SURVEY OF HIGHWAY CONSTRUCTION MATERIALS
IN THE TOWN OF NORTON, ESSEX COUNTY, VERMONT

Prepared by

Engineering Geology Section, Materials Division
Vermont Department of Highways

in cooperation with

United States Department of Transportation
Federal Highway Administration

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Acknowledgments

The work of this Project was implemented with the cooperation and assistance of many groups and individuals. The following were particularly helpful in carrying out the Project's objectives.

1. Various departments and individuals of the Vermont State Department of Highways; notably the Planning Division and Mapping Section and the Materials Division.

2. Professor D. P. Stewart of Miami University, Oxford, Ohio.

3. Professor C. G. Doll, Vermont State Geologist, University of Vermont, Burlington, Vermont.

4. United States Department of Commerce, Federal Highways Administration.

History

The Materials Survey Project was formed in 1957 by the Vermont Department of Highways with the assistance of the Federal Highway Administration. Its prime objective was to compile an inventory of highway construction materials in the State of Vermont. Originally, investigations for highway construction materials were conducted only as the immediate situation required and only limited areas were surveyed; thus, no over-all picture of material resources was available. Highway contractors or resident engineers were required to locate the materials for their respective projects and samples were tested by the Materials Division. The additional cost of exploration for construction materials was passed on to the State bringing about higher construction costs. The Materials Survey Project was established to eliminate or minimize this factor by enabling the State and the contractors to proceed with information on available material resources and to project cost estimates. Knowledge of locations of suitable material is an important factor in planning future highways.

The sources of construction materials are located by this Project through ground reconnaissance, study of maps and aerial photographs and geological and physiographic interpretation. Maps, data sheets and work sheets for reporting the findings of the Project are used to furnish information of particular use to the contractor or construction man. For maximum benefit, the maps, data sheets and this report should be studied together.

Enclosures

Included in this report are two surface-geology maps, one defining the location of tests on bedrock, the other defining the location of tests on granular materials. These maps are based on 15-minute or 7-1/2-minute quadrangles of the United States Geological Survey enlarged or reduced to 1:31250 or 1" = 2604'. Delineated on the Bedrock Map are the various rock formations and types in the township. This information was obtained from: Vermont Geological Survey Bulletins, Vermont State Geologist Reports, United States Geological Survey Bedrock Maps, Centennial Geological Map of Vermont, the Surficial Geologic Map of Vermont and other references.

The granular materials map shows areas covered by various types of glacial deposits (outwash, moraines, kames, kame terraces, eskers, etc.) by which potential sources of gravel and sand may be recognized. This information was obtained primarily from a survey conducted by Professor D. P. Stewart of Miami University, Oxford, Ohio, who mapped the glacial features of the State of Vermont during the summer months from 1956 to 1966. Further information is obtained from the Soil Survey (Reconnaissance) of Vermont (conducted by the Bureau of Chemistry and Soils of the United States Department of Agriculture), Vermont Geological Survey Bulletins United States Geological Survey Quadrangles, aerial photographs and other sources. On both maps, the areas tested are represented by Identification Numbers. The number and location of tests taken in each area represented by an Identification

Number is determined by the nature of the material or its topographic feature.

Also included in this report are data sheets for both the Bedrock and Granular Materials Survey, which contain detailed information for each test conducted by the Project as well as information obtained from an active card file compiled and updated by the Engineering Geology Section of the Materials Division over a period of years. Transfer of information from the cards to the data sheets was made and the location of the deposits was plotted on the maps. However, some cards in the file were not used because of incomplete or unidentifiable information on the location of the deposit. Caution should be exercised wherever this information appears incomplete.

Work sheets, containing more detailed information and a field sketch of the area represented by the Identification Number, and laboratory reports are on file in the Materials Division of the Vermont Department of Highways.

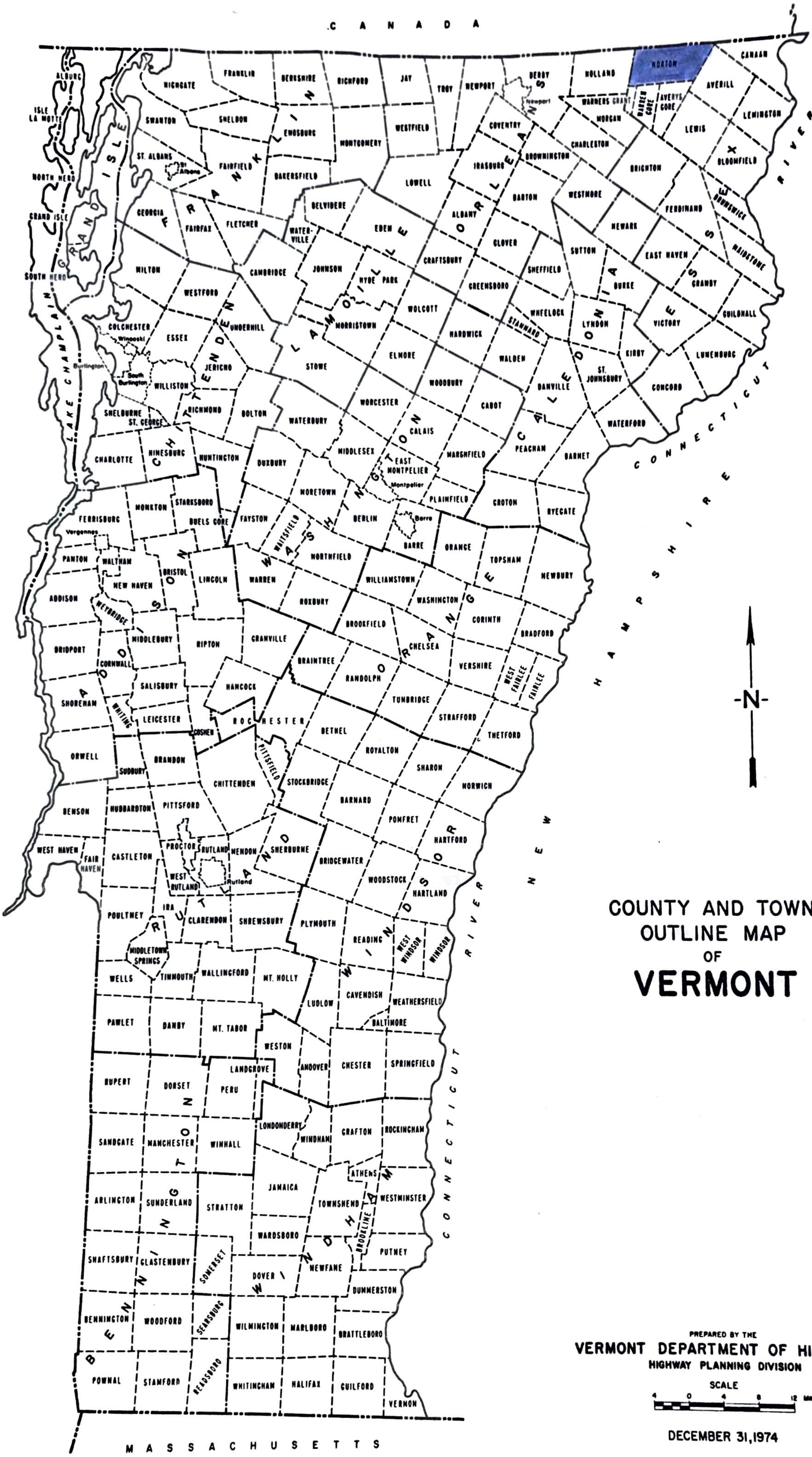
LOCATION

The town of Norton is in the northwest corner of Essex County in northeastern Vermont. It is bounded on the west by Holland, on the south by Warner's Grant, Warren Gore, and Avery's Gore, on the east by Averill, on the northeast by Canaan, and on the north by Canada. (See County and Town Outline Map of Vermont on the following page.)

The western three-quarters of town lie in the Vermont Piedmont (a region of broad valleys and rounded hills.) Three peaks are over 2,240 feet elevation in the eastern quarter of the town which lies in the Northeastern Highlands physiographic sub-division of the New England Upland. This upland is characterized by rugged, steep-sided, terrain. Elevations range from 2,714 feet atop Brousseau Mountain, to less than 1,240 feet where the Coaticook River crosses the Canadian Border at Norton Mills.

Regional drainage is northeastward from Norton Pond via the Coaticook River. Its eastern tributaries are Station, Davis, Number Five, and Number Six Brooks; its western tributaries are Sutton, Gaudette, Mosher Meadow, and Black Turn Brooks. Coaticook and Hurricane Brooks flow south and southeastward into Norton Pond. Other minor drainage is via many unnamed brooks.

Halfway Pond and parts of Averill Lake and Norton Pond are the major bodies of water in Norton.



COUNTY AND TOWN OUTLINE MAP OF VERMONT

PREPARED BY THE

VERMONT DEPARTMENT OF HIGHWAYS

HIGHWAY PLANNING DIVISION

SCALE

4 0 4 8 12 MILES

DECEMBER 31, 1974

Procedure for Rock Survey

The method employed by the project in a survey of possible sources of rock for highway construction is divided into two main stages: office and field investigations.

The office investigation is conducted primarily during the winter months and comprises the mapping and description of rock types as indicated in the many reference sources, as indicated in the bibliography. These references differ considerably in dependability due to new developments and studies that have contributed to the obsolescence of a number of reports. In addition, the results of samples taken by other individuals are analyzed, and the location at which these samples were taken, is mapped when possible. As complete a correlation as possible is made of all the available information concerning the geology of the area under consideration.

The field investigation is begun by making a cursory survey of the entire town. The information obtained from this preliminary survey, as well as that assimilated in the office investigation, is used to determine the areas where sampling will be concentrated. When a promising source has been determined by rock type, volume of material, accessibility, and adequate exposure and relief, chip samples are taken with a hammer across the strike or trend of the rock, and are submitted to the Materials Division for abrasion testing by the Deval Method (AASHTO T-3) and the Los Angeles Method (AASHTO T-96). Samples taken by the chip method are often within the weathered zone of the outcrop and consequently may give a less satisfactory test result than fresh material deeper in the rock structure. When the rock is uniform, and the chip samples yield acceptable abrasion test results, the material source is included in this report as being satisfactory.

Discussion of Rock and Rock Sources

The information on the Rock Materials Map (Plate II) is simplified. (For a more detailed description of the respective rock formations, see the summary included in this report). In the summary, it is apparent that igneous rocks of the undifferentiated granites of the New Hampshire Plutonic Series comprise almost the entire lithology within the Town of Norton.

The undifferentiated granitic rocks of the New Hampshire Plutonic Series were sampled from Averill Mountain (Map Identification No. 1), where failing test results were obtained, and Brousseau Mountain (Map Identification No. 2), were acceptable test results were obtained only by the Deval Method (AASHTO T-3). Most of Norton was covered by dense forests, so rock was obtained from the zones of greatest relief in the eastern part of town. There was a small mapped zone of the Gile Mountain Formation phyllite or schist just west of Averill Mountain, but it was not located.

SURVEY OF SAND AND GRAVEL SOURCES

Procedure for Sand and Gravel Survey

The method employed by the project in a survey of possible sources of sand and gravel for highway construction is divided into two main stages: office and field investigations.

The office investigation is conducted primarily during the winter months and comprises the mapping of potentially productive areas from various references. Of these references, the survey of glacial deposits mapped by Professor Stewart proves to be particularly helpful when used in conjunction with other references such as soil-type maps, aerial photographs, and United States Geological Survey Quadrangles. The last two are used in the recognition and location of physiographic features indicating glacial deposits, and in the study of drainage patterns. The locations of existing pits are mapped, as are the locations in which samples were taken by other individuals.

The field investigation is begun by making a cursory survey of the entire town. All pits, and any areas that show evidence of glacial or fluvial deposition are noted, and later investigated by obtaining samples of materials from pit faces and other exposed surfaces. Test holes in pit floors and extensions are dug with a backhoe to a depth of approximately 11 feet to obtain samples which are submitted to the Materials Division where they are tested for stone abrasion by the AASHTO T-4 Method, and sieved for gradation.

Discussion of Sand and Gravel Deposits

Results of this survey showed that granular materials suitable for highway and related construction purposes were deposited in Norton mostly along a narrow belt on the east side of the Coaticook River valley. These deposits were formed by glaciofluvial and glaciolacustrine processes at elevations from 1,300 to 1,400 feet. Most of the material is mapped as being in kame moraines; however, there is a mapped kame terrace along the heavily wooded northwest shore of Norton Pond. Other material was sampled from five small pits in shallow bodies of sand or gap-graded gravel at the Hurricane Brook Wildlife Preservation Area, in the remote west and southwest part of Norton; these pits are accessible from Vermont Route 114 in Warren Gore.

The most promising source of Gravel for Sub-base, Item 704.05 is Map Identification No. 5, a pit in the woods east of Vermont Route 114.

The most promising sources of Sand Borrow and Cushion, Item 703.03 are Map Identification No. 3 (a pit), No. 4 (a roadcut on Vermont Route 114), and No. 10. Two other areas yielded acceptable Granular Borrow, Item 703.05, and another four areas yielded material which was not acceptable for Granular Borrow. Brown Co. pits in Warren Gore have supplied material in the past.

Summary of Rock Formations in the Town of Norton

Gile Mountain Formation: Gray quartz-muscovite phyllite or schist, interbedded and intergradational with gray micaceous quartzite (graywacke northeast of Nulhegan River), calcareous mica schist, and, locally quartzose and micaceous crystalline limestone like that of the Waits River Formation. The phyllite and schist commonly contain porphyroblasts of biotite, garnet, staurolite, and locally kyanite, andalusite, or sillimanite.

Undifferentiated Granitic Rocks of the New Hampshire Plutonic Series: Mostly granitic bodies emplaced during or slightly after the regional metamorphism. Sillimanite and locally cordierite occur near many contacts in northern part of state in small dikes and sills too narrow to show on map.

Glossary of Selected Geologic Terms

Andalusite: A variously colored orthorhombic aluminum silicate, Al_2SiO_5, found in schistose rocks.

Bedrock: Solid, undisturbed rock in place at the surface or just beneath surficial deposits.

Bedrock Control: Land features which show bedrock on, or close to, the surface. It is used to describe part of the topography.

Biotite: A platy silicate commonly known as black mica.

Calcareous: Pertaining to, or containing from 10- to 50- percent calcium carbonate ($Ca\ CO_3$).

Cordierite: A blue silicate of magnesium, aluminum, and iron.

Dike: A sheet-like igneous rock that fills a fissure in older rocks while still in a molten state. It varies from less than an inch wide and a few yards long, to thousands of feet in width and many miles in length. May radiate in groups from a center, or occur singly and isolated from other igneous bodies.

Drainage: The manner in which water of an area passes off by surface streams and rivers, or by subsurface channels.

Drift: A deposit of earth, sand, gravel and boulders, carried by glaciers (glacial drift), or by water flowing from glaciers (fluvioglacial drift). Large areas of North America and Europe are drift-covered in higher latitudes.

Graywacke: Dark-colored, hard sandstone consisting of angular grains of quartz, feldspar, and rock fragments embedded in a fine, compact matrix of micas, clay minerals, and chlorite.

Interbedded: Occurring between beds, or adjacent and parallel to, other beds of a different nature.

Kame Moraine: Stratified sands and gravels deposited by water flowing beneath a glacier.

Kame Terrace: Stratified sands and gravels deposited by water flowing between a glacier and an adjacent valley wall.

Kyanite: A blue aluminum silicate occurring in thin-bladed crystals, or crystalline aggregates.

Muscovite: An important member of the mica group, known also as white mica, potash mica, or isinglass.

Outcrop: A part of a body of rock that appears, bare and exposed, at, or just below the surface.

Phyllite: A fine-grained, foliated metamorphic rock intermediate and gradational between the mica schists and slates. The foliation is caused by large amounts of potash mica (Sericite) which gives the rock its distinctive silvery appearance.

Porphyroblasts: Large crystals which have grown in place within the fine-grained groundmass of a metamorphic rock. They have been formed by heat, pressure, and infiltrating solutions occurring later than the rocks in which they form.

Rock Flour: Glacially ground, angular, unweathered, silt and clay size rock material which does not posses the cohesion characteristic of clay minerals.

Schist: A crystalline metamorphic rock with a secondary foliation or lamination based on parallelism of platy or needle-like grains. The name refers to the tendency to split along the foliation.

Sediments: All material deposited from water (streams, lakes, or seas), wind, or ice.

Sill: A tabular body of igneous rock which has been injected while molten between layers or foliations of rock. Sills have relatively great lateral extent as compared to thickness.

Sillimanite: A brown, grayish or pale green aluminum silicate, Al_2SiO_5, forming in long, slender, and often fibrous crystals.

Staurolite: A brown to black, iron aluminum silicate, $HFeAl_5Si_2O_{13}$, occurring in prismatic crystals, often twinned in the form of a cross.

Water Table: The upper surface of a zone of saturation, except where the surface is formed by an impermeable body.

Weathered: Showing the effects of exposure to the atmosphere.

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PARTIAL SPECIFICATIONS FOR HIGHWAY CONSTRUCTION MATERIALS

Listed below are partial specifications for Highway Construction Materials as they apply to this report at date of publication. For a complete list of specifications see Standard Specifications for Highway and Bridge Construction, approved and adopted by the Vermont Department of Highways, January, 1972.

DIVISION 700 - MATERIALS

703.03 SAND BORROW AND CUSHION. Sand borrow shall consist of material reasonably free from silt, loam, clay, or organic matter. It shall be obtained from approved sources and shall meet the requirements of the following table:

TABLE 703.03A - SAND BORROW AND CUSHION

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
2"	100	
1½"	90-100	
½"	70-100	
No. 4	60-100	100
No. 100		0- 30
No. 200		0- 12

703.05 GRANULAR BORROW. Granular borrow shall be obtained from approved sources, consisting of satisfactorily graded, free draining, hard, durable stone and coarse sand reasonably free from loam, silt, clay, or organic material.

The Granular Borrow shall meet the requirements of the following table:

TABLE 703.05A - GRANULAR BORROW

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
No. 4	20-100	100
No. 200		0- 15

The maximum size stone particles of the Granular Borrow shall not exceed 2/3 of the thickness of the layer being spread.

704.05 GRAVEL FOR SUB-BASE. Gravel for Sub-base shall consist of material reasonably free from silt, loam, clay, or organic matter. It shall be obtained from approved sources and shall meet the following requirements:

(a) Grading. The gravel shall meet the requirements of the following table:

TABLE 704.05A - GRAVEL FOR SUB-BASE

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
No. 4	20-60	100
No. 100		0- 18
No. 200		0- 8

The stone portion of the gravel shall be uniformly graded from coarse to fine, and the maximum size stone particles shall not exceed 2/3 the thickness of the layer being placed.

(b) Percent of Wear. The percent of wear of the gravel shall be not more than 25 when tested in accordance with AASHTO T-4, or more than 40 when tested in accordance with AASHTO T-96.

704.06 CRUSHED STONE FOR SUB-BASE. Crushed stone for sub-base shall consist of clean, hard, crushed stone, uniformly graded, reasonably free from dirt, deleterious material, pieces which are structurally weak and shall meet the following requirements:

(a) Source. This material shall be obtained from approved sources and the area from which this material is obtained shall be stripped and cleaned before blasting.

(b) Grading. This material shall meet the requirements of the following table:

TABLE 704.06A - CRUSHED STONE FOR SUB-BASE

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE
4½"	100
4"	90-100
1½"	25- 50
No. 4	0- 15

(c) Percent of Wear. The percent of wear of the parent rock shall be not more than 8 when tested in accordance with AASHTO T-3, or the crushed stone a percent of wear of not more than 40 when tested in accordance with AASHTO T-96.

(d) Thin and Elongated Pieces. Not more than 30 percent, by weight, of thin and elongated pieces will be permitted.

Thin and elongated pieces will be determined on the material coarser than the No. 4 sieve.

(e) Filler. The filler shall be obtained from approved sources and shall meet the requirements as set up for Sand Cushion, Subsection 703.03.

(f) Leveling Material. The leveling material shall be obtained from approved sources and may be either crushed gravel or stone screening produced by the crushing process. The material shall consist of hard durable particles, reasonably free from silt, loam, clay or organic matter.

This material shall meet the requirements of the following table:

TABLE 704.06B - LEVELING MATERIAL

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE
3/4"	100
1/2"	70-100
No. 4	50- 90
No. 100	0- 20
No. 200	0- 10

704.07 CRUSHED GRAVEL FOR SUB-BASE. Crushed gravel for sub-base shall consist of material reasonably free from silt, loam, clay or organic matter. It shall be obtained from approved sources and shall meet the following requirements:

(a) Grading. The crushed gravel shall be uniformly graded from coarse to fine and shall meet the requirements of the following table:

TABLE 704.07A - CRUSHED GRAVEL FOR SUB-BASE

GRADING	Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
COARSE	4"	100	
	No. 4	25- 50	100
	No. 100		0- 20
	No. 200		0- 12
FINE	2"	100	
	1½"	90-100	
	No. 4	30- 60	100
	No. 100		0- 20
	No. 200		0- 12

(b) Percent of Wear. The percent of wear of the parent gravel shall be not more than 20 when tested in accordance with AASHTO T-4, or the crushed gravel a percent of wear of not more than 35 when tested in accordance with AASHTO T-96.

(c) Fractured Faces. At least 30 percent, by weight, of the stone content shall have at least one fractured face.

Fractured faces will be determined on the material coarser than the No. 4 sieve.

704.09 DENSE GRADED CRUSHED STONE FOR SUB-BASE. Dense graded crushed stone for sub-base shall consist of clean, hard, crushed stone, uniformly graded, reasonably free from dirt, deleterious material and pieces which are structurally weak, and shall meet the following requirements:

(a) Source. This material shall be obtained from approved sources and the area from which this material is obtained shall be stripped and cleaned before blasting.

(b) Grading. This material shall meet the requirements of the following table:

TABLE 704.09A - DENSE GRADED CRUSHED STONE FOR SUB-BASE

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE
3½"	100
3"	90-100
2"	75-100
1"	50- 80
½"	30- 60
No. 4	15- 40
No. 200	0- 10

(c) Percent of Wear. The percent of wear of the parent rock shall be not more than 8 when tested in accordance with AASHTO T-3, or the crushed stone a percent of wear of not more than 40 when tested in accordance with AASHTO T-96.

(d) Thin and Elongated Pieces. Not more than 30 percent, by weight, of thin or elongated pieces will be permitted.

Thin and elongated pieces will be determined on the material coarser than the No. 4 sieve.

704.10 GRAVEL BACKFILL FOR SLOPE STABILIZATION. Gravel backfill for slope stabilization shall be obtained from approved sources, consisting of satisfactorily graded, free draining, hard, durable stone and coarse sand reasonably free from loam,

silt, clay, and organic material.

The gravel backfill shall meet the requirements of the following table:

TABLE 704.10A - GRAVEL BACKFILL FOR SLOPE STABILIZATION

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
No. 4	20-50	100
No. 100		0- 20
No. 200		0- 10

The stone portion of the gravel backfill shall be uniformly graded from coarse to fine, and the maximum size stone particles shall not exceed 2/3 the thickness of the layer being placed.

704.11 GRANULAR BACKFILL FOR STRUCTURES. Granular backfill for structures shall be obtained from approved sources, consisting of satisfactorily graded, free draining granular material reasonably free from loam, silt, clay, and organic material.

The granular backfill shall meet the requirements of the following table:

TABLE 704.11A - GRANULAR BACKFILL FOR STRUCTURES

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves TOTAL SAMPLE	SAND PORTION
3"	100	
2½"	90-100	
No. 4	50-100	100
No. 100		0- 18
No. 200		0- 8

TABLE I

NORTON GRANULAR DATA SHEET NO. 1

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing 2"	1-1/2"	1/2"	#4	#100	#200	Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
1	1	1975	1-15	0-1	Yes	90	81	67	50	33	19	16.0%	----	Owner: Roland A. Devost. Area is a knoll with private road No. 2 passing through it; small pit is adjacent to both sides of road. Pit is 0.2 mile southwest of Vermont Route 114, and 0.638 mile south of its junction with Town Highway No.3. (Private road No. 2 is road to Earth People's Park). The owner did not allow digging in knoll or field to the north because they were planted in oats; south of the road the pit borders woods. Test No. 1 was on hard-packed, vertical north face of pit: Material was: 1'-15', lenses and interbeds of fine gravel and silty sand; some cement-ation was noted in the gravel layers.
	2	1975	10-18	0-10	Yes	100	100	88	77	47	31	16.0%	-----	Test No. 2 was on hard-packed, vertical south face of pit, 80 feet south of Test No. 1. Material was: 10'-13', fine gravel; 13'-15', pebbly gravel; 15'-17', pebbly sand; 17'-18' silty sand. Material was 20% gravel, and 60% to 80% silt or silty sand.

TABLE I

NORTON GRANULAR DATA SHEET NO. 2

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing 2"	1-1/2"	1/2"	#4	#100	#200	Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
2	1	1975	2-9	0-2	Yes	77	65	62	57	20	13	27.6%	Gran. Borrow (Gravel)	Owner: Earth People's Park. Area is small bank on wooded knoll, west of Coaticook River and private road No. 2, and 0.43 mile west of Vermont Route 114, 0.638 mile south of its junction with Town Highway No. 3. Owners would allow only one hand sample on face of pit. Test No. 1 was on face of bank near curve in road west of bridge. Material was: 2'-3', silt and angular stone fragments; 3'-5', sand and silt; 5'-6', pebbly gravel; 6'-9', pebbly sand; bottoms on sloughed materials.
3	1	1976	0-16	-----	Yes	100	100	100	94	24	8	------	Sand	Owner: Florent Roy. Area is shallow pit west of Canadian National Railway Tracks, 0.15 mile west of Vermont Route 114, and 0.35 mile north of its junction with Town Highway No. 12. Irregularly-shaped pit is roughly 150' x 150'. A power line right-of-way runs north and northwest of pit, and would limit extension of material. Owner would not sell material, as he uses it for his farm. Test No. 1 was in north face of lower level of pit. Material

TABLE I

NORTON GRANULAR DATA SHEET NO. 3

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing 2"	1-1/2"	1/2"	#4	#100	#200	Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
	2	1975	0-23	-----	Yes	100	100	100	92	20	7	-------	Sand	was: 0'-9', interbedded sand, pebbly sand, silts, and silty sand; 9'-16', sand and pebbly sand (looks better than 0-9 foot interval material). Test No. 2 was on north face of upper level, 130 feet north-northeast of Test No. 1. Material was: 0'-9', interbedded silty sand and pebbly sand; 9'-23', clean, interbedded pebbly sand and sand.
4	1-A	1975	0.5-25	0-0.5	No	100	100	100	83	15	7	-----	Sand	Owner: State of Vermont (formerly owned by Florent Roy). Area is road-cut through granular ridge on east side of Vermont Route 114, 0.26 mile north of its junction with Town Highway No. 12. Bank was sampled to show the type of material in field east of road cut in which the owner did not allow digging. Test No. 1-A was on upper part of road-cut. Material was: 0.5'-4', pebbly sand; 4'-6', coarse sand; 6'-8', pebbly sand; 8'-10', silty pebbly sand; 10'-12', pebbly, silty fine sand; 12'-13', sand; 13'-14', pebbly sand; 14'-16', sand and silt-clay seams; 16'-18', pebbly sand and silty sand; 18'-20', coarse

TABLE I

NORTON GRANULAR DATA SHEET NO. 4

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing						Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
						2"	1-1/2"	1/2"	#4	#100	#200			
														sand; 20'-22', pebbly sand; 22'-25', pebbly coarse sand. This feature is 20 to 25 feet higher than the feature at Map Identification No. 3, but has similar material.
	1-B	1975	25-45	0-0.5	No	100	100	100	91	32	14	-----	Gran. Borrow (Sand)	Test No. 1-B was below Test No. 1-A. Material was: 25'-27', sand and pebbly silty sand; 27'-31', sand and pebbly sand; 31'-33', pebbly sand; 33'-39', pebbly coarse sand; 39'-41', sand and pebbly sand; 41'-45', silty sand, fine sand and sand seams.
5	1-A	1975	1-21	0-1	Yes	84	78	63	54	19	10	21.6%	Gran. Borrow (Gravel)	Owner: Roland A. Devost. Area is an active pit in woods, 0.08 mile east of Vermont Route 114, 0.7 mile south of its junction with Town Highway No. 12. A band of material extends 300 feet to the north and northeast. There is much slash and brush in the heavy woods around the pit, and private camps lie along an old logging road southeast of the pit road. Several small brooks are near the pit. Access is very good and owner is willing to sell. Test No. 1-A was on northeast

TABLE I

NORTON GRANULAR DATA SHEET NO. 5

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing 2"	1-1/2"	1/2"	#4	#100	#200	Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
														face of west lobe of pit. Material was: 1'-6', gravel; 6'-7', silty sand 7'-8', pebbly sand; 8'-10', silty sand; 10'-11', fine gravel; 11'-16', interbedded fine gravel and silty sand; 16'-21', interbedded sand and pebbly sand. This test represents a northerly extension.
	1-B	1975	21-33	0-1	Yes	100	100	86	75	27	14	----	Gran. Borrow (Sand)	Test No. 1-B was below test No. 1-A. Material was: 21'-33', interbedded sand and silty sand with a thin layer of pebbly sand; bottoms on sloughed material.
	2-A	1975	1016	0-1	Yes	72	62	54	49	12	7	21.6%	Gravel	Test No. 2-A was on northeast face of pit. Material was: 1'-6', gravel; 6'-14', interbeds of silt, sand and fine gravel; 14'-16', gravelly sand. Test represents the northeastern and eastern extensions; the east face caved too easily to allow sampling, but material seemed about the same.
	2-B	1975	16-33	0-1	Yes	95	92	79	69	12	7	------	Gran. Borrow (Sand)	Test No. 2-B was below Test No. 2-A. Material was: 16'-33', interbedded sand, silt, fine gravel, and pebbly sand. Some gravel and fine gravel was near the bottom of face.

TABLE I

NORTON GRANULAR DATA SHEET NO. 6

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing 2"	1-1/2"	1/2"	#4	#100	#200	Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
6	1	1975	2-5	0-2	Yes	85	85	69	63	32	19	-----	----	Owner: State of Vermont, Dept. of Fish and Game; former owner: Brown Co. Area is small, nearly depleted pit on the west side of Norton; access is 5.2 miles northwest of Vermont Route 114 in Warren Gore, and is via the Hurricane Brook Wildlife Preserve access road. Pit has several very large boulders in entrance, north-west of access road. Bedrock appears to be very close to surface. Test No. 1 was in low face near south end of pit. Material was: 2'-5', brown, stony, compact sand, becomes gray with depth; bottoms in sloughed material. Material may be rock flour and angular rock fragments.
	2	1975	2-7	0-2	Yes	100	100	80	74	43	27	----	-----	Test No. 2 was on gently sloping north face of pit, 100 feet north of Test No. 1. Material was: 2'-4', brown sand with random angular stones and pebbles; 4'-6', gray sand and angular rock fragments; 6'-7', gray silty sand and small angular pebbles; bottoms on sloughed material. Material was compact, but showed no signs of bedding.
7	1	1975	2-12	0-1	Yes	100	100	100	84	28	19	----	-----	Owner: Vermont Department of Fish and Game; former owner:

TABLE I

NORTON GRANULAR DATA SHEET NO. 7

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing 2"	1-1/2"	1/2"	#4	#100	#200	Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
														Brown Co. Area is a steep-faced road-cut through wooded knoll, 0.92 mile southwest of cable across access road, and 4.7 miles from the junction of the Hurricane Brook Access Road and Vermont Route 114 in Warren Gore. The faces had ill-sorted, poorly worked material with angular rock fragments. The feature may have been a ground moraine. The knoll extends 150 feet north-northwest, and 100 feet south-south-east into the woods. Test No. 1 was on east face of bank. Material was: 0'-12', ill-sorted mixture of angular pebbles, sand, angular rock fragments and silty sand; bottoms in sloughed material.
	2	1975	1-12	0-1	Yes	100	100	100	84	28	19	-----	----	Test No. 2 was on west face of bank. Material was: 1'-12' angular pebbles, and rock fragments; bottoms in sloughed material.
8	1	1975	1-8	0-1	Yes	100	100	100	87	20	16	-----	----	Owner: Vermont Department of Fish and Game; former owner: Brown Co. Area is small pit 0.15 mile north of main wildlife access road, 0.40 mile northwest of Hurricane Brook culverts and 2.86 miles northwest of the junction of Hurricane Brook

TABLE I

NORTON GRANULAR DATA SHEET NO. 8

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing 2"	1-1/2"	1/2"	#4	#100	#200	Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
														access road and Vermont Route 114 in Warren Gore. The 40' x 40' pit was 75 feet west of a brook. Test No. 1 was on west face of pit. Material was: 1'-3', pebbly sand; 3'-8', random boulders with sand and pebbly sand. Many plus 12 inch boulders were noted. Material is nearly depleted; the only good material is in scattered thin lenses which would not be economically feasible to work.
9	1	1975	1-8	0-1	No	71	68	64	60	11	6	-----	Gravel (Grading only)	Owner: Vermont Department of Fish and Game; former owner; Brown Co. Area is small low bank on east side of curve 150 feet northeast of the Hurricane Brook culverts, 2.48 miles northwest of the junction of the Hurricane Brook access road and Vermont Route 114 in Warren Gore. Wooded slopes drop off just beyond the face. The face was smooth-over by a Job Corps Training Bulldozer after sample was taken. Test No. 1 was on low face of small bank. Material was: 1'-2.5', cobbly gravel with 3" to 5" stones; 2.5'-4', gap-graded gravel (cobbles and silty sand; 4'-5.5', clean sharp sand; 5.5'-7',

TABLE I

NORTON GRANULAR DATA SHEET NO. 9

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing 2"	1-1/2"	1/2"	#4	#100	#200	Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
														pebbly sand; 7'-8', sand.
10	1	1975	1-7	0-1	Yes	100	100	76	66	22	16	-----	-----	Owner: Vermont Department of Fish and Game; former owner: Brown Co. Area is wooded ridge with two pits, 0.12 mile east of the Hurricane Brook culverts, and 2.6 miles northwest of the junction of the Hurricane Brook access road and Vermont Route 114 in Warren Gore. The trend of the ridge ranges from northwest-southeast to north-northeast-south-southwest. The ridge is 650 feet long, 70 feet wide, and up to 40 feet high. Test No. 1 was on face of low northerly pit. Material was: 1'-3', sand and gravel; 3'-6', gravel; 6'-7', silt and angular rock fragments. The floor of the northern pit is 30 feet higher than that of the southern pit.
	2-A	1975	1-20	0-1	Yes	90	88	76	63	9	6	------	Gran. Borrow (Sand)	Test No. 2-A was on high northwest face of southern pit, 650 feet south of Test No. 1. Material was: 1'-20', interbedded fine gravel and pebbly sand with some cobbles and a few random small boulders.

TABLE I

NORTON GRANULAR DATA SHEET NO. 10

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing						Abrasion AASHTO T-4-35	Passes VHD Spec.	Remarks
						2"	1-1/2"	1/2"	#4	#100	#200			
	2-B	1975	20-34	0-1	Yes	100	91	78	65	7	4	------	Sand	Test No. 2-B was below Test No. 2-A. Material was: 20'-34', pebbly sand and sand layers with some thin layers of pebbly fine gravel; bottoms at 34' (floor) in pebbly sand.

Table I
Supplement

NORTON PROPERTY OWNERS - GRANULAR

	Map Identification No.
Devost, Roland A.	1, 5
Park, Earth People's	2
Roy, Florent	3
Vermont, State of	4,6,7,8,9,10

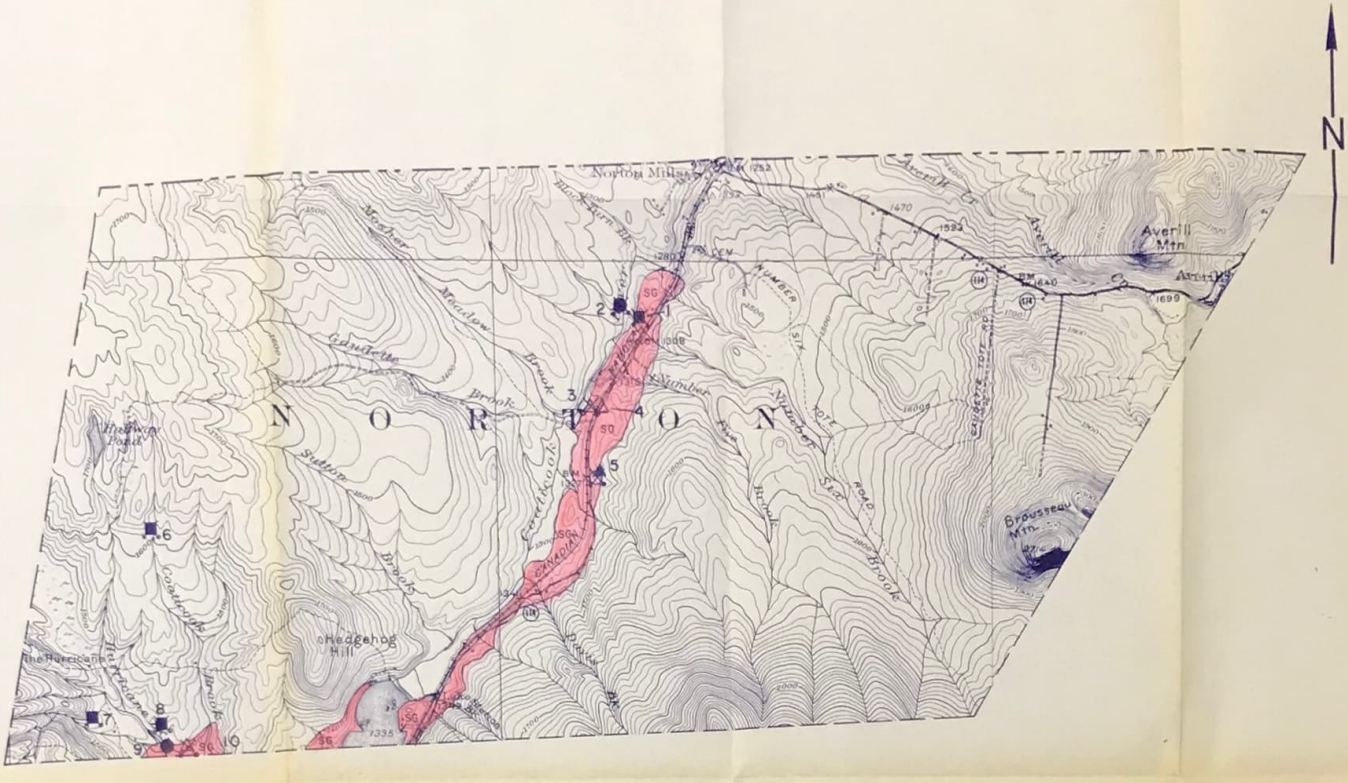
Table II

NORTON ROCK DATA SHEET NO. 1

Map Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHTO T-3	Abrasion AASHTO T-96	Remarks
1	1-A	1975	Granitic	No	Chip	9.4%	74.0%	Owner: State of Vermont. (former owner: Jacques Cattier). Area is near summit of Averill Mountain, 0.7 mile north of, and 540 feet above Vermont Route 114 in the northeast corner of town. A foot-trail leads north from Vermont Route 114, 150 feet west of its junction with Norton State Highway. The trail has a grade of about 770 feet per mile and progresses northwesterly to the summit. The former owner donated Averill Mountain to the State and may have had a "no development" clause inserted in the deed. The rock is a coarse-grained, light gray to light brown granite which weathers to a sugary texture. The rock broke in rather thin and flat (tabular or chip-like) pieces, and seemed quite soft. The mountain side is quite steep and heavily wooded. Test No. 1-A was from 75 feet of random blocks along east end of summit.
	1-B	1975	Granitic	No	Chip	11.8%	73.1%	Test No. 1-B was from 75 feet of random blocks along west end of summit.
2	1-A	1975	Granitic	No	Chip	6.9%	67.0%	Owner: Brown Co. Area is wooded north slope of Brousseau Mountain, with random blocks and low, smooth outcrops. Access follows tree-blazes and signs to "Brousseau Mtn." The area is 0.15 mile south-southeast of the south end of Town Highway No. 7, and is near a logging operation. The greatest relief occurs at the vertical exposure on south edge of the summit, and a steep talus slope lies on the heavily wooded, lower south slopes. Test No. 1-A was from 75 feet of random blocks near trail.
	1-B	1975	Granitic	No	Chip	6.4%	70.0%	Test No. 1-B was from 75 feet of random blocks near trail, just east of test No. 1-A. The best site for a rock quarry would be along the steep south slope of Brousseau Mountain; however, an access would have to be put in around the northwest side of the mountain.

NORTON PROPERTY OWNERS - ROCK

	Map Identification No.
Brown Co.	2
Vermont, State of	1



LEGEND

- ○ GRAVEL, ACCEPTABLE FOR ITEM 704.05 (gravel for sub-base)
- ● GRAVEL, DEPLETED OR NOT ACCEPTABLE FOR ITEM 704.05
- △ SAND, ACCEPTABLE FOR ITEM 703.03 (sand borrow and cushion)
- ▲ SAND, DEPLETED OR NOT ACCEPTABLE FOR ITEM 703.03
- □ GRANULAR BORROW, ITEM 703.05
- ■ MATERIAL NOT ACCEPTABLE FOR ITEM 703.05
- ✕ EXISTING PIT
- SG SAND and GRAVEL DEPOSIT
- S SAND DEPOSIT
- 3 IDENTIFICATION NUMBER (refer to data sheets)

NORTON

SCALE 1:31,250

0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1976

GRANULAR MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

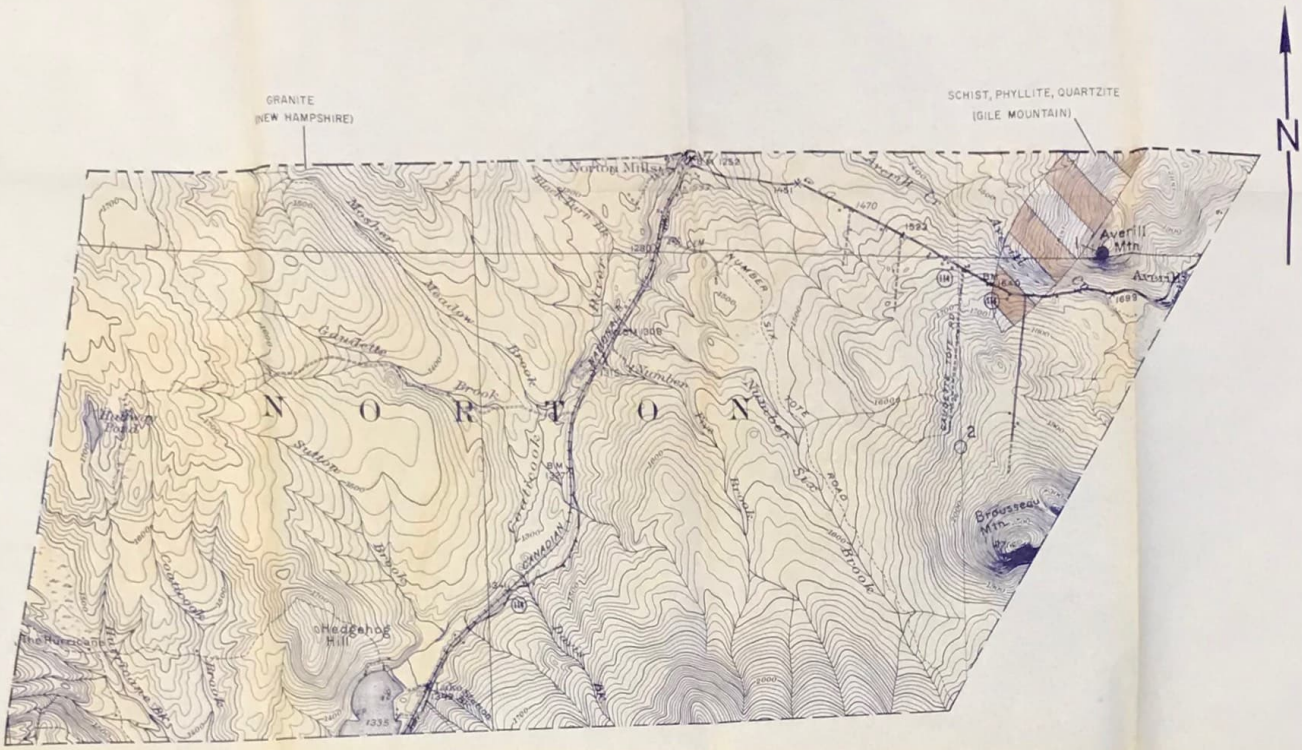
NOTE: BASED ON U.S.G.S. TOPOGRAPHIC MAPS

PLATE 1 GRANULAR

ESSEX COUNTY VT. HWY. DISTRICT NO. 9

REVISIONS

DATE						
BY						



LEGEND

- ROCK, ACCEPTABLE FOR ITEM 704.06 (crushed stone for sub-base)
- ROCK, NOT ACCEPTABLE FOR ITEM 704.06
- EXISTING QUARRY
- GRANITE TO DIORITE (light to intermediate igneous rocks)
- AMPHIBOLITE, GABBRO, DIABASE, METADIABASE, GREENSTONE, TRAP DIKES (basic or dark igneous rocks)
- PERIDOTITE, PYROXENITE, SERPENTINITE (ultra-basic igneous rocks)
- GNEISS
- QUARTZITE
- DOLOMITE
- MARBLE, LIMESTONE
- SCHISTS, SLATES, PHYLLITES, SHALES, CONGLOMERATES
- 3 IDENTIFICATION NUMBER (refer to data sheets)

NORTON

SCALE 1:31,250

0 .5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1976

ROCK MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

NOTE: BASED ON U.S.G.S. TOPOGRAPHIC MAPS

ESSEX COUNTY VT. HWY. DISTRICT NO. 9

REVISIONS

DATE							
BY							

PLATE II

ROCK