On the same map, there are already elaborate motorways developed in London. Heathrow was at that time connected by a motorway M4 on the north and other country roads. The reason for this would be the early planning and development of motorways in London in the 1920s. In the 1930s, plans were carried out to improve the city's road network. After the war, the precedents of the Ringways appeared in the 1943 County of London Plan and the 1944 Greater London Plan which was prepared by John Henry Forshaw and Sir Leslie Patrick Abercrombie for the then London County Council and the Ministry of Transport, and these plans were followed and partially carried out in later years. (Fig. 46)

5.2.2 Connecting Heathrow (1960s-1970s)

Heathrow was one step closer to the current one in terms of ownership. Following the Airport Authority Act 1965, the British Airports Authority (BAA) was established. The responsibility of four state-owned airports – Heathrow Airport, Gatwick Airport, Prestwick Airport and Stansted Airport – were given by the Ministry of Aviation to the BAA.

Meanwhile, these two decades saw a significant change in the layout of the airport. The former "Star of David" is not seen anymore. To handle the newly developed jumbo jet Boeing 747, the two parallel runways running east-west are seen extended in the 1960s. Meanwhile, three other runways were closed as they were no longer needed. With continuous growth of air passengers two terminals were opened in 1961 and 1968, following the closure of two old terminal buildings.



Fig. 47
Heathrow Terminal 4 Underground Station

The 1960s-1970s was also an important period for the infrastructure development of Heathrow. The expansion of air travelling induced the investment in public transportation. In December 1977, the London Underground had officially opened the Heathrow Central Stations for Terminals 2, 3, and 4 on the Piccadilly Line. For the first time, the airport was the linked to London's Mass Transit system and passengers were able to travel to Central London through direct rail services. (Fig. 47)

In addition to the "tube", there were more driveway constructions aiming to increase the traffic capacity between the city and the airport. To the east of the airport, in 1969, the then Greater London Council decided to widen the original A312 road. It then became a dual carriage way and was renamed as the Parkway. Following the start of Ringway planning in 1966, the first section of M25, of the London Orbital Motorway was also opened in 1975 and connected the airport on its west. (Fig. 48) On the 1980 map, motorways can be seen extended on both the west and east of Heathrow.

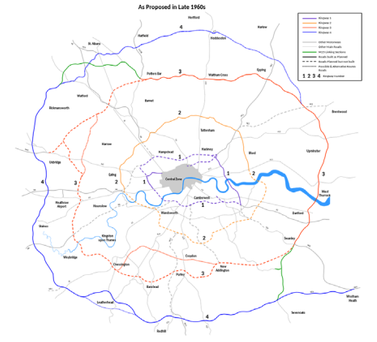


Fig. 48
Ringways of London

5.2.3 Upgrading Heathrow (1980s-2023)

Until the 1980s, Heathrow was owned by the British government. However, the government took action to privatise government owned assets in 1986. The Airports Act in 1986 was passed and the then British Airports Authority became a public limited company (BAA plc). In 2012, the company changed its name to Heathrow Airport Holdings Limited which is also the airport's current owner and operator. Such privatisation led to an expansion in retail within the airport which generated more revenue for the operator.



Fig. 49
Heathrow Airport, Terminal 5, 2009

On the other hand, the runways of Heathrow did not present much change since the 1960s. Despite continued heated discussion about constructing the third runway and expanding the airport capacity, we can see there are still only two runways running in parallel on the 2023 map. The major upgrades of the airport itself in the past four decades would be on the new terminals. In 1986, terminal 4 was added due to the continued growth in air travel. This terminal was planned further away from the other three terminals which locate at the heart of the airport, there was a need to expand the London Underground. Meanwhile, a new station at terminal 4 was also constructed. Eleven year later, in 1997, terminal 5 was also planned after extensive public consultation. With construction started in 2002, terminal 5 was realised in 2008 together with its own underground station. Currently, the main air carrier, British Airways, operates in both terminal 3 and 5. (Fig. 49)



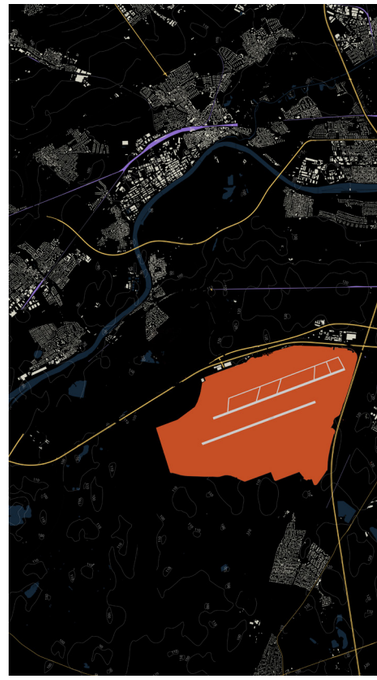
Fig. 50
Hayes Bypass, 1992

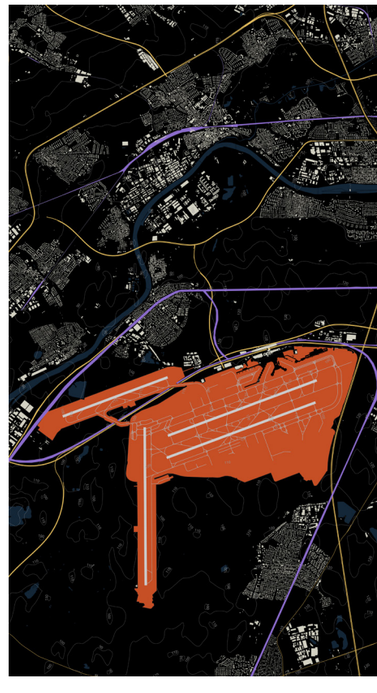
Furthermore, enhancement of transport infrastructure has been done. In 1980, the British Airport Authority expressed the need to construct the Hayes bypass together with the new terminal 4 and the extension of the Piccadilly Line. (House of Commons, 1980) (Fig. 50) Following a local authority scheme proposed by the Greater London Council, a motorway was added on the map on the north-east side of the airport in 1992. As a part of The Parkway, or A312, that was constructed in 1969, the Hayes Bypass started serving as a direct link between the A40 Western Avenue and the M4 motorway which leads to Heathrow.



Fig. 51
Heathrow Express

In terms of rail services, although not visible from the 2023 map, it has grown again main on two services: express rail services and underground rail services. In 1998, Heathrow Express was launched and connected with the Great Western Rail line. (Fig. 51) As proposed by Heathrow Airport Limited (a wholly-owned subsidiary of BAA plc) and the British Railways Board, it takes passengers from Heathrow to London Paddington in 15 minutes. (House of Commons, 1989) Two decades later, a new underground line, the Elizabeth line, opened in 2022 with services from Heathrow to central London. According to Ross Baker, Heathrow's Chief Commercial Officer, "it is a huge step in boosting rail connections to the UK's hub airport directly linking Canary Wharf with Heathrow by rail for the first time." (Transport for London, 2022)





Legend

- Urban - Airport
- Urban - Buildings
- Transport - Highway
- Transport - Railway
- Landscape - Water
- Landscape - Contours

0 1 2 3 4km

1:100 000

N

In-between Cities - Frankfurt Airport 1956

Fig. 52

Legend

Urban - Airport

Urban - Buildings

Transport - Highway

Transport - Railway

Landscape - Water

Landscape - Contours

N

0 1 2 3 4km

1:100 000

In-between Cities - Frankfurt Airport 2023

Fig. 53

6 Case Studies of Remote Airports

6.1 Frankfurt Airport (FRA)

6.1.1 Relocation, Destruction and Reconstruction of Frankfurt (1936-1956)

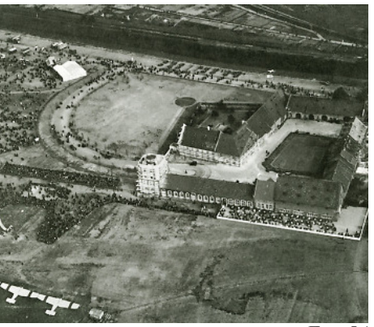


Fig. 54
Frankfurt-Rebstock Airport, 1931

Before the official opening, Frankfurt Airport and its operator Fraport had more than two decades of history at the site. In 1910, the Frankfurt-Rebstock Airport was constructed as a facility for the German Airship Travel Corporation in Bockenheim, located west of Frankfurt. (Fig. 54) The inter-war period saw an expansion and later in 1924, Südwestdeutsche Luftverkehrs AG was established as the operator, which later became Fraport, the owner and operator of Frankfurt. In the same year, evaluation was done on the airport, and it was concluded that expansion was not possible on that site. Together with the continued growth in air traffic and the founding of Deutsche Luft Hansa, there was a plan for a new airport. Ten years later, Frankfurt Airport was constructed on the current site in 1936 by the Nazi Party after they seized power.



Fig. 55
Rhein-Main Air Base

When the Second World War broke out, Frankfurt operated under the German Air Force and all foreign air carriers had withdrawn. By the end of the war in 1944, all the original runways were destroyed by the Allies. In 1945, the US Army took control of the airport. Three year later, the airport served, together with Hamburg Airport and Hannover Airport, as bases for the Berlin Airlift. Three years after the war, two parallel runways were built by the US Army and they can be found on the 1956 map. In 1951, civil air traffic in Germany started to grow again after air restrictions for German air passengers were lifted. Air sovereignty was given back to Germany and Lufthansa resumed flights to and from Frankfurt Airport. Meanwhile, on the 1965 map, southern part of the airport was still used as the Rhein-Main Air Base for the US Air Forces in Europe until 2005. (Fig. 55)

By 1956, Frankfurt Airport was served mainly by two motorways and they are still used until the current day. In the north-south direction, motorway A5 was opened before the Second World War in 1935 and it connects the east boundary of the airport to the periphery of Frankfurt's urban area. Perpendicular to A5, another motorway is running east-west to the north of Frankfurt Airport. The A3 motorway shown on this map contains two sections which opened in 1951 and 1956. The entire motorway connects the Dutch border at Elten and the Austrian border at Passau which makes it one of the busiest and most important motorways in Germany. (Wegenwiki, 2023) However, there had not yet been any kind of rail link to the airport at that time, even though the airport is situated far from any cities or towns.

6.1.2 Prosperity as Germany's Main Airport (1957-2023)

Transitioning from the 1956 map to the 2023 map, the airport, the infrastructures and the city have undergone many transformations. In the 1950s, Frankfurt Airport was even confirmed by the government of Western Germany as the country's central hub and expansions subsequently took place. (Boucsein et al., 2018) To begin with, there have been multiple renovations of runways. To accommodate larger civil aircrafts, the two parallel runways were extended in 1957 and 1964 respectively. Within a decade, the growth in air traffic prompted the planning for a third runway, Runway 18 West, in 1973. (Fig. 56) Despite facing enormous difficulty due to massive violent protests by residents and environmentalists, construction was completed and it started operation since 1984. (Fig. 57) Plans for the remaining runway was drawn in 1997. Located towards the north-west of the airport, the shorter, 2.8 km fourth runway was opened in 2011 under a mutually accepted plan between Fraport, resident groups and environmentalists. Together with an addition of the third passenger terminal in 2026, the airport was expected to handle up to 100 million passengers a year.



Fig. 56
Frankfurt Airport, Runway 18 West, 2003



Fig. 57
Protest against new runway, 1980

The motorway network of Frankfurt continued to be improved through the 1960s with some additions seen on the 2023 map. Yet, the greatest improvement for airport transport would be the rail services which prospered since the 1970s. Funded by the state government of Hesse, Deutsche Bahn (DB) and Fraport, the Frankfurt Airport Regional Railway Station was opened in 1972. The S-Bahn rapid commuter rail system and regional trains have been added to serve the airport. From 1982, this station also provided access to Lufthansa Airport Express which was also operated by DB but was eventually discontinued in 1993 due to financial reasons. However, another major transport-related development took place in 1999. The Frankfurt Airport Long-distance Station is located in between the airport and the motorway A3 and is served mainly by inter-city express trains on the high-speed rail lines. (Fig. 58) The airport can currently be accessed from Frankfurt by not only two motorways, but also three types of rail services directly from different cities.



Fig. 58
Frankfurt Airport Long-distance Station

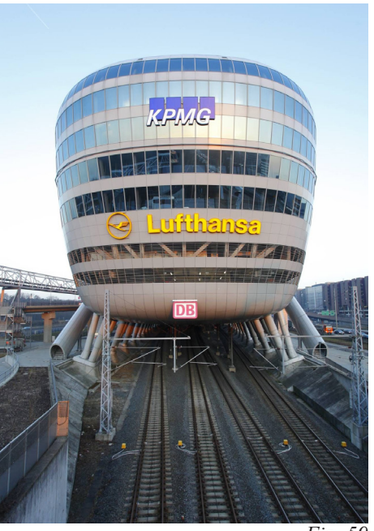


Fig. 59
The Squaire



Fig. 60
Aerial render of Gateway Gardens

For a remote airport, Frankfurt is relatively close to its host city with a distance of only 12 km. Located in between two cities, it is also only 21 km from Mainz. From the map, we can recognise a polycentric growth of urban regions. From 1965 to 2023, there has been growths in most of these metropolitan regions, but most of them did not show evidences related to the airport. Meanwhile, airport-driven real estate development has also been one of the focuses of Fraport. (Boucsein et al., 2018) The key project would be a small complex of an “airport city” named the Squaire, which is constructed right above the existing long-distance station from 2006 to 2011. (Fig. 59) Comprised of hotels, offices, leisure and shopping facilities, it promotes itself as the biggest office building in Germany and the most central one because of its proximity to the airport and the A3 motorway. (theSquaire, 2022) Another development would be Gateway Gardens located near the north-east tip of the airport. (Fig. 60) Once a living quarter for the US Army of the Rhein-Main Air Base, Gateway Gardens has now transformed into a combination of working environment and quality living area targeting international businessmen. Nevertheless, unlike what we saw in other case studies, all the abovementioned projects are either redevelopments or single-building constructions. There is not a large-scale airport-related town development shown on the map despite being in between multiple developing towns.





Legend

- Urban - Airport
- Urban - Buildings
- Transport - Highway
- Transport - Railway
- Landscape - Water
- Landscape - Contours

1:100 000 0 1 2 3 4km

N

Remote - Stockholm Arlanda Airport 1981

Legend

- Urban - Airport
- Urban - Buildings
- Transport - Highway
- Transport - Railway
- Landscape - Water
- Landscape - Contours

1:100 000 0 1 2 3 4km

N

Remote - Stockholm Arlanda Airport 2023

6.2 Stockholm Arlanda Airport (ARN)

6.2.1 Arlanda as New Main Airport (1962-1980)

Stockholm Arlanda Airport is the largest airport in Sweden. It is the youngest airport of all cases studied and one of the two airports studied which was designated for civil air traffic. The project was agreed by the Swedish Parliament in 1946 and it officially opened in 1962. The airport equipped with two runways paved with asphalt oriented in different directions. Before it was opened, Bromma Airport, located much closer to the city centre of Stockholm, served the city as the main airport. (Fig. 63) However, the operation of Bromma brought noise problems in the urban centre. In addition, there were insufficient runway lengths to accommodate larger planes and thus expansion was considered impossible. (Sweden 1944 Airport Inquiry, 1946) As a result, all intercontinental flights and some domestic flights moved to Arlanda by airlines like the Scandinavian Airlines and Linjeflyg, the domestic airline of Sweden.



Fig. 63
Aerial view of Bromma Airport



Fig. 64
E4 motorway passing through Arlanda

From the smaller map, Arlanda Airport is located very far from the country's capital. Similar to the case of Frankfurt Airport, it is in between two cities of Stockholm and Uppsala. The airport is 37 km away from Stockholm to the south and 40 km away from Uppsala to the north. We can see that there is only one motorway giving access for ground transport to the airport. Planned by the Swedish Government, it is called the E4 motorway in Sweden, forming an extensive north-south connection throughout the whole country and ending at the border with Finland. There are two sections shown in the map. (Fig. 64) The southern section, from nearer the centre of Stockholm to Arlanda was opened first in 1963, right after the airport's inauguration. Direct connection from Arlanda to Uppsala was enabled with the opening of the second section in 1972. Together with the short highway 273, the motorway could be connected to the airport. While a rail link can also be found on the map, it is yet to be connected to the airport in the year of 1981. Therefore, only the motorway and the highway formed a major link between the airport and two cities.

6.2.2 Infrastructure Developments of Arlanda (1981-2023)

Arlanda Airport was continuously developed by the Civil Aviation Administration, a Swedish government agency regulating aviation. From the 1980s to the 1990s, three new terminals were added to the airport. As of 2023, there are a total of four terminals. In order to increase the airport's capacity, a new parallel runway was constructed to the south-east of the airport. It was built from 1998 to 2002 and finally opened in 2003, helping the airport in handling large aircrafts. After 2005, the Swedish Civil Aviation Administration was split up. After ten years of organisational restructuring, commercial airport operations and ownerships, including Arlanda Airport's, were finally transferred to a state-owned company formed in 2010, Swedavia.

Regarding transportation, the first formal railway planning proposal for Arlanda Airport was made in 1986. (Nilsson et al., 2008) The Swedish government aimed at increasing traffic capacity to the airport without increasing the existing road traffic. This is why there is an extension of the railway on the 2023 map, but no change can be found concerning the motorway E4. Altogether three railway stations were opened between 1999 and 2000. Arlanda North Station and Arlanda South Station were first opened in 1999. These stations are served only by the Arlanda Express, which is the first public-private partnership with government fundings and fate operation. (Fig. 65) Later on, the Arlanda Central Station was opened in 2000 which allows the connection by regional and intercity trains, as well as commuter rail services which started from 2006.



Fig. 65
Arlanda Express

Four decades since the previous map of 1981, Arlanda Airport is still situated in a remote location even though two major urban growths can be found on the latest map. To the south-west of the airport, Märsta, a town in Sigtuna Municipality, has expanded the most. Planned by the government, Märsta has become a residential area where airport employees live. Together with housing, schools and other facilities, the town was developed to accommodate the new settlement. (Johansson, 1987) While the plan was made back in the 1960s, the expansion of Märsta can still be seen from the maps of 1981 to 2023. Together with residential developments, multiple logistic centres can also be found on the 2023 map, which are located nearer to the Cargo City of the airport. Other urban expansions include Rosersberg on the bottom of the map and Knivsta on the upper part of the map. However, there is no direct linkage between these growths and the development of Arlanda Airport. They are rather related to the advancement of railway systems, which the Güllers call the "E4-Corridor". (Güller and Güller, 2003)

From 2013-2015, a new urban planning strategy had been commissioned by Airport City Stockholm, a partnership between Swedavia, the Municipality of Sigtuna and Arlandastad Group AB. (AirportCityStockholm, 2022) Developed by Spacescape, the project proposed development principles, such as city growth based on urban nodes, and neighbourhood growths based on infrastructure. (Fig. 66) Multiple urban districts are listed: Sky City at the airport, Park City at the airport entrance, business area in Märsta, etc. (Spacescape, 2013) However, there is no signs of the start of execution and construction. Märsta remains the largest airport-driven urban development until 2023.

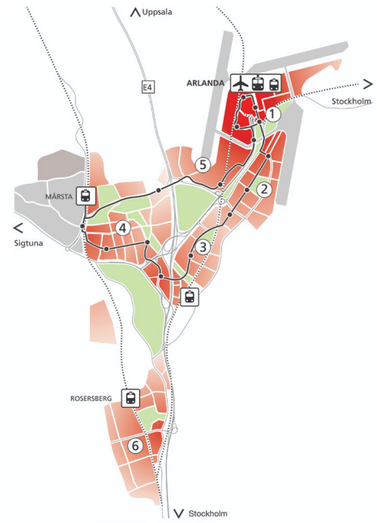


Fig. 66
Airport City Stockholm Urban Design Strategy Proposal

7 Understanding the Differences in Developments

7.1 Urban Airports – Comparing Paris Orly and Copenhagen

Comparing Paris Orly Airport and Copenhagen Airport, different developments in all three levels of the airports, the cities and the infrastructures are shown. In terms of the airports, Copenhagen has had in general a continued growth since its establishment. Even today, there is a public consultation in progress on the redevelopment of the norther parts of the airport as well as its infrastructure. Being an airport with a longer history, Orly had experienced a period of halt as well. It is noticed that the airport has only had a few improvements from the 1980s to 2000s. As for urban developments, both cases show planned, airport-related districts. However, the scale of developments exhibited are contrasting. To the north of Orly, there are three business districts: Cœur d'Orly, Roméo and Orlytech, and the total area adds up to be 1.38 sq. km. On the other hand, Ørestad is a new town development of 3.1 sq. km. which comprises of high-density offices (60%), facilities (20%) as well as housing (20%). (Majoor, 2014) Lastly, the type of infrastructure developed in Copenhagen has a larger impact and is also at a larger scale when compared with that in Orly. While metro and tramway systems were developed to connect Orly, there has been a much larger-scale cross-strait bridge near Copenhagen Airport. These all demonstrate a greater extent of development in Copenhagen than that in Orly.

Despite these distinctions, similarities could still be recognised. Their main actors on urban planning for both would be stronger roles of the central governments mixed together with the cities. Also, the structure of the airports is both public-private ownerships with the states holding large portion. (Fig. 67) Therefore, the stakeholders of planning and ownership would not be the primary cause of such difference in airport-relate developments. In this sub-chapter, we will look into these differences and the causes behind.

Locations of Airports

One of the main reasons for such differences between the two cases would be the types of airports. Both cases are very close to the urban centre according to the 2023 maps and they are currently categorised as urban airports. However, Copenhagen is not only an urban airport but also an in-between cities airport. As previously mentioned, there had been a marine link from Copenhagen Airport to Malmö from 1984 to 2000. This suggests a frequent flow of people and goods between Copenhagen and Malmö, and the airport is actually serving more than one city. Malmö, the third largest city of Sweden, is located at the Southern tip of the country's territory. While the city has its own airport, Malmö Airport, the distance between them is roughly the same as that to Copenhagen Airport. Located in such a strategic position, together with an advantageous in airport size and capacity, Copenhagen is a quintessential in-between cities airport, serving two large cities in both countries. Continuous growth in both air traffic volumes and the airport stimulated the Øresund Link Project to replace the marine link. With such development of mass transport infrastructure, commuters from the Malmö area are encouraged to travel to Greater Copenhagen. This increase in accessibility had led to 19 380 commuters per day, which in turn helped the development of Ørestad New Town. (Knowles, 2012) Alternately, Paris Orly Airport is in the opposite situation. In addition to Orly, there are three more airports serving Paris metropolitan area, namely Gharles de Gaulle Airport, Beauvais-Tillé Airport and Le Bourget Airport. Consequently, there is not a need for Paris to invest a massive sum into transport infrastructure for Orly. Therefore, this comparison illustrates the role of airport's relation with cities, and thus its type, in affecting the way cities and infrastructures develop.

Fig. 67
Table comparison of urban airports

Urban Airport	ORY	CPH
Ownership	Groupe ADP *50.6% French State* *8.0% VINCI* *7.7% Credit Agricole Assurances* *31.9% Others*	Københavns Lufthavne *52.4% Macquarie Infrastructure Company* *39.2% Government of Denmark*
Operator	Paris Aéroport	Københavns Lufthavne
Main Air Carrier	Air France	Norwegian Air Shuttle Scandinavian Airlines
Main Planning Body	Government of France	Government of Denmark
Air transport movements	229,052	
Passengers (million)	33.1	30.3
Transfer %	/	23
International % (incl. Europe)	66.7	89
Cargo (million tonnes)	-	-
Other International Airports	Charles de Gaulle Airport Beauvais-Tillé Airport Le Bourget Airport	/

Competitions between Airports

While the location of airports justifies the differences in urban and infrastructural developments, it does not explain why Orly did not have any major improvements for two decades. Competitions between airports would be a valid reason for all three levels of differences in this case. As mentioned, there are three more airports serving Paris excluding Orly, and two of them in vicinity. Since the establishment of Orly, it had been secondary to Le Bourget Airport. Albeit exceeding Le Bourget in airport figures in the mid-1950s with new runways and terminal expansions, CDG was opened in 1974. Since then, Orly has turned into a secondary airport again. Influenced by CDG's opening, major developments did not take place in Orly during the 1980s and 1990s. This is reasonable as CDG had more than double number of Orly's passengers and aircraft movements. (Groupe ADP, 2019) In addition, the total of 1.38 sq. km. of three small-scale business park developments next to Orly is nowhere to compare with the 1.98 sq. km. of developed land in CDG's high-tech business park, Aerolians Paris. Together with another 3 sq. km. of Cargo City at the heart of it, CDG can definitely be seen as a result of state planning and the large, lead airport of Paris. (Kasioumi, 2021) The reasons for Orly not topping the national government's priority varies but are not within the scope of this study. However, with this in mind, it become very understandable that the co-existence of other larger airports in the same region is a cause for Orly's pause of expansion. Orly and Copenhagen are at two extremes when it comes to their significance on the neighbouring cities as individual airports. It also explains the smaller-scale urban and infrastructural development when compared to Copenhagen Airport.

The two cases illustrate the importance of positioning an airport in relation with cities when it comes to future expansion and development. With the role as an in-between cities airport, it is possible for Copenhagen Airport to continue its expansion and extend its reach to neighbouring cities, given that it is only main airport in the region. In the contrary, competitions between airports in the region has affected the growth of Orly. Therefore, it also depends on the strategy of the region, whether a multi-airport system is adopted or not, like Paris and London. If so, with a lower priority compared with other airports in the system, it is very likely for an airport to face downfalls like Orly.

7.2 Urban Periphery Airports – Comparing Schiphol and Heathrow

Amsterdam Schiphol Airport and London Heathrow Airport started as military airfields during the war periods and are both now leading airports in the world. According to 2018 statistics, these two case studies are airports of similar scale, and they show similarities in statistics. (Fig. 68) In addition, transport developments such as the motorway system (1960s), railway systems (1970s) and high-speed railway systems (1990s-2000s) were developed within a similar timeframe. Yet, relatively more airport-related urban developments were shown in the case of Schiphol.

Throughout the three maps of Amsterdam Schiphol Airport, an increase of built-up areas, especially around the airport, is more significant when compared with the maps of Heathrow Airport. In addition to the new town development of Hoofddorp, multiple logistics business parks were developed around the airport, forming what is called the "aerotropolis". Being mentioned in the national planning policy, the development of Zuidas also formed a "airport corridor" between Schiphol and Amsterdam. Even though both Schiphol and Heathrow share similar relationships with their host cities, being urban periphery airports, these planning concepts could only be found in the case of Schiphol but not Heathrow.

Fig. 68
Table comparison of urban periphery airports

Urban Periphery Airport	AMS	LHR
Ownership	Royal Schiphol Group *69.77% The State of the Netherlands* *20.03% City of Amsterdam* *8.0% Geoupe ADP* *2.20% City of Rotterdam*	Heathrow Airport Holdings *25.00% Ferrovial S.A.* *20.00% Qatar Investment Authority* *12.62% Caisse de dépôt et placement du Québec* *11.20% GIC* *11.18% Alinda Capital Partners of the United States* *10.00% China Investment Corporation* *10.00% Universities Superannuation Scheme (USS)*
Operator	Royal Schiphol Group	Heathrow Airport Holdings
Main Air Carrier	Royal Dutch Airlines	British Airways
Main Planning Body	Government of the Netherlands	Greater London Authority
Air transport movements	499,444	474,500
Passengers (million)	71.1	80.1
Transfer %	36.6	35
International % (incl. Europe)	99.3	87.6 (2021)
Cargo (million tonnes)	1.72	1.7
Other International Airports	/	Gatwick Airport Stansted Airport Luton Airport Southend Airport London City Airport

National Planning Systems

The first reason for such a difference in urban development between the two urban periphery airports would be the difference in national planning systems. Plannings are regarded as national perspectives and plans, the Dutch government decides the broad pattern of spatial development, while in the UK, the government sets out policies to guide planning in a more general way. (Shaw et al., 1995) Being the chief source of funding for planning and exercising influence, the central government develops National Spatial Strategies and Spatial Planning Acts which involved developments of Schiphol and neighbouring business districts. (Thomas et al., 1983) As for the UK, planning policies are more fragmented and market-driven due to the liberal model of society. They generally face more fundamental challenges concerning neo-liberalism of being a welfare state and adherence to individualism. (Nadin & Stead, 2008) Executions of planning strategies are regarded more efficient in the Netherlands, allowing more planning policies to take place.

Stakeholders in the Planning Processes

Another reason of such difference in urban developments could be attributed to the stakeholders of the urban and airport planning processes. In the previous case study of Schiphol, it is noticed that most of the urban planning policies are made by the Government of the Netherlands, or the central government. Meanwhile, almost 70% of ownership of the Royal Schiphol Group is possessed by the state government, while another 20% is in two city governments' hands. Together with a strong initiative and major role taken up by the government to develop new business districts, policies could easily be implemented around a partial state-owned airport. Meanwhile, most of the airport-related plannings and developments around Heathrow were carried out by the Greater London Authority. Unlike Amsterdam, the ownership of Heathrow Airport is distributed among different private organisations, with most of them from the overseas. This is a result of the 1986 Airports Act in the UK, which turned the government-owned BAA into a private company, and the more substantial impact of the act was the ownership structure which allowed airport shares to be sold by the local authorities. Being now a privately owned airport, Heathrow could obtain more private capital for growth and expansion. (Humphreys, 1999) However, it is possible to conclude the privately owned Heathrow Airport is comparatively less involved in government-planned urban development of the region.

Availability of Land

Last but not least, the existing urban density of the area also contribute to the different results of urban development we see in Heathrow and Schiphol. From the first map of Schiphol Airport, it is observed that the area around airport is mostly for agricultural purposes, with the periphery of city centre further away from Schiphol. In contrast, the first map of Heathrow, a year before that of Schiphol, shows much more built-up area sprawling out from the centre of London to the surroundings of the airport. In the case of London, if similar urban developments of logistical business parks were to be implemented around Heathrow by the Greater London Authority, it is very likely that more resistance opposition from the local community would be faced. This could also be related to the number of stakeholders present in the policy making process. When the region is more densely populated before planned development, more voices of opposition are present which would lead to a more difficult policy implementation.

While one may argue that competition between airports in London is one of the reasons behind having less development around Heathrow, the impact of competition is, however, not significant. For London, Heathrow has a priority over all other airports. Being the largest airport in the UK and in Europe, it faces few challenges from airport competitions. To explain the difference in airport-related urban development between the case of Schiphol and Heathrow, multiple factors could be summarised. In general, the national policy making processes and structures of the two countries demonstrate an essential difference in terms of major actors, instruments and ideologies. More explicit examples can be concluded from the case studies, such as the stakeholders and ownership of airports, together with land availability of the airport surroundings. Despite both having similar relationships with the urban centres, the two cases demonstrate many other factors affecting airport-related urban developments.

7.3 Remote Airports – Comparing Frankfurt and Arlanda

Unlike the previous two groups of comparisons, the cases of Frankfurt Airport and Arlanda Airport show in general similar developments in both the city and infrastructure. In terms of road transport, the major motorways connecting the airports to the cities are developed after the airport was built in the remote location (E4 in Arlanda, A3 & A5 in Frankfurt). The railway network was linked to the two airports in a later period (both Arlanda Express and Frankfurt-Cologne high-speed rail link were opened in 1999). Besides, in both cases, extensive airport-related urban developments could not be found.

On the other hand, the two airports are different in a number of ways. In terms of their stakeholders in policy making, the urban planning is managed in Frankfurt by the state of Hesse, while the national government takes a more active role in leading projects for Arlanda. Regarding ownership, Frankfurt Airport is only partially owned by the state but Arlanda Airport is completely owned by the Swedish government. (Fig. X) This implies considerable difference in planning and development processes. As for geographic relations with host cities, the distance between Arlanda and Stockholm (37 km) triples that of Frankfurt and the city centre (12km). Lastly, the scales of the two differ greatly. (Fig. 69) Considering these differences, we will look into why these airports demonstrate similar development patterns.

Identical Type of Airports

The biggest factor is the same type of airport – remote – shared by both cases. Even with the differences in distances with their host cities, they are both isolated from large metropolitan areas and situated in the middle of green spaces. Compared with other types of airports, remote airports are closer to other cities (Mainz for Frankfurt and Uppsala for Arlanda) and are given the opportunities to exert their influences further like the case of Copenhagen. However, for businesses, these two airports are in general too far away from the city to be an attractive location for urban developments even though they provide proximity to air traffic. (Güller and Güller, 2003) Therefore, the urban developments around Arlanda are generally residential, amenities and logistics. Relatively, Frankfurt is nearer to the city centre. Also, Frankfurt's status as Europe's largest financial hub with the European Central Bank set up in the city have added attractiveness to Frankfurt Airport. Thus, Fraport has been able to develop a single, large building – the Squaire – for business-related activities. However, with a total floor area of 140 000 sq. m., the Squaire is still far smaller than other examples like Ørestad and Zuidas. As for Arlanda, urban developments have been planned to concentrate at the densely urbanised areas. 40 km from the city, Aranda has been limited to becoming just "a platform for heavy infrastructure". (Güller and Güller, 2003) Thus, the remote location of two airports leaves them without large-scale airport-related urban developments.

Absence of Competitions

The absence of competitions in both cases is another reason for their similar mode of development. From the case studies, both Frankfurt Airport and Arlanda Airport have been developing with priority over other airports, and they have been operating without fierce competitors. In the state of Hesse, there are a total of four airports: Frankfurt, Allendorf, Egelsbach and Kassel. Among the other three airports, Kassel Airport is a relatively larger regional airport with higher number of passengers and aircraft movements. However, Frankfurt remains the only international airport in the region and as mentioned previously, has been prioritised among others. In the case of Arlanda, it was newly developed under the Swedish state planning and proposals to expand its civil airports. It was already planned to become the major airport and replace Bromma Airport as the main hub for international flights. (Sweden 1944 Airport Inquiry, 1946) The two cases are, therefore, regarded as the main ports of their regions. In the meantime, the remoteness of them results in the reliance on transport infrastructures to provide access. To further boost these airports as the main hub of the region, investments of railway infrastructure were observed. Financed by the government, the Arlanda project was Seven given top priority by the infrastructure holder, the National Railway Administration. (Nilsson et al., 2008) Without doubt, the two cases were able to continuously expand to equip them with the sufficient airport and transportation capacity.

From these two cases, we can see that the type of airport is sometimes very crucial to their developments. This category of case studies proved the Güllers' statement that remote airports exert limited impacts on the structure of metropolitan areas. Therefore, even though there are differences in the organisation structures of airports, government planning bodies, distances from cities and scales of airports, the airport-related developments for Frankfurt and Arlanda are already dictated by their remote characteristic. Together with the prioritised status, the mentioned mode of transport-oriented developments is found.

Fig. 69
Table comparison of remote airports

Remote Airport	FRA	ARN
Ownership	Fraport *31.31% State of Hesse* *20.92% Stadtwerke Frankfurt am Main Holding GmbH* *8.44% Deutsche Lufthansa AG* *3.08% ATLAS Infrastructure Partners (UK) Ltd.* *36.25% Others*	Swedavia *100% Swedish Government*
Operator	Fraport	Swedavia
Main Air Carrier	Luthansia	Scandinavian Airlines
Main Planning Body	State Government of Hesse	Government of Sweden
Air transport movements	512,155	120,059
Passengers (million)	69.5	26.8
Transfer %	55	-
International % (incl. Europe)	89	73.8
Cargo (million tonnes)	2.2	-
Other International Airports	/	Bromma Stockholm Airport

8 Conclusion

The three categories: urban, urban periphery and remote airports serve as a framework for comprehending how geographical and socio-political forces behind airport-related developments. Previous sections have discussed unique causes for individual cases, it is then possible to summarise the more important factors for each category. This thesis will now end with comparing the level of impacts each factor has on urban, periphery and remote airports representatively. (Fig. 70)

To start with, the most determining factors for all categories would be the competitions from neighbouring airports. As seen from the case of Orly, the development of an airport is significantly affected by the priority it has over other airports in the same region. Orly Airport, its surrounding urban area and infrastructure experienced a period of time without major growth when CDG was opened. Reorientation was needed for Orly to start growing again. Concluding the six case studies, all the remaining five except Orly have either been on top of the region's priority among other airports or been the sole airport serving the region. Their continuous development can be attributed to the lack of competitions, or the advantageous positions they have in airport competitions. Regardless of their types, competition is a prerequisite to determine the resources and willingness to develop.

Apart from competitions, another important factor is the remoteness of airports. As stated in the beginning of this paper, the type of airports is one of the main themes of analysis. While airport types are served also as a structure for case studies, they are also an important factor influencing how developments are planned. This is proved by comparing remote airports to urban and urban periphery airports. According to chapter 7.3, being a remote airport is the most crucial factor. The more remote an airport is, the less likely for large-scale airport-related urban developments to take place. Yet, remote airport closer to the city like Frankfurt would still be able to establish smaller-scale developments around the airport, keeping "airport city" as one of their planning strategies. In the cases of Frankfurt and Arlanda, developments are dictated by their remote characteristics. There are not significant Durban developments despite being in between two cities.

Developments around urban and urban periphery airports are less influenced by their type. However, in similar contexts of locating between two cities, these airports could gain huge advantage for more elaborate urban and infrastructural growth. This can be seen in the case of Copenhagen Airport. Located in between Copenhagen and Malmö, extensive urban growth and large-scale infrastructure are witnessed in the region. Situating in between two cities is proved as a dominate factor for urban and urban periphery airports. Meanwhile, other factors are equally important for urban and periphery airports: stakeholders, national planning strategies, land availability for manoeuvre and other external factors such as being a host city of the Olympics.

Reflecting on the research question on whether the type of airports is the most crucial factor for airport-related development, findings conclude that it is indeed valid for remote airports. For other cases, situating in between two cities is as well a determining factor, followed by other factors like the presence of competition, stakeholders and planning strategies. Nonetheless, throughout the whole paper, time has been the most powerful player because all the abovementioned factors change over time. More importantly, it should not be forgotten that the categorisation of airports is based on a moment in time when the maps were drawn. Airports and cities are never static and thus the classifications of airport type should not be seen as a fact, but a temporary outcome subject to change. (Kasarda, 2008) Therefore, it is possible for all kinds of factors to influence plannings and developments decisions throughout the lifetime of an airport.

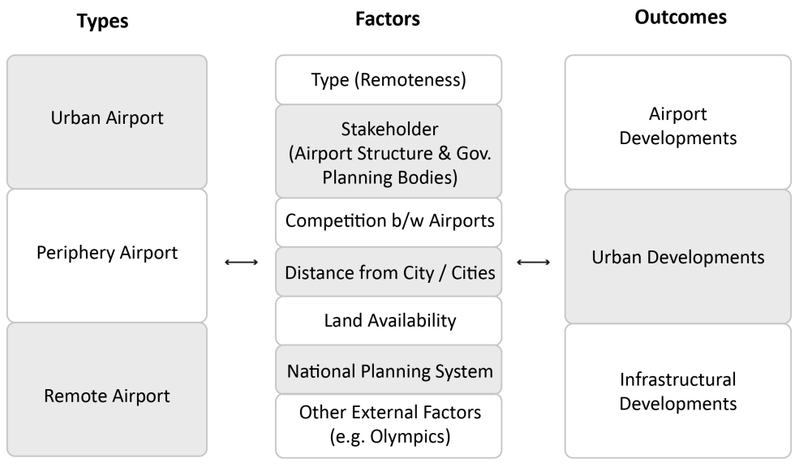


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Fig. 2 Airports of Europe. Airports of Europe map. (n.d.). Retrieved April 20, 2023, from https://www.mapmania.org/map/108620/airports_of_europe_map

Fig. 3 The Comet, world's first jet airliner. Singh, S. (2021, April 22). *How the de Havilland Comet kickstarted the jet age*. Simple Flying. Retrieved April 20, 2023, from https://simpleflying.com/how-the-de-havilland-comet-kickstarted-the-jet-age/

Fig. 4 Airport-centred urban development concepts. Gollain, V. (2022, February 21). *Le marketing territorial des places Aéroportuaires*. Marketing Territorial. Retrieved April 19, 2023, from https://www.marketing-territorial.org/2016/09/le-marketing-territorial-des-places-aeroportuaires.html

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Fig. 6 Aerial photo, Paris Orly Airport. Verguet, W. (2019). *Aviation Photo #5740249: N/A -*. Airliners.net. Retrieved April 19, 2023, from https://www.airliners.net/photo/-/-/5740249

Fig. 7 Aerial photo, Copenhagen Airport. Airlive. (2020, March 18). *Two runways of Copenhagen Airport to be converted as aircraft parking zones*. AIRLIVE. Retrieved April 19, 2023, from https://airlive.net/news/2020/03/19/two-runways-of-copenhagen-airport-to-be-converted-as-aircraft-parking-zones/

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Fig. 9 Aerial photo, London Heathrow Airport. Aboveallimages. (2012, September 6). *Aerial Photography Gallery: Above all images: Aerial, aerial photography, aerial photograph*. Pinterest. Retrieved April 19, 2023, from https://www.pinterest.co.uk/pin/546272629770726552/

Fig. 10 Aerial photo, Frankfurt Airport. Gottschalk, M. (n.d.). *Germany, Hesse, Frankfurt am main, aerial view of Frankfurt...* Getty Images. Retrieved April 19, 2023, from https://www.gettyimages.com.au/detail/photo/frankfurt-airport-aerial-view-royalty-free-image/479209473

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Fig. 18 Orly South Terminal, 1961. Histoire, F. (2020, June 26). *En 1961 Orly était la "merveilleuse antichambre de la France"*. LEFIGARO. Retrieved April 20, 2023, from https://www.lefigaro.fr/histoire/archives/quand-orly-etait-la-merveilleuse-antichambre-de-la-france-20200625?noheader

Fig. 19 Boulevard Périphérique, 1974. UZAN, G. (1974, September 23). *Blocage du Boulevard Périphérique lors d'une manifestation de...* Getty Images. Retrieved April 20, 2023, from https://www.gettyimages.nl/detail/nieuwsfoto%27s/blocage-du-boulevard-p%C3%A9riph%C3%A9rique-lors-dune-manifestation-nieuwsfotos/967719816

Fig. 20 Paris in 20 years, 1967. Loup, C. (2017, September 16). *Paris dans 20 ans / paris match / 1967*. PICTURBAN. Retrieved April 20, 2023, from https://loupcalosci.com/paris-dans-20-ans-paris-match-1967/

Fig. 21 Orlyval. CCI Business. (n.d.). *Ile-de-France Mobilités Ouverte aux propositions pour l'avenir d'orlyval*. Ile-de-France mobilités ouverte aux propositions pour l'avenir d'Orlyval | Transport. Retrieved April 20, 2023, from https://grandparis.ccibusiness.fr/transport/ile-de-france-mobilites-ouverte-aux-propositions-pour-lavenir-dorlyval

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Fig. 23 Render of Grand Paris Express Metro, 2020. Chokier, S. de. (2020, October 6). *Alstom dévoile Les Futur Rames de Métro pour les lignes 15, 16 et 17 du Grand Paris Express*. Actu Train. Retrieved April 20, 2023, from https://actutrain.com/france/alstom-devoile-les-futur-rames-de-metro-pour-les-lignes-15-16-et-17-du-grand-paris-express/

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Fig. 25 Mapping urban airport – Copenhagen Airport, 1985. Own Illustration.

Fig. 26 Mapping urban airport – Copenhagen Airport, 2023. Own Illustration.

Fig. 27 Aeiral view of Copenhagen Airport, 1931. Unknown. (1931, April 28). *Kastrup Lufthavn*. kbhbilleder.dk. Retrieved April 20, 2023, from https://kbhbilleder.dk/kbh-museum/23908

Fig. 28 Finger Plan, 1947. Heward, J. (2019, September 4). *The finger plan at 70* . danish architecture and design review. Retrieved April 20, 2023, from http://danishdesignreview.com/kbhnotes/2017/9/3/the-finger-plan-at-70

Fig. 29 Amager poster for advertisement, 1948. Jans, L. (n.d.). *Amager*. Amager - Lis Jans. Retrieved April 20, 2023, from https://www.

danskplakatkunst.dk/plakater/alle-plakater/amager

Fig. 30 Øresund Fixed Road and Rail Link. Popa, B. (2012, January 8). *Oresund Bridge – half-tunnel, half-bridge and a bonus artificial island*. autoevolution. Retrieved April 20, 2023, from https://www.autoevolution.com/news/oresund-bridge-half-tunnel-half-bridge-and-a-bonus-artificial-island-41655.html

Fig. 31 Aeiral view of Ørestad New Town. *Tourism moves: ørestad*. Ørestad Innovation City Copenhagen. (n.d.). Retrieved April 20, 2023, from https://oicc.dk/tourism-moves-restad

Fig. 32 Mapping urban periphery airport – Amsterdam Schiphol Airport, 1961. Own Illustration.

Fig. 33 Mapping urban periphery airport – Amsterdam Schiphol Airport, 1997. Own Illustration.

Fig. 34 Mapping urban periphery airport – Amsterdam Schiphol Airport, 2023. Own Illustration.

Fig. 35 Aerial view of Schiphol Airport, 1946. Amsterdam City Archives. (n.d.). *Archive of Amsterdam Schiphol Airport: photos and films*. Inventarissen. Retrieved April 20, 2023, from https://archief.amsterdam/inventarissen/details/30470/path/2.1.1

Fig. 36 General Expansion Plan of Amsterdam, 1934. Eesteren, C. van, & Lohuizen, T. K. van. (2012, November 7). *Algemeen UITBREIDINGSPLAN Amsterdam | general expansion plan for Amsterdam*. Flickr. Retrieved April 20, 2023, from https://www.flickr.com/photos/nai_collection/8157209840/in/photostream/

Fig. 37 Runways of Schiphol Airport. Schiphol. (n.d.). *Flight paths and runway use*. Schiphol. Retrieved April 20, 2023, from https://www.schiphol.nl/en/schiphol-as-a-neighbour/page/flight-paths-and-runway-use/

Fig. 38 Construction of Schiphol Tunnel, 1966. Ministerie van Infrastructuur en Waterstaat. (2023, March 10). *Schipholtunnel (A4)*. Rijkswaterstaat. Retrieved April 20, 2023, from https://www.rijkswaterstaat.nl/wegen/wegenoverzicht/a4/schipholtunnel-a4#&gid=1&pid=5

Fig. 39 Aerial view of Zuidas Development. Biezen, B. van de. (n.d.). *Stock aerial footage*. OverflightStock. Retrieved April 20, 2023, from https://www.overflightstock.com/

Fig. 40 Aerial view of the Fifth Runway. Schiphol Group. (2001). *Schiphol Group annual report 2001*. Schiphol Group's Annual Report. Retrieved April 20, 2023, from https://www.schiphol.nl/en/schiphol-group/page/archive-annual-reports/

Fig. 41 National Spatial Structures: Economy, infrastructure, urbanisation. Vink, B., & van der Burg, A. (2006). New Dutch Spatial Planning Policy creates space for development. *DisP - The Planning Review*, *42*(164), 41–49. https://doi.org/10.1080/02513625.2006.10556946

Fig. 42 Mapping urban periphery airport – London Heathrow Airport, 1960. Own Illustration.

Fig. 43 Mapping urban periphery airport – London Heathrow Airport, 1980. Own Illustration.

Fig. 44 Mapping urban periphery airport – London Heathrow Airport, 2023. Own Illustration.

Fig. 45 Aeiral view of Heathrow Airfield, 1955. NUKELIES. (2011, November 27). *In Plane Sight : Heathrow Star of David / Baphomet*. Retrieved April 20, 2023, from https://big-lies.org/NUKE-LIES/www.nukelies.com/forum/heathrow-airport-star-david-baphomet.html

Fig. 46 Greater London Plan, 1944. MINISTRY OF WORKS OFFICIAL COLLECTION. (n.d.). *Post war planning and Reconstruction in Britain: Professor Abercrombie's Greater London Plan 1944*. Imperial War Museums. Retrieved April 20, 2023, from https://www.iwm.org.uk/collections/item/object/205132880

Fig. 47 Heathrow Terminal 4 Underground Station. Bowroaduk. (2010, May 30). *Heathrow Terminal 4 underground station*. Flickr. Retrieved April 20, 2023, from https://www.flickr.com/photos/24772733@N05/4654409914

Fig. 48 Ringways of London. Webster, L. (2021, October 25). *The roads that could've made your journey easier*. Freeway Insurance. Retrieved April 20, 2023, from https://www.freewayinsurance.co.uk/2020/10/06/the-roads-that-couldve-made-your-journey-easier/

Fig. 49 Heathrow Airport, Terminal 5, 2009. Jorda, I. (2009). *British airwaysboeing 747 400london - Heathrow Airport*. London Heathrow Terminal 5 - Large Preview - AirTeamImages.com. Retrieved April 20, 2023, from https://www.airteamimages.com/boeing-747__british-airways_90388_large.html

Fig. 50 Hayes Bypass, 1992. Chapman , P. (1992). *Hayes Bypass (A312) just prior to... © Pete Chapman CC-BY-SA/2.0*. Hayes Bypass (A312) just prior to... © Pete Chapman cc-by-sa/2.0 :: Geograph Britain and Ireland. Retrieved April 20, 2023, from https://www.geograph.org.uk/photo/40562

Fig. 51 Heathrow Express. Micklethwaite, J. (2016, May 31). *Heathrow Express fares increase*. Evening Standard. Retrieved April 20, 2023, from https://www.standard.co.uk/news/london/heathrow-express-fares-increase-a3259831.html

Fig. 52 Mapping remote airport – Frankfurt Airport, 1956. Own Illustration.

Fig. 53 Mapping remote airport – Frankfurt Airport, 2023. Own Illustration.

Fig. 54 Frankfurt-Rebstock Airport, 1931. *Historische Bilddokumente*. Historische Bilddokumente : Erweiterte Suche : LAGIS Hessen. (n.d.). Retrieved April 20, 2023, from https://www.lagis-hessen.de/de/subjects/xsrec/id/164-005/current/2/mode/grid/setmode/grid/sn/bd?q=YToxOntzOjU6InNhY2hlIjtzOjEzOiJMdW

Fig. 55 Rhein-Main Air Base. *Nice to meet you.* Gateway Gardens. (n.d.). Retrieved April 20, 2023, from https://www.gateway-gardens.com/en/

Fig. 56 Frankfurt Airport, Runway 18 West, 2003. NASA. (2022, December 27). *Runway 18 west*. Wikipedia. Retrieved April 20, 2023, from https://en.wikipedia.org/wiki/Runway_18_West#/media/File:Frankfurt_intl_airport_(nasa).jpg

Fig. 57 Protest against new runway, 1980. Reinle, D. (2020, July 21). *Stichtag - 22. Juli 1980: Bau der startbahn west in Frankfurt am main angeordnet*. WDR. Retrieved April 20, 2023, from https://www1.wdr.de/stichtag/stichtag-startbahn-west-frankfurt-am-main-100.html

Fig. 58 Frankfurt Airport Long-distance Station. Thundiyil, P. T. (2017). *Frankfurt am Main Editorial Photo. image of autobahn - 92863226*. Dreamstime. Retrieved April 20, 2023, from https://www.dreamstime.com/editorial-photo-frankfurt-main-germany-march-landmark-airport-city-airport-long-distance-train-station-image92863226

Fig. 59 Aerial render of Gateway Gardens. *Nice to meet you.* Gateway Gardens. (n.d.). Retrieved April 20, 2023, from https://www.gateway-gardens.com/en/

Fig. 60 E4 motorway passing through Arlanda. Phillips, P. (2012). *Stockholm Arlanda Airport, Långtidsparkering*. Mynewsdesk. Retrieved April 20, 2023, from https://www.mynewsdesk.com/se/swedavia/images/stockholm-arlanda-airport-laangtidsparkering-170776

Fig. 61 Mapping remote airport – Stockholm Arlanda Airport, 1981. Own Illustration.

Fig. 62 Mapping remote airport – Stockholm Arlanda Airport, 2023. Own Illustration.

Fig. 63 Aerial view of Bromma Airport. Wu, Y.-C. T. (2017). *Aviation Photo #4436347: N/A* -. Airliners.net. Retrieved April 20, 2023, from https://www.airliners.net/photo/-/-/4436347?qsp=eJwljDEOwkAMBP%2BydRpAorgOeAAUfMDyWUmkgE%2B2C6Iof8cc3WhGmg2s75BPPNcmKHAh4wkDGhm9HGVDmzT0RiGj2opyHOBqcU1ETXthlhZS8fd3q2K%2FJM59M%2Bb2kCD26IzTOX2dvS3UHxI0L9j3Lw36Lnk%3D

Fig. 64 E4 motorway passing through Arlanda. Swedevia. (n.d.). *Stockholm Arlanda Airport, Långtidsparkering*. Mynewsdesk. Retrieved April 20, 2023, from https://www.mynewsdesk.com/se/swedavia/images/stockholm-arlanda-airport-laangtidsparkering-170776

Fig. 65 Arlanda Express. Føns, K., & Skrevet af Kristoffer Føns Her på Rejsekris.dk skriver jeg om mine egne rejser og udarbejder samtidig rejseguides til bl.a. seværdigheder. (2022, October 19). *Transport fra Arlanda lufthavn til Stockholm Centrum - Guide*. Rejsekris. Retrieved April 20, 2023, from https://rejsekris.dk/transport-fra-arlanda-lufthavn-til-stockholm

Fig. 66 Airport City Stockholm Urban Design Strategy Proposal. Furuto, A. (2013, May 14). *Airport City Stockholm Urban Design Strategy Proposal / Spacescape*. ArchDaily. Retrieved April 20, 2023, from https://www.archdaily.com/371822/airport-city-stockholm-urban-design-strategy-proposal-spacescape?ad_medium=gallery

Fig. 67 Table comparison of urban airports. Own illustration.

Fig. 68 Table comparison of urban periphery airports. Own illustration.

Fig. 69 Table comparison of remote airports. Own illustration.

Fig. 70 Airport types, factors and outcomes. Own illustration.

References

Ball, P. (2022, February 24). *The revolution that built the streets of Paris*. BBC Future. Retrieved April 7, 2023, from https://www.bbc.com/future/article/20130722-revolution-in-paris-street-design

Bontje, M. A., & Sleutjes, B. W. H. (2007). *Amsterdam: History meets modernity. Pathways to creative and knowledge-based regions.* (ACRE wp; No. 2.1). A'dam inst. for Metro. & intern. develop. Studies.

Bosma, K. (Ed.). (2013). *Megastructure schiphol: Design in spectacular simplicity*. Nai010 Publishers.

Boucsein, B., Christiaanse, K., Kasioumi, E., Salewski, C., & Michaeli, M. (2018). *The noise landscape: A spatial exploration of airports and cities*. Nai010 uitgevers/publishers.

Edwards, B. (2000). *The Modern Terminal: New approaches to airport architecture*. E. & F.N. Spon.

Groupe ADP. (2019). Traffic at Paris Aéroport up by 3.8% in 2018, at 105.3 million passengers. *Press Release*. Retrieved April 9, 2023, from https://www.parisaeroport.fr/docs/default-source/groupe-fichiers/finance/relations-investisseurs/trafic/2018/15-january-2019-groupe-adp-december-2018-traffic-figures.pdf?sfvrsn=c9f8f4bd_2.

Güller and Güller. (2003). *From airport to airport city*. G. Gili.

Heeres, N., Tillema, T., & Arts, J. (2012). Integration in Dutch planning of motorways: From "line" towards "area-oriented" approaches. *Transport Policy*, *24*, 148–158. https://doi.org/10.1016/j.tranpol.2012.08.002

House of Commons. (1980). *Hansard, Hayes Bypass*. HAYES BYPASS (Hansard, 17 January 1980). Retrieved March 23, 2023, from https://api.parliament.uk/historic-hansard/commons/1980/jan/17/hayes-bypass

House of Commons. (1989). *Heathrow Express railway bill [H.L.]*. Heathrow Express Railway Bill [H.L.] (Hansard, 28 February 1989). Retrieved March 23, 2023, from https://api.parliament.uk/historic-hansard/lords/1989/feb/28/heathrow-express-railway-bill-hl#S5LV0504P0_19890228_HOL_383

Humphreys, I. (1999). Privatisation and commercialisation: Changes in UK airport ownership patterns. *Journal of Transport Geography*, *7*(2). https://doi.org/https://doi.org/10.1016/S0966-6923(98)00038-6

Johansson, I. (1987). *Stor-Stockholms Bebyggelsehistoria: Markpolitik, planering Och byggande under Sju Sekler*. Gidlunds i samarbete med Byggforskningsrådet.

Kasarda, J. (2008). The Evolution of Airport Cities and the Aerotropolis. Airport Cities: The Evolution.

Kasarda, J. D., & Lindsay, G. (2012). *Aerotropolis: The way we'll live next*. Penguin Books.

Kasioumi, E. (2021). *Planning the impossible: Urban Development and Spatial Strategies in the Paris Charles de Gaulle Airport Region*. Birkhäuser.

Knowles, R. D. (2012). Transit Oriented Development in Copenhagen, Denmark: From the finger plan to ørestad. *Journal of Transport Geography*, *22*, 251–261. https://doi.org/10.1016/j.jtrangeo.2012.01.009

Majoor, S. (2014). Ørestad: Copenhagen's Radical New Town project in transition. *Planning Theory & Practice*, *15*(3), 432–438. https://doi.org/10.1080/14649357.2014.935610

Nadin, V., & Stead, D. (2008). European Spatial Planning Systems, social models and learning. *DisP - The Planning Review*, *44*(172), 35–47. https://doi.org/10.1080/02513625.2008.10557001

Nilsson, J.-E., Hultkrantz, L., & Karlström, U. (2008). The Arlanda Airport Rail Link: Lessons Learned from a Swedish construction project. *Review of Network Economics*, *7*(1). https://doi.org/10.2202/1446-9022.1139

Omega Centre. (2014). The Øresund Link Sweden. Retrieved March 27, 2023, from http://www.omegacentre.bartlett.ucl.ac.uk/

SADC. (2018, March 7). *Plots*. SADC. Retrieved March 20, 2023, from https://www.sadc.nl/en/locations/green-park-aalsmeer/plots/

Schiphol Group. (2003). (rep.). *Schiphol Group Annual Report 2003* (p. 13). Schiphol, The Netherlands: Schiphol Group.

Schiphol Group. (2010). (rep.). *Schiphol Group Annual Report 2010* (p. 73). Schiphol, The Netherlands: Schiphol Group.

Shaw, D., Nadin, V., & Westlake, T. (1995). The Compendium of European Spatial Planning Systems. *European Planning Studies*, *3*(3), 390–395. https://doi.org/10.1080/09654319508720313

Spacescape. (2013). *Airport City stockholm*. Spacescape. Retrieved April 11, 2023, from https://www.spacescape.se/project/airport-city-stockholm/

theSquaire. (2022). *The squaire*. The Squaire. Retrieved April 10, 2023, from https://www.thesquaire.com/

Thomas, D., Barrell, D., Faludi, A., Hamnett, S., Hopkins, S., & Minett, J. (1983). *Flexibility and commitment in planning: A Comparative Study Local Planning and development in the Netherlands and England*. Martinus Nijhoff.

Transport for London. (2022, August 23). *Elizabeth line with services into central London from reading, Heathrow, and Shenfield from 6 November*. Transport for London. Retrieved March 23, 2023, from https://tfl.gov.uk/info-for/media/press-releases/2022/august/elizabeth-line-with-services-into-central-london-from-reading-heathrow-and-shenfield-from-6-november&lang=en

van der Wouden, R. (2017, July 17). *The spatial transformation of the Netherlands 1988-2015*. International Planning History Society Proceedings. Retrieved March 19, 2023, from https://journals.open.tudelft.nl/iphs/article/view/1788

Vuk, G. (2005). Transport impacts of the Copenhagen Metro. *Journal of Transport Geography*, *13*(3), 223–233. https://doi.org/10.1016/j.jtrangeo.2004.10.005

Wegenwiki. (2023). *A3 (Duitsland)*. Wegenwiki. Retrieved April 10, 2023, from https://www.wegenwiki.nl/A3_(Duitsland)#K%C3%B6ln_-_Frankfurt

Appendix: Timeline of General Airport-related Developments

Name	ITIA Code	Opened	Type (now)	Host city(s)	Size (km2)	1910s	1914-1919	1920s	1930s	1939-1945	1940s	1950s	1960s	1970s	1980s	1990s	2000s	2010s	2020s
General Urban Transportation							WW1			WW2		1958 Jet Engine developed					2008 A380 in service		
Paris Orly Airport	ORY	23 May 1909	Urban	Paris - 13km	15.3	1824 **N7 motorway, connected to Orly** 1909 Airfield for military purposes			1932 Opened to public, commercial operations started Secondary airport to Le Bourget Airport	Occupied by Germay Suffered much bomb damage 1945 Groupe ADP founded	Post-war Rebuilt by US Air Force 1947 Third runway built (2100m)	1952 Air France transferred from Le Bourget 1954 Code d'Urbanisme	1961 New South terminal inaugurated Mid 1960s **Construction of CDG began** 1966 Constructed fourth runway	1970 **Opening of Boulevard Peripherique** 1971 West terminal opened (last major act in Orly's development, layout remained unchanged since) 1974 **Opening of CDG**	1987 **High-tech business park built next to CDG** **Cargo City**	1991 **Rapid transit train system (Orlyval) built between airport and Paris Metro** (passengers b/w terminals) 1993 New hall opened to handle wide-body aircraft		2013 **Tramway link to paris metro line 7,** connecting business zone 2013 **Coeur d orly (business park, 1.3km2)**	2024 **Grand Paris Express**
Amsterdam Schiphol Airport	AMS	16 Sep 1916	Peripher y	Amsterdam	27.87		First military aircraft landed on 19 Sep 1916 First complaints from locals: armed forces personnel (young men have eye on local girls)	1923 Worked as civilian airport, Dutch Air Force left No paved runways, aircraft became heavier due to groundwater 1926 Documents signed, airport owned changed from Ministry of War to Amsterdam municipality 1928 Olympic Games Field & roads improved Concrete platform, first terminal, air traffic control tower built	1934 Amsterdam Expansion Plan - architect & urban planner Cornelis van Eesteren with De Stijl founder Theo van Doesburg (they met in Bauhaus) Cornelis was chairman of CIAM, devised the Plan, implemented only after WW2	10 May 1940 Bombed by the German air force 15 May 1940 Dutch capitulation, Germans repaired damage 1943 70 German military aircraft stationed Repeatedly bombed 8 Jul 1945 Rebuilt, first plane landed		1950 Air traffic control tower opened 1955 Day-trip tourism as main revenue sources 1957 First tax-free shops opened 1958 Jet engine developed New concrete runway (3300m) added	1961 Government approval to build a new Schiphol 1963-1967 New terminal building constructed 1966-67 **Opening of Schiphol Tunnel - diverted Rijksweg 4 (A4 motorway), Badhoevedorp junction**	1975 Opening of new terminal building, twice the size, replaced old one New pier 1978 **Schiphol linked by NS**	1981 Direct rail link Amsterdam-Leiden-The Hague-Rotterdam completed 1988 **"Forth National Policy Document on Spatial Planning"** Zuidas as key project 1989 **"Masterplan Schiphol 2003"** Large scale expansion in 15 years	1991 New air traffic control tower in use 1992 Complete integration of NS with terminal 1995 **Opening of Schiphol Plaza** 1997 **"Masterplan Schiphol 2015"** Airport City concept City that never sleeps Facilities: shops, restaurants, hotels, banks, library, museum, casino	2003 Fifth runway opened (constructed in 2000) **"Masterplan Schiphol 2020"** Strenghten "Airport corridor" 2009 **Schiphol connected by high-speed HSL rail (Antwerp, Brussels, Paris)**	**Schiphol Trade Park (3.5 km2)**	
Copenhagen Airport	CPH	20 Apr 1925	Urban	Kastrup - 8km Malmo - 24km	11.8			1925 Opened as one of the first civil airports in world Wooden barrack as main terminal building	1936-1939 New airport terminal built	Closed for civil services except for periodic flights Unscathed during the war	Post-war: most modern international airport in Europe as it was untouched 1947 **Five Finger Plan** 1948 3rd largest in Europe, continued rapid growth	1950s Start construction of E47	1960 Terminal 2 opened 1969 Large expansion: 3600m runway, new control tower, terminal extensions built	1972 Passenger 8 million, continued growth, but not expanded further 1973 Third runway opened	1980-1982 Decision of expanding CPH, instead of building another airport in Saltholm island 1984 **Marine link to Malmo** (closed in 2000 due to opening of Oresund Bridge)	1992 **Ørestad New Town (3.1 km2)** 1998 Third terminal added	2000 **Opening of the Oresund Bridge connecting Malmo (motorway & train)** **E20** 2007 **Metro station opened** (connects airport to Copenhagen Metro)	2015 Terminal 1 closed	2023 Public consultation on redevelopment (airport, North of airport, infrastructure)
London Heathrow Airport	LHR	1929	Peripher y	London	12.27			1929 Farmland was bought	1930 Private airport to assemble and test aircraft 1 grass runway & some buildings	1944 **Greater London Plan** Early schemes for the Ringway plan Land requisitioned to build RAF Heston Construction of runways	1 Jan 1946 Handed to Air Ministry as new civil airport Officially opens 1947 **Town and Country Planning Act**	1951 British architect designed permenent buildings Central area with vehicular subway, control tower, passenger terminal (Terminal 2), office block 1955 Central Terminal Area & Control Tower opened	Longest runway extended 1960s **The Ringway Scheme planning started** 1961 Old terminal closed Terminal 2, 3 operated 1965 **Britissh Airports Authority established (before Heathrow Airport Holdings)** 1969 Terminal 1 opened **Widening of A312 to dual carriage way, became The Parkway, by Greater London Council**	1975 **First Ringway opened (M25 connecting airport on west side)** 1977 **London Underground link opened, opening of Heathrow Central Station (Stations now: one for T2&3, one for T4, one for T5)**	1985 **Heathrow Airport Holdings founded** 1986 Terminal 4 opened (**with new underground station - extension of Piccadilly Line**)	1992 **Opening of the Hayes Bypass (part of The Parkway / A312), direct link between AA40 Western Avenue and M4 motorway (which leads to Heathrow), Greater London Council as highways authority, also supported by local councils (Hounslow, Hillingdon, Ealing)** 1997 Terminal 5 public planning inquiry ended (longest in UK history) 1998 **Heathrow Express rail service launched (15min to London Paddington)**	2007 New air traffic control tower operated (tallest in UK) 2008 Terminal 5 opened 2009 Terminal 4 underwent major refurbishment	2010 Terminal 2 demolished, £1 billion replacement 2011 **Extension of Piccadilly Line to Terminal 5** 2012?? Plans to increase airport capacity in **South East England** 4 Jun 2014 New Terminal 2 opened 2015 Terminal 1 closed (to be demolished and make space for 2nd phase of T2, predicted in 2024)	2022 **Elizabeth line Heathrow - London - Canary Wharf** Current In progress... The London Plan 2021 ƒ [Policy T8 Aviation]
Frankfurt Airport	FRA	8 Jul 1936	Remote	Frankfurt Mainz	21	1910 Construction commenced in Bockenheim (western Frankfurt) 1912 Rebstock Airship Station opened Later became Frankfurt-Rebstock Airport		Post war Expansion 1924 Demand outgrew facility Study found further expansion were limited	1933 Nazi Party seized power Revived plans to construct new airport facility (southwest to city) 1936 Airport at current location opened	German Air Force took control Foreign carriers withdrawn 1944 Destoryed by allied airstrikes 1945 US forced built temporary runway after Germany surrendered 1948 Key departure point for allied aircraft during Berlin Airlift		Considerable growth as restrictions on German air passengers lifted 1957 "Jet Age" Northern runway extended to 3900m 1958 New terminal constructed	1964 Southern runway extended to 3750m	1972 Another new terminal opened	**1984** **Third runway (runway 18) opened despite opposition, southern, 4000m length, paved with concr**ete (previous paved with asphalt) **Violent confrontations by environmental groups and local citizens [FRA 01]**	1994 New terminal (terminal 2) opened 1999 **New high-speed Frankfurt Cologne line**, opening of second station		2011 Fourth runway opened (nothern, concrete, 2800m)	
Stockholm Arlanda Airport	ARN	1 Apr 1962	Remote	Stockholm Uppsala	30					1945 **Master Plan "The Future Stockholm": - suburbs centered around an underground station**	1946 Airport project aggreed by Parliament Air traffic flies out of Bromma Stockholm at that time	1952 Construction began Simple concrete runway was built (Halmsjon Runway) (later converted to taxiway of runway 2 1954 First official flight 1959 Runway 1 (main) opened	1960 Opened to international air traffic 1962 Official opening	**1976** **Arlanda International Terminal (now T5) opened**	**1983** **Domestic Terminal 1 (now T4) opened**	**1990** **Domestic Terminal 2 (now T2) opened** 1998 Runway 3 construction started (economy recovered) New air traffic control tower, fire station, new pier for T5 1999 **High-speed train Arlanda Express begins service** (b/w Stockholm Central Station and Stockholm Arlanda)	2001 New air traffic control tower built (opened in 2002) 2002 New pier in T5 built & opened **2003** **Third runway built** 2006 Cargo City inaugurated	**2015** **Long-term development plan launched (next 30 years SEK 13 billion invested)** **Airport City Stockholm (by SPACESCAPE)**	

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