SURVEY OF HIGHWAY CONSTRUCTION MATERIALS

IN THE TOWN OF WESTON, WINDSOR COUNTY, VERMONT

prepared by

Engineering Geology Section, Materials Division

Vermont Department of Highways

in cooperation with

United States Department of Transportation
Federal Highway Administration

Montpelier, Vermont

January, 1974

TABLE OF CONTENTS

Acknowledgements

The work of this Project was greatly implemented by 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 and Mapping Division and the Highway Testing Laboratory.

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, Bureau of Public Roads.

History

The Materials Survey Project was formed in 1957 by the Vermont State Department of Highways with the assistance of the United States Bureau of Public Roads. Its prime objective was to compile an inventory of highway construction materials in the State of Vermont. Prior to the efforts of the personnel of the Survey as described in this and other reports, searches for highway construction materials were conducted only as the immediate situation required. Thus only limited areas are surveyed, and no overall picture of material resources was available. Highway contractors or resident engineers are usually required to locate the materials for their respective projects and have samples tested by the Highway Testing Laboratory. The additional cost of exploration for construction materials is passed onto the State in the form of higher construction costs. The Materials Survey Project was established to minimize or elimate this factor by enabling the State and its contractors to proceed with information

on materials sources available beforehand. Prior 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 were designed with their intended use in mind. These maps and data sheets were devised 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 simultaneously.

Inclosures

Included in this folder are two surface-geology maps, one defining the location of tests conducted on bedrock sources, the other defining the location of tests conducted on granular materials. These maps are derived from 15-minute or 7½-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 types of the area. This information was obtained from numerous sources: Vermont Geological Survey Bulletins, Vermont State Geologist Reports, United States Geological Survey Bedrock Maps, and the Centennial Geological Map of Vermont, as well as other references.

The granular materials map depicts 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 had been mapping the glacial features of Vermont during the summer months since 1956. Further

information was obtained from the Soil Survey (Reconnaissance) of Vermont conducted by the Bureau of Chemistry and Soils of the United States Department of Agricultrue, and from Vermont Geological Survey Bulletins, United States Geological Survey Quadrangles, aerial photographs, the Surficial Geologic Map of Vermont, and other sources. On both maps the areas tested are represented by Identification Numbers. Several tests are usually conducted in each area represented by an Identification Number, the number of such tests being more or less arbitrarily determined either by the character of the material or by the topography.

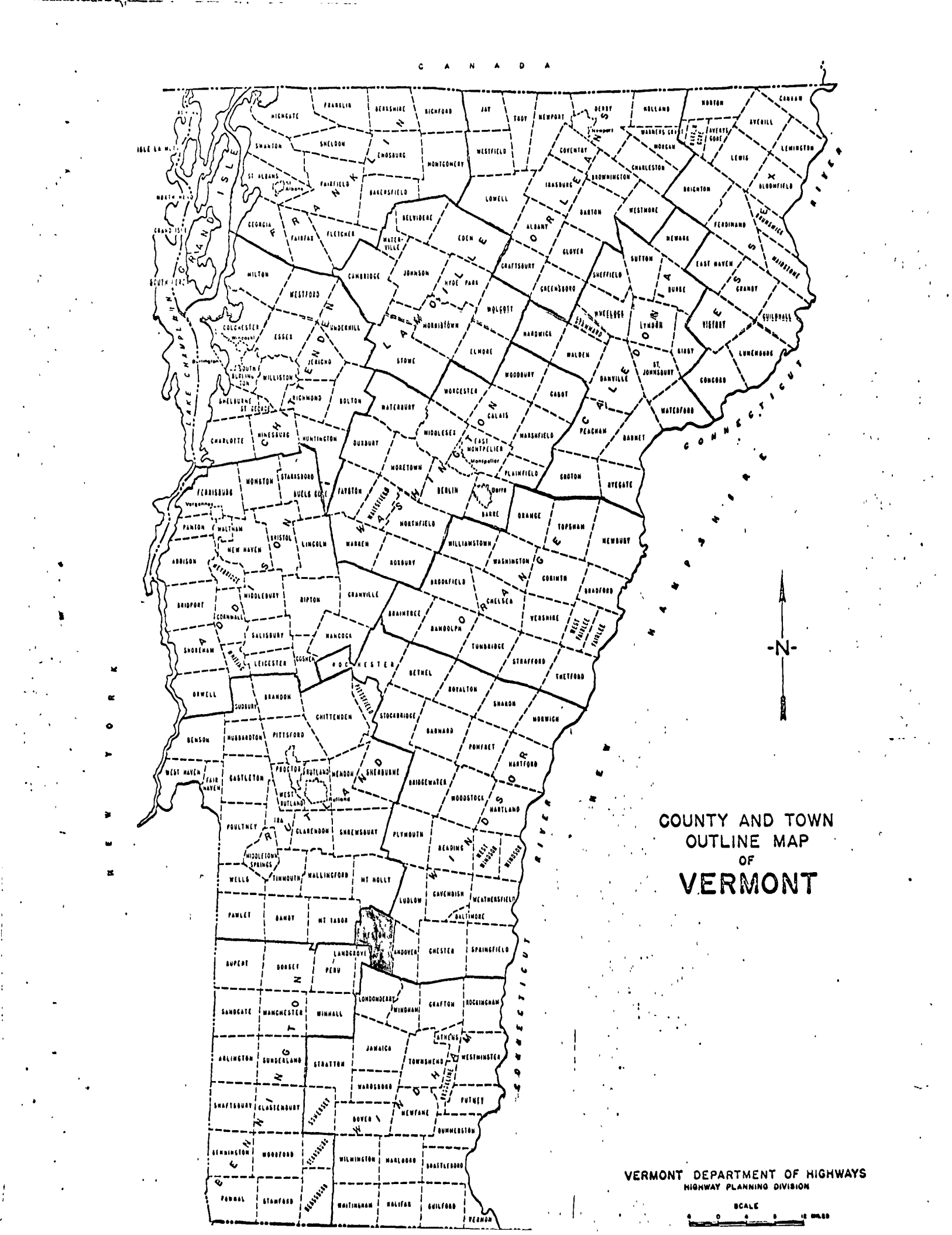
Also included in this folder are data sheets for both the Bedrock and Granular Materials Survey, which contain detailed information for each test conducted by the Project as well as information obtained from other sources, and including an active card file compiled by the Highway Testing Laboratory. The latter information was gathered over a period of years by many persons and consequently lacks the organized approach and detail required for effective use. The information on the cards varied widely in completeness. Transfer of information from the cards to the data sheets was made without elaboration or verification. When possible, the locations of the deposits listed in the card files have also been plotted on the maps; however, some cards in the file were not used because the information on the location of the deposit was incomplete or unidentifiable. Caution should be exercised wherever this information appears incomplete. This Project does not assume responsibility for the information taken from the card files.

Work sheets contain more detailed information on each test and a detailed sketch of each identification Number Area. The work sheets and laboratory reports are on file in the office headquarters of this Project.

The town of Weston is located in the southeast corner of Windsor County in the southern part of the state. It is bounded on the north by the town of Mount Holly, on the northeast by Ludlow, on the east by Andover, on the south by Londonderry, on the southwest by Landgrove and Peru, and on the west by the town of Mount Tabor. (See County and Town Outline Map of Vermont on the following page.)

Weston lies entirely within the Green Mountain physiographic region, and its rugged topography is characterized by steep terrain. Elevations range from 2,804 feet at the summit of Peabody Hill, to less than 1,160 feet at the Londonderry town line where the West River crosses it on the way to Brattleboro and the Connecticut River.

Principal drainage is eastward, via Greendale Brook, Jenny Coolidge Brook and several unnamed streams, into the south-flowing West River. Subsidiary drainage west of Peabody Hill and Holt Mountain is westward via Utley Brook, a tributary of the West Branch of the West River.


CANADA
NEW YORK
LAKE CHAMPLAIN
GRAND ISLE
FRANKLIN
LAMOILLE
ORLEANS
ESSEX
CHITTENDEN
WASHINGTON
ORANGE
CALEDONIA
WINDSOR
RUTLAND
ADDISON
WINDHAM
BENNINGTON
CONNECTICUT RIVER
NEW HAMPSHIRE
N
COUNTY AND TOWN
OUTLINE MAP
OF
VERMONT
VERMONT DEPARTMENT OF HIGHWAYS
HIGHWAY PLANNING DIVISION
SCALE

SURVEY OF ROCK SOURCES

Procedure for Rock Survey

The routine 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 primarilty during the winter months and comprises the mapping and description of rock types as indicated in various reference sources. Many different sources of information are utilized, as indicated in the bibliography. These references differ considerably in dependability due to new developments and studies that have contributed to the obsolescense 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. In other words, as complete a correlation as possible is made of all the information available concerning the geology of the area under consideration.

The field investigation is begun by making a cursory preliminary survey of the entire area. The information obtained in the preliminary survey, together with the information assimilated in the office investigation, is employed to determine the areas where testing and 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. The samples are submitted to the Material Testing Laboratory for abrasion testing both by the Deval Method (AASHO T-3) and the Los Angeles Method (AASHO T-96). It should be kept in mind that the 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 material is uniform and acceptable abrasion tests result from the chip samples, the material source is included in this report as being satisfactory.

Discussion of Rock and Rock Sources

It should be noted that information on the Rock Materials Map is somewhat simplified. (For a more detailed description of the respective rock formations, see the Summary included in this report.) Complex metamorphic rocks comprise most of the lithology within the town of Weston.

Occasionally, rocks belonging to the same formation and exhibiting similar characteristics (i.e., color, texture, etc.) may produce different abrasion test results owing to different physical and chemical properties. Therefore, in no case should satisfactory test results of an area be construed to mean that the same formation, even in the same area, will not later produce unsatisfactory material. This is especially true of metamorphic rocks.

Much of Weston is underlain by the gneiss of the Mount Holly Complex. Due to lack of relief, inaccessibility, or a mask of glacial drift, there were only two rock areas sampled in Weston. Both are in the Mount Holly Gneiss, and yielded material acceptable for Subbase of Dense Graded Crushed Rock, Item 704.06.

The Mount Holly Complex in Weston is represented by three units: the schistose quartzite and the gneiss, both of which were located; and a few small mapped occurrences of Mount Holly marble and dolomite, which were undetected by this survey.

The remainder of the town, a small portion in the west, is underlain by the Readsboro schist member of the Cavendish formation, which was not sampled because it was too thin-bedded; and a small mapped zone of the marble, dolomite and granulite of the Cavendish formation, which was not found by this survey.

In the town of Mount Holly on the east side of Vermont Route 155, just north of the Weston town line, the schistose quartzite of the Mount Holly Complex yielded acceptable material.

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 possible potentially productive areas as indicated from various references. Of these references, the survey of glacial deposits mapped by Professor Stewart proves to be valuable, particularly 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. In addition, the locations of existing pits are mapped when known. The locations in which samples were taken by other individuals are noted and mapped when possible.

The field investigation is begun by making a cursory preliminary survey of the entire town. All pits and other areas which show physiographic features that give evidence of glacial or fluvial deposition are noted. These locations are later investigated by obtaining samples of pit faces and other exposed materials. Test pits, dug with a backhoe to a depth of approximately 11 feet, are also sampled. The samples are submitted to the Materials Testing Laboratory where they are tested for gradation and stone abrasion, the latter by the Deval Method (AASHO T-4), and the Los Angeles Method (AASHO T-96).

Discussion of Sand and Gravel Deposits

According to Stewart and MacClintock, two types of glaciofluvial features are mapped as containing granular materials in Weston. They are: spillway gravels, which occur along stretches of the West River; and kame terraces, which flank the river near The Island, north of the Londonderry town line. A small kame area occurs about half a mile southwest of Zion Chapel. Although these features occur up to 1,500 feet in elevation, no material acceptable for sand or gravel items was found above 1,400 feet.

Acceptable gravel sources are concentrated in the kame terrace at Map Identification Numbers 5, 9, and 12. At least six pits were investigated in its vicinity. This feature seems to have ample material for future projects. Map Identification Number 12 was the only proven source of Sand Borrow and Cushion. An outwash gravel was the source of acceptable material at Map Identification Number 4.

The survey noted that potentially the most likely areas for granular materials in Weston are the lowlands along the West River, south from Zion Chapel to Weston Village. Pits at Map Identification Numbers 6, 7, 8 and 13 had materials acceptable for Granular Borrow. Pits at Map Identification Numbers 1, 3, 10, and 11 appeared to be depleted, and were not sampled.

Possible granular materials may be found on Casper Woodcock's land just southeast of Vermont Route 100, and northeast of the Londonderry town line. This conifer-wooded property was not sampled, but has knob-like features with some granular material exposed on the surface, which the survey believes to be the northeast extension of the Donald Larsen pit (Londonderry Map Identification Number 1).

SUMMARY OF ROCK FORMATIONS IN THE TOWN OF WESTON

Cavendish formation - Buff dolomite; minor white to pink calcite marble; actinolitic and diopsidic marbles and beds of actinolite diopside common in Chester Dome.

Readsboro member of the Cavendish formation - Quartz-muscovite schist containing biotite or chlorite and characterized by conspicuous porphyroblasts of sodic plagioclase; less commonly quartz-muscovite-paragonite schist containing chlorite, garnet, or chloritoid, and locally kyanite (Gassetts schist).

Mount Holly Complex - Mainly fine- to medium-grained biotitic gneiss, locally muscovitic, and in western areas chloritic; massive and granitoid in some localities; fine-grained, or schistose and compositionally layered in others; also abundant amphibolite and hornblende gneiss, and minor beds of mica schist, quartzite, and calc-silicate granulite; includes numerous small bodies of pegmatite and gneissoid granitic rock.

Mount Holly Complex - Quartzite, locally in massive beds as much as 30 feet thick, micaceous quartzite, and quartz-mica schist that commonly contains garnet or pseudomorphs (largely chlorite) after garnet; schists are locally rusty weathered and contain conspicuous flakes of graphite; also includes amphibolite and minor hornblende gneiss, biotite gneiss, and pegmatite.

Mount Holly Complex - Calcite and dolomite marbles, locally coarse grained; commonly contain phlogopite, actinolite, and diopside, and are interbedded with medium- to coarse-grained calc-silicate granulite; includes minor amounts of other types of Precambrian rock.

GLOSSARY OF SELECTED GEOLOGIC TERMS

ACTINOLITE - A variety of amphibole, occurring in greenish bladed crystals or in masses.

AMPHIBOLITE - A metamorphic rock, the distinguishing characters of which are that they consist partly or largely of amphibole (i.e. tremolite, actinolite, hornblende or arfvedsonite), and that they possess a more or less pronounced schistose structure. Color varies from green to black.

BIOTITE - A silicate mineral commonly known as black mica.

CALCITE - A common rock-forming carbonate mineral having the chemical formula $CaCO_3$. Calcite is distinguished by its softness, perfect rhombohedral cleavage, white or pale color, vitreous luster and its ready effervescence in cold dilute hydrochloric acid. The last named property serves to distinguish it from DOLOMITE with which it is ordinarily confused.

CHLORITE - A general designation for a group of hydrous silicates of magnesium and iron, with or without aluminum, so named because of their green color.

CHLORITOID - A brittle member of the mica mineral group.

DIOPSIDE - A mineral of the pyroxene group having the composition $CaMg(SiO_3)_2$. It is especially characterisitic of contact metamorphic zones, and occurs in some gneisses and schists.

DOLOMITE - A rock consisting predominantly of the mineral calcium magnesium carbonate (dolomite), containing carbon dioxide 47.7%, lime 30.4% and magnesia 21.9%.

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

GLACIO-FLUVIAL - A term used to denote formation by or relation to streams within, upon or emerging from glacial ice.

GNEISS - Originally meaning a more or less banded metamorphic rock with the mineral composition of granite. The term now designates a foliated metamorphic rock with no specific composition implied, but having layers that are mineralogically unlike and consisting of particles visible to the eye. Usually gneiss displays an alternation of granular minerals and schistose minerals with the rock tending to split along the schistose bands.

GRANULITE - A quartz feldspar rock, poor or lacking in mica, and characterized structurally by a single regular plane of schistosity easily visible to the eye. The schistosity is determined mainly by parallel orientation of flat lenses of coarse-grained quartz set in a quartzose matrix of smaller equidimensional grains.

HORNBLENDE - A common member of the amphibole group of minerals. The color is usually black, dark-green or brown. The hardness is 5 to 6 and the specific gravity about 3.0. The mineral commonly occurs in prismatic masses and is found in both igneous and metamorphic rocks.

KAME - A conical hill of stratified drift, deposited at a glacial terminus by glacial streams flowing in or on the ice.

KAME TERRACE - An accumulation of stratified drift laid down chiefly by streams between a glacier and an adjacent valley wall.

KYANITE - An aluminum silicate mineral occurring usually in blue, thin-bladed crystals and crystalline aggregates.

METAMORPHIC ROCKS - Rocks that owe their distinctive characteristics to the transformation of pre-existing rocks, either through intense heat or pressure or both.

MUSCOVITE - An important member of the mica group of minerals, known also as white mica, potash mica, or isinglass.

OUTWASH - Stratified sands and gravels that are stream-built beyond the glacier; deposited by meltwater streams issuing from the face of the glacial ice.

PARAGONITE - A mica, similar in appearance and composition to muscovite but containing sodium instead of potassium.

PEGMATITE- A vein-, pipe-, dike-like, or irregular igneous body associated with large intrusives of similar composition. It is characterized by large average grain size, interlocking texture, and unusually great range in grain size.

PHLOGOPITE - A mica, $KMg_3AlSi_3O_{10}(OH)_2$, usually yellowish-brown, but sometimes reddish-brown.

PHYSIOGRAPHIC - Pertaining to the physical divisions of the earth.

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

PSEUDOMORPH - A mineral having the outward form of another species (or of some object, as a shell), such as a piece of quartz having the cubic form of flourspar. Pseudomorphs are formed from the original crystals (whose form alone they retain) by a process of substitution, incrustation, infiltration, or alteration.

SCHIST - A crystalline 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.

SODIC PLAGIOCLASE - A feldspar high in sodium; the mineral albite.

SPILLWAY GRAVEL - Outwash gravel deposited in a valley that acted as a spillway for a melting glacier.

BIBLIOGRAPHY

A survey of the glacial geology of Vermont conducted by D. P. Stewart, the partial results of which were published in Vermont Geological Survey Bulletin No. 19; 1961.

The Surficial geology and Pleistocene history of Vermont, David P. Stewart and Paul MacClintock; 1969; Vermont Geological Survey Bulletin No. 31.

Soil Survey (Reconnaissance) of Vermont, W. J. Latimer; 1930; Bureau of Chemistry and Soils, United States Department of Agriculture.

Soil Exploration and Mapping; 1950; Highway Research Board, Bulletin 28.

Survey of Highway Aggregate Materials in West Virginia; December, 1959; Engineering Station, West Virginia University, Morgantown, West Virginia.

Materials Inventory Bangor Quadrangle, South Half; September, 1959; University of Maine.

Glacial Geology and the Pleistocene Epoch, R. F. Flint; 1947; John Wiley and Sons, Inc.

A Handbook of Rocks, J. F. Kemp; June, 1946; D. Van Nostrand Company, Inc.

Rock and Rock Minerals, L. V. Pirsson; June, 1949; John Wiley and Sons, Inc.

Glossary of Selected Geologic Terms; J. L. Stokes and D. J. Varnes; 1955; Colorado Scientific Proceedings, Vol. 16.

Centennial Geologic Map of Vermont, C. G. Doll; 1961.

Londonderry Quadrangle: Geological Survey, United States Department of the Interior, 1932.

Wallingford Quadrangle: Geological Survey, United States Department of the Interior, 1955.

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 in July, 1971.

DIVISION 700 - MATERIALS

Section 703, Soils and Borrow 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 - Gradation Requirements

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, and organic material.

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

Table 703.05A - Gradation Requirements

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.

Section 704, Aggregate

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 - Gradation Requirements

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves	
	Total Sample	Sand Portion
No. 4	(20-60)	100
No. 100		0-10
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 AASHO T 4, or more than 40 when tested in accordance with AASHO 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 - Gradation Requirements

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 AASHO T 3, or the crushed stone a percent of wear of not more than 40 when tested in accordance with AASHO T 96.

(d) Thin and Elongated Pieces
Not more than 30 percent, by weight, of thin and elongated peices 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 - Gradation Requirements

Sieve Designation	Percentage by Weight Passing Square Mesh Sieves Total Sample
1"	100
3/4"	90-100
1/2"	50- 90
No. 4	30- 70
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 - Gradation Requirements

Grading	Sieve Designation	Percentage by Weight Passing Square Mesh Sieves Total Sample	Sand Portion
	4"	100	
Coarse	No. 4	25- 50	100
	No. 100		0- 20
	No. 200		0- 12
	2"	100	
	1½"	90-100	
Fine	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 AASHO T 4, or the crushed gravel a percent of wear of not more than 35 when tested in accordance with AASHO 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 - Gradation Requirements

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 AASHO T 3, or the crushed stone a percent of wear of not more than 40 when tested in accordance with AASHO 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 - Gradation Requirements

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 - Gradation Requirements

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

WESTON GRANULAR DATA SHEET NO 1

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
1	--	1973	---	---	Yes	----------		NOT		SAMPLED				Owner - Green Mountain National Forest Area is a pit in the woods west of Vermont Route 155. The 20-foot long access road joins the highway about 1.77 miles north of junction of Vermont Route 155 with Vermont Route 100. The 425' x 50' pit appeared to be depleted. In spite of being smoothed-over, boulders and stripping piles remain on the floor.
2	1	1973	1-9	0-1	Yes	100	81	67	56	35	19	----	-----	Owner - Weston Priory Area is a pit in the woods east of Vermont Route 155. The 400-foot long access road joins the highway about 1.23 miles north of junction of Vermont Route 155 with Vermont Route 100. The 110'x60' pit appeared to be depleted. Small trees are growing in the poorly stripped, boulder-strewn floor. Test No. 1 was in the north face of the pit. Material is: 1'-9', sand and pebbly sand; bottom, silt.

WESTON 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						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
3	---	1973	----	----	Yes	-----	--NOT		SAMPLED	----	----	----------	-----	Owner - Weston Priory Area is a pit in the woods west of Vermont Route 155. The 300-foot long access road joins highway about 1.23 miles north of junction of Vermont Route 155 with Vermont Route 100. The 80'x20' pit floor was fronted by a smoothed-over south face, which truncates a 200 foot-long wooded ridge
4	1	1973	1-13	0-1	Yes	100	77	71	56	11	6	17.5%	Gravel	Owner - F. W. Newbury Area is a large, rambling active pit in the woods west of Vermont Route 100. The 0.2-mile long access road joins Vermont Route 100 about 0.55 mile south of its junction with Town Highway No. 7. Trees, boulders and stripping piles clutter the floor. Test No. 1 was in the 18' high east face. Material is: 1'-13', sandy fine gravel; bottom, fine gravel
	2	1973	0-10	---	Yes	81	64	60	50	7	4	19.2%	Gravel	Test No. 2 was in face, about 200' west of Test No. 1. Material is: 0-10', sandy fine gravel; bottom, same.

WESTON 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						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
	3	1973	0-7	-----	Yes	56	54	45	35	26	14	19.0%	Gran. Borrow (Gravel)	Test No. 3 was in north face, about 135' north of Test No. 2. Material is 0-7', fine gravelly sand with 10% estimated to be coarser than 6"; bottom, same.
	4	1973	1-8	0-1	Yes	76	69	54	40	14	7	22.1%	Gran. Borrow (Gravel)	Test No. 4 was in far northwest face. Material is: 1'-8', fine sandy gravel; bottom, silty gravel.
	5	1973	0.5-9	0-0.5	Yes	81	63	58	46	24	15	13.6%	Gran. Borrow (Gravel)	Test No. 5 was in lower east face near far northeast corner of pit. Material is: 0.5'-9', fine sandy gravel; bottom, silty gravel.
5	1	1973	1.5-6	0-1.5	Yes	57	53	41	31	31	24	19.4%	----	Owner - Ralph Johnson (formerly: Rollin Johnson) Area is an active pit in meadow near the West River. The 0.41-mile long access road joins north side of Town Highway No. 34 about 0.15 mile west of its junction with Vermont Route 100. Pit was about 825' long and 190' wide near the south end. Test No. 1 was in north face. Material is: 1.5'-6', fine gravel; bottom, silty gravel.

WESTON 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 AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
	2	1973	1-13	0-1	Yes	73	71	59	50	31	18	19.6%	---	Test No. 2 was in northwest face of pit. Material is: 1'-13', fine sandy gravel; bottom, silty gravel.
	3	1973	1-7	0-1	Yes	100	73	72	71	65	46	----	----	Test No. 3 was in northwest face of pit, 300' south of Test No. 2. Material is: 1'-7', silt and fine sand; bottom, silt.
	4	1973	1-5	0-1	Yes	77	75	61	46	14	9	19.6%	Gran. Borrow (Gravel)	Test No. 4 was in southwest face of pit. Material is: 1'-5', sandy grave bottom, fine gravel.
	5	1973	1.5-11	0-1.5	No	84	73	47	32	11	7	17.0%	Gravel	Test No. 5 was in extension, about 270' north of Test No. 1. Material is: 1.5'-11', sandy coarse gravel; bottom, same.
6	1	1973	1-8	0-1	Yes	95	79	71	50	20	10	23.2%	Gran. Borrow (Gravel)	Owner - Ralph Johnson (formerly: Rollin Johnson) Area is an active pit in woods west of West River. The 0.51-mile long access road joins north side of Town Highway No. 34 about 0.15 mile west of its junction with Vermont Route 100. The pit was 330' long and 135' wide at south end. Test No. 1 was in south face. Material is: 1'-7', gravel; 7'-8', sand; bottom, sand.

WESTON GRANULAR DATA SHEET NO. 5

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
	2	1973	0-1	1-12	Yes	69	60	45	32	19	12	14.1%	Gran. Borrow (Gravel)	Test No. 2 was in southwest face. Material is: 1'-12', gravel; bottom, fine gravel.
7	1	1973	1-10	0-1	No	88	80	58	47	27	14	21.8%	Gran. Borrow (Gravel)	Owner - Percy Foster Area is a multi-lobed pit in field east of West River. Access road is west of Vermont Route 100, about 0.24 mile north of its junction with Town Highway No. 46. Test No. 1 was near access road about 0.07 mile from the state highway. Material is: 1'-10', sandy, bouldery gravel; bottom, same.
	2A	1973	1.5-4	0-1.5	Yes	59	52	37	29	25	16	22.7%	----	Test No.2A was on small ridge in field about 0.13 mile southwest of Test No. 1. Material is: 1.5'-4', coarse bouldery gravel; bottom, silty sand.
	2B	1973	4-9	0-1.5	Yes	---	100	90	82	63	41	----	----	Test No. 2B was below Test No. 2A. Material is: 4'-9', silty sand; bottom, same.
	3	1973	6-8	0-6	No	81	67	48	38	23	14	17.2%	Gran. Borrow (Gravel)	Test No. 3 was in field about 0.09 mile south of Tests No. 2A & 2B. Material is: 6'-8', river gravel; bottom, same and water table.

WESTON GRANULAR DATA SHEET NO. 6

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Exist-ing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
8	1	1973	2-15	0-2	Yes	71	65	54	44	18	14	19.5%	Gran. Borrow (Gravel)	Owner - Ralph Johnson (formerly: Rollin Johnson) Area is a pit 240' north of Town Highway No. 34, about 0.15 mile west of its junction with Vermont Route 100. The 710'x150' pit was bounded on the east by woods and on the west by pasture. Test No. 1 was in east face. Material is: 2'-15', fine gravel; bottom, same.
9	1	1973	1.5-11	0-1.5	No	80	79	63	48	20	14	20.7%	Gran. Borrow (Gravel)	Owner - Casper Woodcock Area is a field with small, inactive pit near middle of its east side, north of Vermont Route 100. Field is about 1400' long with a maximum width of 240'. A north-south stone wall divides field. Test No. 1 was near southwest corn of field about 0.12 mile north of the junction of Town Highway No. 34 with Vermont Route 100. Material is: 1.5'-11', silty gravel with 10"-25" boulders; bottom, same.

WESTON 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						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
	2	1973	1.5-11	0-1.5	No	83	80	62	51	12	8	20.5%	Gravel	Test No. 2 was near edge of field, 360' east of Test No. 1, and 65' west of stone wall. Material is: 1.5'-6', silty gravel; 6'-11', sandy, coarse gravel; bottom, sandy gravel.
	3	1973	0.5-11	0-0.5	Yes	59	53	37	27	11	7	16.5%	Gravel	Test No. 3 was just east of pit, and about 250' southeast of Test No. 2. Material is: 0.5'-11', sandy gravel; bottom, same.
	4	1973	0.5-11	0-0.5	No	72	64	50	38	11	6	15.2%	Gravel	Test No. 4 was about 460' north of Test No. 3, and 300' east of stone wall. Material is: 0.5'-8', sandy, coarse gravel; 8'-11', sand; bottom, sand.
	5	1973	2-11	0-2	No	66	63	48	38	12	8	18.8%	Gravel	Test No. 5 was atop a small ridge, about 575' east of Test No. 4. Material is: 2'-10', sandy, coarse gravel; 10'-11', fine sand; bottom, fine sand.
	6	1973	1.5-11	0-1.5	No	77	72	49	39	11	6	17.7%	Gravel	Test No. 6 was about 735' southeast of Test No. 4. Material is: 1.5'-2.5', gravel; 2.5'-3.5', sand; 3.5'-11', sandy coarse gravel with sand layers; bottom, same.

WESTON GRANULAR DATA SHEET NO. 8

Map Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft)	Over-burden (Ft)	Existing Pit	Sieve Analysis % Passing						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
10	--	1973	----	----	Yes	---------NOT			SAMPLED----------					Owner - Town of Weston Area is a small,depleted pit used as a repository for junk west of Town Highway No. 34. Access is 0.03 mile from Vermont Route 100.
11	--	1973	----	----	Yes	----------NOT				SAMPLED----------				Owner - Casper Woodcock Area is a small depleted pit, 270' southeast of Town Highway No. 46. Access is about 0.05 mile east of Vermont Route 100. Utility line poles in possible extension would preclude further development.
12	1	1973	1-11	0-1	Yes	---	--	--	100	2	1	----	Sand	Owner - Casper Woodcock Area is a pit in pasture east of Vermont Route 100, just north of the Londonderry town line. The 450'-long access road is 0.20 mile south of the junction of Town Highway No. 34 with Vermont Route 100. Pit was 190'x 235'. Test No. 1 was in northeast face of pit. Material is: 1'-11', fine sand; bottom, same.

WESTON 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						Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						2"	1½"	½"	#4	#100	#200			
	2A	1973	0.5-5	0-0.5	Yes	89	82	72	43	9	6	13.5%	Gravel	Test No. 2A was in upper southwest face of pit. Material is: 0.5-5', gravel; bottom, sand.
	2B	1973	5-7	0-0.5	Yes	---	100	98	91	2	1	----	Sand	Test No.2B was below Test No. 2A. Material is: 5'-7', sand; bottom, same.
	3	1973	1-10	0-1	Yes	---	100	98	97	8	2	----	Sand	Test No. 3 was in west face of pit. Material is: 1'-10', sand and fine sand; bottom, sand.
	4	1973	1.5-11	0-1.5	No	100	92	75	60	38	28	----	----	Test No. 4 was in field, about 100' west of pit. Material is: 1.5'-9', silt, sand, gravel; 9'-11', silt.
13	1	1973	1-8	0-1	Yes	91	75	52	36	24	15	22.5%	Gran. Borrow (Gravel)	Owner - Casper Woodcock Area is a meadow east of Town Highway No. 36, about 0.22 mile south of Vermont Route 100. There was an inactive, 450 foot-long pit on west side of area. Test No. 1 was in possible extension 30' from face. Material is: 1'-8', sandy gravel; bottom, bedrock or boulder. A test hole, 150' east of Test No. 1, encountered boulders at 2.5'.

TABLE I
SUPPLEMENT

WESTON PROPERTY OWNERS - GRANULAR	MAP IDENTIFICATION NUMBER
Foster, Percy	7
Johnson, Ralph	5, 6, 8
Newbury, F, W.	4
Priory, Weston	2, 3
U.S. Forest Service	1
Weston, Town of	10
Woodcock, Caspor	9, 11, 12, 13

WESTON ROCK DATA SHEET NO. 1

Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T-3	Abrasion AASHO T-96	Remarks
1	1A	1973	Gneiss	No	Chip	1.9%	24.0%	Owner - State of Vermont (R.O.W.) Area is a rockcut on the east side of Vermont Route 100 about 0.18 mile south of its junction with Town Highway No. 15 The land to the east of the R.O.W. is densely wooded and slope up to the east to land owned by David Ward. The northern half of the roadcut is about 15' to 20' high (Test #1A); the southern portion is about 5' high (Test #1B). The rock is mapped as being the schistose quartzite of the Mt. Holly complex, but it is a gneiss which varies from nearly granitic, to a quartz-veined, greenstone-banded gneiss which is heavily weathered. If this area is unsatisfactory for developing, the samples from it are from the same rock formation that forms a large unnamed wooded hill about one-half mile up slope to the southeast. Test No. 1A was the northern 100 feet of outcrop.
	1B	1973	Gneiss	No	Chip	6.3%	37.8%	Test #1B was southern 100 feet of outcrop.
2	1A	1973	Gneiss	No	Chip	8.8%	31.3%	Owner - Weston Priory Area is a low outcrop which is on the west side of Vermont Route 155 and extends westward into a low wooded area with a few scattered outcrops. The area would not yield enough material to make it a worthwhile source, and the low relief would require development down from the surface. Another detrimental factor is that the outcrop is adjacent to the road, and initially, operations would interfere with traffic.

WESTON ROCK DATA SHEET NO. 2

Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T-3	Abrasion AASHO T-96	Remarks
								Rock varies quite a bit, in composition and texture, over a small area; this would adversely affect the quality of material. The rock is a gray and white, streaked and layered gneiss, which is in four inch- to one foot-thick rhomboidal slabs resulting from jointing. The rock surface parallels the foliation and slopes east down to the road. The maximum height of the exposure is 15 feet. Test #1A was on the northern half of the outcrop, (0'-75').
	1B	1973	Gneiss	No	Chip	8.7%	34.8%	Test #1B was south of Test #1A.
Mt. Holly #1	1A	1973	Schistose Quartzite	No	Chip	5.0%	39.4%	Owner - James Kinsey Area is outcrop in the town of Mt. Holly, on east side of Vermont Route 155 approximately 0.13 mile north of the Weston town line. This source is listed only because of the shortage of construction material in Weston. The outcrop rises east, from the road, to a high, wooded bedrock-controlled hillside. The owner has smaller exposures of rock 0.1 mile south, but they were not sampled because any quarry operation would have to be started elsewhere due to the dangerous, hilly curves on the nearby road. There was speculation, in late 1973, that the owner was planning an animal farm tourist attraction nearby so this may preclude developing the rock source.

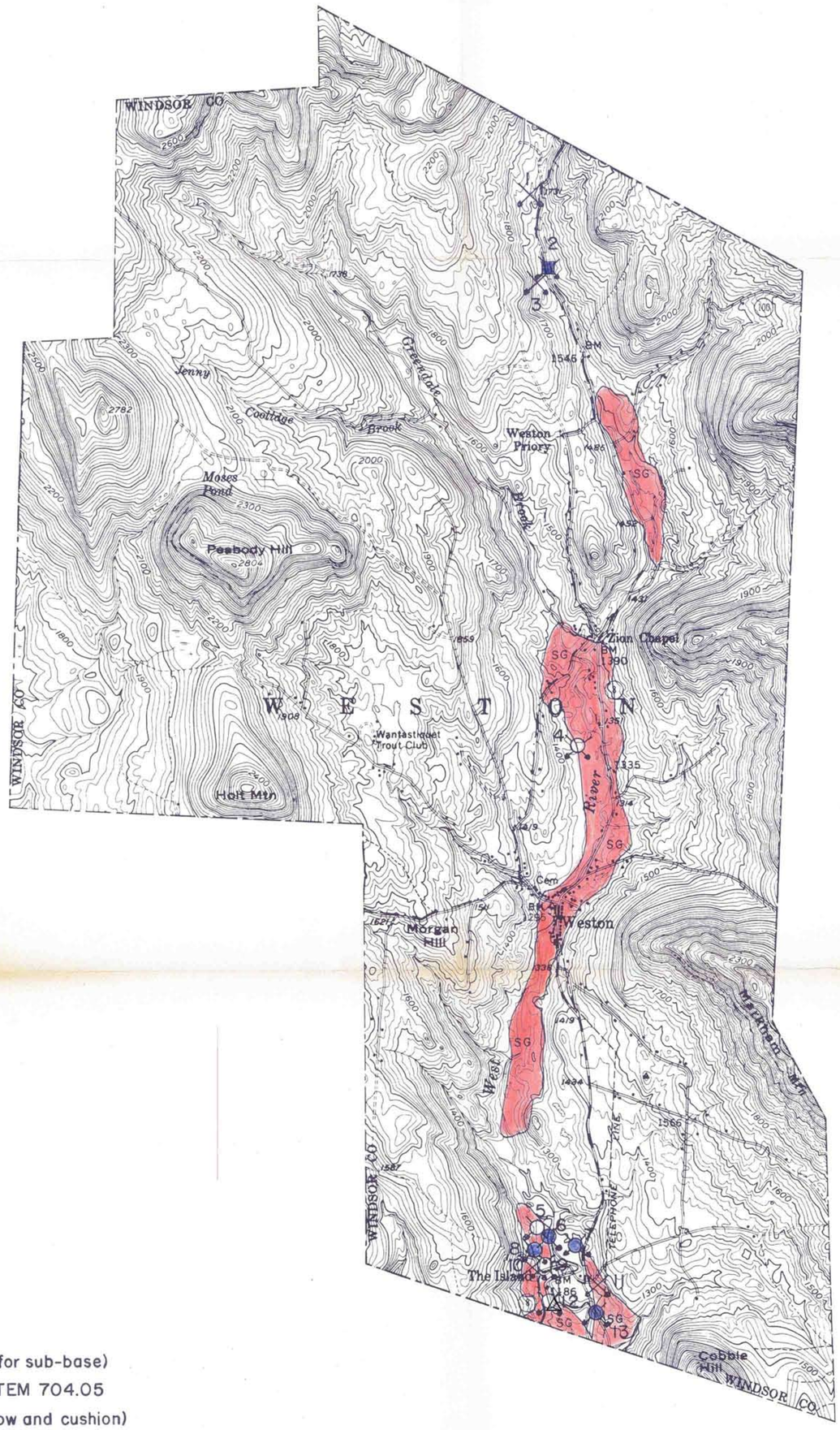
WESTON ROCK DATA SHEET NO 3

Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T-3	Abrasion AASHO T-96	Remarks
	1B	1973	Schistose Quartzite	No	Chip	1.7%	38.6%	This location has several favorable features: Empty trucks would travel uphill, then turn around on pull-off space on west side of Vermont Route 155; full trucks would only have to go downhill; and traffic is not of sufficient volume to bother a crushing operation. Test #1A was on the northern half of the roadside outcrop (0'-125') Test #1B was south of Test #1A (125'-250') The rock was mapped as the schist and quartzite of the Mt. Holly Complex, but there was some amphibolite and greenstone in this area.

TABLE II
SUPPLEMENT

WESTON PROPERTY OWNERS - ROCK	MAP IDENTIFICATION NUMBER
Priory, Weston	2
Ward, David	1

Kinsey, James	Mt. Holly #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 & GRAVEL DEPOSIT
- S SAND DEPOSIT
- 3 IDENTIFICATION NUMBER (refer to data sheets)

WESTON

SCALE 1:31,250

0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1973

GRANULAR MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

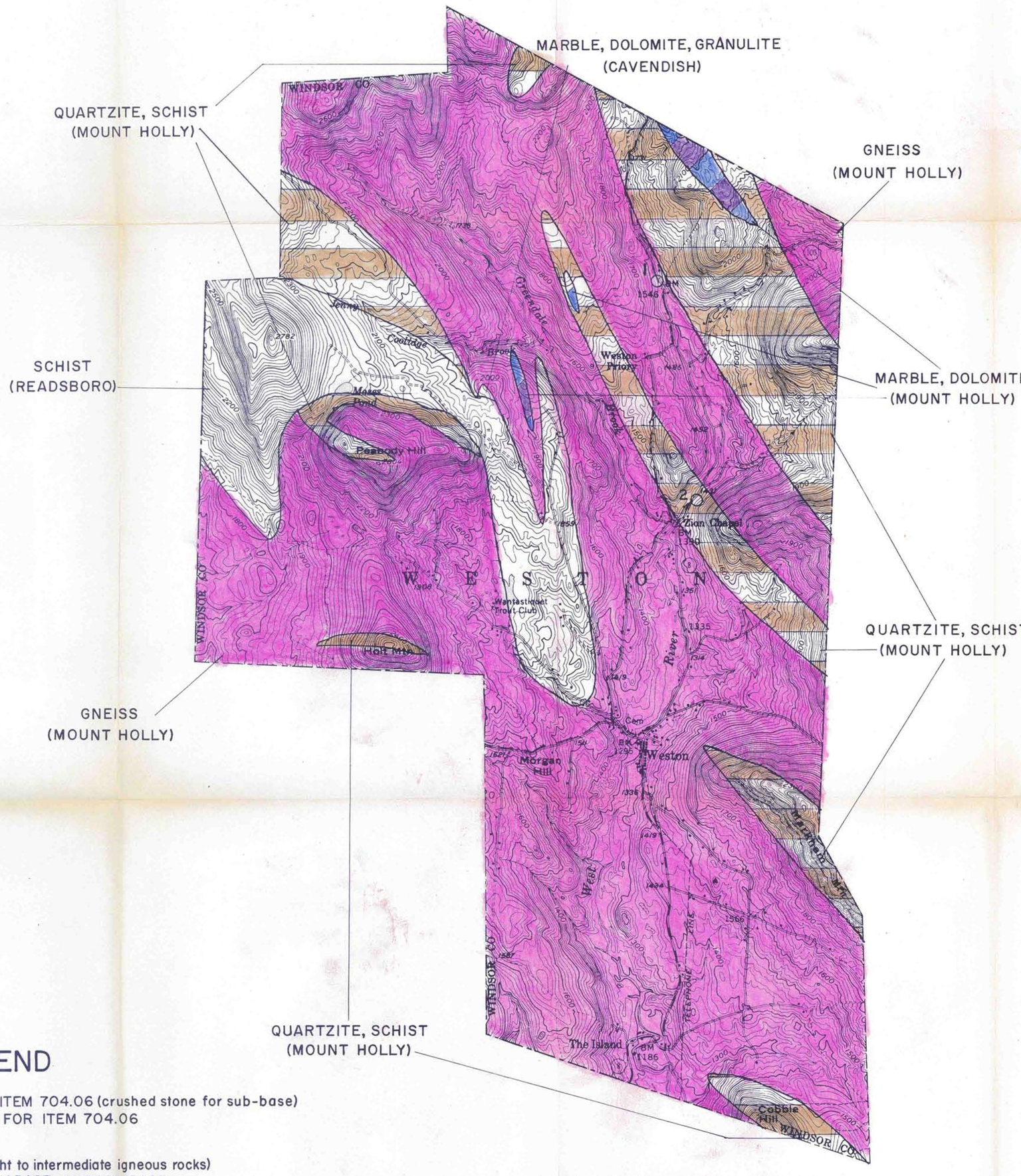
NOTE: BASED ON U.S.G.S. TOPOGRAPHIC MAPS

PLATE I GRANULAR

WINDSOR COUNTY VT. HWY. DISTRICT NO. 2

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)

WESTON

SCALE 1:31,250

0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1973

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

PLATE II

ROCK

WINDSOR COUNTY VT. HWY. DISTRICT NO. 2

REVISIONS

DATE						
BY						