



## GROUND INVESTIGATION GUIDELINES 02 – PLANNING & PROGRAMMING CONSIDERATIONS

### ▶ Introduction

Ground investigation data are most useful only when they have been obtained from carefully planned and executed programmes. It is not uncommon to find data obtained from investigation programmes to be insufficient, irrelevant and their availability ill-timed. Therefore, the GI programme should be considered as part of the design programme to ensure sufficient information is available for the design.

Achieving an effective ground investigation programme requires a clear understanding of the objectives and their relation to the project's overall programme. This will require collaboration between the Project Manager and Geotechnical Manager and in many instances other engineering disciplines/designers to identify the technical requirements for the investigation programme. Planning of the works alone by the Geotechnical Manager or Engineer is not advised for any project irrespective of scale.

Planning of investigation contracts should also consider both the contractual arrangements and technical aspects of the works. Reporting requirements should be clearly defined to ensure they are to a standard suitable to end-users.

These guidelines should be used in conjunction with the following three other Ground Investigation Guidelines (GIG's):  
Contract Documentation for Ground Investigations (01)  
Procurement of Ground Investigations (03)  
Design of Ground Investigations (04)  
Supervision of Ground Investigations (05)

### ▶ Objectives of Ground Investigation

For new projects and works to be designed and constructed, the main purpose of the ground investigation programme is to obtain relevant and reliable information to produce a safe and economical design. Investigation can also be done for the purpose of assessing specific problems or checking of existing works.

In any investigation works, it is essential that information on subsurface ground conditions, identification of any natural or man-made geological and/or geo-environmental hazard and conditions of existing works, form the basis of the reporting.

Nevertheless, the main objectives for commissioning an investigation programme must be properly thought out. Generally, the following objectives are regarded as the minimum requirements for ground investigation programmes.

### Objectives:

1. Determination of soil and rock profiles and establish Geological Model;
2. Determination of engineering parameters of the soil and rock material;
3. Assessment of hydrogeological conditions;
4. Identification of geological and geo-environmental hazards
5. Geotechnical investigations of existing structures/services;
6. Determination of chemical contents contamination;
7. Monitoring of geotechnical instruments.

In addition, other specific objectives may include underground cavities and corrosivity of soils and groundwater.

### ▶ Programme Aspects

A programme for procuring ground investigation contracts must be developed and reference can be made to the bar chart showing the timescales required for such work.

The time allowed for the investigation works to be executed and reported must be coordinated with the overall programme of the project. Sufficient time must be allowed to complete the works including logging, checking of preliminary logs and reports and final reporting in order for the designer to be able to make proper use of the information obtained.

It is advisable to adopt a “phased” approach for all investigation programmes, but especially for large and/or complex projects where each stage of an investigation may require significant modifications based on the findings of previous phases. The recommended general “phased” approach is as follows:

Desk Study (including Aerial Photograph Interpretation) &  
Walkover Survey, Characterise Geotechnical &  
Geological Conditions, Define Geological Model

Design of Preliminary Investigations

Design of Detailed Investigations

Design of Supplementary Investigations

Following a Desk Study where existing information relevant to the project is identified, aerial photograph interpretation (API), a site-specific walkover survey, a geological model of the project area should be formulated, which can be used as a basis for investigations to be designed and correlated against. The first phase of the investigation should include a preliminary study consisting of mapping and geophysical surveys and a limited number of investigation stations and methods to determine the general site conditions. This should then be followed by more selective investigations in terms of numbers, locations and methods (sampling, insitu testing and installations employed) based on the findings from the preliminary phase. Other methods to study specific areas or identify hazards may also be applied during this stage. Finally, supplemental investigations can be undertaken to provide additional information to assist in cost estimation of the overall proposed construction works and provide additional information to tenderers which may alleviate perceived risks, future claims and provide more competitive tender prices.

In Hong Kong and its densely populated urban environment, it has been recognized that the single major constraint on executing ground investigation fieldworks is the availability of site access. This constraint is often encountered for works located in both government and private land. As an example, applications for a road excavation permit submitted to the Highways Department and the Police Department's Road Management Office normally requires a minimum period of two weeks for obtaining approval while application in more sensitive areas such as a heavily congested walkway or roadway may require a longer time period perhaps in excess of one month. Applications for access in private properties with assistance from Lands Department can vary with no fixed time period. The flow chart (opposite) on permit applications recommends the considerations that should be made.

Specific statutory requirements outlined in the government circulars such as Works Bureau's ETWBTC, Buildings Departments PNAP and PNRC, Environmental Protection Department's ProPECC may also impose certain conditions on the investigation works. Therefore, sufficient time must be allowed in the investigation programme to plan and prepare applications for securing site access. Investigation for contaminated materials may require submission of a Marine Sediment Sampling and Testing Plan and Contamination Assessment Plan which normally require EPD approval.

In addition to adopting a "phased" approach to investigations and securing access, the investigation programme should also make allowance for the following issues:

- ▣ Methods of investigation;
- ▣ Frequency and location of investigation stations;
- ▣ Types of insitu testing;
- ▣ Prioritizing the investigation works;
- ▣ Site constraints (i.e. access, noise restriction, utilities, other statutory requirements).

### ▶ Technical Considerations

When planning an investigation programme the methods to be employed and the frequency/location of the investigation stations

that should be adopted need careful considerations. The various methods of investigation are described in detail in GIG04-the guidelines on "Design of Ground Investigation". However, the number of drillholes, trial trenches or insitu tests, for example, should be compatible with the design requirements and ground conditions.

British Standard BS5930 : 1999 on Code of Practice in Site Investigations suggests a general spacing of 10m to 30m for the investigation stations. Although it is recognized that no hard and fast rules exist on assigning spacing of drillholes, the frequency or the number of investigation stations should be carefully planned since it is directly proportional to the budget and perhaps more importantly the time required to complete the works.

If the contractor's resources to execute the works are limited, priorities on the works should also be assigned to allow for timely completion and availability of the results to the designers.

The following technical aspects should be considered in planning a ground investigation programme:

- ▣ Methods of investigation;
- ▣ Frequency and location of investigation stations;
- ▣ Types of insitu testing;
- ▣ Prioritizing the investigation works;
- ▣ Site constraints (i.e. access, noise restriction, utilities, other statutory requirements).

### ▶ Reporting of Ground Investigation Data

It is important that information derived from the ground investigation programme is reported in a format that is most suitable to the end users. This not only applies to the format for the hardcopy of the report but also data in various electronic formats.

It is now commonly expected that ground investigation data including its associated testing data can be transferred electronically. Therefore, such reporting requirements, as recommended below, should be well thought out and stated in the specifications.

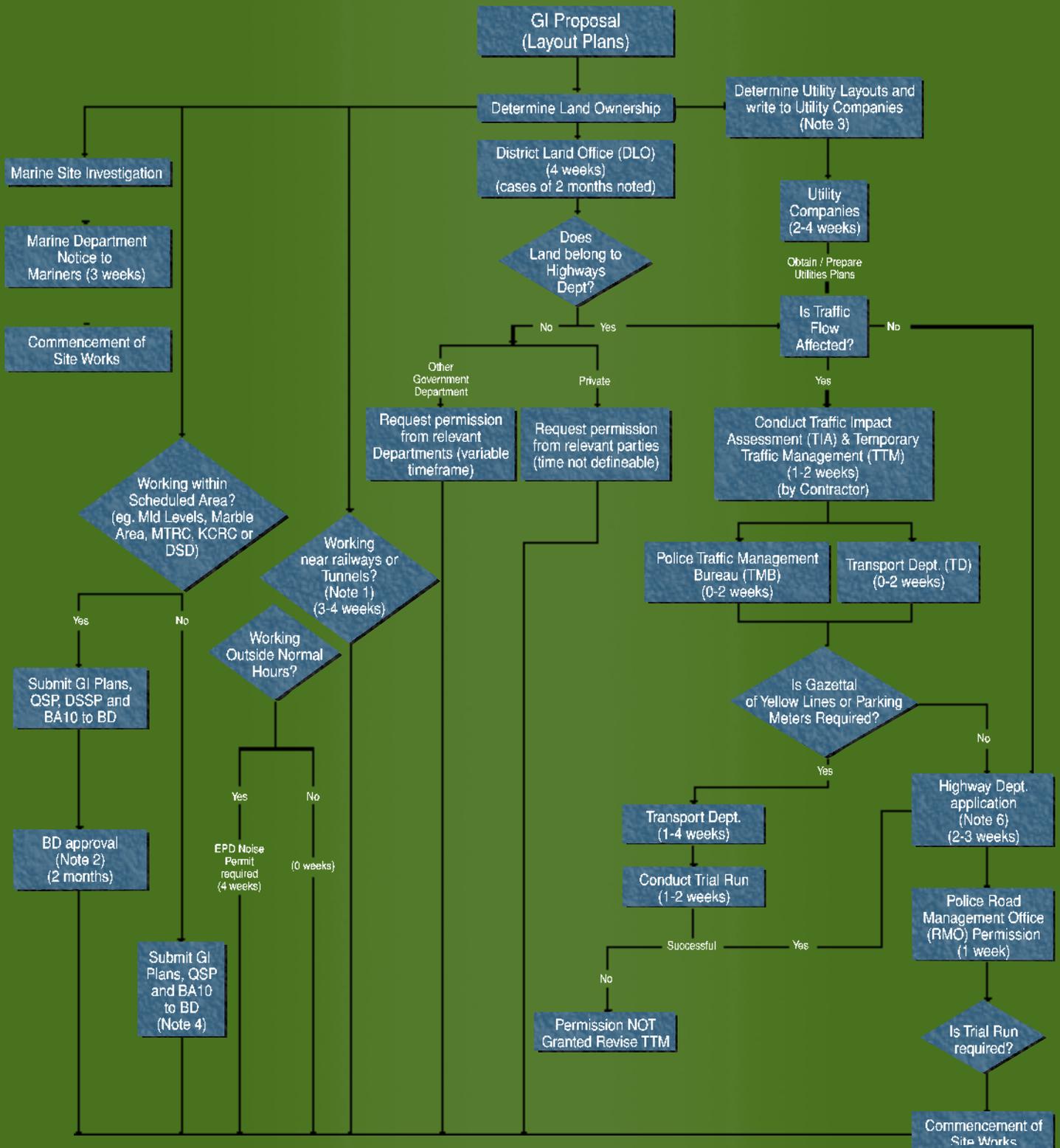
- ▣ Adobe Acrobat for hardcopy reporting (good print quality, small file size and free reader software);
- ▣ AGS formatted drillhole and laboratory testing data;
- ▣ Drawings in AutoCad, Microstation or in a format acceptable to clients or designers.

### ▶ Other Considerations

Other issues related to site conditions which should also be considered include the following:

- ▣ Site safety;
- ▣ Presence of archeological remains (consultation with AMO);
- ▣ Tree felling requirements;
- ▣ "Fung Shui" matters related to burial grounds and other sites;
- ▣ Compensation to affected Third Parties.

**AGS General Considerations in Application for Work Permit**



**Notes**

1. LRT, KCRC, MTRC, WSD, DSD etc need to be informed of any works which may affect their facilities.
2. This assumes that all submissions are accepted first time, allow double for re-submission.
3. WSD, DSD, HK & China Gas, CLP, Cable TV, New T & T, Rediffusion, New World Telephone, Hutchison, EMSD, PCCW and HK Electric.
4. In non-scheduled areas BA10 must be submitted 7 days before site commencement, formal BD approval is not required before commencement.
5. Scheduled areas include: Midlevels, Ma On Shan(Marble), NTWEST(Marble), DSD, MTRC and KCRC (West Rail) sites.
6. Highway Dept. Excavation Permit Form No. HyD14(NT); HyD14A(HK & KLN)

**AGS General Timescales for Ground Investigation Contracts**

