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25. LANDSLIPS AT PARKLANDS, BURNIE

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INTRODUCTION

A landslide on the southern side of the Bass Highway about 200 yards west of Hilder Street, at Parklands, Burnie, recently caused a partial blockage of the Bass Highway and some damage to property and services. The slip has been studied by Geologists K. L. Burns and R. D. Gee and two interim reports have been submitted. On 28th August, 1962, the author also examined the slip and the area surrounding it. This report includes a summary of the reports of Burns and Gee and is based largely upon their findings.

GEOLOGY

In the immediate vicinity of the landslide the bedrock is obscured by talus, built up ground and roads. However, the general geological setting is fairly clear although bedrock levels would be difficult to determine accurately without drilling.

Between the shoreline and the cliffs south of Bay Street an elevated marine terrace has been eroded in Precambrian dolerite and sediments of the Rocky Cape Group. South of this terrace the ground rises steeply, the lower cliffs being composed of Precambrian sediments, but Tertiary basalt with interbedded, poorly consolidated sediments occupies the higher parts of the cliffs and the plateau to the south.

Between the cliffs south of Bay Street and the Bass Highway the Precambrian rocks are covered by a wedge of talus consisting of blocks of basalt, dolerite and sandstone set in an abundant clay matrix. The Parklands subdivision has been built on this wedge of talus.

DETAILS OF THE LANDSLIDE

Burns has supplied a tentative history of previous landslides in this area dating back to about 1920. The present slip is about 100 feet wide by 50 feet long and occurs between Button Street and the Bass Highway. The tension zone at the heel of the slide has destroyed part of Button Street, closed the access to some houses and disrupted water, drainage and communication services. The toe has extended onto the Bass Highway destroying part of the embankment, disrupting drainage and partially blocking the highway.

The material in the slide is a soft brown clay which, where excavated above Highway level, proved to be remarkably dry. The water entering the heel of the slip must be confined to the slip plane and apparently has not permeated the landslip mass to any extent. Striations on the heel of the slip dip at about 65° and Burns estimated that the slip circle passes a few feet beneath the highway. No slip plane could be identified in the available exposures above road level. It appears that the highway impounded the groundwater, saturating the toe below road level and that the landslip mass sheared off at load level and spread out across the highway.

The present tendency of the slip is to spread laterally but all the ground above the slip is now potentially unstable. If no permanent remedial measures are adopted damage to houses and property upslope of the landside is inevitable.

REMEDIAL MEASURES ALREADY ADOPTED

Up to the present the remedial measures have been designed simply to restore damaged services and to maintain access along the Bass Highway. A little effort has been made to prevent some surface water from entering the heel of the slip but this is by no means completely effective.

To maintain access along the highway, portion of the toe of the slip has been removed and part of the material replaced with loose stone filling. This must be regarded as a temporary expedient. At the present time all parties who may conceivably be involved are hesitant to take any action, presumably through fear of assuming liability. In the meantime the slide is still active and the only factors preventing complete collapse are cohesion and friction along the slip plane.

HYDROLOGY

The water table throughout the Parklands subdivision is high and normal groundwater is considerably augmented by water entering the talus from the hills behind, partly as runoff and partly by conduction through the basalt. The groundwater in the basalt appears to be "channelled" along low areas in the sub-basaltic basement leading to local aggravation of groundwater troubles. Local residents complain that groundwater troubles have increased over the past few years and this may well be connected with the disposal of stormwater and the increased use of water generally on the newly built up areas on the plateau south of Parklands. Burns noted a number of seepages in the area, some of which are not related to the local drainage system.

THE CAUSE OF THE LANDSLIP

The Parklands subdivision is situated on potentially unstable ground. Without any alteration to the pre-existing conditions it is quite likely that the area would have remained stable for a long period. However, the disruption of natural drainage by buildings and other construction works, the removal of the toe of the slope by roadworks and inadequate stormwater drainage have all contributed to the formation of the present slip. It would be impossible to isolate any one factor as the prime cause of the slide. The factors listed below are therefore not listed in order of importance.

(1) *Groundwater*

Large quantities of groundwater are being received due to geological conditions peculiar to the site. This may be related to increased building activity on the plateau south of Parklands and an examination of the water disposal method there is warranted. However, a large proportion of the groundwater received via the basalt is natural percolation which will be unaffected by such developments.

(2) *Drainage*

Provision for stormwater and household drainage over the entire Parklands subdivision appears unsatisfactory. I am informed that stormwater disposal from the individual allotments is the responsibility of the owners. Even if this is so it is doubtful if the owners, if willing, are able to design and construct efficient drainage systems. Some householders have constructed french drains which simply transmit the surface water underground whilst other drains are quite inadequate. The amount of water flowing through private drainage systems during heavy rain appears to be quite unrelated to the amount of runoff which would be expected. It is therefore suspected that many of the drains have been disrupted by soil creep. A thorough inspection of the entire drainage system, both council and private, is necessary. Steps should be taken to seal open drainage channels and to enforce property owners to provide adequate and properly maintained drains which will conduct the water away from the unstable ground.

(3) *Construction works*

The top of the embankment has been loaded by surplus spoil from house construction and by the building of Button Street. In addition to this the toe of the talus slope has been oversteepened by cuttings from the Bass Highway. Drainage under the highway appears to be inadequate causing a local rise in the groundwater level.

(4) *General*

Trenches put in for sewerage, water and P.M.G. cables have tended to act locally as water conduits. Such trenches should be either properly filled with impermeable material or designed with sufficient gradient to act as drains and backfilled with permeable material.

RECOMMENDATIONS

1. It is considered that the only permanent solution to the present landslide lies in the construction of a retaining wall capable of withstanding active earth pressures. A graded filter and an

adequate drainage system should be provided behind the wall. Bedrock is reported to be present at shallow depths so that foundation problems for such a wall should not be severe. The minimum length necessary to stabilize the present slip area is 150 feet but it would be wise to construct the wall over the entire length of the embankment west of Button Street. Detailed design of such a wall is an engineering problem beyond the scope of this report.

2. The wall will simply serve to support the toe of the talus slope and prevent further slips of the kind which has occurred. In addition to this it is necessary to provide an adequate drainage system over the whole of the Parklands subdivision. Every effort must be made to prevent surface water from being transmitted underground. Unsealed drains and french drains, whether council or private, should be banned and drains should be inspected regularly.

3. To prevent groundwater derived from the basalt plateau to the south from entering the talus wedge a drainage system near the foot of the steep ground south of Bay Street is necessary.

For the present a system of concrete lined surface drains are recommended. Much of this water is being conducted underground and if the surface drains prove insufficient, deep drainage may be necessary ultimately. A careful check should be kept of groundwater entering the talus wedge.

4. Immediate steps should be taken to prevent water entering the heel of the present slip.

5. Heavy traffic should be banned from Button Street until all recommendations outlined above are carried out.

6. Drainage under the Bass Highway over a distance of 1 mile west of Hilder Street should be reviewed and made effective. Table drains should be given adequate fall and lined with concrete. It should be noted that the earlier recommendations should result in a much higher runoff from the Parklands subdivision.

7. No further building permits should be issued on the Parklands subdivision until adequate drainage has been provided.

SLOPE STABILITY AT BURNIE

Since a number of landslips have occurred in the Burnie district during the past few years an opportunity was taken to review the general problem of slope stability in the district.

As a result of this it is considered that the position is serious enough to warrant the urgent and immediate attention of all parties concerned.

Geologically the same problems which led to the recent Parklands landslips persist over much of the steep land within the town of Burnie. That is, the most desirable and expensive building sites are located on steep talus slopes which flank the basalt plateau south of Burnie. These slopes generally are inherently unstable and receive quantities of ground water via the basalt to the heels of the unstable talus wedges. Numerous old landslip scars are present.

In the past, subdividers appear to have selected the more stable areas for home building but the increased building activity over the past 10 years has led to a gradual encroachment of building onto more and more unstable land. At the present time there are subdivisions approved and housing developments being built upon, or close to land which is dangerously unstable.

In recent years one house has been destroyed by landslides and another seriously endangered. At the present time there is at least one house which is being disrupted by earth movements and several which are endangered by landslides. On a recent subdivision, land has been sold or is being offered for sale about 100 yards down-slope of a small landslide which appears to have moved during the past few months. Another subdivision is reported to have been approved on top of an old landslip which may well be reactivated by building activities. It is quite clear that if the present trend continues serious damage to housing and services will occur in the future. Even if no further building is permitted on unstable ground I consider that some property will be damaged or destroyed due to building activities which have taken place over the past decade. If building in these areas is not restricted, a series of disasters in total at least as grave as the Lawrence Vale landslip appears to be inevitable.

In a report to the Burnie Council, presented in 1958, T. D. Hughes pointed out the risks involved in building on such ground and urged councils to "exercise extreme care in granting permits for subdivision". This warning seems to have passed unheeded.

It is accepted that the refusal of building permits on the hillsides around Burnie will impose a financial liability on the Burnie Council. Most of this land is locally regarded as desirable building blocks and fetches relatively high prices. The areas in question are fairly close to existing services and access and may therefore be developed relatively cheaply. If development of this land is forbidden it will undoubtedly cause a drastic revaluation of land values within the areas. However, it is surely wiser to accept reduced land values than to allow building on land which will result in the wholesale destruction of property.

A further serious problem arises from the construction of driveways and new buildings in areas already built up. It should be realized that whilst certain areas may be stable at present this stability can be endangered by later building activities. The excavation of driveways, construction of garages, roadwidening and disposal of stormwater and septic tank effluence may all effect the stability of nearby areas which would otherwise have remained stable. If the present building regulations do not provide control over such activities they should be reviewed; if they do they should be rigidly enforced. Where street or highway widening is envisaged, great care should be taken to ensure that the resulting works will not affect the stability of nearby property, which in some cases appears to be delicately balanced.

RECOMMENDATIONS

1. No further subdivision should be approved on the hillsides around Burnie until the stability of the sites has been established.
2. No further building permits should be issued for allotments already sold unless the appropriate authorities consider that the proposed site is safe and that the proposed building will not affect the stability of neighboring sites.

3. Very strict control should be exercised over minor excavations and buildings such as driveways, garages, &c.

4. The use of septic tanks on steep hillsides should be banned and local drainage should be brought up to desirable standards and periodically inspected.

5. The public should be made aware of the general problems and warned against building on unstable ground. They should also be made aware of the dangers which may arise due to inadequate or inefficient drainage.

6. It would be possible for this Department to prepare a map indicating the relative stability of land in the town of Burnie. The map would serve the following purposes:—

- (a) As a guide to the council in considering proposed subdivisions.
- (b) Outline drainage and other works which may be desirable on potentially unstable land which is already built up.
- (c) Guide planning for future street and highway widening.
- (d) Form some basis for the inevitable re-adjustment of land values.

This mapping would have to be done carefully on a large scale and it is anticipated that the project would occupy about 2 months. The work should be carried out about mid-summer when surface drainage is at a minimum and underground seepages may be detected most readily.

7. Land which is considered to be unsuitable for building should be planted with trees and shrubs so as to prevent landslips which may ultimately affect neighbouring properties.

8. The existing provisions for drainage of private roads are inadequate. The council should have power to provide such drainage and accept liability for damage resulting from inadequate drainage.

REFERENCE

HUGHES, T. D., 1959.—Landslides at Burnie. *Tech. Rep. Dep. Min. Tas.*, 3, 135-136.