ABEM WALKTEM

Transient Electro-Magnetic Solutions

DETECT QUICK CLAY WITH GEOPHYSICS

High sensitivity clay is mostly known to have a resistivity around 10 Ωm whereas clay resistivities of few Ωm occur for low sensitivity clay. With the ABEM WalkTEM system, the ground resistivity can be mapped with maximum field efficiency and accuracy.

Laboratory tests have shown that the most reliable information is the sensitivity of the clay, which is determined by measuring the clays remoulded shear strength.
There is however a correlation between sensitivity and electrical resistivity which means that geophysical resistivity measurements can be used to assess the extent of quick clay in an area where it is known to occur.

TEM METHOD - FAST AND EFFECTIVE

TEM stands for Transient Electro-Magnetic and it is an inductive method with excellent suitability for measuring of ground resistivity with good depth penetration and no need for galvanic ground contact, making it fast and effective even in high resistivity surficial zones and in areas covered by ice and exposed rock. For this reason, TEM is also a highly useful complement to electrical resistivity tomography (ERT).

ABEM WALKTEM SYSTEM - HIGH PERFORMANCE SOUNDINGS OF CONDUCTIVE STRUCTURES

The WalkTEM system comprises a high current transmitter and a dual channel high dynamic and wide band width receiver in one box, which also contains an integrated field PC and dual internal batteries, chargers and a built-in GPS.

The WalkTEM system comes with two models of low noise air-cored receiver coils; one optimised for high resolution shallow soundings and the other with larger effective area, suitable for deeper soundings.
The receiver coils can be used in combination and measures taken simultaneously using the two receiver channels.

WalkTEM operates using dual-moment transmission where it automatically alternates between maxium and reduced current pulses, thus utlizing the benefits from both high energy fields as well as fast current pulse turn-off. The advantage is high resolution response from shallow depths to maximum depths.

WalkTEM's unique acquisition technology allows it to accurately resolve a wider span of amplitudes; from higher level signals from shallow structures down to very low near noise levels from deeper layers.

What is quick clay?

Quick clay originates from what is referred to as marine clay, formed under the past glaciation about 10,000 years ago when the land was pushed down by the weight of the ice (isostatic depression). Marine clay is formed in salt water and the sea-salt ions functions as a "glue" to strongly bond a soil skeleton. This makes the marine clay very stable, although it imposes a unique problem as well. Since the glaciers retreated and the land mass rose, the clay was exposed to rainfall and snowmelt which causes the ionic "glue" of the clay to weaken, loosening the soil skeleton with a worst case scenario of landslides.

Quick clay has been involved in most serious, large clay slides in Sweden, Norway, and Canada and is normally caused by a shock that exceeds the capacity of the topsoil layer, such as a larger earthquake, or abnormal rainfall which leaves the topsoil fully saturated so that additional water has nowhere to permeate except into the clay. That kind of disturbance can initiate the process of liquefaction.

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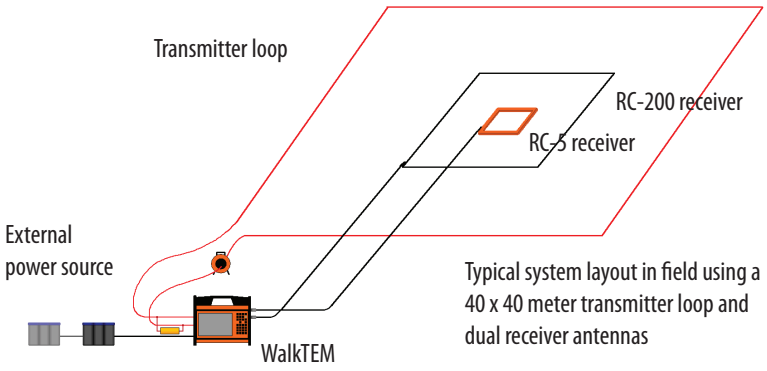
FIELD SETUP

A single-core cable, called the transmitter loop, is laid out on the ground in a square shape. A typical loop size is 40 x 40 m.

The WalkTEM is placed at the start and end corner of the loop The two receiver coils are subsequently placed in the centre of the transmitter loop and their respective lead-in cables are laid out and connected to the receiver inputs on the WalkTEM.

After a short power on, the measuring project is quickly set up and executed using the easy and intuitive user interface. When the sounding is complete, an inversion can be made directly in the instrument in order to display a layer model.



Typical system layout in field using a 40 x 40 meter transmitter loop and dual receiver antennas

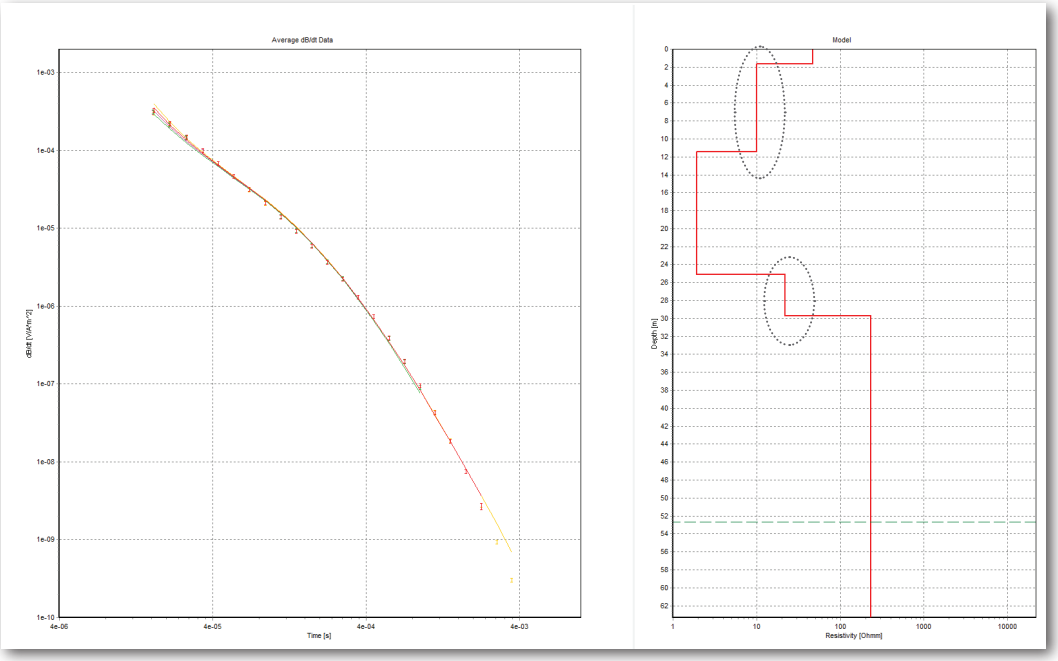
A FIELD EXAMPLE

The WalkTEM system has successfully been used for a field survey in an area where quick clay is known to exist. The data shows the transitions between stable clay and the more sensitive quick clay.
By conducting several soundings in the area, it was possible to make a quick assessment of quick clay presence and compare it with what was previously known about the ground conditions in this area.

In the layered resistivity model on the right, the resistivity is around 10 Ωm between 2 and 12 meters depth, from which the clay probably enters a deeper zone with higher salt content making it less sensitive.

At around 25 meters depth the resistivity once again indicates that quick clay might be present. Below 30 meters depth there is no longer any indication of quick clay.

All data was processed with ABEM ViewTEM processing software and data residual was around 2.8 %.



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