



ACCREDITATION SCHEME FOR INSPECTION BODIES

TECHNICAL NOTE: SI 01

SPECIFIC REQUIREMENTS FOR THE ACCREDITATION OF INSPECTION BODIES FOR SITE INVESTIGATION

Technical Note SI 01, 09 July 2018

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1. INTRODUCTION

- 1.1 The purpose of accreditation of the inspection body for site investigation is to ensure the inspection process of site investigation conforms with standards or other normative documents and/or general requirements.
- 1.2 The scope of site investigation¹ covers drilling, rock coring, functional testing, sampling, storage and transportation of soil/rock samples. "Site Investigation" has the same meaning as "Ground Investigation". "Functional Test" has the same meaning as "In-situ Test" or "Field Test"
- 1.3 This accreditation covers the site investigation, sampling and functional tests as listed in Appendix 1
- 1.4 This technical note (SI 01) should be read in conjunction with documents listed in the References Section and government regulations when applicable.
- 1.5 Supplementary information for specific areas of inspection may be published as other Technical Notes.

2. EQUIPMENT

- 2.1 Equipment which affect results that are critical to the conclusion of the examination, soil sampling, rock coring and testing shall be appropriate for the particular site investigation to be performed.
- 2.2 Inspectors shall ensure that all equipment, including equipment not under the charge of the inspection body, used during investigation work are calibrated and traceable to the SI unit. Calibration shall be performed by recognised accredited laboratories² or the National Measurement Institute who is a member of the BIPM³ MRA where possible. The inspectors shall ensure that the acceptance of calibration reports be based on the measurement traceability as specified in SAC-SINGLAS 006: Traceability of Measurement.
- 2.3 Where calibration facilities are not available, in house calibration shall be validated using well recognised methods endorsed by the approved signatory.
- 2.4 Each in-house validation report shall be endorsed by the approved signatory.
- 2.5 Table 1 sets out the normal frequencies for calibrations and checks of critical equipment used in the field of site investigation.

¹ Exclude geophysical survey and deep rock investigation

² Recognised accredited laboratories refer to those accredited by SAC or its MRA partners

³ BIPM MRA refers to listing of signatories maintained by the International Bureau of Weights and Measures (BIPM) and publicly available on the BIPM website: <http://www.bipm.fr>

3. TESTING

- 3.1 Analytical testing is a laboratory activity and therefore does not come within the scope of ISO/IEC 17020. Examples of analytical testing are Atterberg Limit test, sieve analysis, consolidation test, direct shear test, triaxial tests or chemical analysis.
- 3.2 Where analytical testing is required to support the evaluation, the inspection body shall ensure that the testing is performed by an accredited laboratory whenever possible and the tests performed are accredited. The inspection body shall ensure that it receives SAC-endorsed test reports from accredited laboratories where available.
- 3.3 When an organisation is providing analytical testing and inspection for the same project, the organisation has to ensure that there is sufficient independence between the two activities (e.g. results of inspection activities and testing activities should not be approved by the same person).
- 3.4 Functional testing forms a normal part of the activities of an inspection body and are therefore within the scope of ISO/IEC 17020. Examples of functional testing are Standard Penetration Test (SPT), Vane Shear Test, Pressuremeter Test, Cone Penetration Test (CPT) and Field Permeability Test.

4 INSPECTION PERSONNEL

4.1 INSPECTORS

- 4.1.1 Inspectors shall be suitably qualified and have sufficient relevant experience in their scope of inspection.
- 4.1.2 Inspectors must be familiar with the relevant standards or codes used in the inspection activities.
- 4.1.3 Inspection bodies shall note that qualification requirements of inspectors may be superseded or limited by the regulatory requirements of the countries where the site investigation is carried out.
- 4.1.4 Inspection bodies shall maintain records of inspectors' qualifications, training and experience. The records shall include how and when each inspector is authorised by the inspection bodies to perform specific inspection or testing.
- 4.1.5 All approved signatories shall be assessed by the assessment team prior to award of accreditation. Subsequent assessments will consist of sampling of approved signatories.
- 4.1.6 The assessment team will assess the nominated signatories. Those assessed to be competent in their area of inspection will be submitted to the Council Committee for Inspection for endorsement as approved signatories.

- 4.1.7 Approved signatories are to sign on endorsed inspection report for inspection performed by themselves or where they have direct supervision of the inspection work.

4.2 QUALIFICATION CATEGORIES FOR INSPECTION TEAM

4.2.1 Driller

- a. Be able to communicate in basic English; and
- b. The competencies of the drillers to be assessed by the approved signatories; and
- c. Skills Evaluation Certificate (Knowledge) [SEC(K)] for Soil Drilling & instrumentation, issued by the Building and Construction Authority

4.2.2 Site Investigation Supervisor

- a. Should have at least:
 - i) Diploma in Civil Engineering or Geology with at least one year experience in site investigation works; or
 - ii) Five years experience in site investigation works for other qualification levels and
- b. Site Investigation Supervisor certificate recognised by BCA such as those issued by Geotechnical Society of Singapore (GeoSS) or equivalent.

4.2.3 Project Manager

- a. Should have at least:
 - i) Degree in Civil Engineering or Geology with at least three years experience in site investigation works; or
 - ii) Diploma in Civil Engineering or Geology with at least five years experience in site investigation works;

4.2.4 Approved Signatories

- a. Professional Engineer (Civil) registered with the Professional Engineers Board, Singapore; and
- b. With at least three years experience in site investigation works; and
- c. Shall be an employee or under long term contract (min 2 years contract), **exclusively** serving with one company

5. Format of report

- 5.1 The inspection report shall be an SAC-endorsed report that contains at least all information attached in Appendix 2 where applicable.
- 5.2 The list attached is not exhaustive and may include requirements as specified by the customer. Non accredited inspection procedures/methods/products are to be clearly shown or identified in the inspection report.

- 5.3 Where more than three boreholes are specified for the project, registered surveyor is to be engaged to endorse location and elevation of the borehole.

6. INSPECTION METHODS AND PROCEDURES

- 6.1 The inspection body shall have detailed procedures and instructions for the application of the appropriate regulations, codes of practice, standards, specifications, guidance documents and customer requirements.
- 6.2 Soil and rock description shall follow the classification under BS EN ISO 14688 and BS EN ISO 14689 where applicable.
- 6.3 The site investigation supervisor shall not supervise more than two rigs concurrently.
- 6.4 The inspection body which prepares the site investigation report for borehole log shall be accredited to perform the site investigation including drilling, sampling and functional tests that are necessary to characterise the soils and rocks. Where other functional tests listed in Appendix 1 are required for the project, the inspection body shall subcontract those tests to an accredited inspection body if it is not accredited for those tests.

7. Safety and Environmental Requirement

- 7.1 Staff on-site shall have the requisite personal protection equipment (PPE), example, safety helmet, safety shoes and any other safety equipment as deemed necessary by the site safety officer.
- 7.2 The company shall have procedures for safety and ensuring the safety of its staff and the general public.
- 7.3 The company shall ensure that they comply with relevant regulatory requirement with regards of environmental issue.

8. FORMAT OF ACCREDITATION SCOPE

The scope of accreditation is granted only for specific items, materials or systems being inspected. An example of the accreditation scope is attached in Appendix 1.

9. REFERENCE

- a) ISO/IEC 17020:2012 – Conformity Assessment-Requirements for the operation of various types of bodies performing inspection
- b) ILAC P15:06/2014 – Application of ISO/IEC 17020:2012 for the Accreditation of Inspection Bodies
- c) SAC-SINGLAS 006 - Traceability of Measurement
- d) BS 5930:2015 – Code of practice for site investigations

- e) SS EN 1997 Part2:2010 – Eurocode 7: Geotechnical Design. Ground Investigation and Testing
- f) BS EN ISO 14688-1:2002+A1:2013 – Geotechnical investigation and testing. Identification and classification of soil. Identification and description
- g) BS EN ISO 14689 Part1:2003 – Geotechnical investigation and testing. Identification and classification of rock
- h) BS EN ISO 22282-1:2012 – Geotechnical investigation and testing – Geohydraulic testing: Part 1- General rules
- i) BS EN ISO 22282-2:2012 – Geotechnical investigation and testing – Geohydraulic testing: Part 2 – Water permeability tests in a borehole using open systems
- j) BS EN ISO 22282-3:2012 – Geotechnical investigation and testing – Geohydraulic testing: Part 3 – Water pressure tests in rock
- k) BS EN ISO 22282-4:2012 – Geotechnical investigation and testing – Geohydraulic testing: Part 4 – Pumping tests
- l) BS EN ISO 22282-6:2012 – Geotechnical investigation and testing – Geohydraulic testing: Part 6 - Water permeability tests in a borehole using closed systems
- m) BS EN ISO 22475 Part1:2006 – Geotechnical investigation and testing. Sampling methods and groundwater measurements. Technical principles for execution.
- n) BS EN ISO 22476 Part1:2012 – Geotechnical investigation and testing. Field testing. Electrical cone and piezocone penetration test
- o) BS EN ISO 22476 Part 3:2005+A1:2011 – Geotechnical investigation and testing – Standard Penetration Test.
- p) BS EN ISO 2274 Part 4:2012 – Geotechnical investigation and testing – Menard Pressuremeter Test
- q) BS EN ISO 22476 :Part 5 :2012 – Geotechnical investigation and testing – Flexible Dilatometer Test
- r) BS EN ISO 22476: Part 11:2006 – Geotechnical investigation and testing – Flat Dilatometer Test

Appendix 1

Inspection body: Type A or B or C

Type of Product	Type and Range of Inspection	Inspection Method, Codes or Standards Used
1) Soil	<p>Site Investigation</p> <p>Identification, description and classification</p> <p>Under Undisturbed Sampling</p> <p>a) Stationary Piston Sampler</p> <p>b) Open Thin Wall Sampler</p> <p>c) Mazier Sampler</p> <p>d) Block Sampling</p> <p>e) Others</p> <p>Under Functional Testing</p> <p>a) Cone Penetration Test</p> <p>b) Dynamic probing</p> <p>c) Standard Penetration Test</p> <p>d) Pressuremeter Test</p> <p>e) Vane Shear Test</p> <p>f) Weight Sounding Test</p> <p>g) Dilatometer Test</p> <p>h. Field Permeability Test</p> <p>i) Plate Loading Test.*</p> <p>j) Others</p>	
2) Rock	<p>Site Investigation</p> <p>Identification, description and classification</p> <p>Under Undisturbed Sampling</p> <p>a) Rock Core Barrel</p> <p>Under Functional Testing</p> <p>a) Pressuremeter Test</p> <p>b) Plate Loading Test</p> <p>c) Field Permeability Test</p>	

* Plate Loading Test may be accredited under Laboratory Accreditation Scheme.

Approved signatories

Er. [Signatory A]

- for item 1 and 2

Er. [Signatory B]

- for item 1

NOTE :**Type A inspection body**

The inspection body providing “third party” services.

Type B inspection body

The inspection body which forms a separate and identifiable part of an organisation involved in the design, manufacture, supply, installation, use or maintenance of the item it inspects and has been established to supply inspection services to its parent organisation.

Type C inspection body

The inspection body which is involved in the design, manufacture, supply, installation, use or maintenance of the items it inspects or of similar competitive items and may supply inspection services to other parties not being its parent organisation.

Appendix 2

The following information is to be included in the inspection report (applicable to site/geotechnical report generated)

1. The purpose and scope of the site/geotechnical investigation.
2. Identification of the document, i.e. date of issue and unique identification.
3. Identification of the client, consultants and subcontractors (if any).
4. Description of the work ordered, method adopted and the type of field tests conducted.
5. Date of site/geotechnical investigation conducted.
6. Survey Coordinates of site/geotechnical investigation borehole conducted.
7. Desk studies and field reconnaissance of the site of the project and the surrounding areas.
8. Description of the equipment, methods and procedures used for conducting the field tests.
9. The results of site/geotechnical investigation, including field tests, laboratory tests, findings and issues encountered in the course of boring.
10. Name of the staff member and site investigation supervisor who performed site/geotechnical investigation works.

The following Technical Requirements for Borehole log are the minimum information to be included. Additional information may be required for projects.

1. Project title
2. Date of work,
3. Name of project manager/supervisor/driller
4. Reduced level of the ground
5. Depth of each soil or rock layers
6. Location, Survey Coordinates (using SVY21)
7. Legend and description of the different soil/rock layer
8. Depth and value of SPT, and/or other in-situ test(s)
9. UD Sampling
10. Ground water level
11. Geological formation and weathering grade
12. Total core recovery, Rock Quality Designation, Fracture Index.
13. Rock core photographs (colour)
14. Field/laboratory test results

The following Administrative Requirements for Borehole log should be included.

1. SAC Accreditation Mark with Certificate Number
2. Identification of the creator of the Borehole log
3. Identification of the reviewer of the Borehole log

TABLE 1 RECOMMENDED EQUIPMENT CALIBRATION AND CHECK INTERVALS

S/N	TYPE OF TEST	FREQUENCY OF CALIBRATION OR CHECK	EQUIPMENT/PARAMETERS TO BE CHECKED	GENERAL PROCEDURES AND COMMENTS
1.	Pressuremeter Test	a) Functional check before each and every test at site b) Annual Calibration	a) Membrane b) Pressure gauge	BS EN ISO 22476 Part 4 EN ISO 22476 Part 6 EN ISO 22476 Part 8
2.	Vane Shear Test	Annual Calibration	a) Head unit (spring)	BS EN ISO 22476 Part 9
3.	Plate Loading Test	Annual Calibration	a) Pressure gauge for jack b) Dial gauges	EN 1997-2:2007 (E) EN ISO 22476-13
4.	Cone Penetration Test	Annual Calibration	a) Piezocone	BS EN ISO 22476 Part 1
5.	Dilatometer Test	a) Functional check before each and every test b) Annual Calibration	a) Diaphragm b) Pressure gauge	BS EN ISO 22476 Part 11
6.	Standard Penetration Test	Annual Calibration either through in-house calibration or through 3rd party calibration laboratories	a) Parameters checked/calibrated in accordance to BS EN ISO 22476 Part 3 Annex B. b) Hammer weight (63.5 kg; tolerance 0.5kg) c) Falling height (rod length 760 mm; tolerance 20mm) d) Anvil weight (15 to 20 kg)	BS EN ISO 22476 Part 3

S/N	TYPE OF TEST	FREQUENCY OF CALIBRATION OR CHECK	EQUIPMENT/PARAMETERS TO BE CHECKED	GENERAL PROCEDURES AND COMMENTS
			e) Whole equipment weight ($\leq 115\text{kg}$) f) Hammer free fall mechanism g) Cone angle and dimensions of SPT sampler	
7.	Field Permeability Test (Packer Test)	Annual Calibration either through in-house calibration or through 3rd party calibration laboratories	a) Pressure Gauge b) Flow meter	Water pressure tests in rock, BS EN ISO 22282-3:2012 Permeability tests in a BH using open systems, BS EN ISO 22282-2:2012 Permeability tests in a BH using closed systems, BS EN ISO 22282-6:2012 Pumping Tests, BS EN ISO 22282-4:2012