Inspecting dock road slab structures with ground penetrating radar

Introduction

The wharf road slab plays an important role in ensuring the safety of wharf transportation. In cities with river transport or sea transport, the waterways of hydraulic docks are distributed all over the city's river banks and coasts, and the scale is very large.

Due to the age of some wharves, the reinforced concrete at the bottom of the road plate has been washed and soaked by the water flow for a long time, and it is more susceptible to corrosion by chloride ions and industrial sewage in the water. The bottom plate of the dock road plate often has serious problems such as surface concrete corrosion and spalling or internal steel rust breakage.

Challenge

The workload can be challenging due to the large area of the dock road plate, so a fast and non-destructive testing method is required, as well as the effective test results which can be directly shown on the spot to facilitate the real-time determination of the damaged area.

Entering the bottom of the road plate for human detection requires the use of pontoons and other transportation equipment, which has certain safety risks. The water level at the pier is usually high, resulting in the inability to use pontoons to enter the bottom area of the road board for inspection work.

It is necessary to effectively detect the position of the reinforcement within 50cm and the thickness of the plate to determine the health status of the plate.

Solution

Screening Eagle's GP8000 is a compact and lightweight small structure ground penetrating radar (GPR) that can transmit test results to the iPad wirelessly, and with the help of the powerful app, it can help customers quickly, effectively and clearly detect the change of steel layer and plate thickness within 50cm.

Results

Let's take a look at this recent dock road slab inspection in China.
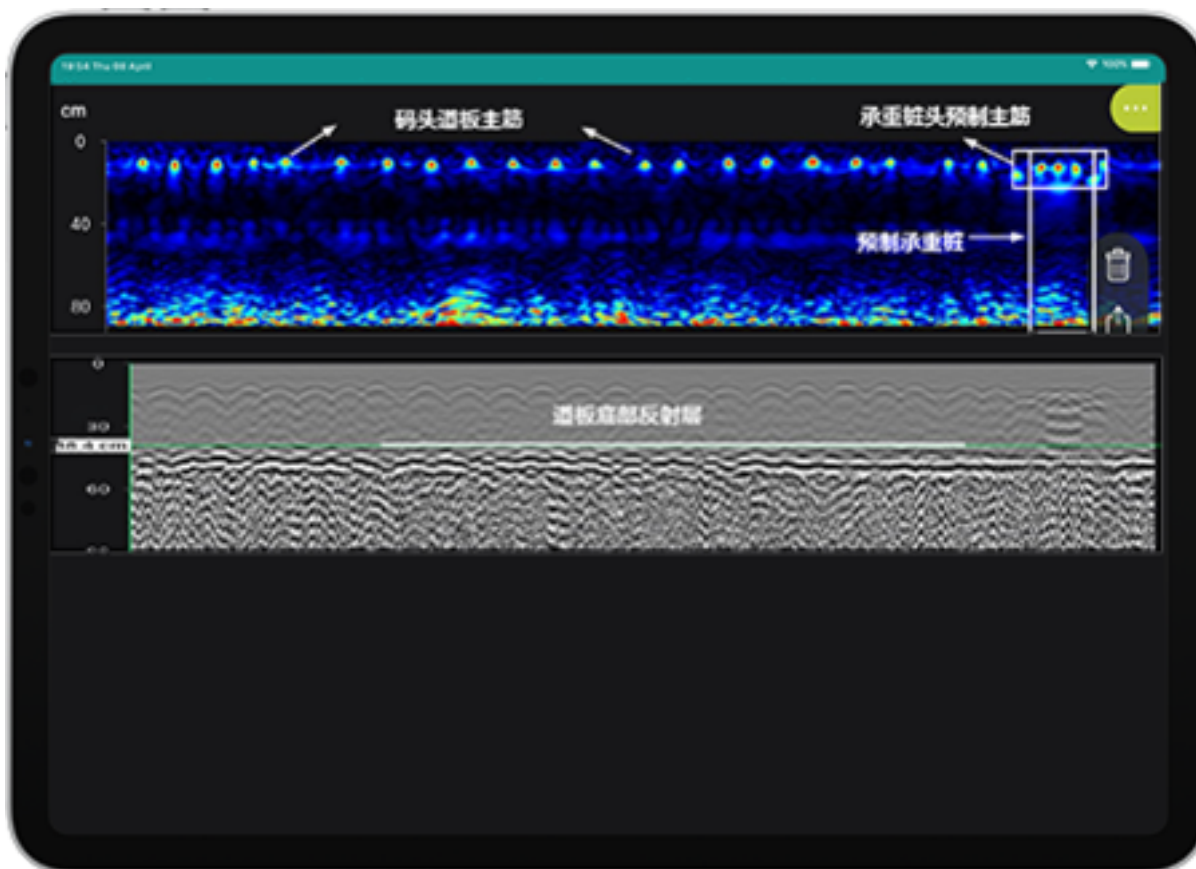
The radar map of the Road Plate detected by GP8000

As can be seen from the figure, the GP8000 can clearly detect the health of the debut plate structure: the main rib is clearly visible, the bottom reflection is clear and continuous, flat, and there is no large-scale spalling and damage at the bottom.
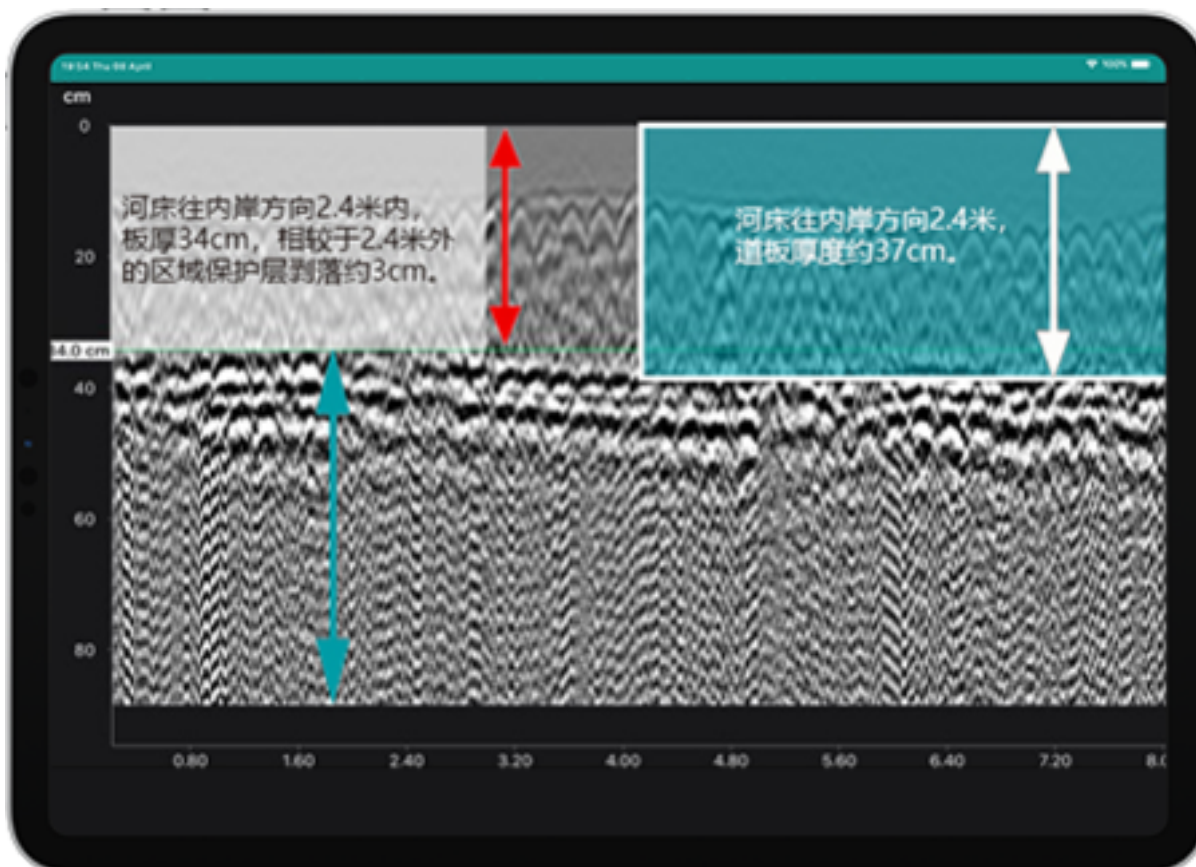
Suspected damage to the road plate detected by GP8000

Through the GP8000 radar checking test, it is not difficult to find that the thickness of front plate where riverbed is within 2.4 meters to the inner bank is about 34cm; and the thickness of back plate where the riverbed is 2.4 meters away from the inner bank is about 37cm. that means the protective layer of the front plate is reduced by about 3 cm.
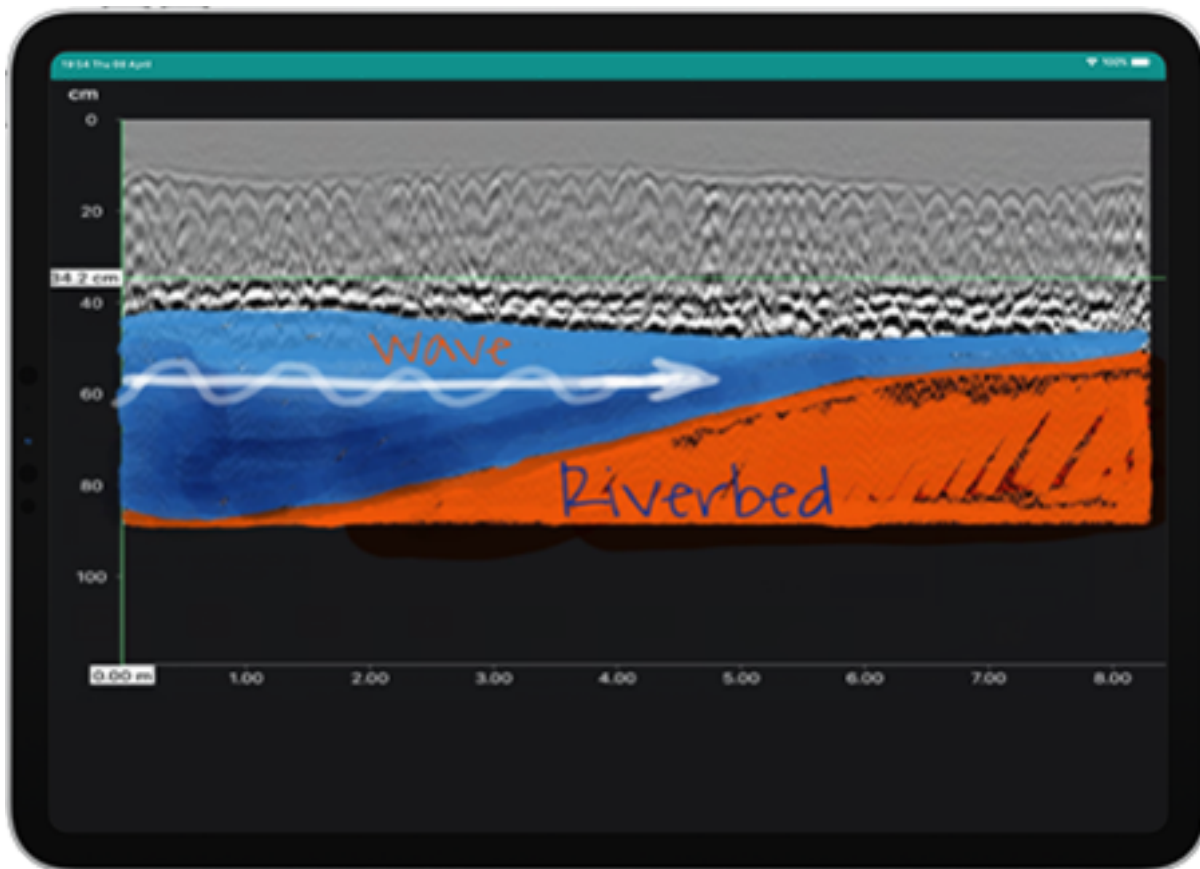
Result verification images

Rusting and peeling areas (front plate)

Undamaged areas (back plate)

Cross-sectional view of water wave erosion

During the dry period, the field conditions verified by the inspectors coincided with the response of the GP8000 GPR detection signal. Due to the impact of the water wave, the front road plate is attacked by moisture and ions for a long time, resulting in the long-term corrosion activation state of the steel reinforcement inside the concrete. This caused the concrete protective layer to corrode and crack, peeling, resulting in the exposed steel bar, which in turn aggravates the damage of the steel bar and the lack of bearing capacity of the road plate.

Through the result of GP8000 GPR, the rust spalling area can be effectively detected, which greatly helps the inspectors to effectively judge the development trend of the rust area and damage, and provides an effective basis for further strengthening the engineering maintenance and protection.

See more case studies and application notes using GPR in our Tech Hub.