



Multimodal Mobility in Denmark: A Collaborative Approach to Bridge Building

By Lars Møller



The past 15 years have been historic for Danish bridge building, with bridges having been completed across the strait of Great Belt within Denmark and the strait of Øresund to Sweden and another under consideration between Denmark and Germany. The Great Belt and Øresund links are among the largest bridge and tunnel projects in the world, and the Denmark–Germany structure, if built, will be as well. The three projects were envisioned as a means of upgrading the main corridors of Denmark’s infrastructure. Not surprisingly, their impact on the country’s traffic and economy has been significant.

The Great Belt Bridge

The 11.5-mile-long, fixed link across the Great Belt between eastern and western Denmark comprises three parts: the Western Bridge, a beam



bridge for road and rail traffic; the Eastern Bridge, a suspension bridge for cars; and the Eastern Tunnel, for rail transport. Denmark's population of approximately 5 million is evenly split between the two sides of the Great Belt. The link therefore is a key component of the Danish—and European—road and rail network.

The Eastern Bridge has a free span of approximately 1,624 meters, or 1 mile, making it the second-largest suspension bridge in the world, after the Akashi-Kaikyo Bridge in Japan, which measures 1,991 meters. Traffic adjusted very quickly to the Eastern Bridge, and car and lorry traffic across it today is more than double the traffic on the ferryboats that operated on the Great Belt before the bridge opened, in June 1998. Today, more than 25,000 cars cross the bridge daily.

Although the Great Belt link replaced three ferry routes on the Great Belt strait, ferry services continue to operate north and south of the link, across the sea of Kattegat and between the islands of Lolland and Langeland. The link, however, is the most used passageway between east and west Denmark, and its opening brought about several important changes in traffic between the two regions. The link attracts many people who previously traveled by air or used ferry services across the Great Belt. It also has created a relatively large volume of new traffic because the link is easier, faster, and cheaper to use than the previous ferry routes.

Spreading the Costs

The total cost of the Great Belt project amounted to almost US\$6 billion including interest. By and large, those costs have been spread evenly between the road and rail components.

To cover construction costs, The Great Belt Company, which is solely owned by Danish holding company Sund & Bælt Holding A/S, acquired loans in Danish and international capital markets. All loans are guaranteed by the Danish state, resulting in favorable loan conditions. The Great Belt Company repays the loans, including interest, from the toll revenue from the link's motorists and the Danish National Railways Agency, which operates the rail link. The agency pays a fixed annual fee of approximately US\$100 million to the company to use the bridge, while motorists pay US\$32 per passenger-car passage and US\$150 per lorry passage. In 2005, revenue from motorists exceeded US\$300 million. The Great Belt Company's debt is expected to be repaid in full by 2028.

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The Øresund Bridge and Beyond

The fixed link across Øresund connects Denmark and Sweden and comprises a 4-kilometer, immersed tunnel; an artificial island, Peberholm, which measures 4 kilometers long; and an 8-kilometer, cable-stayed bridge with a main span of 490 meters. The bridge, whose two pylons are 204 meters high, has two levels: the railway, which runs along the lower deck, and the motorway, which runs along the upper deck.

Construction of the Øresund fixed link took place between 1995 and early 2000. The land works on the Danish side comprise an approximately 7-mile-long electrified railway from the Øresund coast to the Copenhagen Central Station, along with a 6-mile-long motorway from the coast to the existing motorway network in east Denmark. The Swedish land works comprise approximately 6 miles of railway and motorway from the coastline to Malmö. The consortium Øresundsbro Konsortiet's parent companies, A/S Øresund and SVEDAB AB, administer and finance the land works in Denmark and Sweden, respectively. The bridge's revenues will also finance the land works.

As mentioned earlier, a third bridge, the Fehmarnbelt Bridge, is under consideration. Currently Sund & Bælt Holding A/S, together with German counterparts, is conducting an evaluation of the proposed 13-mile fixed rail and road link between Denmark and Germany. It has not yet been decided which financing model should be applied to the new structure, but the state guarantee model described above is a possibility.

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Strategies for Multimodal Solutions

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Because ferry traffic suffered severe competition from the link, it was agreed that two ferry routes, one to the north and another to the south (see map, page 82), should maintain their operation with financial support from The Great Belt Company if the routes couldn't survive commercially on their own. This has been the situation since 1998 on the Spodsbjerg and Tårs ferry route, which The Great Belt Company has supported financially since that time. The argument for enlisting the company's support was that large regions of Denmark far away from the link would lose their normal ferry

service to the other side of the country if the Spodsbjerg and Tårs route were to go under. These travelers would suffer increased travel times and distances if they were forced to use the new link instead.

Another fundamental tenet of the Great Belt link political agreement was that the road link across the strait should partly finance the rail link. The rail link's payment for the use of the fixed link is lower than the project's construction and operational costs. The difference, as alluded to above, is covered by revenues from road traffic.

After a few years of operation, it was obvious that the traffic level and the revenue from the road link exceeded expectations. As a result, a strong debate arose pushing for lower tolls, and in early 2005 the political parties

behind the Great Belt law decided to lower the tolls for road and rail traffic on the Great Belt bridges.

Delegating Responsibilities

Three central parts of the Great Belt political agreement focused on delegating responsibilities regarding other means of transportation, including the proposed Fehmarnbelt Bridge, the Great Belt rail link, and several Danish harbors.

First, the political parties involved decided to form the Danish Fehmarnbelt Company to handle the Danish share of preparations for the proposed link to Germany, including studies on financing, technical solutions, and the organization of the bridge company. The company has been established as a sister company to The Great Belt Company under Sund &



Bælt Holding A/S. In this way, it was hoped the experience gained in other large bridge projects in Denmark regarding construction and operation could be exploited in the Fehmarnbelt project.

Second, it was decided that responsibility for operating and maintaining the rail link across the Great Belt should be transferred from the Danish National Railways Agency to The Great Belt Company. This was logical because the latter owns the railway link across the strait. This arrangement ensured that the operation and maintenance of the total fixed link would be the charge of one organization, so as to minimize maintenance-related disturbances to road and rail traffic.

The third part of the political agreement allowed The Great Belt Company to negotiate a takeover of the harbors in Odden, Ebeltoft, Spodsbjerg, and Tårs for the benefit of the Danish public. These harbors include the ferry routes that enjoy the possibility of gaining financial support from The Great Belt Company as outlined in the original Great Belt law. The agreement stipulated that the takeover should be agreed to under normal com-



mercial conditions, however, meaning that the cost of purchasing the harbors should be repaid by the users through a harbor toll. Thus, the takeover would not include financial support to the harbor owners or ferry operators.

Negotiations over Odden and Ebeltoft were successfully completed by the end of 2005. The owner of these harbors was ferry operator Mols-Linien. The harbors in Spodsbjerg and Tårs are owned by the Danish State Road Directorate and are expected to be taken over by May 2006.

The harbor takeovers benefit the Danish public in several ways. First, they ensure that The Great Belt Company can make a public tender in the event

the ferry routes can no longer be run commercially. Second, the company's ownership ensures that very strong alternative routes would exist between east and west Denmark should an accident or security incident disconnect the fixed link across the Great Belt. In such an event, the company could activate extra ferry operations from all four harbors. Third, the company's ownership of the harbors fosters stronger relationships with the ferry operators, which were previously considered



competitors. In this way, company staff and ferry staff can share with one another their knowledge of technical operations and maintenance, traffic congestion solutions, traffic information, toll plaza operations, and customer service. This optimizes operation of the East–West-oriented infrastructure in Denmark and permits coordinated action in the event of accidents or restrictions to traffic. It does not, however, prevent the Great Belt link operators and the ferry operators from competing with one another when it comes to setting toll rates and marketing their products.

Relevance of a Broad Multimodal Perspective

Taking such substantial action to consider other modes of transport as was done in the Great Belt link and likely will be done with the proposed Fehmarnbelt Bridge isn't necessarily appropriate for all types of user-financed bridges. First, the project must be of sufficient size such that it affects several modes of transportation and potentially threatens the survival of infrastructure.

Second, a multimodal perspective such as the one illustrated by Great Belt is relevant when the revenues from the basic project are substantial and constitute a potential source of financing for other modes of transportation. In other words, a considerable cash flow from the toll-financed operation is essential. Finally, the various modes of transportation involved must offer mutual benefits of some kind, such as being able to cover the demand for transportation when accidents, inclement weather, or other incidents disturb traffic on one or more of the main transport corridors.

As the Great Belt link project shows, when transportation modes work together, a productive, efficient transportation network can result.

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