

Factsheet Denmark



The Great Belt East Bridge. The final missing link between the Danish islands opened to traffic in 1998. The motorway bridge is part of the fixed link between Zealand and Funen. This crowned a century's efforts to connect the Danish islands with the European continent. The 6,790 metre long suspension bridge with 67 metre clearance has a span of 1,624 metres. Photo: Dissing+Weitling.

JANUARY 2008

INFRASTRUCTURE

Denmark's main transport infrastructure consists of two networks and a number of important terminals and gateways. Each network includes general and subsidiary transport links and both roads and railways form key axes within the country's transport systems. One general network consists of the main highways, approx. 900 kilometres of which form the key axes. The other network is the rail network whose main axes extend for approx. 800 kilometres. The two main networks each form a Big H and they virtually overlap. The Big H forms Denmark's main structure. Copenhagen Airport is the main terminal and a hub of European significance. The largest transport ports are Copenhagen, Fredericia, Århus and Esbjerg, but none of the Danish ports is of European significance. In addition to Copenhagen Airports and the largest ports, a number of gateways are important access entrances to the country. Land

transport has gateways at Padborg (to Germany) and Copenhagen (to Sweden) and sea transport at Frederikshavn, Hirtshals, Esbjerg, Rødby and Elsinore.

The total road network in Denmark extends for approx. 96,000 kilometres. Together with a number of other highways, the 900 kilometres of motorway of the main axis form a network between all major towns and gateways with a total length of approx. 3,800 kilometres. In addition, there are roads of regional or local significance and an extensive road network within the individual urban areas. The main railways are supplemented with a secondary network establishing rail links to many of the country's towns as well as the international gateways. In addition, Greater Copenhagen has a well-developed local commuter train system. The total rail network is approx. 2,600 kilometres long. Denmark has 124 ports in total. Some of these are international

goods transport hubs, others are fishing centres and yet others handle national and foreign ferry transport. The Danish air transport hierarchy is dominated by a strong main centre in Copenhagen. In addition, eight smaller airports have regular services. These are mostly to Copenhagen, but one airport, Billund, has developed a regional route network to European cities.

Denmark's urban system includes one international metropolis – Greater Copenhagen – which with 1.8 million inhabitants is one of the dynamos on the European continent. The city is a network hub, an international service centre, a university city and Denmark's capital. Greater Copenhagen is also part of a border-crossing integration project with the centres Malmö and Lund in Southern Sweden. This project was energised by the opening of the bridge between Denmark and Sweden to traffic in 2000. It will lift the

Limfjord Bridge 1879. North Jutland is the second-largest island in Denmark, separated from the Jutland peninsula by the narrow sound Limfjorden. The 403 metre long railway bridge was the first lattice girder bridge in Denmark with a pivoting centre section, built where the sound is narrowest near Aalborg, the fourth-largest city in Denmark. In 1933, it was supplemented with a road bridge and in 1971 with a motorway tunnel. Photo: The Danish Railway Museum.



Structural map of Denmark 2007. Two major urban areas and other cities are circled. The main infrastructure axes are indicated and peripheral areas are shown with dotted lines. Ministry for the Environment: "National Planning Report 2007".

Denmark's highway network, 1862. Tom Rallis: "Transport i Danmark". Nyt Nordisk Forlag 1992.



Southern Scandinavian urban region to an even higher level within the European urban system. No other Danish city reaches the sub-metropolitan level of large European urban units, but four cities play a role as regional centres alongside Greater Copenhagen: Århus, the triangle area (Vejle, Kolding and Fredericia), Odense and Aalborg. The regional centres each have 150,000-300,000 inhabitants. The next level of the urban hierarchy includes urban regions with 30,000-150,000 inhabitants. There are eight of those: Esbjerg-Ribe, Herning-Ikast-Holstebro-Struer, Sønderborg-Åbenrå, Randers, Horsens, Silkeborg, Næstved and Viborg. The rest of the country is dominated by small

towns and rural districts, including peripheral areas, a medium-sized island (Bornholm), small islands (Ærø, Samsø, Læsø, Fanø) and very small populated islands (approx. 75). To the picture of the Danish urban system should be added that the band of East Jutland towns from Århus to the triangle area aims to create a joint city region, which can play a more significant European role.

Denmark is a small, prosperous country which aspires to develop its infrastructure to a high level. People have to be able to get from A to B quickly, effectively, comfortably, safely and cheaply. The country has to be cohesive, with the rail network and main roads forming an overall structure. The urban regions have to function well – also during the rush hour – and congestion therefore has to be reduced to an acceptable level. However, Denmark is geographically located where land and marine transport networks intersect and where important trade routes between the European continent and the Nordic countries are concentrated. This

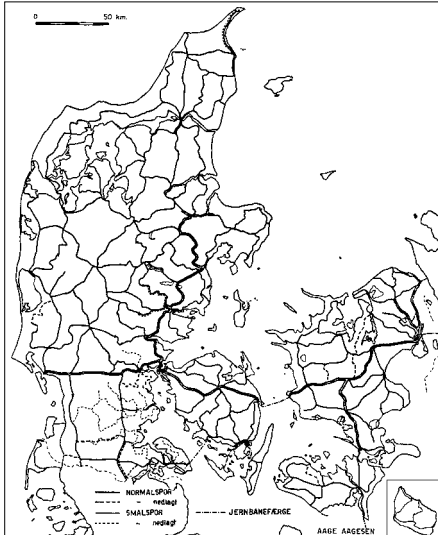
location is a challenge because transit transport is a burden on the environment, but also offers an opportunity for development and growth, because the transport network hubs are excellent location points.

Development through a millennium

Denmark's infrastructure has developed to its current stage on the basis of the gradual change of the transport routes as the settlement pattern changed and as a result of technological advances and economic growth. The current infrastructure is the consequence of a series of economic developments. Before around the year 1000, the country's settlements created a network of villages supplemented with a few towns. They were connected by paths and roads. Some slightly more significant roads followed ridges in the landscape, so that it was not necessary to cross streams or wetlands, and were among other things used for cattle driving. Travelling on the roads was slow and difficult and the roads were not suited to heavy transport. The main transport method was small ships,



Little Belt Bridge 1935. The three sounds connecting the Baltic Sea with the oceans are international passages. The first fixed link between the Jutland peninsula and Funen, the third-largest Danish island, was a combined railway and road bridge. The lattice girder structure is 1,178 metre long with 33 metre clearance. Photo: The Danish Railway Museum.



Railway network in Denmark, 1930, showing its maximum extent. Aage Aagesen: "Geografiske studier over jernbanerne i Danmark". Kulturgeografiske Skrifter 1949.

The **IC 4** is the most recent train on the Danish railways. Photo: Danish State Railways.



which could be used for slightly larger cargoes or more people, but trade was not particularly important compared with local consumption.

The first centuries of the second millennium introduced social change. Agriculture became increasingly profitable due to improved technology, which in turn boosted trade. In addition, state and church became powerful and able to organise society. The foundation of the Danish town system was established with trade privileges. Most of the current major towns in Denmark go back to the approx. 90 towns established at that time. Until the 18th century, the Danish road network was dominated by small and poor roads between villages and between towns and nearby villages. Gradually, a few roads were developed into links between the towns, but the basic pattern of the road network did not change until the 18th century. Until then, sea transport by small ships between the towns was still the main method of goods transport and almost all Denmark's royal boroughs were ports.

In the 16th century, there was a revolutionary change. After the Reformation in 1536, the state took over the church's secular tasks, which were thereby considerably strengthened. The king wanted and got a large, impressive capital, Copenhagen. This concentrated the international trade which developed at that time due to the European discoveries and the European conquest of large parts of the world, partly as a result of new ship technology (frigates and navigation instruments). Copenhagen became the focus of international and Baltic trade.

Towards the end of the 17th century and especially during the 18th century, sea transport was gradually supplemented with an effective system of highways between the towns. Decisions were made by the Crown and the roads were drawn along a ruler, planned with military precision and built by compulsory peasant labour. Mail routes and mail coaches were established, but the peasants were not allowed to use the Crown roads. The road building period reached its peak in the

mid 19th century, when a fine-meshed network of cobbled main highways, road-side trees, ditches and bridges covered the country. The Danish islands and peninsulas were linked by regular ferry connections. The urban pattern was the same as in the Middle Ages: villages, royal boroughs and the increasingly important capital.

The industrialisation in the second half of the 19th century led to a new type of transport, which soon became dominant. The rail network was developed very quickly and opened up the interior of the country to heavy transport. Industrial companies were established – initially in the ports, but gradually also inland, at the railway hubs. At the same time, royal power was replaced by popular power in 1849 and one of the first acts of democracy was to introduce freedom of trade (1857). This resulted in urban growth outside the old royal boroughs (which used to have trade monopoly) and a significant number of new towns developed. The railway towns were the result of the industrialisation of agriculture, which

Storstrøm Bridge 1937. The fixed link between Denmark's largest island, Zealand, and the fifth-largest, Falster, is an important part of the "direct line" connection between Copenhagen and Hamburg. When it opened to road and railway traffic, it was the longest bridge in Europe. The arched steel girder bridge is 3,199 metres long with 26 metre clearance. Photo: The Danish Railway Museum.



changed from corn-growing to secondary produce, and of the greater wealth of the farmers. There was a demand for agriculture-oriented industry (dairies, abattoirs, machine industry) and the new purchasing power needed an outlet: the railroad towns. Investments in highways declined and they were downgraded by the government, which invested in railways, developing them into the backbone of the transport network. They handled transport between the towns and were supplemented with local transport by horse-drawn carriage in and around the towns. When the rail network reached its peak around 1930, the country had almost 5,000 kilometres of railway. Sea transport between islands and peninsulas and on the oceans still played a part and industrialisation also affected the ports in the old royal boroughs, where industrial companies often chose to establish themselves. Many ports were expanded and modernised.

Cars began to play a significant part in the 1920s and already in the mid 1930s,

vehicle transport overtook the rail transport volume. The highways were again given a higher priority, while investment in railways was reduced. From the 1930s and during the following decades, a state arterial road system between the main towns and with connections to the neighbouring countries gradually became the backbone of the country's infrastructure, while the rail network was reduced to a supplement. Secondary road networks were established, while numerous secondary railway lines were closed. Between 1930 and 1970, the rail network was reduced to less than half of its maximum size. During the same period, bridges and tunnels were built over and under straits and sounds. In this way, the major Danish islands and peninsulas were gradually linked to the mainland and the country's network of railways and roads became increasingly complete. However, the largest national task – the fixed link between Zealand and Funen across the Great Belt – was still far into the future, as were the

fixed links from the Zealand archipelago to Sweden and Germany respectively.

An island country

Vehicle and rail ferries have a long history in Denmark, because Denmark is an island country. Over time, a fine-meshed network of ferry and ship routes developed between the different parts of the country and between the major peninsulas and islands, along with a host of ferries to small and medium-sized islands. The main bottlenecks arose where the distance between islands and mainland was shortest and here the traffic regularly broke down at weekends and during holidays. In the 1920s and 1930s, serious efforts were made to eliminate the bottlenecks and link the transport networks by bridges wherever technology and budgets allowed. The ferries between Lolland and Falster were replaced by a bridge in 1934. This was followed by the large bridges which it took a decade to build. Most of the bridges had to carry both road and railway. The bridge over the Little Belt opened in 1935 and spans 33 metres over an international navigation passage. It connects Jutland and Funen and is 1,100 metres long. In 1937, Zealand and Falster were connected by a 3,200 metre long bridge with navigation clearance of 26 metres. The North Jutland island was linked to the rest of Jutland by the opening of the Limfjord bridges in 1933 and 1943. Als was connected with the mainland in 1930, Mors in 1939, Møn in 1943 and the last of the islands of any size, Langeland, got its bridge connection in 1966. Around 1940, Denmark's overall infrastructure consisted of two separate rail and road networks, one covering Jutland and Funen and another covering



The national missing link. Historically, the belt between the main Danish islands of Zealand and Funen was the bottleneck of the Danish transport system. When the Great Belt traffic peaked in 1997, 16 large ferries provided a train and car shuttle service lasting about an hour. The photo dates from 1955. Photo: Scanpix.



Oddesund Bridge 1938. Limfjorden, the sound separating North Jutland from the Jutland peninsula, is 180 kilometres long. There are fixed links at four narrow points and small car ferry crossings at four other points. The 472 metre long arched bascule bridge carries railway and road. Photo: Unknown.

The public transport network

With very few exceptions, the Danish public road network is a tax-funded public service to the citizens. This implies that the state and municipalities construct the road network, keep the roads navigable and maintain them. Accordingly, the public network is in principle available free to everyone. The overall allocation of tasks is laid down by law and the road network is divided into two administrative levels – state and municipalities – corresponding to just under 100 authorities with the responsibility, and the associated financial burden, of operating their respective parts of the road network. The exceptions are the fixed links across the Great Belt and Øresund, which are covered by separate legislation in the Sund og Bælt Holding A/S Act. Through its subsidiaries Storebælt A/S and Øresund A/S, the limited company Sund og Bælt A/S was responsible for the construction of the Great Belt Link and the Danish land works in connection with the Øresund Link. With a corresponding Swedish company, Øresund A/S was also responsible for the construction of the coast-to-coast part of the Øresund Link. The companies were able to obtain state-guaranteed loans for the two fixed links. The companies are the present and future operators, and the loans will gradually be repaid by the users of the two links. The future fixed link over the Femer Belt will be organised according to the same model.

The railway sector has historically been characterised by significant state involvement in both train operation and track administration. During the 1990s, the Ministry of Transport initiated various major changes in continuation of EU objectives of “revitalising” the railways, partly to introduce the possibility of competition in a formerly monopolised sector and to initiate a clarification of the role and responsibility allocation in the sector. On this background, the responsibility for the administration of the state rail network is today divided between the Directorate of Transport and Banedanmark. Banedanmark is responsible for the actual operation and maintenance of the tracks, while the Directorate of Transport is the planning and safety authority. The other part – the operating activities – consisting of passenger trains and ownership of all terminals, including a negotiated contract with the state about passenger transport operation, is handled by the Danish State Railways (DSB), which is an independent

public company under the Ministry of Transport. DSB is obliged to make stations available to all interested operators against a fee. All costs of operation, maintenance and regular renewal of the state network are managed through the Appropriation Act. The remaining part of the network is owned and operated by the Danish regional transport companies. The metro in Copenhagen is based on separate legislation and is a partnership owned by the state together with the municipalities of Copenhagen and Frederiksberg. The management of the infrastructure has been sub-contracted to the private company Metro Service A/S along with the actual train operation.

The ports are normally publicly owned, as the various municipalities often play a key role in the group owning the port activities. Currently there are only three state-owned ports. As a starting point, the establishment of new ports or expansion of existing ports do not involve the state. The state’s main role is to ensure that the ports are competing on equal terms. Traditionally, there has been free access to operate ferry services in Denmark. Public authorities’ opportunities to subsidise the operation of ferry services are regulated by law and, after a tendering process, public authorities can pay private or corporate public shipping companies to operate ferry services or even give them a monopoly.

Authority regulation of air transport in Denmark is primarily handled by the Civil Aviation Administration, which is an authority under the Ministry of Transport. The authority regulation principally helps to ensure that air transport is a safe method of transport. This is done through comprehensive monitoring of all air transport elements. The Danish state owns approx. a third of the shares in Copenhagen Airports A/S – the rest of the shares are private owned. The state also owns the airport on the island of Bornholm. The regional airports are owned by municipal parties. The airports are to a significant extent run on a commercial basis and operation and investments are partly financed through taxes, which the airports claim from the airlines. In addition, especially Copenhagen Airport earns significant income from the shopping centre and parking fees.

Source: Infrastructure Commission, 2007. Document number 77.

the Zealand archipelago. In addition, a number of small and larger islands were served by ferries. There were also still ferry connections between the parts of the country where the distance to the bridges made it worthwhile, and the transport between the Zealand archipelago and Germany and Sweden respectively continued to occupy many ferries. Finally, there was significant ferry traffic between Jutland and Norway and Sweden respectively.

Roads and vehicles

The explosive growth of car ownership after the end of World War II and the resumed economic growth led to new challenges. The towns developed and changed as the cars proliferated. Only the four largest cities had tram lines and these networks were discontinued in the 1970s. An effective commuter rail network was only established in Greater Copenhagen. The cars resulted in pressure on urban growth almost everywhere and area-

demanding suburbs developed during the 1960s, especially near the cities and large towns. Car ownership also gave industrial companies a much freer choice of location and these too gradually spread to almost all built-up areas of the country. Zone legislation gradually brought the urban development under control and prevented Denmark from becoming an urban sprawl. From 1970, new strong municipalities and new regional governments were able to exercise effective planning for

Munkholm Bridge 1952. The purpose of many small road bridges across bays is to reduce distances. The arched bridge is 114 metres long with 3 metre clearance. Photo: Unknown.



The Big H is the development plan for Denmark's overall infrastructure of railways and motorways. It dates from 1962 and has largely been achieved. The National Survey and Cadastre and the Road Directorate.

The Greater Copenhagen railway network. The diagram covers an area of approx. 100 x 65 kilometres. The network comprises national and regional railways linked to the Danish and European railway networks, commuter trains (S-trains), metro and small, often independently owned, local railways. Danish State Railways.



the localisation of urban development.

Highway transport grew explosively, especially from the mid 1950s, and the network of arterial roads gradually became inadequate. The situation was particularly bad where urban and highway transport shared the same road network and attempts were made to relieve bottlenecks by introducing by-pass roads. In addition, the major bridge building in the 1930s turned out to be under-dimensioned in terms of land transport. Nobody had anticipated the massive growth of road transport and the transport between the different parts of the country again developed bottleneck characteristics. The answer to the problem was to plan a completely new comprehensive motorway system on the German and American model.

The national plan for the development of a nationwide motorway network is called the Big H. The plan was developed over a period of time, but can nonetheless be dated very specifically to 1962. By then, a few isolated motorway stretches had already been built, but now the Danish state began the overall task based on major appropriations. The plan involved creating a motorway network which would form the backbone of the transport system. The western perpendicular line in the H was formed by the connections from the Danish-German border at Padborg through the major towns in East Jutland to Aalborg and then – with a later addition to the plan – to the ferry connections (Hirtshals and Frederikshavn) to Norway and Sweden. The eastern perpendicular line connected the ferry terminal in Rødby (connections to Germany) with the similar Sweden terminal in Elsinore through Greater Copenhagen. The vertical line of the H went from Esbjerg (connections to England) through Odense to Copenhagen and on to Sweden.

The Big H is now complete. This has introduced new fixed links over straits, bays and sounds. The old bridges from the 1930s have been supplemented with



Svendborgsund Bridge 1966. Part of the fixed road link between Denmark's third-largest island, Funen, and the smaller islands Tåsinge, Sjø and Langeland, the concrete box girder bridge is 1,220 metre long with 33 metre clearance. Photo: Preben Eider.

parallel links for road transport only. The Limfjord tunnel was completed in 1969, the bridge over the Little Belt in 1970 and the new link between Zealand and Falster in 1985. With exceptions in the form of the Great Belt link and the extensions from Aalborg to the northern ferry ports, the Big H was completed in 1994.

The national bottleneck

The bottleneck at the Great Belt is a chapter in itself and familiar to all Danes who remember the years before 1998. Even though ten large, modern, state-owned vehicle or railway ferries, the largest with three decks and a capacity of up to 500 cars, and a competing private shipping company with five ferries provided a shuttle service for the one-hour crossing, the capacity was inadequate at peak times. On Friday afternoons and evenings, when goods transport and weekend traffic peaked, people often had to wait for the ferry for eight hours. Building a bridge across the 18 kilometre wide international navigation passage had been discussed since the mid 19th century and many grand projects had been presented. For decades, analyses were carried out and Great Belt solutions were discussed in the Danish Parliament. In 1987, the Great Belt Fixed Link Act was finally passed by Parliament. Using state-guaranteed loans, a state-owned limited company was entrusted with building a 6,611 metre long low bridge (18 metres clear height above sea level) with motorway and double-track railway between Funen and the small half-way island of Sprogø, where road and rail divide for the remaining stretch to Zealand. The railway runs

through a tunnel 8,024 metres long, while the motorway is carried on a fantastic 6,790 metre long suspension bridge (67 metres clear height above sea level) with a free span of 1,624 metres. The low bridge was completed in 1993, the tunnel in 1997 and the suspension bridge opened to traffic in 1998. The days of the Great Belt ferries were over and the Danish traffic networks were without any major bottlenecks. The construction cost was DKK 32

billion (in 2007 prices) and the money will be repaid over 30 years through bridge tolls.

Copenhagen Airport

Greater Copenhagen is a centre where many types of transport interact, allowing the transfer of passengers and goods between air, rail, land and sea transport, and with second-to-none electronic communication. The city is the most important cross-point in Scandinavia. Copen-



Copenhagen Airport is the largest international air transport hub in Northern Europe. Its metropolitan location is unrivalled, six kilometres from the centre of Copenhagen, connected to the bridge between Denmark and Sweden via a tunnel under check-in, on the motorway network and with railway links to Copenhagen Central and Malmö Central and the Danish and Swedish railway networks. Photo: Polfoto.

Little Belt Bridge 1970. The second fixed link between the Jutland peninsula and Denmark's third-largest island, Funen, is a suspension bridge with a six lane motorway, which is part of the east-west motorway connection through Denmark. It relieved the first Little Belt Bridge (page 3) of most of the road traffic. The bridge is 1,700 metre long with 44 metre clearance. Photo: Cees van Roeden.



hagen Airport is one of the main international air transport hubs on the European continent. It is also a hub for all Danish domestic air transport. The airport is not in the same class as Europe's four large "Intercontinental Gateways" (London, Paris, Frankfurt and Amsterdam). It belongs to the next level, "Large International Gateways", a status it shares with hubs such as Milan, Rome, Munich, Madrid and Manchester. The airport services 130 international routes, including 19 intercontinental routes, and nine domestic routes. It is used for both passengers and cargo and is a transfer hub as a result of its geographic location at a natural cross-point for Nordic and European air transport. The largest operator is Scandinavian Airways (SAS). The airport is ideally situated just six kilometres from Copenhagen City and in direct contact with motorway, rail and metro networks. It is also important for the airport's local and regional penetration that the abutment of the fixed link to Sweden is a few hundred metres from check-in.

The Finger Plan

The Finger Plan is Denmark's town planning showcase, because it involves comprehensive concepts. The infrastructure of roads and commuter railways forms the backbone of the Finger Plan, but it covers the overall metropolitan development, i.e. where people will work, live and have their service requirements met. The Finger Plan is historic – presented in 1947 – but its key principles still apply to Denmark's metropolis, Greater Copenhagen.

The plan was developed during World War II by a group of town planners, who realised that Greater Copenhagen, which then had about a million inhabitants, was beginning to spread uncontrollably, rather like an onion growing by the addition of layer upon layer. Public transport – local railways, trams and buses – were in danger of reaching capacity. It was necessary to control the urban growth and develop a citywide network of railways and arterial roads. The concepts behind the Finger Plan came from town planning in Britain, where there was already a tradition of

establishing new Garden Cities. Britain was facing massive development pressure and planned to resolve it by establishing new towns well away from existing cities, but with public transport links to them. Around London, Liverpool, Birmingham, Glasgow and the other large British cities, new towns with 25,000 to 250,000 inhabitants were shooting up. They formed a ring around the old centres at a distance of 30-40 kilometres. They were scientifically planned with good access to open country and with a transport infrastructure separating pedestrians and vehicles and involving road system hierarchies. People were able to live, work and obtain daily services in the new towns, but relied on the nearby major city for less frequent requirements such as culture, high street shopping and business services.

The British New Town planning was the model for the metropolitan planning around Copenhagen, but in a less expensive form. The name Copenhagen means the merchants' harbour and, in that spirit, the planners wanted to avoid expensive road and rail links between new town and city. The new towns were to be developed as tentacles stretching from the outskirts of the city towards the nearest major town. Overall, Greater Copenhagen would form a hand with the existing city as the palm, while the fingers grew around commuter railways and highways. Shops, schools and service organisations were placed around the local stations. Near them, people lived close together in multi-storey blocks, while there was space for one-family houses further away and open country was left between the fingers. Industry was located at the transition between palm and finger and the industrial areas were linked by ring railways and ring motorway.

The ring road around Copenhagen. Photo: The Road Directorate.



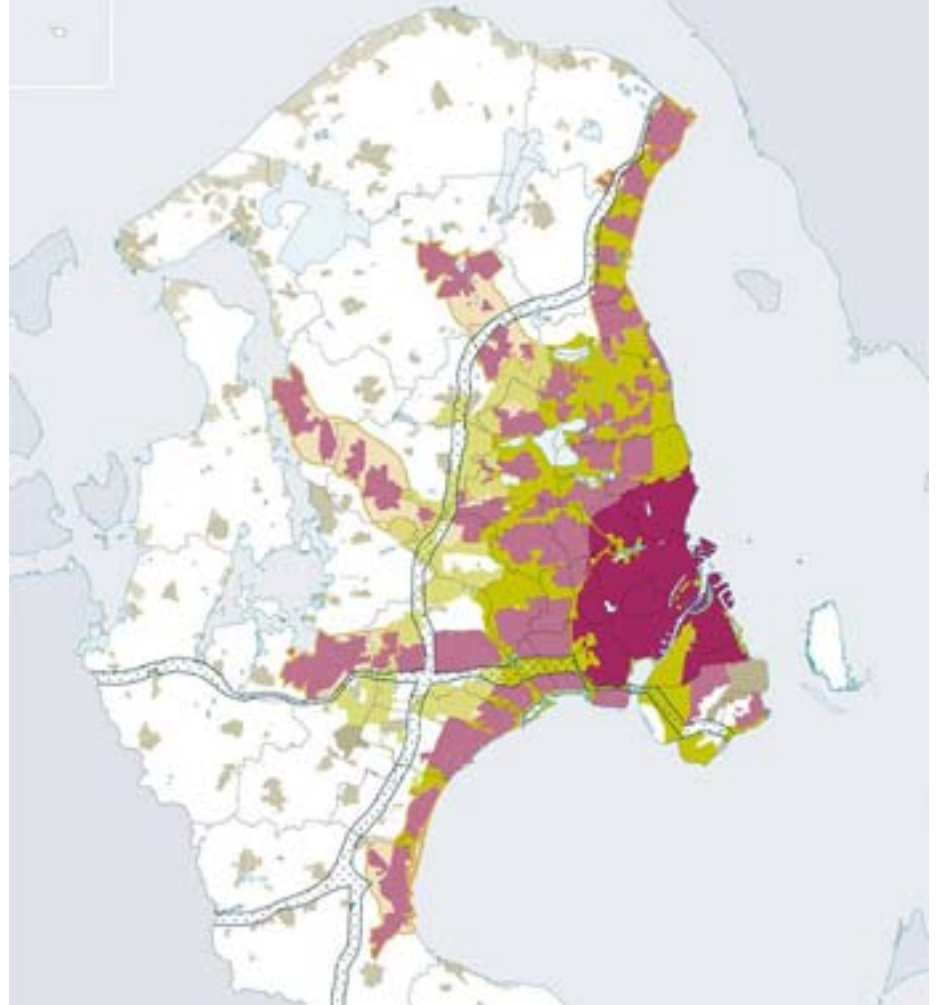


Vejle fjord Bridge 1980. Part of the north-south motorway connection through Jutland, the bridge carries the traffic across Vejle fjord so that it bypasses the town of Vejle. The concrete box girder bridge is 1,712 metre long with 40 metre clearance. Photo: Cees van Roeden.



The Finger Plan for Greater Copenhagen was developed in 1947 and remains the basis of the urban development and structure. In 1947 the city had approx. 1 million inhabitants, now it has 1.8 million. Although the fingers stretch further than originally envisaged, Copenhagen remains a city where built-up areas –“the fingers” – alternate with open country. The Road Directorate.

Finger Plan 2007. The Road Directorate.



The Finger Plan was given legal status in 1949 in the form of urban zone legislation, but its strength was promotional. Everyone understood the intention and the decision-makers were sympathetic towards the overall concept. The Danish State Railways and Road Directorate built the necessary links, local planning controlled the detail of the urban development and the Finger Plan still forms the basis of the development of Greater Copenhagen, which in 2007 has approx. 1.8 million inhabitants. Not everything has gone according to plan. The explosion of private car ownership has resulted in a demand for new urban areas virtually everywhere and, at times, the town planners have been too lenient. The fingers have become fatter than originally intended

and large industrial areas and regional centres have been established in the fingers themselves. Since World War II, the urban development has moreover year by year demanded more land per inhabitant and per workplace, and the fingers are now reaching the nearby large towns. Moreover, urban renewal in the city has removed or modernised the old working class areas from the second half of the 19th century and thus resulted in even greater growth within the metropolitan area. Finally, grandiose plans for explosive growth and almost total decentralisation of the capital's centre functions and workplaces have been presented and agreed. Although these plans have not managed to infringe the overall principle of the Finger Plan, they have led to the develop-

ment of new systems of ring motorways at the outskirts of the city.

Denmark's capital is furnished with a rail network which handles the daily transport of people going to and from work, education or other destinations. Three overall networks together cover the transport tasks: the S-train network, the long-distance railways and the metro. They are supplemented with a number of branch lines. The railways in Greater Copenhagen form a network of approx. 600 kilometres, with 200 stations. Every day approx. 300,000 people travel on the Copenhagen railways. Greater Copenhagen is also covered by a fine-meshed network of bus routes, including two water bus routes, and public transport in the capital is excellent. Altogether, the

Farø Bridge 1985. Part of the second fixed link between Denmark's largest island, Zealand, and the fifth-largest, Falster, the motorway bridge diverts the long distance traffic away from the Storstrøm Bridge (page 4). The cable stay bridge is 1,726 metre long with 26 metre clearance. Photo: John Sommer.



public transport network accounts for approx. 700,000 journeys a day. There is a comprehensive ticket system and public transport is a monopoly managed by a public company, which sub-contracts the individual routes to various operators.

Greater Copenhagen is the only urban region with an actual urban railway. Some stations on the long-distance railways are used for internal transport in other urban regions, but in the remaining Danish cities and many other towns, public transport consists of a fine-meshed network of bus routes. The Danish rural areas are served by regional bus routes, which supplement the national rail network.

The international bottleneck

For many of the 850 years of its history, Copenhagen was a fortress and the capital grew within ramparts. By the 19th century, the fortification was out-of-date and Copenhagen gained growth potential

through the discontinuation of its fortress function and the repeal of the building ban outside the ramparts in 1852. At that time, the capital had approx. 150,000 inhabitants. Since then it has grown inland, along and away from the Øresund coast. In 1992, the Danish and Swedish governments decided to build a fixed link across Øresund. The decision to build the 18 kilometre long link was based on regional-economic considerations. The governments wanted to integrate the Malmö-Lund metropolitan region in Southern Sweden with Greater Copenhagen. They aimed to develop a border regional metropolitan region with 2.5 million inhabitants, where the commercial profile could be specialised on the basis of the total volume, thus strengthening the city in the global competition. The Øresund link also related to international transport and the advantage of developing the Southern Scandinavian metropolis into the most

important cross-point in Northern Europe, with all the associated related activity. In the direction Denmark-Sweden, the fixed link consists of a four kilometre long tunnel under the international navigation passage linking the Atlantic to the Baltic Sea through Øresund, a four kilometre long artificial island and an eight kilometre long suspension bridge. The Danish abutment leads directly to Copenhagen Airport, which is the most important air transport hub in the entire Baltic region. The distance from the abutment to Copenhagen City is six kilometres.

The fixed link to Sweden is in itself a fantastic structure, but also involves a new challenge to the Finger Plan. The growth

Copenhagen Metro is the latest addition to the metropolitan transport system. The first line opened in 2002. There are now three lines and a fourth on the way. Photo: Ørestad Development Corporation.

Person transport in Denmark measured by person kilometres

Means of transport	Million	Per cent
Passenger car	61,198	81.5
Bus and coach	7,301	9.7
Train	6,074	8.1
Domestic flight	308	0.4
Ferry	247	0.3
Total	75,128	100.0

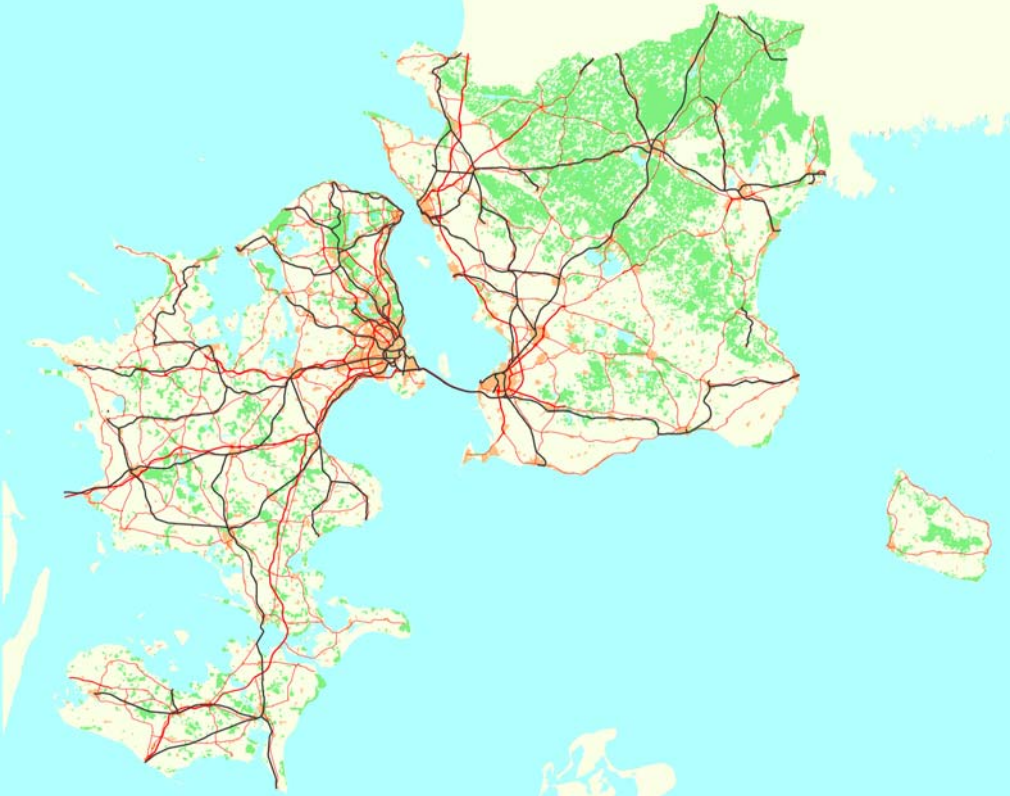
Goods transport in Denmark measured by tons kilometres

Means of transport	Million	Per cent
Lorry	10,538	76.3
Railway	1,095	7.9
Ship and ferry	2,184	15.8
Total	13,817	100.0





Øresund Bridge 2000. The fixed link between Sweden and Denmark's largest island, Zealand, was one of Europe's missing links. It consists of a tunnel under the international waterway Øresund, an artificial island and a 7,845 metre long combined steel girder and cable stay bridge with 57 metre clearance, carrying motorway and railway. The bridge connects Greater Copenhagen with Sweden's third-largest city Malmö. Photo: Jørgen Schytte.



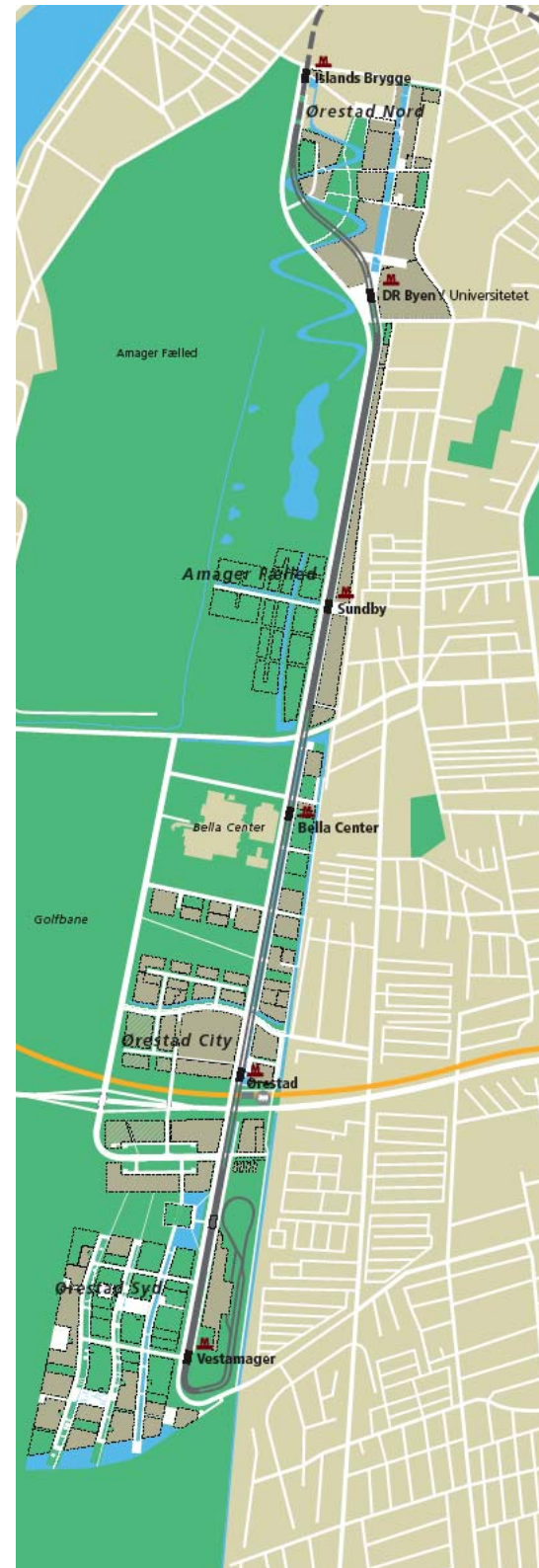
and development of Copenhagen has been reoriented towards the east and this forms the basis of realising new projects. Some of these were unavoidable, as it was necessary to build rail and motorway connections to the fixed link and therefore also to Copenhagen Airport, which has become much more accessible. The airport was Denmark's air transport hub and has now become the local hub for both passenger and goods transport for the whole of Southern Scandinavia.

Other development projects accompanying the building of the Øresund link are the result of planning activities. Soon after the link construction started, the central metropolitan municipalities, Copenhagen and Frederiksberg, together with the Danish state decided to plan and initiate a new large urban development project in the zone between Copenhagen City and Copenhagen Airport. The aim was to provide space for international companies, which were looking for locations near these functions and also saw an advantage in a central location in the

The Øresund area. The perspective is cross-border regional integration following the opening of the bridge between Denmark and Sweden in 2000. The Øresund Committee, with the permission of the National Survey and Cadastre.

Urban development has been activated and implemented as a result of the fixed link from Denmark to Sweden. Crossed by motorway and national railway and structured by a new metro line, the area is directly linked to the centre of Copenhagen and reflects the philosophy of the Finger Plan. Area Development Company.

Southern Scandinavian metropolitan region. Another aim was to provide more space for central Copenhagen functions. The expansion is already visible in 2007, in the form of a suburb stretching approximately ten kilometres to the south from Copenhagen's old ramparts. The suburb has been developed with a new metro line as the main structure and – in addition to commercial companies – includes creative units, two universities and many residential properties. The metro intersects with the main railway linking Copenhagen



Infrastructure

Factsheet Denmark. Published by the Ministry of Foreign Affairs of Denmark.

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Published Januar 2008.

ISBN 978-87-7667-825-8

Central Station, the airport and Sweden. From the new suburb, the metro continues underneath the harbour and City to the centre of Copenhagen and it also has a branch to the airport. Transport links to the suburb, called Ørestaden, is simply superb.

The transport picture

The total annual person transport within Denmark's borders amounts to approx. 78 billion of person kilometres, of which approx. 77 per cent is by car, 12 per cent by bus and coach, 7 per cent by train and 3 per cent by bicycle. Internal goods transport by land amounts to approx. 13 billion tons goods kilometres, of which 85 per cent is by lorry and 15 per cent by rail.

Transport networks and terminals play a key role in countries' productivity and competitiveness. At regular intervals, various international forums carry out surveys of the world's countries and in this connection rank them in order. Denmark usually receives top ranking, both for competitiveness (World Competitiveness Yearbook 2007 puts the country in fifth

place) and for the overall distribution capacity of its infrastructure (the same source ranks the country in second place).

Mobility is top class and the opportunities to transport products and to travel to and from home, work, leisure interests or service offers are key conditions of a modern society. Peak loads and congestion also appear to be a basic condition of the modern society and although many years' efforts to develop and extend nationwide high-class road and rail networks have been implemented, there are still many transport political challenges. Currently these involve reducing congestion, reducing emissions into the environment, improving public transport and reducing car usage. These are tackled by various means, ranging from continued development of the transport infrastructure by using information technology initiatives to ensure better exploitation of the existing systems via road pricing to compression plans for the urban area.

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Sea transport still plays a significant role in Denmark. Fixed links connect the islands and the Jutland peninsula, but the journey from Jutland to Norway has to be by ferry. The photo from Hirtshals shows ferries operating on the route across Skagerrak to Oslo or Kristianssand. Photo: Rambøll.