



Asia Digital Lab

# Underground Scanning Technology

## Drone Electromagnetic Survey

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# Our Idea: Developing Digital Twin of Underground World

## Typical Geotechnical Investigation

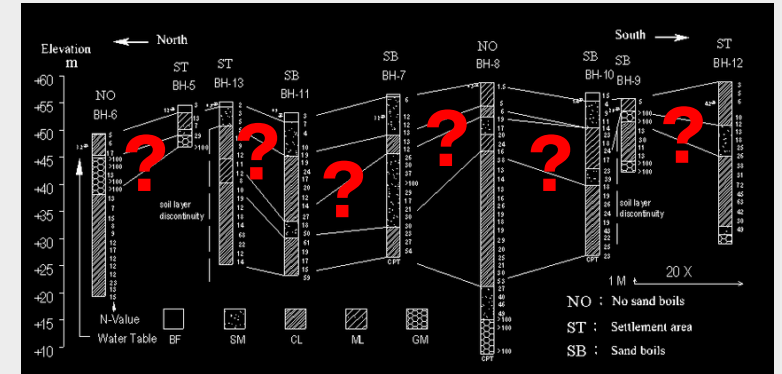


Site Boring Investigation



DEPTH (m)	MOISTURE (%)	DRY DENSITY (kN/m <sup>3</sup> )	SYMBOL	CLASSIFICATION U.S.C.C.	DESCRIPTION/INTERPRETATION
17	1.7	127.7	ML	ALLUVIUM	Light brown, dry, dense, gravelly sandy SILT.
21	5.7	96.8	SM		Light brown, dry to damp, medium dense, silty fine SAND; covered fine gravel.
19	1.2		SP		Grayish brown, dry, loose, gravelly SAND.
14					Medium dense, locally layers of sandy silt with carbonate stringers.
23	1.4	110.0	SP		Grayish brown, dry, medium dense, fine to coarse SAND with fine gravel; trace silt.

Boring Data



Geotechnical Profile  
2D Discontinuous Analog Data

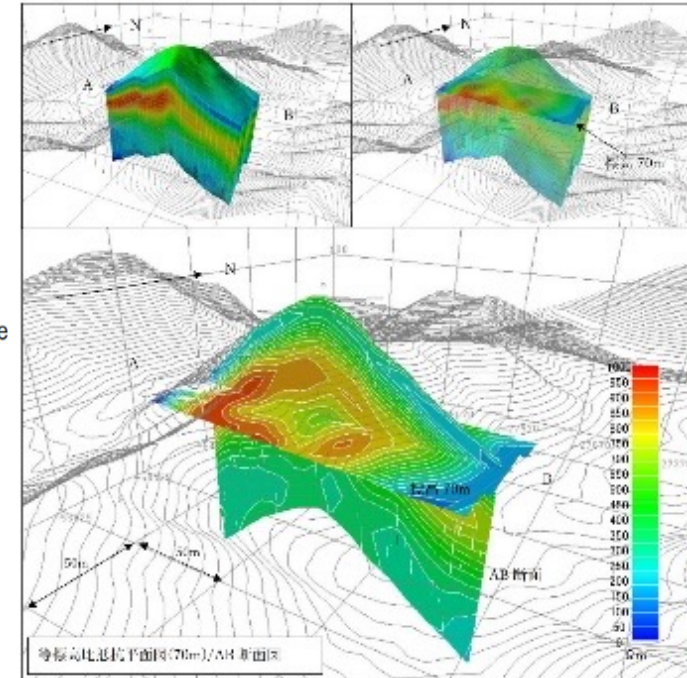
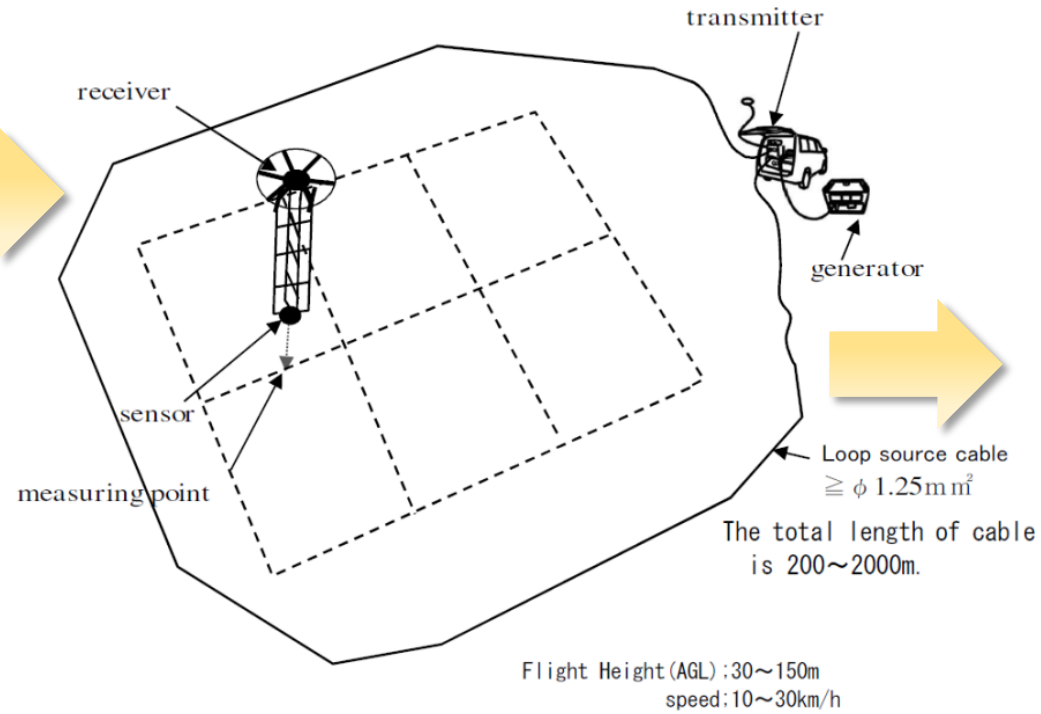
Can we get **3D Digital Data** by scanning **underground**?

# Our Solution : Drone Electromagnetic Survey

## New Solution Drone



## Typical electromagnetic survey by helicopter




## Drone Electromagnetic Survey Advantages


- Has the potential to improve the **quantity and quality** of geophysical investigations
- Even in areas where access is **difficult**, geophysical surveys can be carried out **quickly and easily**
- Provide **continuous three-dimensional digital data**


# Drone Electromagnetic Survey Trial

Our innovation challenge proposal for a **Demonstration of Drone Electromagnetic Surveying in Singapore** was chosen by the Japan External Trade Organization (JETRO)

Asia Digital Transformation (ADX) projects


## Obayashi Corporation





**OBUYASHI**

- ❑ Address: Tokyo, Japan
- ❑ Employees: 9,026
- ❑ Established in: Dec. 1936
- ❑ Business: General Contractor

<https://www.obayashi.co.jp/en/>

### Targeted economic/social issues

- In the ASEAN region, there are some cases where the geophysical investigations that form the basis of construction projects are not sufficiently executed, or the quality of the investigations is inferior. Lack of ground information can bring about unknown construction risks.

### Details of demonstration

- The project will promote improvements in the quantity and quality of geophysical investigations by deploying airborne electromagnetic surveys by drone, recently developed in Japan, to the ASEAN region.
- Even in areas where access is difficult, geophysical survey can be carried out quickly and easily by drone.
- Airborne electromagnetic surveys provide continuous three-dimensional digital data.

### Expected outcome of beneficiary effects

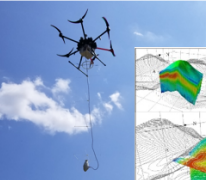
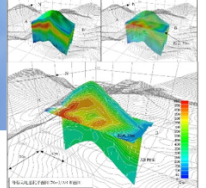
- The introduction of drone-based electromagnetic survey is expected to improve the quantity and quality of geophysical investigations. Furthermore, as an improvement of the construction industry as a whole, it is expected to reduce construction risks due to the poor quality of the geophysical investigation and to reduce environmental impact compared to geophysical surveys.

### Outline of the demonstration project

- Demonstration project of drone electromagnetic survey (geophysical survey) in Singapore

### Cooperation with local companies/governments

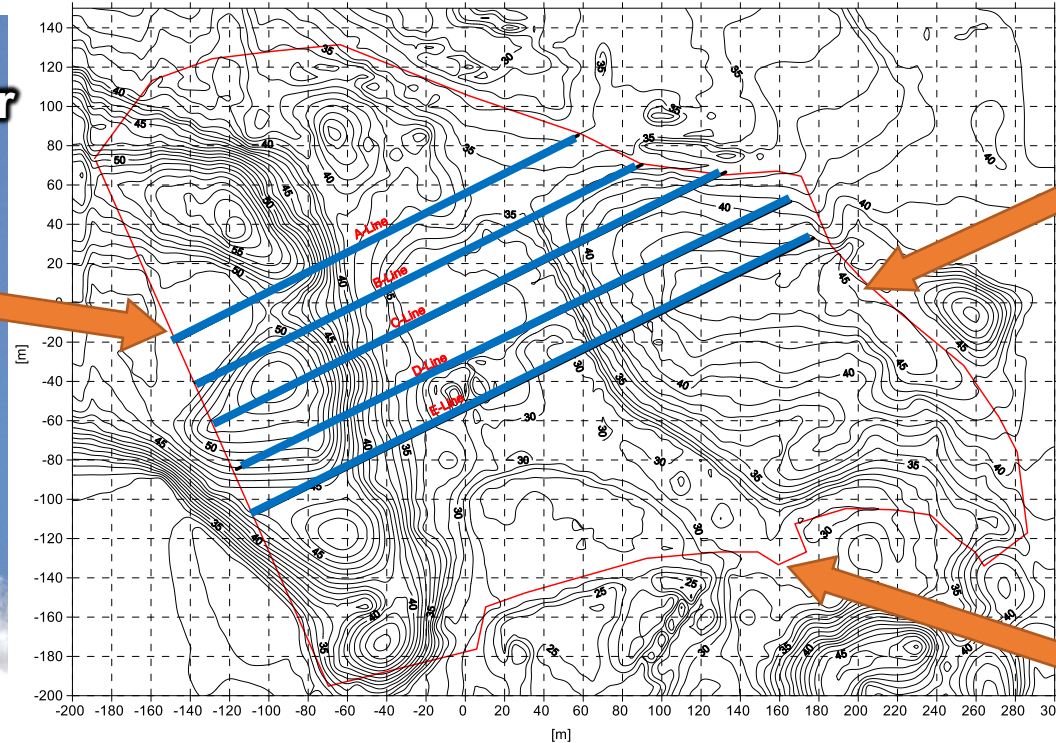
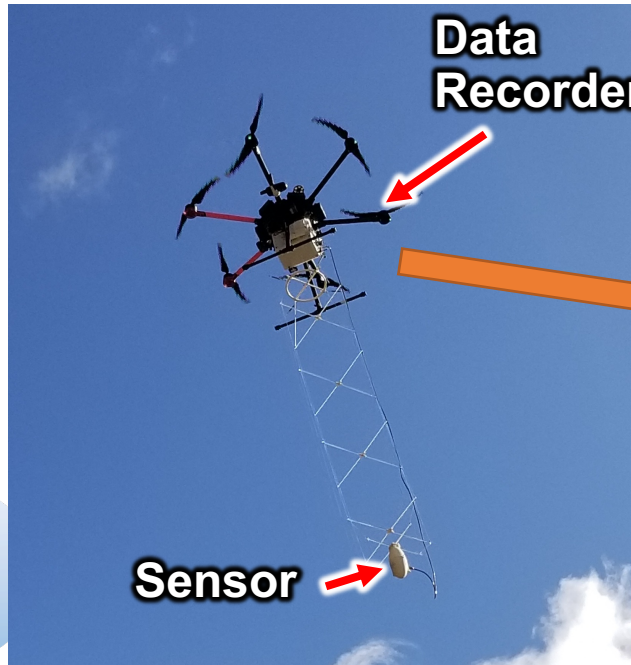
- Local Partner:
- Details of cooperation and collaboration: Conduct of drone operation certified and approved by local authority, providing equipment, certified drone operators and project management of the operation in Singapore. Assisting data processing for 3D plotting.

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# Drone Electromagnetic Survey Trial

We chose the **Ground Loop Source Method** for the trial



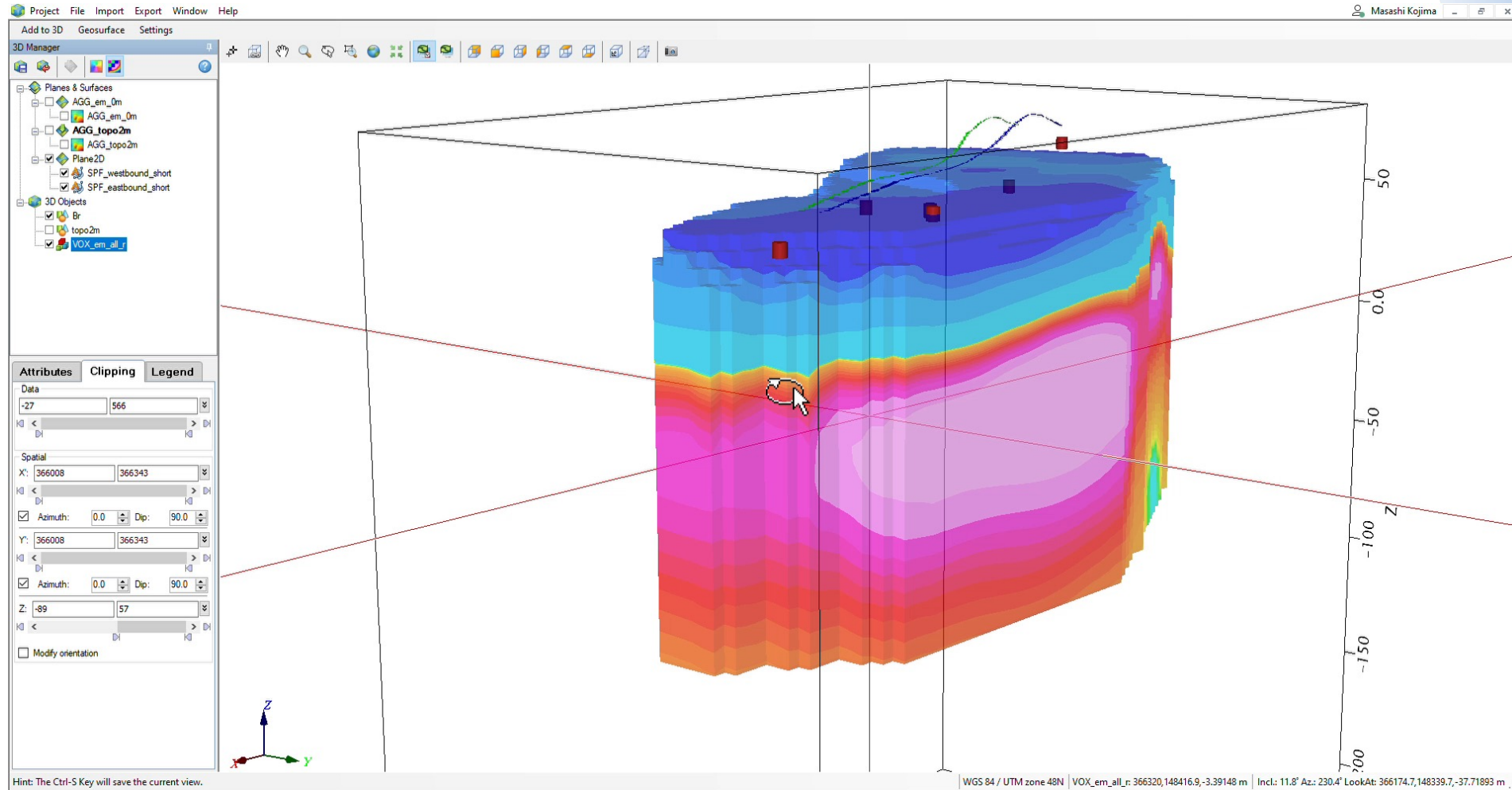
**Generator**  
100V / 1KW

# Drone Electromagnetic Survey Trial

Carried out on 24 Nov 2022



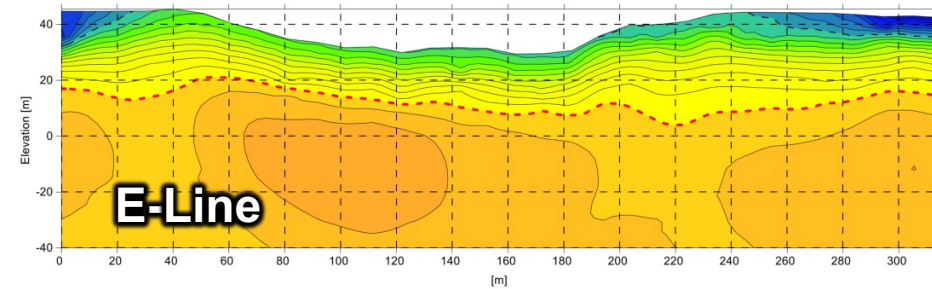
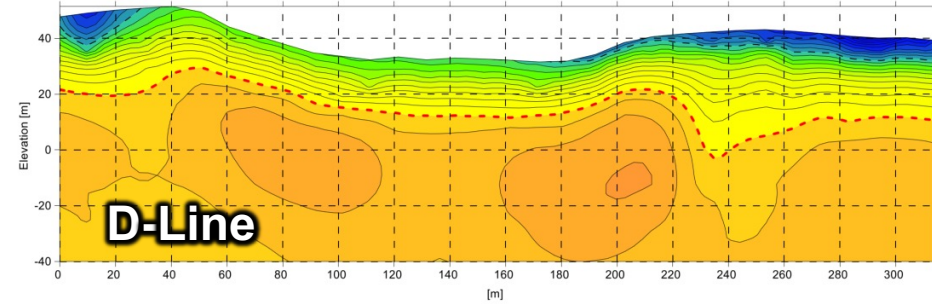
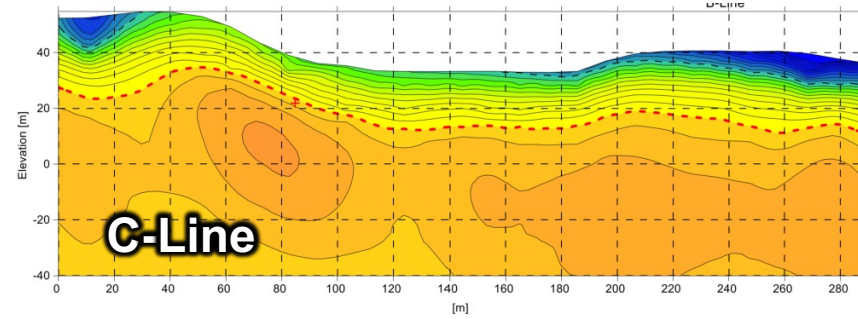
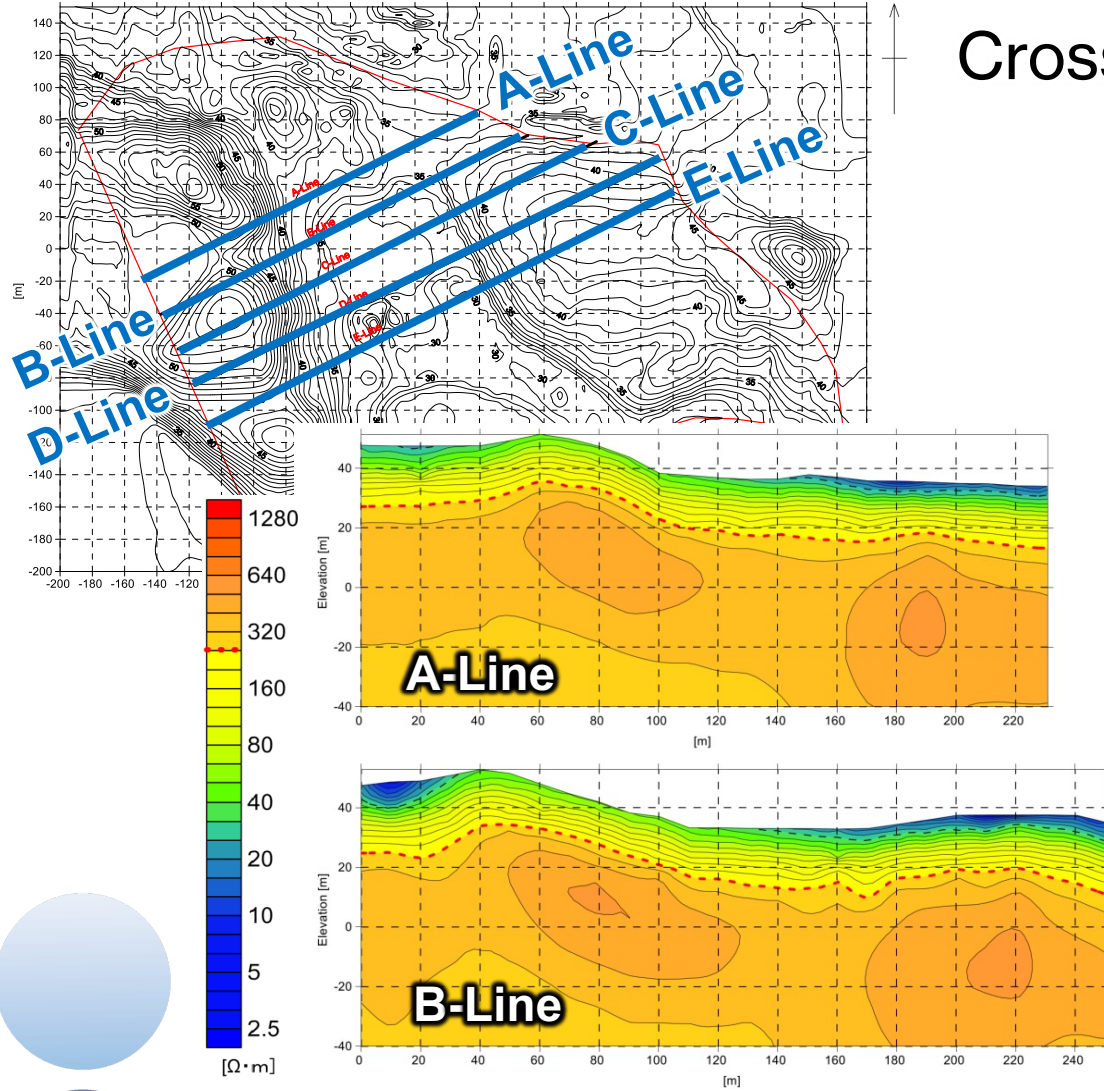
A 3D model of the resistivity was created from the surveyed data

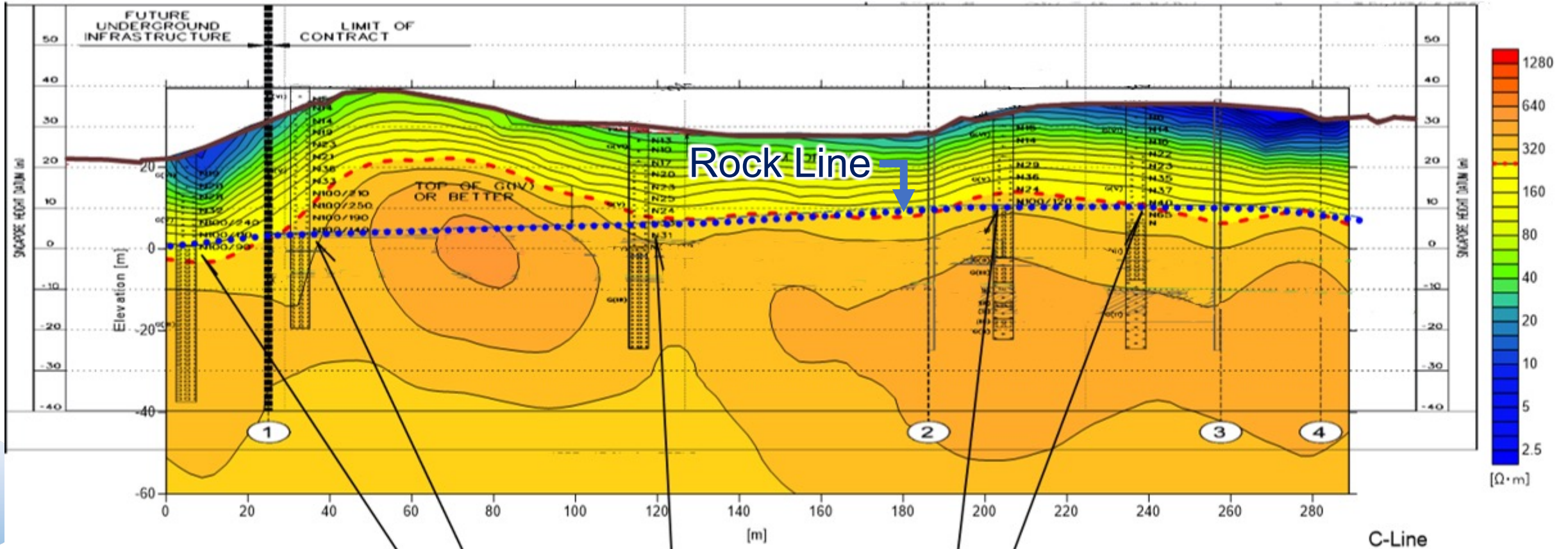




# Drone Electromagnetic Survey Data

Cross sections under drone flight route

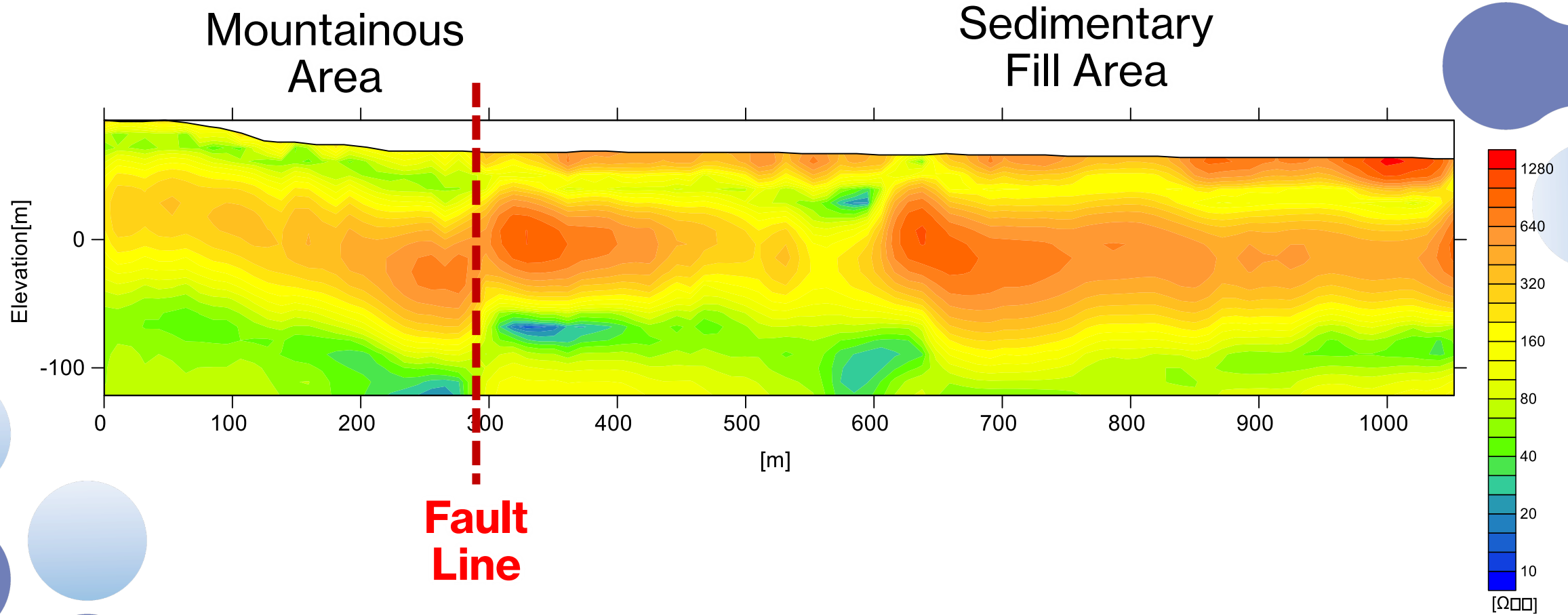




The resistivity **250Ω·m** is matched with **the top of rock** of boring data

# Drone Electromagnetic Survey Benefits

Drone Electromagnetic Survey can be used for searching fault zones





## Drone Electromagnetic Survey Summary

- The airborne electromagnetic surveys by drone was tested in **Singapore first time** and it is ready for applying to other projects
- The airborne electromagnetic surveys by drone can make possible to carry out geophysical survey in areas where **access is difficult**
- The airborne electromagnetic survey can provides **continuous three-dimensional digital data**
- The airborne electromagnetic surveys can be used for **searching fault zones**
- The airborne electromagnetic surveys can **save cost and time** for detailed geotechnical investigation