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# FROST INVESTIGATION 1945-1946

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REPORT ON  
DOW FIELD, BANGOR, MAINE

TECHNICAL REPORT  
NUMBER 9



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CORPS OF ENGINEERS, U.S. ARMY  
U.S. ENGINEER OFFICE, BOSTON, MASS.  
JUNE 1946

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APPENDIX I  
TO COMPREHENSIVE REPORT  
DATED JUNE 1946

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APP-1

WAR DEPARTMENT  
U. S. ENGINEER OFFICE  
BOSTON, MASSACHUSETTS

APPENDIX 1

REPORT ON  
DOW FIELD, BANGOR, MAINE

FROST INVESTIGATION  
1945-1946

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FROST INVESTIGATION

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FROST INVESTIGATION  
1945 - 1946

APPENDIX 1

REPORT ON  
DOW FIELD, BANGOR, MAINE

1. Authorization. The 1945-1946 frost investigation program was authorized by the Chief of Engineers by letter to the Division Engineer, New England Division, dated 4 August 1945, subject "Frost Investigation During Fiscal Year 1945-1946" and subsequent indorsements, File SPEER.
2. Purpose. The purpose of this investigation has been the determination of development of frost action in the soils underlying airfield pavements as affected by various conditions of weather, soils, and ground water, and to augment the tests made and data obtained from the frost investigations conducted at Dow Field, Bangor, Maine during 1944-1945.
3. Scope. This report presents the results of the frost investigation conducted at Dow Field, Bangor, Maine during the period from 11 October 1945 through June 1946. The investigation at Dow Field includes four test areas in which observations were made of ground water table, subsurface temperatures, frost penetration, ice segregation, water content, and density. Plate bearing tests were conducted. The climatic and other general conditions related to the frost investigation at Dow Field also are included in this report.
4. General Conditions.
  - a. Location, Terrain, and Drainage. Dow Field is located approximately two miles west of the city of Bangor in Penobscot County, Maine. Plate 1 shows the geographical location of the airfield in the Boston District. The field is located in an area of rolling terrain with hills

composed of a thin mantle of slightly gravelly silt (glacial till) overlying bed-rock. In the low areas between the hills a deposit of firm, brown to grey silty clay overlying the glacial till or bed-rock is found. There are a few bed-rock outcrops in the airfield area. The drainage system consists of paved gutters, ditches, culverts, pipe drains and catch basins. Surface water from the landing strips is generally collected by longitudinal open ditches placed parallel to the outer edge of the landing strips. The ground water varies from approximately 2 feet to more than 6 feet below the surface.

b. Types of Pavement. All the airfield pavements are of the flexible type with the exception of approximately 276,000 square yards of portland cement concrete aprons, warm-up aprons, turnarounds and hardstands. The turnarounds and warm-up aprons at the ends of the runways are paved with seven inches of portland cement concrete with the outside lanes and lanes adjacent to longitudinal expansion joints uniformly thickened to 10 inches. The portland cement concrete pavement was placed on approximately 20 inches of well graded sand and gravel (GW). The runways are paved with 3.5 inches of bituminous concrete for a width of 150 feet placed on a well graded sand and gravel base (GW) of variable thickness, (32 to 50 inches). The shoulders 75 feet on each side of the runway are bituminous surface treated gravel.

c. Previous Frost Investigations. An investigation consisting of field and laboratory tests during the freezing period, and traffic tests and field and laboratory tests during the frost melting period were made during the winter and spring of 1944. This investigation is covered in a report entitled "Frost Investigations and Pavement Behavior Test, Dow Field, Bangor, Maine", January 1946. The investigation of 1944 was augmented by a

more comprehensive investigation during the fiscal year 1944-45, which is reported in "Report on Dow Field, Bangor, Maine," Appendix 1 to "Comprehensive Report Frost Investigation 1944-1945," dated June 1945. The program consisted of installation and subsequent periodic observations of ground water wells and subsurface temperature recording devices. It also included measurements of pavement heave, excavation of test pits to determine the variation in water content and density of the base and subgrade soils affected by frost action and the conditions affecting frost. Plate bearing tests were conducted at periodic intervals of time, and traffic tests were conducted during the frost melting period. The frost investigation program conducted in the fiscal year of 1944-1945 is covered by "Comprehensive Report Frost Investigation 1944-1945", dated June 1945 and Appendices 1 to 15 inclusive. References to this report will be designated as "Frost Investigation 1944-1945" and to specific appendices of this report as "Appendix - - Frost Investigation 1944-1945". The installations for measurements of ground water and subsurface temperatures made during the previous investigations have been utilized in the present investigations covered by this report.

d. Weather Data. The winter temperatures at Dow Field are considered moderately severe with a normal (10 year) freezing index of 1275. The normal precipitation for the four month period September to December inclusive is 13 inches. The freezing index for 1945-46 was 1421 while 22 inches of precipitation occurred in the four months, September to December inclusive. The excess precipitation occurred during the period 25-30 December 1945 with ground frozen from one and one-half to three feet. Precipitation which occurred prior to freezing period was approximately normal. A summary of the weather data is included as Plate 2.

5. Definitions. The description of the tests and analysis of results involve a specialized use of certain terms and words. These words and terms are defined for use in this report as follows:

a. Test Area. The test area is the portion of the airfield selected for observations and investigations.

b. Pavement. The term pavement is defined as a covering of a prepared or manufactured product superimposed upon a subgrade or base to serve as an abrasive and weather resisting structural medium.

c. Base. The term base applies to the course of specially selected soils, mineral aggregates or treated soils placed and compacted on the natural or compacted subgrade.

d. Subgrade. The term subgrade applies to the natural soil in place or to fill material upon which a pavement or base is constructed.

e. Frozen Soil. Frozen soil is referred to in this report as follows:

(1) Homogeneous Frozen Soil. A homogeneously frozen soil is a soil in which all the water in the soil is frozen within the natural voids existing in the soil, without observable accumulation of ice lenses or frost forms exceeding in volume such natural void spaces.

(2) Stratified Frozen Soil. A stratified frozen soil is a soil in which a part of the water in the soil is frozen in the form of observable ice lenses, occupying space in excess of the original soil voids.

f. Ice Crystals. The formation of ice particles found in the pores of homogeneous frozen soil is referred to as ice crystals.

- g. Ice Lenses. Ice lenses are the ice formations in stratified frozen soil occurring in repeated layers essentially parallel to each other and normal to the direction of heat loss.
- h. Frozen Zone. The limits of depth within which the soil is frozen is referred to as the frozen zone.
- j. Frost Penetration. The maximum depth from the surface to the bottom of the frozen soil.
- k. Depth of Freezing Temperature Penetration. The depth of freezing temperature is the maximum depth below the surface of freezing temperature.
- l. Frost Action. Frost action is the accumulation of water in the form of ice lenses in the soil under natural freezing conditions.
- m. Frost Heave. Frost heave is the raising of the pavement surface due to the accumulation of ice lenses. The amount of heave in most soils is approximately equal to the cumulative thickness of ice lenses.
- n. Frost Susceptible Soil. Frost susceptible soil is a soil in which frost action is possible. Any soil which contains three per cent or more by weight of grains smaller than 0.02 mm in diameter shall be considered a frost susceptible soil.
- o. Non-Frost Susceptible Materials. Non-frost susceptible materials are crushed rock, sand and gravel, gravel, slag, cinders or any other cohesionless material in which frost action is not possible.
- p. Normal Period. The normal period is the time of year, summer and fall, when there is no reduction in strength of foundation materials due to frost action.
- q. Freezing Index. Freezing index is a measure of the combined duration and magnitude of below freezing air temperatures occurring during any given winter.

r. Normal Freezing Index. Normal freezing index is the freezing index computed for normal air temperatures based upon a long period of record usually 10 years or more.

s. Ground Water Table. The ground water table is the free water surface nearest to the ground surface.

t. Density. Density is the unit dry weight in pounds per cubic foot.

u. Water Content. Water content is the ratio, expressed as a percentage, of the weight of water in a given soil mass to the weight of solid particles.

6. Test Area D.

a. Type of Pavement, Base and Subgrade. Test Area D, 75 feet x 80 feet, is located on the bituminous concrete paved East-West Runway between stations 8 / 20 and 9 / 00 from the centerline to the north edge of the pavement. The test area is within the limits of Test Area C, 1944-45 Frost Investigation (which was located between stations 3 / 00 and 10 / 00) and was selected on the basis of pavement, base and subgrade conditions and the proximity of existing installations. The pavement consists of 3.5 inches of bituminous concrete placed on a well-graded sand and gravel base (GW) with an average thickness of 39 inches, ranging from 36 to 49 inches. The subgrade consists of silty clay (CL) overlying at depths greater than six feet a silty glacial till (GC). Plan and profile of the test area are shown on Plate 3.

b. Explorations. Five test pits were excavated during the winter and spring to determine the depth of frost, ice lens and ice crystal formations during the freezing period, and soil conditions during and after the frost melting period. Two auger borings were excavated for the installation

of observation wells in the subgrade. The locations of the explorations are shown on Plate 3. A chronological summary of the explorations is presented in Table 1, and the data obtained from the explorations are shown in Table 2.

c. Installations.

(1) General Location. Two observation wells in the subgrade and one thermometer well installation were installed in Test Area D. Two observation wells in the base were installed adjacent to the area. The area contained one existing subgrade observation well, and adjacent to the area was one existing base observation well. The locations of all installations are shown in plan on Plate 3.

(2) Observation Wells in the Gravel Base. The new observation wells in the gravel base consisted of 3/4-inch galvanized iron pipe capped with a standard galvanized iron coupling and plug. A small steel rod was welded across the outside of the coupling to prevent turning of the coupling when the plug is being removed. The 3/4-inch pipe contained a wooden plug in the bottom end. The lower portion of the pipe was perforated with 1/8-inch holes at every 90 degrees of circumference. The perforations, spaced 2 inches apart vertically, extended up from the bottom of the pipe a distance of one to three feet dependent on the depth of the well. Two similar holes were drilled in the pipe six inches from the top. The wells were installed so that the bottom six inches were firmly

imbedded in the subgrade. The hole in which the pipe was set was backfilled with sand and gravel and sealed at the top with cement grout. Details of observation wells installed are shown on Plate 4.

(3) Observation Wells in the Subgrade. The new observation wells in the subgrade consisted of a 3/4-inch galvanized iron pipe with a standard galvanized iron coupling and plug on the upper end and a standard pipe cap on the lower end. A small steel rod was welded across the outside of the coupling to prevent turning of the coupling when the plug is being removed. The lower eight feet of the pipe was perforated with 1/8-inch holes spaced at 90 degrees around the pipe and 4 inches apart vertically. The hole in which the pipe was set was backfilled with coarse clean sand up to within 12 to 15 inches of the top of the subgrade. The hole was then backfilled to the top of the subgrade with cement grout. From top of subgrade to the top of gravel base the hole was backfilled with sand and gravel. The top of the hole was sealed with cement grout. Details of observation wells installed are shown in Plate 4.

(4) Thermometer Wells. The thermometer well installation consisted of eight separate wells, installed at predetermined depths which vary by approximately one foot intervals from 0.6 foot to eight feet. Each well consisted of one inch diameter plastic pipe (Saran) plugged at each end with a rubber stopper. The lower end contained

not less than three inches of antifreeze in which was suspended a mercury thermometer. The thermometer was insulated from the tip of the bulb to the immersion line with paraffin and plastic tubing to allow sufficient time for withdrawing the thermometer without appreciable change in readings. The thermometers were withdrawn as rapidly as possible for readings. The top of the well consisted of a standard galvanized iron pipe nipple, three inches in diameter which was capped with a standard coupling and plug. The nipple was attached to the one inch plastic tubing by means of a rubber bushing which fitted tightly inside the pipe nipple. Details of the thermometer well construction and layout are shown on Plate 5.

- (5) Thermograph. A recording thermograph was installed 325 feet south of Station 14 / 50 on the E-W Runway. This location was also used during previous investigations. Continuous records of air temperature were obtained from the thermograph. These data were used to compute the freezing index for the period 1 November 1945 to 1 May 1946.

d. Observations and Measurements.

- (1) Water Table. The depth to ground water was measured from the surface of the pavement periodically in all observation wells. Seasonal variations in the ground water elevations as observed in the subgrade wells are shown as profiles on Plate 3. Observations covering the extent

of Test Area C, which contains Areas D and E, were considered in preparing the profiles. Observations of the subgrade wells indicate that in general the ground water elevations ranged from an average depth of 3.4 feet (approximate top of subgrade) on 28 November 1945 to an average depth of 7.0 feet on 4 March 1946. Readings obtained on 17 January 1946 averaged 4.6 feet. On 1 April 1946 the ground water table was at a depth of 3.6 feet and on 20 May 1946 the table had risen to an average depth of 3.0 feet. Table 3 is a summary of the ground water table observation.

- (2) Frost Heave. Pavement elevations on a 10 foot grid system were obtained prior to the freezing period and again at the period of maximum heave. These data were plotted in the form of the frost heave contours shown on Plate 7.
- (3) Frost Penetration. The excavation of one test pit T888PA on 28 November 1945 indicated that there was no frost in the ground on that date. Thereafter, the depth of frost penetration was determined by one test pit, T924P, on 21 December 1945, and by another, T936P, on 12 March 1946. The maximum frost penetration measured was 4.2 feet on 12 March 1946. The frost had completely left the ground on 25 April 1946 when another pit, T941PA, was excavated. A plot of frost penetration versus time is shown on Figure 3, Plate 2.
- (4) Subsurface Temperatures. A record of subsurface temperatures was obtained by periodic readings of the eight

thermometers in the thermometer well installation TW-3. A plot of typical subsurface temperatures versus depth for this installation is presented on Plate 8. The subsurface temperatures are summarized in Table 4.

- (5) Ice Lens Survey. Ice lenses were noted in the subgrade in test pit T936p, excavated on 12 March 1946. The lenses were widely isolated and disconnected and ranged from hairline to 1/16-inch thickness. Ice crystals were also apparent in the subgrade and there were a few crystals formed in the gravel base.

e. Field Tests.

- (1) Test Procedures. Test procedures are described in detail in "Appendix 14 Frost Investigation 1944-45". Any variations from the procedures are described in this report.
- (2) Plate Bearing Tests (Static Load). Four plate bearing tests were made on the bituminous concrete pavement in Test Area D to determine the relative strength of the pavement in November, April and June. One test was made in November prior to the freezing period, two in April during the frost-melting period, and one in June after the frost melting period. The load deflection curves of the static load plate bearing tests are plotted on Plate 9. Test data are summarized in Table 5.
- (3) Plate Bearing Tests (Repeating Load). Three plate bearing tests were performed on the bituminous concrete pavement in November, April and June. Test results are plotted on Plate 9 and summarized in Table 5.

(4) Water Content. Continuous water content samples were obtained in 4 test pits, T888 pa, T936 pa, T941 pa, and T945 pa excavated in November, March, April and June respectively. Water contents plotted against depth are shown in Figure 2, Plate 10. Water content samples were obtained with each density sample and the percentage of saturation was computed and the results are presented in Table 2.

(5) Density. The density and water content of the base and subgrade were obtained in 3 test pits, prior to the freezing period, during the frost melting period, and after the frost melting period. The densities were obtained to determine density changes due to frost action. The results of these tests are plotted in Figure 2 on Plate 10 in relation to the soil profile and are summarized in Table 2. Plots of water content versus density are shown in Figures 1 and 2 Plate 11.

f. Laboratory Tests.

(1) Soil Classification. No laboratory tests were conducted on samples of the base and subgrade materials. Since test Area D is located within the limits of Test Area C of the 1944-1945 Frost Investigation Program the results of classification tests on representative samples made during the investigation are considered applicable to Test Area D. The gradation of base and subgrade materials are shown in Figure 3 Plate 11. The physical properties of the representative samples of the base and subgrade materials

are shown in tabular form in Figure 4 Plate 11.

6. Summary of Results. Results of tests and observations for Test Area D are summarized as follows:

- (1) Soils. The frost susceptibility of the subgrade soil and the presence of frost susceptible soil in scattered pockets in the gravel base of Test Area C was established during the 1944-1945 investigation. The subgrade and base materials of Test Area D are considered to be frost susceptible.
- (2) Freezing Index and Precipitation. The freezing index of 1945-1946 was 1421 or 11 per cent above the normal freezing index. The rainfall during three months, September to November inclusive was 11.1 inches with the normal precipitation for the same period of 11.2 inches.
- (3) Ground Water. The ground water table was at or near the top of the subgrade during the fall and dropped progressively to a depth of seven feet during the freezing period. During the frost melting period it was at an average depth of 3.0 feet below the pavement surface.
- (4) Pavement Heave. The maximum frost heave in Test Area D was 0.10 foot. No detrimental effects occurred as a result of this slight heave.
- (5) Depth of Frost Penetration. The depth of frost penetration was 2.6 feet when the freezing index was 306. The maximum measured frost penetration was 4.2 feet. The maximum depth of freezing temperature penetration, as determined from thermometer well readings, was 4.1 feet.

- (6) Ice Segregation. Ice crystals were found throughout the frozen base and subgrade. Ice lenses were found widely isolated in the subgrade and ranging from hairline to 1/16 inch in thickness.
- (7) Soil Conditions.
- (a) Water Contents and Density. The water content of the base material showed a decrease from 13.5 per cent to 6.8 per cent from the normal period to the frost melting period. In the subgrade the water content was 21.7 per cent during the frost melting period compared to 17.7 per cent during the normal period. The density of the base was 128 pounds per cubic foot during the normal period and 139 pounds per cubic foot during the frost melting period. In the subgrade the density showed a decrease from 115 pounds per cubic foot during the normal period to 107 pounds per cubic foot during the frost melting period. No tests were made during the freezing period.
- (8) Effect of Frost Action on Subgrade Strength. Plate bearing tests indicate that there is a definite loss of pavement strength during the frost melting period. During the normal period the supporting capacity of a 30-inch diameter plate on the pavement was 1.5 times greater than that measured during the frost melting period. The first application of a 20,000 pound load on a 24-inch diameter plate produced approximately 1.5 times as much

deflection during the frost melting period as during the normal period. The fifth application produced the same difference in the relative deflections.

7. Test Area E.

a. Type of Pavement, Base and Subgrade. Test Area E, 75 feet x 80 feet is located on the bituminous concrete paved East-West runway between Stations 2 / 80 to 3 / 60 and from the centerline to the north edge of the pavement. The area is within the limits of Test Area C, 1944-1945 Frost Investigations (which was located between stations 3 / 00 and 10 / 00) and was selected on the basis of pavement base and subgrade conditions and the proximity of existing installations. The pavement consists of 3.5 inches of bituminous concrete placed on a well graded sand and gravel base with an average thickness of 35 inches ranging from 32 to 41 inches. The subgrade consists of silty clay (CL) overlying, at depths greater than six feet, a silty glacial till (GC). Plan and profiles of the test area are shown on Plate 3.

b. Explorations. Eight test pits were excavated during the fall, winter and spring to determine soil conditions, prior to the freezing period, the depth of frost penetration, ice lens and crystal formations during the freezing period and conditions after the frost melting period. Two subgrade observation wells were installed adjacent to the test area. The locations of the explorations are shown on Plate 3. A chronological summary of the explorations is presented in Table 1 and the data obtained in the explorations are shown in Table 2.

c. Installations.

(1) General Location. Installations consisted of one thermocouple installation, one thermometer well group, and two observation wells in the gravel base within the test area. Two observation

wells in the subgrade were installed adjacent to the area. Existing installations consisted of one observation well in the subgrade within the area and one observation well in the gravel base adjacent to the area. The location of all installations are shown on Plate 3.

(2) Thermocouple. The thermocouple installation was made in test pit T886pa. A detailed description of this type of equipment and the method of installation are presented in Appendix 11, Frost Investigation 1944-1945. The switch box was installed along the west edge of test pit T886pa and the thermocouples in the SW corner of the pit. Plan and typical layout of the thermocouple installation are shown on Plate 6.

(3) Thermometer Wells. The thermometer well installations are described in paragraph 6c(4) and the construction details are shown on Plate 5.

(4) Observation Wells. The observation wells in the gravel base are described in paragraph 6c(2) and the observation wells in the subgrade are described in paragraph 6c(3). Details of both types of wells are shown on Plate 4.

d. Observations and Measurements.

(1) Water Table. The depth to ground water was measured periodically in all observation wells. Seasonal variations in the ground water elevations are shown as profiles on Plate 3. Observations of all wells in Test Area C, which contains Areas D and E, were considered in preparing the profiles. Observations of the subgrade wells indicated that in general the ground water elevations ranged from

an average depth of 3.4 feet (approximate top of subgrade) on 28 November 1945 to an average depth of 7.0 feet on 4 March 1946. Readings obtained on 17 January 1946 averaged 4.6 feet in depth. On 1 April the ground water table was at a depth of 3.6 feet and on 20 May 1946 it had risen to a depth of 3.0 feet. Table 3 is a summary of the ground water table observations.

- (2) Frost Heave. Pavement elevations at intervals of 10 feet were obtained prior to the freezing period and again at the period of maximum heave. These data are plotted in the form of the frost heave contours shown on Plate 7.
- (3) Frost Penetration. The excavation of one test pit, T886pa, on 21 November 1945 indicated that there was no frost under the pavement at that date. Thereafter, the depth of frost penetration was determined by test pit T925p, on 21 December 1945, T927p on 10 January 1946, T932p on 6 February 1946, and T935p on 11 March 1946. The maximum frost penetration measured was 4.0 feet. No frost was encountered during excavation of one test pit, T938p, on 28 March 1946. A plot of frost penetration versus time is shown on Figure 3, Plate 2.
- (4) Subsurface Temperatures. A record of subsurface temperatures was obtained by periodic readings of the thermocouple installation at T886pa and the thermometers at thermometer well group TW2. Plots of typical subsurface temperatures versus depth are shown on Plates 8 and 12 for the thermometer wells and thermocouple installations

respectively. The subsurface temperatures are summarized in Table 6 and Table 7 for the thermocouple and thermometer well respectively.

- (5) Ice Lens Survey. Ice lenses were noted in the subgrade in test pit T935p excavated on 11 March 1946. They were isolated and disconnected, ranging from hairline to 1/16 inch in thickness, and occurred about two lenses per inch of depth from 3.1 feet to 4.0 feet. Ice crystals were also apparent in the subgrade. Occasional crystals were noted in the gravel base.

e. Field Tests.

- (1) Test Procedures. Test procedures are described in detail in "Appendix 14 Frost Investigation 1944-1945". Any variation from the procedures are described in this report.
- (2) Plate Bearing Tests (Static Load). Three plate bearing tests were made on the bituminous concrete pavement in Test Area E to determine the relative strength of the pavement in November, April, and June. The load deflection curves of the static load plate bearing tests are plotted on Plate 9. Test data are summarized in Table 5.
- (3) Plate Bearing Tests Repeating Load. Three plate bearing tests were performed on the bituminous concrete pavement in Test Area E to determine the relative strength of the pavement in November, April, and June. Test results are plotted on Plate 9 and summarized in Table 5.

- (4) Water Content. Continuous water content samples were obtained in four test pits to determine the water content of the gravel base and the subgrade prior to the freezing period, during the freezing period, during the frost melting period and after the frost melting period. Water contents plotted against depth are shown in Figure 1 Plate 10. Water content samples were obtained with each density sample and the percentage of saturation computed and the results are presented in Table 2.
- (5) Density. To determine the changes in density of the base and subgrade due to the frost action, density samples were obtained from three test pits during the normal, frost melting and after frost melting periods. The results of the tests are plotted on Plate 10 in relation to the soil profile and are summarized in Table 2. The plots of water content versus density are shown in Figures 1 and 2 Plate 11.
- f. Laboratory Tests.
- (1) Soil Classification. No laboratory tests were conducted on samples of the base and subgrade materials. Since the Test Area E is located within the limits of Test Area C of the 1944-1945 Frost Investigation program the results of classification tests on representative samples made during this investigation are considered applicable to Test Area E. The gradation of base and subgrade materials are shown in Figure 3 Plate 11. The physical properties

of the representative samples of the base and subgrade materials are shown in tabular form in Figure 4 Plate 11.

6. Summary of Results. Results of tests and observations for Test Area E are summarized as follows:

- (1) Soils. The frost susceptibility of the subgrade soil and the presence of frost susceptible soil in scattered pockets in the gravel base of Test Area C was established during the 1944-1945 investigation. The subgrade and base materials of Test Area E are considered to be frost susceptible.
- (2) Freezing Index and Precipitation. The freezing index of 1945-1946 was 1421 and 11 percent above the normal freezing. The rainfall during three months, September to November inclusive was 11.1 inches, which is approximately normal.
- (3) Ground Water. The ground water table was at or near the top of the subgrade during the fall and dropped progressively to a depth of seven feet during the freezing period. During the frost melting period it was at an average depth of 3.3 feet below the pavement surface.
- (4) Pavement Heave. The maximum frost heave in Test Area E was 0.20 foot. No detrimental effects occurred as a result of this slight heave.
- (5) Depth of Frost Penetration. The depth of frost penetration was 2.6 feet when the freezing index was 306, 3.0 feet when the freezing index was 440 and 3.7 feet when the freezing index was 1088. The maximum measured frost

penetration was four feet. The maximum depth of freezing temperature as determined by subsurface temperature readings was four feet.

(6) Ice Segregation. Ice crystals were found in the frozen gravel base and throughout the frozen subgrade. Ice lenses, widely isolated and disconnected, were found in the subgrade in thicknesses ranging from hairline to 1/16 inch.

(7) Soil Conditions.

(a) Water Contents and Density. The water content of the base material showed a decrease from 10.1 per cent to 9.4 per cent from the normal period to the frost melting period. In the subgrade the water content was the same during the frost melting period and the normal period. The density of the base increased from 136 pounds per cubic foot during the normal period to 139 pounds per cubic foot during the frost melting period. The density of the subgrade increased from 101 pounds per cubic foot during the normal period to 109 pounds per cubic foot during the frost melting period.

(8) Effect of Frost Action on Subgrade Strength. Plate bearing tests indicate that there is a definite loss of pavement strength during the frost melting period. During the normal period the supporting capacity of a 30-inch diameter plate on the pavement was twice as great as that measured during the frost melting period. The first

application of a 20,000 pound load on a 24 inch diameter plate produced over twice as much deflection during the frost melting period as during the normal period. The fifth application produced the same difference in the relative deflections.

8. Test Area F.

a. Type of Pavement, Base and Subgrade. Test Area F is located on the portland cement concrete pavement turn-around constructed in a cut area at the west end of Taxiway A (Sta. 1 / 50 to Sta. 2 / 50). The pavement consists of a uniform seven inch slab except that the outside lanes and lanes adjacent to the longitudinal expansion joints are uniformly thickened at the edges to 10 inches. The pavement was placed on a well-graded sand and gravel base (GW) with an average thickness of 21 inches. The subgrade consists of silty clay (CL). A plan and cross section of the test area are shown on Plate 3.

b. Explorations. Seven auger holes, for the installation of four observation wells in the subgrade and three observation wells in the base were excavated in Test Area F. One test pit T887pa, was excavated prior to the freezing period, three test pits T928p, T931p, and T934pa, during the freezing period to determine depth of frost penetration, two test pits, T937p, and T939pa, during the frost melting period, and one test pit, T947p, after the frost melting period. The locations of the explorations are shown on Plate 3. A chronological summary of the explorations is presented in Table 1 and the data obtained in the explorations is shown in Table 2.

c. Installations.

(1) General Location. Installations consisted of three observation wells extending to the bottom of the gravel base

and four observation wells extending to a depth of 15 feet for determining ground water level in the subgrade. In addition, one thermometer well group, (TW-1) was installed in the vicinity of an existing thermocouple installation in Test Area A (1944-1945 investigations). Observations from these installations are considered representative of Test Area F. Location of installations are shown on Plate 3.

- (2) Thermometer Wells. The thermometer well installations are described in paragraph 6c(4) and the construction details are shown on Plate 5.
- (3) Observation Wells. The observation wells in the base are described in paragraph 6c(2) and the observation wells in the subgrade in paragraph 6c(3). Details of both types of wells are shown on Plate 4.

d. Observations and Measurements.

- (1) Water Table. Installation of the observation wells was completed in the latter part of December, 1945. Seasonal variations in the ground water elevations as observed in the observation wells are shown as profiles on Plate 3. The formation of ice in the wells resulted in infrequent measurements of the ground water table from 4 January 1946 to 1 April 1946. Measurement obtained from observation wells in the adjacent Test Area A and from one well in Test Area F indicated that the water table on 17 January 1946 was in the subgrade at a depth of between 5.5 and six feet from the pavement surface. On 2 March 1946 the

only available well reading indicated the ground water table to be at a depth of 7.5 feet. On 19 April the water table was in the base at a depth of 1.3 feet below pavement surface and on the 27 May no appreciable change had occurred in its elevation. Table 3 is a summary of the ground water table observations.

- (2) Frost Heave. Elevations at the southeast corners of the concrete slabs in the test area were obtained prior to the freezing period and at the period of maximum heave. The results of these surveys are shown in the form of heave contours on Plate 7. The contours indicate the difference in elevation of the pavement between the two surveys.
- (3) Frost Penetration. The depths of frost penetration were determined by the excavation of one test pit T887pa, in November, one test pit T928p, in January 1946, one test pit T931p, in February, 2 test pits, T934pa and T937p in March and one test pit, T939pa, in April. The maximum frost penetration was 4.5 feet on 7 March 1946. A plot of frost penetration versus time is shown in Figure 3, Plate 2.
- (4) Subsurface Temperatures. Records of subsurface temperatures in Test Area A, which is adjacent and comparable to Test Area F, were obtained by periodic readings of one thermocouple installation T697p, and one thermometer well group T71. The subsurface temperatures are summarized in Table 8 and Table 9, for the thermocouple installation and

thermometer well respectively. A plot of typical sub-surface temperatures versus depth for the thermocouple readings and thermometer well readings are shown on Plates 12 and 8 respectively.

(5) Ice Lens Survey. Ice lenses were noted in the subgrade in test pit T934pa, excavated 7 March 1946. The lenses were isolated and disconnected and ranged from hairline to 1/8-inch in thickness. Ice crystals were also apparent in the subgrade material. Test pit T928p, excavated on 11 January 1946 to determine depth of frost penetration was not suitable for lens survey, but definite evidence of crystals in the gravel base and subgrade material was noted in the excavated materials.

(6) Crack Survey. A crack survey was made over the entire cement concrete pavement in Test Area F in October 1945 and again in April 1946. A comparison of the number and length of the cracks for both surveys is shown by light and heavy lines on Plate 13.

e. Field Tests.

(1) Test Procedures. Test procedures are described in detail in Appendix 14 "Frost Investigation 1944-1945". Any variation from the procedures are described in this report.

(2) Water Content. The water contents of the base and subgrade materials were determined in four test pits at vertical intervals of 0.2 feet during the fall, winter, and spring. The data obtained are plotted in relation to the soil

profiles in Figure 3, Plate 10. Water content samples were obtained with each density sample and the percentage of saturation was computed and the results are presented in Table 2.

- (3) Plate Bearing Tests (Rupture). Three plate bearing tests on top of the pavement using a 24-inch diameter plate were made at the corner of pavement joints. The tests were made on 16 November 1945, 18 April 1946 and 10 June 1946. All tests failed to crack the portland cement concrete after 5 repetitions of the maximum available load of 60,000 pounds. The locations of the tests are shown on Plate 3. Table 5 presents a summary of the tests, and Plate 14 contains plots of test results.
- (4) Plate Bearing Tests (Foundation Modulus). Three tests were performed directly on the sand and gravel base after the pavement had been removed. Locations of the tests are shown on Plate 3. Results of tests are plotted on Plate 14 and tests results are summarized in Table 5.
- (5) Density. The density and water content of the base and subgrade were obtained in three test pits prior to the freezing period and after the frost melting period. The results of these tests are plotted in relation to the soil profile on Figure 3 Plate 10, and are summarized in Table 2.

f. Laboratory Tests.

- (1) Soil Classification. No laboratory tests were conducted

on samples of base and subgrade materials. Since the Test Area F is located adjacent to Test Area A of the 1944-1945 Frost Investigation Program the results of classification tests on representative samples made during this investigation are considered applicable to Test Area F. The gradation of base and subgrade materials are shown in Figure 3 Plate 11. The physical properties of the representative samples of the base and subgrade materials are shown in tabular form in Figure 4 Plate 11.

6. Summary of Results. Results of tests and observations for test Area F are summarized as follows:

- (1) Soils. The frost susceptibility of the base and subgrade materials of Test Area A was established during the 1944-1945 investigation. The subgrade and base materials of Test Area F are considered to be frost susceptible.
- (2) Freezing Index and Precipitation. The freezing index of 1945-1946 was 1421 or 11 per cent above the normal freezing index. The rainfall during three months, September to November, inclusive was 11.1 inches which is approximately normal.
- (3) Ground Water. No ground water measurements were made prior to the freezing period and only infrequent readings could be obtained during the freezing period. Readings obtained from wells in the adjacent Test Area A indicate that the ground water in the fall was generally about one foot below the top of the pavement. No water was found in the gravel base during the freezing period and it is believed

that the water table dropped to about 7.5 feet below the pavement. During the frost melting period the water table rose into the base between one foot and 1.3 feet below the pavement surface.

- (4) Pavement Heave. The maximum frost heave measured was 0.3 foot. No detrimental effects were caused by the heave.
- (5) Depth of Frost Penetration. The depth of frost penetration was 3.0 feet on 11 January 1946 when the freezing index was 448, and 4.5 feet when the freezing index was 1062. The maximum frost penetration was 4.5 and the maximum freezing index was 1421. The maximum depth of freezing temperature in the adjacent Test Area A was recorded as 4.3 feet by the thermocouples and 3.9 feet by the mercury thermometers.
- (6) Ice Segregation. Ice crystals were found in the frozen gravel base and subgrade. Ice lenses were found widely isolated and disconnected in the subgrade. The thickness of the lenses ranged from hairline to 1/8-inch.
- (7) Soil Conditions.
  - (a) Water Content and Density. The water content of the base materials increased during the frost melting period. The average water content of the base materials was eight per cent during the normal period and 10.7 per cent during the frost melting period. The average water content of the subgrade materials increased from 22.5 per cent during the normal period

to 33.9 per cent during the frost melting period. The density of the base materials was approximately the same during the frost melting period and the normal period and in the subgrade the density decreased from 110 pounds per cubic foot in the normal period to 95 pounds per cubic foot in the frost melting period.

(8) Cracks in Pavement. The number of cracks in the pavement increased approximately 10 per cent during this investigation.

(9) Effect of Frost Action on Subgrade Strength. Plate bearing tests on the portland cement concrete pavement indicate a loss of foundation strength during the frost melting period. Prior to the freezing period the supporting capacity of a 24-inch diameter plate was 1.5 times greater than that measured during the frost melting period. Plate bearing tests performed directly on top of the base also indicated a loss of strength. Prior to the freezing period supporting capacity of a 30-inch diameter plate was 1.1 times greater than that measured during the frost melting period.

9. Turf Area.

a. Location and Description. The Turf Area is located adjacent to the South edge of the E-W Runway between Sta. 13 / 50 and 14 / 50. This Turf Area was investigated during the 1944-1945 investigations and the existing installations, two thermocouple installations and one observation well have been utilized. The Turf Area consists of seeded top soil from 0.2 to 0.5

foot in depth overlying approximately three feet of silty clay (CL). Below the silty clay stratum is a silty glacial till (GC). Location of Turf Area is shown on Plate 3.

b. Explorations. Four test pits T926p, T929p, T930p, and T933p, were excavated in the Turf Area during the freezing period to determine the depth of frost penetration. Locations of explorations are shown on Plate 3.

c. Installations. One thermometer well group was installed in the vicinity of the existing thermocouple installation T693p. Location of installations are shown on Plate 3.

d. Observations and Measurements.

- (1) Water Table. Ground water measurements in the one observation well in the area indicated that the water table was at 5.8 feet in depth during the freezing period. During the frost melting period the ground water table rose to within 0.2 foot of the surface. The periodic well readings are recorded in Table 3.
- (2) Frost Heave. No frost heave measurements were made in the Turf Areas. However, indications were that heave of the surface did occur.
- (3) Frost Penetration. The frost penetration was measured at 1.2 feet depth in December 1945, 2.0 feet depth in January 1946 and 2.2 in March 1946. A plot of frost penetration versus time is shown on Figure 3 Plate 2.
- (4) Subsurface Temperatures. A record of the subsurface temperatures in the thermocouple installations T693p, and T694p, and thermometer wells TW4 was obtained by periodic

readings. Tables 10, 11 and 12 are summaries of the temperatures obtained from the thermocouple installations T693p and T694p, and the thermometer wells T74 respectively. Plots of typical subsurface temperatures versus the thermometer wells and thermocouple installations are shown on Plates 8 and 12 respectively.

- (5) Ice Lens Survey. Ice crystals were noted from 0.1 foot depth to 1.7 feet in the pit excavated in March 1946. Ice lenses ranging from  $1/4$  to  $3/4$  inch thickness were found from 1.7 to 2.2 feet in depth.

e. Field Tests.

- (1) Test Procedures. Test procedures are described in detail in Appendix 14 "Frost Investigation 1944-1945". Any variation from the procedures are described in this report.
- (2) Water Content. Continuous water content samples were taken in the test pit T933p, excavated in March 1946. Summary of results are shown in Table 2.

f. Laboratory Tests.

- (1) Soil Classification. No laboratory tests were conducted on samples of the subgrade materials. The results of classification tests on representative samples made during 1944-1945 Frost Investigation Program are considered applicable. The gradation of the subgrade materials are shown in Figure 3 Plate 11. The physical properties of the representative samples of the subgrade materials are shown in tabular form in Figure 4 Plate 11.

g. Summary of Results.

- (1) Soils. The subgrade soil is a silty clay (CL) and is frost susceptible.
- (2) Ground Water. The ground water table was at a depth of 5.8 feet during the freezing period and rose within two inches of the ground surface during the frost melting period.
- (3) Depth of Frost Penetration. The depth of frost penetration on 21 December 1945 was 1.25 when freezing index was 306 and on 31 January was 2.0 feet when the freezing index was 938. The maximum depth of frost was 2.2 feet. with 1421 freezing index. The maximum depth of freezing temperature penetration was 2.1 feet.
- (4) Ice Segregation. Ice crystals were found to a depth of 1.7 feet and ice lenses ranging from 1/4 inch to 3/4 inch in thickness were found from 1.7 to 2.2 feet in depth.
- (5) Soil Conditions. No data are available for density studies. The water content shows a marked increase in the lower part of the frozen zone.

10. Conclusions. The following conclusions are presented based on a study of the data:

- a. Soils. The base and subgrade soils are frost susceptible.
- b. Weather. Weather conditions were more severe than normal and closely paralleled the 1944-1945 conditions. The freezing index was 11 per cent above normal and the precipitation in the three months, September to November 1945 inclusive was normal. The cumulative snowfall from 1 December

1945 to 8 April 1946 was 52 inches. The paved test areas were kept free from ice and snow consistent with normal runway plowing schedules. The only exception occurred during the period 25 February 1946 to 1 March 1946 when six inches of ice and six inches of snow was allowed to accumulate before plowing operations were started.

c. Pavement Heave and Ground Water. The maximum pavement heave (0.3 foot) was measured in the portland cement concrete pavement of Test Area F. The maximum heave measured in Test Area D was 0.1 foot and in Test Area E it was 0.2 foot. Ground water measurements indicate gradual lowering in Test Area D and E from about 3.4 feet below the surface in the fall to seven feet during the freezing period and a subsequent rise to 3.3 feet below the surface during the frost melting period. In Test Area F the ground water table dropped from about one foot below the surface in the fall to 7.5 feet during the freezing period. In the frost melting period the water rose to about 1.3 feet below the surface.

d. Frost Penetration. The depth of maximum frost penetration was approximately the same (4.0 to 4.5 feet) in Test Areas D, E and F although there is considerable variation in thickness of pavement and gravel base between the areas. There was slightly greater penetration under the cement concrete. In the Turf Test Area the depth of maximum frost penetration was approximately one half as great as that under the paved areas. Plate 15 presents a plot of the frost penetration versus thickness of pavement and base which summarized the data for Test Areas D, E and F. A plot of the measured thickness of the frozen subgrade versus pavement heave is shown on Plate 16. The data is limited and does not indicate any definite relationship.

e. Reduced Subgrade Strength. During the normal period the supporting capacity of the pavements in the test areas, as measured by pavement bearing tests using 30-inch diameter bearing plate, was 1.5 to 2.0 times greater than that measured during the frost melting period. From the data obtained a definite correlation between the supporting capacity and the variations in thickness of frozen subgrade cannot be established as shown on Plate 17.

f. Comparison Actual Frost Penetration to 28°F and 32°F Temperatures. A comparison of the actual frost penetration with the curves for 28°F and 32°F as determined from the thermocouple installations and thermometer wells for Test Areas D, E, and F and Turf Area is shown on Plate 18. It will be noted that generally the actual frost penetration is at a greater depth than the depth reached by the 28°F and 32°F temperatures.

## CHRONOLOGICAL SUMMARY

### EXPLORATIONS AND OBSERVATIONS

#### DOW FIELD, BANGOR, MAINE

<u>DATE</u>	<u>OPERATION</u>
1945	
1 - 5	October Existing installations checked and prepared for future observations.
11 - 30	October Initial level surveys at corners of slabs in Test Areas A and F and on 10-foot grid system in Test Areas B, C, D and E. Crack Survey made.
5 - 19	November Two repeating load, 1 foundation modulus, 2 static load and 1 rupture, plate bearing test performed. 8 observation wells in base and 6 observation wells in subgrade installed.
23 - 30	November Three test pits excavated to determine subsurface conditions prior to frost penetration. 1 thermocouple installation completed. 9 observation wells in base installed.
3 - 7	December Four groups of thermometer wells installed.
11 - 18	December Eleven observation wells in subgrade installed.
21	December Three test pits excavated to determine depth of frost penetration.
1946	
10 - 11	January Two test pits excavated to determine depth of frost penetration.
31	January Two test pits excavated to determine depth of frost penetration.
5 - 6	February Two test pits excavated to determine depth of frost penetration.
3 - 12	March Four test pits excavated to observe ice crystals and lenses, and to determine depth of frost penetration and water content of base and subgrade materials. Maximum frost heave surveys made on all test areas.

<u>DATE</u>		<u>OPERATION</u>
1946		
27 - 28	March	Two test pits excavated to observe ice crystals and lenses and to determine limits of the frozen zone and water content of base and subgrade materials.
16 - 19	April	Two repeating load, 3 static load, 1 rupture and 1 foundation modulus plate bearing tests performed.
22 - 25	April	Three test pits excavated to determine density and water content of base and subgrade materials. Crack survey made.
6 - 12	June	Two repeating load, 3 static load, 1 rupture and 1 foundation modulus plate bearing tests performed.
11 - 15	June	Four test pits excavated to determine subsurface conditions after the frost melting period.

WAR DEPARTMENT

FROST INVE  
SUMMARY OF SO  
DOW FIELD.

EXPLORATION NO.	DATE	TEST AREA	TYPE	DEPTH (FT.)	FROST PENETRATION (FT.)	DEPTH TO WATER TABLE (FT.)	SOIL CLASS.	GRAIN SIZE DISTRIBUTION			
								% finer than			
								0.005 mm	0.02 mm	0.05 mm	0.10 mm
1986 pa	21 Nov. 1945	B	Bituminous Concrete	0.0-0.3	0.0	8.0	GW				
			Base	0.3-3.2							
			"	0.5-0.9							
			"	1.6-2.0							
1987 pa	26 Nov. 1945	F	Subgrade	3.2-10.5	0.0	See Remarks	GW				
			"	0.6-2.3							
			"	0.6-1.0							
			"	2.2-2.6							
1988 pa	28 Nov. 1945	D	Base	0.0-0.3	0.0	See Remarks	GW				
			"	0.3-4.4							
			"	0.4-0.0							
			"	1.6-2.0							
1989 pa	21 Dec. 1945	D	Subgrade	4.4-8.2	2.6	3.1	GW				
			"	0.0-0.35							
			"	0.35-3.1							
			"	2.6-3.0							
1989 pa	21 Dec. 1945	E	Base	0.0-0.3	2.6		GW				
			"	0.3-3.1							
			"	0.0-0.2							
			"	0.2-2.2							
1989 pa	21 Dec. 1945	B	Turf	0.0-0.2	1.25	2.2	GW				
			Subgrade	0.2-2.2							
			"	0.2-2.2							
			"	0.2-2.2							
1989 pa	10 Jan. 1946	E	Base	0.0-0.3	3.0		GW				
			"	0.3-3.0							
			"	0.3-3.0							
			"	3.0-4.0							
1989 pa	11 Jan. 1946	F	Base	0.0-0.6	3.0	4.0	GW				
			"	0.6-2.3							
			"	2.3-4.0							
			"	2.3-4.0							
1989 pa	31 Jan. 1946	B	Turf	0.0-0.2	2.0	2.8	GW				
			Subgrade	0.2-2.8							
			"	0.2-2.8							
			"	0.2-2.8							
1989 pa	31 Jan. 1946	B	Turf	0.0-0.3	2.0	2.8	GW				
			Subgrade	0.3-2.8							
			"	0.3-2.8							
			"	0.3-2.8							
1989 pa	5 Feb. 1946	F	Base	0.0-0.7	4.5	5.2	GW				
			"	0.7-2.3							
			"	2.3-5.2							
			"	2.3-5.2							
1989 pa	6 Feb. 1946	E	Base	0.0-0.3	3.7		GW				
			"	0.3-3.5							
			"	3.5-4.5							
			"	3.5-4.5							
1989 pa	3 Mar. 1946	B	Turf	0.0-0.1	2.2	3.2	GW				
			Subgrade	0.1-1.7							
			"	1.7-2.2							
			"	2.2-3.2							
1989 pa	7 Mar. 1946	F	Base	0.0-0.6	4.4	4.6	GW				
			"	0.6-2.4							
			"	0.6-2.4							
			"	2.4-5.0							
1989 pa	7 Mar. 1946	F	Subgrade	2.4-5.0	4.4	See Remarks	GW				
			"	0.0-1.2							
			"	1.2-2.2							
			"	2.2-3.2							
1989 pa	7 Mar. 1946	F	Base	0.0-0.6	4.4	See Remarks	GW				
			"	0.6-2.4							
			"	0.6-2.4							
			"	2.4-5.0							
1989 pa	7 Mar. 1946	F	Subgrade	2.4-5.0	4.4	See Remarks	GW				
			"	0.0-1.2							
			"	1.2-2.2							
			"	2.2-3.2							

A



FROST INVESTIGATION  
SUMMARY OF SOIL TESTS  
DOW FIELD, BANGOR

EXPLORATION NO.	DATE	TEST AREA	TYPE	DEPTH (FT.)	FROST PENETRATION (FT.)	DEPTH TO WATER TABLE (FT.)	SOIL CLASS.	GRAIN SIZE				
								% Finer than indicated				
								0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm
T935p	11 Mar. 1946	E	Bituminous Concrete	0.0-0.3	See Remarks	5.0	GW					
			Base	0.3-3.1								
			"	0.3-1.5 1.7-5.1								
T936p	12 Mar. 1946	D	Bituminous Concrete	0.0-0.3	See Remarks	5.1	CL					
			Base	0.3-3.4								
			"	0.3-1.3 1.3-2.1								
T937p	27 Mar. 1946	F	Cement Concrete	0.0-0.6	See Remarks	See Remarks	GW					
			Base	0.6-2.2								
			Subgrade	2.2-4.3								
T938p	28 Mar. 1946	E	Bituminous Concrete	0.0-0.3	See Remarks		GW					
			Base	0.3-3.7								
			Subgrade	3.7-5.8								
T939 pa	23 Apr. 1946	F	Cement Concrete	0.0-0.6	0.0	See Remarks	GW					
			Base	0.6-2.5								
			"	0.7-1.1 1.5-2.4								
T940 pa	24 April 1946	E	Bituminous Concrete	0.0-0.3	0.0		GW					
			Base	0.3-3.0								
			"	0.3-0.7 2.0-2.4								
T941 pa	25 April 1946	D	Bituminous Concrete	0.0-0.3	0.0		GW					
			Base	0.3-3.5								
			"	0.3-0.7 2.0-2.4								
			Subgrade	3.4-6.6			CL					
			"	3.4-3.9 4.3-4.8								
			"	5.5-6.0								

A

FROST INVESTIGATION  
 SUMMARY OF SOIL TEST DATA  
 / FIELD, BANGOR, ME.

SOIL DATA						FIELD IN-PLACE TESTS				REMARKS			
GRAIN SIZE % Finer than indicated grain size						ATTERBERG LIMITS		SPECIFIC GRAVITY			DENSITY LBS./CU.FT.	WATER CONTENT	PER- CENT SATUR- ATION
0.075 mm	0.10 mm	0.297 mm	2.0 mm	4.7 mm	19.1 mm	L.L.	P.L.	< 4	> 4				
											5.1 7.5		Frozen zone 1.6' to 4.0' depth. Ice lenses, from hair- line to 1/16", widely isolated and disconnected - 3.1' - 4.0' depth.
											23.6 20.4		
											6.9 11.2		Frozen 2.1' to 4.2'. Ice lenses, from hairline thickness to 1/16", widely isolated and disconnected.
											5.8		
											21.6		
													Frozen zone 2.2' to 4.3'.  Water seeped into pit from gravel and surface of clay at rate of 1 gallon in 10 minutes.  No frost encountered.
										116 116	8.4 8.5	100 % 100 %	
										89.6 76.0 136.0	31.4 63.0 48.9	98 100 %	Water seeped into pit from depth 1.8' to 2.5' at rate of 3 gallons per minute. Auger hole from 6.0' to 13.5'.
										141 128	5.2 7.7	79 65	Water seeped in slowly between gravel and subgrade on all sides of pit. Auger hole from 6.0' to 13.9'.
										108.3 113 113	20.8 21.1 23.8	100 % 100 % 100 %	
										143 120.2	3.6 6.1	60 43	
										105.2 109 113	21.7 21.6 22.5	100 % 100 % 100 %	

B

FROST INVESTIGATION  
SUMMARY OF SOIL TESTS  
DOW FIELD, BALTIMORE

EXPLORATION NO.	DATE	TEST AREA	TYPE	DEPTH (FT.)	FROST PENETRATION (FT.)	DEPTH TO WATER TABLE (FT.)	SOIL CLASS.	GRAIN SIZE						
								% Finer than indicate						
								0.075 mm	0.075 mm	0.075 mm	0.075 mm	0.075 mm		
75469	11 June 1946	D	Stimulus Concrete	0.0-0.3										
			Base	0.3-3.3										
			Base		0.3-0.8				GW					
			Base		1.3-1.7				GW					
			Base		2.3-2.8				GW					
			Subgrade	3.3-6.5			5.0		GW					
			Subgrade		3.3-3.7				CL					
			Subgrade		4.4-4.8				CL					
			Subgrade		5.5-6.0				CL					
75470	13 June 1946	E	Stimulus Concrete	0.0-0.3										
			Base	0.3-3.4										
			Base		0.3-0.8					GW				
			Base		1.4-1.8					GW				
			Base		2.3-2.9					GW				
			Subgrade	3.4-13.7			3.4		GW					
			Subgrade		3.4-3.9				CL					
			Subgrade		4.4-4.9				CL					
			Subgrade		5.4-6.0				CL					
75471	14 June 1946	F	Common Concrete	0.0-0.8										
			Base	0.8-2.6										
			Base		0.8-1.3						GW			
			Base		1.3-2.2					GW				
			Subgrade	2.6-15.2			2.6		GW					
			Subgrade		3.6-4.2			12.0		CL				
			Subgrade		4.6-5.2					CL				
			Subgrade		5.6-6.0					CL				
										CL				

A

FROST INVESTIGATION  
 SUMMARY OF SOIL TEST DATA  
 LOW FIELD, BANGOR, ME.

CORPS OF ENGINEERS, U.S. ARMY

SOIL DATA						FIELD IN-PLACE TESTS			REMARKS				
GRAIN SIZE						ATTERBERG LIMITS		SPECIFIC GRAVITY		DENSITY LBS./CU.FT.	WATER CONTENT	PER- CENT SATUR- ATION	
% finer than indicated grain size						L.L.	P.L.	< 4					> 4
0.075 mm	0.15 mm	0.3 mm	0.6 mm	1.18 mm	2.0 mm								
										113.8	5.5		
										111.4	5.6		
										119.0	6.6		
										111.4	21.8		
										108.0	21.7		
										105.8	21.5		
										113.5	18.8		
										110.8	6.3		
										137.9	13.7	Auger hole 6.0' - 13.7'.	
										103.0	25.3		
										110.0	21.5		
										108.5	25.1		
										125.3	7.1		
										15.9	15.9	Water encountered at 2.0' depth in gravel base and again at 12.0' in auger hole.	
										109.2	18.6	Auger hole 6.0' - 15.0'. Encountered top soil 4.6' - 5.2'.	
										105.0	22.6		

B

TEST AREAS C, D AND  
SUBGRADE OBSERVATION WELLS

DATE	T657a 3 / 50 70' S	T658a 3 / 50 70' N	T656a 3 / 75 235' C	T607a 3 / 75 150' S	T696a 3 / 75 65' S	T699a 3 / 75 Z	T900a 3 / 75 65' N	T901a 3 / 75 150' N	T902a 3 / 75 235' N	T656a 4 / 50 70' S	T659a 4 / 50 70' N	T655a 5 / 50 70' S	T660a 5 / 50 70' N	T654a 6 / 50 70' S	T661a 6 / 50 70' N
5 Nov. 45	3.5	2.1	-	-	-	-	-	-	-	3.6	3.4	3.0	-	2.9	3.4
16 Nov. 45	3.6	3.2	-	-	-	-	-	-	-	3.5	3.9	3.5	-	2.9	3.5
28 Nov. 45	3.6	3.2	-	-	-	-	-	-	-	3.4	4.0	3.5	-	2.9	3.4
17 Dec. 45	4.6	3.6	5.2	5.8	5.7	7.5	8.8	9.5	7.8	4.0	4.0	3.7	4.0	3.8	3.7
4 Jan. 46	5.0	5.2	7.5	6.7	6.0	6.7 Ice	4.5	4.0	5.1	3.9	5.3	4.1	4.5	4.5	3.6
17 Jan. 46	5.6	4.9	7.5	6.6	5.5	7.7 Ice	4.4	3.7	5.4	3.2	5.2	3.9	4.5	5.2	3.6
29 Jan. 46	-	5.4	8.0	8.0	7.2	0.6 Ice	5.4	4.5	6.5	3.6	Dry	4.8	Dry	5.9	4.1
4 Mar. 46	6.3	-	-	-	10.2	0.8 Ice	7.7	4.9	-	6.3	6.1	6.6	6.3	6.3	5.9
22 Mar. 46	6.7	-	2.3	0.8 Ice	3.0	9.3	3.3	0.9 Ice	4.1	3.5	-	-	-	-	4.5
1 Apr. 46	3.4	3.2	7.9	2.5	3.8	7.1	3.5	2.5	2.6	3.3	6.4	3.4	3.7	3.1	3.7
8 Apr. 46	3.4	2.6	2.9	1.0	3.3	5.2	3.1	2.1	0.9	3.3	4.3	3.5	3.3	2.9	3.5
19 Apr. 46	2.5	2.6	2.0	1.6	3.2	3.9	3.5	2.1	0.8	3.2	3.2	3.5	3.1	2.9	3.2
29 Apr. 46	3.2	3.4	1.2	1.0	3.4	3.9	3.3	2.1	1.0	3.4	3.5	3.5	3.8	2.9	3.7
10 May 46	-	2.9	0.7	0.1	3.0	3.4	3.0	1.9	0.5	3.3	2.8	3.4	3.0	2.8	3.3
20 May 46	3.1	3.0	0.3	0.6	3.4	3.3	3.1	2.0	0.6	3.3	3.9	3.2	3.4	2.9	3.4
27 May 46	3.6	3.3	0.5	1.0	3.2	3.4	2.9	2.4	1.9	1.9	3.8	3.2	3.3	2.9	3.5
DEPTH OF WELL	5.9	6.3	15.1	15.1	15.1	15.1	15.2	15.5	15.1	6.1	6.0	6.5	6.0	6.2	6.2

BASE OBSERVATION WELLS

DATE	T685a 3 / 50 170' S	T690a 3 / 50 120' S	T691a 3 / 50 60' S	T692a 3 / 50 Z	T693a 3 / 50 65' N	T694a 3 / 50 120' N	T695a 3 / 50 170' N	T682a 3 / 75 40' S	T681a 3 / 75 40' N	T679a 6 / 25 40' S	T680a 6 / 25 40' N	T610a 9 / 25 170' S	T611a 9 / 25 120' S	T612a 9 / 25 65' S	T678a 9 / 25 40' S
5 Nov. 45	-	-	-	-	-	-	-	-	-	2.2	2.0	-	-	-	2.8
16 Nov. 45	-	-	-	-	-	-	-	2.9	3.0	-	3.3	-	-	-	2.5
28 Nov. 45	-	-	-	-	-	-	-	3.0	2.7	-	3.2	-	-	-	2.5
17 Dec. 45	Dry	Dry	Dry	Dry	3.6	Dry	3.7	Dry	Dry	2.2	Dry	Dry	Dry	4.8	Dry
4 Jan. 46	Dry	0.6 Ice	Dry	Dry	3.3	Dry	2.5 Ice	5.8	Dry	2.1	Dry	Dry	0.8 Ice	0.5 Ice	Dry
17 Jan. 46	1.6 Ice	0.6 Ice	-	Dry	3.4	Dry	-	4.1	Dry	2.5 Ice	Dry	0.3 Ice	0.3 Ice	0.4 Ice	Dry
29 Jan. 46	1.6 Ice	0.5 Ice	4.1 Dry	Dry	3.4	Dry	1.5 Ice	3.9	Dry	Dry	Dry	0.4 Ice	0.8 Ice	0.4 Ice	3.1
4 Mar. 46	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
22 Mar. 46	1.1 Ice	0.2 Ice	2.4	3.1	2.8 Ice	2.2 Ice	0.9	2.9	-	-	-	-	-	-	-
1 Apr. 46	1.0	-	3.0	-	3.0	0.9 Ice	0.4	3.9	Dry	2.3	3.1	2.0	0.2	0.2 Ice	-
8 Apr. 46	1.1	5.0	3.0	2.9	2.9	0.6	0.4	3.9	Dry	2.3	3.1	2.0	0.2	-	Dry
19 Apr. 46	1.4	1.3	1.9	2.9	2.2	1.0	0.8	2.7	2.7	2.0	3.0	2.0	0.0	3.1	2.5
29 Apr. 46	1.1	1.2	3.1	3.0	3.0	1.0	0.8	2.3	2.8	1.7	3.3	2.8	0.4	3.0	2.5
10 May 46	0.9	1.1	2.3	2.9	2.9	1.0	0.8	2.9	3.0	2.2	3.4	2.1	0.5	3.0	2.6
20 May 46	1.1	1.2	3.0	3.0	3.1	1.2	0.5	2.8	2.8	1.6	3.0	1.9	0.3	2.9	2.1
27 May 46	1.1	1.2	3.1	3.0	3.1	1.3	0.5	3.0	3.0	1.6	3.4	1.7	1.0	3.2	2.4
DEPTH OF WELL	3.1	3.1	4.1	4.1	4.1	3.1	3.0	4.2	3.6	3.1	3.4	3.1	1.2	3.1	2.6

A

AREAS C, D AND E

WATER OBSERVATION WELLS

T660a 5 / 50 70' B	T650a 6 / 50 70' B	T661a 6 / 50 70' B	T653a 7 / 50 70' B	T662a 7 / 50 70' B	T903a 8 / 50 235' B	T904a 8 / 50 150' B	T652a 8 / 50 70' B	T663a 8 / 50 70' B	T905a 8 / 50 65' B	T906a 8 / 50 65' B	T907a 8 / 50 65' B	T908a 8 / 50 150' B	T909a 8 / 50 235' B	T651a 9 / 50 70' B	T664a 9 / 50 70' B
-	2.9	3.4	-	3.5	-	-	-	-	3.2	-	-	-	-	2.7	3.3
-	2.9	3.5	3.9	-	-	-	5.5 Green	3.6	-	-	-	-	-	2.6	3.6
-	2.9	3.4	3.8	-	-	-	3.4 *	3.5	-	-	-	-	-	2.9	3.2
4.0	3.8	3.7	4.6 Green	-	3.9	4.6	3.6 *	3.8	4.9	5.8	5.4	4.6	3.6	3.9	3.7
4.5	4.5	3.6	4.3	4.5	-	4.8	4.9 *	4.3	4.0	5.3	3.3	3.3	2.5 Ice	3.2	4.0
4.5	5.2	3.6	4.6 Green	4.6 Green	4.2	4.6	4.7	4.1	0.5 Ice	4.9	4.4	3.4	1.9	4.7	4.7
Dry	5.9	4.1	5.1 *	4.9	0.5 Ice	5.2	-	5.1	0.5 Ice	6.0	5.4	4.0	3.1	-	5.4
6.3	6.3	5.9	-	6.8	-	6.2	-	6.5	-	7.3	-	5.4	-	-	Dry
-	-	4.5	2.0	-	2.7	0.8 Ice	2.5	3.3	2.1	4.3	3.2	3.1	1.3	3.1	-
5.7	3.3	3.7	3.1	3.2	1.9	0.8	2.8	3.4	2.7	3.7	3.0	1.9	0.9	3.0	3.3
3.3	2.9	3.4	2.6	3.1	1.7	0.4	2.6	3.4	2.4	3.3	2.9	1.1	-	2.9	4.8
3.1	2.9	3.2	2.5	2.9	0.6	1.1	2.6	3.2	2.5	3.8	2.7	1.6	0.7	2.9	2.4
3.0	2.9	3.7	2.6	3.2	1.2	2.4	2.6	3.6	2.5	3.3	3.0	1.4	0.4	2.9	3.1
3.0	2.8	3.3	2.2	2.6	0.9	2.4	1.8	3.4	2.4	3.3	2.9	1.4	-	3.0	2.9
3.4	2.9	3.4	2.4	2.7	1.0	2.2	2.5	3.4	2.6	3.0	2.7	1.3	-	2.9	3.8
3.3	2.9	3.5	2.3	2.9	2.1	2.3	2.4	3.4	2.7	3.2	2.8	1.7	0.5	2.9	3.1
6.0	6.2	6.2	-	6.1	12.0	12.9	5.7	6.4	11.9	15.1	15.0	11.5	15.1	6.8	6.8

T911a 9 / 25 120' B	T912a 9 / 25 65' B	T913a 9 / 25 40' B	T914a 9 / 25 65' B	T915a 9 / 25 120' B	T916a 9 / 25 170' B
-	-	2.8	-	2.5	-
-	-	2.5	-	3.3	-
-	-	2.5	-	3.2	-
Dry	4.8	Dry	Dry	3.4	Dry
0.8 Ice	0.5 Ice	Dry	-	Dry	1.5 Ice
0.8 Ice	0.4 Ice	Dry	4.2	Dry	1.4 Ice
0.8 Ice	0.4 Ice	3.1	4.6	Dry	1.5 Ice
-	-	-	-	-	-
0.7	0.2 Ice	-	3.3	1.8	0.9
0.2	-	Dry	3.8	3.2	0.9
0.0	3.1	2.5	3.6	3.1	0.7
0.4	3.8	2.5	3.7	3.3	0.9
0.5	3.0	2.6	3.6	2.4	0.5
0.3	2.9	2.1	3.6	2.3	0.5
0.1	3.8	2.5	3.5	3.2	0.7
0.0	3.2	2.4	3.7	3.3	0.1
0.7	3.1	2.6	3.1	3.9	3.1

NOTE: Depths are measured in feet from top of pavement.

B

FROST INVESTIGATION  
DOW FIELD, BANGOR, ME

GROUND WATER TABLE  
OBSERVATIONS

FROST EFFECTS LABORATORY, BOSTON, MASS. JUNE 1946

TEST AREA B

SUBGRADE OBSERVATION WELLS

DATE	T650a	T655a	T660a	T665a	T668a	T667a	T667a	T668a	T655a	T666a	T669a	T665a	T670a	T666a
	10/50 70' S	10/50 70' S	11/50 70' S	11/50 70' S	12/50 70' S	12/50 70' S	13/50 70' S	13/50 70' S	13/50 209' S	14/50 70' S	14/50 70' S	15/50 70' S	15/50 70' S	16/50 70' S
5 Nov. 45	2.7	-	2.4	-	2.8	1.4	2.6	2.8	-	2.3	2.8	3.0	-	3.6
16 Nov. 45	2.6	-	2.5	-	2.9	2.8	-	3.6	-	2.8	2.8	3.5	3.0	3.8
28 Nov. 45	2.7	-	2.5	-	2.9	2.8	2.8	3.1	-	2.8	2.9	3.9	3.3	3.6
17 Dec. 45	3.5	3.5	3.4	3.8	4.1	4.0	3.0	4.2	-	3.6	3.5	3.8	4.1	4.2
4 Jan. 46	4.3	3.7 (Grass)	4.2	5.2	4.9	5.0	4.5	5.7	5.2	4.7	4.7	5.2	5.0	5.4
17 Jan. 46	4.4	4.8 (Grass)	3.9	5.2	4.7	5.0	-	5.2	5.1	4.3	4.1	4.9	4.9	5.3
30 Jan. 46	6.0	5.6	5.1	6.1	5.9	5.7	- (Ice)	6.0	-	5.5	5.6	5.5	5.8	Dry
4 Mar. 46	-	6.0	-	Dry	Dry	5.7	-	Dry	-	-	Dry	-	Dry	-
22 Mar. 46	2.5	-	-	-	-	3.7	1.6	6.0	0.6	3.3	-	-	5.4	-
1 Apr. 46	2.8	3.3	2.1	2.8	2.4	2.5	2.2	3.0	2.1	2.2	2.4	3.1	2.6	3.1
8 Apr. 46	2.5	2.9	2.3	2.6	2.5	3.2	2.0	3.3	0.2	2.1	2.5	3.1	4.4	3.4
19 Apr. 46	2.5	2.9	2.0	2.4	2.1	1.5	1.9	2.8	0.2	2.0	1.5	2.9	2.8	3.2
29 Apr. 46	2.6	3.2	2.2	2.9	2.8	3.5	2.2	3.1	0.0	2.4	2.4	1.3	4.1	3.4
10 May 46	2.5	2.8	1.9	2.6	2.4	2.5	-	2.6	0.4	2.4	2.3	2.5	2.2	2.8
20 May 46	2.7	3.0	2.1	2.6	2.5	2.5	1.9	2.8	0.9	2.1	2.7	3.1	3.0	3.4
27 May 46	2.6	3.0	2.1	2.5	2.6	2.7	2.0	2.3	1.6	2.0	2.5	3.2	2.8	3.4
DEPTH OF WELL	6.0	5.8	6.5	6.3	5.8	6.0	6.1	6.2	5.9	5.1	6.2	6.2	6.0	6.0

TEST AREA A

SUBGRADE OBSERVATION WELLS

DATE	T690a	T695a	T698a	T698a
	-5/36 43.5' S	-7/36 43.5' S	-5/36 43.5' S	-7/36 43.5' S
5 Nov. 45	3.3	2.3	4.2	1.2
16 Nov. 45	3.1	2.3	4.2	3.1
28 Nov. 45	2.5	2.6	4.1	4.2
17 Dec. 45	4.5 (Grass)	4.6 (Grass)	4.5 (Grass)	5.1 (Grass)
4 Jan. 46	-	-	-	-
17 Jan. 46	Dry	Dry	Dry	Dry
30 Jan. 46	-	-	-	-
4 Mar. 46	-	-	-	-
22 Mar. 46	6.4 (Ice)	5.8 (Ice)	3.6	5.3 (Ice)
1 Apr. 46	3.0	1.7	3.7	1.2
8 Apr. 46	1.1	1.6	3.7	1.2
19 Apr. 46	1.2	1.9	4.2	1.6
29 Apr. 46	2.2	2.1	4.0	1.1
10 May 46	1.4	1.2	3.9	0.7
20 May 46	1.7	1.1	3.9 Dry	1.1
27 May 46	1.6	2.0	-	1.3
DEPTH OF WELL	6.1	6.0	5.6	5.6

BASE OBSERVATION WELLS

T690a	T686a	T692a	T687a
-5/36 23.5' S	-7/36 23.5' S	-5/36 23.5' S	-7/36 23.5' S
0.6	1.1	0.4	0.6
1.1	1.9	1.1	1.6
1.4	1.8	1.5	1.6
Dry	Dry	Dry	Dry
-	-	-	-
Dry	Dry	Dry	Dry
-	-	-	-
-	-	-	-
-	0.7 (Ice)	-	0.6 (Ice)
0.6	1.6	0.6	1.2
0.8	1.6	0.7	1.3
1.1	1.8	1.8	1.6
1.1	1.7	0.9	1.5
0.6	1.1	0.6	0.4
0.9	1.6	0.6	1.0
1.0	1.0	0.4	1.6
1.5	2.0	1.5	1.6

BASE OBSERVATION WELLS

T971a
2/31
11' S
-
-
-
-
0.3 (Ice)
0.2 (Ice)
0.8 (Ice)
0.9 (Ice)
0.4
1.9 (Ice)
0.6
1.1
0.9
0.5
0.8
0.6
2.1

A

B

BASE OBSERVATION WELLS

T670a 15/50 70' W	T660a 16/50 70' W	T671a 16/50 70' W
-	3.6	-
3.0	3.8	-
3.3	3.6	-
4.1	4.2	4.1
5.0	5.4	5.3
4.8	5.3	4.6
5.8	Dry	5.7 (Freeze)
Dry	-	5.3
5.4	-	-
2.6	3.1	2.9
4.4	3.4	2.8
2.8	3.2	2.8
4.1	3.4	2.9
2.2	2.8	2.9
3.0	3.4	2.9
2.8	3.4	2.8
6.0	6.0	5.9

T677a 11/25 40' W	T676a 11/25 40' W	T675a 15/75 40' W	T675a 15/75 40' W	T673a 16/25 40' W	T672a 16/25 40' W
2.6	2.1	-	-	3.4	2.1
2.5	2.8	-	-	Dry	2.8
2.6	2.7	-	-	-	-
-	-	Dry	Dry	Dry	2.5 (Ice)
Dry	Dry	-	-	Dry	2.3 (Ice)
Dry	Dry	-	-	-	-
Dry	Dry	-	-	-	-
Dry	Dry	-	-	-	-
2.6	2.0	-	-	-	-
2.6	2.7	1.7	2.0	Dry	2.4
2.5	2.6	1.6	1.7	3.1	2.5
2.2	2.6	1.9	1.9	3.0	2.6
2.5	2.6	2.0	1.8	3.2	2.5
2.5	2.4	1.9	1.4	3.1	2.4
2.6	2.7	2.0	1.9	3.3	Dry
2.6	2.8	2.2	2.0	3.3	2.6
3.4	3.2	2.3	2.1	3.5	2.7

TEST AREA F

BASE OBSERVATION WELLS

T971a 2/51 11' W	T918a 1/29 11' W	T919a 2/51 11' W
-	-	-
-	-	-
-	-	-
-	-	-
0.3 (Ice)	1.3 (Ice)	1.0 (Ice)
0.2 (Ice)	-	0.5 (Ice)
0.8 (Ice)	0.8 (Ice)	0.8 (Ice)
0.9 (Ice)	0.0 (Ice)	0.0 (Ice)
0.4	-	0.8 (Ice)
1.9 (Ice)	Ice	0.7 (Ice)
0.6	1.2	0.7
1.1	1.6	1.0
0.9	1.3	0.8
0.5	0.9	0.5
0.8	1.4	1.0
0.6	1.4	1.0
2.1	2.7	2.1

SUBGRADE OBSERVATION WELLS

T920a 1/71 11' W	T921a 1/71 31' W	T922a 2/69 11' W	T923a 2/69 41' W
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
1.9 (Ice)	7.8	0.3 (Ice)	0.6 (Ice)
0.5 (Ice)	5.4	0.2 (Ice)	0.5 (Ice)
-	-	0.0 (Ice)	6.5
0.4 (Ice)	7.5	-	-
2.1 (Ice)	1.6 (Ice)	0.4	0.4
3.8	4.9	3.5	9.8
2.4	3.1 (Ice)	4.8	5.6
2.7	2.5	1.1	1.3
2.3	2.2	1.1	1.2
2.8	2.1	0.6	0.4
2.5	2.5	1.8	0.7
2.6	2.8	0.9	0.7
15.1	14.6	15.0	15.9

NOTE: Depths are measured in feet from surface of pavement.

B

FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.  
  
GROUND WATER TABLE  
OBSERVATIONS  
  
FROST EFFECTS LABORATORY BOSTON MASS. JUNE 1946

SUMMARY OF THERMOMETER DATA AT IN  
TEST AREA D  
STA. B + 65, 55' N. OF  $\square$ , E-W RUNWAY

THERMOMETER NO.	DEPTH IN FEET	JAN. 8	JAN. 9	JAN. 11	JAN. 14	JAN. 16	JAN. 21	JAN. 28	FEB. 1	FEB. 4	FEB. 8	FEB. 11	FEB. 15	FEB. 20	FEB. 26	MAR. 4	MAR. 11	MAR. 20	MAR. 25	APR. 1	APR. 8
1	0.7	24.0	31.0	31.0	21.0	29.0	21.0	24.0	22.0	25.0	26.0	21.0		22.0	22.0	30.5	32.0	36.0	36.0	35.0	38.0
2	1.3	27.0	31.0	31.0	24.0	22.0	25.0	26.0	24.0	25.0	29.0	24.0		25.0	25.0	30.0	33.0	37.0	37.0	38.0	39.0
3	2.2	33.0	31.0	31.5	30.5	28.5	27.0	30.0	27.0	27.0	29.0	28.0		26.5	27.0	29.5	32.0	34.0	36.0	39.0	38.0
4	3.1	36.0	33.0	32.5	33.0	33.0	31.0	31.5	31.0	30.5	30.5	30.5		30.0	29.0	30.0	32.0	32.0	32.0	30.0	38.0
5	4.2	36.0	35.5	35.0	35.0	35.0	34.0	33.0	33.0	33.5	32.5	32.5		32.0	32.0	32.0	33.0	32.5	32.0	37.5	38.0
6	5.2	38.0	38.0	38.0	38.0	38.0	37.0	36.0	36.0	35.5	35.0	35.0		34.5	34.0	34.0	34.5	34.5	34.0	36.0	38.0
7	6.0	-	40.0	40.0	40.0	40.0	39.0	38.0	38.0	37.5	37.5	37.0		37.0	35.5	36.0	36.0	35.0	35.0	36.0	38.0
8	8.1	42.0	45.5	45.0	44.5	45.0	44.0	43.0	42.5	42.0	42.0	42.0		41.0	40.0	40.0	40.0	39.0	39.0	38.5	39.0
Time	(A)	-	P.M. 1:10	P.M. 2:05	P.M. 3:40	A.M. 10:20	A.M. 10:15	A.M. 10:30	A.M. 9:35	A.M. 10:20	A.M. 9:50	A.M. 9:35		P.M. 12:40	A.M. 10:15	P.M. 3:00	A.M. 9:35	A.M. 10:15	A.M. 9:20	A.M. 9:35	A.M. 9:50
Ground Temp.	(B)	-	-	32.0	0.0	0.0	20.0	28.0	25.0	9.0	20.0	11.0		24.0	9.0	53.0	26.0	-	45.0	30.0	55.0
Air Temp.	(C)	15.0	45.0	-	2.0	-0.0	17.0	25.0	26.0	7.0	20.0	13.0		22.0	12.0	40.0	26.0	46.0	45.0	26.0	45.0
Weather	(D)	Clear	Clear	Clear	Clear	Clear	Snow	Cloudy	Cloudy	Clear	Clear	Clear		Snow	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Snow Cover (Timber)(E)	(E)	2.0	0.0	0.0	0.0	-	5.0	3.0	12.0	10.0	6.0	6.0		6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind (Beaufort's Scale) (F)	(F)	5 SW	5 SW	5 SW	-	5 SW	-	2 SW	-	-	2 SW	2 SW		4 SW	5 SW	-	4 SW	4 SW	3 S	2 SE	4 SW

A

NOTES  
(A) Time of reading thermometer within  
(B) Reading of mercury thermometer  
(C) Reading of mercury thermometer  
(D) Weather at time readings were obtained  
(E) No distinction made between snow and  
(F) Approximate wind intensity and direction  
- No readings obtained.



WAR DEPARTMENT

SUMMARY

TEST AREA	TEST NO.	DATE	TYPE OF TEST	STATION LOCATION	OFFSET (in Feet)	NEAREST EXPLORATION	PAVEMENT
D	PBT 91	14 Nov. 1945	Static Load	8/85	18' N. of g	T888 pa	3.6 Bit C
L	PBT 95	16 Apr. 1946	" "	8/75	33' N. of g	T941 pa	3.6 "
D	PBT 98	17 Apr. 1946	" "	9/00	30' N. of g	T941 pa	3.6 "
D	PBT 102	7 Jun. 1946	" "	8/90	10' N. of g	T945 pa	3.6 "
E	PBT 92	15 Nov. 1945	" "	3/10	65' N. of g	T886 pa	3.6 "
E	PBT 101	19 Apr. 1946	" "	3/17	48' N. of g	T940 pa	3.6 "
E	PBT 103	7 Jun. 1946	" "	3/15	40' N. of g	T946 pa	3.6 "
F	PBT 93	16 Nov. 1945	Rupture	1/69	41' N. of g	T887 pa	7.2 Cem.
F	PBT 99	18 Apr. 1946	" "	1/89	21' N. of g	T939 pa	7.2 "
F	PBT 104	10 Jun. 1946	" "	2/09	2' N. of g	T947 pa	7.2 "
F	PBT 94	19 Nov. 1945	Foundation Modulus	1/64	43' N. of g	T887 pa	-
F	PBT 100	18 Apr. 1946	" "	1/85	22' N. of g	T939 pa	-
F	PBT 107	12 Jun. 1946	" "	2/05	3' N. of g	T947 pa	-
E	PBT 90	9 Nov. 1945	Repeating Load	3/05	35' N. of g	T886 pa	3.6 Bit C
E	PBT 97	12 Apr. 1946	" "	3/15	35' N. of g	T940 pa	3.6 "
E	PBT 105	11 Jun. 1946	" "	3/20	35' N. of g	T946 pa	3.6 "
D	PBT 89	8 Nov. 1945	" "	8/75	5' N. of g	T886 pa	3.6 "
D	PBT 96	8 Apr. 1946	" "	8/85	5' N. of g	T941 pa	3.6 "
D	PBT 106	11 Jun. 1946	" "	8/70	15' N. of g	T945 pa	3.6 "

A

FROST INVESTIGATION  
DOW FIELD, BANGOR, MAINE

SUMMARY OF PLATE BEARING TESTS  
1945-1946

MATERIAL UNDERLYING TEST PLATE Thickness in inches			DIAM. OF TEST PLATE (in inches)	TOTAL LOAD IN POUNDS			MAX. RATIO NORMAL TO MELTING PE LOAD FOR O DEFLECTION
CEMENT	BASE	SUBGRADE		@ 0.05 inch Deflection	@ 0.10 inch Deflection	@ 0.20 inch Deflection	
Bit Conc.	49	Sand & Gravel	30	17,000	36,000	- *	1.6
" "	39	" " "	30	12,500	21,000	47,000	
" "	39	" " "	30	13,000	24,000	46,000	
" "	39	" " "	30	18,000	34,000	57,000	
" "	32	" " "	30	21,000	34,000	- *	
" "	32	" " "	30	9,000	17,000	32,000	
" "	41	" " "	30	16,000	31,000	59,000	
Cem. Conc.	22	" " "	24	24,000	40,000	- *	1.6
" "	23	" " "	24	16,000	27,000	47,000	
" "	22	" " "	24	23,000	43,000	- *	1.09
" "	22	" " "	30	7,000	12,000	20,000	
" "	23	" " "	30	5,000	11,000	21,000	
" "	22	" " "	30	6,000	11,000	17,000	
				Deflection in inches @ 20,000 lbs.			
				1st. load		5th Repetition	
Bit Conc.	32	" " "	24	.063		.083	SUMM
" "	32	" " "	24	.135		.168	
" "	41	" " "	24	.080		.108	
" "	49	" " "	24	.073		.085	
" "	39	" " "	24	.114		.136	
" "	39	" " "	24	.080		.116	
				* Deflection not reached with available load.			

Silty Clay

B

CORPS OF ENGINEERS, U.S. ARMY

TESTS

TOTAL LOAD IN POUNDS			MAX. RATIO OF NORMAL TO FROST MELTING PERIOD LOAD FOR 0.1" DEFLECTION	AVG. THICKNESS OF PAVEMENT PLUS BASE (Feet)	MAX. DEPTH OF FROST PENETRATION (Feet)	THICKNESS OF FROZEN SUBGRADE (Feet)
0.05 inch Deflection	0.10 inch Deflection	0.20 inch Deflection				
17,000	36,000	- *	1.6	3.9	4.2	0.7
12,500	21,000	47,000				
13,000	24,000	46,000				
18,000	34,000	57,000	2.0	3.0	4.0	1.0
21,000	34,000	- *				
9,000	17,000	32,000				
16,000	31,000	59,000	1.6	2.5	4.5	2.0
24,000	40,000	- *				
16,000	27,000	47,000				
23,000	43,000	- *	1.09	2.5	4.5	2.0
7,000	12,000	20,000				
5,000	11,000	21,000				
6,000	11,000	17,000	3.0	4.0	1.0	0.3
Deflection in inches @ 20,000 lbs.						
1st. load		5th Repetition				
.063		.083	3.9	4.2	4.2	0.3
.135		.168				
.080		.108				
.073		.085				
.114		.136				
.080		.116				

\* Deflection not reached with available load.

SUMMARY OF PLATE BEARING TESTS

TABLE 5

SUMMARY OF THERMOCOUPLE DATA AT  
TEST AREA "E"  
E-W RUNWAY, STA. 2+90, 50' NORTH OF C

THERMO- COUPLE NO.	DEPTH IN FEET	1945 DEC. 17	1946 JAN. 2	JAN. 8	JAN. 14	JAN. 16	JAN. 21	JAN. 26	FEB. 1	FEB. 4	FEB. 8	FEB. 11	MAR. 11	MAR. 25	APR. 1	APR. 8	APR. 15	APR. 19	APR. 22	APR. 29
0	0.15	18.50	22.50	33.00	21.50	19.50	17.50	24.00	26.00	26.50		17.00	32.00	44.50	40.0	60.0	44.0	61.0	71.0	48.5
1	0.40	19.50	24.00	33.00	22.00	19.75	18.00	25.00	26.00	27.00		18.50	31.00	42.00	34.0	52.5	44.5	56.0	62.5	45.5
2	1.10	27.00	27.00	32.50	27.00	23.00	20.50	27.50	28.00	28.00		24.50	31.00	41.00	38.5	45.5	45.0	50.0	50.5	47.0
3	1.80	31.00	30.00	32.50	30.00	26.00	23.50	29.50	29.00	29.00		27.50	31.50	40.50	40.5	45.5	45.0	50.0	49.5	49.0
4	2.50	32.00	32.00	32.50	31.50	29.00	26.00	31.00	30.50	30.50		29.50	31.50	37.00	40.0	45.5	43.5	49.0	50.0	49.5
5	3.10	35.50	34.00	34.25	32.50	32.00	30.50	31.50	33.00	32.50		32.50	31.50	37.00	39.0	46.0	44.0	47.5	50.0	47.5
6	3.30	37.00	34.50	34.75	32.50	32.50	31.50	32.50	33.50	32.50		33.00	31.50	38.00	39.0	45.0	40.5	47.0	42.0	47.0
7	4.00	39.50	36.50	36.50	34.50	34.50	34.75	34.25	35.50	35.50		35.00	32.00	38.00	38.0	44.5	40.5	45.0	47.0	46.0
8	4.70	41.50	38.50	37.50	36.25	36.00	35.50	35.50	37.00	35.50		36.50	33.00	39.50	37.0	44.0	40.0	44.5	46.0	46.0
9	5.40	43.50	40.50	39.50	38.00	37.75	37.00	36.0	38.50	36.50		38.00	34.00	39.00	37.5	43.5	40.0	44.0	44.5	44.5
10	6.00	45.00	42.00	40.50	40.00	39.00	38.00	38.50	39.50	37.50		39.50	35.00	39.00	37.5	42.5	40.0	42.0	43.0	43.0
Switch Box Temp	(A)	24.00	21.00	31.00	29.00	20.00	20.00	24.00	26.00	18.00		25.00	32.00	44.00	43.0	48.0	42.0	50.0	57.0	47.0
Indicator Temp	(B)	49.00	40.00	49.00	40.00	49.00	42.00	50.00	48.00	49.00		56.00	64.00	55.00	64.0	60.0	60.0	72.0	60.0	65.0
Time	(C)	A.M. 10:09	A.M. 10:30	A.M. 10:40	A.M. 10:40	A.M. 9:40	A.M. 10:40	P.M. 1:45	A.M. 9:15	A.M. 9:45		A.M. 9:15	A.M. 10:05	A.M. 9:50	A.M. 10:12	A.M. 10:45	A.M. 9:20	A.M. 11:10	P.M. 1:40	
Weather	(D)	Clear	Clear	Clear	Clear	Clear	Snowing	Cloudy	Cloudy	Clear		Clear	Clear	Clear	Clear	Clear	Rain	Clear	Clear	Clear
Snow Cover (Inches)	(E)	0.0	3.0	0.0	1.0	4.0	6.0	5.0	11.0	9.0		3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wind (Beaufort Scale)	(F)	25 W	22 W	26 W	24 W	25 W	25 E	22 W	22 W	24 W		22 W	24 W	25 E	25 W	24 W	22 W	25 W	22 W	25 W
Air Temp	(G)	-	15	0	-1.00	-8.00	18	20	25	6		24	28	46	28	46	42	45	55	50
Grd Surface Temp	(H)	20	14	48	3.00	1.00	23	20	25	8		22	33	45	33	52	40	53	60	55

NOTES

1. This installation made in Bituminous Concrete pavement area but after thermocouple was installed. The switch box was placed in the thermocouple inserted in the base and subgrade at a location in bituminous concrete.
2. On 8 February 1946 the switch box was found to be full of ice during under the cover during a thaw - no readings made.
3. On 11 February 1946 readings were made while switch box was approximately full of ice.
4. On 15 February 1946 no readings were made as switch box and wires 6" to 8" of water.
5. On 20 February 1946 switch box was full of ice. The lead wires directly under the cover was frozen solid. No readings obtained 10 March 1946.
6. Readings taken with switch box one half filled with ice.
7. From 11 March to 20 March 1946 no readings taken. Cover left off melting of the ice. On 20 March switch box cleared of ice but no readings taken.
8. On 25 March 1946 switch box pumped out and completely dried. Dr. taken.

FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.

TCOUPLE DATA AT INSTALLATION T886p  
BITUMINOUS CONCRETE PAVEMENT

OF 6

DEPTH	APR. 29	APR. 29	APR. 29	MAY 7	MAY 13	MAY 20	MAY 27													
0.0	61.0	71.0	48.5	58.0	59.0	72.5	69.5													
0.5	56.0	68.5	45.5	50.0	57.5	65.5	66.0													
1.0	50.0	50.5	47.0	50.5	55.0	59.0	65.0													
1.5	50.0	49.5	49.0	57.5	54.5	59.0	65.0													
2.0	49.0	50.0	49.5	51.0	53.0	58.5	66.0													
2.5	47.5	50.0	47.5	50.0	58.0	57.0	64.5													
3.0	47.0	48.0	47.0	49.0	51.0	57.0	60.5													
3.5	45.0	47.0	46.0	49.5	50.0	55.5	58.0													
4.0	44.5	46.0	46.0	46.5	49.5	53.5	55.5													
4.5	44.0	44.5	44.5	45.5	47.5	51.5	54.5													
5.0	42.0	43.0	43.0	44.5	45.5	50.0	53.0													
5.5	50.0	57.0	47.0	53.0	60.0	65.0	66.0													
6.0	72.0	60.0	65.0	69.0	56.0	70.0	68.0													
Time	A.M. 11:10	P.M. 1:40		A.M. 8:50	A.M. 9:25	A.M. 10:15	A.M. 9:45													
Weather	Clear	Clear	Clear	Clear	Cloudy	Clear	Cloudy													
Wind	0.0	0.0	0.0	0.0	0.0	0.0	0.0													
Humidity	85	88	85	88	84	88	88													
Barometer	45	52	50	50	54	64	64													
Notes	53	60	55	37	38	78	71													

NOTES

Concrete pavement area but pit was not re-surfaced.  
The switch box was placed in a corner of the pit and base and subgrade at a location which is overlaid with  
was found to be full of ice due to surface water seep-  
- at readings made.  
made while switch box was approximately three-quarters  
re made as switch box and surrounding area were under  
Full of ice. The lead wires and insulating mat  
solid. No readings obtained from 20 February to  
half filled with ice.  
readings taken. Cover 3 ft off switch box to expedite  
switch box cleared of ice but was one-half full of water.  
out and completely dried. Drains installed. Readings

NOTES

- (A) Readings of mercury thermometer placed near rotary switch at time of obtaining thermocouple readings.
- (B) Readings of mercury thermometer placed on potentiometer usually located in automobile.
- (C) Time of reading thermocouple within 15 minute period.
- (D) Weather at time of reading thermocouple.
- (E) No distinction made between snow and ice cover.
- (F) Approximate intensity and direction of wind at time of reading thermocouple.
- (G) Reading of mercury thermometer suspended in air near thermocouple at time readings were obtained.
- (H) Reading of mercury thermometer placed on ground surface near thermocouple at time readings were obtained.

B

FROST INVESTIGATION  
DOW FIELD, BANGOR, MAINE

THERMOCOUPLE  
RECORD OF SUBSURFACE  
TEMPERATURES  
INSTALLATION T886 p

FROST EFFECTS LABORATORY, BOSTON, MASS. JUNE 1946

SUMMARY OF THERMOMETER DATA

TEST AREA E

STA. 3+00, 55' N. OF C, E-W RUNWAY

TE THERMOMETER NO.	DEPTH IN FEET	JAN. 2	JAN. 8	JAN. 11	JAN. 14	JAN. 16	JAN. 21	JAN. 28	FEB. 1	FEB. 4	FEB. 6	FEB. 11	FEB. 15	FEB. 20	FEB. 26	MAR. 1	MAR. 11	MAR. 22	MAR. 29
1	0.8	24.0	30.0	30.0	24.0	22.0	22.5	26.0	23.0	22.5		20.0		20.0	23.0	30.0	32.0	34.0	35.0
2	1.5	27.0	31.0	31.0	26.0	24.0	23.0	27.0	24.0	24.0		23.0		22.0	24.0	29.0	33.0	36.0	36.0
3	2.2	32.0	31.0	31.5	31.0	29.0	27.0	30.0	27.0	27.5		27.5		25.0	26.0	29.5	31.5	32.0	34.0
4	3.0	Not yet installed		33.0	33.0	33.0	31.0	34.0	32.0	30.0		30.5		29.5	29.5	30.5	32.0	30.0	32.0
5	4.2	35.5	34.5	35.0	35.0	35.0	33.5	36.0	33.0	33.0		32.5		32.0	32.0	31.5	33.0	31.0	32.5
6	5.2	39.0	37.5	37.0	37.0	37.5	37.0	36.0	36.0	36.0		35.5		35.0	35.5	35.0	35.0	34.0	34.0
7	6.0	Not yet installed	40.0	Could not open		39.0	39.0	38.0	38.0	37.5		37.0		36.5	36.0	36.0	35.5	35.5	35.0
8	8.1	46.0	45.0	44.0	44.0	44.0	43.0	42.5	42.0	40.5		43.0		40.0	40.0	39.5	39.5	Frozen to	38.5
Time	(A)	P.M. 3:15	A.M. 11:55	P.M. 1:30	P.M. 4:20	A.M. 9:55	A.M. 10:30	P.M. 1:50	A.M. 9:20	A.M. 9:50		A.M. 9:25		P.M. 1:30	A.M. 10:05	A.M. 10:10	A.M. 9:45	A.M. 10:15	A.M. 9:45
Ground Temp.	(B)	44.0	-	31.0	7.0	1.0	20.0	20.0	25.0	8.0		22.0		21.0	15.0	30.0	20.0	50.0	45.0
Air Temp.	(C)	35.0	-	-	3.0	- 0.0	17.0	26.0	25.0	6.0		24.0		20.0	12.0	40.0	28.0	46.0	44.0
Weather	(D)	Clear	Clear	Clear	Clear	Clear	Snow	Cloudy	Cloudy	Clear		Clear		Snow	Clear	Clear	Clear	Clear	Clear
Snow Cover (Inches)	(E)	3.0	0.0	0.5	-	0.0	6.0	5.0	11.0	11.0		4.5		3.0	7.0	3.0	0.0	0.0	0.0
Wind (Beaufort Scale)	(F)	5 SW	5 SW	5 SW	-	5 SW	-	2 SW	-	-		2 SW		4 SW	5 SW	-	4 SW	4 SW	2 S

(A) Time of reading the thermometer  
 (B) Reading of mercury  
 (C) Reading of mercury  
 (D) Weather at time reading  
 (E) No distinction made between snow and ice  
 (F) Approximate wind direction  
 - No readings obtained



FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.  
SUMMARY OF THERMOCOUPLE DATA AT INST  
TEST AREA "A"  
E-W RUNWAY, STA. -5+57.30' SOUTH OF &

THERMO- COUPLE NO.	DEPTH IN FEET	1965 OCT. 1	OCT. 12	OCT. 19	OCT. 23	OCT. 29	NOV. 5	NOV. 9	NOV. 13	NOV. 16	NOV. 19	NOV. 26	DEC. 17	1966 JAN. 2	JAN. 8	JAN. 14	JAN. 16	JAN. 21	JAN. 28	FEB. 1	FEB. 4
0	0.30	55.00	49.00	61.00	50.50	35.50	37.00	49.25	44.50	70.00	53.25	31.50	38.50	13.50	38.25	10.50	11.00	12.50	12.00	19.00	14.50
1	0.65	56.00	49.25	55.25	52.00	37.25	37.50	47.50	43.75	65.00	35.00	32.50	21.50	16.50	33.00	14.50	15.00	15.50	15.00	19.50	17.50
2	1.00	56.00	49.25	52.75	52.50	32.75	32.75	47.25	44.00	63.00	35.75	34.00	23.50	18.50	33.25	16.00	16.75	15.00	15.00	20.00	19.50
3	1.30	57.00	50.25	52.00	52.50	43.25	40.50	47.00	44.25	60.00	37.25	35.50	26.50	21.50	32.50	22.50	18.50	17.50	18.50	21.00	21.00
4	1.65	58.75	51.75	52.25	52.50	43.25	42.50	47.00	45.00	58.00	38.75	36.50	30.50	27.00	32.00	27.00	22.50	21.00	23.00	23.50	24.00
5	1.85	60.00	53.00	52.75	52.75	44.50	44.25	46.75	45.75	57.00	40.00	37.50	31.50	27.50	32.25	28.50	25.00	23.00	24.50	24.50	25.00
6	2.25	62.75	55.75	54.00	53.00	47.50	47.00	47.25	47.75	54.00	42.75	41.00	35.00	32.00	33.50	31.50	30.00	30.00	29.25	29.00	29.00
7	3.45	63.75	57.50	55.00	53.50	50.25	49.00	48.50	49.00	52.50	44.50	44.00	37.50	34.50	35.50	32.50	32.50	33.00	32.50	33.00	32.50
8	4.30	64.25	58.75	56.50	54.50	52.50	51.00	50.75	50.50	51.50	46.50	47.00	41.00	37.00	37.75	35.50	34.50	36.00	35.00	35.50	35.00
9	5.15	64.00	60.00	57.25	55.50	54.00	52.50	52.50	52.00	49.50	50.50	50.00	44.00	40.00	40.50	38.00	38.25	38.00	38.00	38.00	37.50
10	6.00	63.25	60.00	58.00	56.50	55.25	54.00	53.50	53.75	47.50	51.75	51.50	46.50	43.00	42.50	40.50	40.25	40.50	40.50	40.50	39.50
Switch Box Temp (A)		-	-	-	-	-	39.00	50.00	46.00	38.00	38.00	35.00	23.00	21.00	26.00	16.00	12.00	20.00	22.00	27.00	26.00
Indicator Temp (B)		-	-	-	49.00	42.00	50.00	65.00	60.00	45.00	66.00	56.00	45.00	43.00	58.00	42.00	50.00	59.00	58.00	56.00	50.00
Time (C)		P.M. 3:30	P.M. 2:10	P.M. 1:40	A.M. 8:30	A.M. 9:25	A.M. 9:25	A.M. 9:30	A.M. 8:50	A.M. 9:40	A.M. 9:25	A.M. 8:35	A.M. 10:20	A.M. 10:20	A.M. 10:05	A.M. 11:50	A.M. 9:25	A.M. 10:55	P.M. 9:25	A.M. 9:00	A.M. 9:10
Weather (D)		-	-	Clear	Cloudy	Clear	Cloudy Snow	Fog	Fog	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Snow	Cloudy	Cloudy
Snow Cover (Inches) (E)		-	-	-	-	-	-	0.0	-	-	-	-	-	1.0	0.0	1.0	-	2.0	2.0	9.0	7.0
Wind (Beaufort Scale) (F)		-	-	-	02 W	03 SW	04 SW	02 S	03 S	07	02 SW	03	03 W	02 SW	03 SW	03 SW	03 SW	03 SW	02 W	02 W	04 W
Air Temp (G)		-	-	60	49	48	39	-	-	-	-	-	-	21	-	4	4	19	16	25	6
Soil Surface Temp (H)		-	-	-	-	-	-	53	49	33	38	32	20	16	43	0	11	21	16	21	14

THERMO- COUPLE NO.	DEPTH IN FEET	MAY 27																				
0	0.30	67.00																				
1	0.65	65.00																				
2	1.00	64.50																				
3	1.30	64.50																				
4	1.65	64.50																				
5	1.85	64.50																				
6	2.25	63.50																				
7	3.45	58.00																				
8	4.30	54.00																				
9	5.15	51.50																				
10	6.00	49.50																				
Switch Box Temp (A)		67.00																				
Indicator Temp (B)		74.00																				
Time (C)		A.M. 10:00																				
Weather (D)		Cloudy																				
Snow Cover (Inches) (E)		0.0																				
Wind (Beaufort Scale) (F)		02 W																				
Air Temp (G)		50																				
Soil Surface Temp (H)		68																				

- (A) Readings of mercury thermometer placed on
- (B) Readings of mercury thermometer placed on
- (C) Time of reading thermocouple within 15 m
- (D) Weather at time of reading thermocouple.
- (E) No distinction made between snow and ice
- (F) Approximate intensity and direction of wi
- (G) Reading of mercury thermometer suspended
- (H) Reading of mercury thermometer placed on

A

FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.

THERMOCOUPLE DATA AT INSTALLATION T697p  
CEMENT CONCRETE PAVEMENT

100' SOUTH OF C

AP. 14	JAN. 16	JAN. 21	JAN. 26	FEB. 1	FEB. 6	FEB. 8	FEB. 11	FEB. 15	FEB. 20	FEB. 26	MAR. 4	MAR. 11	MAR. 20	MAR. 25	APR. 1	APR. 8	APR. 15	APR. 19	APR. 22	APR. 29	MAY 7	MAY 13	MAY 20
0.50	11.00	12.50	12.00	19.00	14.50	23.00	13.50	29.00	20.50	15.50	35.00	30.50	45.00	42.00	39.5	52.0	43.0	56.5	65.0	47.0	48.5	57.5	65.5
1.50	15.00	13.50	15.00	19.50	17.50	26.00	17.00	30.50	21.00	18.00	30.00	31.50	37.50	37.00	35.0	41.5	44.0	48.0	51.5	44.0	47.5	56.0	58.5
2.00	16.75	15.00	15.00	20.00	19.50	27.00	19.50	30.50	21.50	19.50	30.00	31.50	37.50	37.00	36.0	40.5	44.5	46.0	50.0	45.0	48.5	56.0	59.0
2.50	18.50	17.50	18.50	21.00	21.00	28.00	22.00	30.50	23.00	21.00	30.00	31.50	37.50	37.50	38.0	41.5	43.5	46.0	48.5	46.5	48.5	54.5	58.5
3.00	22.50	21.00	23.00	23.50	24.00	28.00	24.50	30.00	24.50	23.50	30.00	31.00	38.00	38.00	38.5	41.5	42.5	45.0	49.5	47.5	49.5	55.5	58.5
3.50	25.00	23.00	24.50	24.50	25.00	28.00	26.00	30.50	25.00	24.00	29.50	31.00	37.00	35.50	38.0	41.5	41.5	44.5	49.0	47.5	49.0	54.0	58.5
4.00	30.00	30.00	29.25	29.00	29.00	29.50	29.00	31.00	28.50	26.50	30.00	30.50	36.50	33.00	35.5	39.5	36.0	41.0	46.5	45.5	47.5	52.5	57.0
4.50	32.50	33.00	32.50	33.00	32.50	32.50	31.50	33.00	32.00	29.50	31.50	31.00	36.00	33.50	34.0	37.5	35.0	38.0	44.0	44.0	45.5	51.5	54.5
5.00	34.50	36.00	35.00	35.50	35.00	35.00	34.50	35.00	34.00	32.00	33.50	32.50	37.50	35.50	35.0	38.0	34.5	37.0	42.5	41.5	44.0	48.0	52.5
5.50	38.00	38.25	38.00	38.00	37.50	37.50	37.00	37.50	36.00	34.50	35.00	34.50	39.00	36.50	36.5	39.0	36.0	37.0	41.5	40.0	42.5	46.5	50.0
6.00	40.25	40.50	40.50	40.50	39.50	39.50	39.00	39.00	38.00	36.50	37.00	36.00	39.00	37.50	37.0	39.5	37.0	38.0	40.5	39.0	41.0	46.0	47.5
6.50	42.00	40.00	42.00	42.00	41.00	41.00	40.00	40.00	39.00	37.00	38.00	37.00	40.00	38.00	38.0	40.0	40.0	41.0	41.0	41.0	42.0	47.0	47.0
7.00	40.00	50.00	50.00	50.00	50.00	47.00	50.00	50.00	50.00	45.00	50.00	65.00	50.00	58.00	70.0	60.0	60.0	68.0	60.0	65.0	72.0	57.0	70.0
A.M. 9:25	A.M. 10:55	A.M. 9:05	A.M. 9:05	A.M. 9:10	A.M. 9:05	A.M. 9:05	A.M. 8:50	P.M. 2:40	A.M. 9:55	A.M. 10:20	A.M. 10:10	A.M. 10:42	A.M. 9:55	A.M. 10:50	A.M. 11:05	A.M. 10:50	A.M. 11:30	P.M. 2:00	P.M. 10:00	A.M. 8:35	A.M. 9:50	A.M. 9:25	A.M. 9:25
Clear	Snow	Cloudy	Cloudy	Clear	Clear	Clear	Clear	Snow	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Snow	Clear	Clear	Clear	Clear	Clear	Clear
0	2.0	2.0	9.0	7.0	4.0	3.0	1.0	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
05 22	05 21	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00	06 00
4	19	16	25	6	20	18	30	28	10	50	33	50	46	28	48	42	45	55	50	53	54	70	
11	21	16	21	14	20	16	27	21	11	42	31	52	46	28	52	40	52	60	55	55	57	60	

NOTES

- (A) Readings of mercury thermometer placed near rotary switch at time of obtaining thermocouple readings.
- (B) Readings of mercury thermometer placed on potentiometer usually located in automobile.
- (C) Time of reading thermocouple within 15 minute period.
- (D) Weather at time of reading thermocouple.
- (E) No distinction made between snow and ice cover.
- (F) Approximate intensity and direction of wind at time of reading thermocouple.
- (G) Reading of mercury thermometer suspended in air near thermocouple at time readings were obtained.
- (H) Reading of mercury thermometer placed on ground surface near thermocouple at time readings were obtained.

B

FROST INVESTIGATION  
DOW FIELD, BANGOR, MAINE

THERMOCOUPLE  
RECORD OF SUBSURFACE  
TEMPERATURES  
INSTALLATION T697 p

FROST EFFECTS LABORATORY, BOSTON, MASS. JUNE 1946

SUMMARY OF THERMOMETER DATA AT  
TEST AREA A  
STA. -5+47, 34' S. OF E, E-W RUNWAY  
CEMENT

Thermometer No.	DEPTH IN FEET	1944 JAN. 8	JAN. 9	JAN. 11	JAN. 16	JAN. 21	JAN. 26	FEB. 1	FEB. 6	FEB. 8	FEB. 11	FEB. 15	FEB. 20	FEB. 26	MAR. 4	MAR. 11	MAR. 20	MAR. 25	APR. 1	APR. 5	
1	0.0	29.0	27.0	31.0	36.0	28.0	18.0	21.0	21.0	27.0	20.0	30.0	25.0	25.0	30.0	34.0	40.0	30.0	35.0	37.0	
2	1.5	Frozen To	30.0	31.0	21.0	21.0	19.0	21.0	22.0	20.0	22.0	29.0	22.0	26.0	30.0	33.0	35.0	36.0	36.0	36.0	
3	2.0	29.0	31.0	31.5	27.0	26.0	26.0	25.0	30.0	28.0	27.0	29.0	26.0	27.0	29.0	30.0	30.0	34.0	36.0	36.0	
4	3.0	33.5	33.0	33.0	32.5	31.0	31.0	29.5	30.0	29.5	29.5	30.0	29.0	29.0	30.0	30.0	Frozen To	Frozen To	30.0	30.5	
5	3.0	36.0	36.0	36.5	35.5	35.0	34.0	33.5	33.0	33.0	30.5	30.5	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.5	
6	5.0	39.5	39.5	39.5	39.0	39.0	36.0	36.5	36.5	35.0	35.5	35.0	35.0	34.0	34.0	34.0	30.0	30.0	30.0	30.5	
7	6.5	41.5	41.0	40.5	40.0	39.0	39.0	38.5	38.0	38.0	37.5	37.0	37.0	37.0	36.0	36.0	36.0	36.0	35.5	35.5	
8	8.0	40.5	40.0	40.0	40.5	40.0	40.5	40.0	40.0	41.5	41.0	40.5	40.0	40.0	39.0	39.5	39.0	38.5	37.5	38.0	
Time	(A)	-	A.M. 10:00	A.M. 11:00	A.M. 9:00	A.M. 11:15	A.M. 9:30	A.M. 9:00	A.M. 9:30	A.M. 9:00	A.M. 9:00	A.M. 9:05	P.M. 2:10	A.M. 9:00	A.M. 10:45	A.M. 10:00	A.M. 10:05	A.M. 10:00	-	A.M. 11:10	
Ground Temp.	(B)	16.0	-	31.0	1.0	21.0	16.0	21.0	16.0	20.0	16.0	27.0	21.0	11.0	30.0	30.0	30.0	16.0	20.0	30.0	
Air Temp.	(C)	21.0	-	-	- 2.0	19.0	16.0	25.0	6.0	20.0	10.0	20.0	20.0	10.0	30.0	35.0	30.0	16.0	20.0	30.0	
Weather	(D)	Clear	Clear	Clear	Clear	Snow	Cloudy	Cloudy	Clear	Clear	Clear	Clear	Clear	Snow	Clear	Clear	Clear	Clear	Clear	Clear	
Snow Cover (Inches)	(E)	0.0	0.0	0.0	0.0	0.0	1.5	9.0	7.0	6.0	3.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	
Wind (Beaufort Scale)	(F)	2 SW	5 SW	5 SW	5 SW	-	2 SW	-	-	2 SW	2 SW	4 SW	5 SW	5 SW	5 SW	-	4 SW	4 SW	2 S	2 SW	4 SW

(A) Time of reading thermometer  
(B) Reading of surface thermometer  
(C) Reading of air thermometer  
(D) Weather at time of reading  
(E) In direction and height  
(F) Approximate wind direction  
- No readings obtained.

A

FROST INVESTIGATION  
DOW FIELD - BANGOR, ME.

THERMOMETER DATA AT INSTALLATION TW-1  
CEMENT CONCRETE PAVEMENT

RUNWAY

MAR. 20	MAR. 25	APR. 1	APR. 6	APR. 15	APR. 19	APR. 22	APR. 25	MAY 7	MAY 13	MAY 20	MAY 27								
40.0	30.0	35.0	37.0	45.0	46.0	47.0	46.0	50.0	50.0	50.0	66.0								
35.0	36.0	36.0	36.0	42.0	46.0	46.0	46.0	50.0	57.0	50.0	65.0								
30.0	36.0	36.0	35.0	39.0	41.5	42.0	47.0	49.5	51.0	50.0	62.0								
Freeze	Freeze	30.0	32.5	35.0	38.0	40.0	45.0	47.0	48.5	50.0	58.0								
"	"	30.0	31.0	30.5	33.0	36.0	39.0	43.0	45.0	46.5	49.0								
"	"	Freeze	33.5	31.5	31.0	36.0	38.0	42.0	44.5	45.0	48.0								
36.0	36.0	35.5	35.5	35.5	36.0	36.0	40.0	42.0	44.0	46.0	46.0								
39.0	30.5	37.5	30.0	30.0	30.0	30.5	39.0	41.0	43.5	44.0	44.0								
A.M. 10:25	A.M. 10:00	-	A.M. 11:10	A.M. 10:40	A.M. 9:50	P.M. 2:05	A.M. 10:05	A.M. 8:40	A.M. 11:50	A.M. 10:00	A.M. 10:05								
50.0	46.0	50.0	50.0	45.0	-	60.0	50.0	55.0	62.0	60.0	68.0								
50.0	46.0	50.0	50.0	46.0	47.0	55.0	55.0	55.0	62.0	60.0	68.0								
Clear	Clear	Clear	Clear	Min	Cloudy	Clear	Clear	Clear	Clear	Clear	Cloudy								
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0								
4 W	0 0	0 00	4 W	0 W	3 W	3 W	3 W	3 W	4 W	0 W	0 W								

- (A) Type of reading thermometer within 25 minute period.
- (B) Reading of surface thermometer placed on surface of ground at installation.
- (C) Reading of survey thermometer suspended in air in vicinity of installation.
- (D) Weather at the readings were obtained.
- (E) No distinction made between snow and ice cover.
- (F) Approximate wind intensity and direction at the readings were obtained.
- No readings obtained.

B

FROST INVESTIGATION  
DOW FIELD - BANGOR, ME.

RECORD OF SUBSURFACE  
TEMPERATURES  
INSTALLATION TW-1

FROST EFFECTS LABORATORY, BOSTON, MASS. JUNE, 1946

FROST INVESTIGATION  
 DOW FIELD, BANGOR, ME.  
 SUMMARY OF THERMOCOUPLE DATA AT IN  
 TEST AREA "B"  
 E-W RUNWAY, STA. 13+50. 215' SOUTH OF C

THERMO- COUPLE NO.	DEPTH IN FEET	1946 OCT. 1	OCT. 12	OCT. 20	OCT. 23	OCT. 29	NOV. 5	NOV. 9	NOV. 13	NOV. 16	NOV. 19	NOV. 26	DEC. 17	1946 JAN. 2	JAN. 8	JAN. 11	JAN. 16	JAN. 21	JAN. 28	FEB. 1	FEB. 8	
0	0.2	58.00	46.00	59.50	50.00	54.00	37.75	48.50	43.00	34.50	34.50	35.00	22.00	25.00	33.00	18.00	19.50	26.50	29.50	27.00	27.00	27.00
1	0.8	58.75	46.75	50.75	50.50	39.50	40.00	45.75	43.00	37.50	36.50	36.00	31.00	29.00	32.75	28.50	24.50	26.50	30.50	28.50	28.50	25.00
2	1.4	55.25	49.75	50.50	50.25	43.50	43.75	45.00	43.75	42.00	39.50	37.50	33.00	31.50	33.00	31.50	28.75	29.50	31.00	31.00	31.00	30.00
3	2.0	58.00	53.00	51.75	50.75	46.25	45.50	45.25	44.75	44.00	42.25	41.00	35.00	33.50	35.00	33.00	32.50	32.50	32.50	33.50	33.50	34.00
4	2.7	59.00	54.25	53.50	51.50	48.50	47.00	46.50	45.75	45.50	44.50	43.50	36.50	34.50	37.00	34.50	33.50	34.25	34.00	35.00	35.00	34.00
5	3.4	59.25	55.00	54.75	52.00	49.75	48.00	47.50	46.75	45.00	46.25	44.50	38.00	36.00	38.75	36.25	34.75	35.75	35.00	36.50	36.00	37.00
6	3.6	59.25	55.50	54.75	50.25	50.25	48.50	48.50	47.00	46.00	47.00	44.50	39.50	36.50	39.25	37.50	35.00	36.50	36.00	37.00	37.00	36.00
7	4.2	59.50	55.75	55.00	52.75	51.00	49.00	49.25	47.75	46.50	48.25	46.50	40.50	38.00	40.00	37.75	36.25	37.50	37.00	37.00	38.00	37.00
8	4.8	59.75	56.25	55.25	53.00	52.00	50.00	50.00	48.25	47.50	49.00	47.00	41.50	39.00	41.00	39.25	37.00	38.50	37.00	39.00	39.00	38.00
9	5.4	59.50	56.25	55.50	53.50	52.50	51.00	50.50	48.75	47.50	49.75	47.50	42.50	40.50	41.75	40.00	37.75	39.50	38.50	39.50	39.50	38.00
10	6.0	59.25	56.50	55.50	54.00	53.50	51.50	51.00	49.25	48.00	50.25	47.50	44.00	41.00	42.50	42.00	39.75	40.00	39.50	40.50	40.50	39.00
British Sea Temp (A)		-	-	-	-	-	39.00	50.00	44.00	37.00	42.00	37.00	20.00	20.00	30.00	23.00	26.00	28.00	28.00	28.00	28.50	22.00
Indicator Temp (B)		-	-	-	-	-	55.00	65.00	65.00	44.00	57.00	52.00	46.00	44.00	45.00	36.00	48.00	53.00	40.00	50.00	47.00	47.00
Time (C)		P.M. 3:50	P.M. 2:30	P.M. 2:05	A.M. 8:42	A.M. 9:08	A.M. 9:59	A.M. 9:15	A.M. 9:04	A.M. 9:50	A.M. 9:55	A.M. 8:55	A.M. 9:50	P.M. 1:45	A.M. 11:29	A.M. 10:10	A.M. 9:55	A.M. 10:40	A.M. 11:30	A.M. 9:50	A.M. 11:15	A.M. 11:15
Weather (D)			Clear	Cloudy	Clear	Cloudy	Fog	Cloudy	Fog	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Snowing	Cloudy	Cloudy	Clear
Snow Cover (Inches) (E)		-	-	-	-	-	1.5	0.0	-	0.0	-	0.0	0.0	-	0.0	2.5	5.8	5.0	10.0	18.0	20.0	20.0
Wind (Beaufort Scale) (F)		-	-	-	00 NW	05 SE	04 NW	02 S	05 S	07	02 NW	05	05 W	02 NW	06 NW	04 NW	05 NW	05 SE	00 NW	00 W	00 W	00 W
Air Temp (G)		-	-	60	50	42	-	-	-	-	-	-	-	15	-	-2	-7	17	23	27	27	27
Soil Surface Temp (H)		-	-	-	-	-	30	52	48	30	46	35	20	16	33	1	-4	26	26	26	26	26

(A) Readings of mercury thermometer placed on  
 (B) Readings of mercury thermometer placed on  
 (C) Time of reading thermocouple within 15 m  
 (D) Weather at time of reading thermocouple.  
 (E) No distinction made between snow and ice  
 (F) Approximate intensity and direction of wi  
 (G) Reading of mercury thermometer suspended  
 (H) Reading of mercury thermometer placed on

A

FROST INVESTIGATION  
 DOW FIELD, BANGOR, ME.  
 COUPLE DATA AT INSTALLATION T693p  
 TURF AREA

DEPTH OF C

JAN. 16	JAN. 21	JAN. 26	FEB. 1	FEB. 6	FEB. 8	FEB. 11	FEB. 20	FEB. 26	MAR. 20	MAR. 25	APR. 1	APR. 8	APR. 15	APR. 19	APR. 22	APR. 29	MAY 7	MAY 13	MAY 20	MAY 27		
19.50	24.50	29.50	27.00	27.00	25.50	15.00	21.00	25.50	34.50	33.00	32.5	40.0	39.5	40.0	56.5	41.5	50.0	57.5	69.0	65.0		
24.50	26.50	30.50	28.50	29.00	26.50	27.50	25.00	27.50	36.50	33.00	32.5	37.0	37.0	40.0	41.5	42.0	48.5	53.5	55.0	59.75		
29.75	29.50	31.00	31.00	30.50	29.50	30.50	29.00	29.50	37.50	32.50	32.0	37.0	35.5	39.5	42.0	44.0	49.5	51.0	54.5	58.0		
32.50	32.50	32.50	33.50	33.00	30.00	33.50	33.00	33.50	38.00	33.00	31.5	37.0	33.0	38.5	42.5	43.5	48.5	48.5	53.5	56.5		
33.50	34.25	34.00	35.00	34.50	30.50	35.00	34.50	35.00	39.50	34.00	32.5	38.0	34.5	38.5	42.5	43.5	48.5	48.5	53.5	56.5		
34.75	35.75	35.00	36.50	35.50	32.50	36.00	35.50	35.50	41.50	35.00	33.5	39.0	35.0	38.5	42.5	43.5	48.5	48.5	53.5	53.5		
35.00	36.50	36.00	37.00	36.00	33.00	36.50	35.50	36.00	41.50	35.50	34.0	39.5	35.0	38.5	42.5	43.5	48.5	48.0	52.5	51.0		
36.25	37.50	37.00	38.00	37.00	34.50	37.00	36.50	37.00	41.50	36.00	34.0	39.5	36.0	38.0	42.5	43.5	48.5	48.5	51.5	51.0		
37.00	38.50	37.00	39.00	38.00	35.50	38.00	37.00	38.00	41.50	36.50	34.5	40.0	36.5	38.0	41.5	43.0	44.0	48.0	50.0	50.0		
37.75	39.50	38.50	39.50	38.50	37.00	38.50	38.00	38.50	41.50	37.50	34.5	40.0	36.5	38.0	40.5	39.5	43.5	48.0	48.5	48.0		
39.75	40.00	39.50	40.50	39.50	38.00	39.50	38.50	39.50	41.50	38.00	35.5	40.0	37.0	37.0	38.5	39.0	41.0	43.5	45.0	46.5		
26.00	26.00	26.00	24.50	22.00	28.00	27.00	31.00	24.00	37.00	35.00	38.5	40.0	40.0	44.0	51.0	53.0	50.0	53.0	66.0	59.0		
40.00	53.00	40.00	52.00	47.00	55.00	55.00	56.00	52.00	45.00	55.00	70.0	60.0	62.0	70.0	65.0	60.0	53.0	53.0	65.0	65.0		
A.M. 9:55	A.M. 10:40	A.M. 11:30	A.P. 9:50	A.M. 11:00	A.P. 10:20	A.M. 10:00	A.M. 10:40	A.M. 10:25	A.M. 8:40	A.M. 8:40	A.M. 9:45	A.M. 10:35	A.M. 9:10	A.M. 10:55	P.M. 1:15	A.M. 8:45	A.M. 9:30	A.M. 9:25	A.M. 10:50	A.M. 9:35		
Clear	Snowing	Cloudy	Cloudy	Clear	Clear	Clear	Snowing	Clear	Clear	Clear	Clear	Clear	Rain	Cloudy	Clear	Clear	Clear	Clear	Cloudy	Clear	Cloudy	
5.0	5.0	10.0	15.0	20.0	5.0	8.0	7.0	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
5 SW	WS	WS	WS	WS	WS	WS	WS	WS	WS	WS	0	WS	WS	WS	WS	WS	WS	WS	WS	WS	WS	
-7	17	23	27	8	28	21	20	12	45	44	26	45	42	45	55	56	55	55	64	62		
4	26	28	26	10	19	12	22	12	-	44	34	40	40	50	66	55	55	55	70	68		

NOTES

- Readings of mercury thermometer placed near rotary switch at time of obtaining thermocouple readings.
- Readings of mercury thermometer placed on potentiometer usually located in automobile.
- Time of reading thermocouple within 15 minute period.
- Weather at time of reading thermocouple.
- Distinction made between snow and ice cover.
- Wind velocity and direction of wind at time of reading thermocouple.
- Reading of mercury thermometer suspended in air near thermocouple at time readings were obtained.
- Reading of mercury thermometer placed on ground surface near thermocouple at time readings were obtained.

B

FROST INVESTIGATION  
 DOW FIELD, BANGOR, MAINE

THERMOCOUPLE  
 RECORD OF SUBSURFACE  
 TEMPERATURES  
 INSTALLATION T693p

FROST EFFECTS LABORATORY, BOSTON, MASS. JUNE 1946

FROST INVESTIGATION  
DOW FIELD, BANGOR

SUMMARY OF THERMOCOUPLE DATA AT  
TEST AREA "B"  
E-W RUNWAY, STA. 14+50, 300' SOUTH OF C

THERMO-COUPLE NO.	DEPTH IN FEET	1965 OCT. 1	OCT. 12	OCT. 19	OCT. 23	OCT. 29	NOV. 5	NOV. 9	NOV. 13	NOV. 16	NOV. 19	NOV. 26	DEC. 17	1966 JAN. 2	JAN. 8	JAN. 14	JAN. 16	JAN. 21	JAN. 26	FEB. 1
0	0.2	51.50	46.00	51.75	49.50	55.25	59.00	46.00	44.50	52.00	54.75	55.00	21.00	25.50	35.00	25.50	24.00	22.50	25.00	25.00
1	0.8	52.75	47.50	49.75	50.00	46.00	46.50	45.50	43.25	57.00	57.25	57.50	28.50	50.00	32.50	29.00	26.25	25.00	28.00	27.00
2	1.3	54.50	49.00	50.50	50.00	48.75	42.50	45.25	44.25	42.50	58.25	59.00	32.50	51.50	33.00	30.50	28.00	27.75	30.00	28.50
3	1.8	56.75	51.50	52.00	50.25	45.25	44.50	45.00	45.75	44.50	40.50	41.00	34.00	53.00	34.50	32.00	31.50	32.00	32.00	32.50
4	2.3	57.75	53.00	53.25	50.50	47.25	45.75	44.75	47.25	46.00	42.50	43.00	36.00	54.50	36.00	33.00	32.75	33.00	33.00	34.00
5	2.8	58.00	53.75	54.50	51.00	48.25	46.25	45.00	48.25	46.00	44.25	44.00	36.50	56.00	37.50	34.25	33.75	34.50	34.00	35.00
6	3.2	58.50	54.25	54.50	51.25	48.50	46.00	46.00	48.50	47.00	44.25	44.00	37.50	57.50	38.50	35.00	34.75	35.50	35.00	36.00
7	3.9	58.50	55.00	55.00	51.50	50.00	47.50	47.50	49.25	47.00	46.25	46.00	39.50	59.00	39.00	36.25	35.50	36.00	36.00	37.00
8	4.4	58.50	55.00	55.00	52.25	50.50	48.25	48.00	49.75	48.50	47.50	47.00	41.00	60.50	40.50	37.25	37.00	38.00	37.00	38.00
9	5.4	58.25	55.25	54.75	52.75	51.25	49.00	48.75	50.00	48.50	48.50	48.50	42.50	62.00	41.00	39.50	38.00	39.00	38.00	39.00
10	6.8	58.00	55.75	54.25	53.00	51.75	50.00	49.75	50.25	50.00	49.00	49.00	43.00	63.00	42.00	39.50	39.25	39.75	39.50	39.75
Switch Box Temp (A)		-	-	-	-	-	59.00	48.00	44.00	40.00	54.00	54.00	22.00	28.00	32.00	22.00	24.00	21.00	26.00	26.00
Indicator Temp (B)		-	-	-	-	42.00	54.00	63.00	61.00	44.00	64.00	56.00	54.00	42.00	48.00	40.00	43.00	56.00	46.00	50.00
Time (C)		4:00P	2:40P	2:14P	8:48P	9:16A	9:44A	9:08A	9:16A	10:05A	9:50A	9:18A	9:55A	1:45P	2:00P	10:50A	9:08A	9:20A	2:45P	10:00A
Weather (D)		-	-	Clear	Cloudy	Clear	Cloudy	Fog	Fog	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Snow	Cloudy	Cloudy
Snow Cover (Inches) (E)		-	-	-	-	-	1.5	0.0	-	0.0	-	0.0	0.0	1.5	0.0	2.0	4.0	3.0	4.0	10.0
Wind (Beaufort Scale) (F)						05 W	04 W	02 S	05 S	07	02 W	05	05 W	05 W	04 W	05 W	05 W	05 W	02 W	05 W
Air Temp. (G)		-	-	60	50	42	-	-	-	-	-	-	-	35	-	-1	-9	13	29	27
Grd Surface Temp. (H)		-	-	-	-	-	58	52	48	29	50	52	21	20	37	25	21	19	20	26

THERMO-COUPLE NO.	DEPTH IN FEET	MAY 27																		
0	0.2	59.50																		
1	0.8	59.00																		
2	1.3	59.00																		
3	1.8	56.50																		
4	2.3	55.00																		
5	2.8	53.00																		
6	3.2	52.50																		
7	3.9	50.00																		
8	4.4	48.75																		
9	5.4	46.00																		
10	6.8	45.00																		
Switch Box Temp (A)		63.50																		
Indicator Temp (B)		65°																		
Time (C)		9:50A																		
Weather (D)		Cloudy																		
Snow Cover (Inches) (E)		0.0																		
Wind (Beaufort Scale) (F)		02 W																		
Air Temp. (G)		60																		
Grd Surface Temp (H)		71																		

- (A) Readings of
- (B) Readings of
- (C) Time of
- (D) Weather at
- (E) In distance
- (F) Approximate
- (G) Reading of
- (H) Reading of

A

FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.

TCOUPLE DATA AT INSTALLATION T694p  
TURF AREA

	JAN. 21	JAN. 28	FEB. 1	FEB. 4	FEB. 8	FEB. 11	FEB. 15	FEB. 20	FEB. 26	MAR. 4	MAR. 11	MAR. 20	MAR. 25	APR. 1	APR. 8	APR. 15	APR. 19	APR. 22	APR. 29	MAY 7	MAY 13	MAY 20
00	22.50	25.00	25.00	25.50	30.00	25.50	30.50	21.50	25.00	31.00	31.50	35.00	33.50	33.0	35.5	38.5	43.0	44.5	40.0	51.00	54.00	50.50
25	25.00	28.00	27.00	28.00	29.50	29.00	30.50	24.50	26.50	30.50	32.00	35.50	34.00	33.0	36.0	37.5	40.0	39.5	42.0	46.00	53.50	54.50
50	27.75	30.00	28.50	29.50	30.00	30.00	30.50	27.00	27.50	30.50	32.50	37.00	34.00	38.5	36.5	36.0	39.0	38.5	42.5	46.50	52.00	55.00
75	32.00	32.00	32.50	32.50	32.00	32.00	32.50	30.50	29.50	31.50	32.50	37.50	34.00	38.5	36.5	36.0	39.0	38.5	42.5	46.50	52.00	55.00
00	33.00	33.00	34.00	34.00	33.00	33.00	34.00	32.50	33.00	34.00	34.00	38.50	34.00	38.5	36.5	34.0	38.0	37.5	42.0	45.40	50.00	55.00
25	34.50	34.00	35.00	35.50	34.00	34.00	35.00	34.00	33.50	35.00	34.50	38.50	35.50	34.0	37.0	34.0	38.5	38.5	40.5	44.50	48.00	54.50
50	35.50	35.00	36.00	36.00	34.50	34.50	36.00	34.00	34.00	35.50	35.00	39.00	35.50	34.0	38.0	34.5	38.5	39.5	40.0	44.00	46.50	53.50
75	36.00	36.00	37.00	37.00	35.50	35.50	37.00	36.00	35.00	36.00	36.00	39.00	36.00	34.5	38.0	35.0	39.0	39.0	40.5	43.50	46.00	53.00
00	38.00	37.00	38.00	38.50	36.00	37.00	37.50	36.50	36.00	36.50	37.00	40.00	36.50	35.0	38.0	36.0	38.5	39.0	40.5	42.50	45.00	51.00
25	39.00	38.00	39.00	39.50	37.00	37.50	38.00	37.00	37.00	37.50	37.50	40.00	36.50	35.5	38.0	36.0	38.5	38.0	40.0	42.00	44.50	48.00
50	39.75	39.50	39.75	40.50	38.00	39.00	39.00	38.00	38.00	38.00	38.50	40.00	37.00	36.5	38.0	37.0	39.0	37.0	39.5	41.50	43.00	47.00
75	21.00	26.00	26.00	24.00	24.00	24.00	25.00	24.00	24.00	33.00	33.00	43.00	37.00	34.5	36.0	39.0	46.0	50.0	46.0	40.0	55.0	62.0
00	56.00	48.00	50.00	53.00	52.00	56.00	51.00	48.00	51.00	57.00	55.00	45.00	58.00	62.0	56.0	62.0	78.0	60.0	46.0	53.0	55.0	65.0
25	9:20A	2:45P	10:00A	10:50A	10:11A	10:29A	9:20A	11:00A	10:50A	9:30A	9:20A	10:02A	8:50A	9:20A	10:20A	9:00A	11:02A	1:30P	9:00A	9:20A	9:15A	11:00A
50	Cloudy	Cloudy	Clear	Clear	Clear	Clear	Clear	Snow	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Rain	Clear	Clear	Clear	Clear	Clear
75	3.0	4.0	10.0	10.0	7.0	5.0	4.0	5.5	-	10.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
00	02 SW	02 SW	03 W	04 SW	05 SW	02 SW	04 SW	04 SW	05 SE	04 SW	04 SW	04 SW	05 S	02 S	04 SW	02 SW	05 SW	05 SW	05 SW	04 SW	04 SW	02 SW
25	13	19	27	8	21	17	30	20	12	48	25	46	44	24	45	42	47	55	46	53	53	44
50	19	28	26	10	20	16	30	23	12	38	26	42	44	38	42	39	52	60	55	54	58	45

NOTES

- (A) Readings of mercury thermometer placed near rotary switch at time of obtaining thermocouple readings.
- (B) Readings of mercury thermometer placed on potentiometer usually located in automobile.
- (C) Time of reading thermocouple within 15 minute period.
- (D) Weather at time of reading thermocouple.
- (E) No distinction made between snow and ice cover.
- (F) Approximate intensity and direction of wind at time of reading thermocouple.
- (G) Reading of mercury thermometer suspended in air near thermocouple at time readings were obtained.
- (H) Reading of mercury thermometer placed on ground surface near thermocouple at time readings were obtained.

B

FROST INVESTIGATION  
DOW FIELD, BANGOR, MAINE

THERMOCOUPLE  
RECORD OF SUBSURFACE  
TEMPERATURES  
INSTALLATION T694p

FROST EFFECTS LABORATORY, BOSTON, MASS. JUNE 1946

SUMMARY OF THERMOMETER DATA AT  
TURF AREA  
STA. 13+60, 215' S. OF C, E-W RUNWAY

THERMOMETER NO.	DEPTH IN FEET	1946 JAN. 8	JAN. 11	JAN. 14	JAN. 16	JAN. 19	JAN. 21	JAN. 23	FEB. 1	FEB. 4	FEB. 6	FEB. 11	FEB. 15	FEB. 20	FEB. 26	MAR. 4	MAR. 11	MAR. 20	MAR. 25	APR. 1
1	0.0	27.0	29.5	30.0	-	29.0	29.0	29.0	29.0	25.0		29.0		Frozen In	26.0			30.0	32.0	32.0
2	1.1	32.0	31.5	31.0	32.0	29.0	29.0	32.0	26.0	29.0		30.0		Frozen In	Frozen In			Unable to Open	33.0	31.0
3	2.1	34.0	33.0	33.0	33.0	33.5	32.0	32.0	31.5	31.5		31.5		Therm. broken	30.0			32.0	32.0	33.0
4	2.8	37.0	36.5	36.0	36.0	36.5	35.5	35.0	35.0	35.0		34.0			34.0			Unable to Open	Unable to Open	34.0
5	4.2	39.0	38.0	38.0	37.5	37.5	37.0	36.5	36.5	36.0		36.0			35.5	35.0		Unable to Open	Unable to Open	32.5
6	5.2	41.0	39.0	38.5	38.5	38.5	38.0	38.0	37.0	37.0		37.0			36.0	36.0		36.0	35.0	35.0
7	6.0	-	-	40.5	40.0	40.0	40.0	39.0	39.0	38.5		38.5			38.0	38.0		-	37.0	37.5
8	8.0	46.0	43.0	43.0	-	41.5	46.0	41.0	41.5	41.0		41.0			38.0	Unable to Open		-	Water in Tube	-
Time	(A)	-	P.M. 1:30	P.M. 2:30	P.M. 3:30	A.M. 10:35	A.M. 10:00	A.M. 11:20	A.M. 9:50	A.M. 11:10		A.M. 10:10		A.M. 10:00	A.M. 10:35			A.M. 9:35	A.M. 9:15	A.M. 9:25
Ground Temp.	(B)	-	-	29.0	8.0	7.0	26.0	28.0	26.0	18.0		12.0		22.0	12.0			49.0	44.0	50.0
Air Temp.	(C)	19.0	45.0	-	4.0	- 7.0	17.0	23.0	27.0	8.0		21.0		20.0	12.0			45.0	40.0	26.0
Weather	(D)	Clear	Clear	Clear	Clear	Clear	Snow	Cloudy	Cloudy	Clear		Clear		Snow	Clear			Clear	Clear	Clear
Snow Cover (Inches)	(E)	-	0.0	0.0	-	-	5.0	10.0	16.0	19.0		7.0		10.0	1.0			0.0	0.0	0.0
Wind (Beaufort Scale)	(F)	5 NW	5 NW	5 NW	-	5 NW	-	2 SW	-	-		2 NW		5 NE	5 NE			4 SW	3 S	2 SE

(A) Time of reading thermometer  
(B) Reading of mercury thermometer  
(C) Reading of mercury thermometer  
(D) Weather at time readings were made  
(E) No distinction made between snow and ice  
(F) Approximate wind intensity  
- No readings obtained.

FROST INVESTIGATION  
DOW FIELD - BANGOR, ME.  
METER DATA AT INSTALLATION TW-4

-W RUNWAY

DATE	MAR. 31	MAR. 30	MAR. 25	APR. 1	APR. 6	APR. 15	APR. 22	APR. 29	APR. 29	MAY 7	MAY 13	MAY 20	MAY 27						
	37.0	32.0	33.0	34.0	36.0	36.0	36.0	40.0	44.0	-	50.0	56.0							
Unable to open	32.0	32.0	33.0	33.0	32.5	35.0	35.0	39.0	42.0	-	47.0	51.0							
Unable to open	36.0	35.0	35.0	35.0	35.0	35.0	35.5	37.0	40.0	40.0	43.0	45.0							
Unable to open	37.0	37.5	36.5	36.0	36.0	36.4	36.0	36.0	40.0	42.0	43.0	46.0							
Meter in tube	-	-	36.0	37.6	36.0	37.5	36.0	37.5	40.0	-	41.0	42.0							
	A.M. 9:15	A.M. 9:25	A.M. 9:25	A.M. 11:05	A.M. 9:00	A.M. 10:45	P.M. 2:00	A.M. 8:45	A.M. 9:15	A.M. 11:35	A.M. 10:55	A.M. 9:55							
	49.0	44.0	38.0	52.0	40.0	-	66.0	50.0	54.0	62.0	65.0	60.0							
	45.0	40.0	36.0	50.0	42.0	45.0	55.0	46.0	55.0	60.0	64.0	62.0							
	Clear	Clear	Clear	Clear	Rain	Clear	Clear	Clear	Clear	Cloudy	Clear	Cloudy							
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0							
	4 SW	3 S	2 SE	4 NE	2 SW	5 SW	3 SW	3 SW	4 SW	4 SW	2 SW	2 W							

NOTES

- A) Time of reading thermometer within 15 minute period.
- B) Reading of mercury thermometer placed on surface of ground at installation.
- C) Reading of mercury thermometer suspended in air in vicinity of installation.
- D) Weather at time readings were obtained.
- E) No distinction made between snow and ice cover.
- F) Approximate wind intensity and direction at time readings were obtained.
- No readings obtained.

B

FROST INVESTIGATION  
DOW FIELD - BANGOR, ME.  
  
RECORD OF SUBSURFACE  
TEMPERATURES  
INSTALLATION TW-4  
  
FROST EFFECTS LABORATORY, BOSTON, MASS. JUNE, 1946

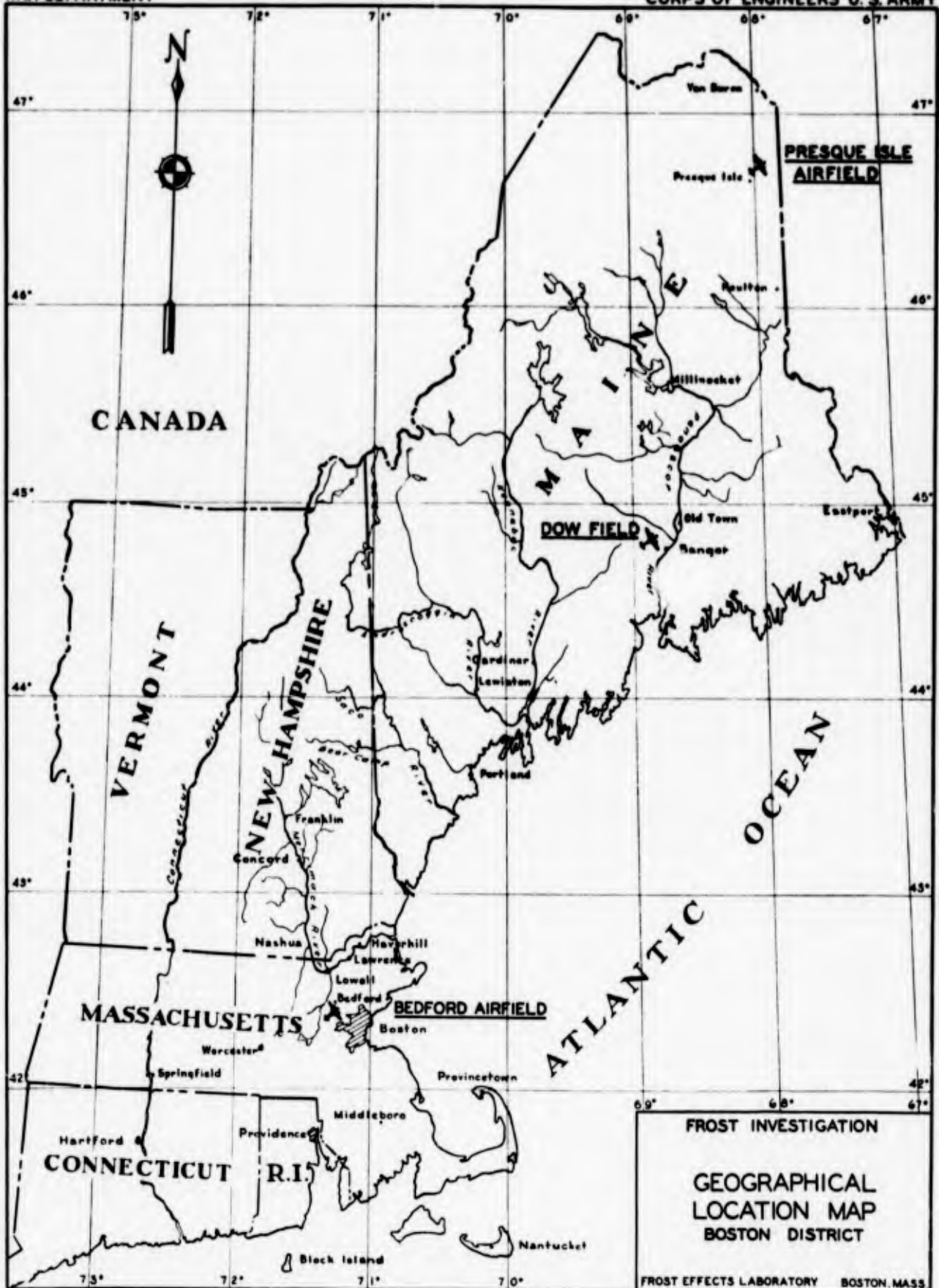
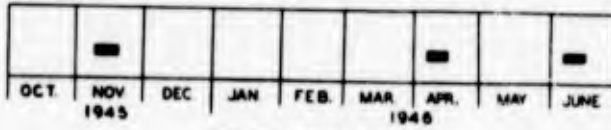


PLATE I



PAVEMENT BEARING TESTS  
FIG. 1

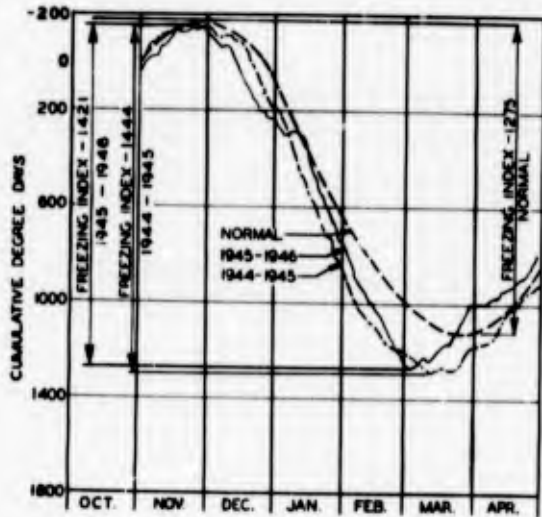


FIG. 2

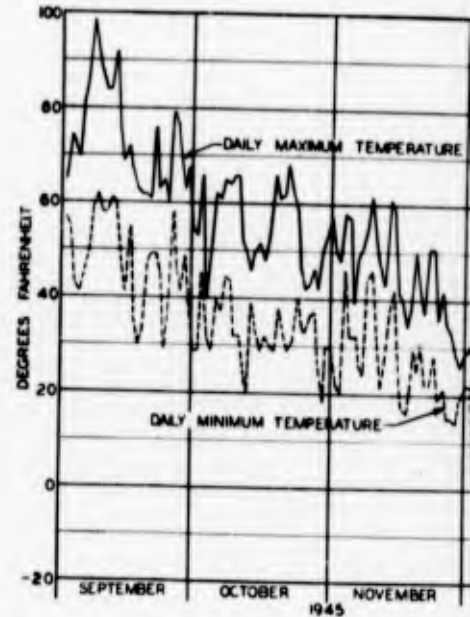


FIG. 4

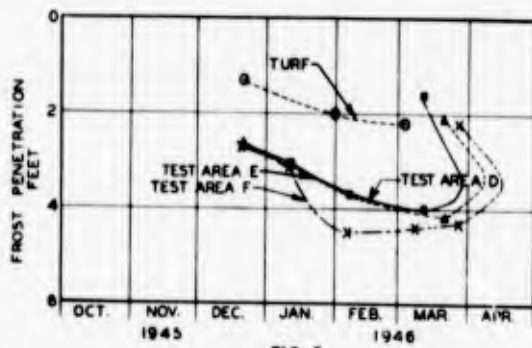


FIG. 3

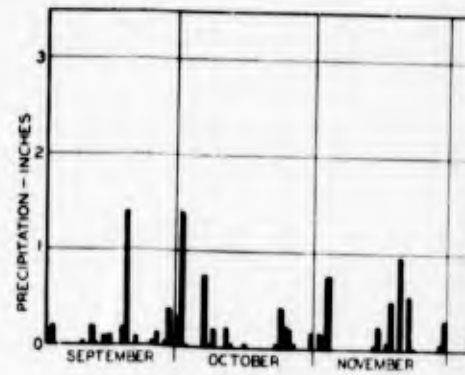


FIG. 5

A

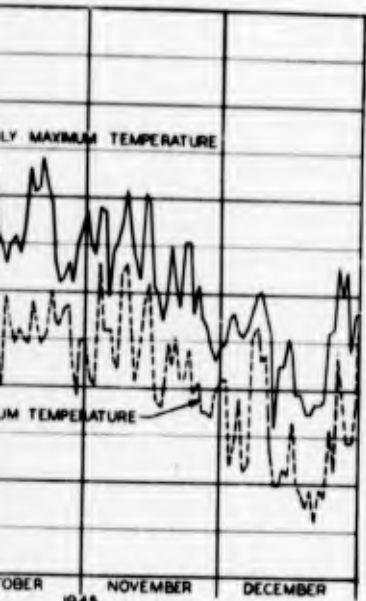


FIG. 4

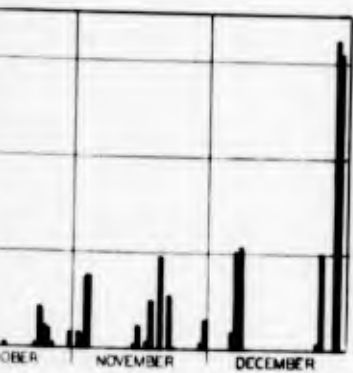


FIG. 5

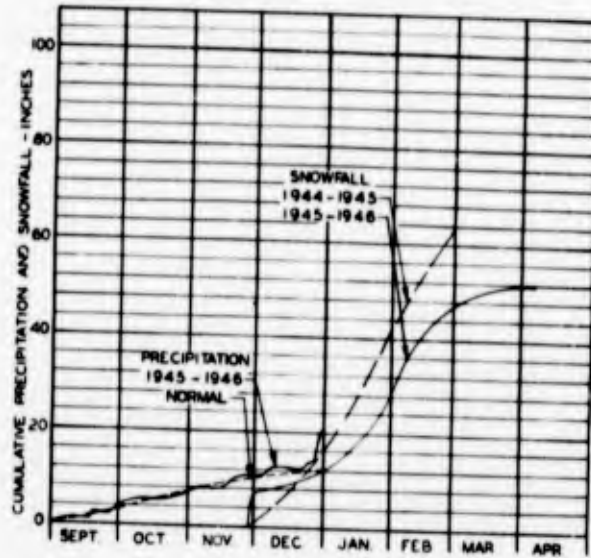


FIG. 6

NOTES

TEST AREA F - CEMENT CONCRETE PAVEMENT  
TEST AREAS D AND E - BITUMINOUS CONCRETE PAVEMENT

SOURCES OF DATA:  
U.S. WEATHER BUREAU (BANGOR HYDRO-ELECTRIC CO.)  
MONTHLY MEAN TEMP, NOV 1934-FEB 1938  
U.S. WEATHER BUREAU (C.A.A. BANGOR)  
MONTHLY MEAN TEMP, MAR 1938-APR 1945  
DAILY MAX. AND MIN. TEMP, SEPT. 1945-JAN. 1946  
DAILY SNOWFALL; JAN 1945-15 APR 1946  
WEATHER OFFICER, A.A.F. DOW FIELD  
DAILY PRECIPITATION, SEPT-DEC. 1945  
DAILY SNOWFALL, NOV 1945-JAN 1946  
U.S.E.D. THERMOGRAPH DATA USED FOR 1945-1946  
CURVE IN FIG. 2  
CONTINUOUS TEMPERATURE RECORDS 5 NOV 1945-  
1 MAY 1946

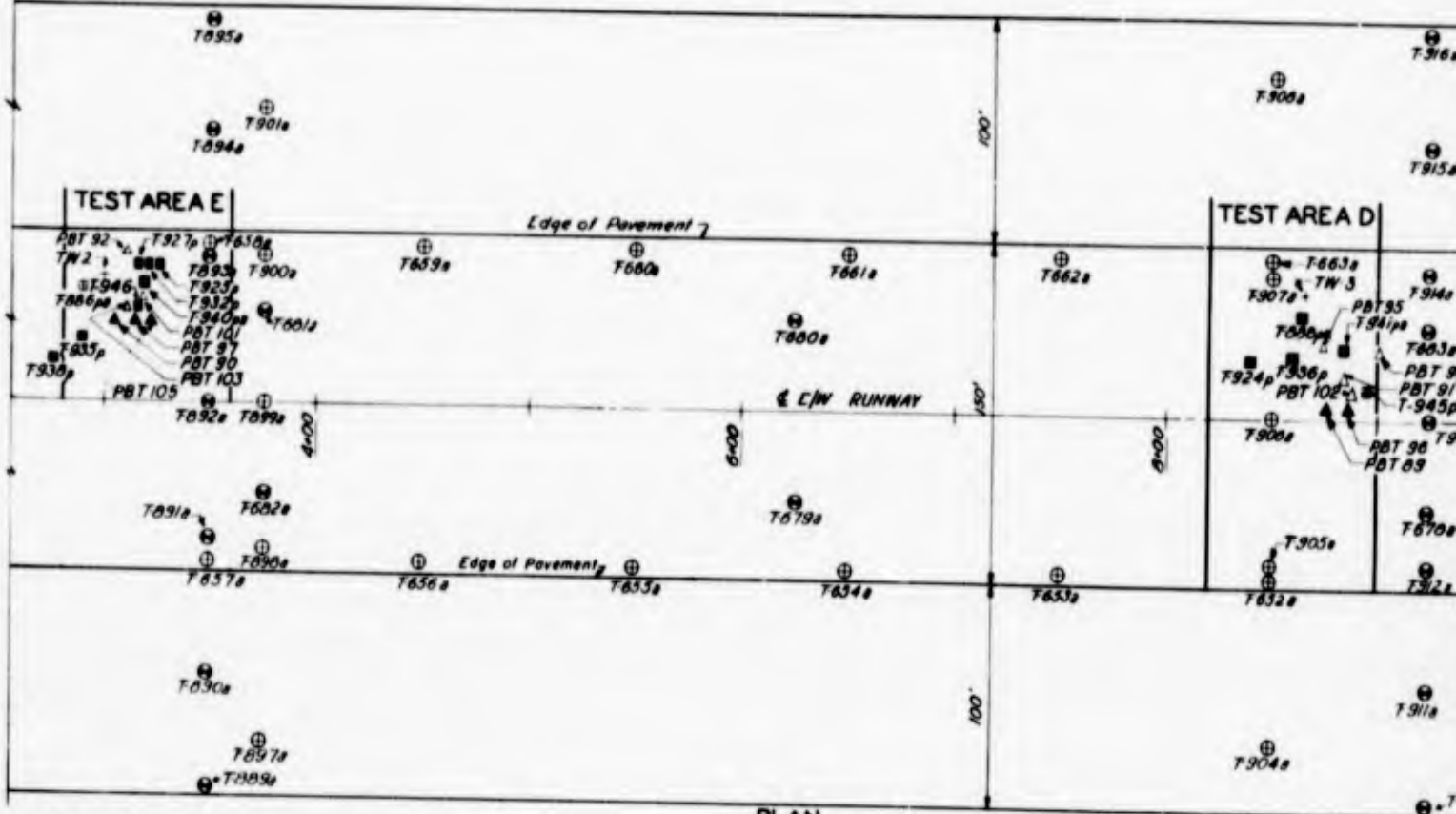
*B*

FROST INVESTIGATION  
DOW FIELD BANGOR ME.

WEATHER AND FROST  
PENETRATION DATA

JUNE 1946

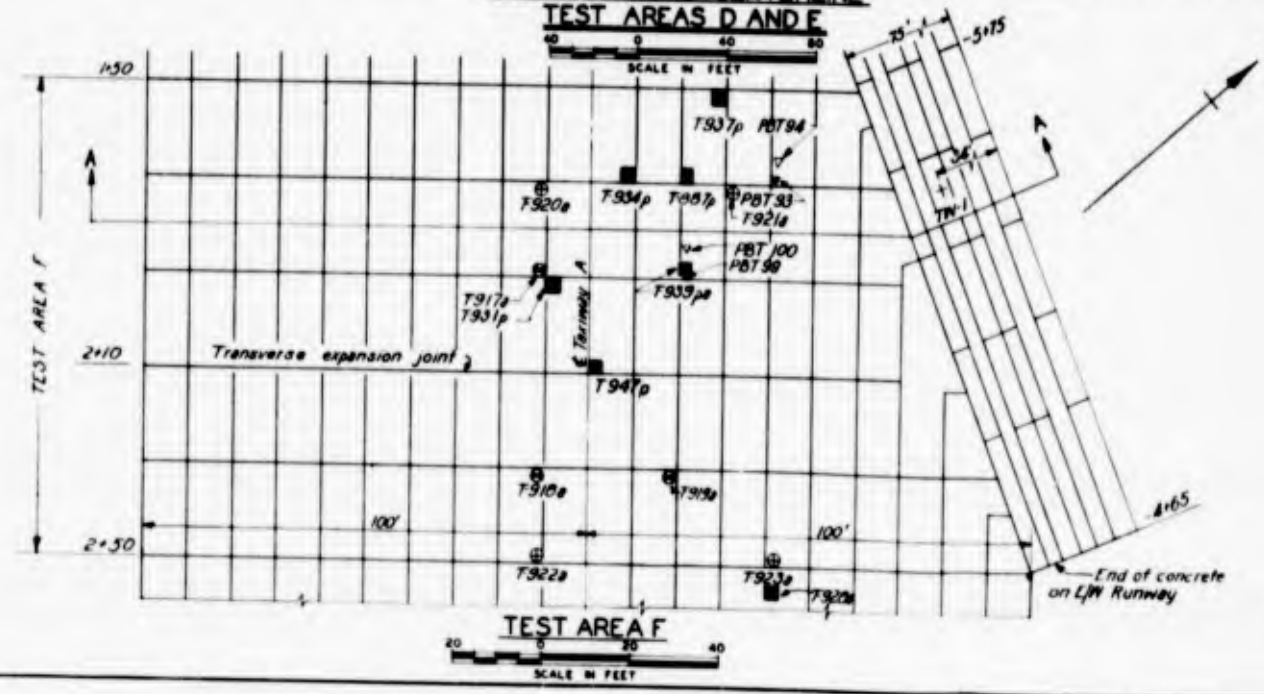
FROST EFFECTS LABORATORY BOSTON, MASS.



PLAN

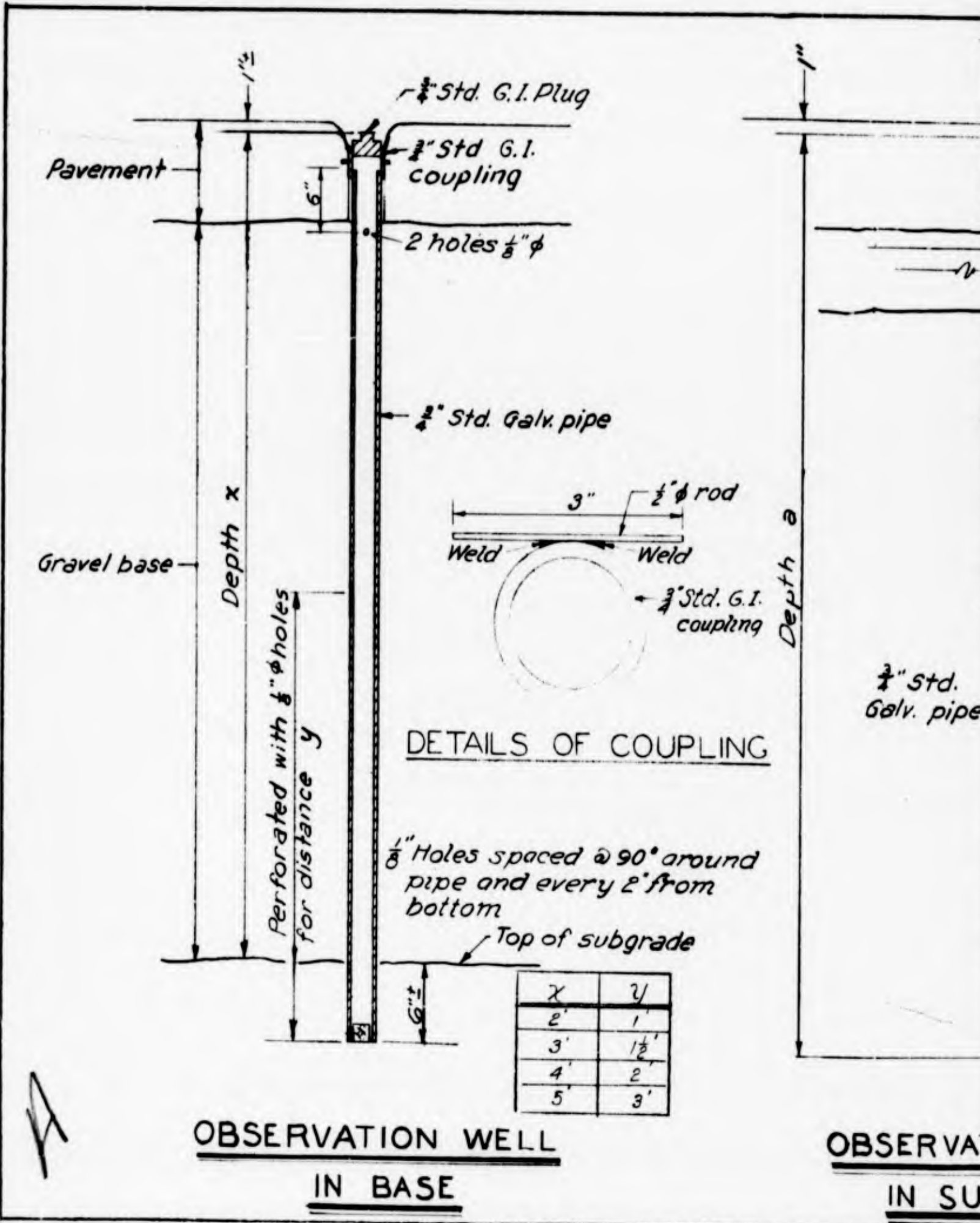


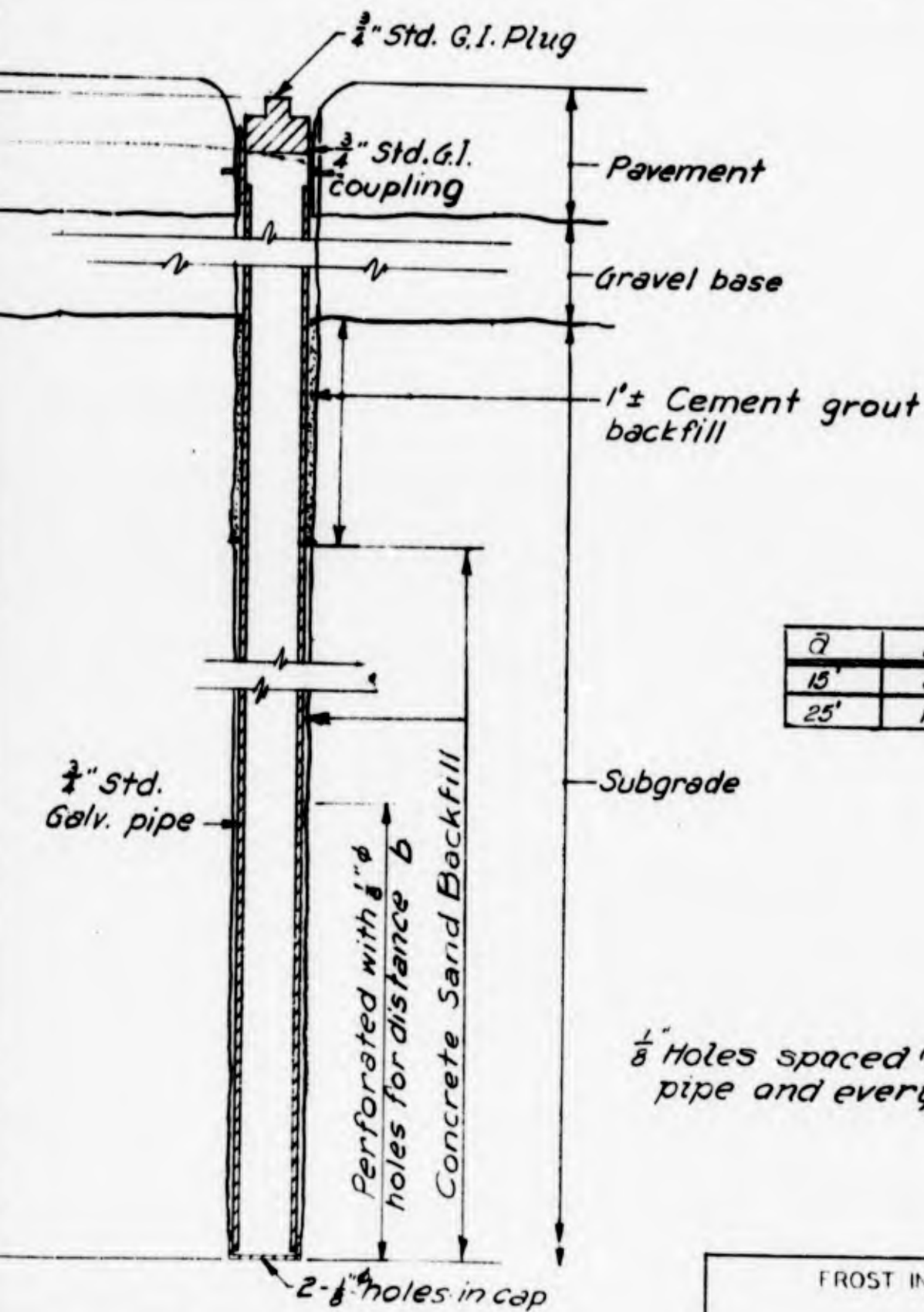
PROFILE ALONG CENTERLINE TEST AREAS D AND E



TEST AREA F





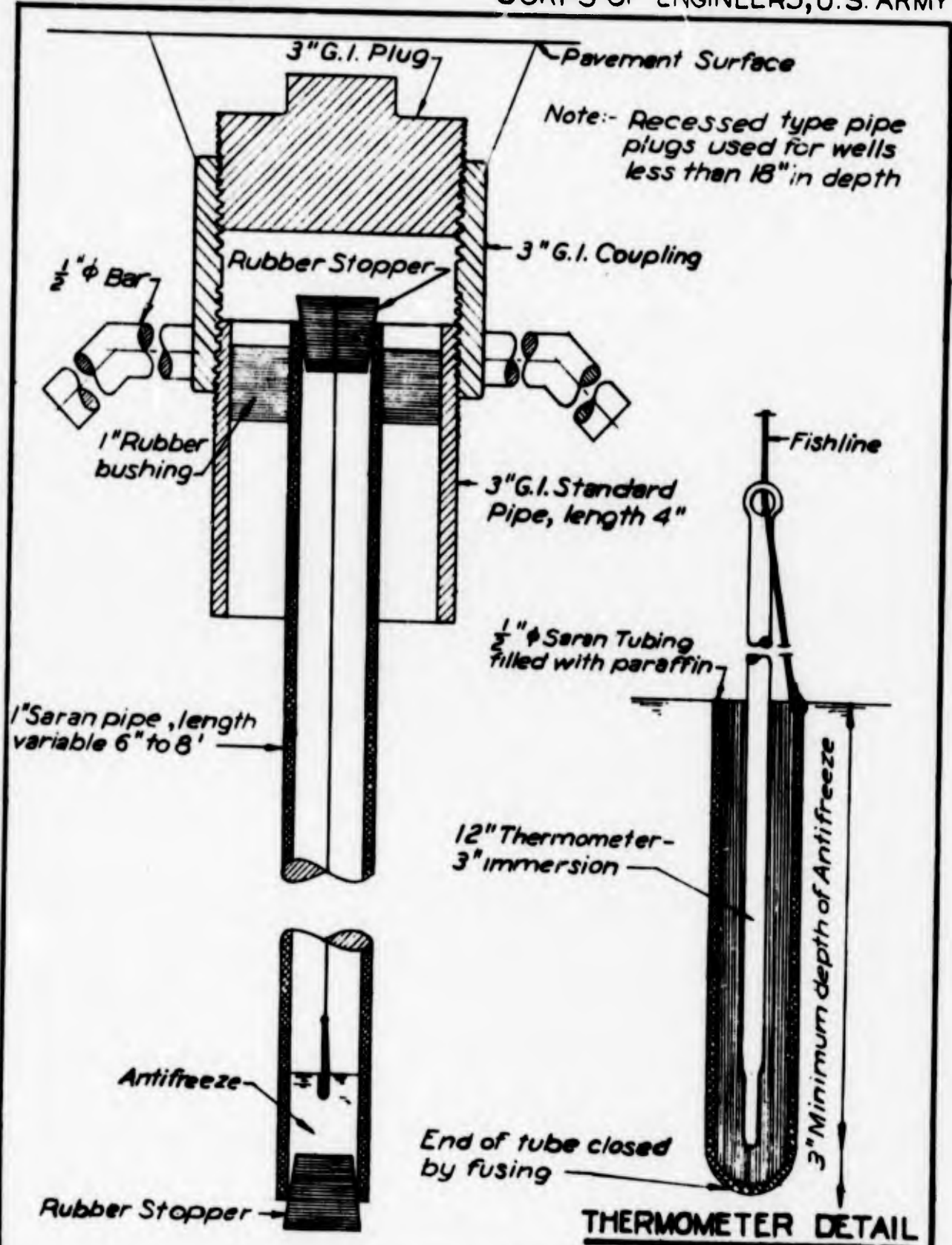


$\frac{1}{8}$ " Holes spaced @ 90° around pipe and every 4"

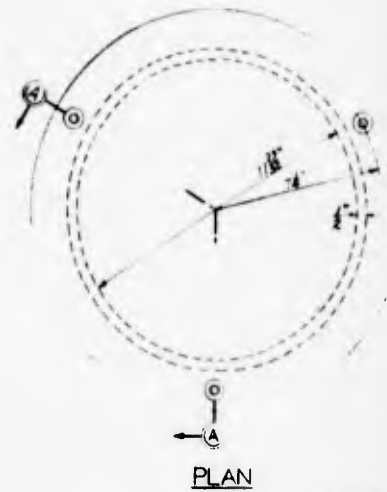
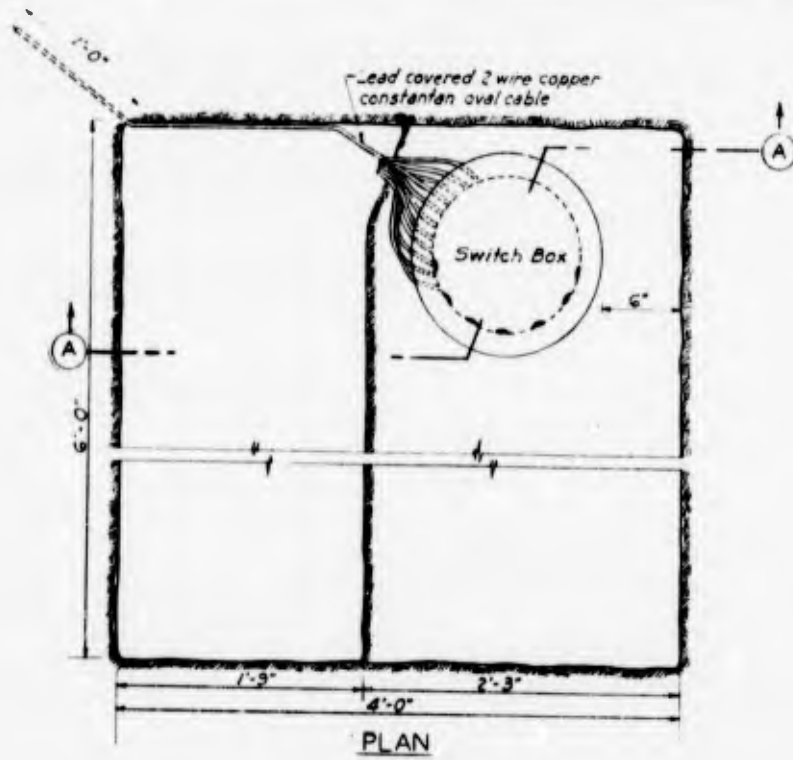
B

OBSERVATION WELL  
IN SUBGRADE

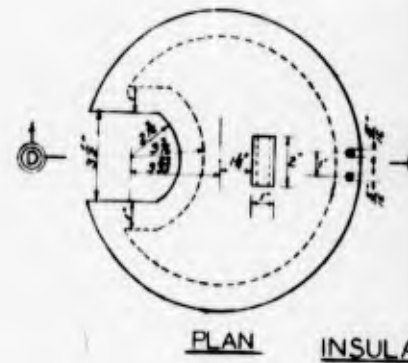
FROST INVESTIGATION  
 OBSERVATION WELL  
 DETAILS  
 JUNE, 1946  
 FROST EFFECTS LABORATORY BOSTON, MASS.



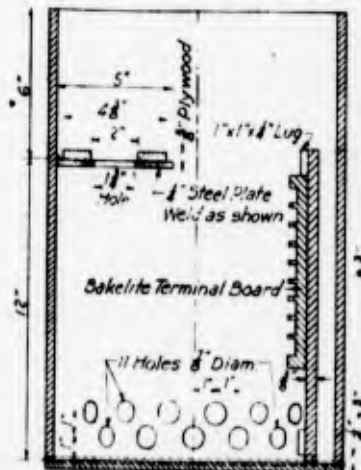
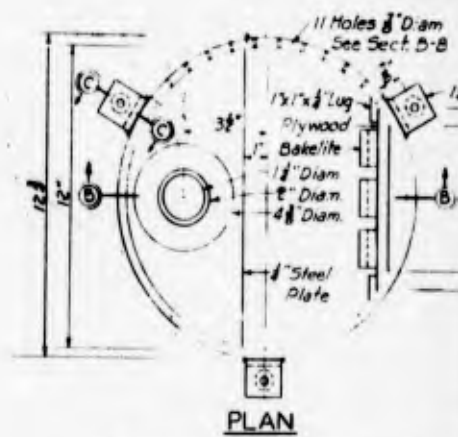
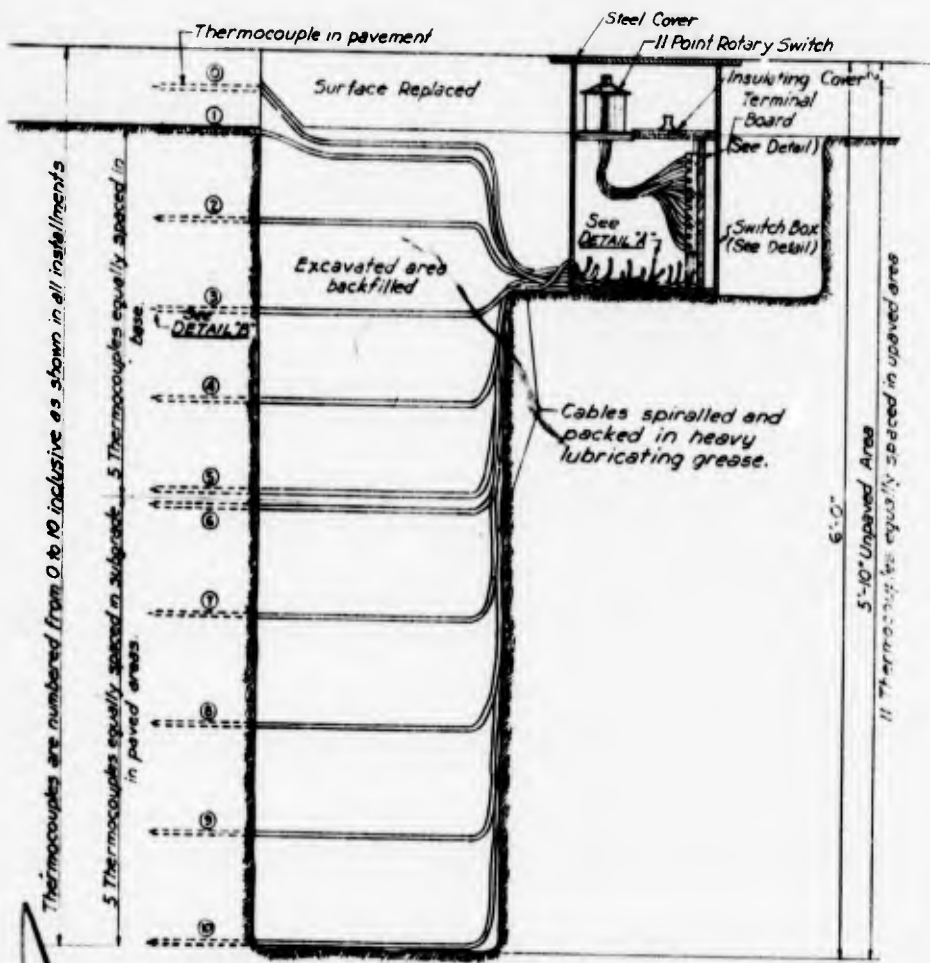
FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.  
**THERMOMETER WELL  
DETAILS**  
NOT TO SCALE  
FROST EFFECTS LABORATORY, BOSTON, MASS, JUNE 1946



STEEL



INSULA



SECTION B-B  
SWITCH BOX DETAILS  
Quarter Scale

SECTION A-A

INSTALLATION OF THERMOCOUPLE EQUIPMENT

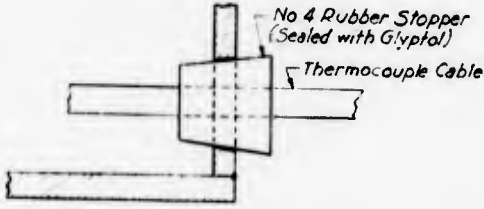
Scale 1/2"=1'-0"



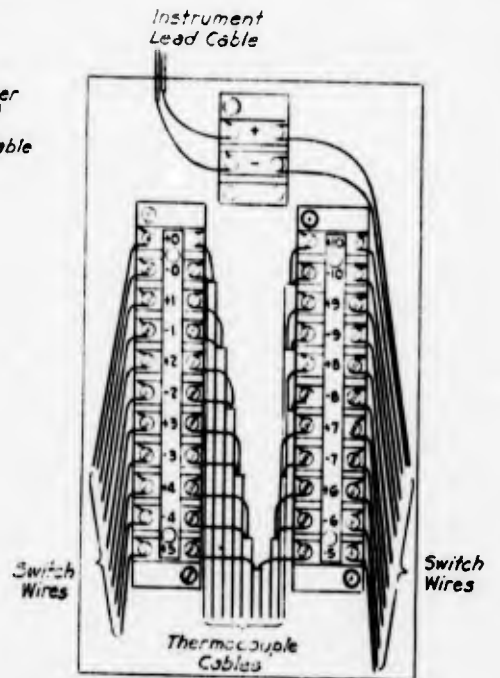
PLAN  
STEEL COVER



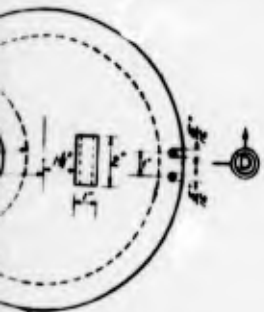
SECTION A-A



DETAIL A  
Not to Scale



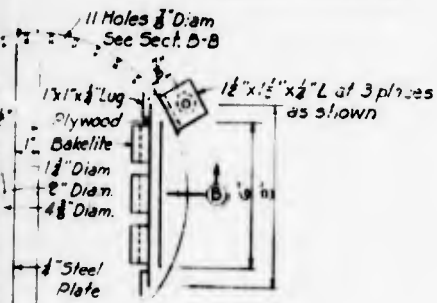
Plywood Terminal Board  
DETAIL OF TERMINAL BOARD



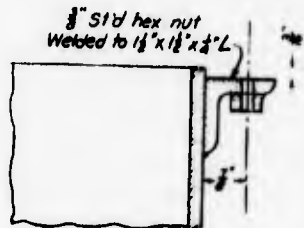
PLAN  
INSULATING COVER



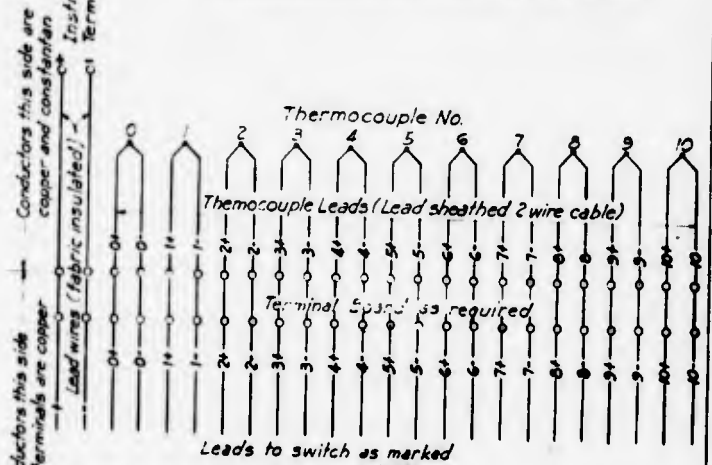
SECTION D-D



PLAN

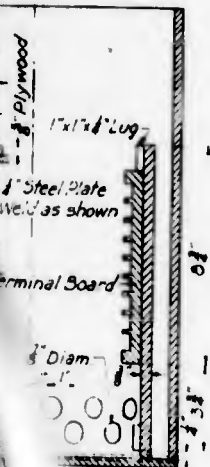


SECTION C-C  
Half Scale

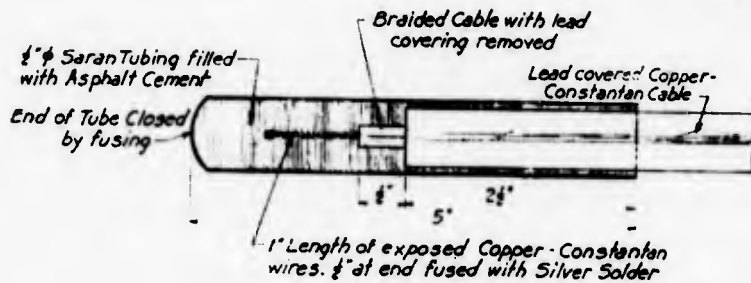


**NOTES**  
Copper wire is always plus (+), conductor is red colored and has white insulation.  
Constantan wire is always minus (-), conductor is white colored and has red insulation.  
Clean all conductors thoroughly before making connections. It is not necessary to remove tin from switch lead wires. All terminals should be set as tight as possible so that vibrations will not loosen screws.  
Terminal boards should be protected from sudden or fluctuating temperature changes during measuring periods.  
Terminals should be inspected at regular intervals and cleaned if corrosion is noted.

WIRING DIAGRAM

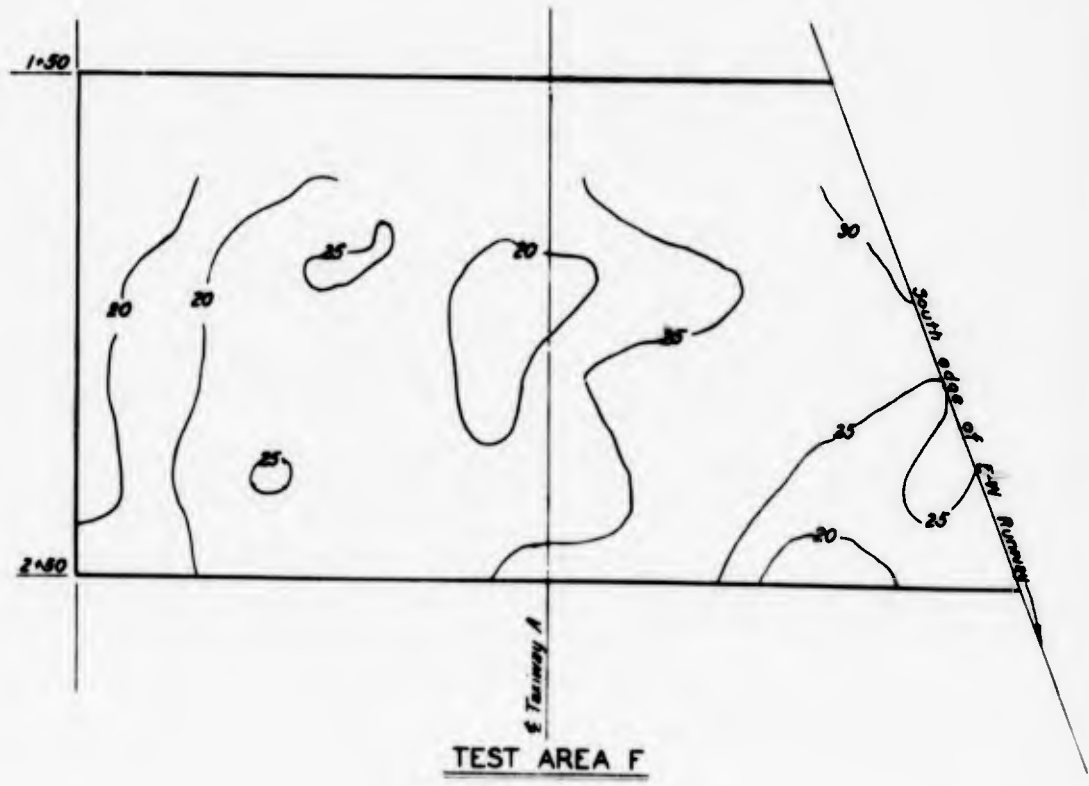
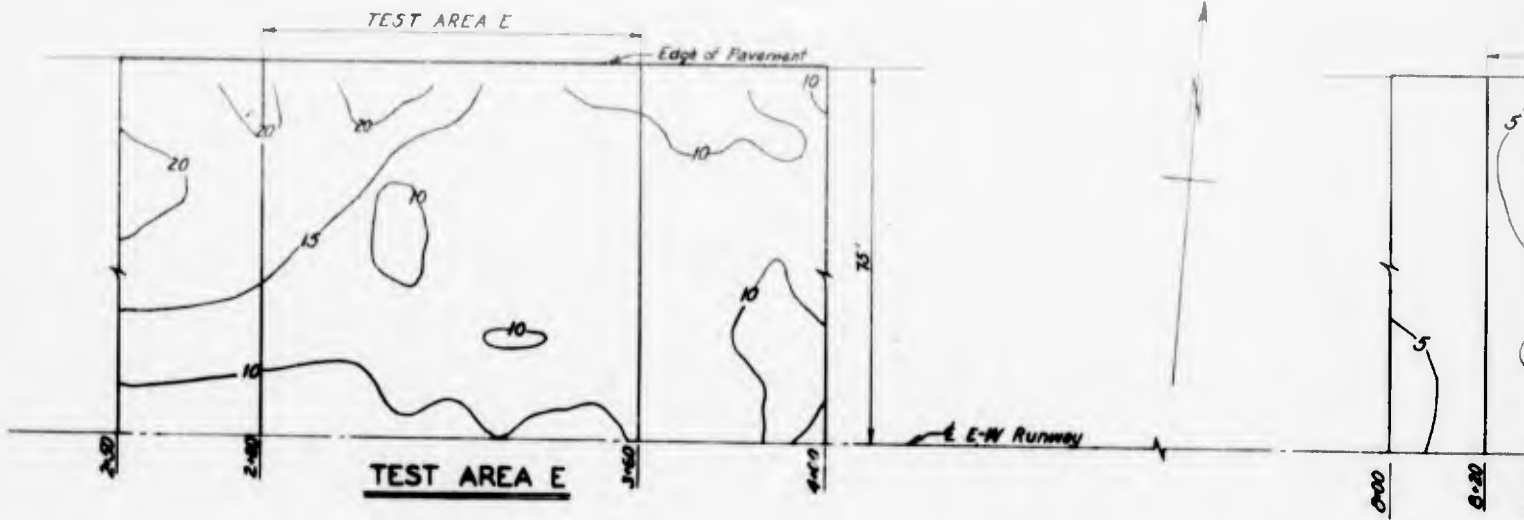


B-B  
DETAILS

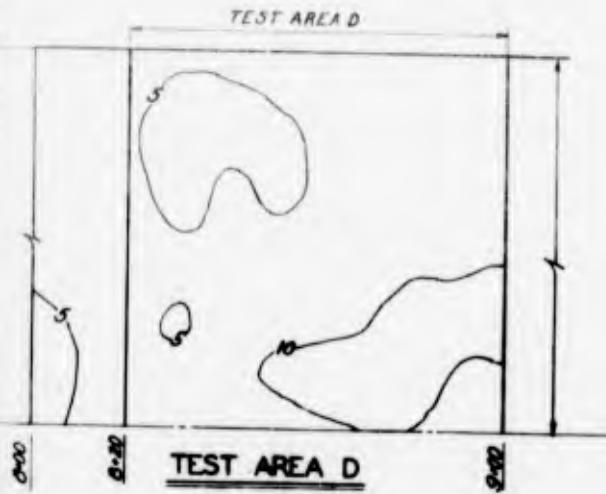


THERMOCOUPLE CONSTRUCTION  
DETAIL B  
Full Scale

FROST INVESTIGATION  
THERMOCOUPLE INSTALLATION  
AND SWITCH BOX DETAILS  
SCALE AS SHOWN  
FROST EFFECTS LABORATORY, BOSTON, MASS. JUNE, 1945



A



NOTES

SURVEY BY OCT 1945 - 6 MAR 1946  
CONTOUR INTERVAL = 0.25'  
CONTOUR IN HUNDRETHS OF FEET

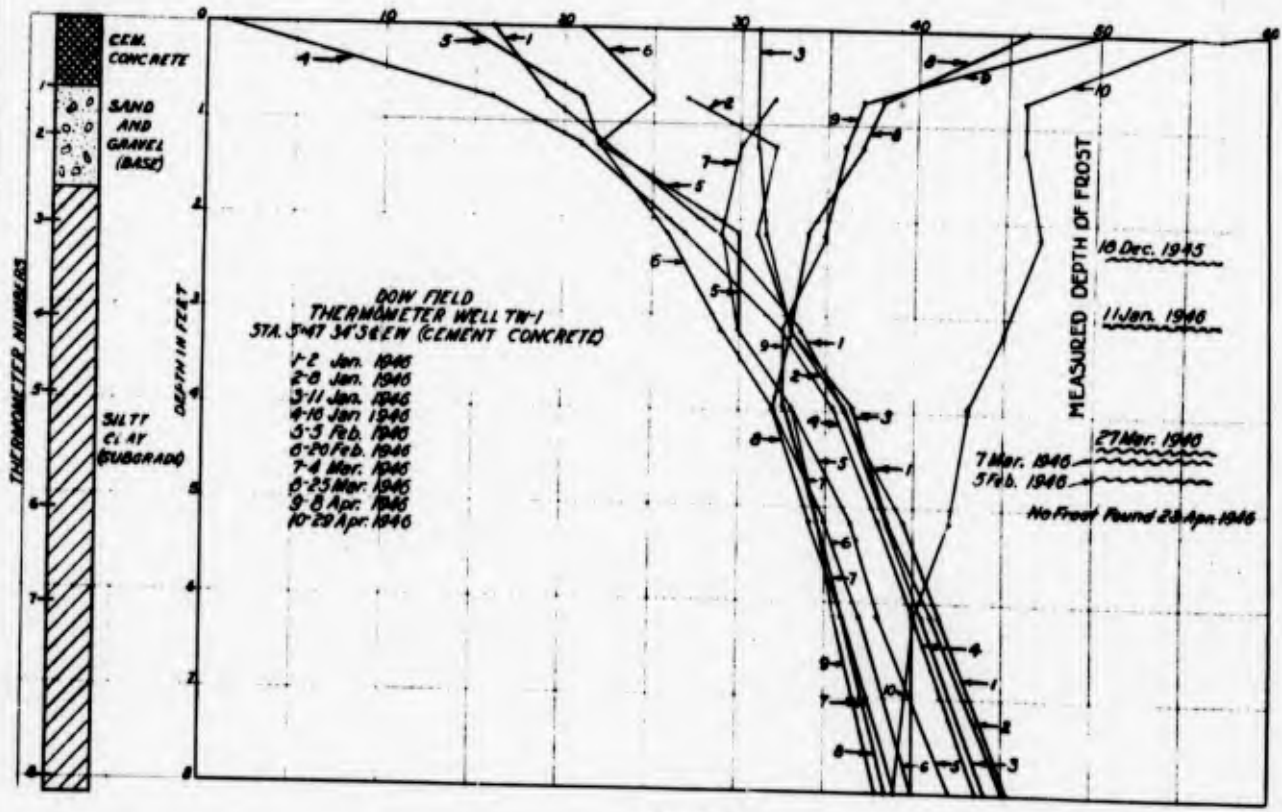
B

FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.

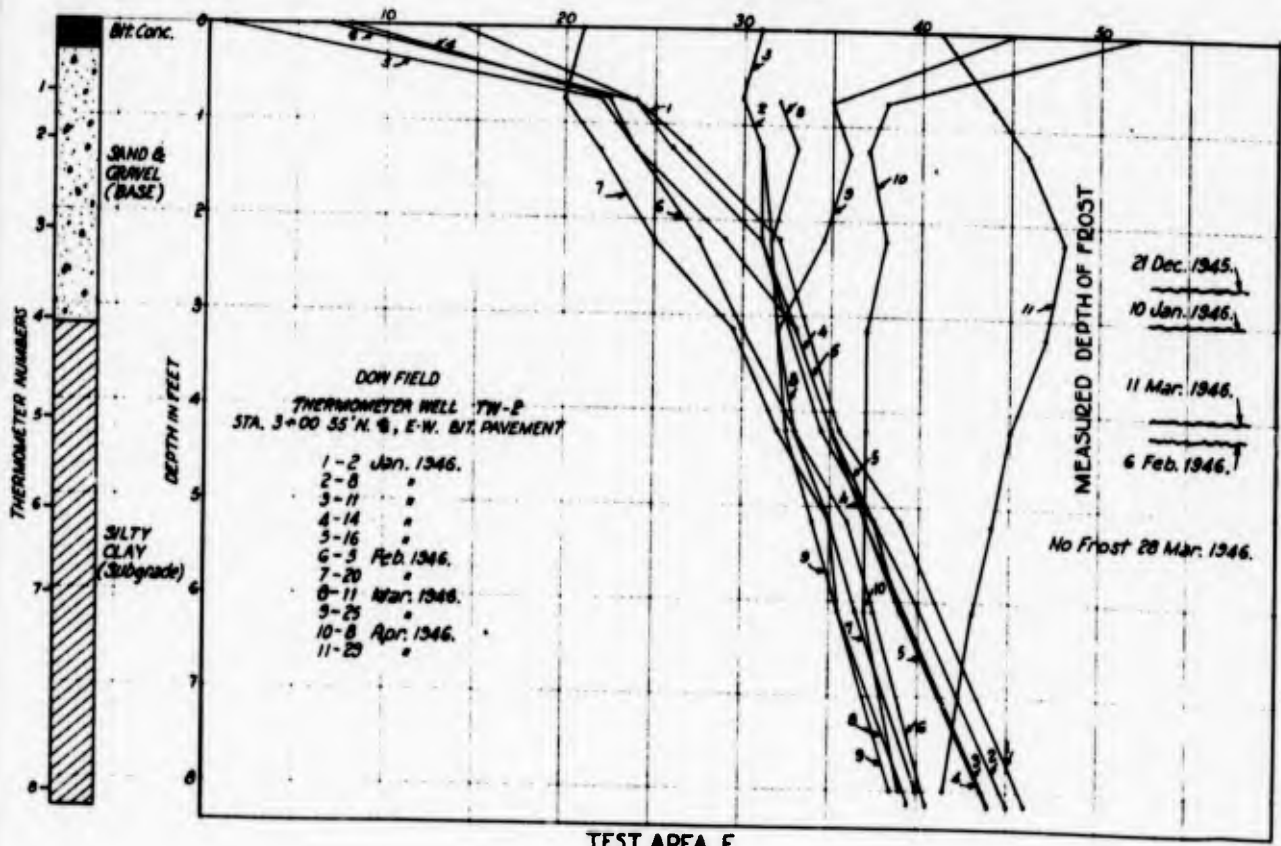
FROST HEAVE CONTOURS  
TEST AREAS D, E AND F



FROST EFFECTS LABORATORY BOSTON MASS JUNE 1946

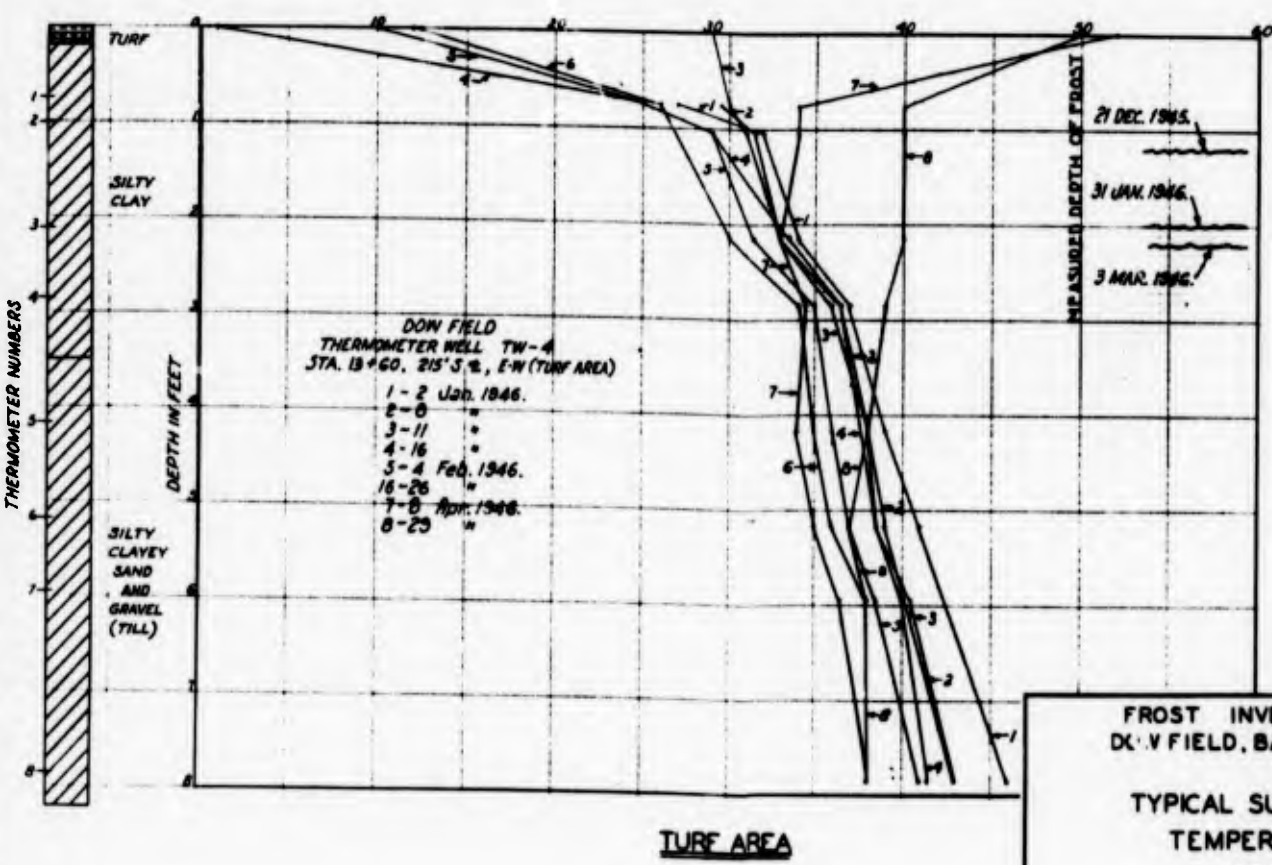
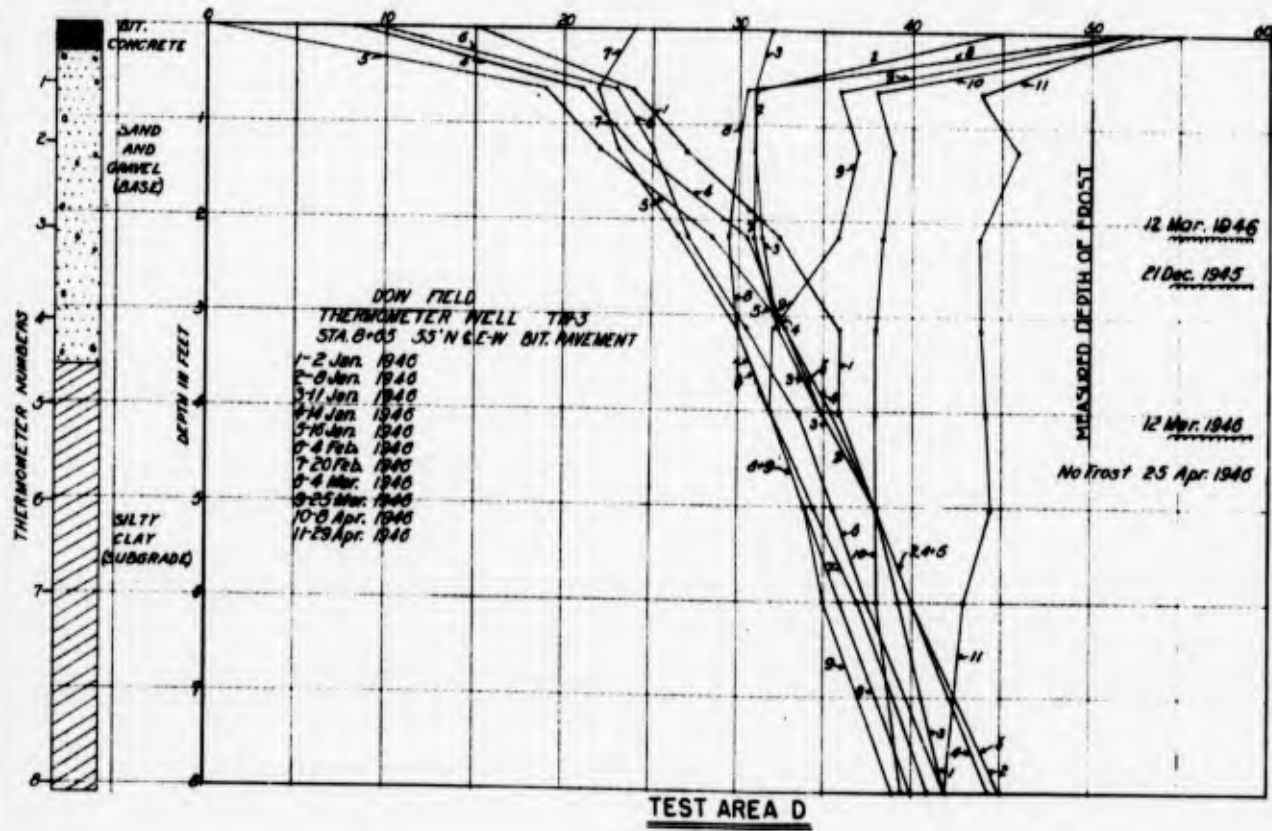


TEST AREA A



TEST AREA E

A

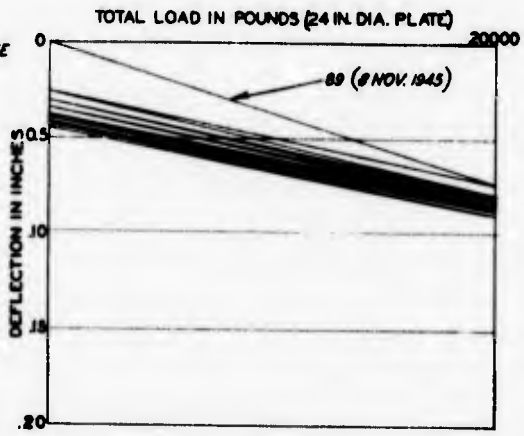
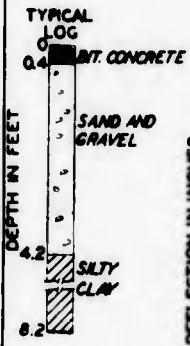


FROST INVESTIGATION  
DOW FIELD, BANGOR, MAINE.

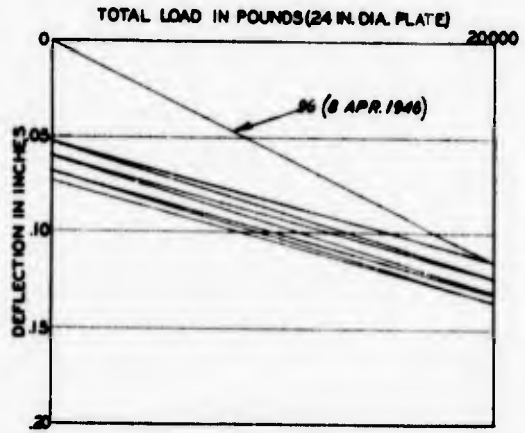
TYPICAL SUBSURFACE  
TEMPERATURES  
FROM  
THERMOMETER WELLS

FROST EFFECTS LABORATORY, BOSTON, MASS. JUNE 46

B

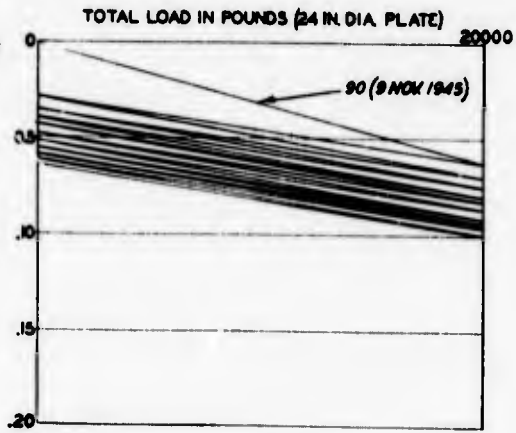
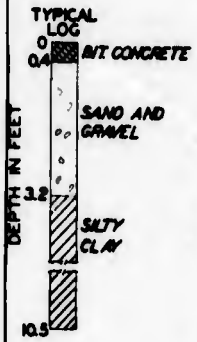


PBT NO. 89

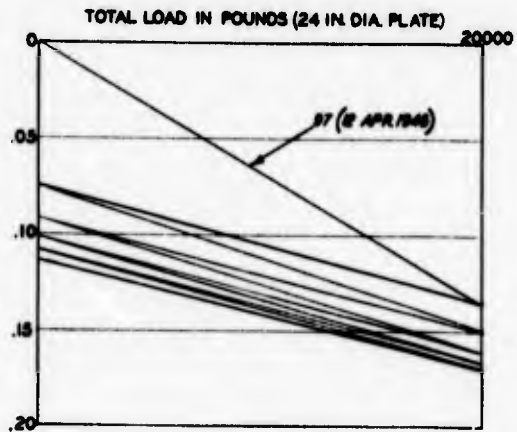


PBT NO. 96

TEST AREA D



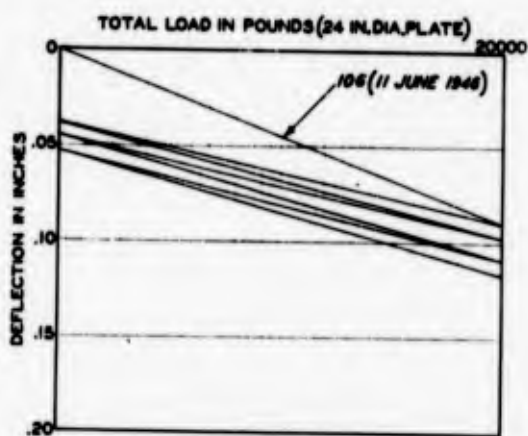
PBT NO. 90



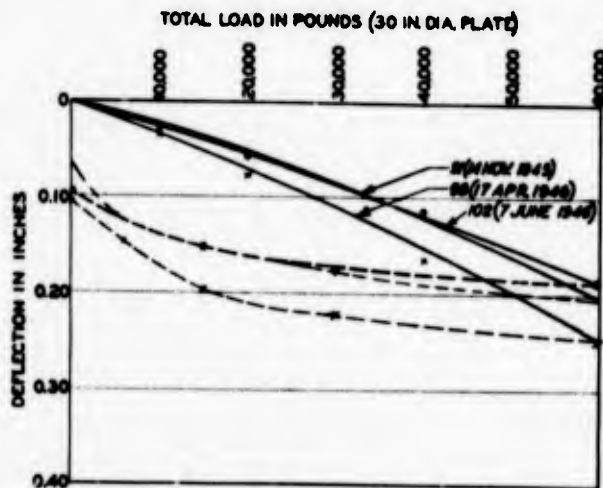
PBT NO. 97

TEST AREA E

REPEATING LOAD

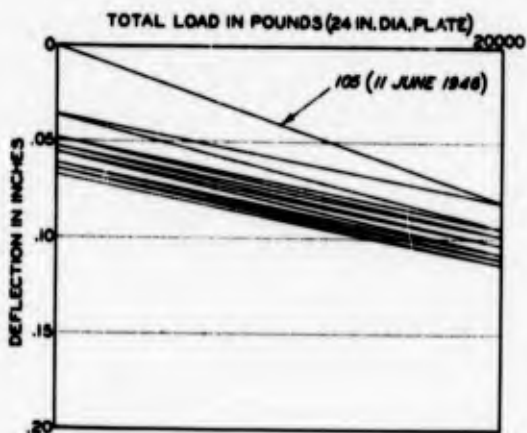


**PBT NO. 106**

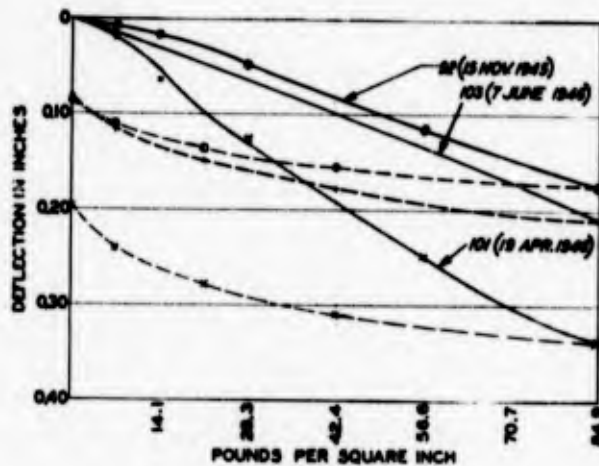


**PBT NOS. 91-98 AND 102**

**TEST AREA D**



**PBT NO. 105**



**PBT NOS. 92-101 AND 103**

**TEST AREA E**

**STATIC LOAD**

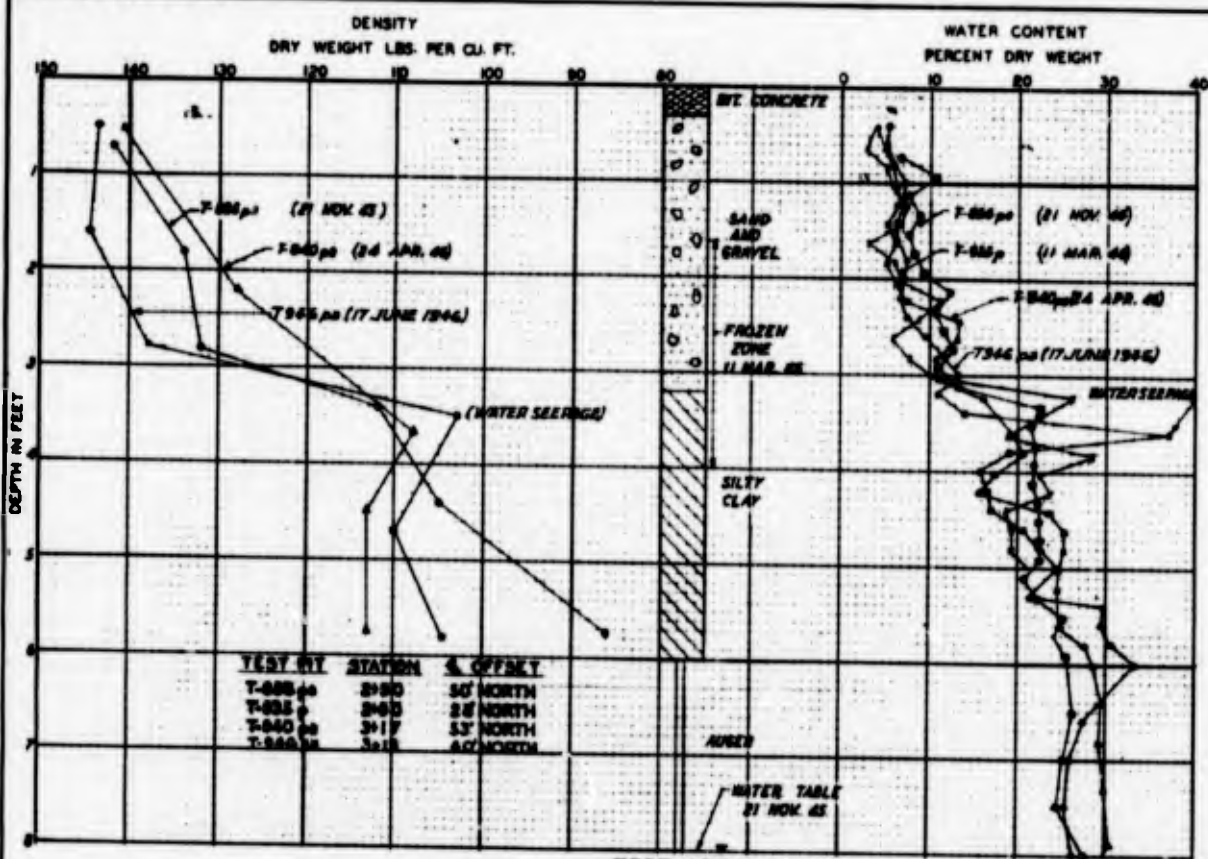
B

**REPEATING LOAD**

TEST NO.	LOCATION	STATION	OFFSET
98	E-W RUNWAY	8+73	3'N
99		3+05	38'N
96		8+85	3'N
97		3+15	38'N
91		8+85	16'N
92		3+10	63'N
98		9+00	30'N
101		3+17	48'N
102		8+90	10'N
103		3+17	40'N
105		3+20	35'N
106		8+70	15'N

FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.  
**PLATE BEARING TESTS**  
**REPEATING AND STATIC LOAD**  
**TEST AREAS D AND E**

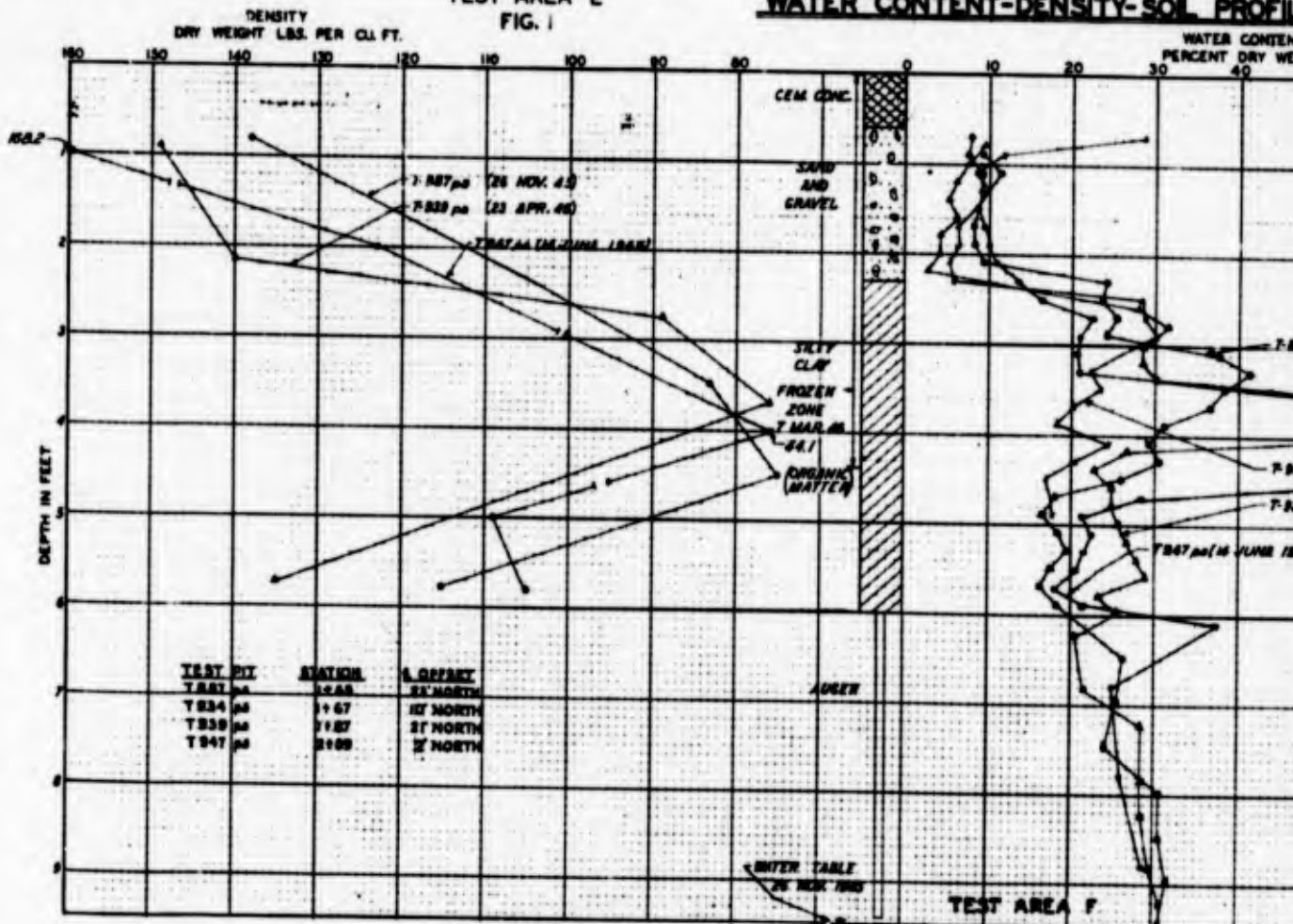
WAR DEPARTMENT



TEST NO	STATION	± OFFSET
T-886 ps	2+90	50' NORTH
T-885 ps	2+80	25' NORTH
T-840 ps	3+17	53' NORTH
T-844 ps	3+15	50' NORTH

TEST AREA E  
FIG. 1

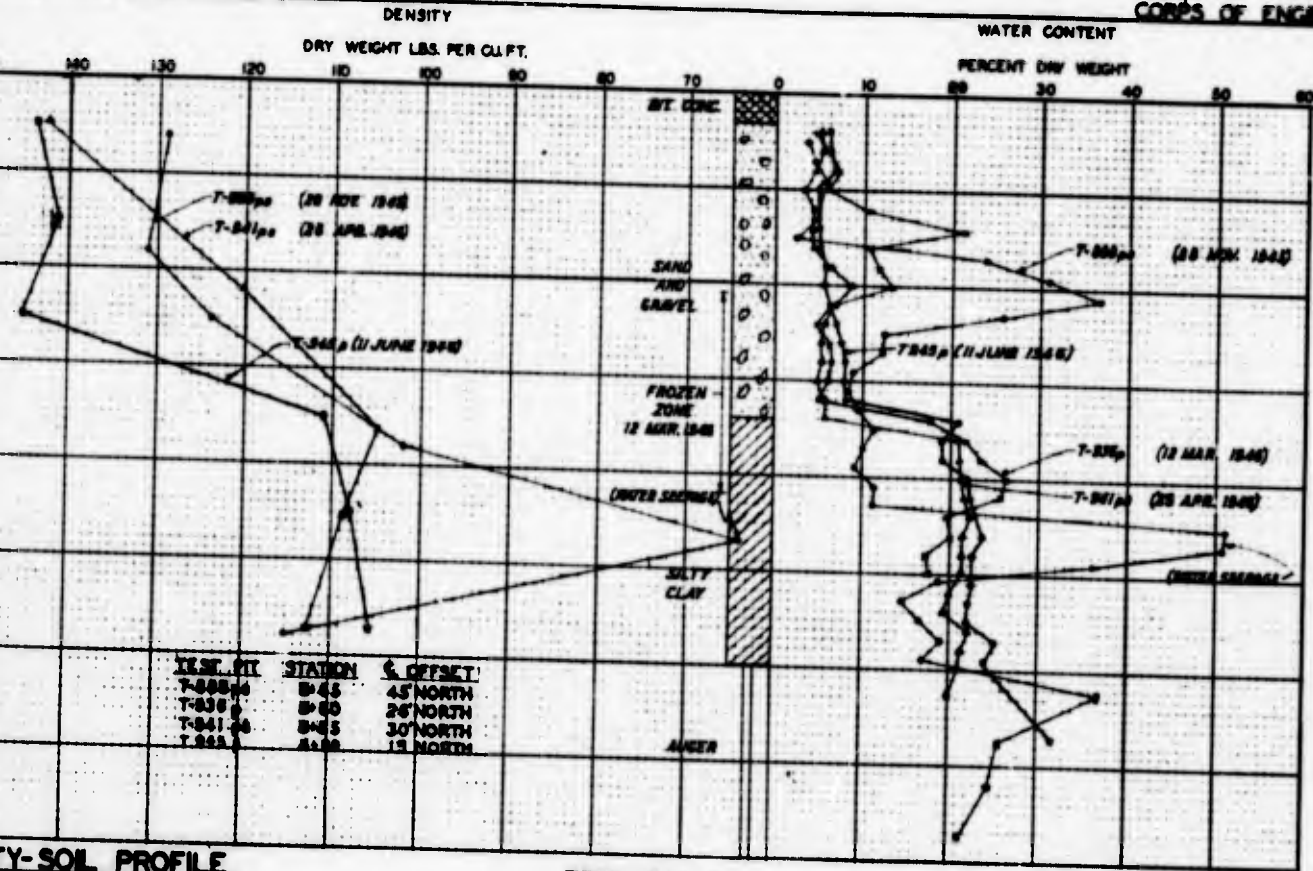
WATER CONTENT-DENSITY-SOIL PROFILE



TEST NO	STATION	± OFFSET
T-887 ps	1+48	25' NORTH
T-834 ps	1+67	10' NORTH
T-839 ps	1+87	21' NORTH
T-847 ps	2+89	27' NORTH

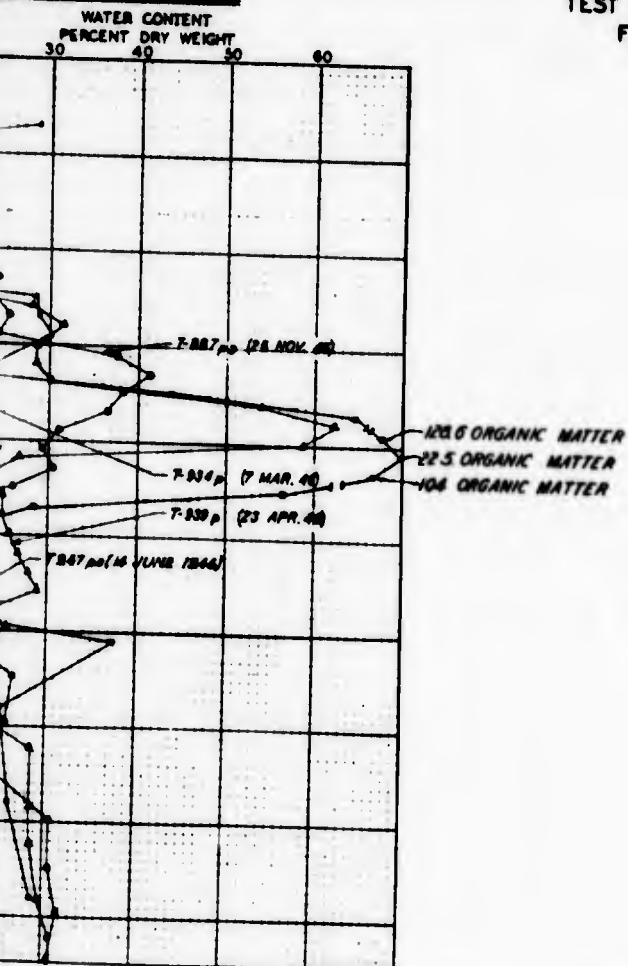
TEST AREA F  
WATER CONTENT-DENSITY-SOIL PROFILE

A



TEST AREA D  
FIG. 2

Y-SOIL PROFILE

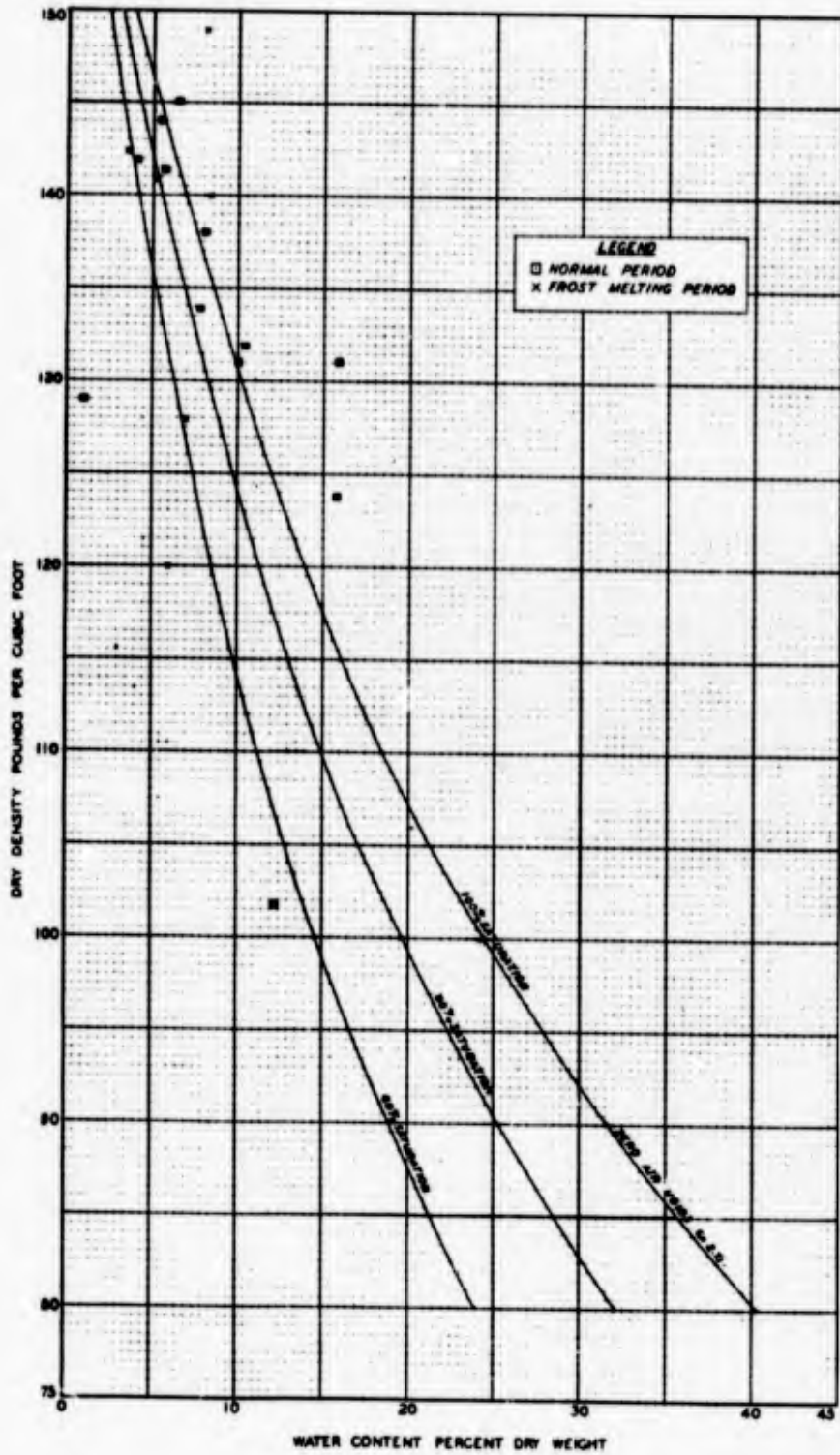


B

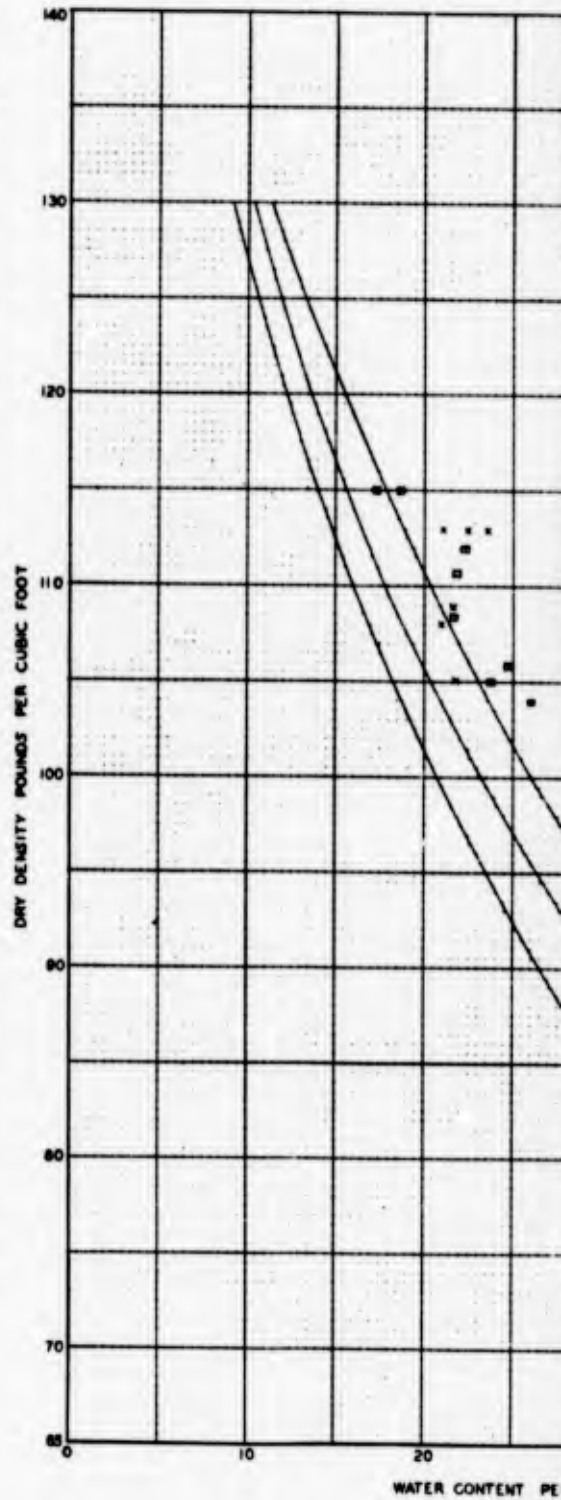
FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.

SOIL DATA SUMMARY  
TEST AREAS D, E AND F

FROST EFFECTS LABORATORY BOSTON MASS. JUNE, 1946



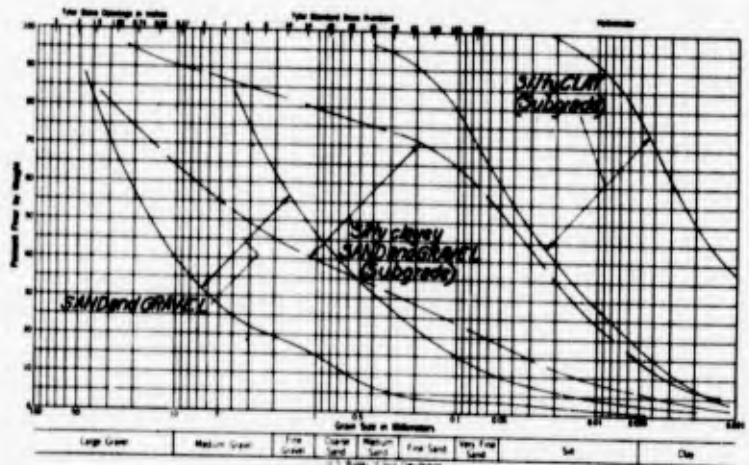
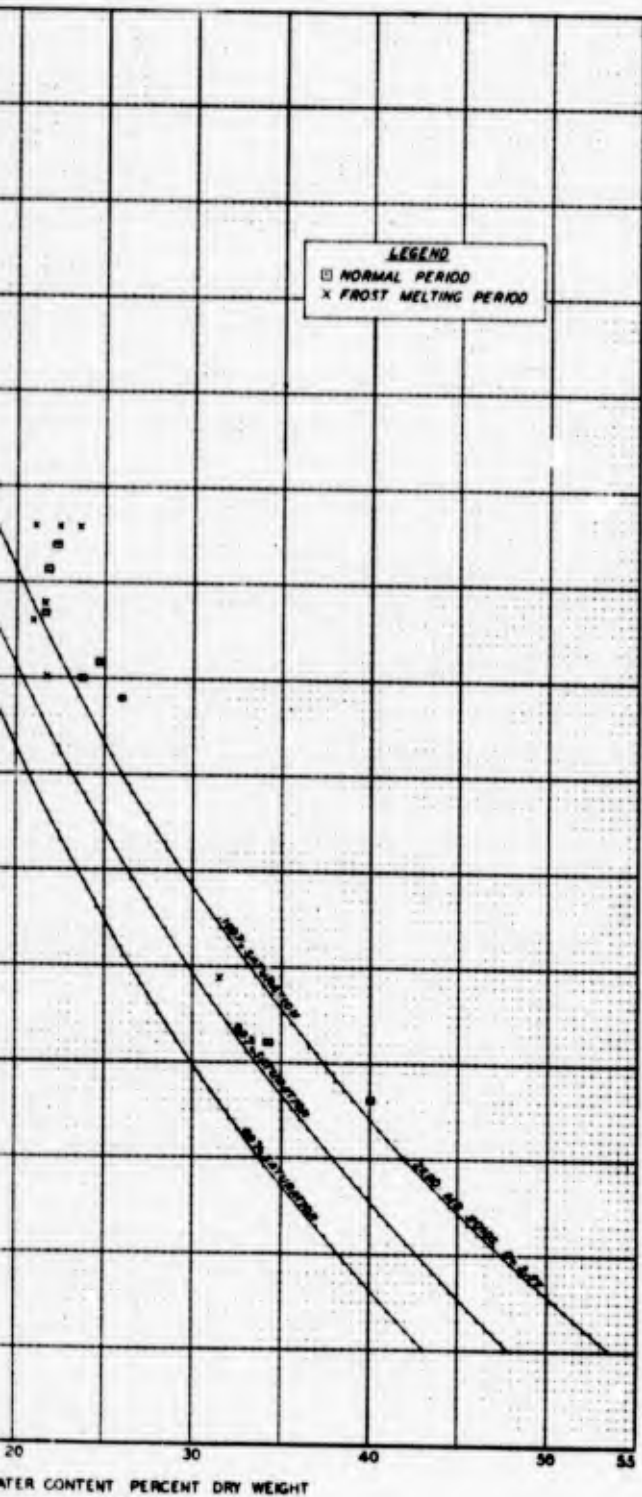
BASE  
 FIG. 1



SUBGRADE  
 FIG. 2

WATER CONTENT DENSITY

A



GRADATION OF BASE AND SUBGRADE MATERIALS  
FIG.3

TEST AREA	TYPE	CLASSIFICATION	ATTERBERG LIMITS			SPECIFIC GRAVITY	
			LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	> 1/4	< 1/4
DE+F	Base	Well graded SAND and GRAVEL (GM)	AVG. —	NON-PLASTIC	—	2.67	2.74
			RANGE —			2.60-2.71	—
DE+F and Turf	Subgrade	Silty CLAY (CL)	AVG. 33	20	13	—	2.74
			RANGE 29-36	19-22	11-17	—	2.71-2.76
Turf	Subgrade	Silty clayey SAND and GRAVEL (GC)	AVG. 20	16	4	2.60	2.79
			RANGE 19-21	15-17	2-8	—	—

FIG.4

B

FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.

SOIL DATA SUMMARY  
TEST AREAS D,E AND F

FROST EFFECTS LABORATORY BOSTON MASS. JUN. 1946

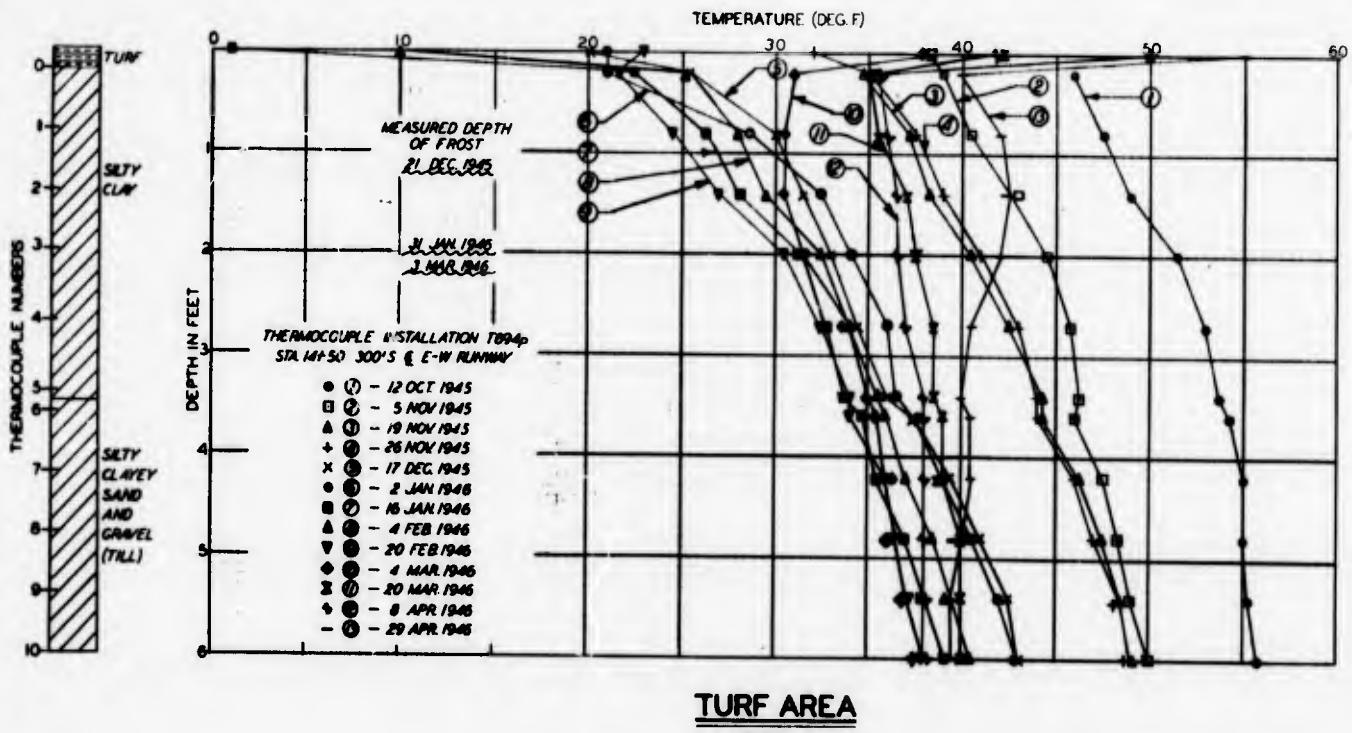


FIG. 1

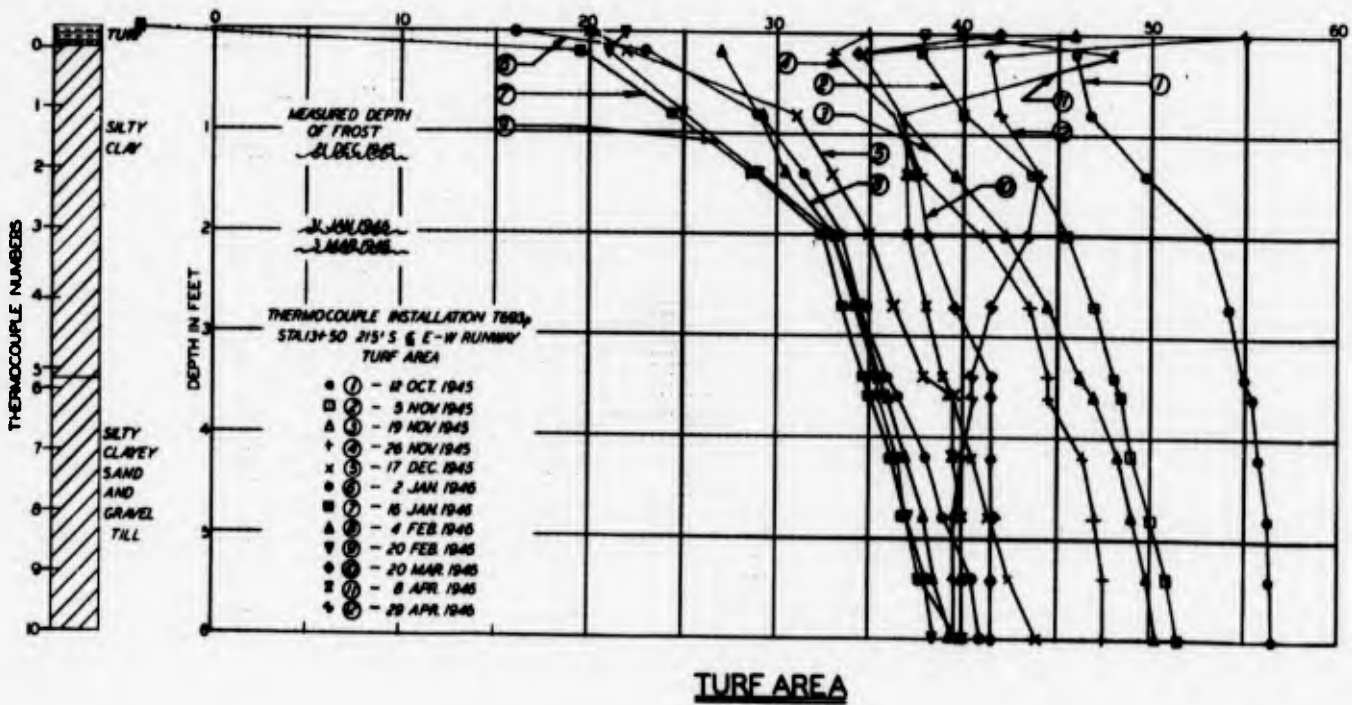
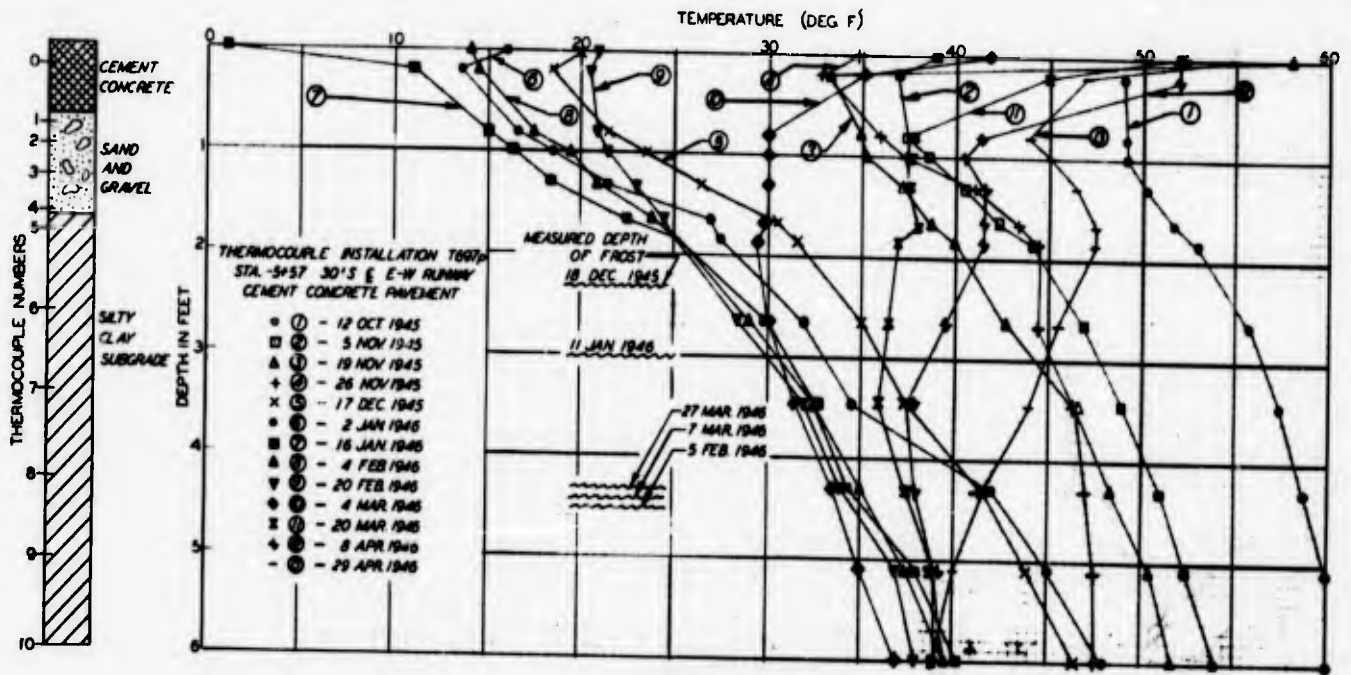
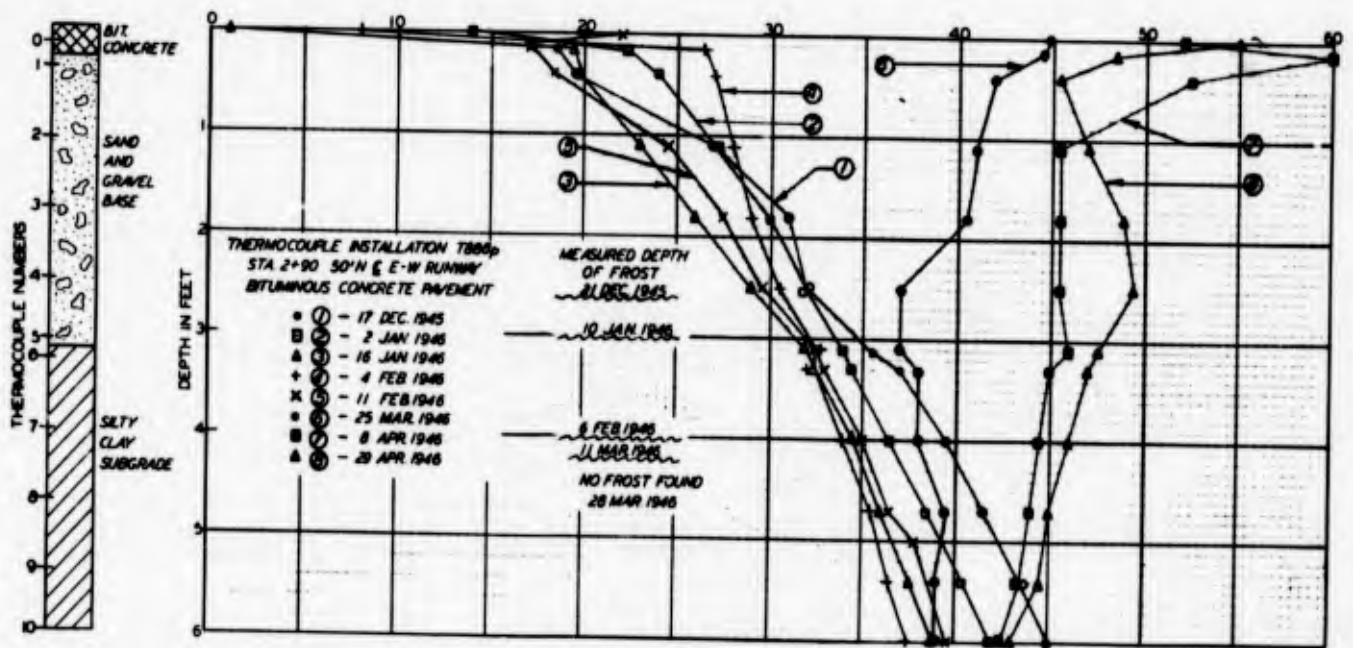


FIG. 3

A



TEST AREA A  
FIG. 2



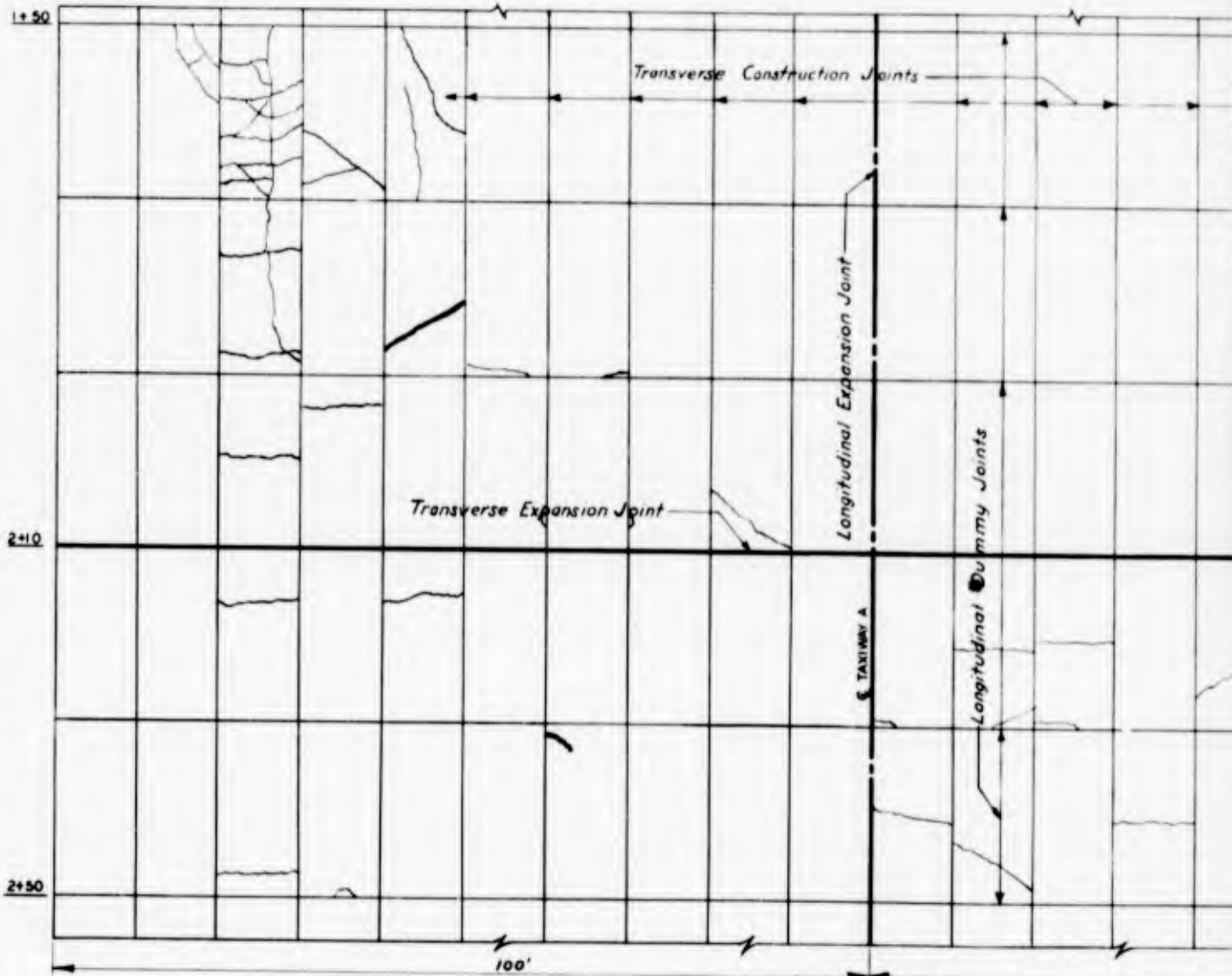
TEST AREA E  
FIG. 4

NOTE

PAVEMENT, BASE AND SUBGRADE CONDITIONS AT LOCATION OF THERMO-COUPLE T697p IN TEST AREA A ARE REPRESENTATIVE OF TEST AREA E

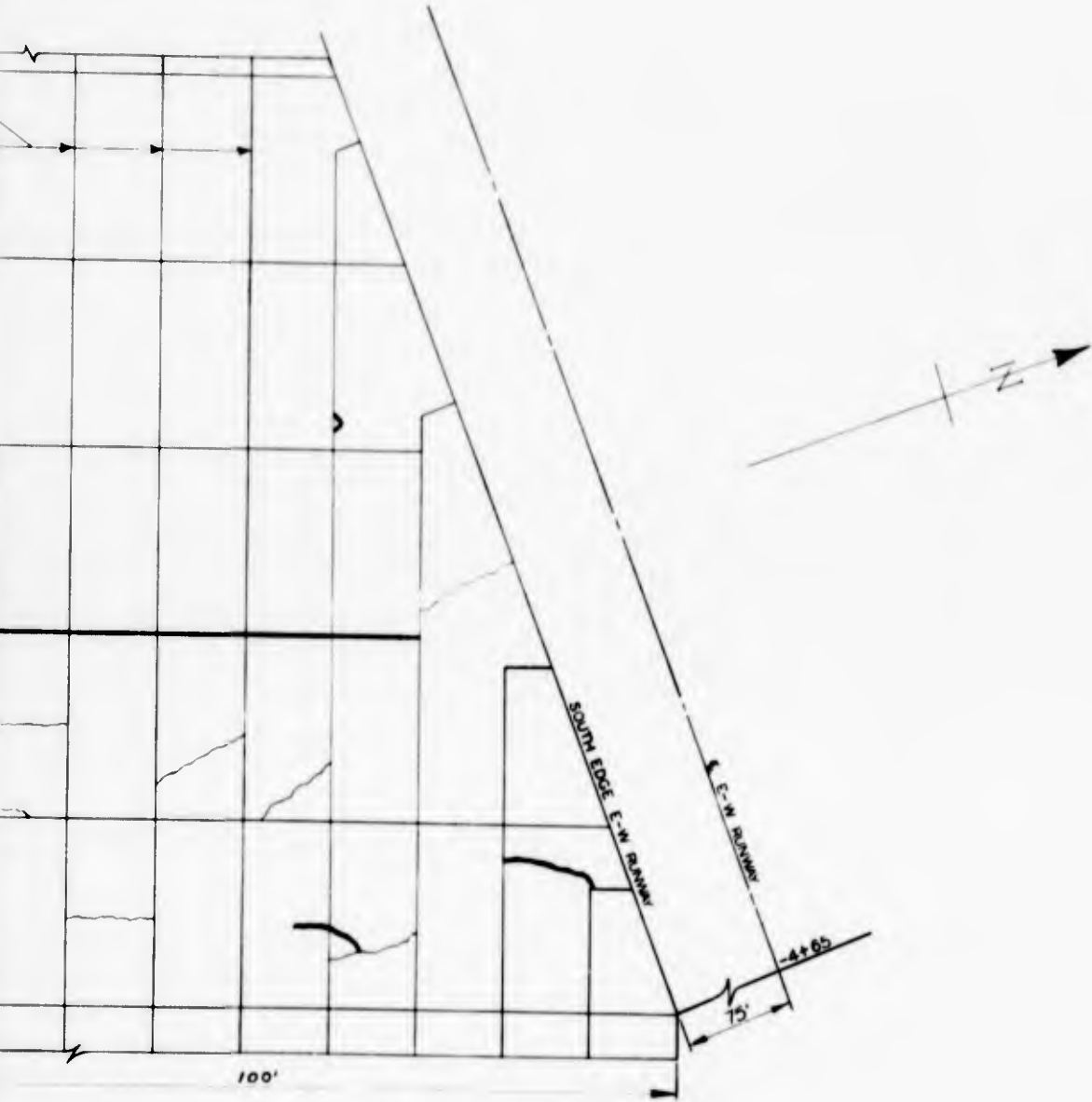
FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.  
TYPICAL SUBSURFACE  
TEMPERATURES  
FROM  
THERMO-COUPLES

B



TEST AREA F

A



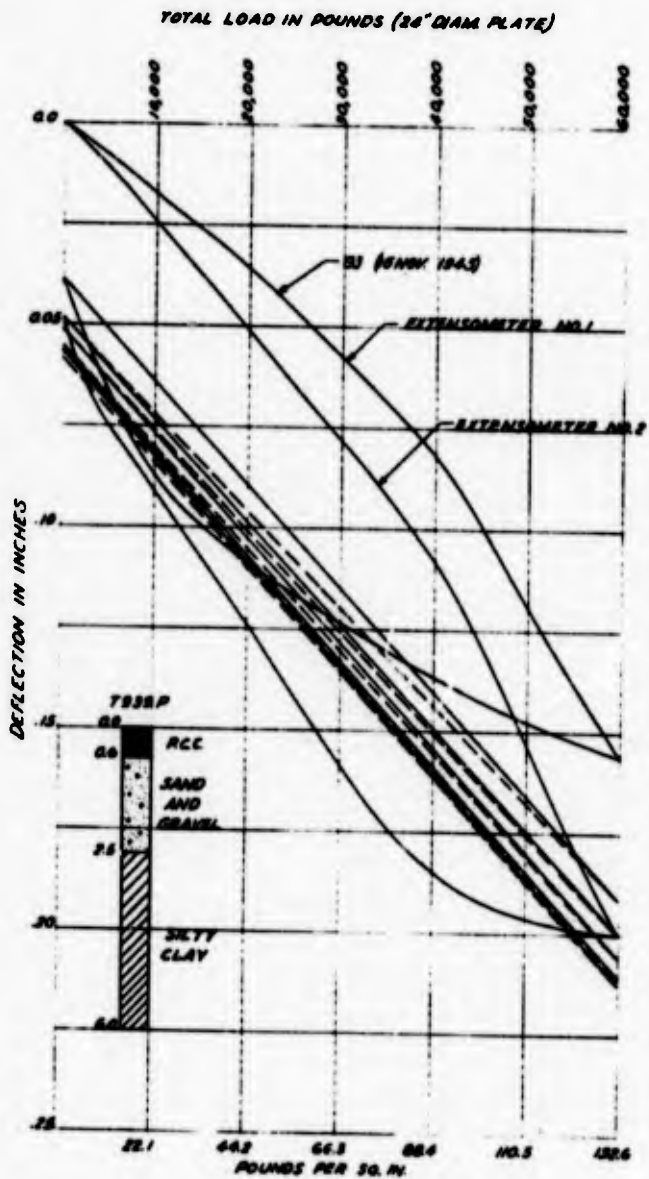
LEGEND

- CRACKS OCTOBER 29, 1945
- CRACKS APRIL 22, 1946

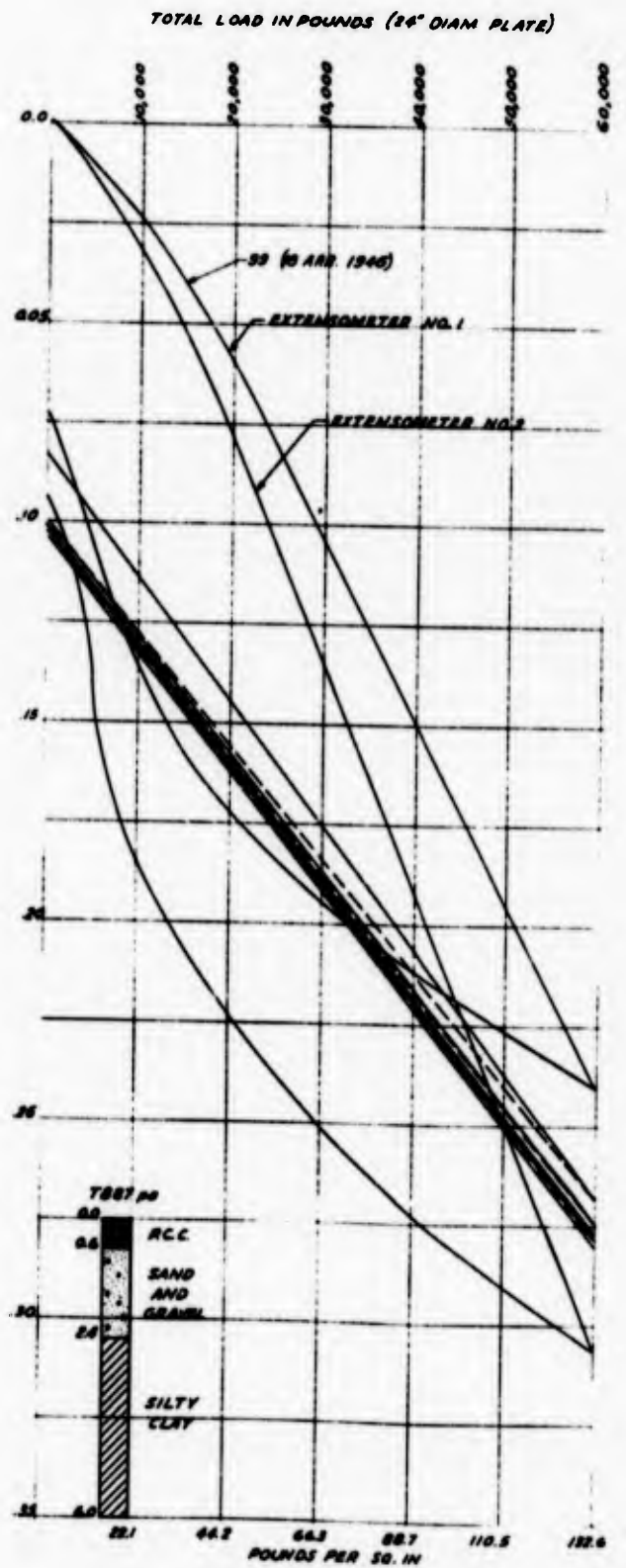
B

FROST INVESTIGATION  
DOW FIELD, BANGOR, ME.  
CRACK SURVEY  
TEST AREA F





**PBT NO. 93**



**PBT NO. 99**

**RUPTURE**

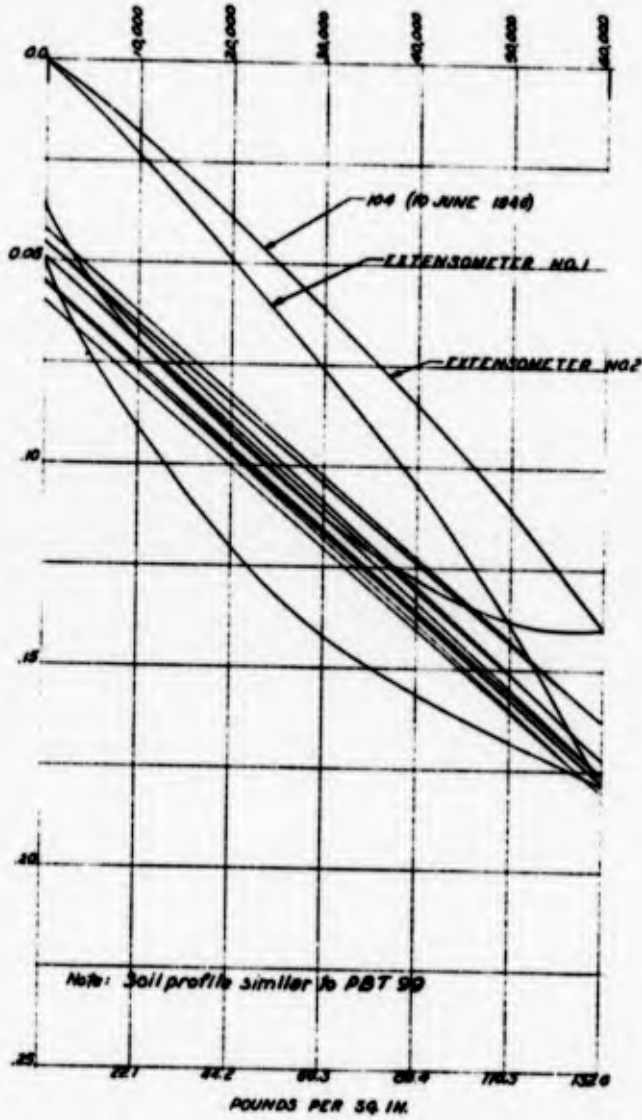
TEST NO.	LOCATION	STATION	OFFSET
93	TAXIWAY A	1+64	41' N E
94	TAXIWAY A	1+60	43' N E
100	TAXIWAY A	1+86	22' N E
99	TAXIWAY A	1+89	21' N E
104	TAXIWAY A	2+09	2' N E
107	TAXIWAY A	2+05	3' N E

A

PLATE)

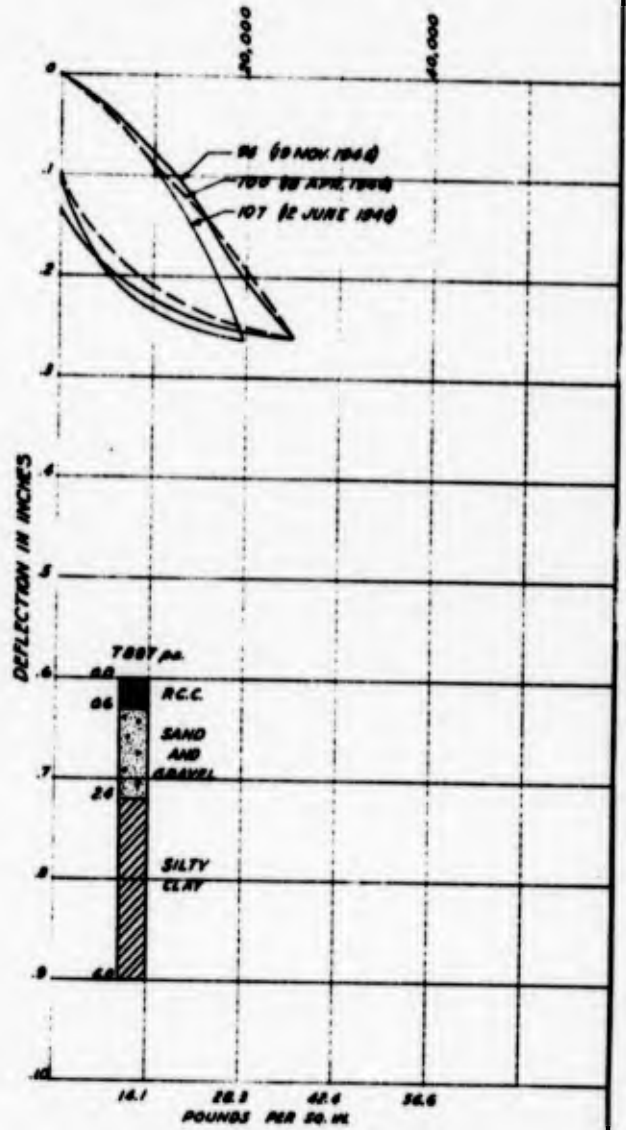
60,000  
10,000

TOTAL LOAD IN POUNDS (24" DIAM. PLATE)



PBT NO. 104

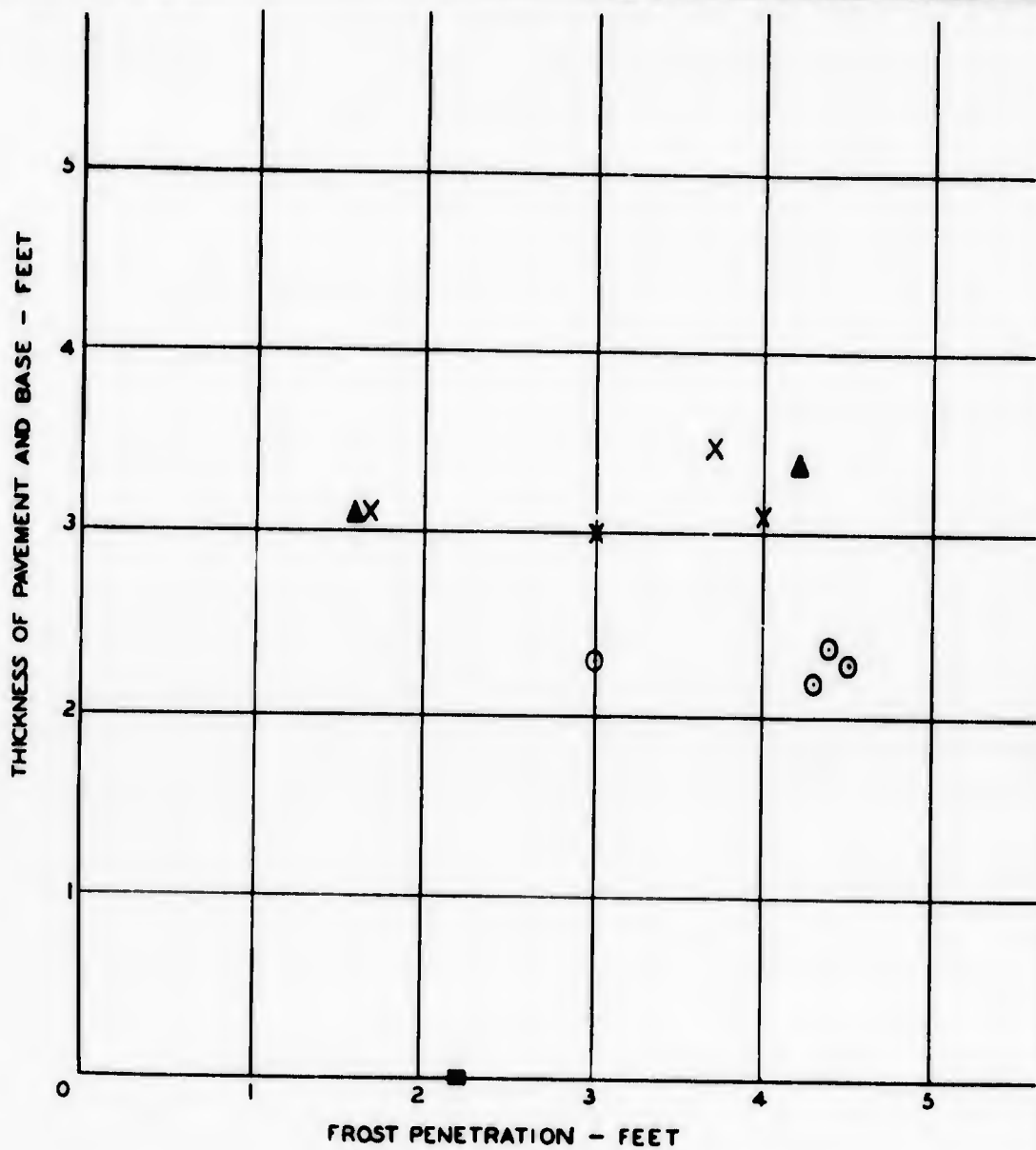
TOTAL LOAD IN POUNDS (30" DIAM. PLATE)



PBT NOS. 94, 100 AND 107  
FOUNDATION MODULUS

B

FROST INVESTIGATION  
DOW FIELD-BANGOR, ME.  
  
PLATE BEARING TESTS  
RUPTURE AND FOUNDATION MODULUS  
TEST AREA F



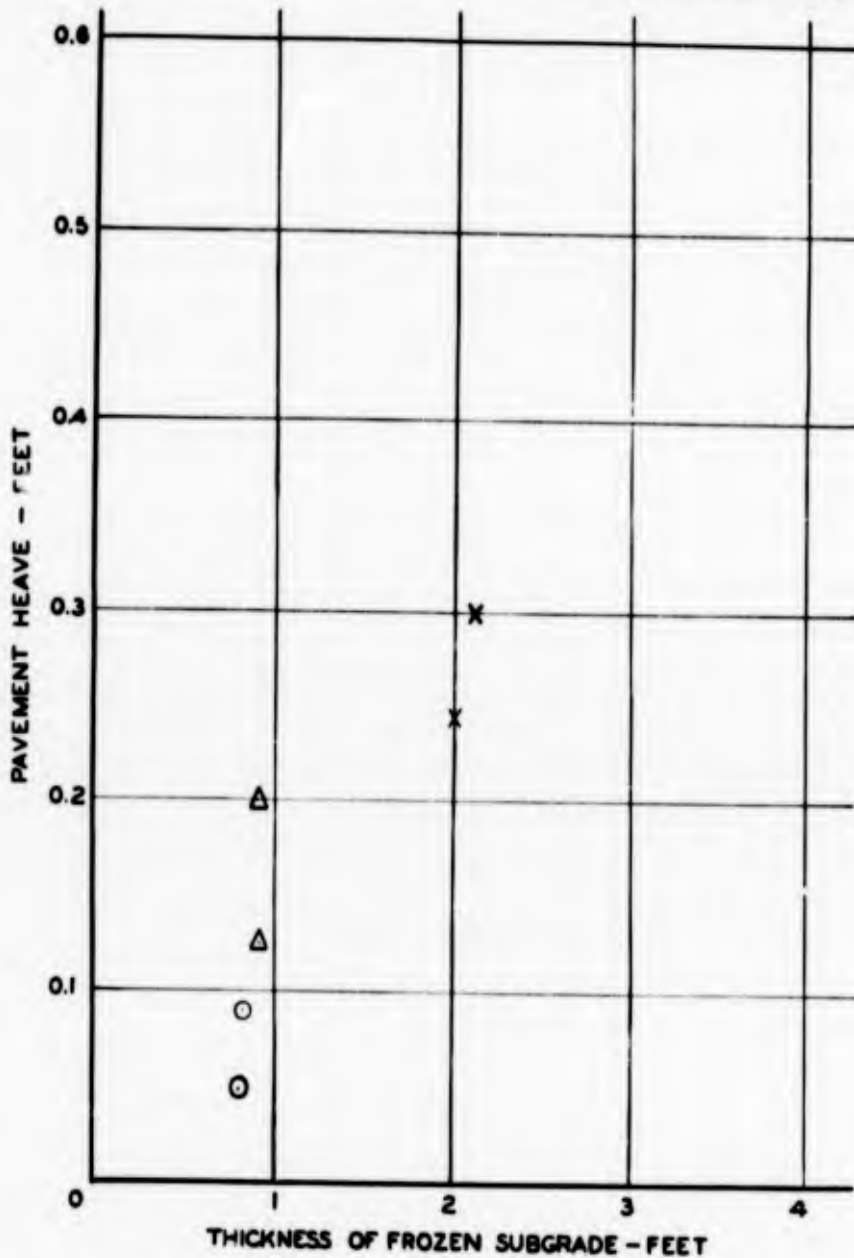
**LEGEND**

- ▲ TEST AREA D: BITUMINOUS CONCRETE PAVEMENT, GRAVEL BASE, SILTY CLAY SUBGRADE.
- × TEST AREA E: BITUMINOUS CONCRETE PAVEMENT, GRAVEL BASE, SILTY CLAY SUBGRADE.
- TEST AREA F: CEMENT CONCRETE PAVEMENT, GRAVEL BASE, SILTY CLAY SUBGRADE.

FROST INVESTIGATION  
 DOW FIELD, BANGOR, ME.  
 FROST PENETRATION VS.  
 THICKNESS OF PAVEMENT  
 AND BASE

JUNE 1946

FROST EFFECTS LABORATORY BOSTON, MASS.



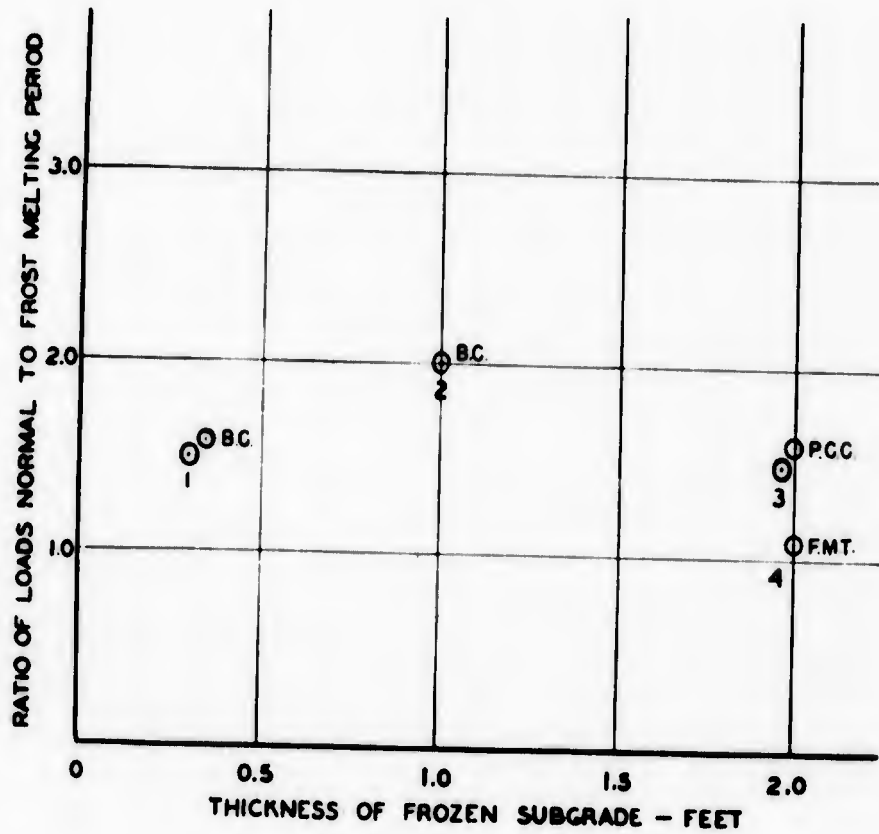
**LEGEND**

- ⊙ TEST AREA D: BITUMINOUS CONCRETE, GRAVEL BASE, SILTY CLAY SUBGRADE.
- △ TEST AREA E: SIMILAR TO AREA D.
- × TEST AREA F: CEMENT CONCRETE PAVEMENT, GRAVEL BASE, SILTY CLAY SUBGRADE.

**NOTE**

THICKNESS OF FROZEN SUBGRADE OBTAINED BY SUBTRACTING THICKNESS OF PAVEMENT AND BASE FROM DEPTH OF FROST PENETRATION.

**FROST INVESTIGATION**  
**DOW FIELD BANGOR, ME.**  
**PAVEMENT HEAVE RELATED TO**  
**THICKNESS OF FROZEN SUBGRADE**  
 JUNE 1946  
 FROST EFFECTS LABORATORY BOSTON, MASS.



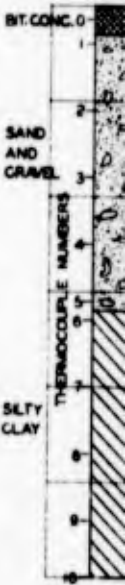
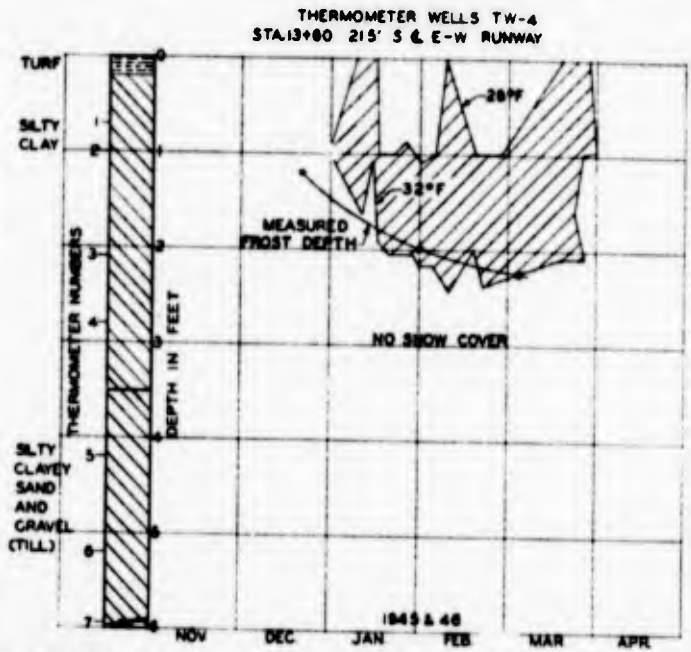
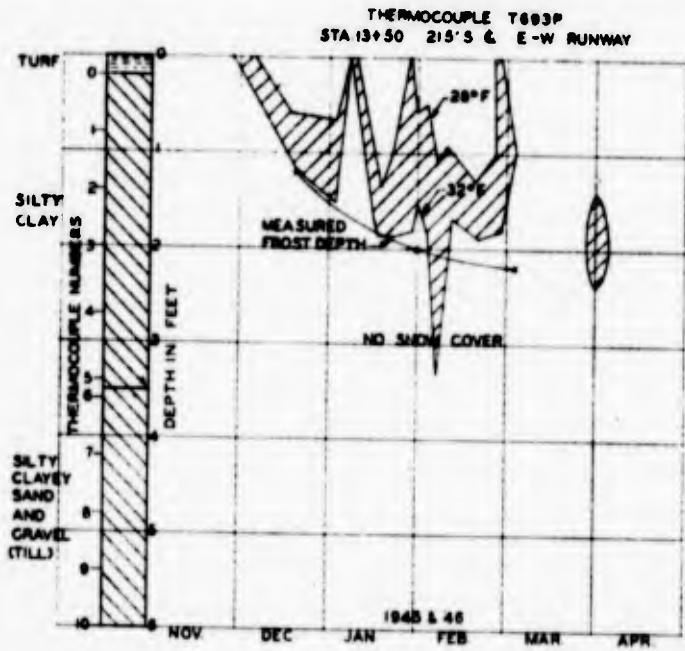
POINT NO.	TESTS USED FOR RATIOS
1	PBT 91/PBT 98
2	PBT 92/PBT 101
3	PBT 93/PBT 99
4	PBT 94/PBT 100
5	PBT 102/PBT 95
6	PBT 104/PBT 99

**NOTES**

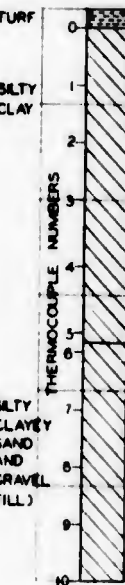
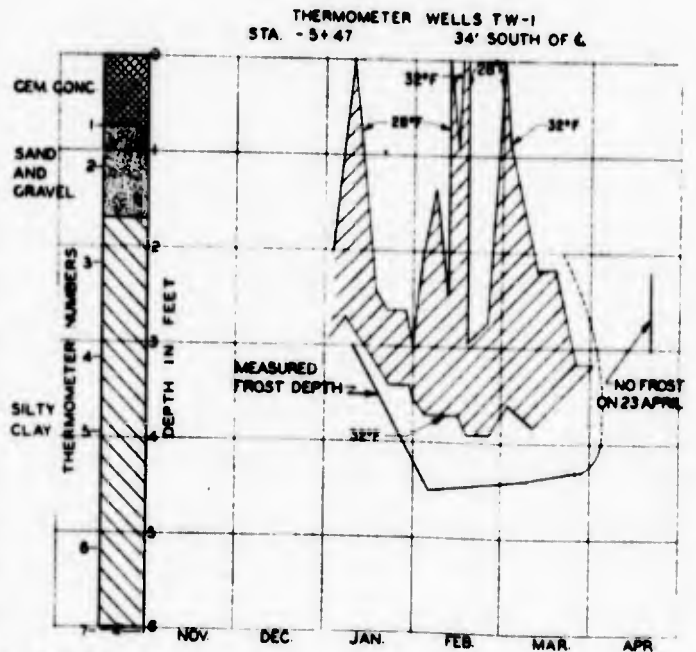
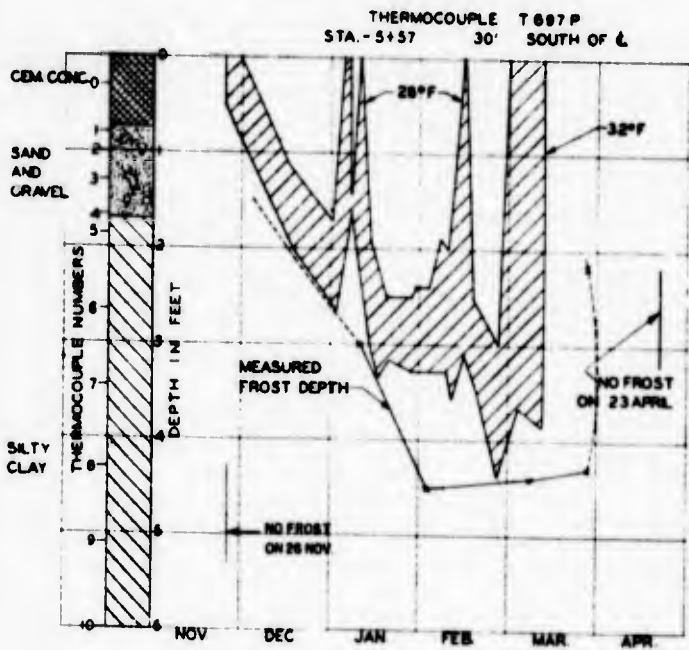
RATIO OF LOADS NORMAL TO FROST MELTING PERIOD IS RATIO OF TOTAL LOAD ON 30" DIA. PLATE AT 0.1" DEFLECTION.

THICKNESS OF FROZEN SUBGRADE OBTAINED BY SUBTRACTING THICKNESS OF PAVEMENT AND BASE FROM DEPTH OF FROST PENETRATION.

**FROST INVESTIGATION**  
**DOW FIELD, BANGOR, ME.**  
**RATIO OF PLATE BEARING TESTS**  
**NORMAL TO FROST MELTING**  
**PERIOD, RELATED TO THICKNESS**  
**OF FROZEN SUBGRADE**  
 JUNE 1946  
 FROST EFFECTS LABORATORY      BOSTON, MASS.



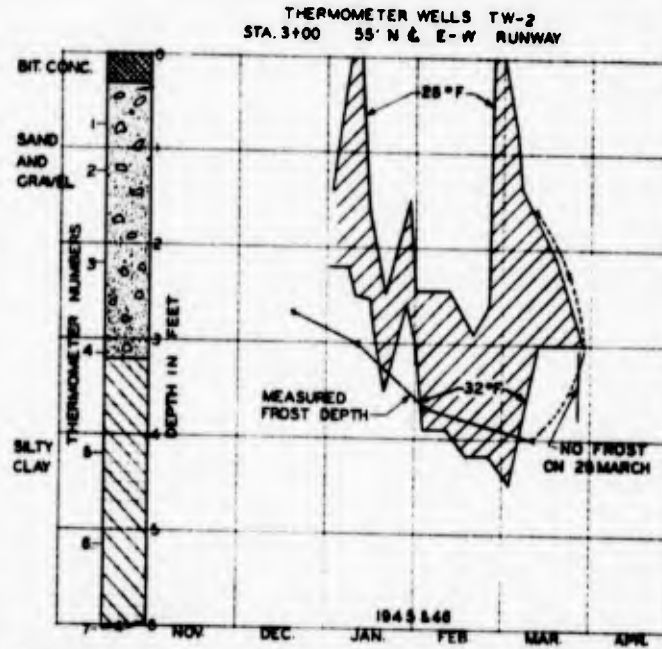
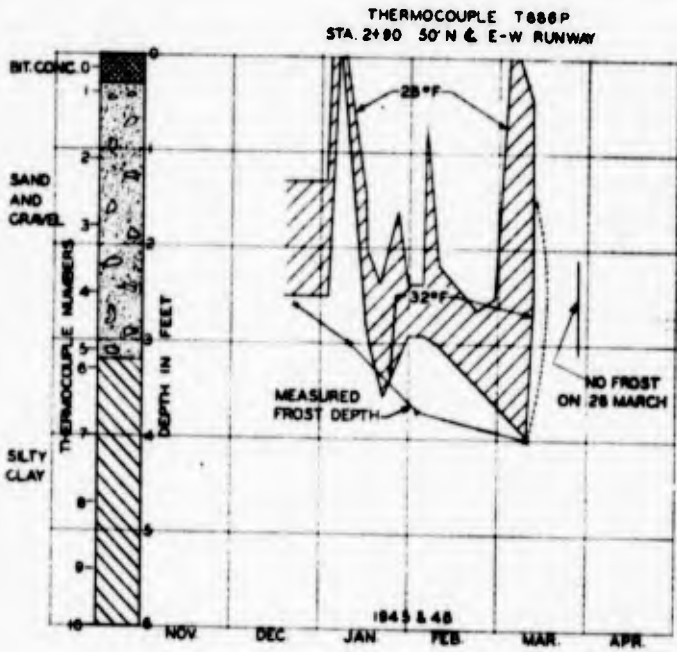
**TURF AREA**



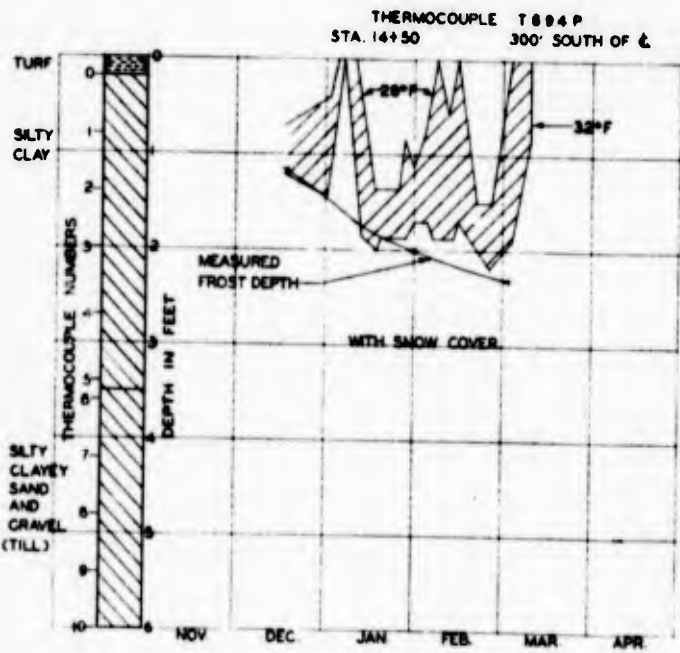
**TEST AREA A**

NOTE: PAVEMENT, BASE, AND SUBGRADE CONDITIONS IN TEST AREA "A" ARE REPRESENTATIVE OF TEST AREA "F"

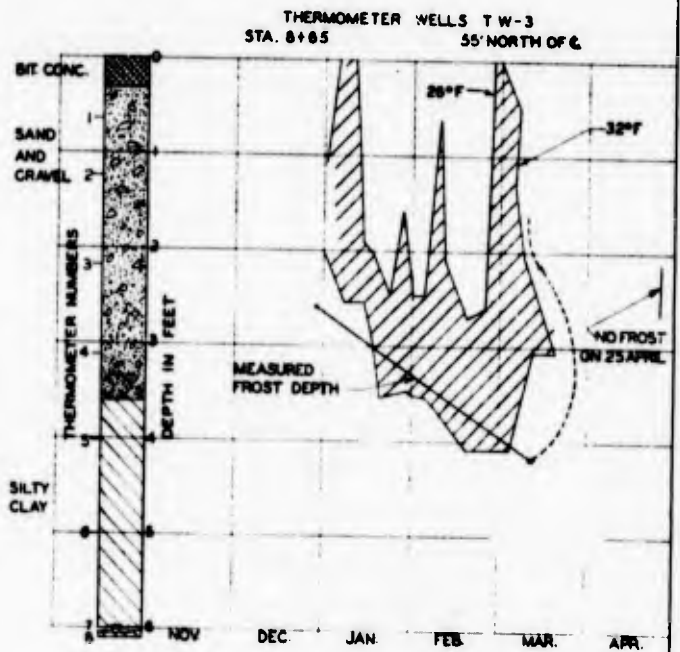
A



**TEST AREA E**



**TURF AREA**



**TEST AREA D**

FROST INVESTIGATION  
DOW FIELD BANGOR, ME.  
SUBSURFACE TEMPERATURES  
AND  
FROST PENETRATION

FROST EFFECTS LABORATORY, BOSTON MASS. JUNE 1946