HOKLAS Supplementary Criteria No. 55

Construction Materials Test Category – Accreditation of Underground Utility Survey

0 Introduction

(a) This document serves to clarify and supplement the requirements of ISO/IEC 17025:2017 and HKAS Policy Document No. 1 for accreditation of laboratories performing underground utility survey under the test category of 'Construction Materials'. It should be read in conjunction with the current issue of ISO/IEC 17025:2017 and other relevant accreditation criteria documents. The following sections set out specific technical criteria for underground utility survey which include, but not limited to, the following methods:

- Pipe Cable Locating / Electromagnetic Locating
- Ground Penetrating Radar
- Laser Scanning Survey
- Visual Inspection
- Acoustic Emission Method for leak detection in pressurized water-carrying utilities
- Flow monitoring for drains/sewers

(b) . In addition to the requirements stipulated in this document, an accredited laboratory shall comply with all specific requirements of the relevant test standards.

1 Scope

(No additional explanation)

2 Normative references

(No additional explanation)

3 Terms and definitions

(No additional explanation)

4 General requirements

(No additional explanation)

5 Structural requirements

The management shall structure its laboratory and provide sufficient manpower to ensure effective supervision. The detailed supervisory responsibility of each supervisory staff member shall be documented

6 Resource requirements

6.1 General

(No additional explanation)

6.2 Personnel

6.2.1 An **approved signatory** for underground utility survey shall have the necessary competence (e.g. education, qualification, training, technical knowledge, skills and experience) to ensure the test is performed in accordance with the test standard and HKAS requirements.

6.2.2 For pipe cable locating (PCL) / electromagnetic locating (EML), an **approved signatory** shall either have:

(i) (a) at least a Bachelor of Science (e.g. Geomatics/Land Surveying) or Engineering (e.g. Civil/Electrical/Materials/Mechanical/Gas/Industrial) degree, with specialisation in underground-utility (UU) survey not less than 200 contact hours of BSc/BEng's UU training provided by a recognised tertiary institution, plus (b) at least three years of technical and managerial experience of underground utilities, within which a period of two years is substantially(Note 1) related to PCL/EML, or

Note 1: Direct technical and managerial involvement in at least 10 test/survey reports in different contracts/works orders.

(ii) (a) a valid certificate or diploma of specialisation in PCL/EML issued by a recognised organisation, plus (b) at least five years of technical and managerial experience of underground utilities, within which three years are substantially related to PCL/EML, or

(iii)(a) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, plus (b) with at least seven years of direct technical and

managerial experience, within which five years are directly related to PCL/EML, plus relevant training courses covering PCL/EML.

6.2.3 For ground penetrating radar (GPR), an **approved signatory** shall either have:

(i) (a) at least a Bachelor of Science (e.g. Geomatics/Land Surveying) or Engineering (e.g. Civil/Electrical/Materials/Mechanical/Gas/Industrial) degree, with specialisation in underground-utility (UU) survey not less than 200 contact hours of BSc/BEng's UU training provided by a recognised tertiary institution, plus (b) at least three years of technical and managerial experience of underground utilities, within which a period of two years is substantially(Note 1) related to GPR, or

(ii) (a) a valid certificate or diploma of specialisation in GPR issued by a recognised organisation, plus (b) at least five years of technical and managerial experience of underground utilities, within which three years are substantially related to GPR, or

(iii) (a) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, plus (b) with at least seven years of direct technical and managerial experience, within which five years are directly related to GPR, plus relevant training courses covering GPR.

6.2.4 For laser scanning survey, an **approved signatory** shall either have:

(i) (a) at least a Bachelor of Science (e.g. Geomatics/Land Surveying) or Engineering (e.g. Civil/Electrical/Materials/Mechanical/Gas/Industrial) degree provided by a recognised tertiary institution, plus (b) at least three years of technical and managerial experience of underground utilities, within which a period of two years is substantially(Note 1) related to laser scanning survey, or

(ii) (a) a valid certificate or diploma of specialisation in surveying issued by a recognised organisation, plus (b) at least five years of technical and managerial experience of underground utilities, within which three years are substantially related to laser scanning survey, or

(iii) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, with at least seven years of direct technical and managerial experience, within which five years are directly related to the subject matter in this specification, plus relevant training courses covering laser scanning survey.

6.2.5 For visual inspection, an **approved signatory** shall either have:

(i) (a) at least a Bachelor of Science (e.g. Geomatics/Land Surveying) or Engineering (e.g. Civil/Electrical/Materials/Mechanical/Gas/Industrial) degree, with specialisation in underground-utility (UU) survey not less than 200 contact hours of BSc/BEng's UU training provided by a recognised tertiary institution, plus (b) at least three years of technical and managerial experience of underground utilities, within which a period of two years is substantially(Note 1) related to visual inspection, or

(ii) (a) a valid certificate or diploma of specialisation in visual inspection issued by a recognised organisation, plus (b) at least five years of technical and managerial experience of underground utilities, within which three years are substantially related to visual inspection, or

(iii) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, with at least seven years of direct technical and managerial experience, within which five years are directly related to the subject matter in this specification, plus relevant training courses covering visual inspection.

6.2.6 For acoustic emission method for leak detection in pressurized water-carrying utilities, an **approved signatory** shall either have:

(i) (a) at least a Bachelor of Science (e.g. Geomatics/Land Surveying) or Engineering (e.g. Civil/Electrical/Materials/Mechanical/Gas/Industrial) degree, with specialisation in underground-utility (UU) survey not less than 200 contact hours of BSc/BEng's UU training provided by a recognised tertiary institution, plus (b) at least three years of technical and managerial experience of underground utilities, within which a period of two years is substantially(Note 1) related to acoustic emission from water leakage, or

(ii) (a) a valid certificate or diploma of specialisation in acoustic emission issued by a recognised organisation, plus (b) at least five years of technical and managerial experience of underground utilities, within which three years are substantially related to acoustic emission from water leakage, or

(iii) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, with at least seven years of direct technical and managerial experience, within which five years are directly related to the subject matter in this

specification, plus relevant training courses covering acoustic emission from water leakage.

6.2.7 For flow monitoring for drains/sewers, an **approved signatory** shall either have:

(i) (a) at least a Bachelor of Science (e.g. Geomatics/Land Surveying) or Engineering (e.g. Civil/Electrical/Materials/Mechanical/Gas/Industrial) degree, with specialisation in underground-utility (UU) survey with not less than 200 contact hours of BSc/BEng's UU training, provided by a recognised tertiary institution, plus (b) at least three years of technical and managerial experience of underground utilities, within which a period of two years is substantially(Note 1) related to flow monitoring measures, or

(ii) (a) a valid certificate or diploma of specialisation in flow monitoring measures issued by a recognised organisation, plus (b) at least five years of technical and managerial experience of underground utilities, within which three years are substantially related to flow monitoring measures, or

(iii) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, with at least seven years of direct technical and managerial experience, within which five years are directly related to the subject matter in this specification, plus relevant training courses covering flow monitoring measures.

6.2.8 Each laboratory shall have at least one approved signatory for each accredited test. HOKLAS endorsed reports and certificates shall be signed by an approved signatory. HKAS evaluates nominees for signatory approval according to the relevant HOKLAS policy on personnel.

6.2.9 An approved signatory shall not sign a test report containing test/survey results obtained by himself / herself.

6.2.10 Testing personnel shall normally be supervised by a suitably qualified supervisor having the necessary qualifications, experience and technical knowledge not less than that of the testing operator.

6.2.11 **Testing personnel** for PCL/EML shall either have:

(i) (a) a higher diploma or above (e.g. Geomatics/Land Surveying), or an engineering higher diploma or above (e.g. Civil/Electrical/Materials/ Mechanical/Gas/ Industrial), with not less than 75 contact hours of UU

training, provided by a recognised tertiary institution, plus (b) at least one year of on-the-job experience substantially(Note 2) related to PCL/EML, or

(ii) (a) a valid certificate or diploma of specialisation in PCL/EML issued by a recognised organisation, plus (b) at least two years of substantial on-the-job experience(Note 2) related to PCL/EML, or

(iii) (a) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, plus (b) at least three years of substantial on-the-job experience(Note 2) related to PCL/EML, plus (c) relevant training courses covering PCL/EML, or

(iv) at least eight years of substantial on-the-job experience(Note 2) related to PCL/EML.

Note 2: On-the-job involvement in at least 10 test/survey reports in different contracts / works orders.

6.2.12 **Testing personnel** for GPR shall either have:

(i) (a) a higher diploma or above (e.g. Geomatics/Land Surveying), or an engineering higher diploma or above (e.g. Civil/Electrical/Materials/ Mechanical/Gas/ Industrial), with not less than 75 contact hours of UU training, provided by a recognised tertiary institution, plus (b) at least one year of on-the-job experience substantially(Note 2) related to GPR, or

(ii) (a) a valid certificate or diploma of specialisation in GPR issued by a recognised organisation, plus (b) at least two years of substantial on-the-job experience(Note 2) related to GPR, or

(iii) (a) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, plus (b) at least three years of substantial on-the-job experience(Note 2) related to GPR, plus (c) relevant training courses covering GPR.

6.2.13 **Testing personnel** for laser scanning survey shall either have:

(i) (a) at least a Bachelor of Science (e.g. Geomatics/Land Surveying) or Engineering (e.g. Civil/Electrical/Materials/Mechanical/Gas/Industrial) degree provided by a recognised tertiary institution, plus (b) at least one year of on-the-job experience substantially(Note 2) related to laser scanning survey, or

(ii) (a) a valid certificate or diploma of specialisation in laser scanning survey issued by a recognised organisation, plus (b) at least two years of substantial on-the-job experience(Note 2) related to laser scanning survey, or

(iii) (a) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, plus (b) at least three years of substantial on-the-job experience(Note 2) related to laser scanning survey, plus (c) relevant training courses covering laser scanning survey, or

(iv) at least eight years of substantial on-the-job experience(Note 2) related to laser scanning survey.

6.2.14 **Testing personnel** for visual inspection shall either have:

(i) (a) at least a Bachelor of Science (e.g. Geomatics/Land Surveying) or Engineering (e.g. Civil/Electrical/Materials/Mechanical/Gas/Industrial) degree provided by a recognised tertiary institution, with not less than 100 contact hours of UU training, plus (b) at least one year of on-the-job experience substantially(Note 2) related to visual inspection of utilities, or

(ii) (a) a valid certificate or diploma of specialisation in visual inspection of utilities issued by a recognised organisation, plus (b) at least two years of substantial on-the-job experience (Note 2) related to visual inspection of utilities, or

(iii) (a) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, plus (b) at least three years of substantial on-the-job experience(Note 2) related to visual inspection of utilities, plus (c) relevant training courses covering visual inspection of utilities, or

(iv) at least eight years of substantial on-the-job experience(Note 2) related to visual inspection of utilities.

6.2.15 **Testing personnel** for acoustic emission method for leak detection in pressurized water-carrying utilities shall either have:

(i) a higher diploma or above (e.g. Geomatics / Land Surveying) or an engineering higher diploma or above (e.g. Civil / Electrical / Materials / Mechanical / Gas / Industrial) with not less than 75 contact hours of UU training provided by a recognised tertiary institution, plus at least one year of on-the-job experience substantially(Note 2) related to acoustic

emission method, or

(ii) a valid certificate or diploma of specialisation in leak detection issued by a recognised organisation plus at least two years of substantial on-the-job experience(Note 2) related to acoustic emission method, or

(iii) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, plus at least three years of substantial on-the-job experience(Note 2) related to acoustic emission method, plus relevant training courses covering acoustic emission method, or

(iv) at least eight years of substantial on-the-job experience(Note 2) related to acoustic emission method.

6.2.16 **Testing personnel** for flow monitoring for drains/sewers shall either have:

(i) (a) a higher diploma or above (e.g. Geomatics/Land Surveying), or an engineering higher diploma or above (e.g. Civil/Electrical/Materials/ Mechanical/Gas/ Industrial), with not less than 75 contact hours of UU training, provided by a recognised tertiary institution, plus (b) at least three years of on-the-job experience substantially(Note 2) related to flow monitoring measures, or

(ii) (a) a valid certificate or diploma of specialisation in flow monitoring measures issued by a recognised organisation, plus (b) at least three years of substantial on-the-job experience(Note 2) related to flow monitoring measures, or

(iii) (a) at least a higher certificate or diploma issued by a recognised technical institute or an equivalent qualification in a relevant discipline, plus (b) at least three years of substantial on-the-job experience(Note 2) related to flow monitoring measures, plus (c) relevant training courses covering flow monitoring measures, or

(iv) at least eight years of substantial on-the-job experience(Note 2) related to flow monitoring measures.

6.2.17 Each laboratory shall evaluate the technical competence of its test operators for different underground utility survey methods and keep a separate list of **qualified operators** for different underground utility survey methods who are permitted to perform the concerned test and sign the worksheets. Record of assessing the competence of the qualified operator(s) shall be kept in the laboratory and ready for examination during each HKAS assessment visit or upon request by HKAS.

6.2.18 Supervisors have the responsibility to ensure that the operation has been properly conducted. Also, the supervisor shall ensure that the staff members under his or her supervision are working under suitable conditions which allow them to discharge their duties properly and not subject to undue pressure which may compromise the quality of their work, e.g. unreasonable deadlines, long working hours and unbearable working environments.

6.2.19 Adequacy of supervision shall be emphasised in HKAS assessments and the laboratory shall be required to justify their supervision arrangement and to demonstrate that supervisory staff members have been allowed sufficient time in their work schedule to carry out their supervisory duties.

6.2.20 Supervision is of particular importance for work performed on-site remote from the laboratory. The laboratory shall implement a system where HOKLAS approved signatories or other suitably qualified supervisors conduct frequent unannounced on-site visits to check the work of on-site staff. Records of such checks and findings shall be kept.

6.3 Facilities and environmental conditions

(No additional explanation)

6.4 Equipment

Equipment shall be properly stored and maintained. Suitable environment shall be provided for storage. When handling heavy testing/surveying equipment on site, laboratories shall comply with any relevant construction site safety regulations for their testing personnel. Equipment that is moved from one location to another shall, where relevant, be checked before use. Precautions shall be taken to ensure that, after transportation to a site, testing equipment remains in a serviceable state and calibrated properly. Appropriate checks shall be performed on site to confirm calibration status before testing commences.

6.5 Metrological traceability

Where a laboratory has the necessary reference standard or reference material, suitably controlled environment and competent staff, it may perform in-house calibration/verification for its working equipment. Documented internal calibration/verification procedures shall be ready for examination during each HKAS assessment visit. HKAS Executive may require the laboratory to provide the calibration/verification procedures in the briefing notes to the assessment team.

6.6 Externally provided products and services

(No additional explanation)

7 Process requirements

7.1 Review of requests, tenders and contracts

(No additional explanation)

7.2 Selection, verification and validation methods

(No additional explanation)

7.3 Sampling

(No additional explanation)

7.4 Handling of test or calibration items

(a) Items to be tested shall be identified such that traceability is maintained throughout the test and technical records on the traceability of tested items shall be kept. Identification shall be such that the areas specifically tested can be identified against the corresponding test results.

(b) The laboratory shall implement a result recording system which does not allow falsification of results or capable of detecting falsification of results.

7.5 Technical records

For all underground utility survey methods, high resolution digital photograph records shall be taken and kept. These may be in the form of photographs or videos such that the location and identification of the tested areas are recorded. The digital photographs and videos shall include information on the project name, the test locations and the dates when they are taken. Where the location of the test is important, global navigation satellite system (GNSS) records or other records which allow accurate identification of the test sites shall also be kept.

7.6 Evaluation of measurement uncertainty

(No additional explanation)

7.7 Ensuring the validity of results

(a) An applicant or accredited laboratory shall conform with the proficiency

testing requirements as stipulated in HOKLAS SC-33.

(b) Underground utility survey is considered as a test area for the purpose of determining the proficiency testing activities required by the HOKLAS SC-33.

7.8 Reporting of results

(No additional explanation)

7.9 Complaints

(No additional explanation)

7.10 Nonconforming work

(No additional explanation)

7.11 Control of data and information management

(No additional explanation)

8 Management system requirements

(No additional explanation)

REFERENCES

Department of Land Surveying and Geo-Informatics (LSGI) (2019a), *Specifications for Nondestructive Testing, Surveying, Imaging and Diagnosis for Underground Utilities 1,1 Pipe Cable Locating/Electromagnetic Locating*

Department of Land Surveying and Geo-Informatics (LSGI) (2019b), *Specifications for Nondestructive Testing, Surveying, Imaging and Diagnosis for Underground Utilities 1,2 Ground Penetrating Radar*

Department of Land Surveying and Geo-Informatics (LSGI) (2020a), *Specifications for Nondestructive Testing, Surveying, Imaging and Diagnosis for Underground Utilities 1,3 Laser Scanning Survey*

Department of Land Surveying and Geo-Informatics (LSGI) (2020b), *Specifications for Nondestructive Testing, Surveying, Imaging and Diagnosis for Underground Utilities 2,1 Visual Inspection*

Department of Land Surveying and Geo-Informatics (LSGI) (2019c), *Specifications for*

Nondestructive Testing, Surveying, Imaging and Diagnosis for Underground Utilities 2,2 Acoustic Emission Methods for Leak Detection in Pressurized Water-carrying Utilities

Department of Land Surveying and Geo-Informatics (LSGI) (2021), *Specifications for Nondestructive Testing, Surveying, Imaging and Diagnosis for Underground Utilities 2,3 Flow Monitoring for drains/sewers*