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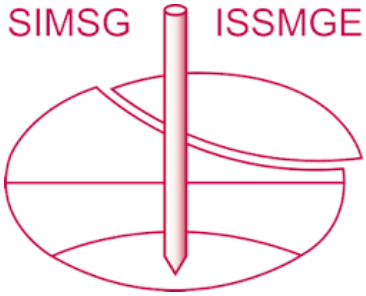

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Trends in the Application of Geomechanics Codes of Practice to Residential Development in Western NSW

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SUMMARY:

This paper will present an overview of the application of geomechanics codes of practice to footings and on-site disposal of effluent for residential development.

An historical perspective will trace the recognition of the problems caused by inappropriate construction and development; the response of the community, approving authorities, housing industry and geotechnical professionals to these problems; and the evolution of the present codes and technology.

A survey of Western NSW Councils will be presented assessing the application of these codes of practice. The application of these codes will be evaluated in terms of economics and environmental effectiveness. Arising out of this evaluation, points for future discussion and development will be tabled with a view to stimulating on-going implementation.

1. INTRODUCTION

Since the beginning of civilisation, the two basics of existence for mankind have been food and shelter. As our lifestyles changed from a nomadic existence to settlement in permanent communities the emphasis on shelter became more important.

An integral part of communal living is the provision of housing and its associated infrastructure, in particular, disposal of domestic effluent. This paper looks at the implementation of codes of practice in relation to footings and effluent disposal for domestic housing in Western NSW Australia in the 1990's.

2. HISTORICAL PERSPECTIVE

In 1995, Australia commemorated 50 years since the end of World War II. Cessation of hostilities brought an end to an era of austerity, and although materials were still in short supply, a new affluence emerged. A reflection of this affluence was very apparent in the styles of houses constructed and lifestyles sought by average Australians. Weatherboard and full masonry made way for "brick veneer" and rural residential (typically 2 hectare allotments) developments were born. Progress brought with it associated demands on the geomechanics fraternity in relation to soil-structure interaction and effluent disposal. The following sections briefly trace the history of these two aspects over the last ten to fifteen years.

2.1 Site Classification

As outlined above, the majority of houses built in reactive soil areas were timber framed fibro/weatherboard cottages, with an iron roof. Soil-structure interaction was not considered, as the strip and pad footing systems adopted for this type of construction performed satisfactorily in reactive soil areas. However, as development snowballed, a number of major deficiencies became apparent :

- inadequate appreciation of the subsurface conditions for new "green fields" developments.
- the extrapolation and approval of footing systems, suitable for clad construction, to brick veneer construction.
- lack of understanding of climatic conditions related to reactive soil movements.

The state-wide drought in New South Wales in the late 1970's clearly showed that the then adopted footings were inadequate to withstand the movement of reactive soils induced by severe drought. Consequently, footing

failure, with all its associated side effects increased dramatically. The number of complaints from dissatisfied home owners and claims for insurance payments sky-rocketed. In response, various state government bodies and universities instigated research and developments, particularly in South Australia and Victoria. The findings of this work, including Australian Standard Draft DR 85108, was applied in an ad-hoc fashion, with discrepancies becoming apparent from application to application. It was not until 1988 when AS2870 - "Residential Slabs and Footings" was launched that some semblance of uniformity of approach was introduced. The major thrust of this code was that the site must first be classified according to the level of reactive soil movement and subsequently an appropriate footing system selected.

2.2 On-site Effluent Disposal

Despite the large number of houses in NSW serviced by onsite effluent disposal systems, the guidelines for system design have historically been very general and arbitrary.

Local Government has had the responsibility of administering the disposal of household effluent on-site. In January 1992 the draft AS1547 "Disposal of Sullage and Septic Tank Effluent from Domestic Premises" was issued. Prior to this time, design guidance for on-site effluent disposal was in the form of AS1547-1973 "Disposal of Effluent from Small Septic Tanks". (First published in part as SAA Int 320 - 1951 and published as AS CA13 in 1968). This document made only brief reference to land capability and provided little guidance on the sizing of disposal areas. More importantly AS1547 - 1973 did not consider the soil type and properties in disposal area sizing.

Due to the lack of design guidelines, many Councils adopted arbitrary standards for disposal area sizing, often without any scientific or empirical basis. As a result, a "standard 30m trench" may have been recommended for sites with widely differing drainage characteristics. In recent years the growth of regional centres in NSW has seen the development of outlying villages as well as a growing demand for a rural-residential style of living. It was usually uneconomic to connect these areas into council sewer systems. Consequently, on-site effluent disposal systems proliferated and often failed, sometimes dramatically.

With the issue of the draft AS1547 in 1992, many of the inadequacies of AS1547 - 1973 were addressed. The draft AS1547 proposed a site evaluation procedure for effluent disposal systems which considered soil permeability, climatic effects, groundwater effects and impacts and seasonal effects.

Sizing of disposal systems were based on assessed soil permeability, effluent flow estimates, and on the site water balance.

The development of the draft AS1547 - 1992 parallelled an increasing community awareness of the impact of nutrient buildup in waterways. The Blue Green Algae Task Force, NSW (1992) acknowledged that septic systems are "an important source of nutrients".

Research into the performance of septic tank soil absorption systems by O'Neill et al (1993) and Geary (1992) of 19 and 2 communities in NSW and South Australia respectively has demonstrated that a large proportion of systems in service are failing. Hydraulic overloading was attributed as a major course of system failure.

The last decade has seen the introduction of new technologies for treating and disposing of household effluent. The most significant of these has been the introduction of the Aerated Wastewater Treatment System (AWTS). The first AWTS was introduced to New South Wales in 1983. Currently it is estimated that over 16,500 units have been installed in New South Wales (Rawlinson, 1994).

The AWTS incorporates an aerobic oxidation secondary settlement and disinfection processes to treat effluent to a standard which enables reuse for surface (or subsurface) irrigation.

The draft AS1547-1992 accommodated AWTS disposal with sizing of disposal areas related to soil permeability, effluent flow estimates and the water needs of the plants to be irrigated.

After a period of critical review, the revised AS1547 was reissued in September 1994 under the title "Disposal Systems for Effluent from Domestic Premises". AS1547-1994 is presently under review; in particular the method for estimating soil permeability/allowable effluent loading.

3. IMPLEMENTATION OF AUSTRALIAN STANDARD CODES

The publication of any Standard or code of practice, ensures that uniformity of technical requirement is achieved, however, uniformity of application is not always achieved. AS2870 has been in place since 1988, while AS1547, in its current issue has only been in place since 1994. A telephone survey was conducted of the following Western NSW Local Government Councils to ascertain the application of each of the latter codes.

Bathurst	Forbes	Orange
Blayney	Greater Lithgow	Parkes
Cabonne	Lachlan	Rylstone
Cowra	Mudgee	Weddin
Dubbo	Narromine	Wellington
Evans	Oberon	Young

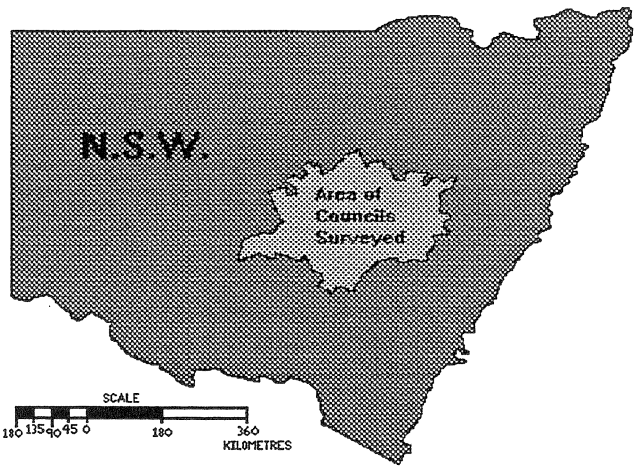

Figure 1 - Council Survey Locality Map

	Compulsory	Selective	Not Required	Information by council
Site Classification AS2870				
- individual allotment	6	3	3	6
- subdivision construction phase	3	2	13	0
Effluent Disposal Investigation AS1547				
- re-zoning	6	1	11	0
- Development Application submission	3	4	10	1
- Building Application	3	3	4	8

Table1 - Tabulated Results of Council Survey

The main thrust of the survey was to gauge the uniformity of application of AS2870 and AS1547 within an area covering a significant portion of NSW (See Figure 1) comprising major rural cities to small villages. The results of this survey are presented in Table 1 and Figure 2. The outcome and findings for each Standard will be discussed separately.

3.1 Site Classification

The application of AS2870 was assessed under two categories, namely, on an individual allotment basis or on a subdivision construction phase. By way of explanation, an individual allotment basis means that the site classification would be undertaken on a lot by lot basis as development occurs over time. This could comprise an assessment of an allotment for construction of a dwelling on an "infill" allotment within a previously developed area or on individual allotments within a new estate. Assessment at subdivision phase, on the other hand, facilitates the assessment of the entire site, with most likely an individual allotment assessment being an extract from an overall assessment.

In 66% of the Councils surveyed, a site classification, on an individual allotment basis is being carried out. For these classifications, 50% of the assessments were

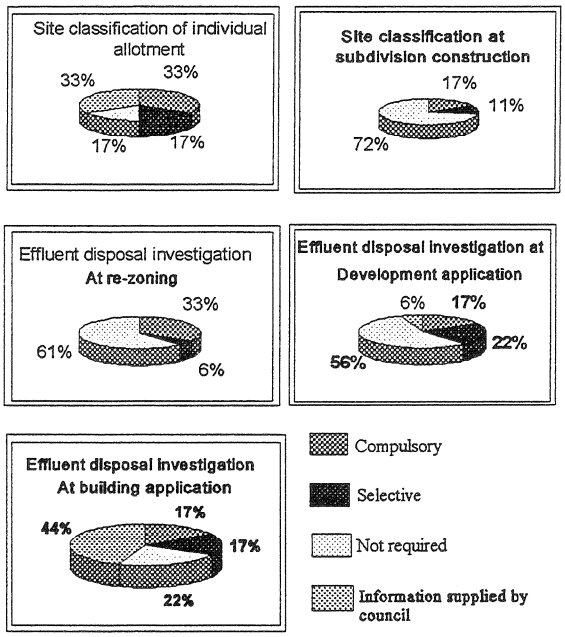

Figure 2 - Graphical Presentation of Council Survey

compulsory at the request of Council and at the building constructor's cost. The remaining 50% of assessments were based on information supplied by the Councils and at no cost to the building contractor.

Classification at subdivision construction phase is only being conducted within 28% of the Council areas surveyed. In this instance, 61% of the classifications are compulsory and 39% are required by council on a selective basis.

3.2 Effluent Disposal

The application of AS1547 was assessed under three categories, namely at rezoning, at development application stage, and at building application stage. Application of AS1547 was considered in general terms as an effluent disposal investigation or land capability assessment involving site specific testing. Some Councils, particularly at rezoning stage, require a land capability assessment without stipulating compliance with AS1547. Rezoning application stage is where the landuse classification is changed to permit residential or rural-residential type development eg. 'rural' zoning to 'rural-residential'. Development application stage is where subdivision or land development details are required. Building application stage is where specific building specifications or particulars are required.

The survey results indicated that 61% of Councils had no requirements for an effluent disposal investigation at re-zoning and development application stage. Twenty two percent (22%) of councils had no requirement for effluent disposal investigation at building application stage.

Whilst 33% of councils have compulsory effluent disposal investigations at rezoning stage, only 17% have

compulsory investigations at development and building application stages.

At building application stage, 44% of Councils supply disposal system specifications, e.g. "conventional septic tank with 30m absorption trench".

In addition to the tabulated survey responses, 50% of Councils reported knowledge of effluent disposal system failure within their Council areas. Fifty percent (50%) of Councils surveyed specified AWTS disposal of effluent where known land capability or site sensitivity problems existed.

4. DISCUSSION OF SURVEY

The results of the survey were, in some aspects predictable, and yet very surprising in others. Particular trends emerged in relation to costs to the community and impact on the environment. Again each of the areas of site classification and effluent disposal investigation will be discussed in turn.

4.1 Site Classification

The survey data clearly shows a maturity of application of a code which has been in use for nearly ten years. However, a number of issues have come to light from the results of the survey:

i) The potential liability to the Council and its officers where information is supplied by Councils.

ii) The often "conservative" nature of this supplied information leading to higher than necessary construction costs.

iii) The very small number of Councils requesting classification at the subdivision construction phase.

Classification at subdivision construction stage has a number of inherent advantages:

a) Assessment of a larger area commonly highlights any trends or anomalies

b) The cost to the community is reduced. Commonly, the cost of an assessment per allotment at subdivision construction stage is up to one third to one half that of the cost of an individual allotment assessment.

c) The ready availability of the information to the potential home constructor is seen as a good marketing tool rather than a cost burden and more "red tape".

4.2 Effluent Disposal

AS1547 in its current form has been in use for less than two years. Consequently, it comes as no surprise that effluent disposal investigations or similar land capability assessments have not been widely implemented by local government.

The survey results reveal that approximately 60% of Councils have no requirements for pre-development effluent disposal investigations, i.e. at rezoning or development application stage.

The risk in not adequately assessing land capability for effluent disposal pre-development, is that areas unsuitable for unsewered residential development may not be identified prior to Council approval being granted. The potential ramifications for Councils approving residential land developments unsuited to onsite effluent disposal include:

- degradation of waterways and/or groundwater.
- potential public health risks.
- litigation involving Councils, developers and/or purchasers.
- unplanned community cost in correcting problems.

Some of the Councils requiring pre-development land capability assessments noted positive benefits from this policy including:

- the ability to identify areas unsuitable for onsite effluent disposal prior to developments proceeding. This gives developers the opportunity to amend development plans by making landuse changes suited to the specific site. eg dedication of areas unsuited to onsite effluent disposal for passive recreation whilst retaining suitable land for residential development.
- the pre-development specification of disposal systems appropriate to the site eg AWTS, common effluent drainage systems.

Forty four percent (44%) of Councils supply disposal system specifications for new system installations. This information is often based on 'rules of thumb' which do not differentiate between areas of different soil landscapes and land capability. The most common Council specification used is a conventional septic tank with an absorption trench length of 30m to 40m (total length); except in problem areas where AWTS units are recommended.

Some of the shortfalls associated with Council supplied specifications are:

- 30m to 40m trench length for most soils in Central Western NSW is under- designed when compared to AS1547 requirements. A result of this insufficient trench length specification is hydraulic overloading and system failure.

- AWTS units are specified as a "cure all" for problem sites. Without adequate site assessment inappropriate use of AWTS units can result.

- Council incurs a liability for disposal system failure where that results from inappropriate Council specifications.

The high reported incidence of disposal system failure is not surprising where implementation of adequate pre-development assessment is rare and the provision of inappropriate system specifications is common.

5. RECOMMENDATIONS

5.1 Site Classification

Further enhancement of the application of AS2870 - "Residential Slabs and Footings" Standard could be achieved by Council stipulation of a Development Application condition requiring classification of each allotment at the subdivision construction phase. This assessment would require appropriate investigation incorporating knowledge of performance of surrounding structures (if possible), subsurface profiling, testing and evaluation.

5.2 Effluent Disposal Investigation

Presently AS1547 "Disposal Systems for Effluent from Domestic Premises" is largely ignored by Western NSW Councils. Implementation of this Standard could be better achieved by adoption of the following recommendations:

- Councils adopt mandatory land capability assessments prior to approval of proposed residential developments incorporating on-site disposal of effluent.

- Councils adopt a mandatory requirement for AS1547 type site assessment and disposal system design for individual building applications rather than adopting arbitrary 'rules of thumb'. Site assessments would make use of information already available from the above land capability assessments.

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