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TOWN PLANNING IN GEOLOGICALLY COMPLEX AREAS

AN ENGINEERS POINT OF VIEW

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1. INTRODUCTION

Land is a valuable resource which normally increases in value during its transition from the rural to urban environment. The need for efficient and beneficial development of land (both privately and publicly) is consequently of high priority. Also, and as a result of the recent upsurge in "Conservation Concern" in our Community, the Local Council and Planning Authorities are becoming far more deeply involved in the development/subdivision of land. Consequently, a number of Government Departments have prepared 'Capability Maps' or 'Land Use Zoning Maps', which are then used by the Council when considering rezoning, and/or subdivision of land. The importance therefore of carefully compiled, accurate maps is a matter of some importance to a Local Council.

2. LAND CAPABILITY ASSESSMENT METHODS

Presently there are a number of methods of assessing (in geological/geotechnical terms) the development capability of land, but principally all Land Capability Assessments are a type of technical information synthesis that implies:

a) The various components of the synthesis, including the land-system, geology, natural hazards, landform, slope, hydrology, vegetation, etc., have been properly researched and documented.

b) The data is presented in a carefully edited manner, specifically directed to the neo-urban proposals, with other non-relevant data excluded (e.g. detailed accounts of topsoil fertility or trace elements are not usually very relevant to planners in urban areas, whereas such data would be particularly relevant to non-urban [farming] areas).

The principal systems of Land Capability Assessment presently in use are:

1. The Geotechnical Terrain Classification

2. The Surface Soil Association approach

3. The Extent of Investigation Required approach

In the Geotechnical Terrain Classification approach, the available geological and topographic data is synthesised using the underlying geology as the BASIC unit which is then further classified by landform, slope, and geomorphological considerations. For relatively small scale maps (1:25,000, 1:100,000, etc.) it is usually only necessary to delineate the geology to the Formation level, but when dealing with the usual Town Planning Map (1:4000 or larger) it is necessary to define the geology to at least the Member level. The system has been widely used by the Geological Surveys in Tasmania & New South Wales, the C.S.I.R.O, and overseas (e.g. U.S.A., Sweden and New Zealand). Due to its 'geological' base the system lends itself to refinement after more detailed investigations, and results in a simple map presentation; thus as the particular causes of slope instability, soil reactivity, etc., are

defined, suitable map changes can be made. The system does however have a significant time/cost limitation, because large- scale geological maps of an area are not often initially available. Therefore, it can take several years to produce a suitable scale Capability map assuming the usual budgetary constraints.

The Surface Soil Association approach has been developed by the Soil Conservation Service of N.S.W., because of the need to produce large-scale Capability maps in a short time combined with the Service's experience in Rural Area Soil Conservation. The approach classifies land primarily on the basis of soil type, slope, and landform categorized into a precise classification system (i.e. land slopes are always defined within certain gradients [e.g. 5-10%, or 15-20%, etc.] soil shrinkage as Critical or Non-Critical according to defined Linear Shrinkage values, and so on). The approach therefore gives rise to a large number of land areas (often quite small) with different classifications, and sometimes the fixed slope/soil categories are inappropriate to the geology of an area. The principal problems with using the approach are mainly the number of small areas classified on a particular map which have very different 'capability or hazard', and the difficulty of refining the maps as more data becomes available.

The system has however, been widely implemented in N.S.W. for the last few years, with the studies generally undertaken by Soil Conservationists.

The 'Extent of Investigation Required' approach was originally proposed by the Author in 1975 (ref:6) principally for Land Stability Investigations, and utilizes the Geotechnical Terrain Classification method to define (on a relatively small scale - say 1:10,000 or 1:25,000) areas within which detailed studies are required, and areas of land obviously unsuitable for development. Implicit in the approach is the recognition of the economic restraints upon any investigation, and the self evident fact that stability, soil reactivity, and other geotechnical problems are often only recognised after considerable knowledge of a particular area has been obtained.

In the light of more recent experience the table proposed in 1975 could be simply modified, as below, to suit the first stage of a Capability Assessment.

CATEGORY	DESCRIPTION
1.	Land Areas not susceptible to significant natural/man-made hazards, and within which conventional building/development practice can be applied with confidence.
2.	Land Areas within which there may occur small areas of significant natural or man-made hazard, principally of one type, and within which development should always be preceded by a careful site investigation and report by properly qualified persons.
3.	Land Areas within which there are a number of significant natural hazards, possibly of more than one type; within such areas all development proposals should be preceded by the most careful, detailed and thorough geotechnical study by properly qualified persons.
4.	Land areas considered generally unsuitable

A similar system is currently used by the Tasmanian Geological Survey (ref: 9), except that colours (Red, Yellow [2 levels], and green) are used rather than numbers. The four-tier classification was also advocated by Chestnut in 1974 (ref:2) as being appropriate to the Town Planning situation, and a similar (but six level) system was used by Bowman in 1972 (ref:1).

The principal problem with the system is that it does not provide an absolute classification for the Council to implement, but rather it provides a systematic approach to the recognition of the problems within a particular area, and an encouragement to prospective developers to carry out proper detailed investigations in the area.

3. DEVELOPMENT IN GEOLOGICALLY COMPLEX AREAS

Some of the most imaginative and inspiring works of man have been undertaken in the geologically complex areas, and often what appears to be impossible today, will prove to be very simple tomorrow. Therefore, whilst it is clear that Councils have a responsibility to prevent unsafe and environmentally damaging developments, our system of town planning must be sufficiently flexible to permit the adjustment of land-use zoning when better geological data becomes available. Any adjustment should however only be made when sufficient, appropriate geological data has been collected.

It is the Author's view that the assessment of Land Capability is primarily an Engineering and Geological Function, because Engineers and Engineering Geologists are trained to determine whether or not Unstable Areas can be Stabilised, the most appropriate guidelines for the construction of Roads, Drains, Building Structures, etc., whereas other professional persons are not.

It is also to be noted that many of the judgements made by investigating geologists, engineers and soil conservationists are based upon the facts and data available to them at the time of their particular investigation; such 'facts' may of course prove to be erroneous with the fullness of time, and consequently it is most necessary to provide a proper method of updating the maps; conversely, if a proper method of updating is not initially provided, then it is usually very difficult to get the zoning changed.

In view of the foregoing remarks it is the Author's view that the initial Land Capability Assessments should be carried out in a way that enables subsequent refinement by a number of technical people over a period of time; in addition, any Town Plan should incorporate provision for adjustment of the Zoning Scheme as better data becomes available. The adoption of the 'Extent of Investigation Required' approach to zoning in Geologically Complex Areas would therefore be appropriate, but would of course necessitate proper review of later reports and studies submitted to a Council (e.g. by qualified Experienced Engineers and Geologists engaged/employed by the Council), before the zoning is amended.

4. CONCLUSION

When the natural geological processes occurring in an area are properly understood, it is usually possible to classify the area into zones of similar stability/urban capability. As the effectiveness of any town plan depends upon the proper recognition of the Engineering/Geological constraints, it is very important that the constraints are accurately evaluated and mapped. However, because the time/cost of the detailed mapping and classification process will always be very large, the process must usually be carried out in stages.

The Geotechnical Terrain Classification approach is considered to be the most technically sound, and as it can be carried out in stages, it should be used for Urban Capability Assessments in Geologically Complex Areas.

The most appropriate first stage of the development of a Capability Map would appear to be an 'Extent of Investigation Required' assessment, as this assessment is simply an adaption of the Geological/Terrain Analysis approach, and permits the editing and refining of the maps as more data becomes available. In this way proper priorities can be established, and the cost of detailed studies borne by those who benefit from the work.

5. REFERENCES

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