

# ***RD1090 - Application of Multi-sensor inspection on sewers/drains***

## Executive Summary

The objectives of this R&D Study are to review and compare different condition inspection methods, and their applicability in different site conditions, to facilitate further planning and design of detailed condition survey for underground sewers and drains.

An Advanced Condition Survey contract (PM10/2012) was carried out under the Consultancy Agreement CE51/2011. The contract was completed on 30 September 2013 with a final contract sum of HK\$2,904,061.70.

Under the contract, condition surveys using a variety of techniques have been undertaken under various Works Orders (WOs):

**CCTV** - provides qualitative visual information on the section of sewer above the water line;

**Sonar** - typically Sonar is used to examine sewers below the water line;

**Totally Integrated Sonar & CCTV Inspection (TISCIT)** - The two technologies of Sonar and CCTV can be deployed on a floating boat or a motorised tractor to inspect significant lengths of sewer;

**Laser scanning** - Laser scanning or profiling is a method for determining the accurate surface profile and internal dimensions and ovality of a sewer;

**Multi Sensor Robot** - The combination of CCTV, sonar, and laser, and gas detection mounted on an ROV or float capable of inspecting several kilometres from one access point

A number of difficulties were encountered whilst carrying out the surveys including inability to locate manholes, difficulties in installing cables for towing equipment through sewers, unexpected blockages, insufficient depth of flow, high flow, and high turbulence causing aeration and impediments to sonar signals.

The advanced condition surveys have shown that there are advantages and disadvantages for each method of condition survey used. Whilst CCTV can provide visual evidence of sewer defects above the water line, laser profiling can provide quantifiable data on sewer deformation and loss of sewer wall thickness. High water levels will impede the use of CCTV and laser profiling. Sonar surveys can provide an accurate profile of the sewer below the water line and also an estimate of the quantity and location of debris within the sewer. Sonar cannot operate when the depth of flow is too low and on the other hand high turbulence can cause the signals from sonar to be affected. There is no one perfect method of assessing the condition of sewers and all present both advantages and disadvantages. A flowchart recommending selection procedure for appropriate survey techniques and a model specification and schedule of rates for the survey methods are provided under the report.