

Soil testing of samples from O'Brien's subdivision, Dilston

by W. R. Moore

Three clay samples were collected from a house site at O'Brien's subdivision, Dilston, on 17 May. This site was inspected at the request of the Lilydale Council.

The samples were tested in the soil laboratory to establish the moisture content, liquid limit, plastic limit, plasticity index and linear shrinkage values, and were X-rayed to give the composition of the clay. In view of the very high plasticity of clay sample 2 a shear box test was requested from the soil laboratory in order to obtain the angle of friction and cohesion value of the clay to indicate the slope's sensitivity to failure. Three chip samples were obtained from large dolerite boulders on the site for petrological examination.

The house is to be situated on a slope which has a high potential for slope failure, and the clay on which the house foundations are to be built will swell and shrink giving seasonal soil movement. The soil laboratory tests (Table 1) confirm the field inspection. With such high plasticity clays (plasticity indices of 97 and 112, moisture content of 46%, linear shrinkage 22 to 31%, and the presence of montmorillonite in varying amounts of 5 to 50%), the slope as well as the cut back will be prone to failure. There will also be movement in the clay due to seasonal swelling and shrinking.

The house clearly should not be sited on any of the unconsolidated fill which has been pushed out onto the slope at the site. The house foundations, as well as the retaining wall at the rear of the house, should be designed by a competent foundation and structural engineer in view of these results.

Excess surface water and stormwater drainage should be removed off the house site and the slope above it. An adequate drainage system to protect the house site, as well as behind the retaining wall, is recommended. Trees should be planted upslope as well as below the house, as they will lower the moisture content of the clay and bind it.

Any leakage from drainage, water and sewer pipes caused by soil movement could cause slope stability problems. Such sensitive clay and steep long slopes gives this area a high potential for slope failure.

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APPENDIX 1
Results of testing

The petrological examination of the three rock chip samples has been completed and shows that the large boulders on the block are dolerite of Jurassic age. The shear box testing of clay sample 2 of Tertiary age gave very low angles of friction of 11° and effective cohesion of 7.9 kPa. These results confirm that the clay on the block is prone to failure and that the dolerite is not in situ.

Table 1

Soil testing results

<i>Sample No.</i>	<i>Moisture content</i>	<i>Liquid limit</i>	<i>Plastic limit</i>	<i>Plasticity index</i>	<i>Linear shrinkage</i>
1	46%	120	33	87	22%
2	44%	146	34	112	31%
3	44%	118	-	-	-

Shear box testing

Sample 2	Angle of friction (ϕ')	11 degrees
	Effective cohesion (c')	7.9 kPa

XRD analysis of clay fraction

Sample 1	Kaolinite (90–95%), illite (5–10%), montmorillonite (0–5%)
Sample 2	Montmorillonite (40–45%), kaolinite (50–55%), illite (5–10%), quartz (0–5% of total fraction)