SURVEY OF HIGHWAY CONSTRUCTION MATERIALS

IN THE TOWN OF WESTMINSTER, WINDHAM COUNTY, VERMONT

prepared by

Geologic Survey Section, Construction Division

Vermont Department of Highways

in cooperation with

United States Department of Commerce

Bureau of Public Roads

Montpelier, Vermont

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REPORT OF MATERIALS SURVEY IN THE TOWN OF WESTMINSTER - WINDHAM COUNTY - VERMONT

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. Prof. D. P. Stewart of Miami University, Oxford, Ohio.

3. Prof. Charles G. Doll, Vermont State Geologist, University of Vermont, Burlington, Vermont.

4. The 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 object is to compile an inventory of highway construction materials in the State of Vermont.

Prior to the efforts of the personnel of this Survey as described in this and other reports, searches for highway construction materials were conducted only as immediate situations required. Thus, only limited areas were surveyed and no over-all picture of material resources were 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 on to the State in the form of higher construction costs. The Materials Survey Project was established to minimize or eliminate this factor by enabling the State and its contractors to proceed with information on material 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 reconnaisance, 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, keeping in mind their intended use. The 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 bed-rock sources, the other defining the location of tests conducted on granular materials. These maps are derived from 15 minute quadrangles of the United States Geologic Survey enlarged 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; i.e. Vermont Geological Society Bulletins, Vermont State Geologist Reports, United States Geological Survey Bedrock Maps, as well as other references. The Surficial Map depicts areas covered by types of glacial deposits (outwash, moraines, kames, kame terraces, etc.) by which potential sources of gravel and sand may be recognized. This information was obtained primarily from a survey being conducted by Prof. D. P. Stewart of Miami University, Oxford, Ohio who, since 1956, has been mapping the glacial features of the State of Vermont during the summer months. Further information was obtained from the Soil Survey (Reconnaisance) of Vermont, conducted by the Bureau

of Chemistry and Soils of the Department of Agriculture; and from Vermont Geological Society Bulletins, United States Geological Survey Quadrangles, aerial photos, and other sources.

On both maps the areas tested are represented by Identification Numbers. Several tests were 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 tested or by topography.

Also included in this folder are Data Sheets for both the rock and surficial survey which contain detailed information for each test conducted by the Project as well as information obtained from other sources, including an active card file compiled by the Highway Testing Laboratory. It was readily apparent that the latter information was gathered over a period of years by many persons and consequently lacks the organized approach and details 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. The locations of the deposits listed in the card files have also been plotted on the maps. However, caution should be exercised wherever the information appears incomplete. Some cards in the file were not used because the information on the location of the deposit was incomplete or unidentifiable. This project does not assume responsibility for the information taken from the card files.

Work Sheets containing more detailed information of each test including a detailed sketch of each Identification Number area are on file in the office headquarters of this Project, together with the respective Laboratory Reports.

Location:

The town of Westminster is located in Windham County in the southeastern section of the state on the Connecticut River approximately 25 miles north of the southern boundary. According to the "Soil Survey of Vermont" of the Bureau

of Chemistry and Soils, the town is in the "Eastern Hill Region", a relatively low plateau in an advanced stage of erosion with fairly smooth hills and generally unprecipitous valley walls. The stream valleys are fairly wide with large flood plains principally in the Connecticut River Valley. Drainage is generally easterly into the Connecticut River.

Procedure for Rock Survey:

The routine employed by the project in the survey of possible sources of rock for Highway Construction is divided into two main stages; the office investigation and field investigation. The first is conducted primarily during the winter months and comprises the mapping of rock types as indicated in various reference sources. Since, at present, the mapping of the bedrock geology in the State of Vermont is incomplete, many different sources of information were utilized, as indicated in the Bibliography. These references differ considerably in dependability due to new developments and studies contributing to the obsolescence of a number of reports. In addition, the results of samples taken by other individuals are analyzed and the location in 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 second stage of the investigation is begun in the field by making a cursory preliminary survey over the entire area. The information obtained in this survey, together with the information assimilated in the first stage of the investigation is employed to determine the areas in which the testing and sampling will be concentrated. When a promising source is encountered as determined not only by rock type but also by volume and the existence of a good working face, chip samples are taken with a hammer and submitted to the Highway Testing Laboratory for testing by the Deval Method (AASHO, T-3). It is kept in mind

that samples taken by the chip method are often in the weathered zone of the outcrop and consequently may show a less satisfactory test result than the fresh material deeper in the body of the rock structure. Should the results of this test prove satisfactory, further samples are taken by drilling and blasting at intervals across the strike or trend of the outcrop. Occasionally, because of the uniformity of the material and a satisfactory test result from the chip sample, no further drilling, blasting or sampling is done and the material source is included as being satisfactory.

Discussion of Rock and Rock Sources:

In general the area included in this report is comprised chiefly of mica schist and quartz mica schist interbedded with quartzite and quartzite conglomerate. A large U-shaped granitic intrusion is found in the east-central section of the town near the eastern edge of the plateau overlooking the Connecticut River Valley. The granite is generally medium-grained, of a light gray color. The southwest corner of a large body of gneiss (Bethlehem Formation) extends into the northeast edge of the area surveyed just south of the village of Bellows Falls. It consists of a medium to coarse-grained gray granite to granodiorite gneiss. A small granite body was mapped by F. C. Kruger in a survey in 1937-40 just south of the larger granitic intrusion as shown on a Geologic Map of the Bellows Falls Quadrangle published in 1945. However, after some investigation, this small body was not verified in the field by the Materials Survey Project. Tests performed on scattered samples, taken in the schist area by other projects, indicated that the schist was not a desirable type of material for highway construction purposes.

The U-shaped granitic intrusion is approximately 2.65 miles long and 1.0 mile wide with its long axis in a north-south direction. The east limb of this formation is clearly delineated physiographically by a ridge with a steep exposed

face on the east edge having an average height of approximately 40 feet above the valley floor. The sampling of this formation is represented on the map by Identification Numbers 4, 5, 6, and 7. The wear of this material as indicated by the samples taken in the four locations ranged from 3.7% to 7.6% representing a material suitable for Item 204 (sub-base of crushed rock) as denoted in the Vermont Department of Highways specifications. The samples in each of the Identification Numbers were taken by drilling to a depth of about three feet and blasting at intervals of approximately 25 feet across the trend or long axis of the formation. The material in Identification Number 4, the northernmost of the four areas, was apparently more gneissic in character and represented a smaller volume due to a lower relief and apparent narrowing of the structure. Identification Number 4 was sampled for a distance of 119 feet across the trend of the formation, while Identification Numbers 5, 6, and 7 were sampled for 253 feet, 185 feet, and 210 feet respectively. The west limb of the U-shaped body was not investigated or sampled due to the large and sufficient quantity of satisfactory material represented in the east limb and to the more advantageous location of the latter for most future highway construction.

A small exposure of gneiss in the northeast corner of the town as represented by Identification Number 1 was sampled. The strike of schistosity of this material was in a general north-south direction. A steep exposure approximately 60 feet high faces northwest towards the Saxtons River Valley. Six blast samples at a depth of about 3 feet were taken at average intervals of 25 feet for a total distance of 155 feet across the strike. The wear of the samples ranged from 7.2% to 13.4% with only two samples indicating satisfactory material. The predominance of samples failing to meet the maximum percent wear allowed by the specifications for Item 204 ruled out the gneiss exposure as a suitable source for this item.

Procedure for Sand and Gravel Survey:

The method employed by the project in the survey of possible sources of sand and gravel for highway construction is divided into two main stages; office investigation and field investigation. 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 proved to be valuable, particularly when used in conjunction with other references such as soil type maps, aerial photos and United States Geological Survey quadrangles. The last two are used in recognizing and locating physiographic features indicating glacial deposits and in studying drainage patterns. In addition, the locations of existing pits, when known, are mapped. The locations in which samples were taken by other individuals are noted and mapped, when possible.

The second stage of the investigation is begun in the field by making a cursory preliminary survey over the entire area noting areas which show physiographic features giving evidence of glacial or fluvial deposits. At this time preliminary sampling is made with the aid of a hand shovel. The samples which indicate satisfactory material when examined megascopically are submitted to the Highway Testing Laboratory where they are tested for gradation and stone wear, the latter by the Deval Method (AASHO, T-4-35). Since the laboratory is somewhat limited in the number of samples which can be processed during the construction season, only samples which are apparently satisfactory are submitted. Should the results of these tests prove satisfactory, the locations from which these samples were taken are further examined by digging test pits with a backhoe to a depth of approximately 12 feet and again sampling the material. An attempt was made to use the resistivity method as an aid in estimating quantity by first obtaining a correlation reading for the satisfactory material and then investigating

its extent. However, since this method only proved 50% successful it was not deemed practical.

Discussion of Gravel and Sand Deposits:

The surficial materials of this area are found primarily in glacial and fluvial deposits. The glacial deposits are restricted almost entirely to kame terraces, which are fairly well stratified deposits of gravel, sand, clay, and silt. The majority of the kame terraces are located in the eastern section of the town as are those which contain the more satisfactory materials. The four small terrace areas to the west as indicated by Identification Numbers 1, 16, 17, and 14-15 generally contain excessive fines although Identification Number 14 would probably prove satisfactory if the pit were properly stripped. The area in the center of the town containing Identification Numbers 2-13 is fairly large but contains only three sources of satisfactory material - two sand deposits and one gravel. The large terrace area (Identification Numbers 29-36) in the northeast corner contains much gravel of good quality, particularly in the western half. The area including Identification Numbers 22-27 contains two good gravel sources in the northern edge. A small deposit of good stream gravel is found in the lower reaches of Morse Brook (Identification Number 28). The long narrow terrace area containing Identification Numbers 18-21 is quite sandy in the northern section and east of U.S. 5. However, only one test was made here as the major portion of the section is occupied by the village of Westminster. The material is too fine to warrant further examination. The section of this area west of U.S. 5 is mainly fine silty sand and clay with the possible exception of the meadow under cultivation by the Kurn Hattin School.

Glossary of Selected Geologic Terms

Drift--Rock material of any sort deposited in one place after having been moved from another; as river drift. Specif., a deposit of earth, sand, gravel, and boulders, transported by glaciers (glacial drift) or by running water emanating from glaciers (fluvio-glacial drift) and distributed chiefly over large portions of North America and Europe, esp. in the higher latitudes.

Fluvial--Pertaining to streams.

Gneiss--A term originally applied to a more or less banded metamorphic rock with the mineral composition of granite. As now employed it designates a foliated metamorphic rock with no specific composition implied, but having layers that are mineralogically unlike and consisting of interlocking mineral particles that are mostly large enough to be visible to the eye. Usually gneiss displays an alteration of granular minerals and tabular or schistose minerals with the rock, tending to split along the planes where tabular or schistose minerals predominate.

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.

Lacustrine--Pertaining to lakes.

Megascopic--Characters of a material that can be perceived by the unaided eye.

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

Moraine--An accumulation of drift with an initial topographic expression of its own built within a glaciated region chiefly by the direct action of glacier ice.

Outwash--Stratified drift that is stream built beyond the glacier; laid down by meltwater streams issuing from the face of the glacier ice.

Quartzite--A firm, compact rock composed of grains of quartz so firmly united that fracture takes place across the grains instead of around them. A metamorphosed sandstone.

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.

Schistosity--The property of a foliated rock by which it can be split into thin layers or flakes. The property of splitting may be due to alternating layers of differing mineral composition or to preferred orientation and parallelism of cleavage planes of the mineral.

Strike--The direction of a line formed by the intersection of a stratum with a horizontal plane.

Surface-geology map--A map showing areas of outcrop of geologic formations, both consolidated rocks and the unconsolidated sediments. Its scale is large enough that pits and quarries can be accurately shown and indexed.

Terrace--A plain, natural or artificial, from which the surface descends on one side and ascends on the other. Terraces are commonly long and narrow, and they border seas, lakes, or interior valleys. A terrace may be built by deposition of sediment from water, it may be cut by the breaking of waves on a shore or the sweeping of currents, or it may be formed by the dislocation of rocks in crustal movements. The descent from river terraces toward the river may be very abrupt, especially in arid regions, the ascent on the other side may be only that of an extensive alluvial slope.

Till--Unsorted drift, or the mixture of rock fragments and fine materials left by melting glaciers.

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Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
1	1	1958	20.0	2.5	Yes		-	55.4	18.0	3.25	2	32.4	Bor. (Grav.)	Owner: A. Bemis. Fails on stone wear & gradation for Item 201, (gravel). Deposit interbedded with clay
2	1	1959	6.5	0.5	No		-	57.9	15.0	1.0	2	20.2	Grav.	Owner: E. Rayt. Smal knoll with limited quantity. Wet area adjacent to knoll. Possible source Item 201 (gravel).
3	1	1959	5.5	1.5	No		—	—	—	—	—	—	Bor. (Sand)	Owner: E. Howe. Narrow knoll-like ridge north of loc.4. Bounded on the east b bedrock & on the west by small stream. Not sampled, sand too fin for Item 202.
	2	1959	6.0	1.5	No		—	—	—	—	—	—	"	
	3	1959	6.5	1.5	No		—	—	—	—	—	—		
4	1	1959	10.5	0	Yes		—	36.6	17.0	5.75	3	23.8	Bor. (Grav.)	Owner: E. Howe. Fails on stone wear & grada tion for Item 201, (gravel). Northeast face of pit sampled & tested with resistivi ty-water standing in bottom of pit. Bedrock bottom exposed by backhoe.
	2	1959	6.0	1.0	Yes		—	—	—	—	—	—		

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
5	1	1959	4.0	1.0	No		—	—	—	—	—	—	Bor. (Sand)	Owner: Mr. Marshall. Not sampled. Gravelly sand to fine sand. Small knoll adjacent & north of old town road now logging road. Contains thin layers of pebbly or gravelly sand changing abrupt-ly to fine sand.
6	1	1959	8.0	1.0	No		100.0	87.6	5.0	1.25	2½	—	Sand	Owner: Mr. Marshall. Test No. 1 is on knoll east of old gravel pit. Test No.2 is on same knoll approx. 50' east of Test No. 1. Test No. 3 was taken at foot of knoll on north side adjacent to brook. Test No. 4 was taken on knoll north of brook & adjacent to logging road. Area was checked with resistivity. No samples were taken in Test Nos.2 & 3 material was gravelly sand to silty sand. The area is a possible source for Item 202 (sand).
	2	1959	8.0	1.0	No		—	—	—	—	—	—	Bor. (Sand)	
	3	1959	5.0	1.0	No		—	—	—	—	—	—	"	
	4	1959	9.0	1.0	No		100.0	77.2	6.0	1.0	2½	—	"	
7	1	1959	4.0	1.5	No		—	—	—	—	—	—	Bor. (Grav.)	Owner: Mr. Marshall. Not sampled. Poorly
	2	1959	3.0	1.5	No		—	—	—	—	—	—	"	

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
														graded gravelly material of limited extent. Bedrock exposed in road adjacent & north of test sites.
8	1	1959	25.0	2.5	Yes		—	—	—	—	—	——	Bor. (Grav.)	Owner: Mr. Marshall. Pit not sampled. Depleted, very coarse, poorly graded, dirty, gravelly material.
9	1	1959	8.5	0.5	No		100.0	90.3	8.0	2.0	2½	——	Sand	Owner: Mr. Kabara. Small knoll approx. 600' north of town road. Bounded on the east & north by wooded area. Bedrock exposed to the northeast of knoll.
10	1	1959	3.0	0.5	No		—	—	—	—	—	——	Bor. (Sand)	Owner: Mr. Kabara. Ridge-like knoll east of loc. 9. Not sampled. Fine sand knoll of limited quantity capped by a thin layer of pebbly sand.
	2	1959	6.0	0.5	No		—	—	—	—	—	——	Bor. (Sand)	
11	1	1959	10.0	1.0	Yes		—	—	—	—	—	——	Bor. (Grav.)	Owner: Mr. Parker. Not sampled. Test No. 1 was taken on the southwest corner of pit. Test No. 2 was taken on the southeast
	2	1959	8.0	1.0	Yes		—	—	—	—	—	——	Bor. (Grav.)	
	3	1959	3.0	1.0	No		—	—	—	—	—	——	Bor. (Sand)	

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
														corner of pit. This material has far less stone than the 40% necessary for subbase of gravel. Test No.3 was taken southeast of gravel pit. Area contains a pebbly sand to fine sand.
12	1	1959	9.0	1.5	No		—	—	—	—	—	—	Bor. (Sand)	Owner: Mr. Lawrence. Not sampled. Gravelly sand. Far less stones necessary for subbase of gravel. Test No.1 & No. 2 taken in field & on knoll-like ridge west of location 13 & east of telephone cable. Test No.3 taken on west edge of knoll west of tele-phone cable. Large deposit of sand borrow.
	2	1959	8.0	1.0	No		—	—	—	—	—	—	Bor. (Sand)	
	3	1959	7.5	1.0	No		—	—	—	—	—	—	Bor. (Sand)	
13	1	1959	6.0	1.5	Yes		100.0	76.3	7.0	1.5	3	—	Bor. (Sand)	Owner: Mr. Lawrence. West face of pit tested, sample fails on gradation. Sand too fine for Item 202. Material extends west of pit under meadow. See location 12.

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
14	1	1959	4.5	0	Yes		—	48.6	3.0	1.0	5	22.7	Grav.	Owner: L. Stokey. Test No. 1 taken from east face of pit. Test No. 2 taken from south face of pit. Pit has been stripped but apparently needs more stripping as both samples failed on color. Possible source for Item 201 (gravel).
	2	1959	7.0	0	Yes		—	51.4	4.0	1.5	5	22.0	Grav.	
15	1	1959	4.0	1.0	Yes		—	—	—	—	—	—	Bor. (Grav.)	Owner: Mr. Hannum. Shallow pit located north of small brook, and east of South Valley school. Material not sampled, sandy gravel with too few stones & excessive fines for Item 201. (gravel).
16	1	1959	3.0	1.5	No		—	—	—	—	—	—	Bor. (Grav.)	Area not sampled. Material is dirty, poorly graded gravel.
17	1	1959	3.5	1.5	No		—	—	—	—	—	—	Bor. (Grav.)	Area not sampled. Poorly graded dirty gravel.

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
18	1	1959	4.5	1.0	Yes		—	—	—	—	—	—	Bor. (Grav.)	Owner: Mr. Peroziello Not sampled. Shallow abandoned pit, fringes of which are filled with debris. Pit located adjacent to apple orchard. Material in pit consists of thin beds of poorly graded gravel with flat soft stones.
19	1	1959	3.0	0	Yes		—	—	—	—	—	—	Bor. (Grav.)	Owner: Mr. Lobdell. Not sampled. Test No. 1 taken in the bottom of old pit located east of washed out area, and south of Fullam Brook. Pit overgrown with scrub trees. Material in pit coarse, dirty gravelly material.
20	1	1959	8.0	1.0	Yes		—	—	—	—	—	—	Bor. (Grav.)	Owner: Mr. Fullam. Pit not sampled, depleted. Deposit extends under meadow land to the north. Owner does not wish to extend pit to the north.

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
21	1	1959	3.0	1.0	No		—	—	—	—	—	—	Bor. (Sand)	This area was not sampled. Test No.1 revealed excessive fine sand, too fine for Item 202. The same material was exposed in trench silos and house foundations to the north & east of U.S. Rte.5 & loc. 21.
22	1	1959	6.0	2.0	Yes		—	—	—	—	—	—	Bor. (Sand)	Old abandoned sand pit. Approximately 40 ft. face. Much of the material has been removed. The remaining material consists of excessive fine sand & silt, too fine for Item 202.
23	1	1959	3.0	1.5	Yes		—	—	—	—	—	—	Bor. (Grav.)	Owner: Fenton sisters Pit depleted not sampled. Bedrock exposed in bottom of pit. East edge of pit adjacent to town road. See loc. 24 for area to the west & north-west.

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
24	1	1959	8.5	0.5	No		—	—	—	—	—	——	Bor. (Sand)	Same owner & deposit as location 23. Test
	2	1959	7.0	0.5	No		—	—	—	—	—	——	Bor. (Sand)	No. 1 taken at north-west corner of meadow west of pit. Ledge at 8.5'. Test No.2
	3	1959	8.5	1.0	No		—	—	—	—	—	——	Bor. (Grav.)	taken 100' southwest of No.1, clay at 7.0' ledge below. Test No 3taken on east edge of meadow directly west of pit. Test No 4 taken in northeast corner of meadow. No samples were taken as material contained stones too large for sand Item 202 and too few stones for gravel Item 201.
	4	1959	8.0	1.0	No		—	—	—	—	—	——	Bor. (Grav.)	
25	1	1958	30.0	2.0	Yes		—	65.1	5.0	1.0	1.5	21.5	Bor. (Grav.)	Owner: A. Wade. Large deposit with very large pit. Test No.1 taken in the center of pit. Test No.2 taken on the east side of pit. The material fails to meet grading requirements too few stones for Item 201 (gravel). See location 26 for area to the north of pit.
	2	1958	30.0	1.0	Yes		—	72.2	10.0	1.5	1	20.6	Bor. (Grav.)	

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
26	1	1959	7.0	1.0	No		—	53.0	3.0	0.75	2	24.0	Grav.	Same owner & deposit as location 25. Test No. 1 taken north of location 25 & actually is an extension of that grave pit. The material contains more stones than tests indicated in gravel Pit. Possible source for Item 201 (gravel).
27	1	1959	10.0	2.0	No		—	47.8	8.0	1.75	2.5	23.2	Grav.	Same owner & deposit as location 25 & 26.
	2	1959	8.0	2.0	No		—	—	—	—	—	—	Bor. (Sand)	Test No.1 taken on wooded ridge several thousand ft.east of location 25. Area would require clearin & stripping & improvement on logging road up steep grade. Possible source for Item 201 (gravel). Test No.2 taken several thousand ft. north east of Test No 1. Material not sampled, too fine sand for Item 202.

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
28	1	1959	3.0	0.5	No		—	27.6	15.0	4.0	2.5	16.8	Grav.	Owner: Mr. Watins. Small, shallow deposit located in the flat area at the junction of Morse & Cobb brooks. Small deposit of limited quantity. Possible source for Item 201 (gravel). Bank areas to the west of deposit revealed silt to clay.
29	1	1959	12.0	6.0	Yes		—	—	—	—	—	—	Bor. (Sand)	Large abandoned sand pit on west side of U.S. Rte 5. Pit not sampled, very fine sand to silt. Silt overburden. Material too fine for Item 202 (sand).
30	1	1959	5.0	1.5	Yes		—	—	—	—	—	—	Bor. (Grav.)	Owner: P. James. Test No.1 taken on south face of pit. No sample taken as material in pit was poorly graded. Tests Nos. 2 & 3 were taken on top of ridge south of pit & north of recreation field. Similar material was
	2	1959	5.5	1.0	No		—	41.6	4.0	1.0	3.5	20.5	Grav.	
	3	1959	5.0	2.0	No		—	38.9	9.0	1.25	2.5	18.9	"	

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
														exposed in the construction of recreation field. Possible source for Item 201 (gravel).
31	1	1959	0 - 6.0	0	Yes		—	41.2	10.0	4.0	5	19.3	Bor. (Grav.)	Same owner & deposit as location 30. Pit located northwest of location 30. Test No. 1 & 1A taken on north face of pit. Test No. 2 & 2A taken on west face of pit. High color in test No. 1 indicates further stripping necessary. Possible source for Items 201 & 202 (gravel, sand).
	1A	1959	6 -11.5		Yes		—	65.5	9.0	2.0	2	18.0	"	
	2	1959	0 - 5.5	0	Yes		—	39.6	9.0	1.75	3.5	19.8	Grav.	
	2A	1959	5.5-12.5		Yes		100.0	97.3	15.0	1.9	1	——	Sand	
32	1	1959	10.0	0	Yes		—	33.9	2.0	0.5	2.0	21.8	Grav.	Owner: J. Allen. Small limited amount remaining. Proximity of ledge rock & exhausted rock bottomed pits to north controlling factors. Possible source for Item 201 (gravel).

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
33	1	1959	6.0	4.0	Yes		—	35.1	4.0	1.75	2	22.4	Grav.	Owner: J. Allen. Large pit much of the material has been removed. Some gravel available in floor of pit. Area to the west is bounded by depleted pit. See location 34. Test No. 1 taken on south-west corner of face. Test No. 2 taken in pit floor. Possible source for 201 (gravel).
	2	1959	7.0	1.5	Yes		—	54.0	3.0	1.0	1.5	23.0	Grav.	
34	1	1959	6.0	0	No		—	—	—	—	—	—	Bor. (Sand)	Owner: Mr. Wilson. Bedrock exposed in floor of pit south-west of Test No. 1 & 2. Pit is depleted. Northeast extension of pit tested but not sampled, material is fine sand too fine for Item 202.
	2	1959	7.0	0	Yes		—	—	—	—	—	—	"	
35	1	1959	6.0	0	Yes		100.0	87.2	1.0	0.5	2	—	Sand	Owner: J. Allen. Small pit opening east of location 32. Pit may be extended to the northeast before butting into a series of rock bottom abandoned

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (Ft.)	Over-burden (Ft.)	Exist-ing Pit	Volume Estimate (Cu. Yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
							1½"	#4	#100	#270				
														shallow pits. Possible source for Item 202 (sand).
36	1	1958	8.0	1.0	Yes		—	61.3	16.0	4.75	5	17.3	Bor. (Grav.)	Owner: C. Reed. Pit located adjacent to town road. Test No. 1 failed for Item 201 (gravel) on both gradation & color. Test No. 2 was taken on the face of pit. Extension to the southwest possible. The pit could be a possible source for Item 201 (gravel).
	2	1958	20.0	1.0	Yes		—	38.4	7.0	2.5	2	16.2	Grav.	

Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T - 3	Distance Between Samples (ft.)	Remarks
1	1	1959	Gneiss	No	Blasted	9.0	0	Owner: Preston James. Samples taken represent 155 ft. across strike. The rock is medium to coarse grained, gray granite to granodiorite gneiss. Not recommended as a desirable source for Item 204 (sub-base of crushed rock).
	2	1959	Gneiss	No	Blasted	7.2	61	
	3	1959	Gneiss	No	Blasted	13.4	21	
	4	1959	Gneiss	No	Blasted	9.8	31	
	5	1959	Gneiss	No	Blasted	7.6	23	
	6	1959	Gneiss	No	Blasted	9.4	19	
2	1	1957	Schist	No	Chip	9.2	0	Bald Hill bed rock. Sample was taken by D. P. Stewart 0.2 mile N.E. of Interstate Highway Station 1568 + 0. The area is not recommended as a desirable source for Item 204 (sub-base of crushed rock).
3	1	1957	Schist	No	Chip	19.8	--	Bed rock near Camp David. Sampled along Interstate centerline from Station 1520 + 0 - 1560 + 0 by survey crew. The area is not recommended as a desirable source for Item 204 (sub-base of crushed rock).
	2	1957	Schist	No	Chip	11.8	--	
4	1	1959	Gneiss	No	Blasted	5.5	0	Owner: Paul Harlow. Samples taken represent 119 ft. across strike. The rock is medium grained, gray granite gneiss. The area tested is located within a few hundred feet of a graveled Town Road. Further testing may show more uniformity in percentage of wear. The area could be considered a source for Item 204 (sub-base of crushed rock). (R) indicates rock was resampled from same blast hole.
	2	1959	Gneiss	No	Blasted	7.4	16	
	3	1959	Gneiss	No	Blasted	9.0-6.2 (R)	18	
	4	1959	Gneiss	No	Blasted	7.4	12	
	5	1959	Gneiss	No	Blasted	8.0	16	
	6	1959	Gneiss	No	Blasted	12.0-5.6 (R)	20	

Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T - 3	Distance Between Samples (ft.)	Remarks
5	1	1959	Granite	No	Blasted	3.7	0	Owner: Preston James. Samples taken represent 253 ft. across trend of rock outcrop. The rock is medium grained, light gray granite. The area is accessible by a logging road which would require improvements to support heavy traffic. Further testing of the area may show more uniformity in percentage of wear. The area could be considered a source for Item 204 (sub-base of crushed rock). (R) indicates rock was resampled from same blast hole.
	2	1959	Granite	No	Blasted	4.0	17	
	3	1959	Granite	No	Blasted	8.8-6.8 (R)	29	
	4	1959	Granite	No	Blasted	7.6	21	
	5	1959	Granite	No	Blasted	7.6	26	
	6	1959	Granite	No	Blasted	7.4	21	
	7	1959	Granite	No	Blasted	8.6-5.6 (R)	12	
	8	1959	Granite	No	Blasted	6.5	17	
	9	1959	Granite	No	Blasted	6.7	25	
	10	1959	Granite	No	Blasted	5.0	21	
	11	1959	Granite	No	Blasted	8.4-7.1 (R)	28	
	12	1959	Granite	No	Blasted	9.3-5.6 (R)	36	
6	1	1959	Granite	No	Blasted	6.2	0	Owner: Charles Goldsmith. Samples taken represent 185 ft. across trend of rock outcrop. The rock is medium grained, light gray granite. Same granitic deposit as Location 5. The area is accessible by a logging road which would require improvement to support heavy traffic. The area could be considered a source for Item 204 (sub-base of crushed rock). (R) indicates rock was resampled from same blast hole.
	2	1959	Granite	No	Blasted	5.8	22	
	3	1959	Granite	No	Blasted	5.6	27.5	
	4	1959	Granite	No	Blasted	5.2	25	
	5	1959	Granite	No	Blasted	4.4	18.5	
	6	1959	Granite	No	Blasted	6.0	41	
	7	1959	Granite	No	Blasted	5.6	20	
	8	1959	Granite	No	Blasted	4.2	32	
	9	1959	Granite	No	Blasted	9.0-6.2 (R)	23	
7	1	1959	Granite	No	Blasted	8.4-8.0 (R)	0	Owner: Kurn Hattin and Mr. A. Lober. Samples taken represent 210 ft. across trend of rock outcrop. The area sampled extends from the Kurn Hattin property on to the adjoining A. Loper property to the west. The rock is a medium grained, light gray granite. Same granatic deposit as Locations 5 and 6. The area is accessible by foot and would require a
	2	1959	Granite	No	Blasted	9.6-5.8 (R)	22	
	3	1959	Granite	No	Blasted	6.4	32	
	4	1959	Granite	No	Blasted	6.4	19	
	5	1959	Granite	No	Blasted	6.8	24	
	6	1959	Granite	No	Blasted	5.2	20	
	7	1959	Granite	No	Blasted	5.2	26	
	8	1959	Granite	No	Blasted	5.8	25	
	9	1959	Granite	No	Blasted	4.0	39	

Ident. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T - 3	Distance Between Samples (ft.)	Remarks
								road to support heavy traffic. The area sampled could be considered a source for Item 204 (sub-base of crushed rock). (R) indicates rock was resampled from same blast hole.

LEGEND

- ○ ROCK, acceptable for ITEM 204 (sub-base of crushed rock)
- ● ROCK, not acceptable for ITEM 204
- ⚒ 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, CONGLOMERATES
- 13 IDENTIFICATION NUMBER (refer to text)

WESTMINSTER

SCALE 1:31,250

1 0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1960

ROCK MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

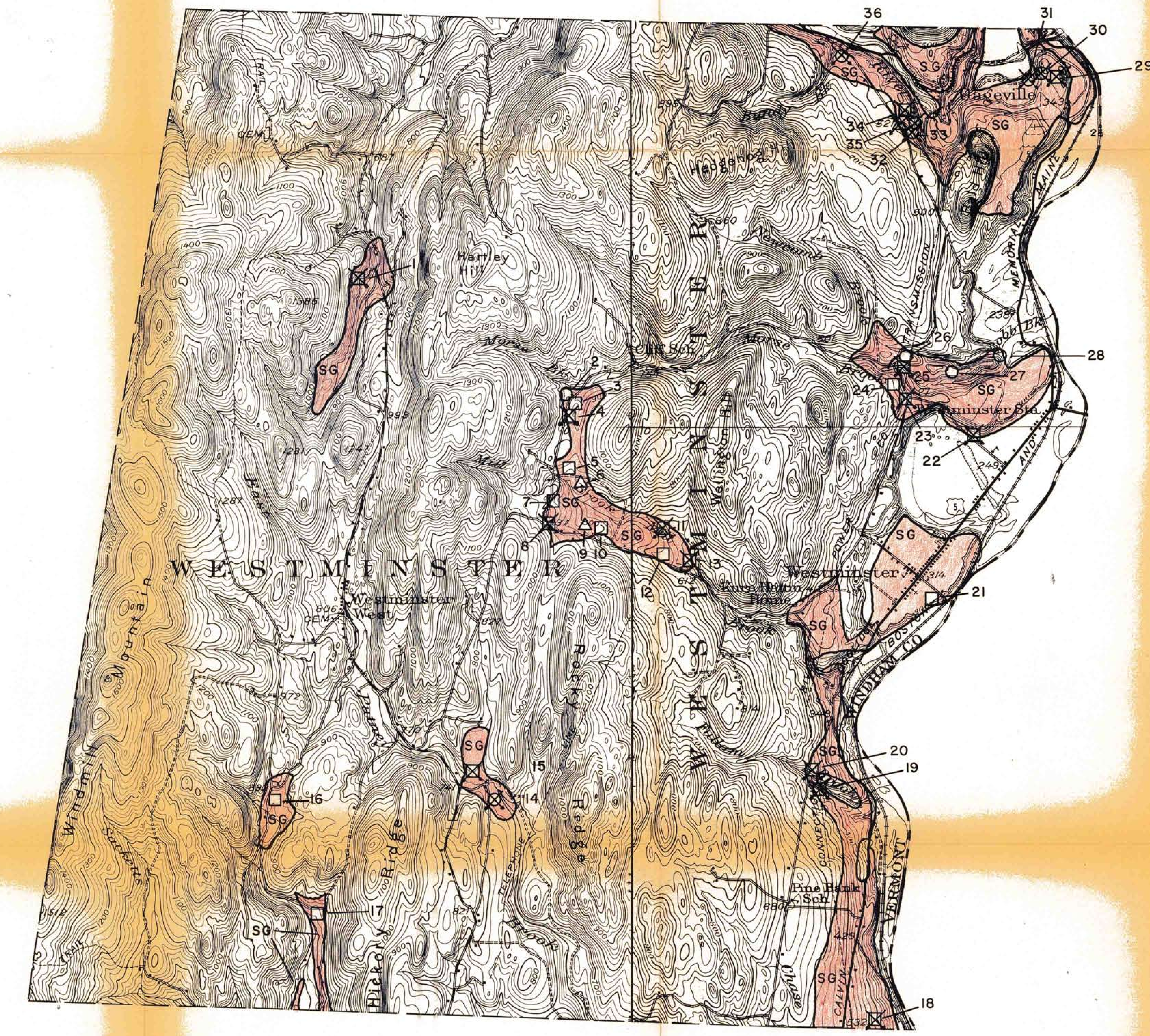
IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

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

ROCK

REVISIONS DATE BY



WESTMINSTER

LEGEND

- ○ GRAVEL, ACCEPTABLE FOR ITEM 201 (sub-base of gravel)
- ● GRAVEL, DEPLETED OR NOT ACCEPTABLE FOR ITEM 201
- △ SAND, ACCEPTABLE FOR ITEM 202 (sub-base of sand)
- ▲ SAND, DEPLETED OR NOT ACCEPTABLE FOR ITEM 202
- □ BORROW
- ✕ EXISTING PIT
- (SG) SAND & GRAVEL DEPOSIT
- (S) SAND DEPOSIT
- 13 IDENTIFICATION NUMBER (refer to data sheet)

SCALE 1:31,250

1 0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1960

GRANULAR MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

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

GRANULAR

WINDHAM COUNTY VT. HWY. DISTRICT NO. 2

REVISIONS

DATE							
BY							