

## Site Investigation and Ground Investigation

### Introduction

"Site investigation" (地盤勘測) is defined in s.2 of Building (Construction) Regulation as "investigation of the physical characteristics of the site and includes documentary studies, site surveys and ground investigation". These works are carried out to obtain adequate geotechnical and other relevant data for the design and construction of building works such as foundation and site formation works. This practice note sets out the acceptable standards of site investigation in general and ground investigation, which constitutes a major part of site investigation, in particular.

2. In this practice note, the term "site investigation" covers a broad scope of investigation including the topography and history of the site. "Ground investigation" refers to actual surface or subsurface investigation by such methods as boreholes and test pits, including on-site and laboratory tests.

### GEOGUIDE

3. GEOGUIDE 2 (Guide to Site Investigation) and GEOGUIDE 3 (Guide to Rock and Soil Descriptions), published by the Geotechnical Engineering Office, present recommended standards of good practice for site investigation in Hong Kong. Site investigation carried out in accordance with the recommendations of GEOGUIDE 2 and GEOGUIDE 3 will be deemed to meet the minimum acceptable standards.

### Documentary Studies and Site Surveys

4. Documentary studies and site surveys are important for planning site investigation and for the design of site formation/foundation works. Useful information is available in the Geotechnical Information Unit of the Civil Engineering Library : see Practice Note for Authorized Persons and Registered Structural Engineers (PNAP) 104 - Geotechnical Information Unit. However, care should be taken in using any ground investigation data obtained from previous building projects. Authorized persons (AP) and registered structural engineers (RSE) should assess the quality and verify the accuracy of such data before using the data in the design of geotechnical works. Any doubtful data should be discarded.

### Ground Investigation

5. Under s.2 of the Buildings Ordinance, "ground investigation" (土地勘測) means any exploratory drilling, boring, excavating and probing of land for obtaining any information on ground conditions and includes the installation of instruments, sampling, field testing, any other site operation and laboratory testing of samples obtained from such operations.

/Ground.....

## Ground Investigation in the Scheduled Areas

6. Ground investigation works in the scheduled areas are subject to special control under the Buildings Ordinance and Building Regulations. Apart from the compliance with the requirements specified in the following paragraphs, approval of the ground investigation plan as prescribed under Building (Administration) Regulation 8(1)(l) and consent from the Building Authority are required before the works can be commenced on site. The following PNAPs cover issues requiring special attention when carrying out ground investigation in the scheduled areas.

Schedule Area	Reference
1 Mid-levels	PNAP 85
2 North-western New Territories	PNAP 161
3 Mass Transit Railway Protection Areas	PNAP 77
West Rail Protection Areas	PNAP 279
4 Ma On Shan	PNAP 161
5 Sewage Tunnel Protection Areas	PNAP 165

## Registered Specialist Contractor (Ground Investigation Field Works Category)

7. Ground investigation field works include all site operations in ground investigation and exclude laboratory testing of samples and field density tests. Ground investigation field works have been designated, by notice in the gazette, as a category of specialized works. A sub-register of registered specialist contractors (ground investigation field works category)(the 'RSC(GIFW)') has been established in the register of specialist contractors, and all ground investigation field works are required to be carried out by the RSC(GIFW). Detailed scope of work and registration requirements of the RSC(GIFW) can be found in PNAP 214. Laboratory testing of samples obtained from site operations in ground investigation is beyond the jurisdiction of RSC(GIFW). Field density tests and all laboratory testing of samples obtained from the investigation are required to be carried out by laboratories which are accredited for carrying out the tests concerned, as outlined in PNAP 167.

8. The RSC(GIFW) are responsible for the carrying out of ground investigation field works mainly for the following purposes:

- (a) compiling a ground investigation report for submission to the Building Authority in support of a plan for approval under the Buildings Ordinance, including but not limited to, foundation plans, site formation plans, excavation and lateral support plans as prescribed under Building (Administration) Regulation 8(1) and 9;
- (b) compiling the geotechnical assessment for submission under Building (Administration) Regulation 8(1)(ba) with a general building plan. The assessment should include a suitable plan showing the scope and extent of the proposed ground investigation.

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9. It is the duty of the RSC(GIFW) to ensure all information in the ground investigation reports submitted to the Building Authority are correct even though some of the actual operations eg geo-physical surveys, might have been carried out by others.

#### **Quality Supervision Requirements for Ground Investigation Field Works**

10. All ground investigation field works, in both scheduled and non-scheduled areas, should be carried out by a RSC(GIFW) under proper supervision. The AP should ensure adequate site supervision of the ground investigation works for the projects under their responsibility. To ensure quality of the works, supervision for the different stages of pre-design ground investigation field works should comply with the requirements set out at Appendix A. Quality supervision requirements for pre-drilling and proof-drilling of foundation works are set out in PNAP 242.

11. Ground investigation field works not within the scheduled areas and involving two or less rigs, with the exception of sites where special geological conditions exist, such as previous landslides, debris flows, threatening boulders and potential rockfalls, are classified as small scale and simple work. In such circumstances, the Cat. III supervision may be omitted provided the Cat. I supervision is raised to 25%.

#### **Standards of Carrying Out Ground Investigation Field Works**

12. All ground investigation field works should be carried out in accordance with the guidelines in GEOGUIDE 2 published by the Geotechnical Engineering Office. The drilling works should be carried out by experienced drillers under proper supervision as stipulated in paragraphs 10 and 11 above.

13. Accurate and detailed borehole logs should be prepared to describe properly the materials encountered so that checks of the logs can be made, and to allow comparison with materials revealed during construction.

14. Logging of samples and preparation of borehole logs should be carried out by a competent person who should be :-

- (a) a degree holder in geology (see Note 10 in Appendix A) or a cognate subject (see Note 11 in Appendix A) in which at least 50% of the course content comprises geological based subjects (see Note 12 in Appendix A) with not less than 3 years of post-qualification experience in ground investigation which must include logging of samples (see Note 13 in Appendix A); or
- (b) a degree holder in geology or a cognate subject in which at least 25% of the course content comprises geological based subjects with not less than 5 years of post-qualification experience in ground investigation which must include logging of samples.

/A person.....

A person who has already been accepted as a Logging Geologist under the Environment, Transport and Works Bureau List of Approved Suppliers of Materials and Specialist Contractors for Public Works in the Category of Ground Investigation Field Works may also be a competent person for logging of samples and preparation of borehole logs.

15. The standards for soil and rock descriptions should be in accordance with GEOGUIDE 3. All drillhole cores and samples obtained during ground investigation (other than those samples selected for testing) are to be kept in good conditions for inspection by staff of the Buildings Department, and if necessary Geotechnical Engineering Office, until acknowledgement of the satisfactory completion of the site formation, foundation or other related works has been given.

16. The location of the boreholes should be properly surveyed and recorded in the ground investigation report.

#### **Administrative Procedures**

17. All ground investigation field works should comply with the administrative procedures set out at Appendix B. Prior to the commencement of the works, a quality supervision plan should be submitted specifying the name of the supervisors appointed and the frequency of inspections and/or extent of supervision. The quality supervision plan should be in the form as at Appendix C.

18. A ground investigation report submitted in support of a plan for approval must contain a certificate by the AP and RSC(GIFW) confirming the standards of ground investigation works (refer to details in item 7 of Appendix B and sample attached in Appendix D).

#### **Acceptance Criteria of Ground Investigation Works**

19. The requirements specified in the above paragraphs apply to ground investigation works in both scheduled and non-scheduled areas. The requirements may be imposed as a condition of approval/consent under section 17 of the Buildings Ordinance for works in the scheduled areas.

20. Any of the plans referred to in paragraph 8 above will be approved only when the Building Authority is satisfied that the ground investigation field works have been undertaken by a RSC(GIFW) in compliance with the requirements specified in the above paragraphs and the results justify the design assumptions.

21. In addition to the above requirements, the key considerations described below would also ensure a high standard of site investigation :

- (a) necessary revision of the aims and methods of ground investigation, as information becomes available from liaison between geotechnical engineers and designers of works (see Chapter 15 of GEOGUIDE 2); and

/(b)....

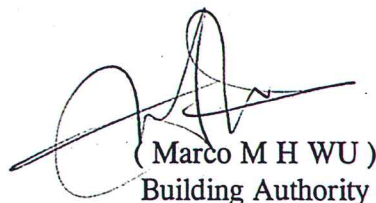


- (b) close observation and review during the construction of the works to determine to what extent conclusions drawn from the ground investigation should be revised in the light of the conditions revealed (see Chapter 16 of GEOGUIDE 2).

### **Progressive Upgrading of Standards of Ground Investigation Field Works**

22. For progressive upgrading of the standards of ground investigation field works, the actual drilling works may be required to be carried out by an experienced driller who has been accredited by a recognized institute or training organization, e.g. Trade Test Certificate for Ground Investigation Operations issued by CITA. The qualification of the authorized signatory of RSC(GIFW) may also be upgraded from higher certificate to university degree in due course.

23. A practice note similar to this one has also been issued to all registered contractors.



( Marco M H WU )  
Building Authority

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Registered Specialist Contractor (Ground Investigation  
Field Works Category)  
Scheduled Areas  
Site Investigation

**Table 1 - Stages of Ground Investigation Field Works &  
Quality Supervision Requirements in Scheduled Areas**

Stages of Ground Investigation Field Works	Objectives of Supervision	Supervision Provided by Qualified Personnel from			
		AP and Geotechnical Consultant		RSC(GIFW)	
Drilling/coring	To check that drilling techniques/methods comply with the approved plans.	Cat III	100%	GFT	Full time
Sampling	To check that the sampling techniques adopted are appropriate to the quality of sample required and ground conditions encountered; to ensure that the samples are properly extruded, sealed and stored and that they are not contaminated and their natural moisture content is maintained; and to properly record the depths and locations at which the samples are recovered.	Cat I	10%	CP (site supervision)	10%
Instrumentation	To check that the field instruments are installed in accordance with the standard of good practice or the manufacturer's recommendations, and in accordance with the approved plans.	AP	As necessary	AS	5%
Field Testing	To check that the tests are carried out in accordance with the standard of good practice (excluding field density tests which are to be carried out by HOKLAS laboratories).				

**Table 2 - Stages of Ground Investigation Field Works &  
Quality Supervision Requirements in Non-scheduled Areas**

Stages of Ground Investigation Field Works	Objectives of Supervision	Supervision Provided by Qualified Personnel from		
		AP and Geotechnical Consultant	RSC(GIFW)	
Drilling/coring	To check that drilling techniques/methods adopted are suitable for the ground conditions encountered.			
Sampling	To check that the sampling techniques adopted are appropriate to the quality of sample required and ground conditions encountered; to ensure that the samples are properly extruded, sealed and stored and that they are not contaminated and their natural moisture content is maintained; and to properly record the depths and locations at which the samples are recovered.	Cat III  Cat I  AP	100%  10%  As necessary	Full time  10%  5%
Instrumentation	To check that the field instruments are installed in accordance with the standard of good practice or the manufacturer's recommendations.			
Field Testing	To check that the tests are carried out in accordance with the standard of good practice (excluding field density tests which are to be carried out by HOKLAS laboratories).			



## NOTES

1. Cat III : Full time supervision by a person who possesses a higher certificate or higher diploma in civil or geotechnical engineering or equivalent with 1 year of experience in ground investigation works, or a person who is a holder of university degree in civil or geotechnical engineering or equivalent with 1 year of experience in civil or geotechnical works. The maximum no. of rigs that a Cat. III person can supervise on any one site is limited to 6. Cat III supervision can be dispensed with for small scale and simple ground investigation field works provided that Cat I supervision is raised to 25%.
2. Ground investigation field works are classified as small scale and simple if they do not fall within any of the following criteria :
  - (a) in the scheduled areas,
  - (b) involving more than 2 rigs, or
  - (c) where special geological conditions exist, such as previous landslides, debris flows, threatening boulders and potential rockfalls.
3. Cat I : Periodic inspection by a qualified geotechnical engineer who will be involved in the preparation of the geotechnical content of the submission to be supported by the ground investigation results. The engineer should be a Registered Professional Engineer (Geotechnical) or equivalent
4. GFT : Geotechnical Field Technician of the contractor. The maximum number of rigs that a GFT can supervise on any one site is limited to 6. A GFT should possess either one of the qualification and experience as set out below:
  - (a) an ordinary certificate in civil or geotechnical engineering or equivalent with 2 years of ground investigation experience, or
  - (b) a degree from accredited university in geology related subjects or civil or geotechnical engineering plus 1 year ground investigation experience, or
5. CP : Competent Person (site supervision) of the contractor. The CP should be a degree holder from accredited university in geology related subjects or civil or geotechnical engineering with 4 years of post qualification experience in civil or geotechnical engineering of which 2 years should be in ground investigation works.
6. AS : Authorized signatory of the contractor.
7. The percentage of supervision is the overall time of the works required to be supervised.



## Appendix A (PNAP 132)

8. Bachelor degrees and higher degrees should be awarded by universities funded by the University Grants Committee or recognised by the Hong Kong Institute of Architects (HKIA), the Hong Kong Institution of Engineers (HKIE) or the Hong Kong Institute of Surveyors (HKIS). Apart from the above, the Building Authority may accept, on a case by case basis, alternative qualification which has been justified by relevant public organisations for academic accreditation or professional institutes as "equivalent" to that required. Such organisations or institutes include the Hong Kong Council of Academic Accreditation (HKCAA).

9. The geology related degrees considered as acceptable qualifications should cover the following subjects:

Persons undertaking the duties of ...	Academic Qualification
site supervision (competent persons/geotechnical field technicians)	The accredited degree should have at least three of its modules* covering any three or more of the following subjects: soil mechanics, rock mechanics, engineering geology, hydrogeology, applied geoscience and foundation engineering.

\* Only modules/subjects that have been satisfactorily completed by the candidates shall be counted. Those completed in more than one degree course may also be counted.

10. Examples of degree in geology are applied geology, earth science, engineering geology, geological sciences, geology, mining geology and petroleum geology.
11. Examples of cognate subjects are environmental science, geography, geomorphology, geotechnical engineering, mining and soil science.
12. Examples of geological based subjects are applied geology, earth dynamics, earth systems, economic/mining geology, engineering geology, environmental geology, field camp/field school/field mapping, geochemistry, geomorphology, earth/surficial processes, landform/quaternary geology, geophysics, historical geology, hydrogeology, mineralogy, palaeontology, petroleum geology, petrology (igneous, metamorphic and sedimentary), physical geology, physics of the earth, plate tectonics, regional geology, rock mechanics, sedimentology/principles of sedimentation, stratigraphy, soil mechanics and structural geology.
13. New applicants for Competent Person (logging) will be required to submit documentary evidence in support of their core logging experience (e.g. submission of logs that the applicant has produced, including a brief statement of 2-3 pages explaining the technical aspects in preparing such logs and the reasons for choosing the submitted logs to support his/her application).

(Rev. 1/2004)

Administrative Procedures under the Buildings Ordinance for Ground Investigation Field Works

Item	Procedure	Detailed Requirements
1.	Appointment of AP/RSE	AP is required to be appointed as the coordinator of the works by the submission of specified Form BA 4. RSE may also be appointed as necessary. The geotechnical consultant responsible for preparation of the geotechnical content of the future submission of foundation, site formation, excavation or other plans or geotechnical assessments should be involved at this stage and work under the direction of the AP and/or RSE.
2.	Submission of ground investigation plans for approval & consent	Ground investigation plans, indicating the extent of works to be carried out, are required to be submitted in all cases. In the case of work within scheduled areas, approval and consent under the BO will be followed whereas in the non-scheduled areas, approval and consent is not required by virtue of s.41(3) of the BO. Nevertheless the ground investigation plan will be useful for BD's record and for the assessment of level of quality supervision required.
3.	Submission of Site Safety Supervision Plan	For ground investigation works in the scheduled areas, it is a mandatory requirement for the submission of site safety supervision plan. For works in the non-scheduled areas, the submission of site safety supervision plan is advised as a good practice.
4.	Submission of Form BA 10 notifying the commencement of work	The RSC(GIFW) is required to submit Form BA 10 which has been signed by the RSC(GIFW) and endorsed by the AP. Form BA 11 and a new Form BA 10 are required if there is a change of contractor during the course of the work.
5.	Submission of Quality Supervision Plan	Prior to or at the same time of submission of Form BA 10, a quality supervision plan is required to be submitted, specifying the name of supervisors appointed and the frequency of inspection and/or extent of supervision for ground investigation field works. No prior approval of the supervising personnel is required before the works are commenced. The AP/RSC should ensure that their supervisors satisfy the qualification and experience requirements specified in Appendix A, and should notify the BA of any subsequent changes of supervisors.



Item	Procedure	Detailed Requirements
6.	Submission of Form BA 14 notifying the completion of work	Form BA 14 is required to be submitted by the RSC(GIFW), AP and RSE (if appointed) upon completion of the ground investigation field works.
7.	Submission of ground investigation reports in support of the approval of foundation, site formation, excavation or other proposals or geotechnical assessments	<p>The ground investigation report shall include the following:</p> <ul style="list-style-type: none"> <li>(a) a certificate (sample attached in Appendix D) from the authorized signatory of the RSC(GIFW) confirming that: <ul style="list-style-type: none"> <li>(i) the RSC(GIFW) is responsible for the works stated in the report and that the works have been conducted according to GEOGUIDE 2 and 3;</li> <li>(ii) the works has been carried out under supervision in accordance with the requirements stipulated in Appendix A of PNAP 132 and the quality supervision plan submitted;</li> <li>(iii) the logging of samples and preparation of borehole logs in accordance with GEOGUIDE 3 have been carried out by a Competent Person as required under para. 13 of PNAP 132 (name and CV to be provided); and</li> <li>(iv) the field density tests and other tests of samples have been conducted by a HOKLAS accredited laboratory.</li> </ul> </li> <li>(v) a certificate from the AP that he has provided supervision in accordance with the requirements stipulated in PNAP 132 Appendix A and the quality supervision plan submitted.</li> <li>(b) copies of the Form BA 10 and BA 14 previously submitted for BD's information in view of possible time lapse between the completion of ground investigation and the submission of foundation plans etc. for approval; and</li> <li>(c) a proper surveyed record of the boreholes.</li> <li>(d) The relevant foundation, site formation, excavation or other plans may be disapproved if the ground investigation report is found not acceptable or not including the above information.</li> </ul>

(Rev. 1/2004)

**BUILDINGS ORDINANCE**

**(Chapter 123)**

**Quality Supervision Plan for Ground Investigation Field Works  
Jointly By Authorized Person and Registered Specialist Contractor  
(Ground Investigation Field Works Category)**

Date : \_\_\_\_\_

To the Building Authority,

**(For works in the scheduled areas)**

- \*(a) Having considered the details of the ground investigation plans approved on \_\_\_\_\_, and in accordance with the conditions of approval imposed in your letter of \_\_\_\_\_ and conditions of consent imposed in your letter of \_\_\_\_\_,

**(For works in the non-scheduled areas)**

- \*(b) For the carrying out of ground investigation field works at the site described below,

we submit the quality supervision plan for the ground investigation field works at the site located at (address of site) \_\_\_\_\_

\_\_\_\_\_ on (Lot No.) \_\_\_\_\_.

2. The site supervisors under the Authorized Person (AP) and registered specialist contractor (ground investigation field works category) ('RSC(GIFW)') streams required for the above ground investigation field works are :

Site Supervisors	Name in English	Name in Chinese	I.D. No. and Registration No. (if any)	Schedule of Inspections
AP Stream				See Appendix I
Authorized Person				
Cat I				
Cat III				
RSC(GIFW) Stream				
Authorized Signatory				
Competent Person (site supervision)				
Geotechnical Field Technician				
Competent Person (logging)				As necessary



3. The CVs of the site supervisors showing their relevant experience and academic qualifications are attached at Appendix II.

4. The management and execution of quality supervision of the ground investigation field works covered by this supervision plan are to be carried out in the manner prescribed by the provisions of the Buildings Ordinance and Regulations.

5. I, the Authorized Person (name in full) \_\_\_\_\_  
(Chinese) \_\_\_\_\_, certify that this Quality Supervision Plan is prepared by me in conjunction with the RSC(GIFW). I shall provide the supervisors for quality supervision under me. I and my supervisors shall carry out the supervision duties in accordance with this supervision plan and in compliance with the provisions of the Buildings Ordinance and Regulations.

Certificate of Registration No. : \_\_\_\_\_  
Date of expiry of registration : \_\_\_\_\_  
Signature : \_\_\_\_\_

6. I, the person appointed to act for the registered specialist contractor (ground investigation field works category) (name in full) \_\_\_\_\_  
(Chinese) \_\_\_\_\_, certify that this Quality Supervision Plan is prepared by me in conjunction with the AP. I shall provide the supervisors for quality supervision under me. I and my supervisors shall carry out the supervision duties in accordance with this supervision plan and in compliance with the provisions of the Buildings Ordinance and Regulations.

Name of the RSC(GIFW) : \_\_\_\_\_  
Certificate of Registration No. : \_\_\_\_\_  
Date of expiry of registration : \_\_\_\_\_  
Signature : \_\_\_\_\_

**Note**

\* Delete as appropriate.

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**Certificate of Compliance/Certificate of Supervision**  
**(for inclusion in ground investigation report)**

Project name & No. : .....  
Contract name & No. : .....  
Works Order No. : .....  
Client : .....

Part 1 : Certificate of Compliance (to be completed by Authorized Signatory)

I, the person appointed to act for the registered specialist contractor (ground investigation field works category)(name in full) \_\_\_\_\_ (Chinese) \_\_\_\_\_, certify that :-

- (i) we are responsible for the works stated in the report and that the works have been conducted according to GEOGUIDE 2 and 3;
- (ii) the works have been carried out under our supervision in accordance with the requirements stipulated and the Quality Supervision Plan for Ground Investigation Field Works submitted to the Buildings Department;
- (iii) the logging of samples and preparation of borehole logs in accordance with GEOGUIDE 3 have been carried out by a Competent Person; and
- (iv) the field density tests and other tests of samples have been conducted by a laboratory which is accredited for carrying out the tests concerned.(\*).

Name of the RSC (GIFW) : .....  
Certificate of Registration No. : .....  
Date of expiry of registration : .....  
Signature (date) : .....

Part 2 : Certificate of Supervision (to be completed by Authorized Person)

I, the Authorized Person (name in full) \_\_\_\_\_ (Chinese) \_\_\_\_\_, certify that I have provided supervision in accordance with the requirement stipulated and the Quality Supervision Plan for Ground Investigation Field Works submitted to the Buildings Department.

Certificate of Registration No. : .....  
Date of expiry of registration : .....  
Signature (date) : .....

\* Delete where appropriate