Purpose of the Project

The primary goal of this project is to detect and map subsurface utilities within the Tous Industrial Complex using Ground Penetrating Radar (GPR) technology. This investigation is intended to prevent damage to existing infrastructure, improve the safety of construction activities and accurately document the precise locations of buried installations. Utilizing the non-invasive GPR method enables fast, accurate, and efficient subsurface assessment without the need for disruptive excavation.

Methodology

Field data acquisition was carried out using the **PinPointR GPR system**, a cutting-edge dual-frequency radar developed by **ImpulseRadar (Sweden)**. Operating simultaneously at 400 MHz and 800 MHz, this system offers a superior balance between penetration depth and spatial resolution, compared to conventional single-frequency GPR units.

Data were collected by scanning the site surface and capturing reflected electromagnetic signals. The recorded raw data were subsequently processed using **Geolitix**, an advanced GPR processing and visualization software that enables precise three-dimensional modeling of subsurface structures.

The integrated **multi-frequency GPS** module allowed for high-accuracy georeferencing, ensuring all survey data could be precisely mapped and spatially analyzed.

Figure 1- View of the project site on a satellite image.

Figure 2 - The ImpulseRadar GPR device, PinPointR model, along with the multi-frequency GPS.

Design and Implementation

The field survey for the project was conducted on June 1, 2025 (10 Khordad 1404), with the esteemed client present throughout the entire route. During this visit, the entire path was meticulously inspected, and critical and priority locations were identified and documented in close coordination with the client. This phase was instrumental in optimizing the design of the Ground Penetrating Radar (GPR) data acquisition. To effectively identify subsurface utilities, the data collection strategy was formulated based on field observations to accurately determine the positions and depths of buried installations. Following a thorough review of the site visit findings, the layout of GPR survey lines was developed. In areas of higher significance, a minimum of three survey lines were conducted at intervals of 0.5 to 1 meter, while at key points, a dense grid pattern was employed to enable detailed data analysis. Overall, 63 profiles covering more than one kilometer were planned and surveyed. Throughout the operation, strict quality control measures were applied to ensure data integrity, precise alignment of survey lines, and compliance with the initial design, guaranteeing the reliability of the collected data for subsequent analysis.

Figure 3 – Specialists performing Ground Penetrating Radar (GPR) data collection.

Figure 4 - Representation of multiple anomalies suspected to be water, gas and telecommunications utilities at approximate depths of 0.3 to 1.2 meters. This area was one of the most sensitive zones of the operation.

Conclusion

Through the application of Ground Penetrating Radar (GPR) technology combined with high-precision positioning, this project successfully gathered valuable subsurface data within the Tous Industrial Complex area. Data acquisition was conducted using a PinPointR system equipped with 400 MHz and 800 MHz antennas and a multi-frequency GPS, resulting in 63 profiles covering approximately 1.5 kilometers. Comprehensive data processing, interpretation and 3D modeling led to the identification of over 400 point anomalies and several linear utility networks at depths reaching up to 2 meters. These anomalies indicated the presence of various buried utilities across the study area, including gas, water, electricity, sewage, and telecommunications lines, providing critical insights for infrastructure management and future construction planning.