



## GPR Use and Activities in Denmark

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Academic work on GPR in Denmark is performed both by the Technical University of Denmark (DTU) and the University of Copenhagen (KU). The work at DTU includes development of antennas and systems, e.g. an airborne ice-sounder GPR system (POLARIS) that today is in frequent use for monitoring of ice thickness in Greenland. DTU often collaborates with ESA (European Space Agency) regarding electromagnetic development projects. At KU there is an ongoing work with GPR applied to water resources. The main objective is to study flux of water and matter across different hydrological domains. There are several recent publications from KU describing research for data analysis and modelling as well as hydro geophysical applications. Also the Geological Survey of Denmark and Greenland (GEUS) performs frequent geological mapping with GPR.

There have been mainly two actors on the Danish commercial market for several years: FalkGeo and Ramboll. FalkGeo has been active for many years acquiring data for several different applications such as archeology, utilities and roads. Their equipment pool comprises both a multichannel Terravision system from GSSI and a 2D system from Mala Geoscience with a comprehensive range of antennas.

Ramboll has performed GPR surveys for two decades mainly with 2D systems from GSSI. In recent years Ramboll has also obtained a system with RTA antennas from Mala Geoscience and a multichannel system from 3D-Radar. These systems have opened markets both for deeper geological mapping and for shallow mapping. The geological mapping with the Mala system has often been combined with resistivity imaging (CVES) and refraction seismic. The 3D system has been applied in airports and on road for mapping of layer thicknesses, delamination and for control of asphalt works. Other areas comprise bridge deck evaluation and utility mapping. Ramboll also acts as client advisor for BaneDanmark, a state owned company who operates and develops the Danish state railway network. For this Ramboll has written a guideline for application of GPR on BaneDanmark railways.

There are no national guidelines or test sites in Denmark.

The use of GPR on roads is very limited in Denmark compared to our neighboring countries. This is possibly due to conservatism in the industry and due to the fact that Denmark decided not to participate in a collaboration between some of our neighboring countries about preparation of guidelines for application of GPR on roads, the Mara Nord Project. An improvement in accuracy and more automatized routines for mapping of delamination and stripping would also widen the market for application of GPR in airports and on roads. International guidelines for application of GPR in several fields would also help to make authorities recognize it as a valid complement and alternative to other established methods.

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