



**Consolidated construction estimate for the Fehmarnbelt Fixed Link - August 2011**

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### 1. Background

Femern A/S has prepared a consolidated construction estimate for an immersed tunnel solution beneath the Fehmarnbelt. The construction estimate takes into account the decision to produce standard tunnel elements at Rødbyhavn and the Finance Committee's approval of Document 149 of 23 June 2011 in which the planning stage budget was increased to EUR 377.4 million.

It should be noted that the construction estimate should be seen as the best possible assumption based on the information currently available. It cannot be excluded that new information, official requirements, political requirements or delays arising from complaints etc. could result in modifications to the project, the timetable and, consequently, to the estimate. It must also be emphasised that the present recommendation was prepared prior to the implementation of the Environmental Impact Assessment (EIA). The final construction budget will be determined in connection with the passage of the Danish Construction Act.

### 2. Overall construction estimate

The construction estimate for an immersed tunnel appears in Table 1.

**Table 1 Construction estimate**

<b>2008 prices</b>	<b>Immersed tunnel</b>
Construction costs	EUR 3.8 billion
Other works	EUR 0.3 billion
<b>Total construction costs*</b>	<b>EUR 4.1 billion</b>
Project management, operational preparations, etc.	EUR 0.7 billion
Reserves	EUR 0.6 billion
<b>Total gross costs*</b>	<b>EUR 5.5 billion</b>
Expected EU subsidy	EUR 0.6 - 1.2 billion
<b>Total net costs*</b>	<b>EUR 4.3- 4.9 billion</b>

\* The total may differ from individual items as a consequence of rounding up.

The construction estimates cover the period from 1 April 2009 until the opening of the fixed link in 2020, cf. the timetable. The estimate includes, therefore, the already earmarked resources for the planning stage and for tender preparations etc. of EUR 377.4 million.

The subsequent sections review the background to the individual items in the consolidated construction estimate.

### 3. Construction costs

**Table 2 Construction costs and other works**

<b>2008 prices</b>	<b>Immersed tunnel</b>
Construction costs	EUR 3,842 million
Other works	EUR 258 million
<b>Total *</b>	<b>EUR 4,100 million</b>

\* Pursuant to Document 149 of 23 June 2011, costs in the amount of EUR 49 million may be incurred for advanced activities

The construction costs cover all the expenses to be paid by the company to the contractors for constructing a fixed link across the Fehmarnbelt. The overall estimate of construction costs is EUR 3.8 billion.

The construction costs are based on the estimates prepared by the consultant Rambøll-Arup-TEC JV for an immersed tunnel solution. The estimate has been examined by the Femern organisation in respect of both technical and financial aspects. This has resulted in a number of adjustments so that the project meets the technical requirements and the basic calculation assumptions such as, for example, the concrete, steel and labour costs. The construction estimate was subsequently adjusted to allow for the location of the production facilities at Rødbyhavn, resulting in an additional cost of EUR 380 million, and the approval of Document 149 in June 2011.

The budget item, Other works, comprises the construction activities that fall within the client's responsibility and therefore do not form part of the conceptual design as well as activities which are necessary to implement the project but not part of the actual construction. The costs have been identified on the basis of the experience from the Øresund project. Other works thus comprise the following:

- Navigational safety in the form of a VTS system, buoyage and/or temporary lighthouses – approx. EUR 33.6 million
- The client's leasing of monitoring boats – approx. EUR 13.42 million
- Investigations and compensation measures (environment, archaeology, removal of explosives, etc.) – approx. EUR 13.42 million
- Replacement and purchase of land (purchase of land, compensation for affected farmers, fishermen and other business operators) – approx. EUR 40.3 million
- All-risk insurance of the construction – approx. EUR 53.7 million
- Toll station and payment system in Denmark – approx. EUR 47 million
- Facilities for customs and border control in Denmark and Germany – approx. EUR 13.4 million
- Visitor centres in Denmark and Germany – approx. EUR 6.7 million

It should be noted that the costs for a number of items are difficult to assess, e.g. the need for removing explosives and the need for compensation, etc.

By virtue of Document 149 of 23 June 2011, Femern A/S already has the authority to incur costs concerning the establishment of a VTS system, the acquisition of land and marine archaeological investigations totalling EUR 49 million prior to the adoption of a Construction Act.

#### 4. Project management, operational preparations, etc.

**Table 3 Project management, operational preparations, etc.**

<b>2008 prices</b>	<b>Immersed tunnel</b>
Planning*	EUR 249.3 million
Tender preparations*	EUR 57.7 million
Construction phase	EUR 380.8 million
Operational preparations	EUR 40.9 million
<b>Total</b>	<b>EUR 728.7 million</b>

\* Granted pursuant to the Danish Planning Act and Document 140 of 3 June 2010 and Document 149 of 23 June 2011

Project management, operational preparations, etc. cover the client organisation's own costs for salaries and operations, etc., costs for external consultants and the preparations for operations.

Most of the funds will be used to cover the costs of external consultants. During the planning phase, these costs will comprise, for instance, the preparation of conceptual designs, environmental investigations, geotechnical surveys and tender preparations, while during the construction phase costs will be incurred for client consultancy, supervision and environmental monitoring.

As is apparent in Table 3, just under EUR 309 million of the costs are expected to be incurred prior to the passage of a Construction Act. The company has the authority to incur costs pursuant to the Planning Act and Document 140 of 3 June 2010 and Document 149 of 23 June 2011. The costs cover both planning and tender preparations which have been brought forward with a view to optimising the time schedule.

During the construction phase, it has been assessed that costs of just under EUR 60.4 million per year will be incurred for project management etc. The assessment is based on experience from the Øresund project. The construction period for an immersed tunnel has been estimated at 6.5 years.

In addition there will be costs relating to the preparations for the operational phase of around EUR 40.3 million which include expenses for the preparation and establishment of the permanent operational organisation and expenses for the training of Danish and German speaking personnel, the establishment of contingency measures, market development, coordination, etc. The assessment is based on experience from the Øresund project.

## 5. Reserves

The total reserves have been calculated on the basis of two risk assessments of the contractor's risks and the client's risks. As a consequence of the fact that the risk allocation in future contracts has not yet been determined, the specific assessments are obviously subject to some uncertainty. Both assessments have been undertaken with the help of so-called Monte Carlo simulations which build on a review of all identifiable risks, an evaluation of the probability of them occurring as well as an assessment of their financial consequences. The reserves also include the reserves for the planning phase and for the tendering phase.

The estimated reserve requirements in respect of a tunnel solution are expected to amount to EUR 644 million. This corresponds to an addition of 14 per cent to the overall costs.

**Table 4 Reserves**

<b>2008 prices</b>	<b>Immersed tunnel</b>
Planning and tendering phase*	EUR 21.5 million
Contractor risks	EUR 208.5 million
Client risks	EUR 361.7 million
Free reserves	EUR 53.7 million
<b>Total</b>	<b>EUR 645.2 million</b>

\* Granted pursuant to the Danish Planning Act and Document 140 of 3 June 2010 and Document 149 of 23 June 2011

The total reserves cover the reserves already allocated in connection with the planning phase of EUR 21.5 million.

The major reserve items cover the contractors' risks, which will be the price the company has to pay in addition to the construction costs with a view to getting the contractors to assume the risks relating, for example, to weather, design responsibility, known geotechnical issues, defective material, breakdowns in production facilities, etc. The item is included under reserves although it is an expected contractual payment to the contractor, as this gives the most accurate picture of the total reserves. The payment thus reduces the company's risks and thereby the size of the client's risk.

The client's risk covers the risks that the company has assumed. This relates, for example, to the risks in connection with extreme weather conditions or cost increases which are due to changes in legislation, etc. A number of risks will be covered by the company's insurance and, therefore, there is no need to allocate reserves to cover these risks.

In addition, there is a free reserve of EUR 53.7 million to cover unforeseen events. As a result, the risk calculations cannot take into account all eventualities which, in one way or another, would have implications on the costs for the project. The free reserve equates to around 1 per cent of the overall project sum.

An additional reserve of approx. 14 per cent of the total project sum is significantly lower than the reserves that are typically allocated for government road and rail projects. That a need for a larger reserve has not been assessed is due to the fact that the detailed work in the planning phase helps to identify the risks and, to a large extent, take them into account in the final project, which reduces the overall risk. Moreover, as a starting point, a major project like the Fehmarnbelt link would be more robust than smaller construction projects in that individual events are less likely to have a significant impact on overall costs.

## **6. EU subsidy**

The Fehmarnbelt link is a priority project under the EU's TEN programme, which means that the company can obtain grants for the planning of the link and for the construction work itself.

The TEN subsidy is granted to infrastructure projects within the framework of the funds allocated in the EU budget's 7-year financial perspectives. The current funding period covers the period 2007-2013 while the future funding period will cover the period 2014-2020, when most of the costs for the establishment of the fixed link are expected to be incurred. As the framework for the next funding period will only be determined in the course of 2013, it is not possible to accurately assess how much EU subsidy the project would obtain.

In connection with the adoption of the Planning Act, it was assumed that the project would be able to obtain 50 per cent funding of the planning costs and 10 per cent in support for the construction costs. Using current assumptions, this means that a tunnel link would obtain EUR 644 million in EU subsidy.

It has turned out, however, that the subsidy for the Fehmarnbelt project during the current funding period (2007-2013) has been significantly higher because the project has been awarded 50 per cent subsidy for planning costs and approx. 24 per cent for construction costs. The possibility exists, therefore, that the company – in the subsequent funding period – would be able to achieve a higher subsidy for the construction costs than previously

anticipated. Assuming that the project can receive 20 per cent subsidy for the construction costs, this would mean that the tunnel project would receive an EU subsidy of EUR 1.2 billion.

**Table 5 EU subsidy**

<b>2008 prices</b>	<b>Immersed tunnel</b>
Planning expenses*	EUR 232.5 million
Construction expenses*	EUR 5,331.1 million
<b>Total expenses*</b>	<b>EUR 5,563.6 million</b>
Subsidy, planning (50 per cent)	EUR 116.2 million
Subsidy, construction (10 per cent/20 per cent)	EUR 533.2 / 1,066.3 million
<b>Total subsidy</b>	<b>EUR 649.4 – 1,182.6 million</b>

\*Expenses eligible for subsidy, including administration overheads, which is why the figures differ from the construction estimate

## 7. Operations, maintenance and reinvestments

Operations, maintenance and reinvestment are not included in the construction estimate but are a pre-condition for carrying out profitability calculations.

Femern A/S has chosen to base the operations, maintenance and reinvestments estimate on experience from the Øresund project which comprises a cable-stayed bridge and an immersed tunnel. This was the same method used for the repayment time calculations carried out in 2008 prior to the passage of the Planning Act.

**Table 6. Operations, maintenance and reinvestments**

<b>2008 prices</b>	<b>Immersed tunnel</b>
Operations, maintenance and reinvestments (annual)	EUR 73.7 million*

\* Calculated annual average based on the expected reinvestments in the link's first 40 years.

## 8. Profitability calculations

Based on the current construction estimates and assumptions for the construction time, as shown in Table 7, profitability calculations have been carried out on the basis of the overall repayment of costs for both the coast-to-coast link and the hinterland infrastructure.

The assumptions that underpin the financial analyses of the Planning Act are unchanged, cf. the Appendix, apart from the construction estimates for the coast-coast link and the hinterland infrastructure. It should be noted that the starting point is a stand-alone calculation where no account has been taken of the consequences, if any, of joint taxation with the Sund & Bælt group.

It is assumed that the Danish hinterland infrastructure will be repaid through dividend from Femern A/S and that the dividend payments will start when the equity has been re-established and constitutes one third of the year's profits. After Femern A/S' debt is repaid, the year's profit will be paid as dividend.

**Table 7 Assumptions for profitability calculations**

<b>2008 prices</b>	<b>Immersed tunnel</b>
Coast-coast link	EUR 5.5 billion
Hinterland infrastructure	EUR 1.1 billion
Construction period	6.5 years

**Table 8 Repayment times for the two conceptual designs**

<b>Number of years</b>	<b>Immersed tunnel</b>	
	Coast-to-coast alone	Including Hinterland infrastructure
10 per cent TEN subsidy/3.5 per cent real interest	33	39

With conservative assumptions of a TEN subsidy of 10 per cent of the construction costs and real interest of 3.5 per cent, the coast-coast link will be repaid after 33 years with a tunnel solution. The hinterland infrastructure will be repaid after 39 years with a tunnel solution.

If the real interest over the period is lower than 3.5 per cent and/or if the project obtains a higher TEN subsidy, this will mean shorter repayment times.

### Appendix – assumptions used in the profitability calculations<sup>1</sup>

In connection with the profitability calculations, the same basic assumptions have been used as in the financial analysis prepared in 2008 for the Planning Act<sup>2</sup>.

The profitability calculations are, however, based on the current construction estimates for a tunnel and hinterland infrastructure. The calculations are also based on the link opening in 2020, which has an impact on the traffic assumptions and price level (both are projected with 2 years' expected inflation and 2 years' expected traffic development).

While based on the current construction estimate costs, the TEN subsidy has been calculated on the basis of the same subsidy assumptions (50 per cent for the planning costs and 10 per cent for the construction costs).

Construction costs, tunnel	EUR 5.5 billion
Operation and maintenance costs, tunnel	EUR 73.7 million p.a.
Construction costs, hinterland infrastructure	EUR 1.1 billion
Equity (EUR million, 2008 prices)	67.1
Real interest	3.5% p.a.
Inflation	2.5% p.a.
Discount rate	6.1% p.a.
Depreciation	Historic original cost depreciated on a straight-line basis over 100 years
Debt payment profile	Annuity
Corporation tax (project company)	25%
Growth rate for road traffic in the first 25 years of operation	1.7% p.a.
Guarantee commission	0.15% p.a.
"Ramp-up" period – road traffic	4 years
Annual rail payment (EUR million, 2008 prices)	47
TEN subsidy (planning costs/construction costs)	50% / 10%

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<sup>1</sup> All amounts are in 2008 prices

<sup>2</sup> It should be noted that the financial analysis was based on calculations in respect of a bridge solution only.