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1976/12. Ground stability at Taroona High School

P.C. Stevenson

The department was asked by the Public Works Department (memorandum of 2 March 1976) to comment on the geological aspects of an engineering report by the Assistant Director (Engineering) dated 21 November 1975.

TOPOGRAPHY

The coast of the Derwent at Taroona has a concave slope, with an overall slope of about 12° from an elevation of 200 m to sea level. A natural microtopography is imposed on this slope so that small steep banks and flat shelves are common and this has been emphasised by the cut and fill for roads and building sites.

The High School lies at the foot of this slope, and here the overall slope is about 8°. Much steeper slopes either created by cut and fill or from natural causes exist locally.

GEOLOGY

The highest parts of the Taroona coast slope are formed by parts of a dolerite sill with a gentle landward dip, but this simple picture is complicated by faults running parallel with the coast. These have involved the underlying Permian mudstone to produce a steep escarpment with the dolerite and mudstone downthrown towards the Derwent trough. The age of this faulting is evidently pre-Tertiary (Leaman, 1974; Stevenson, 1975).

The Derwent trough was filled in Tertiary times by sediments (mainly sand and clay) but where these lie against the dolerite-mudstone escarpment the sand and clay contains a large proportion of dolerite, sandstone and mudstone blocks derived from it. The resulting boulder beds, conglomerate, cemented gravel, grit and lithic sandstone are to be seen in great variety along the shore at the school and in the cliffs north of it. Floating dolerite boulders are a common feature of the shore, in the school rock garden and along the Channel Highway inland.

A proportion of the sediments consists of clay, but this does not commonly crop out. Where the shore forms a point to the east of the school clays are apparent. The foundation excavation for the school building shows a proportion of clay with associated siltstone, soft sandstone and boulders but the clay content of the cliff section is not high. It is to be expected that the clay content of the very mixed sediments would increase away from the old escarpment and this seems to be broadly the case. Clay is of course seen up-slope, for instance in the cuts made for sports grounds to the north of the school, but inland the clay is increasingly associated with coarser deposits up to size of massive boulders. Some of the clay shows a high shrinkage when dried. This is plainly seen in the school foundations where they have been more or less dry for some years. The soils of the school grounds are mainly black in colour and derived from the dolerite; they show a characteristic high shrinkage.

Some of the lithic sandstone requires special comment. It appears to show a structure characteristic of 'sandstone' made of rock fragments that have subsequently been weathered. If undisturbed if behaves as soft sandstone and is able to stand as cliffs or near loading, from buildings, but if greatly disturbed the grains break up into constituent clay minerals and thereafter behaves as a more or less plastic clay. This could be regarded as a very stiff clay or claystone of some sensitivity.

EVIDENCE OF MASS MOVEMENT

The combination of low slope and probable high internal friction in the materials of the school grounds makes landslip unlikely. In detail, no heel, toe or foot areas active or dormant can be identified, no tension cracks, or translational distortion are evident, natural drainage is not disrupted and there are no reversed slopes, or anomulous ponds. Vertical disturbance of the ground is always associated with cut and fill operations and in many cases these have plainly been ill-drained. The landscape is clearly sensitive to disturbance, but this has not been such as to produce any large response. The surface of the rugby ground at the north end and along the west side and the cut above it show this effect very clearly but even here only a surface effect has been produced and no deep-seated failure has taken place.

When artefact structures are examined no evidence characteristic of landslip can be found. Bitumen road surfaces and concrete paths and steps have not failed in tension, building piers are undisturbed, and downslope tension or differential settlement is not evident in walls. Such minor damage to wall junctions and floor slabs as has occurred in buildings cannot be related to downslope movement and is likely to be caused by shrinkage settlement. Similarly, damage to retaining walls appears to be related to the swelling of fill, and the settlement of fill has similarly uncovered foundation slabs and disturbed paved areas.

Some creep of material (probably fill) is seen at high tide mark on Dixons Beach, but where the materials are mainly undisturbed as in the cliffs which stand at angles up to 40°, degradation is by fretting rather than massive failure.

CONCLUSIONS

In the absence of either normal landslip indications or significant damage to building, and realising the nature of the sediments of the school area it is concluded that no landslip condition exists and that the damage to building, pavements, and slopes has been caused by:

(1) soil shrinkage,

(2) movement of sensitive and poorly consolidated fills, and

(3) increased erosion where steep cuts have been made.

RECOMMENDATION

Although the potential for landslip movement does not appear high the fear that it exists could only be dispelled by a programme of drilling, sampling and soil testing and the measurement over several seasons of variations in groundwater conditions.

LEAMAN, D.E. 1974. Geophysical survey on proposed bore site areas, Kingston and Taroona. *Tech.Rep.Dep.Mines Tasm.* 17:106-109.

STEVENSON, P.C. 1975. Ground movement at Taroona. *Unpubl.Rep.Dep.Mines Tasm.* 1975/69.

[16 March 1976]