

GREEN **STRING** CORRIDOR

Øresund-Hamburg in 2½ hours



Green String Corridor has analysed the future passenger rail traffic on the Hamburg – Copenhagen – Malmö route. The analysis shows it is possible to halve the travelling time between Hamburg and Copenhagen-Malmö and establish a service of interregional trains connecting all towns in the STRING corridor

Reducing the mental distance

Although the distance between Hamburg and Copenhagen is only 350 km, the distance feels more like 500 km due to the low standard of the current transport networks on both sides of the Fehmarn Belt.

There is a world of difference between the current situation and the development potential for the transport system in the STRING corridor when the Fehmarn tunnel is in place. Today's train journey time of 4 hours 45 minutes can be halved and the number of train departures multiplied if the players involved work together to create integrated solutions. The resulting energy-efficient rail transport will have a far greater role for business and tourism than today. At the same time, the analysis shows that the corridor can be developed as a green corridor for goods transport.

Impact of a German-Danish high standard railway line

Vectura has analysed which rail system it is possible to establish in the corridor; in other words, how

often the trains can run, and what journey time is physically possible if the track must also carry goods traffic to the extent envisaged in Danish-German agreements. Vectura has further analysed how today's Danish-German rail system, which crosses one land border, can be expanded to cross Øresund and thereby connect Scania and Hamburg/Schleswig-Holstein.

If DB Netz AG decides to upgrade to the same high standard as on the Danish side, i.e. to a train speed between 200 and 250 km/h and not just 160 km/h, it will be possible to travel by ICE trains between Hamburg and Copenhagen in *2 hours and 15 minutes*. Vectura has assumed that the standard of railway on the German side will be the same as on the 230 km/h Hamburg-Berlin route. This means that journey time will be **halved** compared with today.

The two-hour reduction makes the infrastructure upgrade for the STRING corridor one of the European projects with the greatest impact on accessibility and journey time. Even in Germany it is hard to find comparable examples. The project will link together

Today it takes 2½ hours to reach the ferry border crossing. In 2021, it will be possible to cover the entire distance between both city centres in the same time.



the region from Øresund via the Fehmarn Belt to the Elbe and provide the south Scandinavian-north German region with a central position in the Trans-European Transport Network.

The high degree of accessibility will be achieved by combining a direct hourly express train with inter-regional rail departures every two hours via the Fehmarn tunnel serving all towns in the corridor. This principle is well known from other similar corridors in Scandinavia.

The future timetable

Establishing a fully upgraded double track and the same high standard train speed on the German side as on the Danish side will make it possible to plan a

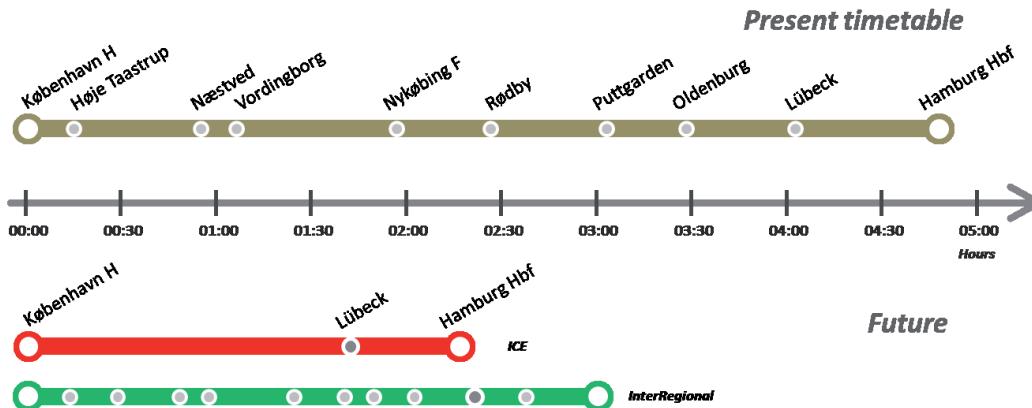
service pattern with several types of train systems, so that all towns will have a connection to the neighbouring country. This is consistent with the formal purpose of the cross-border transport system, which is to increase integration within the region in a practical sense. Today, there are continuous ferry departures every half hour. The timetable below similarly includes two hourly passenger trains.

In the example below, travelling time between Hamburg and Malmö is just under three hours. Berlin can therefore be reached from Malmö in 4½ hours. The fastest journey time between Lübeck and Nykøbing Falster will be 1 hour 9 minutes, and travelling between Lübeck and Copenhagen Airport will take two hours.

| | ICE | IR | ICE | ICE | IR |
|---------------------|------|------|-------|-------|-------|
| Hamburg Hbf | 7:00 | 6:26 | 8:00 | 9:00 | 8:26 |
| Lübeck Hbf | 7:35 | 7:03 | 8:35 | 9:35 | 9:03 |
| Oldenburg | | 7:26 | | | 9:26 |
| Burg N | | 7:45 | | | 9:45 |
| Rødby N | | 7:57 | | | 9:57 |
| Nykøbing F | | 8:12 | | | 10:12 |
| Vordingborg | | 8:26 | | | 10:26 |
| Næstved | | 8:39 | | | 10:39 |
| Ringsted | | 8:52 | | | 10:52 |
| Roskilde | | 9:07 | | | 11:07 |
| København H | 9:15 | 9:28 | 10:15 | 11:15 | 11:28 |
| CPH airport Kastrup | 9:35 | | 10:35 | 10:35 | |
| Malmö C | 9:51 | | 10:51 | 11:51 | |

| | ICE | IR | ICE | ICE | IR |
|---------------------|------|-------|-------|-------|-------|
| Malmö C | 6:24 | | 7:24 | 8:24 | |
| CPH airport Kastrup | 6:40 | | 7:40 | 8:40 | |
| København H | 7:00 | 7:49 | 8:00 | 9:00 | 9:49 |
| Roskilde | | 8:09 | | | 10:09 |
| Ringsted | | 8:25 | | | 10:25 |
| Næstved | | 8:38 | | | 10:38 |
| Vordingborg | | 8:51 | | | 10:51 |
| Nykøbing F | | 9:07 | | | 11:07 |
| Rødby N | | 9:24 | | | 11:24 |
| Burg N | | 9:37 | | | 11:37 |
| Oldenburg | | 9:55 | | | 11:55 |
| Lübeck Hbf | 8:40 | 10:17 | 9:40 | 10:40 | 12:17 |
| Hamburg Hbf | 9:15 | 10:56 | 10:15 | 11:15 | 12:56 |

The above draft timetable includes one direct ICE service every hour and a two-hourly interregional service connecting all large intermediate towns. The present situation and the future transport system through the Fehmarn Belt tunnel are shown below.



A key European corridor emerges

The Fehmarn link and the STRING corridor belong to the central north-south corridor in the EU's new 'core network', the most highly prioritised part of the Trans-European Transport Network (TEN-T).

In sharp contrast to the status of the Hamburg-Copenhagen-Malmö route as a section of one of the EU's nine core network corridors, the average speed of international ICE trains is currently 77 km/h, while rail freight has to take an entirely different and very slow route via Jutland to move between Scandinavia and the European continent.

To derive optimal social benefit from the Fehmarn Belt tunnel, the transport infrastructure must be upgraded throughout the corridor.

On the Danish side, investment of 3.5 billion EUR has been approved for the railway, which will be upgraded to 200-250 km/h over the entire route. Included in this will be the latest standard of European signalling technology (ERTMS level II), a new road and rail bridge across the Storstrøm Strait, and upgrading of the parallel Lille-Syd line, which as well as local traffic will also be able to take some of the international goods traffic.

On the Danish side, three tracks will therefore be available in north-south traffic on part of the route and four tracks close to Copenhagen. Parallel with the initiated railway upgrade, the motorway system

will be upgraded with additional lanes and hard shoulders on the highway E47 (Sydmotorvejen) to increase capacity and safety in the international transport corridor.

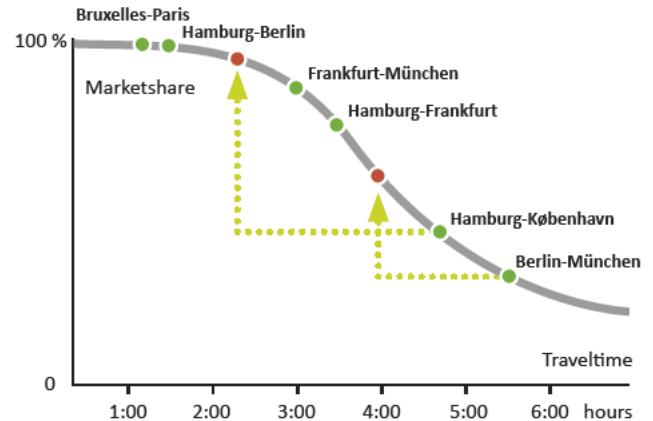
On the German side, DB is currently engaged in a series of technical studies into upgrading the double track in east Holstein, i.e. the Lübeck-Fehmarn route. These studies are part of the regional planning process leading to a choice of route alignment.

The level of investment will be 1.5 - 1.7 billion EUR depending on solution and railway standard. On the Danish side, compliance with the Treaty provisions will be exceeded (line speed will be raised beyond regional train standard to international standard, and a new 4 km double-track Storstrøm Bridge will be built).

On the German side, consideration is being given to a variety of route models and whether to comply with the minimum conditions of a line speed of only 160 km/h. Most recently, a '2+1 solution' has been suggested as an environmental friendly alternative. All the proposed alternatives should be analysed on a uniform technical basis.

Total investment approved and under discussion for the entire STRING corridor, including motorway link, exceeds 10 billion EUR. The combined corridor project therefore belongs in the category of European megaprojects, such as the Brenner tunnel in the Alps.

| | Million EUR |
|--|----------------|
| Danish hinterland | |
| Rødby-Ringsted incl flyover + ERTMS | 1.500 |
| New Storstrømmen Bridge, double track | 500 |
| Ringsted-Copenhagen with branch to Øresund | 1.500 |
| Total | 3.500 |
| Fehmarn Belt link | |
| Coast-to-coast tunnel, road and rail | 5.500 |
| German hinterland | |
| Fehmarn-Lübeck Hbf new double track | minimum 1.500 |
| Total investment | |
| Danish-German infrastructure investments | approx. 10.500 |



Showing the market share for rail compared to air as a function of journey time. Source: Deutsche Bahn (2010). Hamburg-Copenhagen has been inserted as an estimate (TDL).

Dimensioning for the future

The highly prioritised TEN-T corridor from Stockholm to south Italy runs via the Fehmarn Belt and Brenner Pass. In terms of traffic, this is one of the most important north-south corridors in Europe, something that should be reflected in a suitably long-term and ambitious level of investment. With the investment proposed it is vital that the capacity criteria should be satisfied and that the corridor infrastructure should not be under-dimensioned.

Traffic forecasts in Denmark's National Transport Plan for 2012-2027 are unchanged. The annual number

of passenger journeys across the Fehmarn Belt will quadruple to 1.5 million. These journeys are based on train speeds that give a travel time of 3½ hours from Copenhagen to Hamburg, i.e. solely with the effect of the Fehmarn Belt tunnel.

Freight traffic is forecast to increase to 78 trains daily, corresponding to a transported transit volume of 18 million tonnes. This equates to up to three goods trains an hour in each direction.



Experience shows that shorter journey time leads to higher market share. Deutsche Bahn has examined a number of route upgrade examples and typical market reactions where the attraction of rail travel - and thus also passenger flow - is increasing. One example is the modernised Berlin-Munich route where journey time is successively being shortened by 1½ hours so that the line in future can handle a significantly larger part of the demand.

New forecasts are in the pipeline for the future traffic across the Fehmarn Belt. We do not currently know what they will contain but the impact of the upgraded land works that will enable ICE journey time to be reduced to 2 hours 15 minutes will, all things being equal, increase passenger flow in the corridor, cf. the figure.

Increased accessibility and growth

In the 'HTC reports' produced for STRING, an analysis shows a potential travel flow of two million rail passengers annually after the introduction of a high-speed rail service between Hamburg and Copenhagen and an onward link across Øresund. The findings show that the more attractive and faster a transport link becomes, the more people on both sides of the Fehmarn Belt will begin visiting each other's country.

The infrastructure in the corridor is not in itself the objective. The objective is to establish conditions for a corridor that can contribute to growth and, all

other things being equal, reduce environmental impact. This is the real agenda for deciding upon a high standard in the cross-border transport systems.

The dynamic socio-economic impacts, including labour market and business impacts, can generate benefits that far outweigh the costs of establishing the modern infrastructure. For example, 13 years after its opening, the Øresund Bridge has generated a 'consumer surplus' which is twice as large as the initial investment. According to the Øresund Committee, the utility value is quantified as 7 billion EUR compared with building costs of 3.5 billion EUR.

A link that significantly expands the capacity for the transport of goods and creates high-speed rail connections for passengers will bolster the cross-border region against global competition. The position of the two largest cities will be strengthened, but the densely populated and heavily congested central metropolitan areas will also benefit from a large regional labour force in the hinterland with clearly improved accessibility. According to the OECD, a strengthened German-Scandinavian border region is contingent upon an efficient and well-proportioned infrastructure in which a modern railway interfaces with and supports both ports/shipping and aviation.

The process ahead

It is significant that infrastructure development in the Øresund-Hamburg corridor has not come about by means of a coordinated overall political initiative. On the contrary, it is the result of eight separate investment decisions covering individual route sections that must ultimately be combined.

This is unlike other European corridors such as Barcelona-Paris through the Pyrenees, Lyon-Torino through Mont Cenis, or Munich-Verona through the Brenner Pass, so this in itself is striking. To obtain full benefit from the investment a coordinated strategy is called for.

The need for decisions before 2021

To realise the proposed transport system there is a need for joint planning before the corridor is finished. This increases the chances for creating a success.

The organisational question of who is to be the driving force in establishing passenger rail transport across the Fehmarn Belt is becoming urgent, not least because the procurement of new electric trains takes many years.

Investment in new trains able to crossing the Danish-German-Swedish borders demands a consensus on future transport. In Denmark, the Minister of Transport has the responsibility for procurement of passenger transport, while in Germany and

Sweden this responsibility is vested in a mixture of regional authorities and commercial train operators.

Finally, decisions have yet to be taken on whether the German land works shall have the same standard as those in Denmark.

Additional long-term perspectives

In the longer run, considerable potential exists in further developing one of Europe's core network lines after 2021.

A logical step on the German side would be to solve the capacity problems around Hamburg by implementing the S4 suburban railway project in the form of a third and fourth track to Ahrensburg/Bad Oldesloe. In October 2013, the EU granted funding for the preliminary studies. There would also be advantages in extending the line from Lübeck towards Schwerin via Bad Kleinen and in establishing a Lübeck railhub connecting the harbour terminal areas with a northern entry track.

A long-term Danish initiative could be to create a 'shortcut' by building a new line between Køge Nord and Vordingborg that could further reduce journey time. Studies are also taking place on building a second parallel Øresund fixed link that can increase the capacity of the entire STRING corridor and thereby contribute to a greener transport system.





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Background reports

For more details, see the Green STRING Corridor reports:
Traffic Analysis Malmö-Hamburg, Vectura 2012.
Market study: Improved train-service Öresund-Hamburg,
COWI 2014.

Website

www.stringcorridor.org

