

The Ramboll logo, consisting of the word "RAMBOLL" in white uppercase letters on a blue rectangular background. The background of the entire page is a blurred photograph of a busy transit station with people walking and using escalators.

RAMBOLL

UNLOCKING THE TRANSNATIONAL POTENTIAL IN THE FEHMARN BELT REGION

THE RAPID TRANSIT RAILWAY LINE (S4) AND THE ÖRESUND METRO
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PREFACE

In 2011 the European Commission presented a coherent vision for the future of European transport and mobility in the white paper, “Roadmap to a Single European Transport Area”. By doing so the Commission adopted initiatives for the next decade focusing on building a competitive transport system that will increase mobility, remove major barriers in key areas and fuel both growth and employment. The aim was to create a more competitive and resource-efficient transport system in part by optimizing the performance of multimodal logistic chains throughout Europe. Part of the objective was to reduce Europe’s dependence on imported oil and cut carbon emissions in transport by 60% by 2050.

To foster collective action towards the achievement of this objective, a comprehensive infrastructure policy has been developed around the Trans-European Transport Network (TEN-T). Reaching throughout Europe, the TEN-T network connects the continent by creating European transport corridors.

The TEN-T has the potential to create growth, connectivity and sustainability by connecting the regions and urban nodes in Europe and optimizing the performance of multimodal logistic chains. Germany, Denmark and Sweden are part of the longest European corridor known as the Scandinavian-Mediterranean Corridor.

The Fehmarn Belt Fixed Link between Germany and Denmark will be one of the most significant developments along the North-South axis, just like the Brenner Base Tunnel.

However, establishing the Fehmarn Belt Fixed Link can lead to capacity constraints and bottleneck situations as the traffic flow increases between Sweden in the North and Germany in the south. Thus, bottlenecks can occur in Hamburg and between Copenhagen and Malmö.

This report highlights the potentials of two rail projects to solve bottleneck situations which can arise as a consequence of the Fehmarn Belt Fixed Link. The projects are the Rapid Transit Railway Line (S4), running between Hamburg and Bad Oldesloe, and the Öresund Metro, running between Copenhagen and Malmö. In some sense, these two rail projects can be regarded as missing puzzle pieces in the Scandinavian-Mediterranean Corridor which enables a more efficient use of the Fehmarn Belt Fixed Link and the Öresund Bridge.

The report describes how both projects can be expected to create growth, connectivity and sustainability. The two projects solve important local and regional connectivity and accessibility problems between Hamburg and Lübeck as well as between Copenhagen and Malmö. Thus, the two projects are a fundamental element in unlocking the transnational potential in the Fehmarn Belt Region.

“Creating a better connected Europe is of fundamental importance to future growth and prosperity. In this regard developing the Fehmarn Belt Region through the Fehmarn Belt Fixed Link is vital. Making the most of the Fehmarn Belt Fixed Link also means to take a wider perspective and to support it by establishing better regional and local links.

The Rapid Transit Railway Line (S4) and the Öresund Metro represent such links. Thus, they can be seen as keys to unlocking the transnational potentials in the Fehmarn Belt Region”.

Mr. Pat Cox

Coordinator for the Scan-Med Corridor.
Former President of the European Parliament (2002 - 2004)

EXECUTIVE SUMMARY

With the completion of the Fehmarn Belt Fixed Link in 2028, one of the most important missing links in the TEN-T Scandinavian-Mediterranean corridor will be in place. Commuting time between Copenhagen and Hamburg will decrease from 4.5 to 2.5 hours and the total distance for freight between Germany and Sweden will decrease by 160 km. This is expected to be a major contribution towards the integration of metropolitan regions into a powerful space of cooperation and innovation, which will greatly enhance the regions global visibility and competitiveness.

However, without the establishment of local and regional rail projects, the Fehmarn Belt Fixed Link will not operate efficiently. Traffic bottlenecks are found at the crossing of the Fehmarn Belt, but also on its access routes. Hamburg Central Station already faces problems with too many train departures, and Copenhagen Airport is currently operating at close to maximum capacity for passenger trains.

Given the expected increase in passenger and freight trains once the Fehmarn Belt Fixed Link is completed, this will most likely lead to congestion, timetable delays, longer commuting times, as well as increased costs and delays for freight transport. These factors will hamper growth, and thereby reduce the competitiveness of The Fehmarn Belt Region.

Furthermore, without additional local and regional rail projects, the expected modal shift from high-emission transport modes to greener ones (rail and sea) will not occur as much as it could. This will curtail the effect of the Fehmarn Belt Fixed Link in achieving the EU-target to reduce greenhouse gas emissions in the transport sector in 2050 by at least 60% compared to 1990-levels.

This report describes the potentials of the Rapid Transit Railway Line (S4) running between Hamburg and Bad Oldesloe, and the Öresund Metro, running between Copenhagen and Malmö. Both projects will solve important local and regional connectivity and accessibility problems. Furthermore, they are both expected to contribute to growth and the desired modal shift towards greener transportation modes.

Concretely the Öresund Metro is expected to result in a greatly enhanced labour market and to solve expected capacity problems between Copenhagen and Malmö. The project will primarily be user-financed through ticket revenue, with a possible EU support, as well as support from both the Danish and Swedish states. Both countries have the unique option to apply the ticket revenues from the Öresund Bridge as state financing from 2035, when the bridge is paid off by its users. In that sense, the project is cost-neutral in terms of its effect on state expenditure.

The S4 will relieve an existing bottleneck situation at Hamburg Central Station and an expected one between Hamburg and Lübeck once the Fehmarn Belt Fixed Link is established. An increased demand for long-distance passenger and freight trains heading towards Scandinavia via Fehmarn is expected and the S4 will free up much-needed capacity to allow for this increase. Furthermore, the S4 will increase the attractiveness of public transportation in the local area by reducing the distance from home to the next rapid transit station, increasing the frequency of train services and improving connectivity to destinations within Hamburg.

The two projects are described in this report in relation to three interlinked agendas: Connectivity, growth and sustainability.

THE THREE AGENDAS - CONNECTIVITY, GROWTH AND SUSTAINABILITY



THE EU TEN-T NETWORK AND THE SCANDINAVIAN-MEDITERRANEAN CORRIDOR

THE CENTRAL OBJECTIVES OF THE TEN-T CORE NETWORK POLICY ARE TO

- Enhance cross-border connections and remove bottlenecks
- Integrate different transport modes (road, rail, air, sea) to secure multi-modality
- Eliminate technical barriers currently hindering the interconnection of the transport networks of the Member States.

The Trans-European Transport Network

The Trans-European Transport Network (TEN-T) is a European Commission policy directed towards the implementation and development of a Europe-wide network of roads, railway lines, inland waterways, maritime shipping routes, ports, airports and railway terminals. TEN-T aims to establish a comprehensive network, covering all European regions, and a core network, linking the most important nodes to the comprehensive network.¹

With these objectives, the policy aims at harmonising infrastructure policies and streamlining investments at European, national, regional and local levels across Member States.

The Scandinavian-Mediterranean Corridor (ScanMed) (see map, page 9) is the longest of the nine core transport corridors in Europe. It stretches from the Finnish-Russian border in the north to Italy in the south and includes the Öresund Bridge, connecting Sweden and Denmark, the future Fehmarn Belt Fixed Link, connecting Denmark and Germany, as well as the Brenner Base Tunnel Corridor connecting Austria and Italy.²

The coming Fehmarn Belt Fixed Link connecting Germany and Denmark is a vital element in creating the ScanMed Corridor. According to European Coordinator of the ScanMed Corridor, Mr. Pat Cox, the Fehmarn Belt Fixed Link is one of the two most significant developments along this crucial North-South axis. The other being the Brenner Base Tunnel between Austria and Italy, for final ending in Malta.³

1. https://ec.europa.eu/transport/themes/infrastructure/about-ten-t_en

2. https://ec.europa.eu/transport/sites/transport/files/infrastructure/tentec/tentec-portal/site/brochures_images/CorridorsProgrReport_version1_2014.pdf

3. From: https://ec.europa.eu/transport/themes/infrastructure/scandinavian-mediterranean_en

THE EUROPEAN SCANDINAVIAN-MEDITERRANEAN CORRIDOR
SOURCE: RAMBOLL



- Urban Centres
- Scandinavian - Mediterranean Corridor
- - - Ferry connection

THE FIXED LINK AND THE FEHMARN BELT REGION

The Fehmarn Belt Region

The Fehmarn Belt Region consists of Schleswig-Holstein, the City of Hamburg, the western part of Mecklenburg-Vorpommern and the Greater Copenhagen Region which spans Eastern Denmark and Skåne in Southern Sweden, including the city of Malmö. The region is home to 9 million inhabitants which is roughly comparable to Greater London.

The Fehmarn Belt Region is one of the most innovative regions in Europe. The region's innovative capacity is reflected by the fact that Copenhagen, Hamburg and Malmö collectively filed over 9,000 patents between 2008-2012. Compared to neighboring regions, this equals the number of patents filed in Helsinki, Stockholm and Oslo in the same period.⁴ The large innovative capacity is primarily found in the many research institutions, especially in the Life Science sector, but also in other areas including Green Tech, thus making the region highly knowledge-intensive.⁵ This is exemplified through a projected 4 billion Euro investment into new large-scale research infrastructure, which will place the joint region as the world's no. 1 place for research in life science and material science. The emerging research institutions XFEL, PETRA III, ESS, MAX IV are expected to conduct applied research and development that is close to market and the close cooperation among the scientists involved has already contributed greatly towards the integration of the joint region.

The Fehmarn Belt Region (see map, page 11) is among the wealthy areas of Europe. GDP per capita is significantly higher than the 2016 EU28 average of EUR 29,215 per capita. With a value of EUR 49,059 in the Greater Copenhagen Region and EUR 62,144 in Hamburg, the region is characterized by a high degree of prosperity.

However, the Fehmarn Belt Region lacks an increase in growth rates compared to neighboring metropolitan areas. Over the past 10 years, growth has stagnated when compared to benchmarking cities.⁶

Connecting these metropolises, as well as the other parts of the region through better infrastructure, offers a great opportunity to unlock the transnational potential of the region and thereby increase economic growth and regional development. This would encourage higher European integration and prosperity.⁷ A closer integration of the entire region also conforms with the strategies of the three countries in question, all of which are connected to the EU Commission's Roadmap and goals for a single European transport area. The Fehmarn Belt Fixed Link will be able to foster a better connection and aid in increasing sustainable growth rates.

4. Eurostat (2018) from <http://ec.europa.eu/eurostat/web/metropolitan-regions/data/database>

5. Greater Copenhagen: Why Greater Copenhagen. From: <http://www.greatercph.com/why>

6. Rambøll (2016): Collaborative Growth.

7. Rambøll (2016): Collaborative Growth.

NORWAY

THE FEHMARN BELT REGION

SOURCE RAMBOLL

SWEDEN

DENMARK

Greater Copenhagen Region

GDP/capita: €49.059
Inhabitants: 3,920 mio.
Labour force: 2,133 mio.

Copenhagen

Malmö

Schleswig-Holstein

GDP/capita: €31.326
Inhabitants: 2,859 mio.
Labour force: 1,437 mio.






Schleswig-Holstein

Hamburg

GDP/capita: €62.144
Inhabitants: 1,787 mio.
Labour force: 0,976 mio.

Hamburg

GERMANY

	Rapid Transit Railway S4	Construction time: 7-9 years	Costs: €1bn
	Öresund Metro	Construction time: 6,5-7 years	Costs: €4bn
	Fehmarn Belt Fixed Link	Estimated opening year: 2028	Costs: €7bn
	Öresund Bridge		
	The EU ScanMed TEN-T Corridor		

Potentials and forecasted traffic of the Fehmarn Belt Fixed Link

The Fehmarn Belt Fixed Link is projected to open for traffic in 2028. Once it is established, commuting times will decrease considerably and passenger and freight transport is expected to increase. Commuting time from Copenhagen to Hamburg will decrease from 4.5 to 2.5 hours. As a result, forecasts estimate the number of train passengers travelling between continental Europe and Scandinavia to rise substantially after the opening of the fixed link, especially between the European continent and Sweden, which will see an increase in passenger volume of 111% in 2035 compared to current levels.⁸ See figure presenting forecasted passenger traffic between continental Europa and Scandinavia below.

For freight, the total distance between Germany and Sweden will decrease by 160 km, thus allowing for potential time savings of 2 to 3 hours per trip.¹⁰ In effect, the total freight volume is forecasted to grow by 2.2% per year in the period 2018 - 2035 and the number of freight trains through the Fehmarn Belt Fixed Link is forecasted to grow to more than 19,000 trains in 2035. Depending on the underlying assumptions for train operations this would be equivalent to between 75 and 80 trains every 24 hours.¹¹ The Fehmarn Belt Fixed Link will thereby position Scandinavia as a more attractive business region for

areas beyond Northern Germany. See figure presenting forecasted freight traffic across The Fehmarn Belt Fixed Link below.

By connecting Northern Germany to the Nordic Countries, the Fehmarn Belt Fixed Link will further encourage development of a coherent labor market, in which companies have access to a large labour pool among the 9 million inhabitants as well as easier access to foreign markets. The more efficient infrastructure also provides quicker and cheaper access to markets in Central Europe and Scandinavia through the shorter travel routes.

In terms of sustainability the Fehmarn Belt Fixed Link is (for passenger transport) forecasted to lead to a modal shift from short haul air travel between Scandinavia and Central Europe to the more environmentally friendly long-distance passenger trains. Between 335,000 and 381,000 passengers per year or 1 percent of all air travel passengers between Scandinavia and Central Europe are forecasted to shift to train travel in 2030.¹² As a result, the Fehmarn Belt Fixed Link will aid achieve the EU-target of reducing greenhouse gas emissions in 2050 in the transport sector by at least 60% compared to 1990-levels.

8. Intraplan Consult GmbH & BVU Beratergruppe (2016). „Verkehrsprognose für eine Feste Fehmarnbeltquerung 2014 - - Aktualisierung der FTC-Studie von 2002“. Für Femern A/S.

9. The prognosis forecasts an increase in the number of freight trains to 32 trains per day in the opening year of the FBL, 36 trains per day after 3 years, and 38 trains per day after 10 years. The prognosis also forecasts a slight decrease in passenger volume of 1.1 percent per year during the last 10 years of the prognosis, mainly due to lower expectations for GDP growth.

10. HTC (2016). „Importance of Fehmarn Belt Fixed Link for Rail Freight Services on the Scandinavia - Germany corridor“, Transport Market Study on behalf of Naturschutzbund Deutschland.

11. The forecast is based on Intraplan Consult GmbH (2014): Verkehrsprognose für eine Feste Fehmarnbeltquerung 2014. The original traffic prognosis includes two scenarios, Case A (sensitivity scenario) and Case B (main scenario), which differ mainly in terms of expected GDP growth, but also in terms of the number of passenger trains. The figures in this report are based on Case B. The original forecast, however, is based on the initially projected opening of the FBL in 2022. The forecast in this report is instead based on the new opening year in 2028. In practice, this means that we extrapolate the growth from 2011-2021 in the original forecast to continue until 2027. This also means that the traffic jump due to the FBL is imposed in 2028 instead of in 2022 as in the original forecast. Finally, the forecasted number of freight trains differs depending on whether German or Danish train operation assumptions are applied, which explains why reported train numbers deviate from the numbers provided elsewhere in the report.

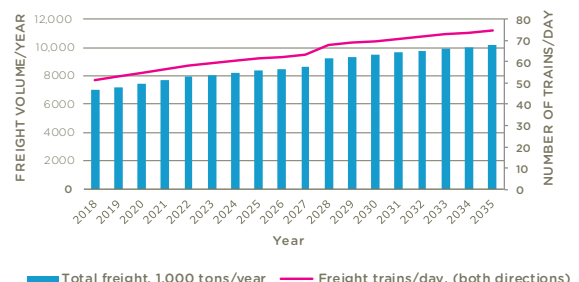
12. Intraplan Consult GmbH & BVU Beratergruppe (2016). „Verkehrsprognose für eine Feste Fehmarnbeltquerung 2014 - Aktualisierung der FTC-Studie von 2002“. Für Femern A/S.

FORECASTED PASSENGER RAIL TRAFFIC BETWEEN CONTINENTAL EUROPE AND SCANDINAVIA, 2018-2035



Source: Ramboll, based on Intraplan Consult GmbH & BVU Beratergruppe (2014).⁹

FORECASTED FREIGHT RAIL TRAFFIC ACROSS THE FEHMARN BELT FIXED LINK, 2018-2035



Source: Ramboll, based on Intraplan Consult GmbH & BVU Beratergruppe (2014).



Photo: Metroselskabet/Peter Sørensen

THE RAPID TRANSIT RAILWAY LINE S4

Description of the project

In 2015 the City of Hamburg had a population of nearly 1.8 million and the entire metropolitan area of Hamburg a population of 5.3 million.¹³ The metropolitan area is serviced by an extensive public transport network that encompasses a high frequency rapid transit railway system (S-Bahn), designed to provide commuters with a fast and reliable public transport service from the outskirts into the city of Hamburg, a very high frequency metro system (U-Bahn) within the city as well as busses and regional trains (Regionalbahn and Regional Express).

Between 2006 and 2016 the public transport system of the metropolitan area has experienced a 26.5% increase in passenger trips¹⁴ that is expected to continue as the city's population is forecasted to grow by an additional 9.1% until 2035.¹⁵

At the same time Hamburg, with the third largest port in Europe, is a major transit zone for goods. With the opening of the Fehmarn Belt Fixed Link, the amount of freight transported by rail to and from Hamburg over the Fehmarn Belt Fixed Link is expected to increase significantly.¹⁶

Yet experts have warned that the road and rail infrastructure in and around Hamburg is already reaching full capacity.¹⁷ Especially Hamburg Central Station, which constitutes the backbone of the railway system in Northern Germany with more than 800 regional and long-distance passenger trains a day, is forecasted to experience substantial problems with excess capacity utilisation and overcrowding of its regional and long-distance platforms in the near future.¹⁸

Based on a forecasted increase in public transport passenger numbers and freight transport via rail and considering already existing capacity constraints – especially at Hamburg Central Station, the City of Hamburg and the State of Schleswig-Holstein have agreed to build an additional rapid transit railway line, the S4, in the Northeast of Hamburg.

The S4 project pursues several objectives

- Increase the capacity of the existing railway lines for long-distance passenger trains and freight trains between Hamburg and Lübeck as well as between Hamburg and Scandinavia, by largely unbundling regional passenger rail services from fast mid- and long-distance passenger and freight rail services.
- Increase the capacity of Hamburg Central Station by reducing the number of regional trains using the regional and long-distance platforms at the station.
- Transferring regional passenger rail services to rapid transit rail services and using existing rapid rail service facilities.
- Improve the connectivity for commuters in East Hamburg by largely replacing the current regional trains on the line from Bad Oldesloe to Hamburg by an equally fast but more frequent rapid transit service with additional stops along the way.
- Improve the accessibility of inner city destinations for commuters in East Hamburg by eliminating the necessity to change trains at Hamburg Central Station.
- Improve the accessibility of Hamburg airport for commuters

in the Eastern Metropolitan region of Hamburg by allowing a more convenient change of trains at Hamburg-Hasselbrook station.

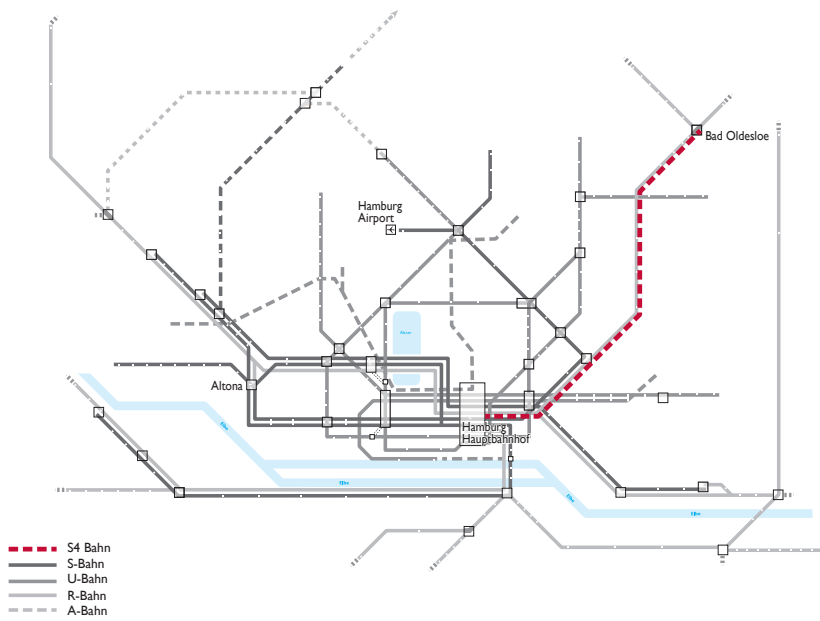
In so doing, the S4 line (map of S4 on page 15) is expected to be beneficial not only to Hamburg's regional public transport system but also to the planned Fehmarn Belt Fixed Link by enabling the long-distance passenger trains and freight trains to reach their full capacity potential and run on time.

Socio-economic impacts

The S4 project is expected to generate several positive impacts on a transnational, regional as well as local level. These impacts relate primarily to improved accessibility, connectivity and reliability of passenger and freight rail transport, such as more frequent services and seamless travel for passengers in the region or additional capacity for long-distance passenger trains and freight trains. This in turn can be expected to generate positive impacts on urban and economic development, as well as reduce CO2 emissions and urban air pollution. In addition, investments to diminish noise pollution are expected to significantly reduce noise levels along the current and planned railway tracks. These impacts are presented in the following sections.

While most of the local and regional impacts can be considered as resulting directly from the S4, the wider transport, economic and environmental impacts, especially as they relate to the Fehmarn Belt Fixed Link, can be considered indirect impacts. By removing important infrastructure bottlenecks, the S4 enables the Fehmarn Belt Fixed Link to substantially reduce travel times

THE S4 LINE



The Rapid Transit Railway Line S4 (red), Source: City of Hamburg.

between Hamburg and Copenhagen and, in so doing, to reach its full potential and meet its connectivity, growth and sustainability targets.

At this point in time, no comprehensive analysis of both the regional and supra-regional socio-economic impacts of the S4 has yet been conducted. The supra-regional transport impacts of the S4 project were analysed as part of a 2009 analysis by the Federal German Transport Ministry of the railway system in Hamburg. This analysis attached a positive monetary value of approximately EUR 30 million per year to the transport related supra-regional impacts of the S4 project. Of these, slightly more than 60% could be attributed to improvements in freight train and long-distance

passenger train services and the remainder to improvements in regional passenger train services.¹⁹ The Federal Transport Infrastructure Plan (Bundesverkehrswegeplan) from 2016 pointed out the need to further investigate options for expanding the capacity of Hamburg Central Station given new traffic forecasts. Consequently, the 2009 analysis is currently being updated with newer traffic data, with results expected to be available in the second half of 2018. Likewise, the States of Hamburg and Schleswig-Holstein have commissioned a benefit analysis of the S4. This analysis which is currently being elaborated, focuses explicitly on the regional transport impacts that the S4 project will generate for passenger train services between Hamburg and Bad Oldesloe.

KEY FACTS ON THE S4

The S4 is a new S-Bahn line that will run mainly parallel to and partly on the existing railway tracks from Hamburg-Altona over Hamburg Central Station in the direction of Lübeck up until the town of Bad Oldesloe. Through this the area between Hamburg-Hasselbrook and Bad Oldesloe will be integrated into Hamburg's rapid transit system.

5 new stations to be added between Hamburg Central Station and Bad Oldesloe.

20 km of new double tracks/single tracks to be constructed and 16 km of existing tracks to be upgraded.

S-Bahn trains will operate on both AC and DC traction, enabling the use of both the rapid transit and the existing rail tracks.

Convenient change of trains towards S1 to Hamburg Airport at Hamburg-Hasselbrook and Central Station.

Costs of the project currently estimated at approximately EUR 1 billion (excl. of general price increases).

The planning phase has been completed and the project is currently undergoing the plan approval process. If no major delays arise, the S4 can potentially be fully operational at around the time the Fehmarn Belt Fixed Link is completed in 2028.

13. Statistikamt Nord (2017). „Bevölkerungsstand, Bevölkerungsdichte und Bevölkerung nach Altersgruppen in der Metropolregion Hamburg“.

14. Hamburger Verkehrsverbund (2007). „Verbundbericht 2006“; Hamburger Verkehrsverbund (2017). „Verbundbericht 2016“.

15. Institut der deutschen Wirtschaft (2017). „Bevölkerungsentwicklung in den deutschen Bundesländern bis 2035“.

16. Intraplan Consult GmbH & BVU Beratergruppe (2016). „Verkehrsprognose für eine Feste Fehmarnbeltquerung 2014 - - Aktualisierung der FTC-Studie von 2002“. Für Fernern A/S.

17. HWWI & HSH Nordbank (2015). „Metropolregion Hamburg 2020. Verkehrsinfrastruktur und ihre Auslastung“.

18. DB Netz AG (2012). „Plan zur Erhöhung der Schienenwegkapazität (PEK) für den als vsl. in naher Zukunft überlastet erklärten Schienenweg Bahnhof Hamburg Hbf“.

19. Intraplan, BVU and SMA+ (2009). „Entwicklung und Bewertung eines Konzeptes für den Schienenknoten Hamburg“, on behalf of the Federal Ministry of Transport.

The Connectivity Agenda: The S4 creates additional capacity for long-distance passenger and freight trains and improves regional connectivity and accessibility

Expanding the capacity of long-distance passenger trains at Hamburg Central Station and on the railway line to Fehmarn via Lübeck

The railway track between Hamburg and Bad Oldesloe is currently operating at nearly 90% of its theoretical capacity of 266 trains per day, providing little to no margin to increase the number of either freight trains, regional or long-distance passenger trains.²⁰ The S4 will reduce capacity utilisation of the existing tracks by shifting most of the current regional trains to the new rapid transit railway tracks. Furthermore, the S4 will use the rapid transit platforms at Hamburg Central Station instead of the regional train platforms. This will reduce the number of trains on

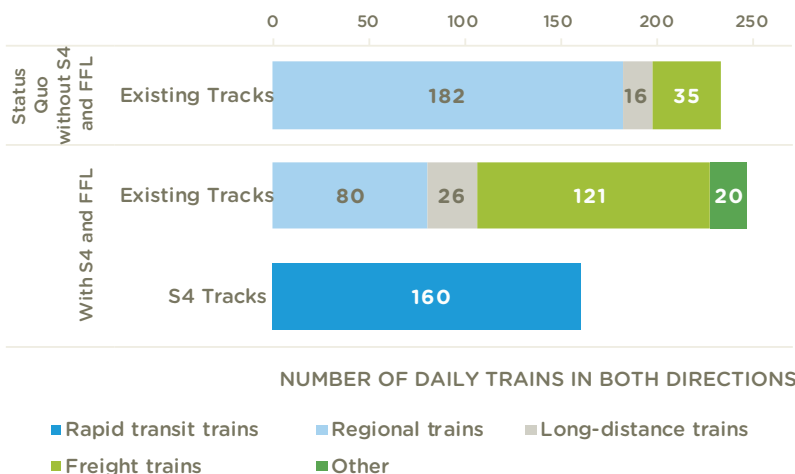
the regional and long-distance train platforms at the Central Station by approximately 110 and the number of passengers by approx. 15,000 passengers daily.²¹ Compared to a little more than 800 regional and long-distance trains and more than 500,000 passengers a day in 2014 for the whole Central Station, these are substantial numbers²² and will contribute significantly to reducing the capacity problems at Hamburg Central Station.²³

Through these two effects, the S4 will free up much needed capacity that will allow the number of long-distance passenger trains heading towards Scandinavia via Fehmarn to be increased to meet additional demands once the Fehmarn Belt Fixed Link opens. Currently, the Deutsche Bahn expects an increase in the number of long-distance passenger trains on that route by nearly 45% to 26 trains per day, compared to 2015.²⁴

Expanding the capacity for freight train services on the railway line to Fehmarn via Lübeck

Without the additional railway tracks for the S4, this forecasted increase in freight train traffic demand cannot be met due to capacity constraints between Hamburg and Bad Oldesloe, and goods would have to be transported by road. Demand for the freight train services between Hamburg and Lübeck is forecasted to grow by 4 trains a day to meet increased demand, which would constitute an 11% increase over the status quo of 35 trains.²⁵ Approximately 9.5 million tonnes of goods per year are forecasted to be transported over the Fehmarn Belt Link by rail in the year after its opening. This creates a demand for additional 78 freight trains a day on the railway tracks between Hamburg and Fehmarn (exclusive of an additional small number of empty and maintenance trains).²⁵

CURRENT AND FORECASTED AVERAGE NUMBER OF DAILY TRAINS ON THE EXISTING AND PLANNED S4 TRACKS



Source: Schüßler-Plan (2013), Hamburger Verkehrsverbund GmbH (2018), Deutsche Bahn (2014)

Improving connectivity and accessibility of inner city destinations and Hamburg Airport for commuters in North-Eastern Hamburg

The new S4 will add five new train stops between Bad Oldesloe and Hamburg Central Station. In addition, it will continue straight on from Hamburg Central Station through the city until it reaches the new long-distance railway station Hamburg-Altona in the West. Despite adding five stops along the way, the total travel time between Bad Oldesloe and Hamburg Central Station will only increase marginally, from forecasted 37 to 41 minutes, due to a faster on- and off-boarding process, a faster acceleration of the trains and faster travel speed (max. 140 km/h).²⁶ In addition, commuting times between Bad Oldesloe and Hamburg will be reduced due to seamless travel for:

- a) Commuters who previously had to travel longer distances until they could board a train in the direction of Hamburg.
- b) All commuters who wish to get off at one of the new stations before the Central Station as well as the inner-city stations after the Central Station.
- c) All commuters wishing to access the airport. They will have the possibility to switch trains to the airport more conveniently at the station Hamburg-Hasselbrook.

The frequency of trains on the S4 line will increase at peak hours from approx. every 15 minutes between Ahrensburg and Hamburg to every 10 minutes and from approx. 30 to 20 minutes between Bargteheide and Ahrensburg. On the last segment of the S4, between Bad Oldesloe and Bargteheide, the S4 will continue to operate a service every hour. In addition, by shifting the current regional trains to the new rapid transit railway tracks, an increase in the punctuality rate of trains from currently 86% will be achieved. Preliminary results of the regional benefit analysis indicate that these improvements in connectivity, accessibility and reliability of passenger train services are forecasted to lead to an approximately 18 percent increase in the total number of passengers trips to 97.100 on a given workday on the S4 once it is completed, compared to a scenario without the S4.²⁷ Based on current estimates, it is expected that around 85 percent of this increase in passenger train trips will come from car drivers leaving their car at home and taking the train instead. This in turn would reduce the number of car kilometres by about 168.000 per working day, equivalent to 50.3 million kilometres per year.

Adding to this the improvements in connectivity, accessibility and reliability of other regional train services, the S4 is forecasted to reduce the travel times for approximately 168.000 daily car drivers in and around Hamburg. Their travel time savings are expected to amount to approximately 556.000 hours per year.²⁷



NEARLY

90%

CAPACITY UTILIZATION

-
- 20. DB Engineering & Consulting GmbH (2016). „Neubau S-Bahnlinie S4 (Ost) Hamburg – Bad Oldesloe. Planfeststellungsabschnitt 1. Unterlage 1 – Erläuterungsbericht“.
 - 21. BWVI (2017). „Multi-track expansion Hamburg-Bad Oldesloe (S4) as part of the Scan-Med Corridor“.
 - 22. Deutsche Bahn (2014). „Der Hamburger Hauptbahnhof – Hamburg Hauptbahnhof ist der wichtigste und größte Bahnhof in Norddeutschland“.
 - 23. DB Netz AG (2012). „Plan zur Erhöhung der Schienenwegkapazität (PEK) für den als vsl. in naher Zukunft überlastet erklärten Schienenweg Bahnhof Hamburg Hbf“.
 - 24. Schüßler-Plan (2013). „S4 (Ost) Hamburg Hasselbrook – Bargteheide: Vorentwurfplanung Los Hamburg Anlage 3, Erläuterungsbericht“.
 - 25. Schüßler-Plan (2013). „The train figures and capacity utilisation refer to the most heavily frequented section between Wandsbek and Ahrensburg.“.
 - 26. DB Netz AG (2017). „Hamburg und Schleswig-Holstein wachsen zusammen. Die S-Bahn Linie S4 von Hamburg nach Bad Oldesloe“; Hamburger Verkehrsverbund GmbH (2017); S-Bahn Hamburg GmbH (2017).
 - 27. Intraplan Consult GmbH (2018). „Nutzenermittlung der S4 Hamburg – Bad Oldesloe in Anlehnung am Verfahren der Standardisierten Bewertung – Auswertungen für den AK Kommunikation“.

The Growth Agenda: The S4 enhances transnational and regional economic integration as well as urban development

Facilitating business and trade across the Fehmarn Belt

By increasing the capacity of the rail infrastructure, the S4 is expected to improve the economic opportunities between the metropolitan areas of Hamburg and the Greater Copenhagen Region as well as the regions of Ostholstein in Germany and Storstrøms County in Denmark. The increased frequency of the long-distance passenger trains that will become possible through the S4 will make it more attractive to commute to or do business on the other side of the Fehmarn Belt Link. Overall, the faster connections make it possible for Denmark to reach 10 million German citizens within three hours. And the Scandinavian market, then faster and more easily accessible, has 20 million potential customers for German businesses.²⁸ This gives a variety of new business opportunities between the Scandinavian countries and Germany as well as Central Europe.

Enhancing business opportunities and labor market integration between Hamburg and Lübeck

The S4 can be expected to also generate positive impacts for residents and businesses in the city of Lübeck. For commuters and business travellers, the increase in the frequency of train connections can be expected to raise the attractiveness of the public transport connection between Lübeck and Hamburg and of Lübeck as a place to live or do business. As a result, the labour markets of the two cities could grow closer together. In addition, business travellers and commuters to other parts of Germany will equally benefit from an improved accessibility as the additional long-distance passenger trains allow them to continue their journey south without having to change trains at Hamburg Central Station. Likewise, the port of Lübeck could also benefit from additional capacities for freight trains heading to or coming from Hamburg or the rest of continental Europe.

Improving the attractiveness of North-Eastern districts of Hamburg and the framework conditions for urban development

Current and new residents in the area between Hamburg Central Station and Bad Oldesloe can be expecting to benefit from the S4 in several ways. By reducing the distance from home to the next rapid transit station, increasing the frequency of train services and improving connectivity to destinations within Hamburg, the S4 will first and foremost increase the attractiveness of public transportation in the area. In addition, residents along the railway tracks will experience a reduction in noise levels from trains due to additional noise protection measures (see section below). Together with a potential reduction in road congestion from an expected reduction in car traffic and a removal of train crossings, the area will likely provide better living conditions for current residents as well as an increase in their property values.

The Sustainability Agenda: The S4 reduces the adverse impact of transport on the environment and people

Reducing the adverse impact of transport on pollution and climate change

The S4 is expected to induce a modal shift from cars to the new S4 of approximately 12,400 trips per workday. This in turn would reduce the number of car kilometres by about 168,000 per workday, equivalent to 50.3 million km per year.²⁹ This expected to result in a moderate reduction of nearly 2,000 tonnes of CO₂ emissions per year. In addition, fine particulate matter and NO_x pollution will also decrease, given the lower emission of these substances from rail as compared to road traffic.³⁰ Indirectly the S4 can also be expected to contribute to achieving the Fehmarn Belt Link's contribution to reducing CO₂ emissions from transport. For freight transport the Fehmarn Belt link is forecasted to lead 9.5 million tonnes of goods to be transported by freight trains. Without realizing the S4 these goods would most likely have to be transported by truck instead.

Reducing the adverse impact of transport on people's health

Once operational, the S4 will lead to a reduction in traffic noise from both rail and road traffic. These include quieter trains as well as noise-insulating walls that will be constructed or replaced on a total length of 45 km.³¹ They will shield off noise from the new rapid transit trains as well as from the regional, long-distance and freight trains on the already existing tracks that run in parallel to the new S4 tracks.³²



Growth



Sustainability

28. Copenhagen Economics: Regional Effects of a Fixed Fehmarn Belt Link Final Report 2006

29. Intraplan Consult GmbH (in Bearbeitung). Standardisierte Bewertung der S4 Hamburg – Bad Oldesloe; Arbeitsergebnisse zum Stand Dezember 2017. Im Auftrag der Nahverkehrsverbund Schleswig-Holstein GmbH, München.

30. Umweltbundesamt (2016). „Emissionsdaten“. Retrieved from: <https://www.umweltbundesamt.de/themen/verkehr-laerm/emissionsdaten#textpart-1>

31. DB Netz AG (July 2017). „Hamburg und Schleswig-Holstein wachsen zusammen – Die S-Bahnlinie S4 von Hamburg nach Bad Oldesloe“.

32. DB Engineering and Consulting GmbH (2016-08-09). „Neubau S-Bahnlinie S4 (Ost) Hamburg – Bad Oldesloe, Planfeststellungsabschnitt 1 – Unterlage 1 – Erläuterungsbericht“; DB Netz AG (2017). „Fragen und Antworten zur Podiumsdiskussion vom 23.10.2017“.



4606

DB

S4 Ahrensburg

THE ÖRESUND METRO

Description of the project

The Greater Copenhagen Region is a metropolitan region that spans Eastern Denmark (Region Zealand and the Capital Region of Denmark) and Region Skåne in Southern Sweden. Four million people live in the Greater Copenhagen region. The Danish and Swedish parts are today connected via the Öresund Bridge and serviced by regional trains running between Copenhagen and Malmö and their hinterlands.

When the Fehmarn Belt Fixed Link opens, the number of train passengers crossing the Fehmarn Belt between Central Europe and Scandinavia will double compared to 2011-levels, as will the number of freight trains.³³ Add to this the high-speed trains in Sweden which are expected to be introduced after 2040 to connect Stockholm with Malmö, Copenhagen Airport and potentially to continue to Hamburg, as well as a general expansion of long-distance trains in the region. Additionally, Copenhagen Airport aims to expand its customer base from 29 million passengers per year in 2017 to 40 million passengers per year in 2030, adding to the existing passengers on the route.

These events combined will put pressure on the current railway capacity between Copenhagen and Malmö. Even if new infrastructure investments are made to and from the Copenhagen Airport, the hinterland connections on both sides of the Öresund Bridge will continue to have a maximum capacity usage and thus be vulnerable to even small delays which will have direct impact on the regularity on the line. Meanwhile the tracks across the Öresund Bridge will be challenged, as capacity will increasingly be occupied by the

long-distance high-speed trains and freight trains as well as regional trains in the future.³⁴

In this respect, a Öresund Metro (see map on page 21) between Copenhagen and Malmö aims at relieving current infrastructure especially around the bottlenecks, as well as enabling an expansion of the public transport capacity between the two cities. Furthermore, it allows the separation of local/regional trains between Copenhagen, Copenhagen Airport and Malmö, from long-distance and freight trains, all of which share the same tracks today.

The construction costs are estimated at EUR 4 billion (incl. 50% uncertainty add-on), of which two-thirds accounts for the coast-to-coast infrastructure. The project will primarily be user-financed through ticket revenue, estimated at a little more than EUR 2.6 billion, with a possible EU support, as well as support from both the Danish and Swedish states. Both countries have the unique option to apply the ticket revenues from the Öresund Bridge as state financing from 2035, when the bridge is paid off by its users. In that sense, the project is cost-neutral in terms of its effect on state expenditure, and can be viewed as a 'third floor' to the present Öresund Bridge.

The Öresund Metro aims to:

- Improve local and regional mobility in the metropolitan area of Copenhagen and Malmö in the Greater Copenhagen Region.
- Relieving the Öresund Bridge of a considerable amount of local and regional trains to create more

capacity for long-distance high speed and freight trains.

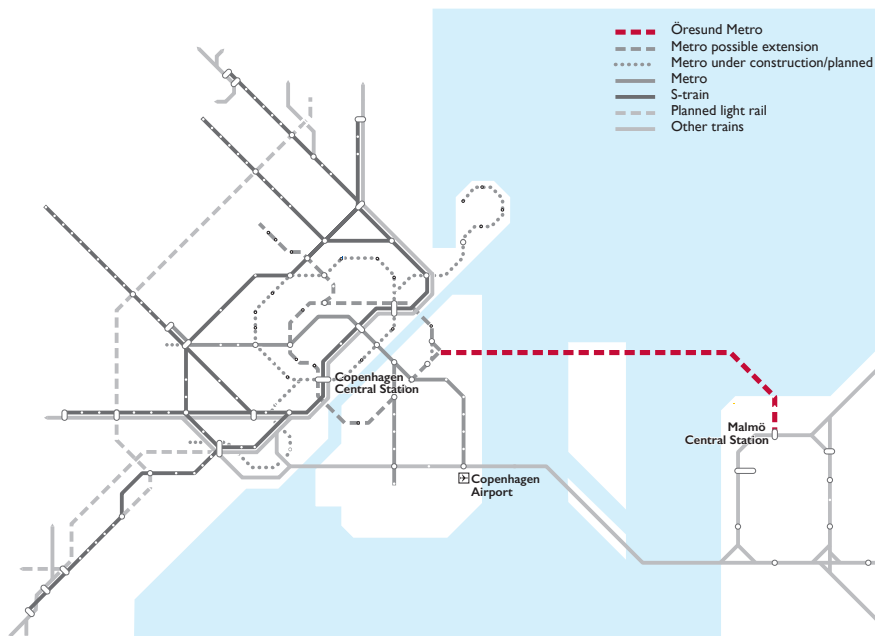
- Expand the effective labour markets within a 60-minute commute in the region between Copenhagen/Malmö city centres.
- Facilitate closer collaboration of research and education, tourism flows and business sector investment as well as the expansion of Copenhagen Airport.
- Increase the catchment area of Copenhagen Airport and connect to long-distance high-speed trains between Stockholm and Copenhagen to improve competitiveness of train trips compared to short-haul flights.

Socio-economic impacts and wider benefits

The Öresund Metro will improve both local and regional accessibility across Öresund in the Greater Copenhagen Region, as well as facilitate improved connectivity and growth prospects across the entire Fehmarn Belt Region. The main socio-economic effects primarily relate to higher user benefits through lower travel times, higher reliability of passenger and freight traffic, as well as an expansion of the accessible labour market within commuting distance from Copenhagen and Malmö, respectively.

The socio-economic effects of a new metro line across the Öresund have been investigated in a Cost-Benefit Analysis based on both Danish and Swedish guidelines. The analyses show that the project has a socio-economic return of 3.2% which is comparable to the Metro City Ring and metro to the Nordhavn currently under construction in Copenhagen.³⁵

THE ÖRESUND METRO



The Öresund Metro (red). Source: The City of Copenhagen.

KEY FACTS OF THE ÖRESUND METRO

The Öresund Metro is projected as a driverless, high frequency rail connection with departures every 1.5 minutes. The metro line will be integrated into the existing transportation networks in both cities. Connecting the northern part of Amager (Prags Boulevard) directly with Malmö the Öresund Metro will reduce the travel time to around 20 minutes from centre to centre.

In Copenhagen, the Öresund Metro will join the Copenhagen Metro system. A prerequisite for this is the expansion of the current system with a part of either an M6 or M7 line connecting the Copenhagen Central Station, both of which are currently being screened by the City of Copenhagen in the KIK-2 analysis and awaiting a decision ultimo 2018.

Preliminary technical analysis has been conducted. The next steps towards realisation could begin with a strategic analysis initiated by the Danish and Swedish states, which is estimated to take around three years. The strategic analysis serves as the foundation for the next step, namely an Environmental Impact Assessment.

Constructions could begin in 2028 and the The Öresund Metro could open in 2035.

Compared to similar projects outside Copenhagen, the Öresund Metro provides a better socio-economic result than both the Malmö City Tunnel and the Västlänken Tunnel in Göteborg.³⁶

Apart from the benefits estimated in the traditional Cost Benefit Analysis, the Öresund Metro is expected to result in wider economic benefits, primarily in the form of agglomeration effects. The agglomeration effects relate to the productivity gains in a geographical concentration of both the labour market, the industry and the service sectors. The precise effect is not known. However, studies from British inter-urban rail projects show that the wider economic benefits can add 22-52% to the traditional user benefits, most of which are accounted for by agglomeration effects.³⁷ For the Öresund Metro, this would equal 0.53-1.25 billion EUR in additional benefits.

33. Fehmarn Belt Forecast 2014, Fehmarn A/S (2014).

34. Trafik-, Bygge- og Boligstyrelsen (2017): Trafikplan for den statslige jernbane 2017-2032 (Høringsudgave)

35. According to Danish method, see Samfundskonomiske beregninger på Øresundsmetro, Incentive Partners (2013). Based on Danish guidelines, the Öresund Metro has a socio-economic impact of EUR -0.36 billion in net present value (NPV) in 2017-prices, whilst the result based on Swedish guidelines is EUR -0.47 billion. The socio-economic return is thus lower than the required return of 4% from the Danish Ministry of Finance. The recent expansions of the Copenhagen Metro System, however, showed even lower socio-economic impacts. The Metro City Ring, for instance, has an estimated impact of EUR -1.41 billion in net present value in 2017-prices.

36. For the Metro City Ring see "Udredning om Cityringen", Transport- og Energiministeriet, Finansministeriet, Københavns Kommune, Frederiksberg Kommune and HUR (2005). For the Nordhavn Metro, see "Cityringen - Udredning om en afgrening til Nordhavnen", Metroselskabet (2011). For the Sydhavn Metro, see "Cityringen - Udredning af metro til Ny Ellebjerg via Sydhavnen, Metroselskabet (2013). For the Malmö Tunnel, see "Citytunneln - Samhøllsekonomisk bedömning, Banverket (2001). For the Västlänken Tunnel, see "Västlänken, en tågtunnel under Göteborg - Underlagsrapport: Samhøllsekonomisk bedömning, Banverket (2006)

37. Rognlien, Lars (2010): Wider Economic Benefits of High Speed Rail, Steer Davies Gleave.



**The Connectivity Agenda:
The Öresund Metro enhances
transnational connectivity in the
Fehmarn Belt Region**

**Boosting integration in the Greater
Copenhagen Region by improving
mobility and accessibility**

In 2017, around 76,500 people travelled across the Öresund Bridge each day (one-way), 40% of whom travelled by train (Öresundståg) in the public transport system. Of these, around 14,000 were commuters.³⁸ The latest available prognoses estimate that the number of public passenger trips across the Öresund Bridge is expected to increase to between 49,000 and 61,000 daily trips in 2030.³⁹ With a new metro line across the Öresund, this number can potentially be boosted by 35% already in its opening year.⁴⁰

Today the trip between Copenhagen Central Station and Malmö Central Station takes 35 minutes. With a new Öresund Metro, this can be reduced to around 20 minutes.

By significantly lowering the travel time between Copenhagen and Malmö, the Öresund Metro can create a much larger home market and thus boost integration and expand passenger flows between the two main cities in the Greater Copenhagen Region.

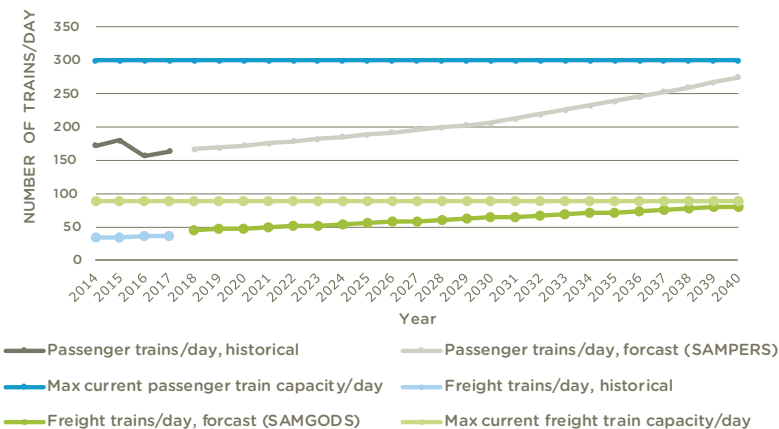
**Relieving existing rail capacity to
facilitate the expansion of freight
and long-distance passenger traffic**

The tracks on the Øresundsbanen have one of the highest capacity usages in the entire Danish railway system, with a very low punctuality of 65-70% during peak hours.⁴¹ The main causes of the low punctuality are sparse capacity to accommodate for the very diverse mix of trains passing the Öresund Bridge, as well as bottleneck issues at the Copenhagen Airport Station. With the current infrastructure and train types, the maximum daily (theoretical) capacity for freight and passenger trains across the Öresund Bridge are 88 and 300 in both directions, respectively. When the Fehmarn Belt Fixed Link opens in 2028, freight trains crossing the Öresund Bridge are expected to almost double in numbers of trains

from around 37 daily in 2017 to 72 per day by 2035. Although there will still be spare capacity, capacity usage will increase from current levels around 42% in 2017 to 56% in 2035. In addition, the fact that every train, and especially long freight trains, needs a safety distance to the following and previous trains, further decreases the possible frequency on the tracks. This may worsen the already low reliability in the freight and passenger traffic across Öresund.

At the same time, the number of passenger trains is projected to increase from around 163 daily trains in 2017 to 238 trains per day in 2035. Coupled with the planned opening of a new high-speed railway between Stockholm and Skåne after 2040, which will eventually connect Sweden and Denmark all the way to Hamburg, rail capacity across the Öresund Bridge needs to be relieved to accommodate the intensification of rail traffic. Capacity usage for passenger and freight trains is expected to be close to maximum capacity by 2035. This situation is illustrated in figure below.⁴²

**FORECASTED FREIGHT AND PASSENGER
TRAFFIC ACROSS THE ÖRESUND, 2014-2035**



Source: Ramboll, based on Trafikverket et al. (2017) and Trafikverket (2017).

38. <http://www.oresundsinstittet.dk/fakta-trafikken-over-oresund-de-seneste-12-maanaderna/>

39. Resande och transporter över Öresund, Trafikverket, Transport-, Byggnings-, og Boligministeriet and Sverigeförhandlingen (2017).

40. Øresundsmetro binder Greater Copenhagen Sammen - Resultater Fase III, Forundersøgelse. Malmö Stad of Københavns Kommune (2017).

41. Trafik-, Bygge- og Boligstyrelsen (2017): Trafikplan for den statslige jernbane 2017-2032 (Høringsudgave)

42. Forecasted numbers are based on forecasts in "Resande och Transporter över Öresund", Trafikverket, Transport-, Byggnings-, og Boligministeriet and Sverigeförhandlingen (2017) with an assumption of 250 weekdays for freight traffic and 320 weekdays for passenger traffic. The forecasts consider the opening of the FFL in 2028, but not the high-speed trains from Stockholm. Maximum capacity figures are from "Förbindelse över Öresund, Järnvägskapacitet, Trafikverket (2017). Capacity is defined as the theoretical capacity of the tracks based on the UIC 406 method.

In response to these capacity and bottleneck problems, the Danish state has decided to expand the Copenhagen Airport Station with two new platforms, which raises the maximum train capacity across the Öresund Bridge to 240 daily passenger trains in each direction, or 480 in total in both directions. Furthermore, when the new railway between Copenhagen-Køge-Ringsted opens in 2019, freight capacity increases to 128 daily trains in both directions. The projected completion of the Ring Syd-project includes improvements through an enlargement of the Ørestad Station, the Glostrup Station, new platforms on and a fly-over at Ny Ellebjerg Station.

Still however, these investments may not be sufficient to efficiently manage the large expected increase in railway traffic in the coming years. Capacity usage of passenger trains will increase from 54% in 2017 to 57% in 2040, whilst capacity usage of freight trains will increase from 42% in 2017 with the current infrastructure to 63% in 2040. Hence, even with the planned capacity improvements to the current infrastructure, capacity usage across the Öresund will increase. The result of this may be a worsening of the already low reliability in the freight and passenger traffic across the Öresund. In addition, the above mentioned capacity figures refer to the theoretical maximum capacities of the tracks across the Öresund. The practical capacity, however, is lower, which means that the actual capacity usage is likely to be even higher than stated above.

Alternatively, it could be argued, that it is possible to expand the capacity through a more efficient timetable. However, this is not necessarily a viable solution as there is an expectation of an increased demand of both passenger and freight traffic and as time tables must be coordinated between two countries and will have impact on both local and regional mobility.

In this respect, the Öresund Metro can relieve capacity across the Öresund Bridge of local trains, as commuters, business travellers and tourists can use a high-speed metro with 1.5 minutes frequency instead. This creates more room for both freight, regional and long-distance high-speed trains. As a result, the mix of trains passing the Öresund will be less diverse, which can ultimately improve the robustness and reliability of the public transportation system in the Greater Copenhagen Region.

Facilitating international connectivity by increasing the catchment area of Copenhagen Airport and connecting to high-speed trains from Stockholm

In 2016, Copenhagen Airport presented its Expanding CPH growth strategy and a EUR 2.7 billion investment, which includes an ambitious goal to expand its customer base from 29 million passengers in 2017 to at least 40 million passengers annually within 2030. The present catchment area of the airport is 4.3 million people, primarily covering Zealand, Southern Sweden, Funen and parts of Jutland. Copenhagen Airport is the largest airport in the Nordics including the

Hamburg airport, but its catchment area is markedly lower compared to other European airports such as in Amsterdam, Frankfurt, Zurich, Munich. According to the Danish Ministry of Transport, Building and Housing the passenger catchment area is a deciding parameter, on which airlines base their decision when placing new direct flight connections.⁴³ If the potential passenger catchment area on both sides of the Öresund is to be reached, the infrastructure connecting the airport to the adjacent transport system must be able to produce the necessary capacity and quality. Not only is this key for the competitiveness of Copenhagen Airport, it is also crucial for the international connectivity of Denmark and Sweden. Today, 62% of air passengers get to or from the airport by public transport, primarily via regional trains or the metro system.⁴⁴

The impact of Öresund Metro is the ability to create a more robust transport infrastructure system across the Öresund within the Greater Copenhagen Region and thus a larger and more integrated home market. A larger home market can be decisive when attracting more direct flight connections to the airport. Further it will enable capacity to long-distance high-speed trains from Stockholm to the airport and thus enlarge the catchment area, without compromising the local and regional needs for mobility.

43. Kortlægning og benchmarking af luftfartssektoren i Danmark (confidential), QVARTZ and Copenhagen Economics (2016) in Aviation Strategy for Denmark (2017).

44. Aviation Strategy for Denmark. Ministry of Transport, Building and Housing, Ministry of Foreign Affairs, Ministry of Finance, Ministry of Industry, Business and Financial Affairs (2017).



Growth

The Growth Agenda: The Öresund Metro as a facilitator of growth and regional development

Expanding the labour market within a 60 minutes commute from Copenhagen/Malmö City centres

Analysis show that the Öresund Metro will expand the functional labour market within 60 minutes commuting time to cover a larger part of the Greater Copenhagen Region.⁴⁵ For instance covering Glostrup, Lyngby-Taarbæk on the Danish side and Lund and Svedala on the Swedish side. The results are illustrated in the maps on page 25, which illustrates the accessibility from Copenhagen Central Station and Malmö Central Station respectively in 2017 (top) including the Öresund train and in 2035 (bottom) including the Öresund train and the Öresund Metro.

The accessibility analysis shown in the table below highlights the impact of the Öresund Metro in terms of inhabitants and workplaces which

can be reached within 60 minutes travel from Copenhagen or Malmö central stations respectively across the Öresund. Thus, 1 million more inhabitants will be able to reach each other within 60 minutes travel in 2035 with an Öresund Metro. This corresponds to a growth rate of 77%.

GROWTH

FROM **1.3** MIO.
TO **2.3** MIO.

LARGER LOCAL MARKET WITHIN 60 MIN. TRAVEL

Furthermore, the workplace accessibility will raise with 0,5 million more workplaces which will be reachable within 60 min. in 2035, using both a Öresund train and the Öresund Metro, compared to 2017. This is a growth rate of 63% from 2017 to 2035.

This represents vast possibilities for further expanding and deepening the regional ties in the Greater Copenhagen Region, and between Denmark and Sweden in terms of a better matching of supply and demand of labour through improved mobility from both sides of the Öresund. In 2016, 93% of commuters were Swedes working in Copenhagen

and living in Skåne.⁴⁶ It is primarily highly skilled workers who commute to the Swedish side, whilst more than half of the Swedish commuters are unskilled. This indicates a large demand for highly qualified labour primarily in the knowledge-intensive sectors such as research and education, business services and finance. On the other hand, the Danish side primarily demands unskilled labour from across the border, mainly to work in the service, tourism and trade sectors.⁴⁷

Facilitating closer collaboration between research and education institutions in the Greater Copenhagen Region

The labour market expansion within 60 minutes travel time from the Öresund Metro can facilitate closer collaboration between research and education institutions in the Greater Copenhagen Region, for instance in the strong Life Science Cluster in Medicon Valley, which employs 36,000 people across its 7 science parks, 15 universities and more than 400 companies.⁴⁸ In addition, the two research facilities in Lund, MAX IV (opened in 2016) and the ESS (expected to open in 2020), will potentially have 500 employees and connect 5,000 researchers within the fields of energy, climate, health, food and productivity.⁴⁹ With the Öresund Metro, travel time between these new research labs and Copenhagen Science City in Medicon Valley will decrease by 20 minutes, thereby making it possible to intensify knowledge-sharing and collaboration.

POPULATION AND WORKPLACE ACCESSIBILITY WITHIN 60 MINUTES TRAVEL TIME FROM COPENHAGEN AND MALMÖ CENTRAL STATION TO THE RESPECTIVE OTHER SIDE OF ÖRESUND. SOURCE: ÅF CONSULTING

	ACCESSIBILITY WITHIN 60 MINUTES	2017	2035	GROWTH (2017-35) (%)
Access for inhabitants	By Öresund train	1.3mio.	1.6mio.	0.3mio. (23%)
	By Öresund train & Öresund Metro	-	2.3mio.	1.0mio. (77%)
Access to workplace	By Öresund train	0.8mio.	0.9mio.	0.1mio. (13%)
	By Öresund train & Öresund Metro	-	1.3mio.	0,5mio. (63%)

45. ÅC consult, analysis of inhabitants and workplace accessibility of the Öresund Metro Line, 2018.

46. <http://www.oresundsinstittuet.dk/fakta-trafikken-over-oresund-de-senaste-12-maanaderna/>

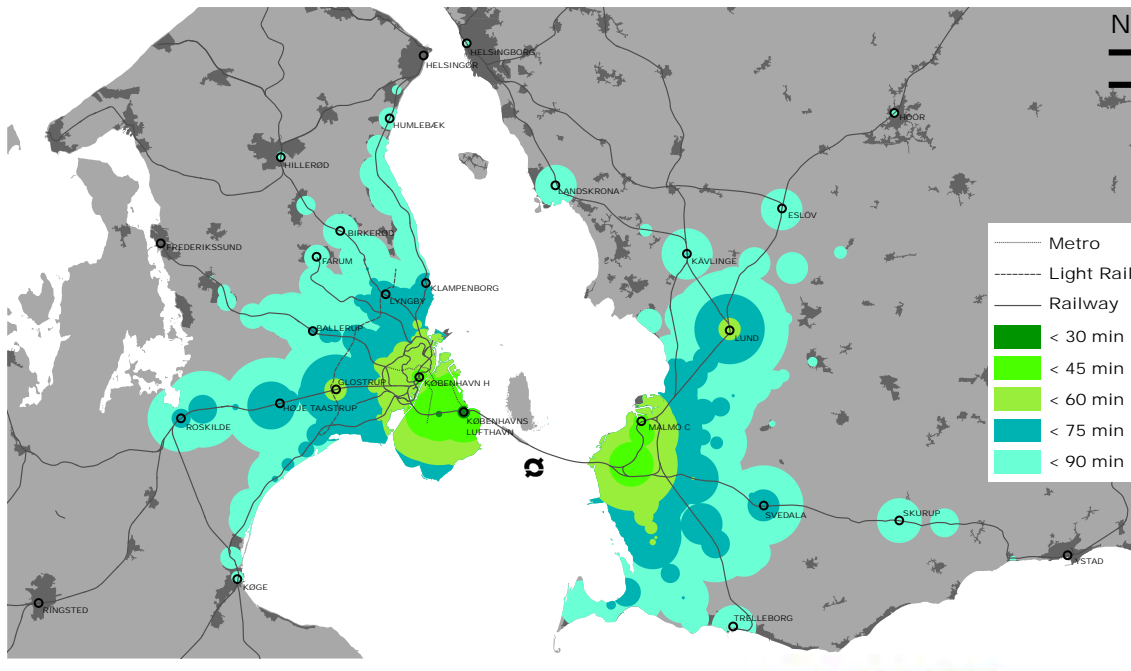
47. Aflædte økonomiske effekter, DAMVAD (2013).

48. http://mva.org/wp-content/uploads/2015/02/State_of_Medicon_Valley_2017.pdf

49. <http://www.gretercph.dk/projekter/ess-max-iv>

TRAVEL TIMES WITH THE ÖRESUND TRAIN

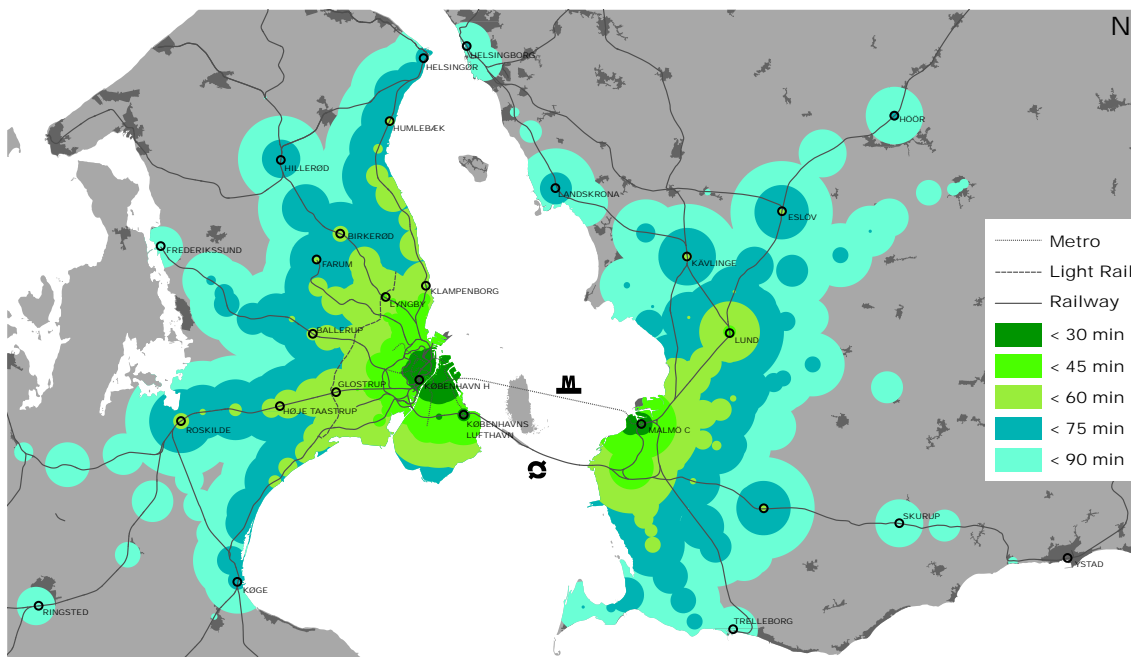
The map shows travel time across Öresund with the Öresund train between Malmö Central Station to the other side, and between Copenhagen Central Station to the other side.



Source: ÅF Consulting

TRAVEL TIME WITH THE ÖRESUND TRAIN AND THE ÖRESUND METRO

The map shows travel time across Öresund with the Öresund train or the Öresund Metro between Malmö Central Station to the other side, and between Copenhagen Central Station to the other side.



Source: ÅF Consulting



The Sustainability Agenda: The Öresund Metro enables modal shifts towards green transport modes, thus promoting green mobility

The Öresund Metro is expected to affect the environment positively. The main effect is a modal shift towards a greener transport mode. Öresund Metro has the advantage of being able to connect to the long-distance high-speed trains between Stockholm-Copenhagen-Hamburg, which is expected to be introduced after 2040. This strengthens the competitiveness of train trips compared to short-haul flights and thus promotes green mobility in the Fehmarn Belt Region. The possible increase in both leisure and business travelers taking the train instead of the plane will affect the climate positively.

In economic terms the Öresund Metro is expected to lead to a decrease in air pollution with a positive value of EUR 2.7 million in net present value, a reduction of CO₂ is estimated at EUR 1.1 million and a decrease in the noise pollution, which is valued at EUR 4.4 million.⁵⁰

The construction of the Öresund metro as a drilled tunnel with separated tracks and a Metro as transportation mode is considered the most environmentally and economically friendly.^{51,52}

50. Samfundøkonomiske beregninger på Øresundsmetro, Incentive Partners (2013).

51. Øresundsmetro binder Greater Copenhagen Sammen - Resultater Fase III, Forundersøgelse. Malmö Stad of Københavns Kommune (2017).

52. Rambøll (2013): Anlægsoverslag-kyst-kyst. Vurdering af koncepter, udførelse og anlægsoverslag for boret tunnel, sænketunnel og kombineret sænketunnel/lavbro.



Photo: Metroselskabet/Peter Sørensen



RAMBOLL