Øresund Link technical visit October 2, 2009
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<th>Times</th>
<th>Company/ Speaker</th>
<th>Subject</th>
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<td>09.30-10.00</td>
<td>DSBFirst</td>
<td>A review of safety features and facts about the trains at Svågertorp Station.</td>
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<td>10.00-11.30</td>
<td>Øresund Bridge</td>
<td>Study visit DSBFirst and Øresund Bridge.</td>
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<td></td>
<td>Rolf Sundqvist/</td>
<td>Guided tour with an Øresund train on the Øresund link</td>
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<td>Alan Rees</td>
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<td>12.00-13.00</td>
<td>Lunch</td>
<td>Luftkastellet (Air Castle)</td>
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<td>Øresund Bridge</td>
<td>Ensuring Crossborder operation without compromising safety</td>
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<td>13.25-13.50</td>
<td>Rambøll</td>
<td>Establishing and Operation of a Safety Management System</td>
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<td>13.50-14.10</td>
<td>DSBFirst</td>
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<td>14.10-14.30</td>
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<td>Banverket</td>
<td>Radio Tele (GSM-R) Telecommunications Systems - GSM-R in general and its implementation on the Øresund Link</td>
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<td>Peter Carlsson</td>
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<td>14.55-15.20</td>
<td>Ansaldo Signal</td>
<td>ATC Signal, ATP System and interfaces between Danish and Swedish Systems</td>
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<td>Lucas Orve</td>
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<td>15.20-15.50</td>
<td>Øresund Bridge</td>
<td>Contingency and contingency plan in operation</td>
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<td>Ulla V. Eilersen</td>
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<td>15.50-16.00</td>
<td>Øresund Bridge</td>
<td>Closing Øresund Link IRSC Technical visit</td>
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<td>Johnny Restrup-Sørensen</td>
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Introduction

The DSBFirst railway company, the Øresund Bridge Consortium and the infrastructure managers bid you welcome to this technical visit to the fixed link between Denmark and Sweden. We look forward to a few pleasant hours with you. This little booklet is intended to give you a little background.

So, just take a seat and enjoy the view.

Please keep the aisles free from baggage

Overview.

Our journey starts in Svågertorp with an inspection of the combined system for detecting hot boxes, dragging brakes and derailments. We then visit the Lernacken toll station. At Lernacken the changeover is made from the Swedish 15 kv 16 ⅓ hz system to the Danish 25 kV 50 Hz system.

- We will stop at the highest point of the Øresund bridge to enjoy the view and mingle a little.
- A brief stop at the Swedish/Danish border point to take photographs
- A brief stop at Pepperholm where the technical systems, Danish/Swedish electricity and traffic control change over
- Tunnel
- The Kastrup peninsula.
The Øresund link from coast to coast

The illustration below gives an overview of the entire Øresund link, including the facilities on both Danish and Swedish territory. A definition of the boundary between the Øresund line (defined as the railway system on the coast-to-coast section of administered by the Øresundbro Consortium) and the relationship between the Danish and Swedish facilities is given in section 3.

•The coast-to-coast section of the Øresund link, which comprises a four-lane motorway and a double-tracked electrified railway over the Øresund, can be divided into the following parts:

•A 430 metre long artificial peninsula at Kastrup

•A 3750 metre long submerged tunnel under Drogden between the artificial peninsula at Kastrup and Pepperholm

•A 4055 m long artificial island, Pepperholm, south of Saltholm

•A bridge and two approach bridges with a total length of 7845 metres. The bridges join Pepperholm and Sweden

•A toll facility at Lernacken.

Figure 2. Overview of the Øresund link.
To minimise the risk of accidents on the Øresund railway, there are detection systems on both the Danish and Swedish sides. The installations detect hot boxes, dragging brakes, hot wheels and derailments, but there is only one profile control system, which is on the Danish side.

This system checks that no wheel on a train has left the rails. If any cable in the loop on each side of the rails is damaged, the stop signal is activated.
The traction power supply system in Denmark is normally AC 25 kV 50 Hz, while the traction power supply system in Sweden is normally 15 kV 16 3/4 Hz. Normally the power changeover would have taken place on the artificial island of Pepperholm, where the traffic management systems and technical systems are separated. However, it would have been an expensive solution and it is not very practical to switch both safety and traffic management systems at the same time.

The actual power shift takes place on the Swedish side at Lernacken station. Below is a diagram of the solution adopted. The principle is that the pantograph going to a lower amperage to the other without power agreed branch is taken down. The train automatically detects the change of amperage and adjusts accordingly.

The traction system is built to handle speeds up to 250 km / h.

The contact wire height is 5330 mm for most of the line.
Expansion joints

Track expansion joints
Expansion: +/- 600 mm

Expansion joints covered by safety grids
Expansion joints above the catenary system
The Lillgrund wind farm

The Lillgrund wind farm was officially opened in June 2008.

It is located around 10 km off the coast of southern Sweden, just south of the Öresund Bridge.

With its 48 wind turbines, Lillgrund is Sweden’s biggest offshore wind farm and one of the largest in the world.

The wind farm will generate 0.33 TWh annually.

This is equal to the domestic electricity demand of more than 60,000 homes.
Stop on the highest section of the bridge

There will be a stop on the highest section of the bridge and a chance to walk around and then go down under the bridge via one of the bridge-pillars. We will also be able to see the escape routes and emergency access stairs.

There will be a stop near the pylons, which are 204 metres high. The Öresund bridge is currently the largest of its kind in the world.

At this point we are about 80 metres above the sea and the shipping lane into Malmö Harbour. The Öresundsbro Consortium also owns lighthouses in the shipping lanes.

If you are not scared of heights, enter the pylons and enjoy the view!

At the official border there will be the opportunity to take photographs
Interlocking Systems on the Fixed Link

DSB 1990

Danish Coast

Relay interface

Peberholm

STLV85

Swedish Coast

System border
Øresunds tunnel

Tunnel Cross Section

- Rock protection liner
- Service gallery
- Limestone
- Ballast concrete
- Drainage
- Crushed gravel
- Cable ducts
- Slab tracks
- Emergency walkway
- Sedimentation pond
- Tunnel construction method
- Motorway
- Railway
- Tunnel Cross Section

Øresund Tunnel

- 3.5 km navigation channel
- Possible future realignment
- Pump station
- Ground anchors

Challenges and Opportunities for Rail Safety
Axle counting system

Az S 350 U
Axle counting system Siemens 350 Universal