MALÅ

Case Story

MIRA HDR

High resolution subsurface mapping using MIRA HDR

Summary: High resolution GPR was successfully used to investigate the subsurface conditions at an industrial site in the southern parts of Stockholm, Sweden. The information delivered by the GPR array was needed for a sustainable transformation of the former industrial site into a residential and office area.

Client

Tyrens AB (www.tyrens.se), is one of Sweden´s leading community development consultancies, creating sustainable solutions in the fields of urban development and infrastructure. Tyrens AB have 3000 employees and operations in Sweden, England, Estonia, Lithuania, Poland and Bulgaria. Tyrens AB is foundation-owned and is driven by curiosity, often in close co-operation with universities and collages

Challenge

The area of investigation, south of Stockholm, Sweden, have been used for industrial purposes during the last 110 years. Now, in 2022, the area is reforming, to contain offices as well as residential areas. With time, information on buried assets has to some extent been lost and detailed mapping of all buried infrastructure is needed.

Solution

Since detailed subsurface mapping of the whole area was needed, MALÅ MIRA HDR was used. The MALÅ MIRA HDR is a GPR array solution, i.e. a multichannel system with very dense channel spacing (6.5 cm). The solution uses real-time sampling HDR technology, measures 22 parallel GPR lines simultaneously and delivers high resolution data of the subsurface.

The field conditions were beneficial for non-vehicle-based measurements. The area of interest was covered with flat asphalt and the MIRA HDR could easily be hand pushed throughout the entire project. In total, high resolution GPR data was collected across 2500 square meters. The entire data acquisition took approximately 2 hours. For positioning, a base-rover GNSS set up was used. The GNSS rover antenna was fitted on top of the MIRA HDR and the base placed at a known position.

Measurements were carried out during afternoon hours when traffic had settled. The MIRAsoft HDR software was used to navigate and help placement of each swath. Spray paint markers, directly on the ground, was also used for additional navigational help.

Processing of data was made with rSlicer, a post-processing software developed for MIRA and MIRA HDR data. rSlicer is a very efficient software for handling of MIRA GPR data, positions, and interpretations. Time/depth slices were created, and interpretations delivered in DXF format.

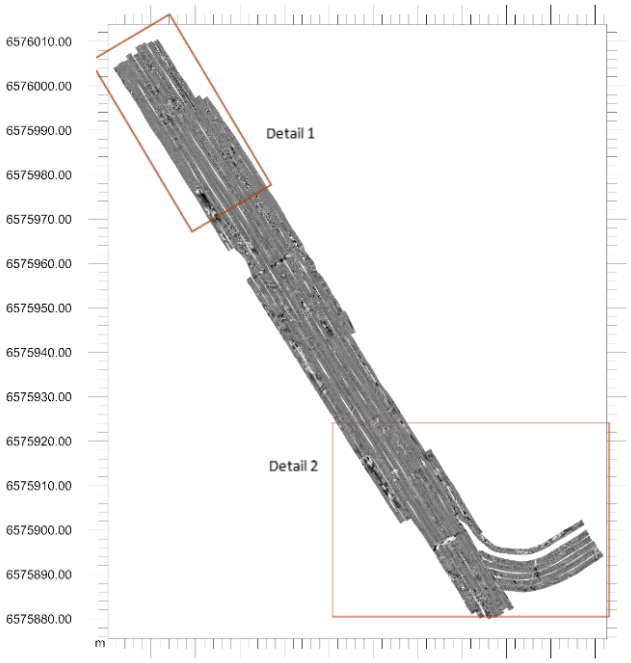
Left: The MIRA HDR measurements were used with the hand-pushed option and a base-rover GNSS set up for positioning.

Results & Conclusion

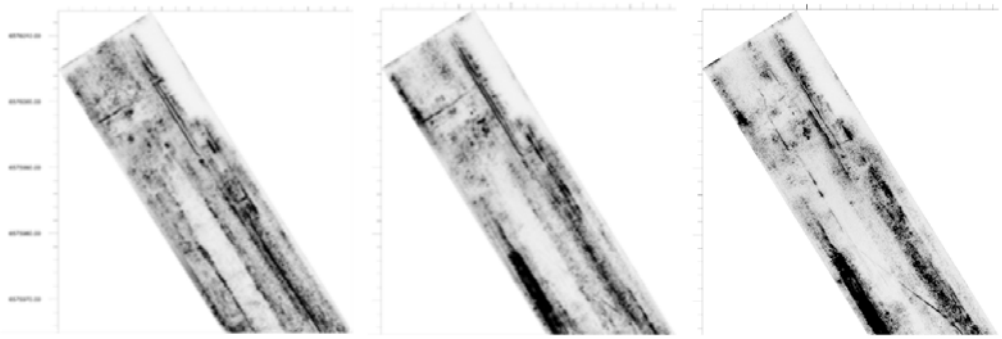
The MALÅ MIRA HDR solution delivered high detailed data across the entire site, revealing and verifying both known and unknown buried utilities and structures.

The satellite based GNSS positioning solution had accuracy issues as data was collected close to higher buildings. Positions had to be adjusted and corrected during the post-processing phase using rSlicer. A more convenient solution to this would have been to use a Total Station instead of the base-rover GNSS set up.

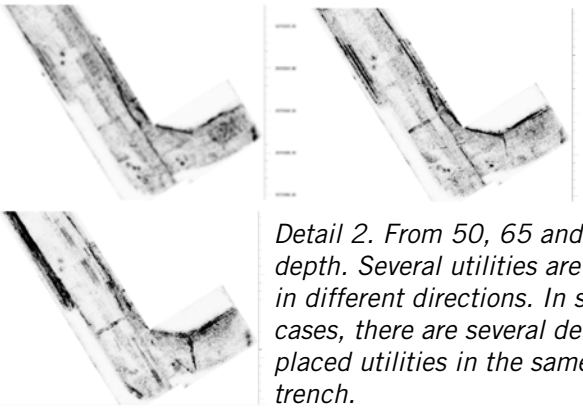
The MIRA HDR results revealed several layers of utilities, at different depths and in varying directions. The high-resolution data clearly shows even small variations in placement of the buried utilities, even connection points could be identified.



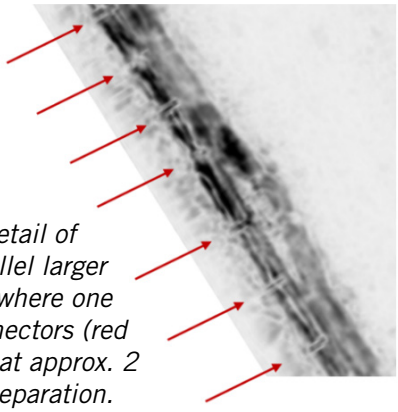
Raw data to show the extent of the investigation area. Already in raw data subsurface features are clearly seen. The marked areas (red) are shown in more detail below.



Detail 1. From 50, 70 and 90 cm depth. Several utilities are clearly seen, some with 90 degrees bends or curves. The bigger black feature at 70 and 90 cm depth is two densely situated larger utilities (see detail below). The MIRA HDR data also reveals differences in structure, parts of the road are constructed using more fine-grained material (as sand) whereas other areas show a coarser matrix, such as stones, pebbles, and boulders.



Detail 2. From 50, 65 and 90 cm depth. Several utilities are seen, in different directions. In some cases, there are several densely placed utilities in the same trench.



Right: Detail of two parallel larger utilities where one has connectors (red arrows), at approx. 2 meters separation.

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