

THE SCOPE AND EXTENT OF GEOTECHNICAL REPORTS
FOR RESIDENTIAL BUILDING & SUBDIVISIONS

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1.0 INTRODUCTION

In New South Wales there have been many areas of land classified as 'subject to slip', or within an area of 'Geological hazard' (i.e. flood prone land, highly reactive soil areas, land affected by landslip or coastal erosion etc.), and within these areas it is often necessary for Council Officers to call for a 'Geotechnical Report'. As these reports often vary widely in technical content and scope, the question of what constitutes a satisfactory 'Geotechnical Report' can therefore often be quite crucial to a Council. Also, as a Council now has an implied 'Responsibility of Care', the Council must consider whether a particular report has properly assessed the site problems when dealing with a particular Development Application.

This paper therefore presents two broad groups of report scope/content 'guidelines', which have been based upon the Author's experience in the preparation of reports to be submitted to a Council, in respect of:

- * An Urban Residential Subdivision
- * A report upon an individual residential block of land

The guidelines are of course not intended to be exhaustive or in any way mandatory; they simply represent the author's view of the minimum requirements. The guidelines are also only probably relevant to reports prepared within the 'Sydney Basin' Geological District, although by suitable adjustment they may apply to a wider base.

2.0 PURPOSES OF REPORTS

The principle purposes of a Geotechnical Report (within the Local Government Environment) can be summarised as:

- (a) To describe factually the present situation of a particular parcel of land, and the nature and Engineering/Geological properties of the soils and rocks evident at the site.

- (b) To assess the way in which these soils/rock conditions will affect various developments and structures constructed by man.
- (c) To establish the influence of any proposed development upon the particular site conditions evident.
- (d) To provide appropriate recommendations to ensure that the structures constructed upon the land are safe, and have a life expectancy compatible with the development itself.

The way in which these aspects are investigated at a particular site will however vary extensively due to variations in the geological conditions, experience of the investigator in a particular area, and nature of the development proposed.

It is also to be noted that these desirable objectives often become confused in a particular situation because of the time delay between development construction, and soil/geotechnical failures (commonly 7 to 20 years) commonly gives rise to a false sense of security in established practices. Therefore, when a private individual or company suffers financial loss as a result of an inadequate geotechnical study, the Local Council is usually the principal target of any Legal Proceedings because the author of the original Geotechnical Report is often no longer in business, or alive.

3.0 TYPES OF REPORTS AND QUALIFICATIONS OF INVESTIGATORS

Within the Local Government Environment, there are principally two groups of reports that 'set the scene' for a particular development. These are:

- * Reports upon Proposed Residential Subdivisions
- * Reports for an intensive development on a small (less than 0.5 ha) parcel of land (e.g. Houses, Factories, Office Buildings, etc.).

The scope and extent of these reports will always vary enormously, due simply to the great variety of problems covered, the scale of the development and the financial resources of the client. Also, a very extensive report may not properly identify the particular problems of a site, simply because of the investigator's lack of local experience, whereas a very short simple report (based upon wide experience and background in a particular area) may very accurately pinpoint the principal site development difficulty. Therefore, the qualifications and experience of the investigator are considered quite crucial to the validity of the report.

In this regard it is suggested that geotechnical reports should normally be prepared under the personal supervision, and direction of an Experienced Geotechnical Engineer (minimum qualification - Corporate Member of the Institution of Engineers, Australia - or equivalent, with at least 10 years experience since graduation, 5 years of which should have been exclusively in the geotechnical field). In addition the Engineer should have demonstrable local experience. It is also noted that, whilst Engineering Geologists and Soil Scientists have a very important, and vital role to play in the proper carrying out of any geotechnical investigation/study, it is considered that the evaluation and interpretation of the potential site difficulties is primarily an 'engineering function'.

It is within the preceding framework that the following guidelines have been developed.

3.1 Reports for Subdivisions

These reports are usually the most important, because if they are not properly carried out, a large number of people can become financially entangled. Also, because there is usually a lack of detailed knowledge in a particular area prior to these reports being commissioned, such reports should provide for adjustment to the completed design/recommendations as more information becomes available during the construction phase.

The principal items to be investigated at this stage are therefore:

- (a) The local and regional geology, and determination of the site geology to at least the 'member' level.
- (b) The engineering properties of the soils/rocks at the site relevant to questions such as:
 - * soil/rock stability and erosion potential
 - * strength and bearing capacity
 - * rock weathering and deterioration
- (c) The existing stability of the area, and the likely impact of the proposed development upon that state of stability.
- (d) The assessed stability of the area on completion of the subdivision, and the necessity for any building constraints for the subdivided allotments.

It would therefore appear that the minimum data presented in the report upon a subdivision should include:

- (1) A descriptive text, describing and interpreting the site and its conditions, the existing site stability, a discussion of the various aspects of the site development, and appropriate recommendations.
- (2) A detailed contour plan of the site at a scale of at least 1:500, with spot heights and relevant topographic features. The datum should also be indicated.
- (3) A detailed geological map (preferably superimposed on the contour plan) that includes all relevant geotechnical features, particularly noting:

- * seepages, springs and drainage paths.
 - * hummocky or uneven ground.
 - * signs of land instability, erosion, slip-scarps, tension cracks, etc.
 - * rock outcrops and boulders.
 - * geological data on rocks (discontinuities, joints, etc.), and mineralogical data relevant to the determination of 'rock weathering'.
 - * vegetation and pertinent notes upon specific species of vegetation.
 - * locations of boreholes, test pits, etc., put down during the course of the study.
- (4) A stability assessment of the site (as existing) expressed in meaningful statistical terms such as 'Degree of Confidence', etc. (Ref. 3).
- (5) Plans and sections of the development, with subsurface conditions and geology superimposed. The scale of the sections should generally be adjusted to suit the site/development conditions, but a cross-section scale of at least 1:250 is usually necessary. Distorted scale sections should be avoided.
- (6) Details of any work considered necessary to ensure the 'long-term' stability of the land.
- (7) Recommendations as to appropriate types of development upon the land, with specific information upon items such as:

- * basic design parameters for roadworks, and restrictions on site cutting and filling for roads.
- * size of allotment, building lines, etc.
- * effluent/stormwater disposal
- * restrictions upon building type(s), easements, etc.

- (8) Such additional data upon the land as may be considered necessary to back up all the various geological sections, stabilization works, recommendations, etc., (e.g. borehole logs, exploratory pit logs, joint diagrams of geological measurements, laboratory test data, summarised results of stability calculations, etc.).
- (9) Any other relevant data.

3.2 Reports for Individual Allotments

When intensive development of a relatively small (less than 0.5 ha) parcel of land is being considered, one of two general types of geotechnical report should be prepared, viz:

- (a) a 'Site Investigation' type report;

or

- (b) a 'Stability', 'Stabilisation' or 'Geotechnical' report.
(Note: this latter type then breaks up into several further categories).

It is considered that A.S. 1726 (the Site Investigation Code) well covers the typical site investigation report, and therefore this paper only covers guidelines for the 'geotechnical' or 'stability' reports.

The actual scope and length of a particular report should be determined by the complexities of the evident site conditions and scale of development, but for a relatively simple site with only the normal geotechnical difficulties, the following should be regarded as the minimum:

- (1) A general description of the site, including surface topography site slopes, existing site development, vegetation types, sub-strata evident at the land, depth to rock, description of subsurface materials, particular identifiable features such as water flow patterns, slip areas, cliff lines, etc. The description should also include the land areas immediately surrounding the site, and statements concerning the location of the land in 'Mine Subsidence Districts', Coastal Protection Districts, etc.
- (2) An assessment of the existing state of stability of the land, and the likely impact of the proposed development upon the state of stability. (Note: as a validation of the assessment, the qualifications of the person responsible for the field observations and data interpretation should be stated).
- (3) Description of the proposed Development, including proposed excavations, access driveways, house/building type, together with a discussion of the problems likely to be encountered at the site in undertaking the development. The discussion should also include specific guidelines as to methods of treating the various site problems which will probably arise as a result of the site geotechnical characteristics (e.g. loose fill, seepage in excavations, etc.) and refer directly to the particular proposal under evaluation.
- (4) Detailed Recommendations as to the method of carrying out the site development including at least:

- (a) Recommendations upon a suitable foundation strata for the support of the proposed structures, and relevant design parameters (e.g. safe bearing pressures, permissible skin friction, etc.).
- (b) Modifications to the house/building design as a result of the inherent site conditions.
- (c) Need for support of excavation/fills including design parameters for any proposed retaining walls.
- (d) Any necessary works at the site to render it effectively stable, or sufficiently stable for the development proposed (e.g. stormwater catch drains, subsoil drains, retaining walls, slope regrading, etc.). The priority of the works should also be clearly stated, and where necessary a timetable for implementation included.
- (e) Methods of disposal of household effluents, stormwater and roof water, together with construction details, where necessary, of transpiration beds, absorption trenches, etc.
- (f) Those parts of the works/site development which need to be inspected and certified during the course of construction by the Investigator or other appropriately qualified person.

It is also to be noted that, whilst it will normally be necessary for the site investigator to prepare a detailed plan and sections through the site for the preceding requirements to be properly fulfilled, it is the author's view that the inclusion of a detailed 'draftsman-type' plan in the report is not always necessary. However, when the matter

becomes relatively complex (i.e. extensive site instability, significant site development, etc.) then the report should be accompanied by an appropriate plan(s) which would include sections through the site area, as well as specific details upon the stabilization works. Such plans should normally include:

- * Details of relevant topographic/geological features including rock outcrops, cliffs, boulders, fill, excavations, slip scarps, tension cracks, batters, water seepages, drainage lines, easements and rights-of-way.
- * Sections through the site showing the substrata through the site and development.
- * Details of any necessary stabilization works.

4.0 CONCLUSION

The nature and scope of any particular geotechnical report will always be finally determined by the individual investigator. However, as Councils have an implied 'Responsibility' when they accept and/or require geotechnical reports, it also seems appropriate that the Council has a right to require that certain standards are met. The guidelines set out above are therefore regarded as a 'first step' in assisting Councils in this regard, and it is hoped that they will generate appropriate informed discussion.

REFERENCES

1. INGLES O.G. (1974) "Unstable Landforms in Australia" Report No. 42 of Water Research Foundation of Australia.
2. INGLES O.G. (ED) (1976) "Workshop Papers - Unstable Landforms" - Report No. 48 of Water Research Foundation of Australia.
3. SHIRLEY A.F. (1975) "The Theoretical & Practical Aspects of Land Stability Classification" 2nd Aust. - N.Z. Conference Geomechanics, July, 1975.
4. SHIRLEY A.F. (1977) "The Problems for Government Associated with Geological Hazards in the Urban Area". Paper prepared for 48th ANZAAS Conference, Melbourne 1977.
Section 3 'Geology in Urban and Regional Development'.
5. SHIRLEY A.F. (1976) "Some Guidelines to Preferred Practice in Hillside Construction". Australian Geomechanics Journal - 1976 (with P.J.Burgess).
6. REILLY K.A. (1974) "Instability - The Individual and The Council" - Symposium on Instability & Land Development in the Illawarra District. Wollongong University Sept. 1974 I.E. Aust.