clear of the ground surface. The sheath may be wired at the base to the indicator pole.

A level value (in terms of the site survey) should be obtained for the top of each indicator pole to facilitate the determination of peak stage.

When carefully installed and results are interpreted with caution this simple method has much to commend it.

Notes on other useful methods of recording maximum water level would be welcomed for publication.

Ed.

NOTES

ANALYSIS OF RIVERBED MATERIALS BY PHOTOGRAPHS

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A knowledge of river bed materials is basic for the study of channel characteristics and stability.

The method of taking satisfactory riverbed photographs is quick, simple and cheap and can be carried out by an unskilled person without any knowledge of photography. The equipment consists of a camera, tripod and scale frame. The tripod is necessary to get the camera axis truly vertical and needs to be about seven feet high to allow a sufficiently representative area of bed material to be photographed. Any of the common types of camera may be used with satisfactory results and when full plate enlargements are made a permanent record is obtained that can be studied and analysed in the office.

From the photographs various types of information may be taken, some of which are listed below.

1. By counting the stones per unit area a "photo average size" can be determined that appears, at this stage, to have a good linear correlation with the sieve grading curve and the Wolman method of analysis.

2. The roundness of the stones may be determined directly.

3. It is hoped to be able to determine the "sphericity" of the stones by measuring the axes appearing in the photographs.

4. Some idea of the cementing of the bed material may be obtained but no actual figures can be placed on the degree of cementing.

5. Long term trends in bed movement may be obtained by studying photographs taken over a period of time at one site.

Although this method is only in the experimental stage the results so far obtained indicate that the method will be satisfactory. The photographs are well worth having for record purposes alone and all persons engaged on channel stability studies should be encouraged to obtain a comprehensive set of bed material photographs.

THE CONTINUOUS RECORDING OF EARTHMOVEMENT ON EARTHFLOWS, SLIPS AND LAND SLUMPS WITH A MODIFIED AUTOMATIC WATER LEVEL RECORDER

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INTRODUCTION

Investigations into the hydrological and mechanical characteristics of land instability phenomena such as earthflows, slumping, gullying and slipping has led to the development of the following device to take a continuous record of the surface displacement and velocity of earthmovement, by the modification of the functions of an automatic water level recorder.

MEASUREMENT PROBLEM

A detailed displacement record of land movement is generally required as part of any investigation into slope instability problems, to determine the relationship of displacement, or velocity, with factors such as rainfall, slope, soil moisture content etc. Periodic observations of the movement at weekly, fortnightly or monthly intervals of a peg or line of pegs on a cross-section do not provide sufficient detail to enable correlations of any analytical value to be made between surface velocity and the other factors. Daily observations may in some instances provide a sufficiently detailed record on slow movements but, in general, sites are remote from centres of population, or are difficult of access while staff time or numbers do not permit such a close frequency of observations.

At most investigation sites of earthflows, access even by foot is an arduous business even if not physically impossible during periods of heavy rain, but it is during these periods that movement is generally most active and the record correspondingly most valuable.

An automatic continuous record is an obvious requirement so that consideration is currently being given to the adaption of the float movement of an automatic water level recorder to provide a continuous trace of a point on a moving inclined land surface. While such a structure has yet to be put into service, proposals are well advanced for an installation, the outline of the proposals being presented below.

OUTLINE OF SYSTEM

The system envisages the replacement of the water level recorder float by a peg or deadman anchored into the earthmovement with the recorder placed on stable ground on one side. Normally the peg would be placed on the line of suspected fastest or greatest movement with other pegs placed on either side which can be manually measured at less frequent intervals. The float cable is to be rigged through a system of cables and pulleys to provide the actuating link between the peg and recorder drum in such a way that all lateral movements of the peg down the inclined surface are faithfully recorded on the chart drum.

It is proposed to suspend a steel cable across the earthmovement, each end of which is to be fixed to anchor blocks in the stable ground alongside. At some sites it may be necessary to erect towers or masts at the anchor blocks to provide clearance above the ground or vegetation. The float cable is attached to the deadman on the earthflow and led through a pulley fixed on the suspended steel cable, then through a series of such pulleys along the cable to the recorder drum and counterweight. A steel pipe sunk into the ground will serve as the counterweight well, with the end sealed off to prevent entry of water. To avoid an excessive depth of well (over 20 feet) provision is to be made for the insertion of standard lengths of cable in the float cable at the deadman, to provide for movement beyond the depth of the counterweight well. Some earthflows which have been manually measured show a movement exceeding 80 feet per annum so that in instances such as this, the counterweight would be fitted with a single block pulley to further limit the counterweight movement.

Alternatively the peg or deadman could be moved back up the slope to a fresh initial point but in some investigations this would interfere with the basis of the investigation, particularly when the total movement of a point on a cross-section over a period of years is being studied.

LIMITATIONS OF SYSTEM

Surging will probably occur during high winds but dampening of the suspended steel cable movement with heavy weights should keep this to manageable limits. Surging is also likely to occur with the float cable during high winds particularly as this cable becomes increasingly longer over a period of years, but increasing the weight of the counterweight should also reduce the trouble.

If stock interference with the cables is likely to be encountered and fencing is not practicable, electrification of the whole system with an electric fence battery and coil could be considered.

Some backlash through the cable and pulley system can also be expected but its effect on the chart trace is expected to be negligible. Obviously the vertical movement of the peg will not be recorded on movements where folding is taking place but cross-sections taken from time to time will reveal the degree of vertical movement.

The system will not be applicable to wide earth-movements of several chains width and its use would normally be restricted to earthflows less than 400 feet in width but even with the above limitations the device should provide velocity and displacement data at present not readily obtainable by any other means.

SNOW AND ICE INVESTIGATIONS IN NEW ZEALAND

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Snow and Ice, in some regions of the earth, are important constituents of the hydrological cycle. A Commission of Snow and Ice is formed within the framework of the International Association of Scientific Hydrology.

In New Zealand a number of investigations into snow and ice problems have been commenced and these are summarised under the following heads:

(a) Name and address of organisation responsible for project.

(b) Name of person in charge of project.

(c) Locality of project.

(d) Purpose of project.

(e) Any results from last 12 months' investigations.

1. (a) University of Otago, Dunedin.

   (b) A.F. Mark.

   (c) Old Man Range and Coronet Peak.

   (d) Measurement of snowfall and study of snow cover characteristics.

   (e) Not available.

2. (a) Otago Catchment Board, Dunedin.

   (b) A.J. Gillies.

   (c) Upper Frazer Catchment.

   (d) Initial survey to asses means to carry out a complete snow survey scheme of the catchment area.

   (e) Not available.

3. (a) Hydrological Survey, Ministry of Works, Christchurch.

   (b) W.B. Morrissey.

   (c) Devil's Elbow Stream.

   (d) Rainfall - runoff - bed load relationships and effect of snow melt on flood peaks.

   (e) Some results to date, but snow work unpromising, mainly due to practical field problems not yet solved.

4. (a) N.Z. Forest Service - Forest Research Institute, Rangiora.
   (b) J.Y. Morris.
   (c) Broken River headwaters - Craigieburn Range.
   (d) To work out a suitable technique for snow survey sampling in mountainous terrain.
   (e) The 1962 winter measurements not yet evaluated.

5. (a) Antarctic Division, D.S.I.R., Wellington.
   (b) A.J. Heine.
   (c) Mount Ruapehu.
   (d) Winter snow cover recording by visual and photographic means, and the recording of the state of all the glaciers during the autumn of each year.
   (e) March 1962 observations showed a general retreat of glacier snouts over previous years' records. The winter of 1962 was one of the poorest on record. Up to September, the mean monthly temperatures were consistently above average and little precipitation fell as snow.

6. (a) N.Z. Geological Survey, Dunedin.
   (b) I.C. McKellar.
   (c) Tasman Glacier.
   (d) To assess the annual budget of the Tasman Glacier and, by photographic means, record surface changes in the glacier.
   (e) Data being evaluated at present time.