

REPORT ON LAND SLIPS (OTHER THAN THAT KNOWN AS GROOMS SLIP) NEAR PENGUIN AND ULVERSTONE.

There are a number of land slips along the North Western districts all of which occurred during the past two months. They have co-incided with a period of exceptionally heavy rainfall and it is apparent that the greater amount of water that has percolated into the surface soil, sub-soil and underlying rocks has been the direct cause of the slips. They occur for the most part on steep hillsides which of course represents another feature which facilitates slipping. Attention was given only to those slips which moved onto the road and railway and therefore, caused stoppage of traffic and expenditure to clear them. In addition to these many other small slips are visible along the coastal districts.

The conditions vary from slip to slip and each one is, therefore, described separately below.

LONAH

Several recent and old landslips occur along Lodder's Cutting between Ulverstone and Penguin.

East End.

Vesicular basalt is exposed upon the beach and dense fine grained basalt in the road cutting. Further up the hillside exposures are few, but serve to indicate the presence of other flows some of which are of the vesicular type of basalt. In general the upper layers have been decomposed to a large extent by weathering to a soft brownish rock. At a height of 50 to 80 feet above the road, old and recent land slips occur. The latter were first noticed a week or so ago when cracks appeared in the soil, there being in some cases a down-throw of 18 inches on the seaward side of the crack, and a small amount of soil slipped down the hill, but was prevented by vegetation &c. from reaching the road.

At the head of the slip the ground is affected over a width of 50 feet, and to a depth of four to five feet. Small seepages of water are noted in a few places.

The slips are restricted to the soil, sub-soil &c. and the bedrock is not affected. They are due to the soil &c. slipping over the water-logged layer which rests upon the decomposed basalt. Further small slips will probably occur and small quantities of soil &c. may reach the road (unless held up by vegetation &c.), but little damage or hindrance is likely to result thereby.

West End.

A slip occurred in this locality on September 18th and soil with a few boulders in it covered the road and railway. It occurred nearly three chains south of the road and approximately 50 feet above the latter. At its head the slip was 60 feet wide and produced a face 10 to 20 feet deep. It was an ordinary slip such as occurs in deeply soiled places on steep hillsides, but the slipping material continued to slide down hill over the solid surface and eventually reached the road. The material at the bottom of the slip was apparently very

fluid (judging by its dried appearance on the lower sand) due to water logging of the sub-soil and caused the further slipping down to road level.

In the head of the slip decomposed basalt is visible on the eastern side, with the suggestion of a less-weathered and harder layer above it. The water logging of the sub-soil caused the latter to slip over the basalt.

A water seepage was visible near the head of the slip and appeared to be coming from the junction of the hard and the decomposed layers. Probably a further seepage is also taking place/in the decomposed layer.
lower

There is little danger of a continuance of this slip as the water is now issuing freely. It would be advisable, however, to keep the seepages open and prevent them being blocked, and to conduct the water down to road level by drains.

1929 Slip.

A slip occurred in Lodder's cutting in 1929, but was not renewed this year. This is due to the tapping of the water and draining it down to the road.

BORTHWICK'S CUTTING.

Borthwick's road cutting is situated about one mile west of Penguin. Several slips have occurred along the cutting and the hillside above.

No. 3 Slip.

This slip is situated at the western end of the cutting.

On the beach basalt outcrops and slightly vesicular basalt extends at least 10 feet above road level. Further up the hillside the rocks are not visible, but pebbly clay appears to overlie the basalt. Still higher blue clay with pebbles is exposed in the land slip. This is overlain by two feet of waterworn gravel from which water is seeping. The gravel is in turn overlain by pebbly clays which appear to grade into basaltic clays probably representing basaltic tuffs with pebbles.

The slips occurred at a height of 100 to 120 feet above the road. The width of the slip was 25 feet but cracks indicate that the ground was affected to a width of 50 or 60 feet. The slip has formed a face 12 feet high above the gravel bed, while it affected the material to a similar distance below the gravel. The displaced material slipped down over the steep surface below and eventually reached and covered the road.

Some further slight slips may occur here, but will probably not reach the road. The cause of the slip was the water (greater than usual due to the recent heavy rains) from the gravels saturating the clayey beds. The dried surface of the slip bear witness to the extremely liquid state of the material at the bottom of the slipping clay, sub-soil &c.

It would be advisable to tap the water issuing from the gravel bed and conduct it by drains down to the road.

Between Nos. 3 & 1.

Going east along the cutting the top of the layer of basalt above the road rises to at least 50 feet above road level. The basalt is overlain by pebbly clays.

Further east the basalt sinks below road level and clayey gravels with large boulders of basalt occurs above road level.

No. 1 Slip.

This slip occurs at a bend in the road towards the eastern end of the cutting. The surface does not slope steeply upwards to the south, but a land-slip has occurred and threatens to cover the road.

The greatest movement has occurred 100 feet off the road where a face of 12 feet has been formed. There does not appear to have been much horizontal movement at the road due to resistance near there. The movement and pressure have however, been relieved by bulging of the surface and differential movements of small blocks along the faults or fractures formed. A small pond occurred in the centre of the affected area and a drain was put into carry off the water, but subsequent movement of subsidence has rendered the pond deeper and the drain ineffective.

There are no outcrops in the affected area, but the soil etc. generally indicate that there are gravelly beds present and the boulders of basalt suggest the same beds that occur further west. A number of bore holes suggest hard ground at depths between four and eight feet. At one of the faults partly weathered basalt has been pushed up and rather suggests that this is the hard ground met within the bore holes. It is evident from this that some of the basalt is involved in the slip which is, therefore, not the usual one of soil, sub-soil &c. slipping over the bedrock. However, the size of the slip is not great and by watching and maintaining the retaining wall it may be possible to prevent it reaching the road. The necessary drainage should be carried out when movement has ceased.

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