

Obayashi Corporation

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



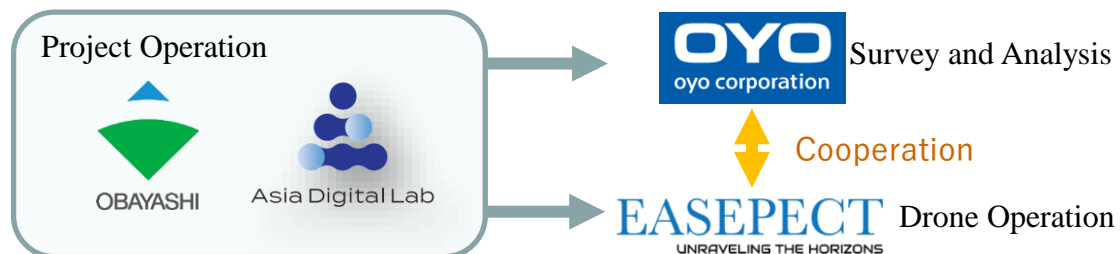
Objective of the project

Conducting a demonstration test of airborne electromagnetic survey by drone and converting the survey results into 3D in the country of Singapore to verify the validity of the survey method and results.

In the ASEAN region, construction projects are affected by a lack of quantity and quality of borehole investigations, as well as geographical difficulties. The objective is to improve the quantity and quality of geotechnical investigations and contribute to improving the quality and cost of construction projects.

Cooperation with local companies/governments

The Asia Digital Lab project team within the Asia-Pacific Regional Headquarters (in Singapore) of Obayashi Corp. took the lead, and the OYO Corporation dispatched equipment and engineers to Singapore to carry out the site survey. In addition, EASEPECT provided materials, equipment and personnel for various applications related to drone flights, as well as operations of drones and on-site airborne electromagnetic surveys.



Targeted economic/social issues

Geotechnical investigations in the ASEAN region usually involve taking ground samples (cores) by boring, and the project design and construction is based on the physical property data. However, in some projects in the ASEAN region, there are cases where sufficient geotechnical investigations are not carried out or the quality of the investigations is poor, e.g. for the following reasons.

Insufficient number of borehole surveys

The cost of a borehole survey is proportional to the number of borings, and the number of borings is sometimes small, for example due to a short of the client budget or a reduction in the survey period. This results in longer distances between borings, which in turn increases the uncertainty of the ground interpretation.

Insufficient quality of borehole investigations

It is essential to ensure technical competence at the field stage of geotechnical investigation work, but there are cases where the data obtained may lack reliability due to the lack of competence of the engineers who carry out the borings. In the ASEAN region, there is no qualification system for geological survey engineers like in Japan. Therefore, securing personnel does not always mean ensuring individual survey technical competence and quality.

Difficulties with borehole surveys

To conduct borehole surveys in remote locations away from cities in the ASEAN region, the access to transport machinery to sites must be constructed, which is a time-consuming and expensive task. In addition, if the access is constructed but the plan is not realized, the construction cost may be wasted.

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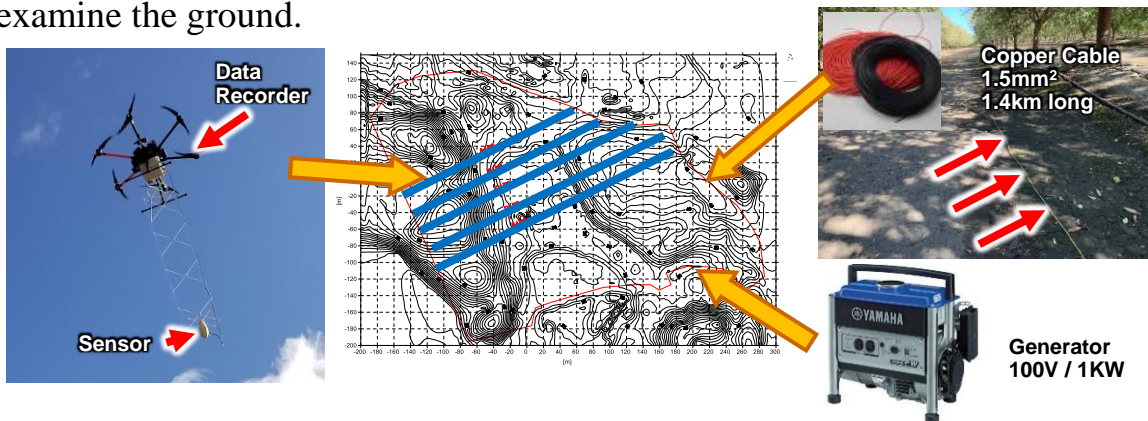


Demonstration period

October 2022 – March 2023

Details of demonstration

In trials of the airborne electromagnetic survey method using a drone, an inductive magnetic field was created by looping and laying down wire of approximately 1.6 km over the survey area and applying a rapidly varying current at regular intervals. The transient response of the induced magnetic field was measured continuously by a receiver towed from the drone to calculate the resistivity value of the ground, which allowed to determine the properties of the ground with this resistivity value. Through this trial, we were able to acquire resistivity data of the ground down to a depth of about 100 m, and the acquired data could be displayed continuously in 3D and used to examine the ground.



Project outcome / Future plans

The first outcome to note this demonstration project is that we were able to conduct an airborne electromagnetic survey using a drone in Singapore to demonstrate that data could be acquired. Although there are many regulations governing drone flights in Singapore, we were able to successfully conduct the demonstration project with the cooperation of local partners. From a technical standpoint, we were also able to demonstrate that the acquired resistivity values could be used to analyse the complex geological formations in Singapore. Specifically, we were able to delineate the boundary between the underlying hard rock and the weathered layers, which are likely to be the objective of geotechnical investigations in Singapore. The results showed good consistency with the results of existing borehole investigations. In the future, we intend to conduct airborne electromagnetic surveys not only in Singapore but also in other ASEAN countries to improve the quantity and quality of geotechnical investigations. We also intend to promote this survey method in industries other than the construction industry, such as the resource mining industry.

