

VI — Papers Presented by the Soviet Delegation in the USA

A delegation of six Soviet soil scientists and engineers visited the United States, May 31-June 21, 1959, in an initial exchange of experiences in the field of soil mechanics research and its application to foundation engineering. The delegates visited laboratories and observed experiments at several universities and were shown field construction jobs and sites on both East and West Coasts and elsewhere. Their technical papers were presented at five seminars.

The visit was sponsored jointly by the American Society of Civil Engineers, the U. S. National Committee of the International Society of Soil Mechanics and Foundation Engineering, and the Highway Research Board of the National Academy of Sciences-National Research Council.

The Soviet engineers had luncheon in Moscow on May 31 and sat down for sup-

per in New York City the same evening. The time-span limit has been reduced, Ivan M. Litvinov, chairman of the visiting delegation, remarked until the "expansion of communications between the Soviet Union and the United States have become limitless for the development of friendly business and scientific relations by our scientists and specialists . . . and will contribute to a quiet, peaceful life on our, as yet, insufficiently firm earth globe."

The USSR visitors held their first scheduled seminar at Princeton University. This was followed by four other seminars and visits to Rutgers, Columbia and Harvard Universities, the Massachusetts Institute of Technology, Purdue University, the University of Illinois and the University of California at Berkeley. The concluding seminar was held at the National Academy of Sciences in Washington, D. C.

Introductory Remarks First Soil Mechanics Seminar for the Visiting Engineers from the USSR

FRED BURGGRAF, *Director,*
Highway Research Board,
National Academy of Sciences-National Research Council
(Princeton University, June 3, 1959)

Civilized man has, no doubt, always been cognizant of some of the properties of soils, since he first recognized his footprints in the sand. He built his home of sun-dried brick made from mud. As a progressive-minded farmer, from earliest times to today, he has been keenly aware of the effect of moisture content in the manipulation of soil and has used that knowledge as a guide to commencement of tillage and even to the herding of his animals following wet weather.

As his experience increased and his knowledge accumulated he built earth dams and founded bridges and larger buildings on soil. Slowly he became aware of settle-

ments and of conditions of overstress. Thus, it is always difficult to place one's finger on some specific point in man's progress and say, here was the beginning of soil science or, here the engineer began to use science for the development of what we now know as soil mechanics.

Neither can we single out one nation nor one man as the forefather of soil mechanics, for here as in other scientific endeavors, it is significant that new-found knowledge often springs forth in widely separated places simply as a product of the time and due to different approaches.

There have been some outstanding indi-

viduals in the developments in soil mechanics, men who have given shape and dimensions to new ideas. For example, men who developed the pedological system of soil classification, the theory of consolidation, the moisture-density relationship in soil compaction, the present concept of the phenomenon of frost heaving and the currently used concept of swelling pressure, to name only a few. The problems in the field have hardly been more than surface explored.

There are among you who meet here today and who will meet at other points, some of those responsible for new findings which give even better definition to dimensions than those previously used. Those of you who are studying soil freezing and permafrost, the response of soil to vibration and to repeated rapidly applied loadings or impact, exemplify my point. Without doubt, you can name a host of others of equal significance.

Wherever we may now be in our progress of development of this young science of soils mechanics and where our future lies, depends in large measure on individuals now in this room, for you are recognized leaders in the field. That development could take a slow pace if each of you elected to

work as an individual and to jealously guard your findings, or that development could be rapid and its benefits be made available to all men quickly if you pool your knowledge through cooperative visits such as this one. The American Society of Civil Engineers and the Highway Research Board of the National Academy of Sciences are organizations whose very existence depends upon cooperation in the solution of engineering problems.

It is my great privilege as director of the Highway Research Board to welcome our distinguished Soviet technical visitors to this the first of five seminars to be held in this country during their three-week visit. We have looked forward to this occasion as one of signal importance and promise. By exchanging ideas and pooling experiences derived from a variety of studies in the two countries we can do much in furthering our knowledge of soils in the field of engineering and in making possible similar future meetings of mutual benefit.

In conclusion, I would like to express my sincere gratitude to each of you who have come to contribute your ideas and experiences, for from a better knowledge of soil mechanics will come better solutions to our soil engineering problems.

Problems of Frozen Soil Mechanics in Engineering Practice

NIKOLAI A. TSYTOVICH, *Chairman,*

National Association of Soil Mechanics and Foundation Engineering, USSR

SUMMARY OF THE REPORT

More than a quarter of the world's land and about 47 per cent of the USSR territory are covered by permanently frozen soils (*Fig. 1*).

Construction on permanently frozen soils is associated with many specific features, which, if not taken into consideration, cause inadmissible deformations quickly destroying structures (*Fig. 2*).

The deformations of structures built on permanently frozen soils are due to their settling at unproportional thawing and the heaving of soils and foundations at freezing (*Figs. 3, 4, 5, 6, 7*).

These deformations are the results of peculiar properties of frozen soil and are caused by sharp alterations of their volume and structure both at freezing and thawing (*Fig. 8*).

The proper solution of the problems of construction on permafrost is possible on the basis of a new science—mechanics of frozen soils—the application of which allows safe and economical design of the constructions.

The main contemporary problems are:

1. Consideration of the parameters and the determination of stress-strained state of frozen soils.