Proposal for study of gravel mat foundations for Eskimo Cabins at E-3 (The New Aklavik Townsite)

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SUBJECT Proposal for Study of Gravel Mat Foundations for Eskimo Cabins at E-3 (the New Aklavik Townsite).

At the 19th meeting of the Aklavik Subcommittee of A.C.N.D. held on June 1, 1956, the question of foundations for Eskimo cabins in the unserviced area was discussed. It was noted that pile foundations had previously been recommended at a liaison meeting between the Department of Northern Affairs and National Resources and the Department of Public Works on February 2, 1956 and that, on the basis of present information, pile foundations appeared to be the most satisfactory for these cabins. It was also noted that 90 of these cabins were to be built this year and were to be placed on temporary gravel mat foundations because the pile foundations would not be ready until next year. These cabins were to be moved to their permanent pile foundations in 1957.

The Committee discussed the possible economies of using gravel mat foundations as permanent foundations in place of piles, and suggested that the question of foundations for Eskimo cabins in the unserviced area should be reviewed. It was further suggested that the cabins to be constructed on temporary mat foundations this year be treated as an experimental installation and their performance observed during the coming winter. The information obtained in this way would be used as a guide in deciding next year whether gravel mat foundations would be acceptable as permanent supports for these cabins. It was agreed that the Division of Building Research of the National Research Council would submit recommendations concerning the details of this project.

The Division's proposal was tabled at the 20th meeting of the Aklavik Subcommittee held on June 15, 1956. This proposal was designed specifically for the short-term study which the Committee had in mind. The number of buildings and observations recommended were kept to a minimum, consistent with obtaining useful results in the time available. It was explained to the Committee that a study of such limited duration as one year cannot be expected to be conclusive. At best it can serve only as a guide to the problems that may arise. The Committee accepted the Division's

proposal, recommended it be implemented and asked the Division to pass it to the Department of Public Works for action. The following is the Division's proposal.

Statement of Problem

Experience with the gravel mat type of surface foundation in permafrost areas suggests that they do not preserve the thermal regime and hence cause the eventual lowering of permafrost under a building. This thawing of the permafrost may introduce problems of settlement and of drainage. The severity of these problems varies with such factors as soil conditions, method of construction of both buildings and foundations, as well as the heating and operation of the building.

On the basis of soil data already obtained by the Foundation of Canada Engineering Corporation Limited, it appears that in all areas of E-3 some settlement is likely to result if the permafrost is thawed. The object of the proposed study is to indicate the possible extent of this settlement under cabins constructed on gravel mat foundations and the effect of such settlement on the performance of the building. This can best be done by observing any changes in the level of the permafrost beneath each building and the extent of differential movement of the structure itself.

There are several possible variables in a study of this kind. These include:

1) Ground cover,
2) Soil conditions,
3) Thickness of gravel mat,
4) Height of air space,
5) Insulation value of floor construction.

Since the study will last only one year it is desirable to keep these variables to a minimum. In addition, owing to the work involved in making the necessary observations on the performance of the buildings, the number of buildings under controlled study should be as small as practicable.

Proposal

It is recommended that:

a) All buildings be built in an area of vegetative cover and this natural cover be preserved;

b) The buildings be located in an area where the soil conditions approximate the conditions in the unserviced area;

c) The floors of all buildings be constructed to meet the minimum requirements for the proposed building code for Aklavik. This

will mean that the floors be insulated with 2 inches of mineral wool or its equivalent. It is also strongly recommended that the underside of the floor joists be sheathed with $\frac{1}{4}$-inch plywood to obtain wind tightness and to protect the insulation;

d) The buildings subject to controlled study be constructed in five groups of four buildings each with variations only in the thickness of gravel mat and in the height of air space as follows:

(i) Group I: No gravel mat - the mud sill foundations to be placed directly on the ground;

No air space - no attempt to provide a ventilated air space between the underside of the building and the surface of the ground.

(ii) Group II: Two feet of gravel mat;

No air space.

(iii) Group III: Four feet gravel mat;

No air space.

(iv) Group IV: One foot of gravel mat;

18- to 24-inch air space - this space between the underside of the building and the surface of the gravel mat to be well ventilated to the outside.

(v) Group V: Two feet of gravel mat;

18- to 24-inch air space - well ventilated.

e) The remaining 70 buildings to be constructed this year not to be used as a controlled study. If these are to be placed in a temporary location they should be built as economically as possible consistent with reasonable protection of the thermal regime. These could be constructed using a one-foot gravel mat and a ventilated air space beneath the floor of approximately 18 inches. If these buildings are to be placed in their permanent location this year then the gravel mat should be at least 2 feet thick. The performance of these buildings should be observed during the winter and reported on at the end of the period with particular reference to snow accumulation and blocking of the air space beneath the buildings.

Observations

To obtain information on changes in the level of permafrost and on the differential movement of buildings that may occur in a

period of one year the controlled study should begin and end at a time when the active layer is at its greatest depth. This means from August 1956 to August 1957. The procedure recommended is as follows:

(i) Prior to placing the gravel mat the area under each building should be rodded in August 1956 to determine the general level of the permafrost table. Five probings will probably be sufficient, one at each corner of the building and one in the middle,

(ii) The profile of the ground surface at each building location should be determined relative to some fixed known reference point,

(iii) The gravel mat should be placed to the required thickness and each building should be set to a known elevation depending upon the height of air space,

(iv) In August of 1957 these measurements should be repeated.

The readings obtained by the above means will indicate the changes that have occurred in both the permafrost and each building during the period of one year's operation. The general condition of each building and each site should also be reported at that time.

It is almost essential that some record be kept of the use and occupancy of these 20 test buildings. This should include at a minimum details of the periods during which these buildings are occupied and heated. It would also be useful, personnel permitting, to have records of temperatures to which the buildings are heated and of snow accumulations around the buildings. Temperature and humidity readings taken in cabins occupied by Eskimo families would also be of value as they would provide data on their living habits.

General Comments

It should be noted that this controlled study of these 20 buildings will depend upon:

1) Their construction being scheduled in late August or early September;

2) The availability of personnel to establish ground elevations just prior to placing the gravel mat and to make a level survey of the buildings shortly after they are up;

3) The availability of personnel to complete the necessary rodding of the area to establish the elevation of permafrost; and

4) General supervision of these buildings during the winter months being provided to ensure that where air spaces are used these are not intentionally blocked by the occupants to conserve heat.

The installation of thermocouples has not been proposed because a large number of these would be required to establish the location of the permafrost table and it is felt that this could be achieved with less effort by rodding. It is recommended that a detailed analysis of soil conditions not be attempted until the year's study is completed and some indication of the performance of these buildings obtained.