

## REVIEWS

FROST ACTION IN SOILS. A Symposium. Highway Research Board, Special Report No. 2, National Academy of Sciences National Research Council, Washington, D.C., Publication 213, 1952. iv+385 pages.

THIS symposium comprises nearly forty papers, prepared at the request of the Highway Research Board Committee, on Frost Heave and Frost Action in Soil. There is a wider diversity of subject-matter in the report than anyone unfamiliar with the engineering literature on frost action might expect. The papers and their references provide a good introduction in one volume to the otherwise scattered literature.

The papers are grouped into the following six sections in the report:

Climate and distribution of soil.

Soil temperature and thermal properties of soils.

Soil moisture and moisture movements.

Basic data pertaining to frost action.

Frost action and spring break-up.

Remedies and treatments.

Mention will be made only of some of those papers of interest to the glacial geologist. There are many other papers of interest to the road engineer.

A paper entitled "Interpretation of permafrost features from air photos," by R. E. Frost, includes a good selection of air photographs of frozen-ground patterns with the object of helping the engineer to predict engineering construction difficulties.

In the field of slope instability and solifluction P. A. Siple rightly stresses as a major factor the impeded drainage of the thaw water caused by the underlying frozen ground.

R. S. Sigafoss and D. M. Hopkins in another paper discuss the forms of movement of thawing ground on Arctic hillsides.

In the section of Soil Temperature and Thermal Properties of Soils, C. B. Crawford provides a useful review of the literature on soil temperatures in cold climates, and there are two papers on instrumental methods of measuring the thermal constants of soil by transient heating methods. M. S. Kersten gives a summary of his recent work on the thermal constants of frozen and unfrozen soil, but this paper and two others on heat transfer are placed curiously in the section on Basic Data Pertaining to Frost Action. In that section too there is a very comprehensive theoretical paper by H. Carlson on the "Calculation of depth of thaw in frozen ground." The method is practical and has checked reasonably with actual observations.

J. F. Haley and C. W. Kaplar in "Cold-room studies of frost action in soils" describe the programme of work and the equipment for studying frost susceptibility of soils in the Frost Effects Laboratory of the U.S. Corps of Engineers. It would be interesting to see included in this study measurements of water movement and of water potential during the freezing process despite the difficulties of this measurement.

In geological literature there are numerous papers on the frozen-ground patterns of Arctic tundra arising from brief summer visits of the authors. Most visitors have only seen the latter part of the thaw season. The fascination of these patterns seems conducive to the production of speculative theories of the origin of the patterns, sometimes without due regard for simple physics and mechanics. These papers have, however, served the purpose of describing the outward form of the patterns. There is no urgent need for further descriptions and the reviewer was glad to see no speculative theories of the formation of patterned ground in this report. Anyone contemplating studies in the patterned ground of the Arctic would do well to study this symposium and the literature referred to therein. He should pursue an instrumental field study of frozen-ground physics for a number of consecutive seasons at an Arctic research establishment. Then a subsequent symposium might include more basic data on the physics of frozen ground than has been possible in the present one.

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