Inspection of non-metallic pipelines and subsurface stratification

Overview

- An inspection team in China needed to detect and map non-metallic objects buried underground for a specific section of a highway
- The Proceq GS8000 was used to locate and map any subsurface pipes, voids and defects
- In a single pass, the team were able to achieve clear imaging of both shallow and deeper non-metallic objects

Introduction

Ground penetrating radar (GPR) is a nondestructive testing method that uses antennas to transmit and receive high-frequency electromagnetic waves to detect the characteristics and distribution of matter inside the target. It is widely used in municipal pipelines, tunnels, subgrades, bridges and building structures because of its fast detection speed, high accuracy, easy operation and cost-effective advantages,

GPR can be divided into pulse radar and continuous wave radar according to the signal form. Different from the single operating frequency of traditional pulse radar, stepped frequency continuous wave radar adopts a step-changing operating frequency, which ranges from tens of MHz to several thousand MHz, which can simultaneously detect shallow and deep underground layers.

Challenge

For this project, the team needed to detect subsurface non-metallic pipes and underground stratification. The length of the highway is about 2000 meters, and it needs to be reconstructed and expanded, but the underground pipeline information and the layering status are unknown. In order to ensure the safety of the pipeline during the construction process, Screening Eagle team was invited to detect the underground situation of the road in advance.

Solution

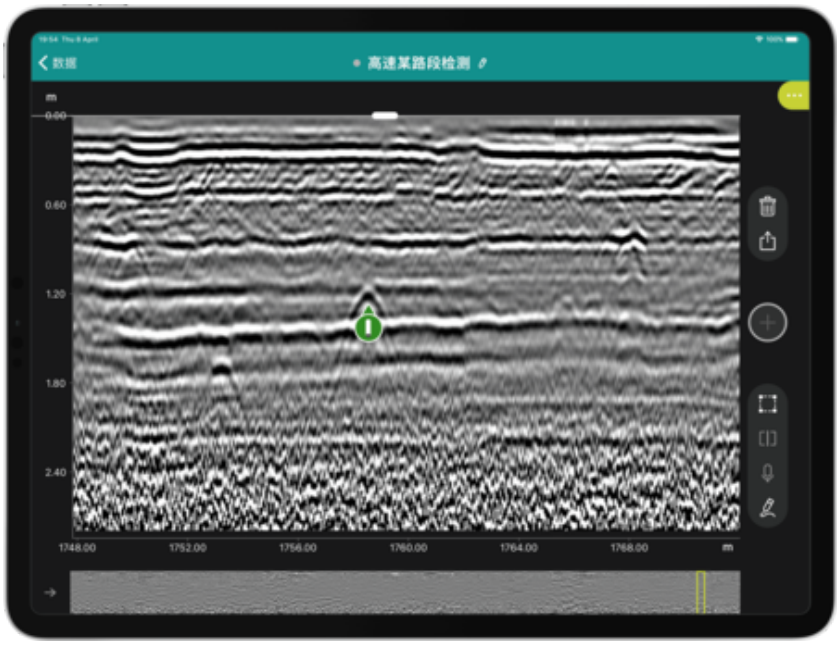
The Proceq GS8000 subsurface detection and mapping system was used for this project. With stepped frequency continuous wave, the GS8000 provides high resolution, precision positioning, long endurance and vehicle-mountable functions.

Combined with the GPR Subsurface app and the post-processing software GPR Insights, it provides unmatched information of the underground during a single detection, and has excellent detection effects on buried structures, defects and pipelines.

The GS8000 adopts dual antenna mode; high frequency mode (40Mhz-3440Mhz), which can carry out high-resolution fine detection of underground delamination, steel structural integrity, and underground defects, plus low-frequency mode (40Mhz-1000Mhz), which can verify each other in shallow depths with high-frequency signals, and is also suitable for deep demarcation, burial or defect detection.

Results

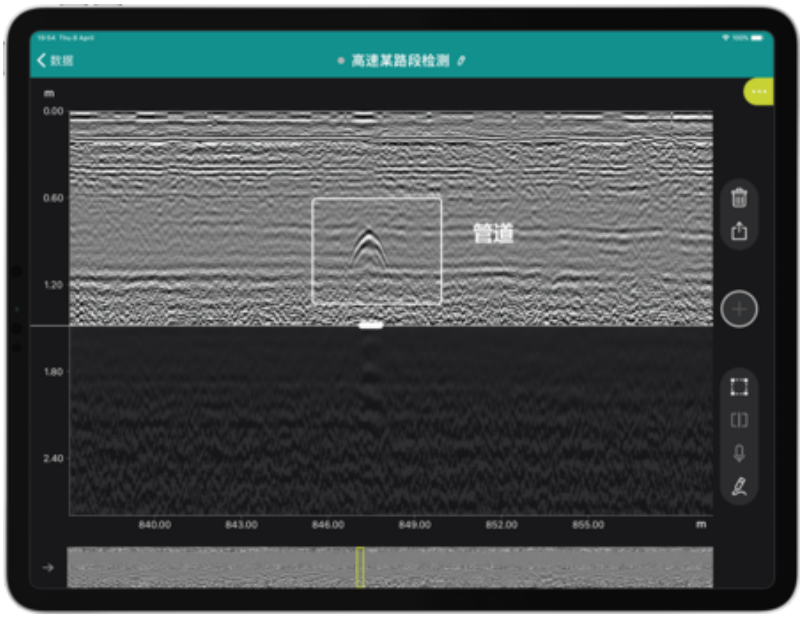
1. PVC drain pipe is detected at low frequency model.



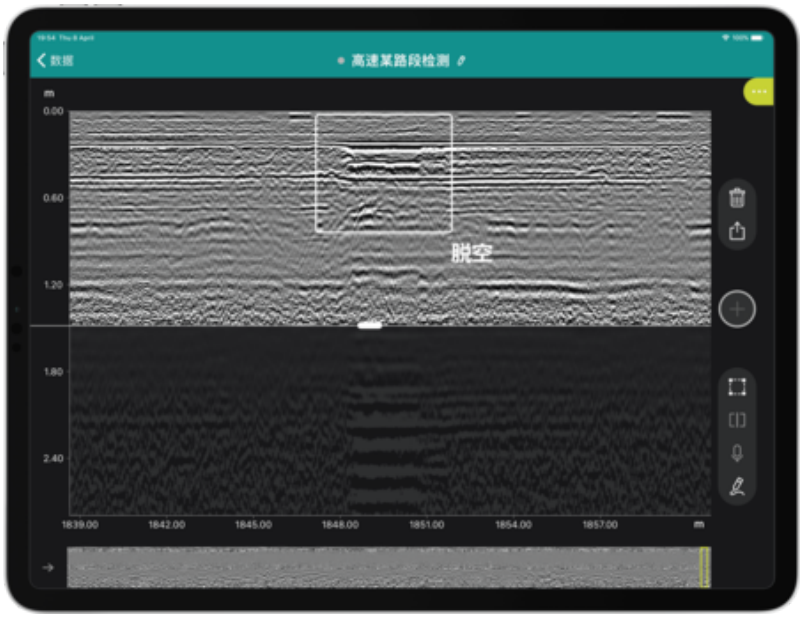
Radar image of pipelines

The results shows a clear pipeline signal 1.2m underground. Excavation verification was carried out at the extension of the pipe outside the highway to determine that a PVC drainage pipe was buried.

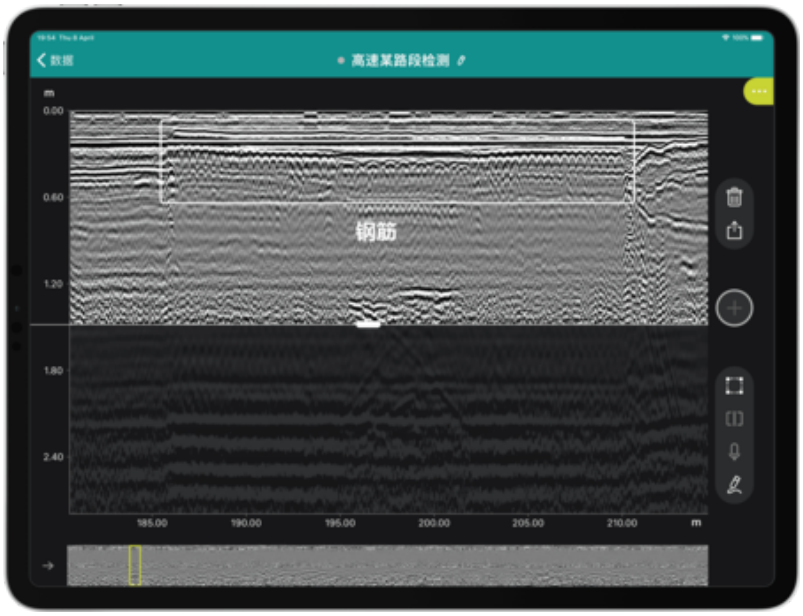
2. Shallow delaminations and defects are detected at high frequency model



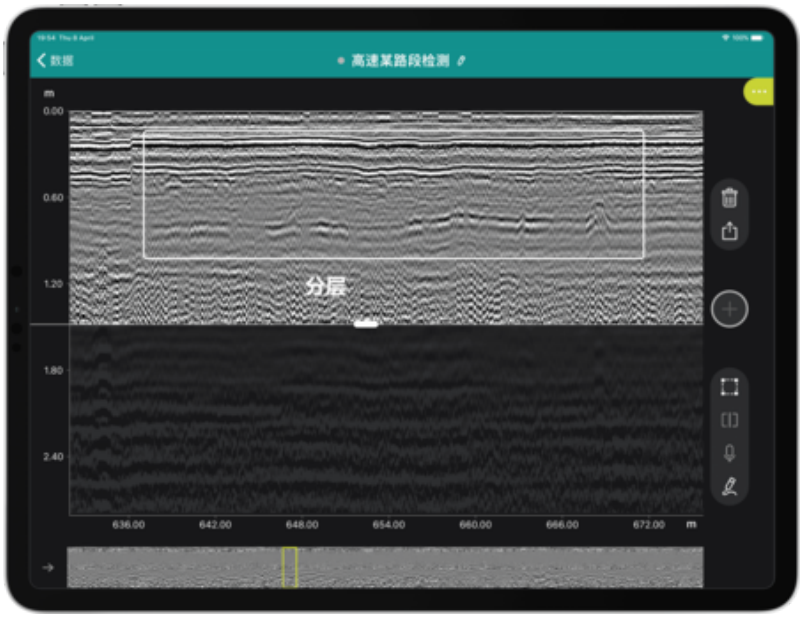
High-frequency radar image of the pipe



High-frequency radar images of void



High-frequency radar image of a steel bar



High-frequency radar images of subsurface layers

After the detailed detection of the highway section, the team showed a number of GPR diagrams with obvious features. By selecting any size of any segment of an image via the GPR Subsurface app, possible key signals such as pipes, small voids, reinforcement structures, and layered lines can be identified and marked in real time. Besides, the identifiers can be selectively hidden.

By adjusting the window and selecting the GPR diagram of the road section with a total length of nearly 2000 meters, the boundaries of the different layers of the road in this section can be clearly defined. Just like the growth of the tree trunk, these boundaries also record the historical information of the paving of the road.

See more case studies and application notes about subsurface inspections and the GS8000 on our Tech Hub.