MAYA GLOBAL GROUP

AI detecting & mapping underground infrastructures

CASE STUDY | GPR-HDR WITH AI

High-resolution subsurface mapping using MIRA HDR

Summary: High-resolution MALA GPR-HDR was successfully used to investigate subsurface conditions at a major site in Tel Aviv, Israel. The area has a lot of infrastructure and underground parking, while the exact location and nature of underground utilities and other objects were either unknown or uncertain.
The client selected Maya's GRP-HDR solution, to run an accurate survey to provide the client with a greater and more trusted visibility of the underground infrastructure before excavation started.
We used MALÅ MIRA HDR Core for the execution of this survey, as it is the first product worldwide to use intelligent real-time interpretation support for utility locating.

Client and scope of the project

NTA – Metropolitan Mass Transit System Ltd.
is a government organization that serves as the executive branch of the Ministry of Transport of Israel. NTA oversees
the design and construction of a mass transit system for the Tel Aviv metropolitan area.
Tel Aviv Metropolitan Area's mass transit system is Israel's largest and most complicated transportation project ever executed in Israel, with 3 light rail and 3 metro lines, the system will serve 27 authorities and some 3 million daily passengers.

Challenge

The work site is intended to be a Metro Station as part of the reforms of the Ministry of Transport. The site is a central place in the heart of Tel Aviv which has many infrastructures and different types of underground objects. There was insufficient information regarding existing underground infrastructure and retaining walls and their exact location. Moreover, NTA couldn't detect and map the retaining walls with other technologies and means, thus they had to find a way to minimize risks and prevent accidents associated with the expected excavation.
As part of the Metro station planning process, we were required to locate an external wall of an underground structure.
Stilts should support the wall itself during the construction of the future station.
The planner required us to locate both the wall structure and the infrastructure in the area

Solution

Since detailed and accurate subsurface mapping of the area was needed, MAYA used a GRP-HDR array solution, experienced manpower, and proprietary software and execution methods to deliver the expected solution. The selected tool and technology are 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 area of interest was covered with flat asphalt and the MIRA HDR was used {alongside other Electromagnetic and Electroacoustic tools and equipment where there was no access to the HDR tool. to scan the subsurface throughout the entire project. In total, high-resolution GPR data was collected across 5000 square meters. The entire data acquisition took approximately 1 hour. For positioning, a base-over GNSS setup was used. The GNSS antenna was fitted on top of the MIRA HDR. Measurements were carried out during afternoon hours when traffic had settled. The MIRAsoft HDR software was used to navigate and help the placement of each swath was also used, for additional navigational help.
The processing of the data was made with rSlicer, a postprocessing software developed for MIRA and MIRA HDR data. The rSlicer is a very efficient software for handling MIRA GPR data, positions, and interpretations. Time/depth slices were created, and interpretations were delivered in DXF format.

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MALÅ AI and MALÅ Controller App for real-time interpretation support

Real-time MALÅ AI algorithm interpretation support is a revolution in the GPR world. MALÅ Easy Locator Core is the first product worldwide using intelligent real-time interpretation support for utility locating. All markers set by the AI algorithm can be converted to standard markers with localized utility color codes directly in the field. This provides invaluable interpretation support for inexperienced users and speeds up the interpretation process for more experienced users, thus saving valuable time. When point objects have been identified and marked with the real-time AI interpretation support tool the markers can be converted into regular object markers and exported to MALÅ Vision software and Controller App. for further processing.

Left: Maya's experts are measuring the surface with the GRP-HDR tool and a base-rover GNSS set up for positioning

Results & Conclusion

MAYA delivered highly detailed data across the site, revealing and verifying known and unknown buried utilities and structures. The main achievement was that utilities and other underground constructions could be mapped, efficiently and in high detail. Even in areas with multiple buildings and infrastructures, MAYA's team, equipped with the GPR-HDR tool and built-in GPS, knew how to overcome the obstacles and detect the infrastructures and the underground structures the client looked for. The client received a well-documented report of the findings with a detailed 3D mapping of the expected area at the exact location of the structure and nature of the various infrastructures and objects.

Image 1: The marking of the outer wall of the underground parking lot.

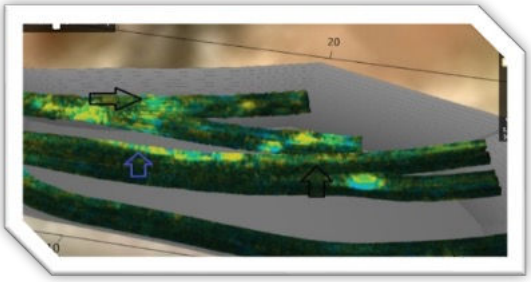
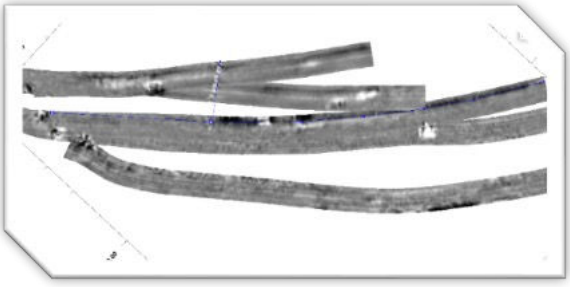


Image 2: The scanned objects are in the rSlicer software. In addition, during the decoding, we saw an internal retaining wall which contributed to the continuation of the planning. The programs also show the depth of the wall, in this case, the wall begins to appear from a depth of 1 meter to 6 meters.



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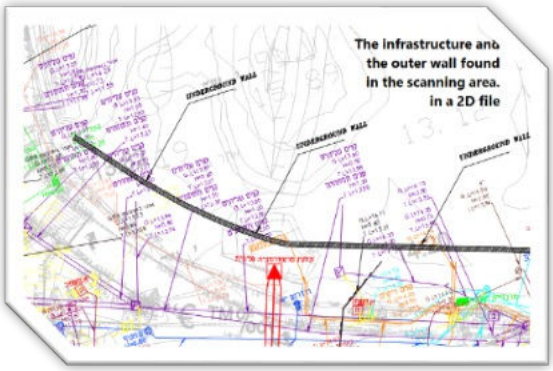

Image 3: (Our output) In this picture we can see various infrastructures that cross the survey's area and are quickly, accurately, and efficiently identified by the technology and its decoding software.

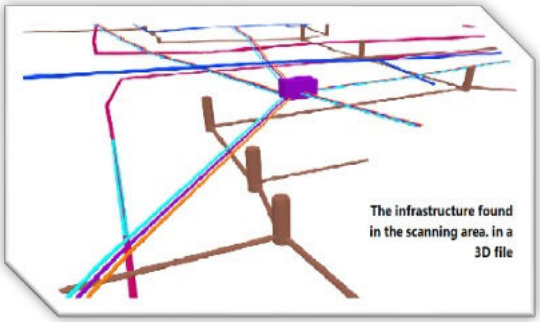

Image 4: Maya's 3D map output

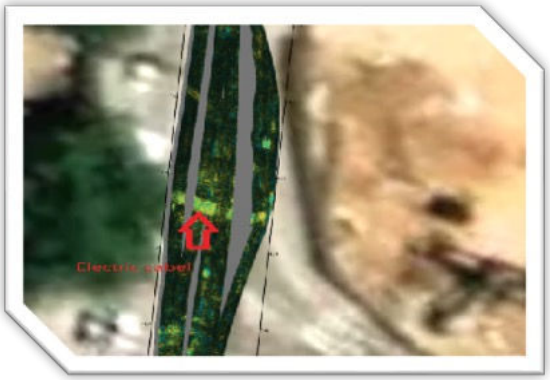

Image 4: Electrical cables that were detected

Project

Method: Ground Penetrating Radar (GPR) with High Dynamic Range (HDR) technology and AI algorithm

Solution: MALÅ MIRA HDR 500 MHz, 11 Tx antennas, and 12 Rx antennas was set up to measure 22 channels, spaced 6.5 cm. The trace interval was set to 5 cm

Measurement: 5 cm trace interval and 100 ns time window.

Software for processing and interpretation: rSlicer, Mala Vision SW, Maya's utilities and object's location SW

Acknowledgment: We would like to thank NTA Metropolitan Mass Transit System Ltd. (https://www.nta.co.il/en/about/) for sharing the information above.