



Member Nation Report 2007 from Denmark.

The Danish Society for Tunnels and Underground Works has during the year 2007 arranged 6 member meetings including technical site visits to see the TBM in action for the service tunnel for district heating in the city center of Copenhagen and at the Malmö Citytunnel project in Sweden. Further more a technical site visit to the Marmaray project in Istanbul, Turkey for 27 tunnel engineers and planners took place from 24 to 28 October. The group had the pleasure to inspect the first 4 immersed tunnel elements placed at the seabed in a world record level of minus 45 m below the Bosperus waterline from the Asian side in Üsküdar.

Members of the society have participated in ITA General Assembly in Prague, Czech Republic from 5 to 10 May 2007 including meetings in three ITA working groups. Three members have participated in activities within PIARC's Tunnel Committee until the closing congress in September in Paris for the period 2004 to 2007.

The year 2007 showed a major progress for the Copenhagen Metro with the inauguration on the 27 September of Phase 3 linking the Copenhagen Airport with the city centre. Phase 3 contains 4½ km of Metro line of which ½ km is underground and 5 new stations. The Copenhagen Metro now operates 21 km of railway line of which 10 km is underground.

In 2007 the Danish Parliament approved a new extension of the Metro. The Metro Cityring will be a circle line with 17 underground stations and 15.5 km twin tunnels and a link of 1.5 km to a new operation an maintenance centre. In total there will be 34 km of tunnels. Two multidisciplinary consultancy services contracts have been signed, one covering Civil Works and one for Transportation Systems. The design work started in November 2007 while geotechnical and archaeological site investigations were initiated in early 2007.

The construction works of the Metro Cityring will start in 2010 with the line expected to be in full operation by 2018. The total cost is estimated to be 2 billion Euros financed by the municipalities of Copenhagen and Frederiksberg, the State and by users charges.

A bored service tunnel as part of an updating of the district heating system in Copenhagen has successfully been performed in the Copenhagen limestone and with up to 40 m water pressure. The contract was granted to a joint venture of MT Højgaard A/S (DK) and Hochtief Construction AG (D) in 2005 with start mining in July 2006 and end mining in April 2007. The tunnel has been performed as a segment lined tunnel and grouted with 2 component grouting system in level - 35 m from a starting shaft at Amager Power Station over one middle shaft in inner town to a receiving shaft on the north side of Copenhagen City. The total length is 3.9 km, and the mining was performed with a 5.1 m Herrenknecht TBM with an EPB shield. Short NATM tunnels have been constructed at all 3 shafts for starting, receiving and re-launching the TBM after being turned into a new direction in the middle shaft. After the TBM has been recovered from the receiving shaft, work has proceeded with concrete inner lining in the shafts. Placing of pipes for district heating was

initiated in October 2007, and the project is scheduled to be completed by mid 2009. Client: Copenhagen Energy. Consultants: COWI (DK).



Figure 1: Breakthrough of the 5.1 m Herrenknecht TBM for a new service tunnel for district heating in the city center of Copenhagen.



Figure 2: Starting shaft established in the Copenhagen limestone in level minus 35 m for TBM activities.

In September 2005 a proposal was published outlining a 12 km immersed road tunnel with 6 lanes linking the motorway system at the north with the motorway system at the south of Copenhagen. The alignment followed the Copenhagen Harbour Canal throughout and included an underwater parking facility. The cost was estimated to be close to 3 billion Euros and proposals for financing were included in the proposal. The proposal got a favorable reception from the public as well as local politicians, because it was design to remove a very substantial part of the road traffic from the center of Copenhagen as well as providing access to previously unreachable development areas to the east of Copenhagen Harbour. The scheme has been developed further by the Copenhagen Municipality together with the consultant Rambøll in 2007, and is now included wholly or partly in two alternative solutions.



The proposed approximately 3 km new road link ("Northern Harbour Link") between Nordhavn and Lyngbyvej located north of Copenhagen has during 2007 been developed further. Four alternatives, comprising cut-and-cover and bored tunnels with a length from 0.5 to 2.5 km have been investigated. The project is being developed by Copenhagen Municipality and the consultant Rambøll. In early 2008 the consultant will perform further alignment and EIA studies on 2 of the alternatives. The project is planned to be tendered for construction works by 2010. The project is expected to take 7 years to complete.

A new Harbour Tunnel in the city of Aarhus is under planning and Environmental Impact Assessment studies (EIA) have been completed. The tunnel will be 2.1 km long connecting the harbour terminal with the motorway E45 passing through the city center of Denmark's second largest city. It will be a unidirectional cut-and-cover tunnel with two tubes and 2 lanes in each tube for carrying up to 40 % of HGV traffic. The final planning based on i.e. public hearings will be performed during 2008 followed by a final political approval. Construction works are estimated to be close to 200 million Euros starting in 2010 with an opening year for traffic in 2015. The project will be financed by the Danish Government and Aarhus Municipality and supported by the EU. Consultants: Grontmij | Carl Bro Group.

Copenhagen Municipality has awarded the contractor PIHL (DK) the contract of construction 3 underground facilities as fully automated parking basements with room for in total 840 cars. The locations of the 3 parking basements are on Nørrebro, Amager and Islands Brygge in the city center of Copenhagen. The three parking basements will be constructed by PIHL assisted by the company Westfalia (D) supplying and installing the elevator systems, which automatically will carry the cars to their correct spaces in the basement and pick them up again. On the street level, only light buildings will be visible. These will contain car elevators used by the car owners while parking the car in the basement. The largest of the three parking basements with four elevators and room for 408 cars will be situated under a green area of Islands Brygge. The second largest with room for 268 cars and three elevators will be situated in the street Under Elmene. The parking basement at Nørrebro with room for 164 cars will be constructed around the street of Nørre Allè just outside Skt. Johannes Church. This basement will be established with two elevators. The construction of the three parking basements will start in February and April 2008.