SESSION 15: LANDSLIDES

Papers:

USE OF MOVEMENTS IN DETERMINING THE STABILITY OF NATURAL GROUND
J.M.O. Hughes, J.N. Clapperton and P.R. Goldsmith; vol 2, 61-64

LANDSLIDES IN SOUTH AUSTRALIA
J. Selby; vol 2, 69-72

THE EVOLUTION OF A RISK-ZONING SYSTEM FOR LANDSLIDE AREAS IN TASMANIA, AUSTRALIA
P.C. Stevenson and D.J. Sloane; vol 2, 73-79

Paper by J.M.O. Hughes, J.N. Clapperton and P.R. Goldsmith

Mr G. Boyd noted that the monitoring of surface movement by precise survey or by simple slope indicators placed down boreholes suffered from the stability of the reference points, and asked how this could be catered for in determining real or absolute displacement downslope. Dr Goldsmith replied that the EDM survey gear was set up on a concrete slab some distance away from the inclinometer tube. The displacement of the top of the tube was then measured relative to this datum.

Mr P. Pells recalled that Dr Beer of Belgium had shown that the most sensitive measure of incipient failure was given by lateral movement obtained from inclinometers installed at the toes of soil slopes. Tension cracks were not a good indicator of instability. However, it appeared that in the failure of soft slopes the displacements at the crest were also a good indicator of instability. He asked whether the author or anyone in the audience had any comment in this regard.

Mr Ecclesby commented on tension cracks observed at the crest of spoil slopes in their mines. When they developed shortly after placement of the spoil, these cracks did not always indicate failure. They had found that a better indicator was the formation of faint tension cracks near the toe of the slope.

Dr Chappell commented that a knowledge of the mechanisms and discontinuities within a slope, especially in difficult ground, was a prime pre-requisite if one was to construct in such ground. He further commented that it was important to use a predictive tool to try and anticipate what might happen and then put in the measuring device and compare the two results. He described toe displacement as a very sensitive and vital parameter.

Mr R.J. Redmayne commented that a number of large scale mass movements along the Kawerau River were being monitored as part of the investigation of the Clutha Valley Development. Plan positions were measured annually by traditional theodolite and EDM survey techniques and some inclinometer instrumentation had been carried out. In between major surveys it had become the practice to undertake a line of precise levels across the upper half of the mass movement. This process was quick, cheap and accurate and served to determine whether or not movement was occurring. It was thought to be a good rapid indicator of movement as most of the movement in the upper half of the slide was expected to be vertical. This technique was used three-monthly, or after heavy rain.

Paper by P.C. Stevenson and D.J. Sloan

Mr R.J. Hayes asked Mr Sloane who paid for the work involved in the establishment of risk zoning system and how many people were involved, and for how long. The reply was that the initial risk zoning system took about 5-6 man years to produce with the cost being supported by the State government. Nobody in Tasmania can obtain insurance against landslip related hazards.

Mr M. Mitchell asked how much success developers had in over-riding the decisions of the initial zoning and how could the zoning be removed from the title once the area had been defined as a marginally stable zone. Developers had not had much success at all in changing the zoning, Mr Sloane said. Recommendations were submitted on the basis of a visual site investigation. However, the situation might call for a more intense investigation ranging from simple test pits to detailed geological testing and stability analysis. In some cases a developer might employ a qualified geotechnical engineer as a backup for his claims. As far as removing the zoning from the title is concerned, this could be done quite readily. Endorsement on the title was made from the Governor's Proclamation and this process was quite reversible.

Mr G. Boyd asked about the legal situation for the government when people had been permitted to build in class B zones, and damage to structures due to landslip occurred. Mr P. Stevenson answered that this situation had not occurred yet, but that the answer in fact was a political one and lay with the Tasmanian Government.

Mr D.P. McNicholl, with the following comments, explained how the Hong Kong Geotechnical Control Office kept track of the condition of slopes.

1. Background

a) Historical

The population of Hong Kong has expanded from about 0.5 million in 1946 to almost 5 million in 1980. Large developments have been carried out in hillslope areas sometimes steeper than 40°. This has resulted in thousands of man-made slopes, many of which were built at a time when geotechnical engineering was not commonly given proper consideration.

b) Statistics

The Geotechnical Control Office is studying over 8000 cut slopes and 2600 fill slopes. There are more slopes yet to be catalogued including 118 km of linear compound slopes in catchment areas.

2. Priorities

a) Need for priorities

There is neither financial resources nor expertise to deal with all cases simultaneously so a procedure has been evolved to deal with slopes as follows:

* Cataloguing of slope by map area with unique reference
* Priority ranking
* Selection of slopes for further investigation
* Detailed studies

b) Assessing priorities

Each slope is given a unique geographical and numerical description. A series of components which describe the slope and its condition have been listed. Each component is considered in turn and points awarded according to its severity. Components are divided into instability components and consequences components.

c) Components

Instability components influence the stability of the feature and include height, slope angle, signs of distress etc.

Consequence components indicate the possible magnitude and severity of danger and include the height of the feature, distance from nearest building and type of building affected. Higher scores are given to houses, schools etc, as against minor roads or infrastructure features.

d) Calculation

Scores for each component are assessed and coded onto computer storage discs. The scores are reduced and summed to give a value of instability or consequence score for each feature.

3. Selection

a) Data Bank

The information on components and result scores form a data bank. A powerful computer program can operate 12 levels of sort from about 20 components to select relevant data according to the users' requirements.

b) Use of selection program

The most simple selection is to list the slopes in descending order of severity. The selection program can also be operated by setting selection parameters which are considered to be a discriminating factor in the cases being considered.

c) Examples of selection

Selection instruction example A:

List by descending order of instability score -

* All rock slopes
* Within map area 11SW-A
* With signs of distress
* Affecting houses
* Maintained by the Crown

Selection instruction example B:

List in descending order of consequences score -

* All slopes
* Within all map areas
* Height 10m $< H <$ 99m
* Colluvium indicated on field sheet
* Maintained by Highways Office

4. Concluding remarks

Because of the large number of slopes involved, it is essential that there is an ordered and logical approach to investigation and maintenance. The methods currently adopted provide the Geotechnical Engineer with the systems to take this approach.