

TR15-87-90

23. Landslips on the northern slopes of Aerodrome Hill, St Helens

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Landslips in the vicinity of Aerodrome Hill, St Helens were inspected on 18 November 1970 in response to a request from the Council of the Municipality of Portland. The area had previously been inspected and reported upon by a consulting geologist, I.R. Mortimore.

The position as set out by Mortimore adequately describes the geology of the area and the landslips. Briefly the area is underlain by a series of unconsolidated and partly consolidated Tertiary sand, sandy clay and plastic clay. The north-facing slope of the hill has been developed as a sea-side resort and a number of cottages have been built by cutting benches back into the hill to provide flat building areas. Two roads, one a main sealed road leading out to St Helens Point and another rough access track to the built-up areas (Treloggens Track), have also been benched out of the hillside. The main landslip area is 600 m long and a few hundred metres wide and lies between Treloggens Track and the foreshore. In addition to this, a series of small slips or embankment failures have occurred along the cuttings of the main road, mainly on the steeper westerly portion of the area concerned.

As indicated by Mortimore there are several contributory factors which have given rise to the landslides.

MARINE EROSION

Very active shoreline erosion is taking place at the foot of the slope, undercutting the Tertiary sediments, uprooting trees and promoting wholesale landsliding. A great number of trees have fallen into Georges Bay and judging from the age of these it appears that a new and vigorous cycle of erosion has been initiated over the past couple of years. The reason for this is not clear from the information available, but could perhaps be sought in the weather patterns for the past two winters. Whatever the cause, the fact is that very active erosion has taken place over the past couple of years and it is still proceeding at an alarming rate. If this erosion is allowed to continue unchecked there can be no doubt that the entire settlement on this hillside is in grave danger. Shoreline erosion is a common and continuing natural process around exposed coastlines. It proceeds in cycles with a few years of active erosion followed by a cycle of relative quiescence. However it is unremitting, and in time huge areas of land may be reclaimed by the sea. Unless urgent remedial steps are taken the settlement must be regarded as facing extinction. Measures to combat erosion of this kind can be extremely expensive and often result only in a temporary reprieve.

ROADWORKS AND DRAINAGE

The roadworks carried out in the area have resulted in oversteepening of embankments along the main road and disruption of the natural drainage. As shown by Mortimore, the drainage from the main road is allowed in some cases to discharge on to the slope above the cottages; it is picked up partly by drains along Treloggens Track and diverted on to the slip areas between the track and the foreshore. This is extremely unsatisfactory; the table drains from both roads must be reconstructed in an efficient and effective manner and the drainage water conducted away from the area in effective, water-tight conduits.

The embankment failures along the main road are a further source of concern. These slips have blocked table drains and disrupted drainage. It is urgently necessary to reconstruct effective table drains along the top

side of the road, conduct the drainage water away from the downslope areas, remove the slip material along the embankment and to stabilise the slopes. These measures will not be simple or cheap. The sliding surfaces of the embankment failures run up-slope at an angle close to that of the natural slope. It will be necessary to remove all existing slip material, trim back to a stable battery, stabilise and drain the foot of the embankment and provide horizontal drains into the embankment.

RAINFALL

The past two years have been of above average rainfall for the St Helens district following at least two years of very much below average rainfall. The relevant figures supplied by the Bureau of Meteorology, are set out in Tables 1 and 2.

Long term average annual rainfall over 79 years is 766 mm(3,057 points).

Table 1. ANNUAL RAINFALL, ST HELENS

Year	mm	Points	Year	mm	Points
1967	473	1,862	1969	925	3,642
1968	458	1,802	1970	1,100	4,325

Table 2. MONTHLY RAINFALL TOTALS, ST HELENS, 1969-1970

	1969		1970	
	mm	points	mm	points
January	33.5	132	92.5	364
February	147.1	579	29.0	114
March	61.2	241	176.8	696
April	32.5	128	40.9	161
May	165.5	652	55.4	218
June	21.1	83	131.3	517
July	42.2	166	47.8	188
August	74.7	294	162.7	641
September	56.9	224	55.4	218
October	66.8	263	12.7	50
November	154.9	610	85.1	335
December	68.6	270	209.0	823
Total	925	3,642	1,100	4,325

These figures indicate, in addition to the present wet cycle, that the rainfall in the district occurs as short bursts of high intensity rainfall interspersed with dry periods. Indeed, on 16 November 1970 137 points of rain were recorded for a single day out of a total for the month of 335.

A rainfall pattern of this kind falling upon an area of porous unconsolidated rocks, underlain by plastic clay, oversteepened by roadworks, subject to poor drainage systems and being actively undermined by shoreline erosion is surely conducive to the promotion of landslips. In such an area extreme care should be given to the design of cuttings, drainage systems and to the development of housing upon steep slopes which are by nature extremely sensitively balanced.

DOMESTIC DRAINAGE

It is understood that a water supply was provided for the homes in this area during the past two years. With the provision of water no attempt appears to have been made to provide stormwater drainage. The result is that water which once was collected in household tanks is now allowed to flow to waste in an uncontrolled fashion. The drainage systems at the cottages in the area appear to consist of french drains and inadequate, unlined surface drains. Septic tanks have been installed and the effluent from these is apparently conducted underground and flows into the affected areas. Thus all the stormwater, sullage and septic tank effluents together with the drainage from both roads is fed almost directly to the unstable wedge of soft Tertiary sediment lying between Treloggens Track and the foreshore. Even if the other factors mentioned earlier were not in force the poor drainage alone is sufficient cause for concern. Steps must be taken to rectify the position with the minimum of delay. Stormwater, sullage and septic tank effluents should be piped away from the affected area and a critical examination made of the drainage systems of each individual property.

HYDROGEOLOGY

The area, as previously stated, is underlain by a series of soft Tertiary sediments and along the shoreline and in the cuttings on the main road, layers of soft plastic clay occur in the sequence. Water passing underground in the porous sandy sediments descends vertically until the clay layers are encountered. At those levels it then runs along the bedding planes and issues along the front of the slope as a series of springs. The water-softened and lubricated clay layers form perfect sites for the initiation of landslides when slopes are oversteepened by earthworks or by shoreline erosion. The original steep slopes in the area were delicately balanced and no doubt slowly retreated to the south due to natural erosion. Development of the area has accelerated the southwards retreat to such an extent that access to the homes is threatened. This access could be cut at any time and eventually the homes themselves will be endangered.

An indication of the urgency of the position may be gleaned by the fact that cracks are already apparent along Treloggens track and that active landslips from the foreshore have already cut back to the edge of this track. If nothing is done the track could fail at any time: a combination of wet weather, high tides and northerly weather could produce a situation whereby the track fails before Christmas. Inevitably, one by one, the houses will follow.

RECOMMENDATIONS

The solution to these problems is by no means easy or cheap. Foreshore protection alone could be a major undertaking. This could be effected by protective stone filling along the shore or by piling. Both of these devices are expensive, perhaps more expensive than the homes they are to protect. Engineering advice on this aspect of the matter should be sought urgently. The measures required to stabilise the road cuttings and to overcome unsatisfactory drainage conditions associated with the houses and both roads have already been indicated. It is also important and urgent that these measures should be put into effect.

Finally it must be said that this area contains all the elements necessary to produce landslips. Any one of these alone could produce instability and the combination present here is a formidable array. Some of these factors are natural causes and some man made; some can be rectified at reasonable

expense and others only by the expenditure of large sums of money.

It seems reasonable to consider how much expenditure is warranted in order to preserve the existing holiday cottages. With reasonable care, moderate expenditure and by the development of alternative access routes many of the homes may be unaffected for some years. Much depends upon weather conditions and the effectiveness of the palliative measures undertaken. However a permanent solution to the problems appears to be possible only by adopting large scale and expensive engineering works at very large capital expense and requiring continuing careful maintenance. It may well be that such expense cannot be justified, and it is for the Council to decide upon long term policy for the area. No further buildings should be permitted in the area until the present instability has been rectified.

If engineering work such as piling or rock filling is undertaken in order to prevent further shoreline erosion, steps must then be taken to attempt to stabilise the slipped ground between the track and the shore. This could be effected by trimming back the slopes and by the development of a drainage system comprising deep vertical slots cut back normal to the shoreline, together with a system of horizontal drains driven into the slip masses and the area behind them. The whole area should then be planted with vegetation having a strong root binding action and maximum transpiration effect. Even if no remedial works are carried out along the foreshore, drainage, slope treatment and planting would be a wise precaution in order to reduce the rate of erosion and slope failure as much as possible.

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