

Marine Seismic Reflection Surveying

A Strategic Framework for Marine Engineering Geophysics
and Subsurface Engineering Risk Mitigation

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Fujian Provincial Institute
of Architectural Design
and Research Co., Ltd.



Smart Underground
Detector Pte Ltd



01

**Marine
Reflection
Seismology**

02

**Track
Record
and Profile**

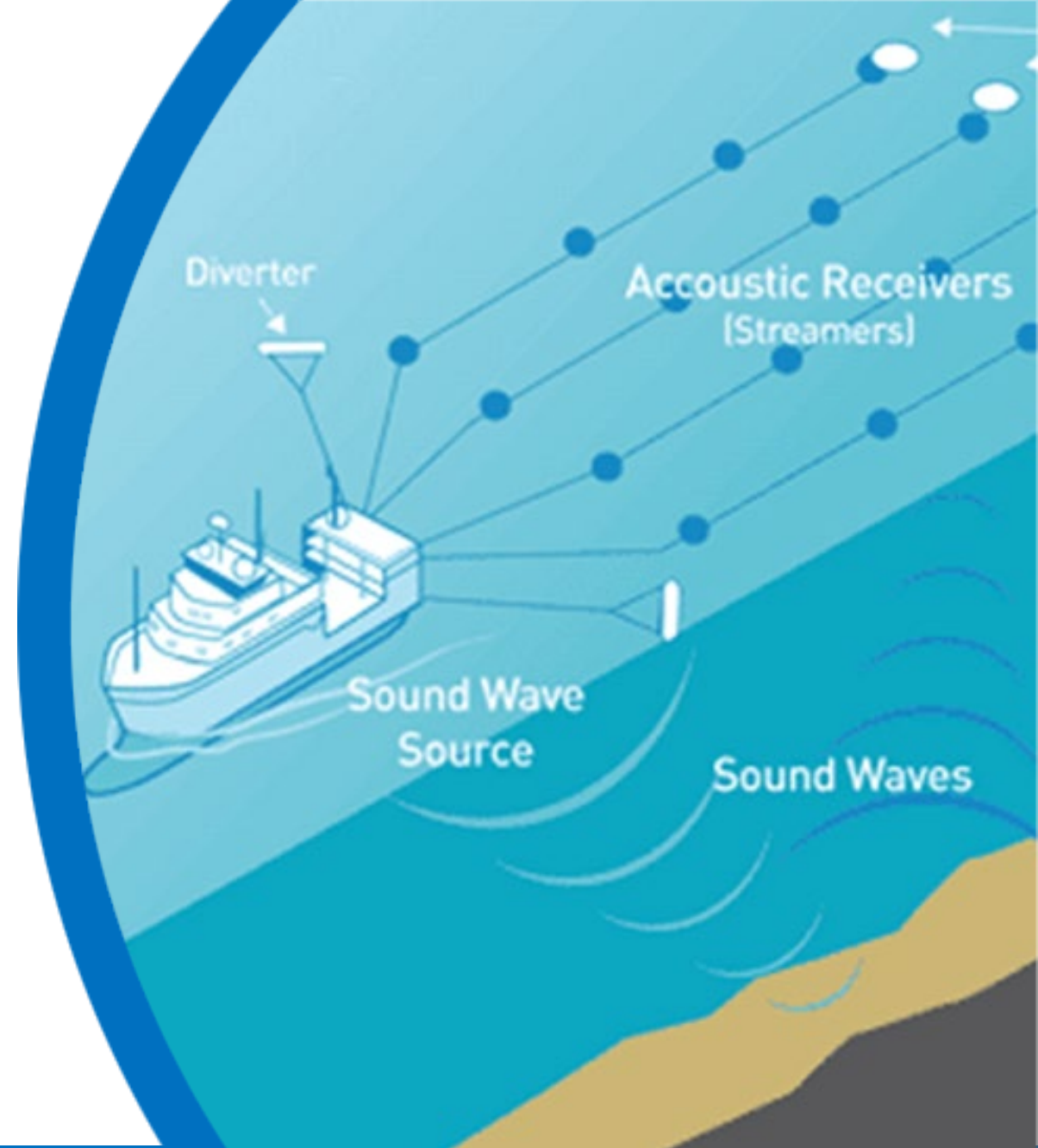
03

**Potential
Applications**

01 Marine Reflection Seismology

02 Track Record and Profile

03 Potential Applications



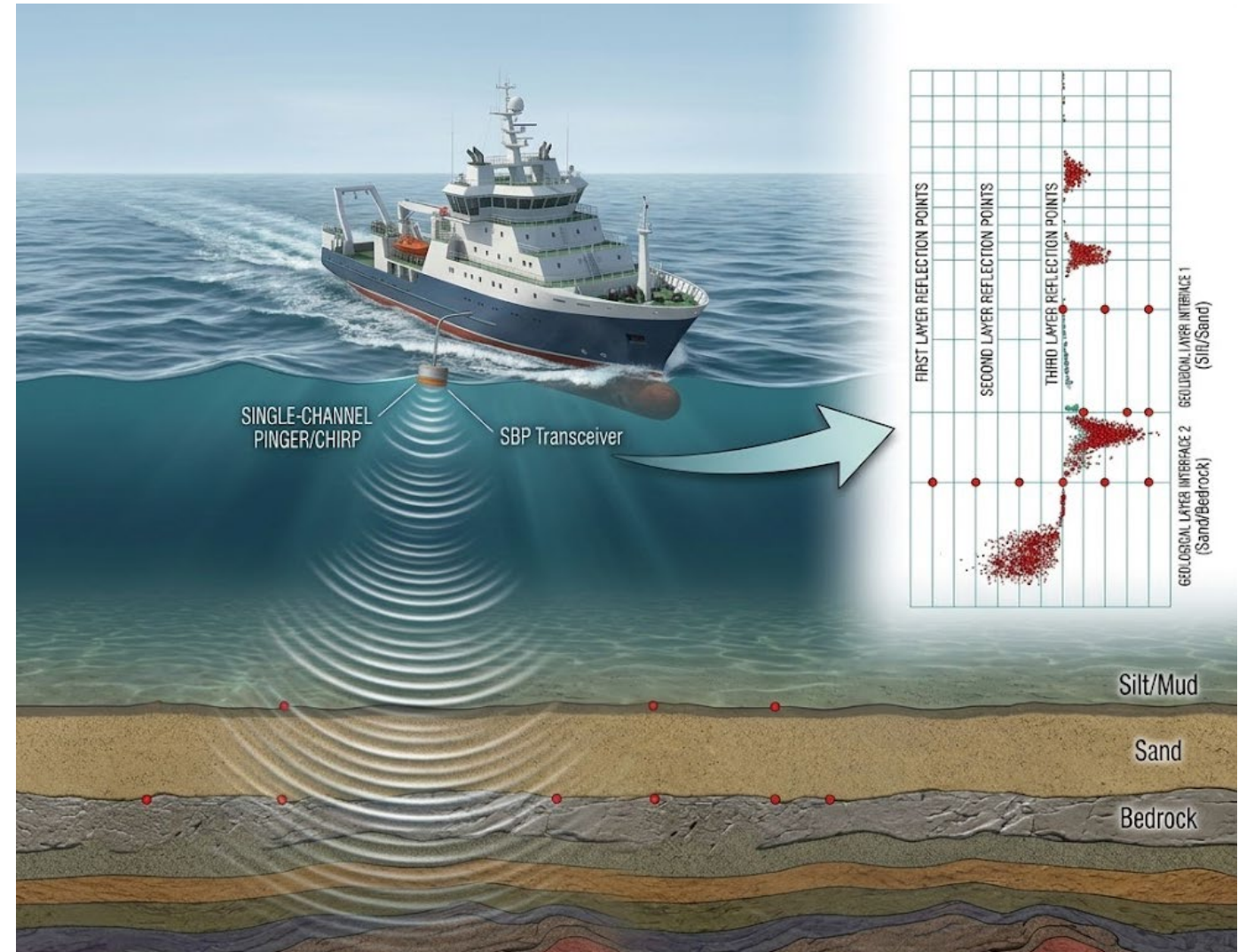
Introduction

Reflection seismology

identifies subsurface conditions by exploiting variations in **acoustic impedance** across different rock and soil strata.

When seismic waves encounter interfaces with significant impedance contrasts, they reflect back to the surface.

By recording and analysing the **spatiotemporal characteristics** of these reflections, geophysicists can accurately map the underlying geological structure.

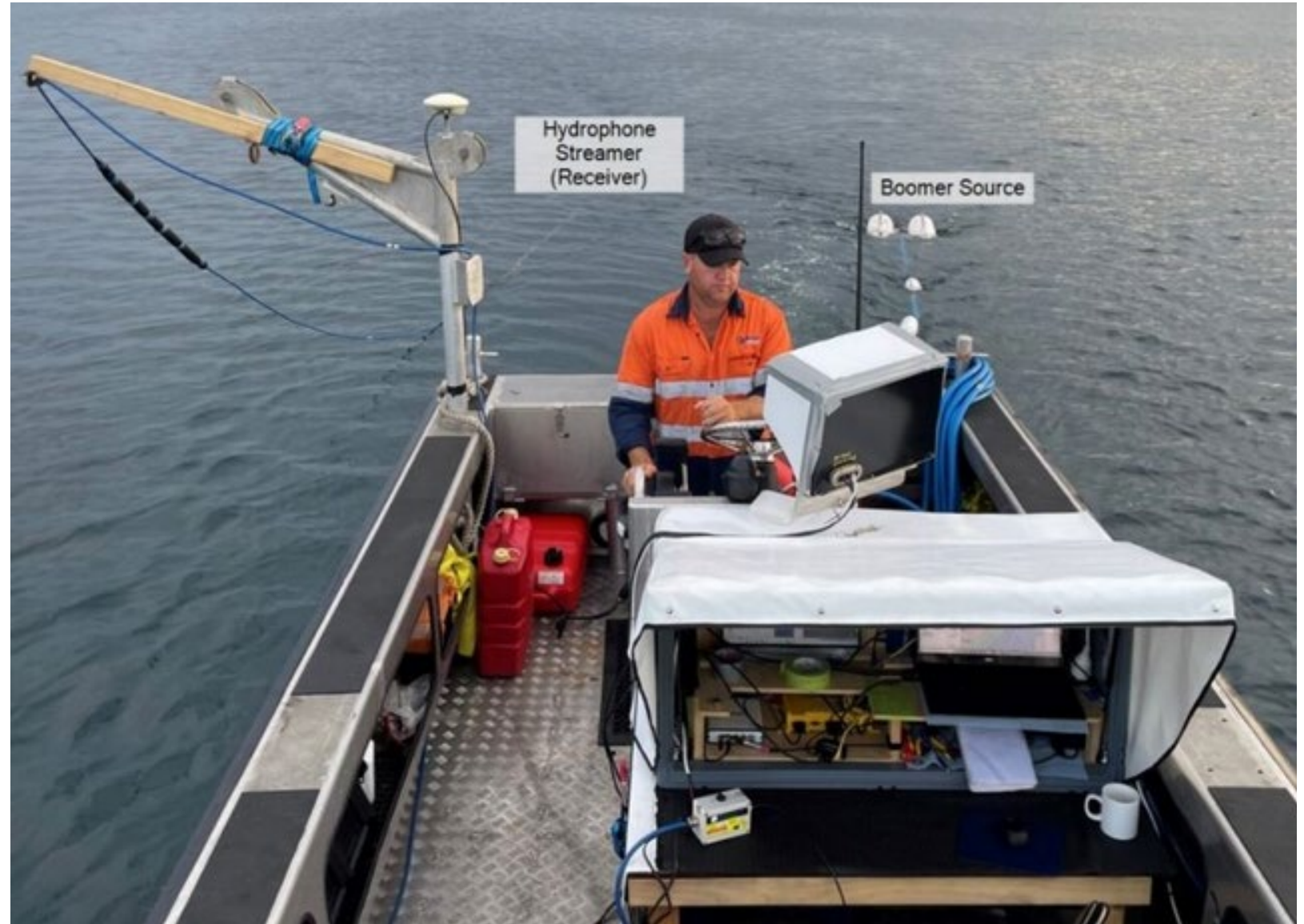


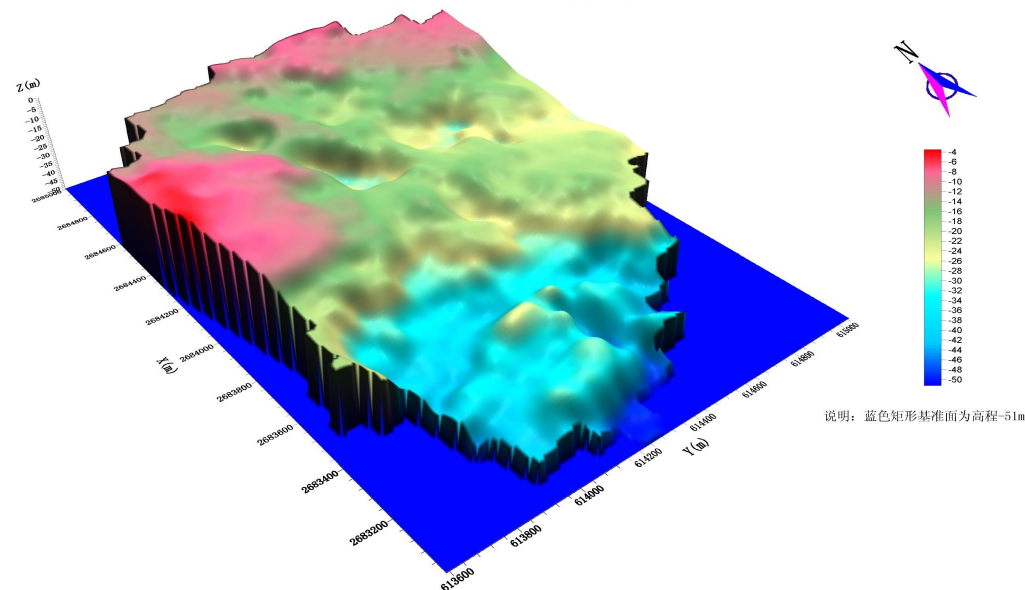
Graphical Illustration for Reflection Seismology for Sub-Bottom Profiling

Introduction (cont.)

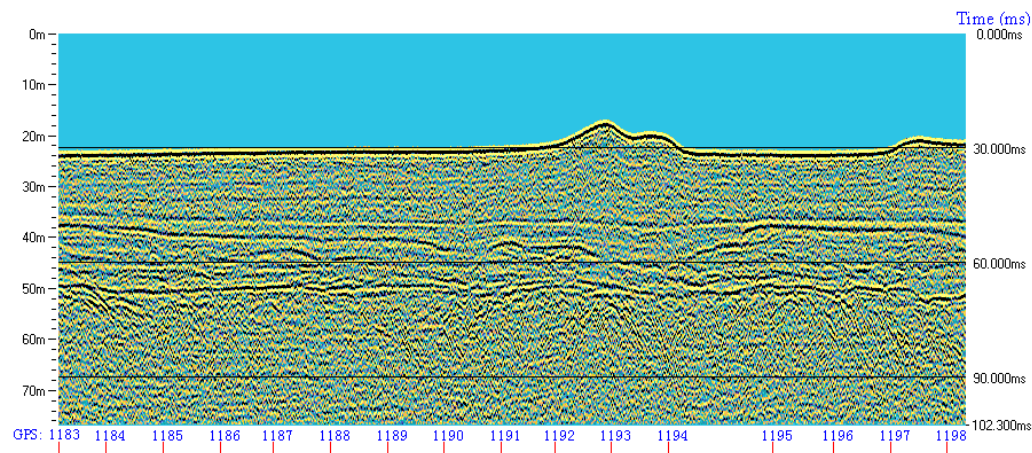
For shallow-water or coastal **sub-bottom profiling**, industry standards favor the use of **12- or 24-channel floating streamers** with narrow (1m to 2m) channel spacing.

This high-resolution approach has established reflection seismology as the premier method for marine engineering and site characterization.





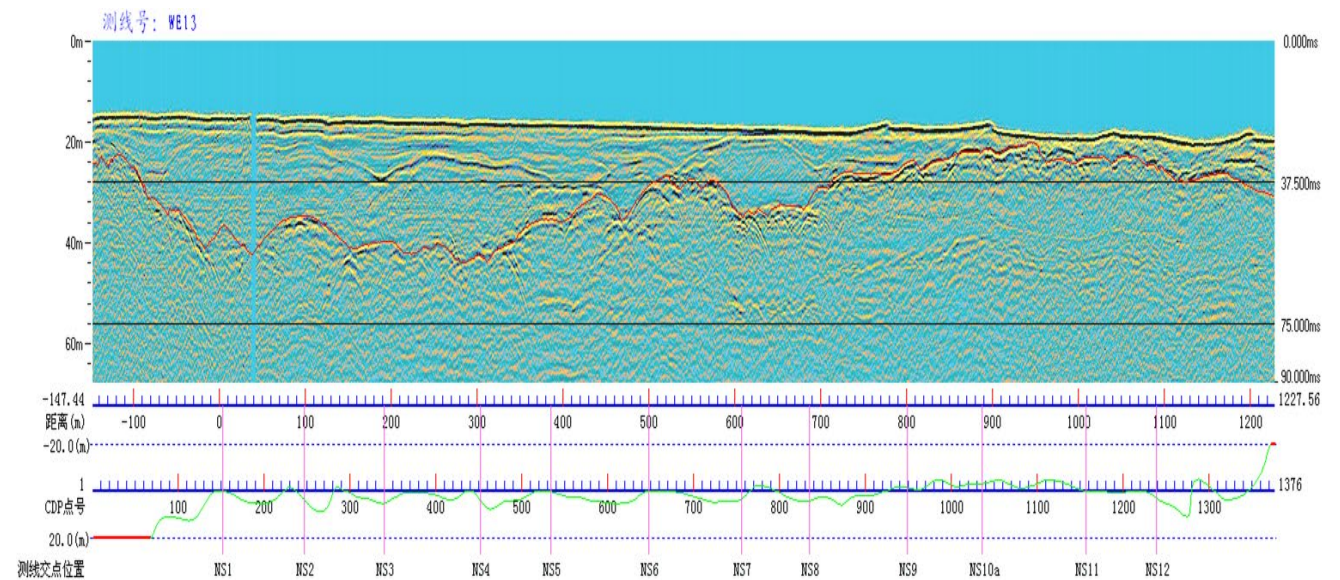
3D Survey for Zhangzhou LNG Receiving Station



2D Survey of an Underwater sand bed in Myiek State, Myanmar

Sub-bottom profiling done using reflection seismology can be utilized to generate 2D and 3D analyses and reports for stakeholders.

This actionable data on subsurface conditions in the field prevents blind guessing and costly mistakes during construction.



2D Survey for Zhangzhou LNG Receiving Station

Accuracy

Exploits acoustic impedance contrasts to deliver mapping of bedrock and complex geological strata (resolution as fine as **15cm to 20cm**)

Multi-Layer Imaging

Generates a complete cross-sectional view of the entire stratigraphic sequence in a single survey pass.

Low Velocity Detection

Accurately images hidden structural weaknesses, such as soft sand layers trapped beneath harder clay

Cost-Effectiveness

Utilizes multi-channel floating streamers for rapid "underway" data acquisition, significantly shortening survey cycles

Non-Destructive

Provides continuous subsurface profiles without the need for invasive physical excavation or environmental disturbance

Environmentally Safe

Employs **patented** pneumatic sources that eliminate the hazards associated with traditional explosives or sparker systems

Advantages of Reflection Seismology



01 Marine Seismology Method

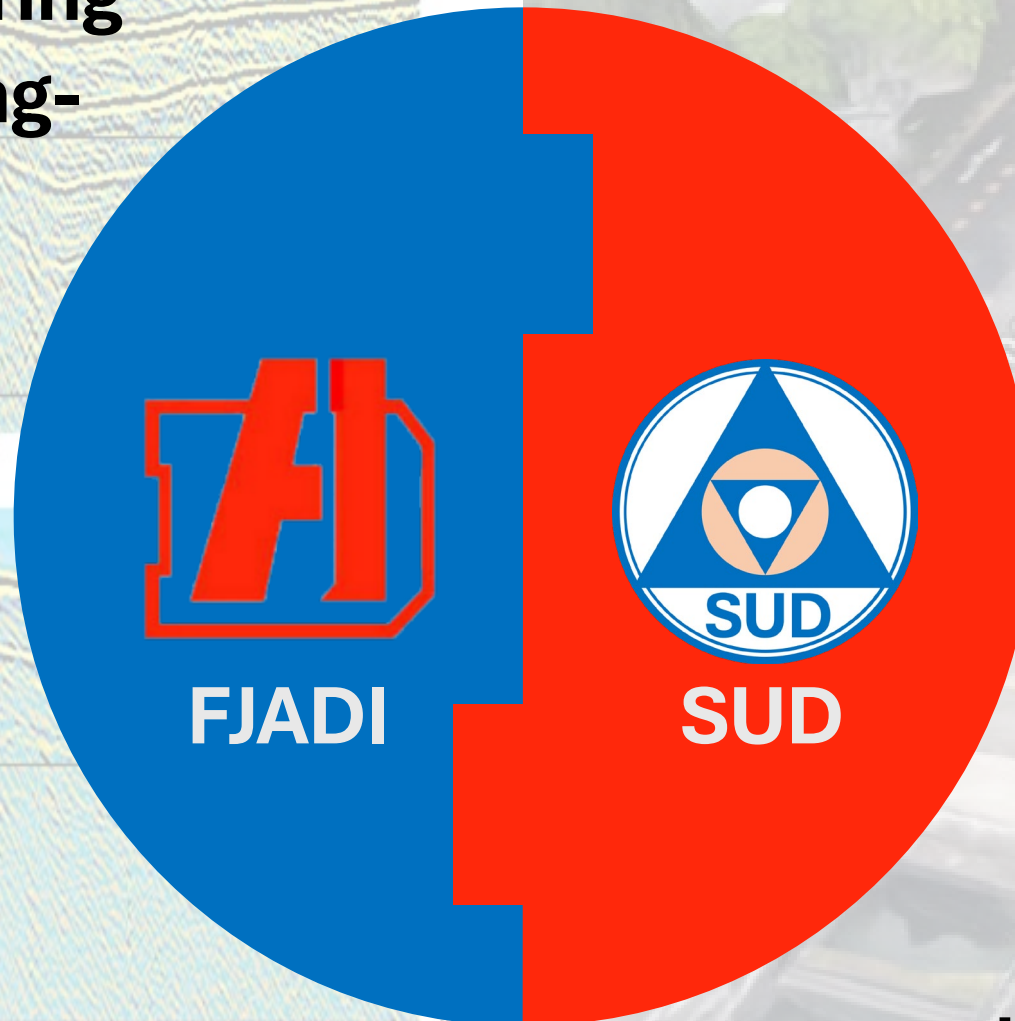
02 Track Record and Profile

03 Potential Applications



Combining engineering expertise and cutting-edge scientific prowess

Smart Underground
Detector Pte. Ltd.



Fujian Provincial Institute
of Architectural Design
and Research Co., Ltd.

**on the ground
expertise and years
of field awareness
and surveying capability**

Fujian Provincial Institute of Architectural Design and Research Co., Ltd.

Fujian Architectural Design and Research Institute Co., Ltd. ("FJADI") was established on 1953 and it is a state-owned sole proprietorship enterprise wholly owned by Fujian Provincial Construction Investment Group Co., Ltd.

FJADI formerly had a presence in Singapore as **FJADI Engineering (Singapore) Pte. Ltd.** During FJADI's earlier presence in Singapore, it collaborated with local companies on geophysical surveys for both private and government work (Marina Bay Sands, DSTA).

FJADI's **Engineering Geophysics Institute** is developing reflection seismology and microtremor analysis as their key thrusts.



FJADI has 46 qualifications under the PRC's Engineering Design Qualification Standards, including 17 Grade A (Level 1) qualifications, 15 Class B (Level 2) qualifications, 7 Class C (Level 3) qualifications and 7 other qualifications.

1400+

employees across 11 functional departments, 16 production departments, 7 owned companies and 16 branches



5 specialized research offices focusing on new technologies for soil investigation and geophysics

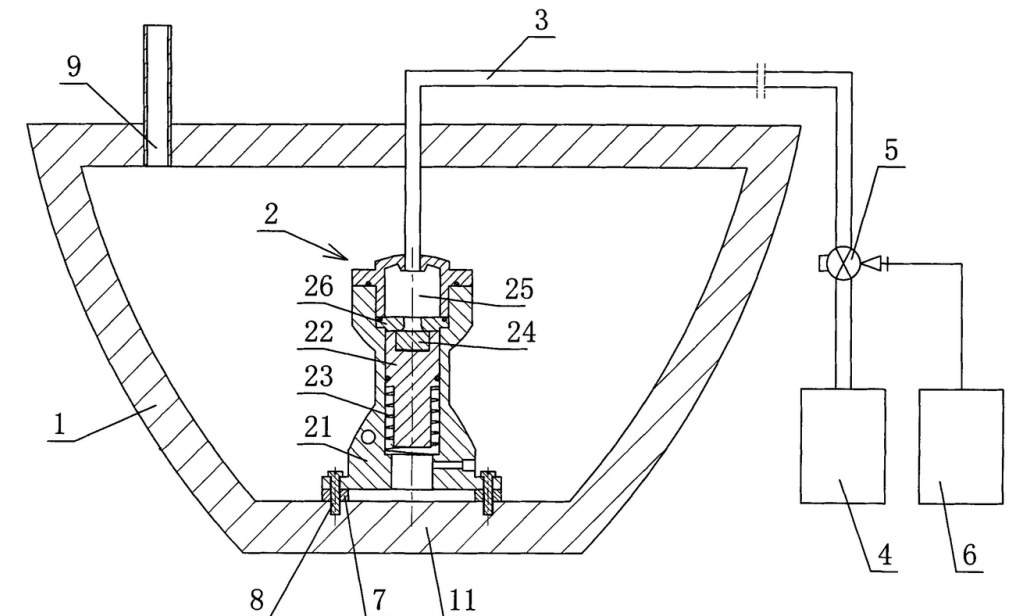
FJADI Engineering Geophysics Institute

FJADI has pioneered in the domain of reflection seismology for sub-bottom profiling, inventing and holding a patent for a **specialised pneumatic acoustic seismic source**.

The patent has been registered with the China Intellectual Property Administration (CN101303413A).

The pneumatic source light and efficient, with a main frequency range of **300–2000 Hz**, delivering exceptional frequency band characteristics and superior pulse definition.

This innovative source is engineered to provide high-resolution data without the logistical burden of traditional equipment. The excitation frequency is equivalent to a **40 in³ air gun** or a 1000J EDM source, yet it remains remarkably compact and easy to deploy.





Copyrighted software developed in-house:

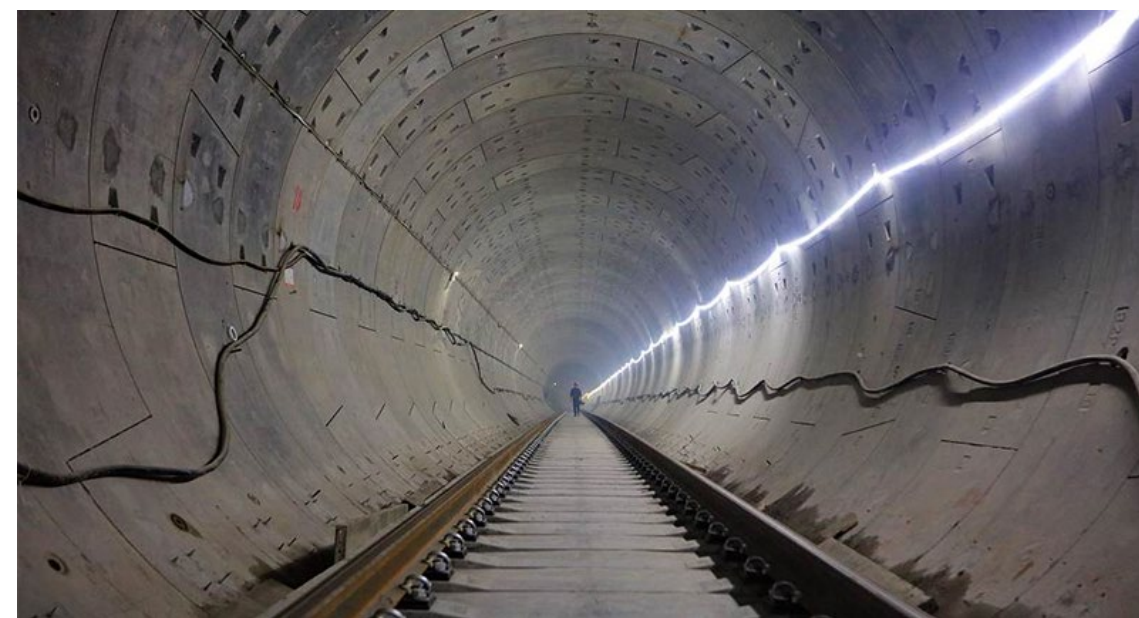
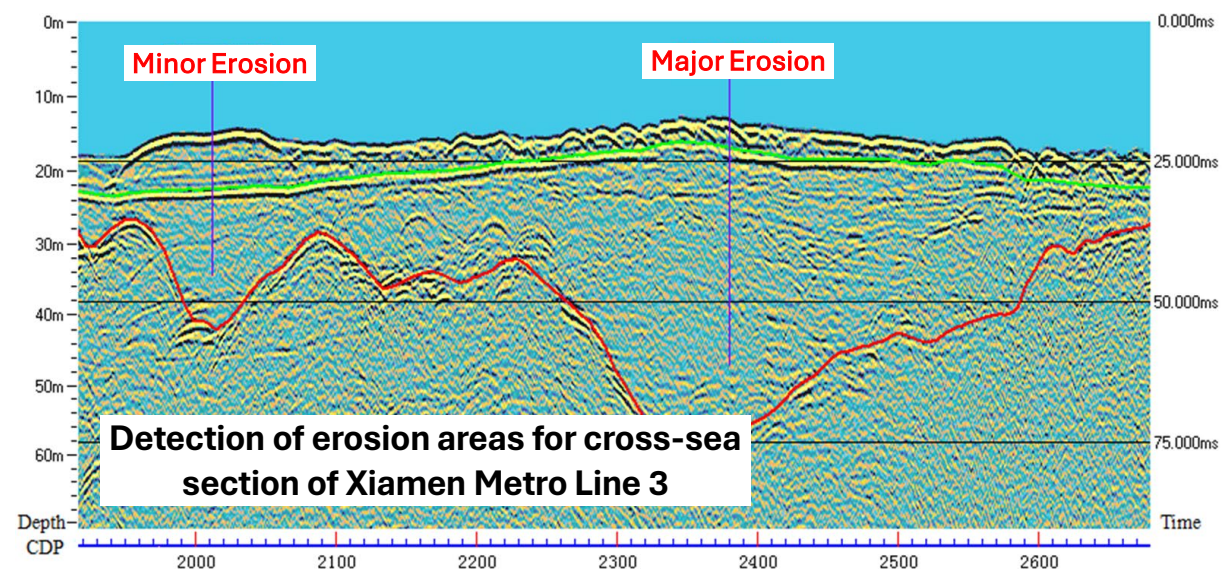
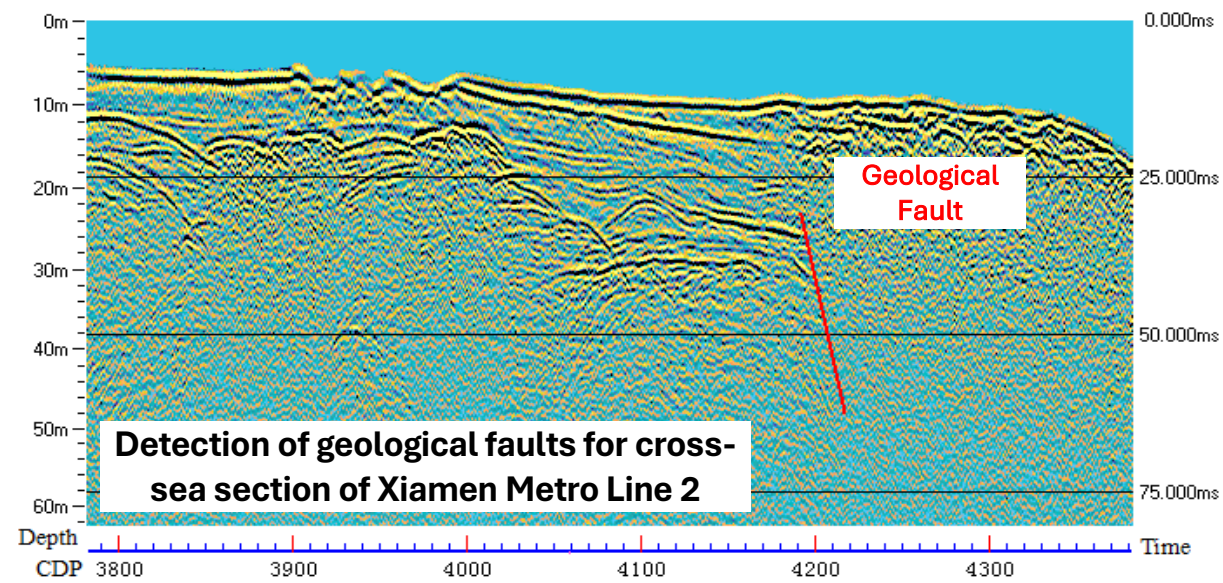
- Organises and processes the data accurately into reports
- Predictively deconvolutes data (removes extra data caused by field interference)

FJADI Engineering Geophysics Institute

Beyond its technical capabilities, the pneumatic source is designed with a commitment to **marine ecology and environmental protection**. By utilizing a moderate energy output that minimizes acoustic impact on marine life, it provides a sustainable alternative for sensitive ecological zones.

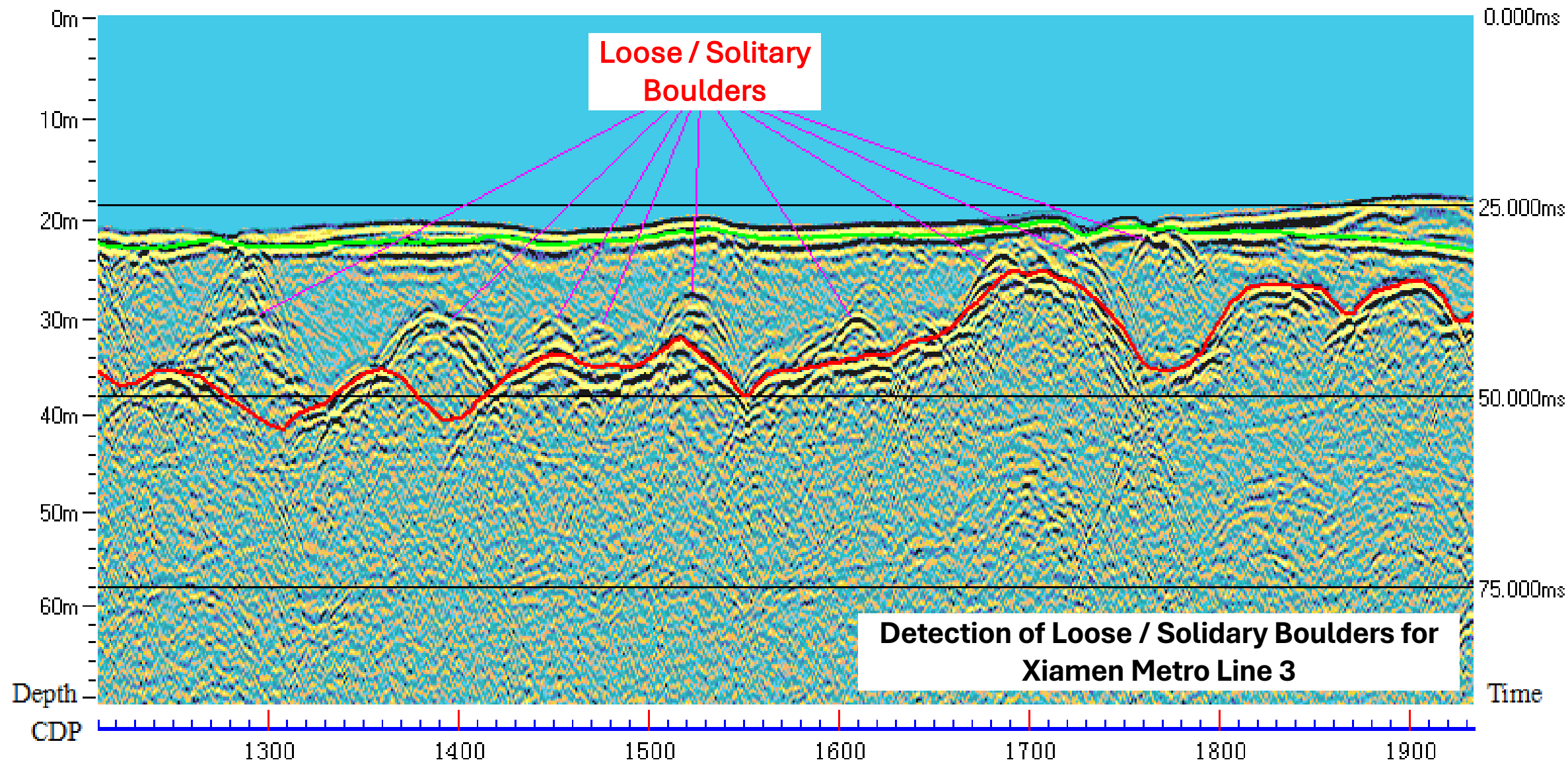
Versatile Applications The source's portability and precision make it the preferred choice for:

- **Shallow Sea Exploration:** Mapping geological structures in coastal waters.
- **Beach-Sea Transition Zones:** Seamlessly operating in challenging, shallow-water environments where larger vessels or traditional air guns cannot navigate.
- **Engineering Detection:** Providing the high-resolution detail required for offshore infrastructure and shallow-water construction projects.



"China has achieved an international lead in comprehensive integrated innovation in constructing undersea metro shield tunnel after the success of cross-ocean Xiamen Metro Line 2, according to Qian Qihu, an academician at the Chinese academy of engineering and a specialist of Chinese protective engineering"

<https://govt.chinadaily.com.cn/s/201907/08/WS5d2306ca498e054923eaf9e9/c hina-achieves-major-breakthrough-in-undersea-shield-technologies.html>



FJADI's Previous Projects

FJADI has undertaken numerous marine seismic reflection operations, surveying the southern coastline of China to support coastal construction operations, and also marine operations in rivers and lakes in the interior of China.



Smart Underground Detector

Smart Underground Detector ("**SUD**") (UEN: **202015680W**) is a geophysical survey company specialising in microtremor and seismic surveying services.

Founded in 2020, SUD performs subsurface soil surveys using cutting-edge microtremor technology, providing detailed information on on-site conditions for construction companies involved in engineering projects across Singapore.

To date, SUD has provided solutions to over 40+ clients with their subsurface mapping needs in Singapore.



SMART UNDERGROUND DETECTOR PTE LTD

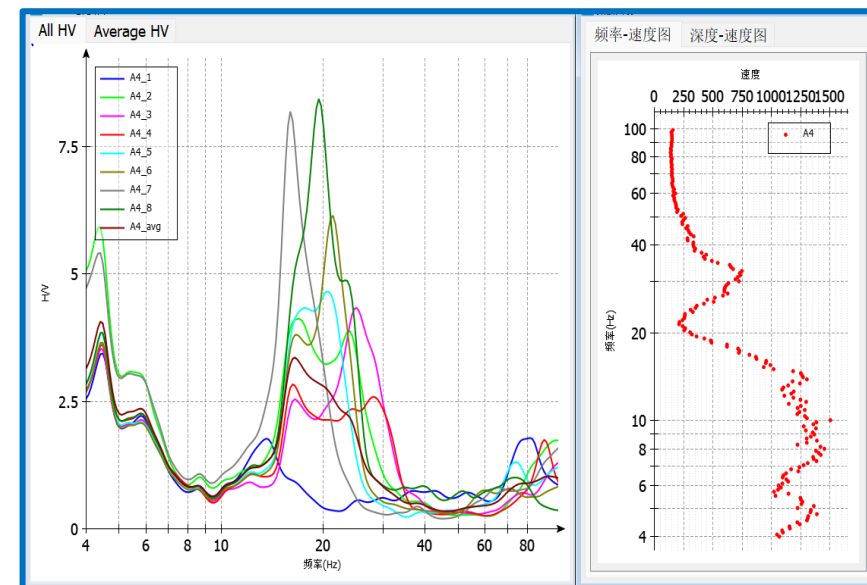
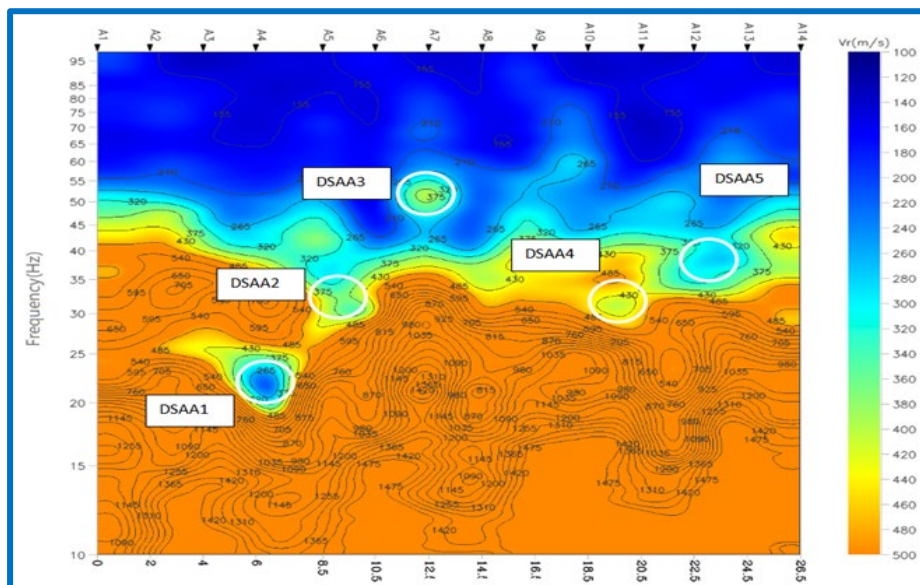
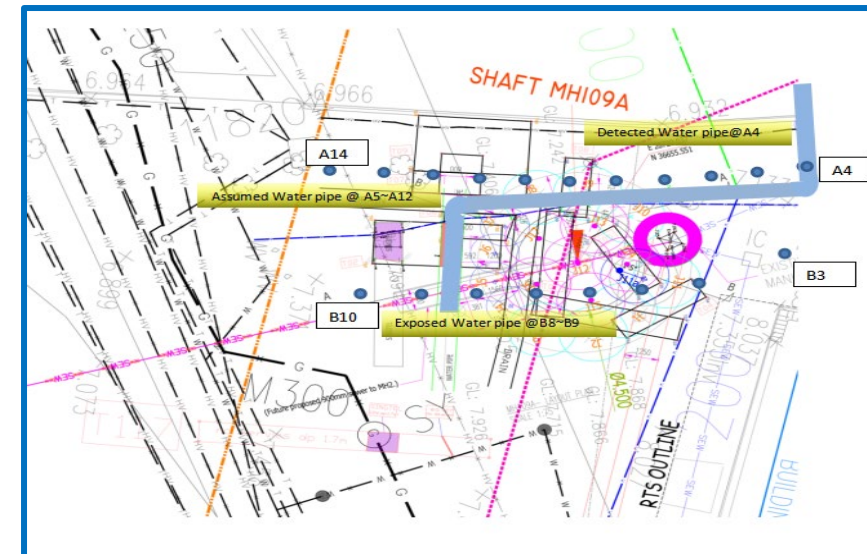
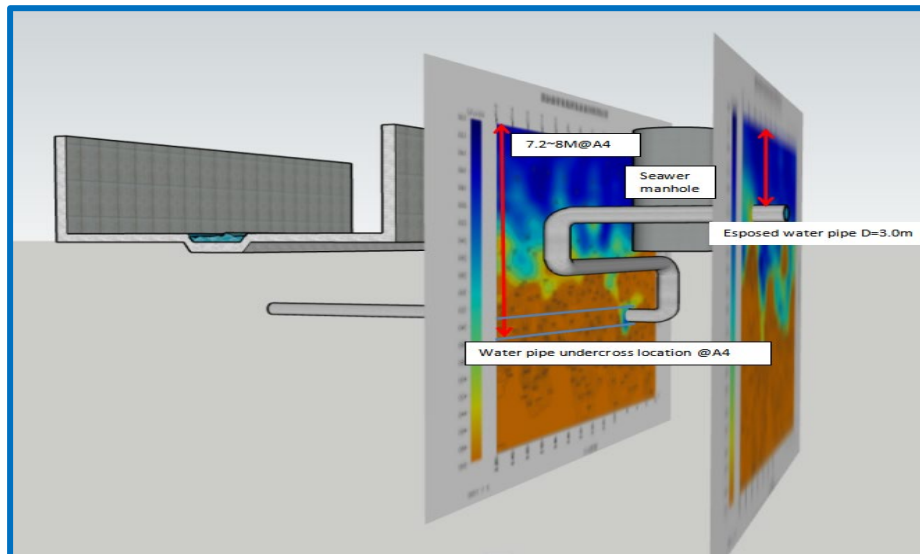
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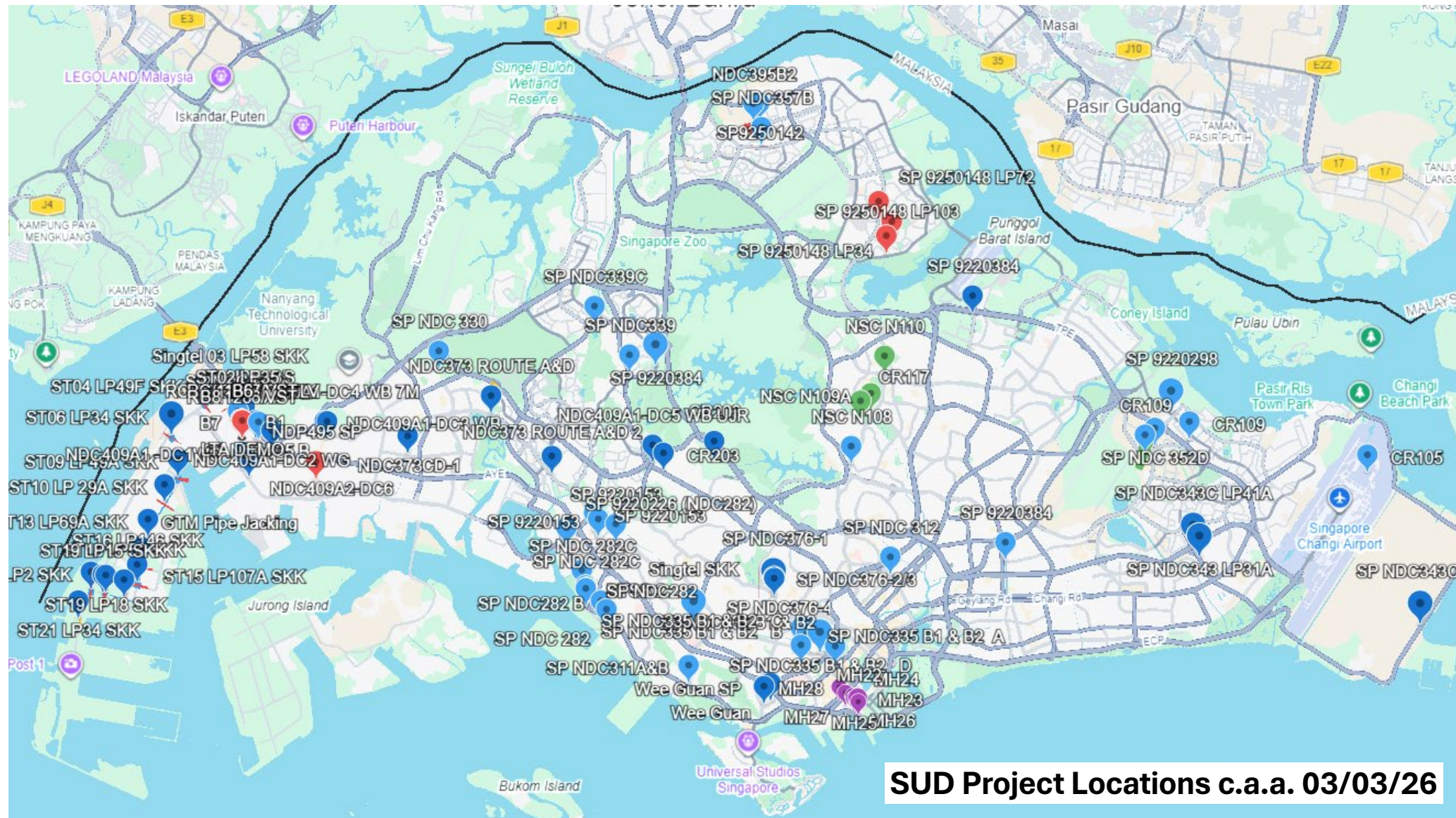
UEN / GST Reg No.: 202015680W Tel: +65 6300 0189

Website: sud.com.sg



China Railway First Group

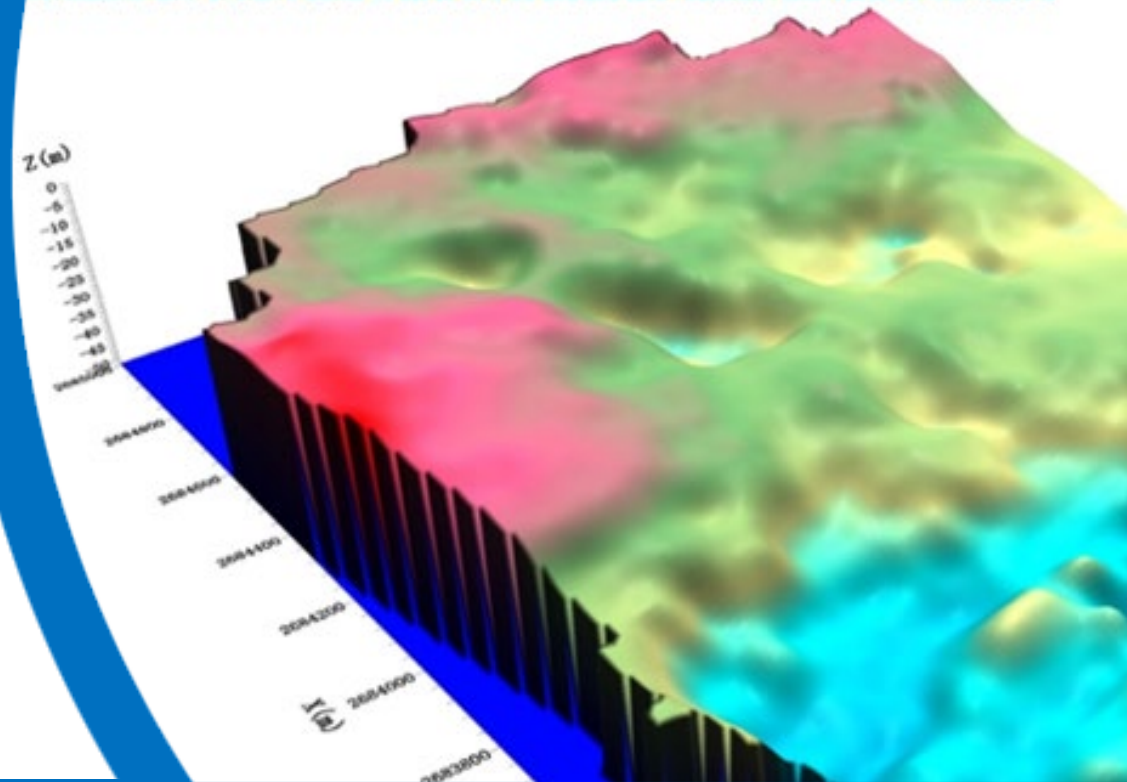
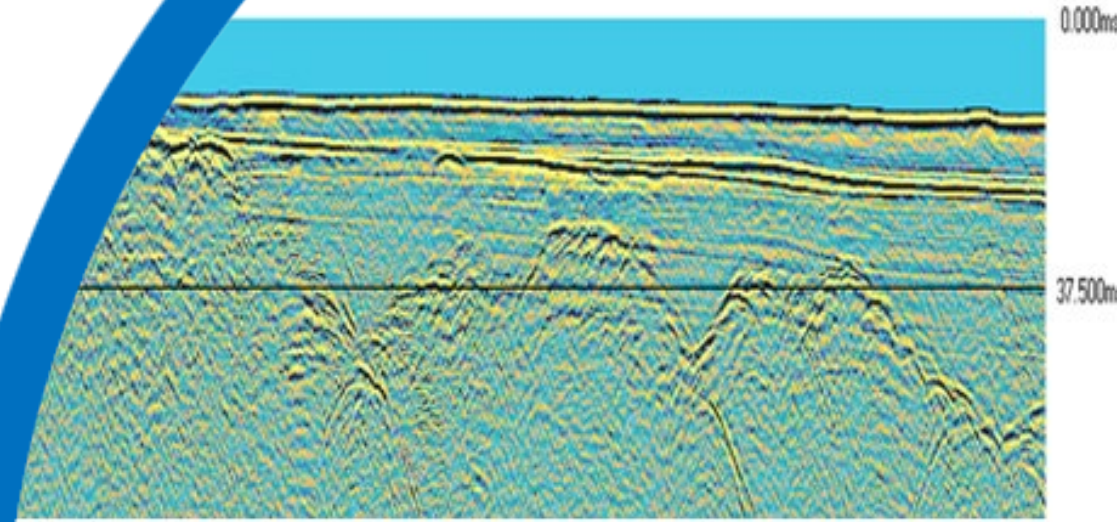




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02 Track Record and Profile

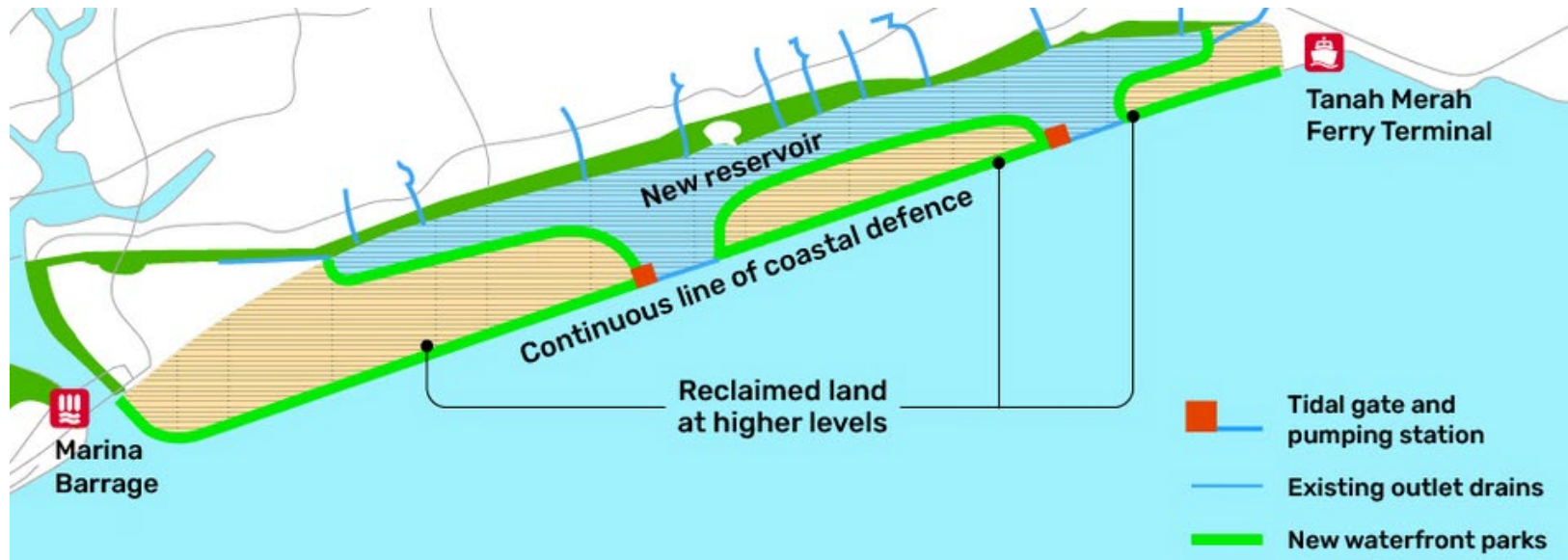
03 Potential Applications



Reclamation and Land Development (East Coast Long Island Plan)

Singapore's plan to create "Long Island" as shared during the National Day Rally 2026 involves reclaiming approximately 800 hectares of land off the East Coast to protect against sea-level rise.

Sub-bottom profiling is used to identify the thickness of soft marine clay layers. This data is could be used for determining where ground improvement (like PVD or soil mixing) is needed before reclamation begins.



Coastal Infrastructure and Coastal Defences (East Coast Long Island Plan)

The East Coast Plan requires the construction of new barrages, tidal gates, and breakwaters.

Reflection seismology provides the precise depth of the bedrock surface, which is a primary design constraint for the heavy foundations of barrages and pumping stations.

Tectonic fractured zones or unfavorable geological bodies can be identified that could compromise the stability of coastal protection walls.





Questions



Thank You