

Executive Summary

Background

Early detection of any underground void at sites where trenchless operation would be carried out is essential as this would allow the project proponent to implement proper ground treatment prior to proceeding with the trenchless work. This would greatly reduce the risk of excessive settlement or collapse of road. To achieve this, it is important that a reliable means for detecting underground voids is available. For a wider application, a reliable means of detection of underground voids could assist the maintenance authorities of roads and underground pipelines to program their maintenance works with a view to minimizing the risk of sudden subsidence due to the formation of underground voids.

Aims

The aims of this Study are:-

- (a) A market review and update on available technologies (other than ground penetration radar and shallow seismic reflection) for detection of underground voids based on the previous R&D Item No. RD1056 – Detection of Underground Voids;
- (b) Based on (a), identification of two suitable means of underground voids detection for Hong Kong situation for further studying;
- (c) A collaborative research with tertiary institution and specialist with a view to formulating measures to improve the effectiveness and reliability of the identified means of detection; and
- (d) Trials of enhanced detection methods at a man-made environment or the typical sites of the Department.

Recommended Geophysical Methods

A literature and market review was conducted and in collaboration with Prof. L S CHAN of HKU, two methods, namely electromagnetic method and electrical resistivity imaging, were selected for this R&D study item.

Site Trials

Site trials were conducted between June and September 2013 at the works sites of Contract No. DC/2009/21 “Provision of Intercepting Facilities at Jordan Valley Box Culvert” and Contract No. DC/2012/09 “North District Sewerage, Stage 2 Part 2A - Pak Hok Lam Trunk Sewer and Sha Tau Kok Village Sewerage”.

Findings

The geophysical trials were successful but did not detect convincingly underground voids in the vicinity of underground pipes due to site constraints. The geophysical methods may plausibly produce useful results only at very favourable site conditions and they should be regarded as indicative measures and not for definitive determination.

Recommendations by Prof. L S CHAN

The effectiveness of all of the geophysical methods is site-specific and depends to some extent on weather and ground conditions. Two other techniques, namely smart ball and leak detector (based on acoustic principles), may warrant further trials.

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