Doolittle, NENTC

United States Department of Agriculture

Soil Conservation Service

National Soil Survey Center, MNTC
Federal Building, Room 345
100 Centennial Mall North
Lincoln, Nebraska 68508-3866

Subject: SOI - Reports - Trip Report - Ground Penetrating Radar (GPR) Study - August 3-10, 1988

Date: August 25, 1988

To: Burton L. Clifford
State Conservationist
SCS, Anchorage, AK

File code: 430-7

Purpose:
To become familiar with the soil survey program in Alaska, to study mapping and classification problems associated with soils having permafrost and to determine whether GPR is a useful tool for identifying permafrost, ice-wedges and contrasting materials in frozen soils.

Participants:
Joseph Moore, Acting State Soil Scientist, SCS, Palmer, AK (part-time)
Joseph White, Party Leader, North Star Survey, SCS, Fairbanks, AK
Doug Van Patten, Soil Scientist, SCS, Homer, AK (part-time)
Larry F. Ratliff, Supervisory Soil Scientist, NSSQA Staff, MNTC, SCS, Lincoln, NE
Robert I. Turner, Soil Scientist, NSSQA Staff, MNTC, SCS, Lincoln, NE
James A. Doolittle, Soil Scientist, Soil Survey Investigations Staff, NENTC, Chester, PA

Activity:
Thursday morning was spent reviewing a videotape on permafrost, observing some housing and road construction problems resulting from permafrost and touring a permafrost tunnel near the University of Alaska at Fairbanks. Thursday afternoon we observed several soil sites with and without permafrost. During this period Mr. Doolittle got the GPR unpacked and ready to operate. On Friday, Monday, and Tuesday we used the GPR in the field and compared information from the GPR with on-site field observations. Transects were made from an uncleared area, across a cleared area with an artificially constructed ice wedge and back into an uncleared area. Several borings indicated a good correlation with the depth to permafrost and to the ice wedge. We also transected other cleared (or burned) areas and uncleared areas in silty soils, soils with bedrock within the control section, silty soils with stratified material in the lower part and soils formed in sandy and gravelly stratified material.

Recommendations:
Mr. Doolittle is making the detailed technical report. It appeared possible to detect permafrost, bedrock, and contrasting stratified areas

with the GPR. The presence of bedrock and contrasting stratified material appears to be detectable in and below the permafrost. In wet silty material the maximum penetration appears to be about 1 1/2 meters. In moist to dry sandy or gravelly material, the maximum penetration may be as great as 8 meters. GPR shows only contrasts in the material through which its beam is transmitted. The depth to the various contrasting materials and the nature of them can only be determined by on-site examination along the transect of the GPR printout. It is possible to pick up ice wedges but it is very difficult to know their size or depth. In addition, the possibility of an error of omission indicates GPR should not be used for this purpose.

Technology Transfer:
Mr. Doolittle's report will discuss the use of the GPR in greater detail but it appeared that the lack of road access plus the heavy vegatative cover will restrict the use of the GPR in interior Alaska mainly to special studies. It does not appear to be a tool that can be used for routine mapping or documentation because of both the access problem and the difficulty in obtaining ground truth in and below the upper boundary of the permafrost. If access were available, the GPR could be used to provide additional documentation on the varability within map units of soils with or without permaforst but would require considerable ground truth to determine the nature of the variation. Possibly an operator with considerable local experience interpreting the GPR printout could predict the nature of the contrasting materials and expand the GPR's useability beyond that observed in this brief study.

We enjoyed working with your staff and are looking forward to additional trips to Alaska.

Robert I. Turner
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National Soil Survey Quality
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cc:
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