III.3. FIELD DESCRIPTION OF PERMAFROST *

J. A. Pihlainen and G. H. Johnston

(Summary)

The need for adequate investigations of permafrost conditions for an engineering appraisal at northern sites is generally recognized. To the present time, however, no uniform procedure has been used for collecting and reporting such information. A suggested method for describing permafrost conditions in the field is presented, primarily for use by engineers but also for others through adaptation.

Permafrost is defined as the thermal condition under which earth materials exist at a temperature below 32°F continuously for a number of years. Although a number of factors affect the occurrence and existence of permafrost, many are quite complex and not easily measured or described in the field. The descriptive system is, therefore, based on a recognition of terrain features which can be more readily assessed in a qualitative manner. Pertinent information should be collected on terrain features which exist on the ground surface -- vegetation and snow cover, relief and drainage; and below the ground surface -- soil type and ice phase.

The vegetative mantle of trees, shrubs, moss, lichen and other plants that covers much of the north acts as an insulator to protect and maintain permafrost. The vegetation should be described using the system outlined in the "Guide to a Field Description of Muskeg" (Technical Memorandum 44) published by the Associate Committee on Soil and Snow Mechanics of the National Research Council of Canada. Although snow is basically a part of the climate, snow cover is generally considered as a terrain factor. The type of snow, the depth of snow cover and their variability over a site throughout the winter season should therefore be observed. Terrain relief influences permafrost occurrence and since it is also a significant factor in drainage, it is an important engineering consideration. Notes on relief features should not be restricted only to the specific location under investigation but should include all of the region in the vicinity of the observation locations and, in addition, small scale or micro features.

The subsurface observations include those of the depth of thaw which is affected by and closely related to terrain features. Records

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* The complete field description will be published in booklet form in the Technical Memorandum series of the Associate Committee on Soil and Snow Mechanics of the National Research Council.

of the depth of thaw should include notes on the date of observation, vegetative cover, relief, drainage and a description of the subsurface materials in the various areas investigated. For engineering purposes, it is convenient to describe the soil and ice phases independently. Mineral soils may be described according to the "Guide to a Field Description of Soils" (Technical Memorandum 37) published by the Associate Committee on Soil and Snow Mechanics; organic soils according to the system outlined in the "Guide to a Field Description of Muskeg" (Technical Memorandum 44).

The descriptive system for the ice phase is based on the form of ice found in frozen materials. It is not intended that this system be an assessment of frozen materials according to properties or performance. For descriptive purposes, frozen materials are divided into three major groups in which the ice is --

1. Not visible by eye
2. Visible by eye with individual ice layers less than 1 inch in thickness, and
3. Visible by eye with individual ice layers greater than 1 inch in thickness.

It is hoped that this suggested field description of permafrost will be utilized by scientists and engineers both in Canada and the United States. It is conceded to be only a first approach to the fundamental descriptive requirements of permafrost and, accordingly, all comments and criticisms will be welcomed.

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Discussion

T. A. Harwood asked how Dr. Radforth's "climafrost" can be included in the original definition of permafrost. J. A. Pihlainen stated that there are many terms associated with permafrost which have been introduced into both the English and Russian literature. It is possible to use any of these terms including "climafrost" in this proposed field descriptive system if the terms are defined and translated into the system.

A. Thorley wanted to know how the presence of permafrost can be detected in a sand with a low moisture content. Pihlainen replied that sands with low moisture content are friable. The bonding characteristics should be noted.

G. Jacobsen remarked that, according to S. W. Müller's definition, permafrost includes material which remains frozen for two years or more. The definition of permafrost in the field descriptive system should be the same. Pihlainen answered that the phrase "number of years" can include two years. The possibility of the presence of

seasonal frost which persists for a few years and then dissipates is acknowledged.

N. W. Radforth commented that it appears that many of the terms that we are dealing with have the suffix "frost". The authors acknowledge the presence of climafrost which demonstrates the flexibility of the field descriptive system. In the definition of permafrost, the number of years should be pinpointed. In depth of thaw observations, the year should be noted in addition to the month and day. The use of the "Guide to a Field Description of Muskeg" applies only to organic terrain. Pihlainen emphasized that this proposed field descriptive system is only meant as a first approximation. It must be tried in the field to see how applicable it is and to improve it. T. Lloyd added that the suggested field descriptive system has the important advantage of being universally applicable, independent of any particular language or local situation.

R. J. E. Brown reported that the problem of permafrost nomenclature is receiving attention in both Canada and the United States. Recently there has been a proposal to form a task committee on Frost and Permafrost nomenclature of the American Society of Civil Engineers. This task committee will consist of six members - three Canadian and three American. The proposed Canadian members are: T. A. Harwood, Defence Research Board, Ottawa; J. R. Mackay, Department of Geography, University of British Columbia; R. J. E. Brown, Division of Building Research, National Research Council. The proposed American members are: F. Hennion, U. S. Corps of Engineers, Washington; A. W. Johnson, Highway Research Board, Washington; A. L. Washburn, Department of Geology, Yale University. It is hoped that this task committee can achieve some uniformity in the definition and use of permafrost terms.