SURVEY OF HIGHWAY CONSTRUCTION MATERIALS

IN THE TOWN OF SOUTH BURLINGTON, CHITTENDEN 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

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Acknowledgments

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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 Material 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 was 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 material were conducted only as the immediate situation required. Thus, only limited areas were surveyed and no overall picture of material resources was available. Highway contractors or resident engineers are usually required to locate the materials on their respective projects and have samples tested by the Highway Testing Laboratory. The additional cost of exploration for construction material 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 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, 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 bedrock 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 Survey Bulletins, Vermont State Geologist Reports, United States Geological Survey Bedrock Maps, as well as other references. The Granular Materials Map depicts areas covered by various 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 (Reconnaissance) of Vermont, conducted by the Bureau of Chemistry and Soils of the United States Department of Agriculture, and

from 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. 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 tested or by 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, 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 detail required for effective use. The information in 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 this information appears incomplete. Some cards in the file were not used because the information on the location of the deposit was incomplete or unidentifiable. The 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 South Burlington is located in Chittenden County in the northwest section of the State, approximately 35 miles south of the northern boundary

of the State. The Town is bounded on the north by Essex, Colchester and Winooski City, on the east by Williston, on the south by Shelburne, and on the west by Burlington City and Shelburne Bay. It is in the "Champlain Valley" physiographic division, an area of relatively smooth relief. The southern half of the town has many swampy areas, indicating poor drainage.

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 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 result of this test prove satisfactory, further samples are taken by drilling to a depth of 3 feet and blasting 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

The rocks encountered in the Town of South Burlington are of many different types: quartzites, dolomites, marbles, limestones, and slates. These rocks occur in different groups or formations which will be discussed in the following paragraphs, proceeding from west to east.

On the western edge of South Burlington is the Monkton Quartzite Formation which consists of red to purple quartzite in layers from a few inches to three feet thick. It occurs at the Queen City Park Quarry (Identification No. 2 on the Rock Map), and runs south, where outcrops are scarce.

The Winooski Dolomite Formation occurs east of the Monkton Quartzite. It is defined as buff to gray dolomite separated by thin siliceous partings. Because of the scarcity of outcrops, no tests were taken in this formation.

East of the Winooski Dolomite is the Danby Formation. It is comprised of dolomite with thin beds of quartzite 1 to 2 feet in thickness. Identification No. 1 (see Rock Map) sits astride a zone of change from the Winooski to the Danby, being the former site of a quarry.

The Clarendon Springs Dolomite occurs east of the Danby Formation. The rock is defined as a massive smooth-weathering gray dolomite characterized by numerous geodes and knots of white quartz. The rock in this formation was not sampled because of the scarcity of outcrops.

East of the Clarendon Springs Formation is the Shelburne Marble defined as "white marble or dove-colored limestone, light-gray dolomite". Identification No. 3 on the Rock Map is representative of the white marble portion of the Shelburne Marble Formation. Outcrops of this formation are extremely scarce and of small relief.

East of the Shelburne Marble, the Cutting Dolomite Formation is encountered. This consists of light to dark gray limestone. Two other thin areas of Cutting Dolomite occur in the southeastern portion of the Town, and another in the eastern section along Muddy Brook. Because of the scarcity of outcrops, no tests were taken in this formation.

The Bascom Formation is the eastern-most formation encountered in South Burlington. It is represented on the Rock Map by Identification Nos. 4 through 9, and consists of "limestone, dolomite, quartzite, limestone breccia, and sandy, calcareous shales". More samples were taken in this formation than were taken in the others due to the greater number of outcrops in the Bascom Formation. The samples taken were massive gray limestones and quartzites interbedded with thinly laminated beds of limestones, abrasions ranging from 1.6% to 18.6%.

There is a small area of Georgia Slate along Muddy Brook. Because of the known poor abrasion qualities, softness, and tendency to split into thin elongated pieces of this type rock, no samples were taken.

As has been stated previously, there is a scarcity of outcrops in the southwestern section of the Town. The western and northern sections of the Town are heavily populated and, as a consequence, available sources of rock are limited here. The eastern section of the Town (Bascom Formation) contains rock that is highly variable in composition. Extreme caution must be exercised when considering usage of this type rock, because of its unreliability. The most promising sources of rock for highway construction use are represented by Identification Nos. 1 and 2 on the Rock Map.

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 Prof. 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 recognizing and locating physiographic features indicating glacial deposits, and in studying drainage patterns. In addition, the location 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. These locations are later examined by digging test pits with a backhoe at a depth of

approximately 12 feet and again sampling the material. The samples 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).

Discussion of Sand and Gravel Deposits

The granular deposits of the town of South Burlington are chiefly sands of delta marine, and fluvial deposition. Two small wind-blown dune-type deposits of fine sand occur in the Town. One is at the intersection of Spear and Swift Streets, the other approximately one quarter mile south of U.S. Rte. 2 and the New Elridge School. These wind-blown dune-type deposits, probably the result of denuding of large sand deposits were not sampled due to the excessive fineness of the sand particles. The lack of gravels in the Town of South Burlington may be better understood after reading the following brief resume of the Glacial History of the area.

At the close of the Pleistocene Period, the glacial ice sheet receded northward up the Champlain Valley. The damming action of the ice in the Champlain Valley, coupled with vast amounts of meltwater from the waning ice sheet, formed an ancient lake called Lake Vermont. As the continental ice sheet retreated farther and farther northward the level of Lake Vermont was lowered to sea level. The sea water spread south from Canada, down the Champlain Valley, forming a salt water body called the Champlain Sea. Evidence of this ancient arm of the sea can be found in the fossils and shorelines north of the Town of South Burlington. The Winooski River, flowing from east to west, was ladened with vast amounts of material. The coarser materials were dropped upstream east of the Town of South Burlington. The remaining materials, fine gravels, sands and silts were emptied into the quiet marine waters of the Champlain Sea, forming a large marine delta. During this "marine stage" Vermont rose differentially from

the releasing load of the great ice mass, and the Champlain Sea gradually was cut off from the ocean waters, giving way to a fresh water body, Lake Champlain. The level of the lake dropped gradually until the lake occupied much the same position as it does today. The Winooski River, on its journey to the now lower lake, began to cut a channel across the large marine delta formerly built. This marine delta is evident today as a vast sand plain covering approximately three-fourths of the Town of South Burlington.

It can now be understood that because the Town of South Burlington was submerged under both fresh and salt water, and deposition in this area was of marine delta origin, that the coarser materials, such as gravels, are lacking and were deposited further east of the area. This is generally true in the towns to the north and south that experienced the same influence of both Lake Vermont and the Champlain Sea.

As shown on the granular map and data sheets, the gradation of sand in South Burlington varies, effecting its possible Highway Construction use. Sand for borrow, granular borrow and sub-base of sand may be found elsewhere in the sand area other than the areas indicated by the Identification Numbers.

Glossary of Selected Geologic Terms

Alluvial--Pertaining to material carried or laid down by running water.

Breccia--A rock consisting of consolidated angular rock fragments larger than sand grains.

Calcareous--Consisting of or containing calcium carbonate. As combined with rock names indicates a considerable proportion, say 50 percent, of calcium carbonate together with an equal or predominant amount of the material indicated by the rock name.

Delta--A predominantly alluvial deposit built out by a stream into the sea or other body of water. Usually having the typical form of the Greek letter delta.

Dip--The angle which a stratum, sheet, vein, fissure or similar geological feature makes with a horizontal plane, as measured in a plane normal to the strike.

Dolomite--As used in this report it applies to rocks approximating the mineral dolomite in composition or consisting predominantly of the mineral dolomite. Mineralogically, dolomite is a mineral of definite chemical composition, $Ca\ Mg\ (CO_3)_2$; carbon dioxide 47.7, lime 30.4, and magnesia 21.9 percent.

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.

Dune--A heap of sand or other material accumulated by wind. The outward form may be that of a hill or a ridge.

Fluvial--Pertaining to streams or stream action.

Geode--As applied in this report, a rock cavity lined with crystals that are not separable from the surrounding rock.

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.

Limestone--A bedded sedimentary deposit consisting chiefly of calcium carbonate. The most important and widely distributed of the carbonate rocks. The percentage of calcium carbonate ranges from 40 percent to more than 98 percent. Common impurities are clay and sand.

Marine Deposits--Sedimentary deposits laid down in the sea.

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.

Normal--Perpendicular to a surface.

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

Pleistocene--The first epoch of the Quaternary Period, in general including the time and deposits of the last great glacial epoch, marked by repeated glacial advances and worldwide fluctuations of the sea level.

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.

Siliceous--Containing or pertaining to silica (Silicon dioxide, SiO_2) or partaking of its nature.

Slate--A homogeneous, metamorphic rock, so fine-grained that no mineral grains can be seen. Slate splits with a foliation so perfect that it yields slabs having plane smooth surfaces.

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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SOUTH BURLINGTON GRANULAR DATA SHEET NO. 1

ent. lo.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds.)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes V.H.D. Spec.	Remarks
							1½"	#4	#100	#270				
	1	1960	3.5-35	0-3.5	Yes		100	98.4	53.1	7.9	1½	—	Gran. Borrow	Owner: Mose & Hildred Dumas. This is a fairly large ridge of sandy material with a small pit. Test #1 was taken in the north face of pit. 0-3.5' overburden; 3.5-4' coarse pebbly sand; 4-20' fine sand with thin beds of silt; 20-35' silt with thin beds of fine sand. Maximum height of pit 35-40'. Material rejected for Item 202 (sub-base of sand) but ok for 102A (granular borrow).
	1	1960	2-9	0-2	Yes		100	98.8	5.9	0.4	1½	—	Sand	Owner: Town of South Burlington. A fairly limited area, nearly depleted. Test #1 was taken in east face of pit. Material passes for Item 202 (sub-base of sand).
	1	1960	0-15	0	Yes		100	100	—	11.9	—	—	Borrow	Owner: Madeline K. Kirby. This is an old sand pit where the good coarse sand has been stripped from the top of a much finer sand. Test #1 was taken in the fine

SOUTH BURLINGTON GRANULAR DATA SHEET NO. 2

ent. o.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-burden (ft)	Existing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes V.H.D. Spec.	Remarks
														sand remaining. Material rejected for Item 102A (granular borrow), ok for Item 102 (borrow). (23.3% passing #200 screen).
	1	1960	0-3	0	Yes		100	100	—	9.5	—	—	Gran. Borrow	Owner: University of Vermont. This is an old sand pit where most of the good coarse sand has been removed. The fine material left was sampled from the floor of pit. 21.0% of material passed the #200 screen. Acceptable for Item 102A (granular borrow) & Item 102 (borrow).
	1	1960	0.5-14	0-0.5	Yes		100	99.5	36.0	5.0	3	—	Gran. Borrow	Owner: Roland J. & E. S. Deslaurier. Test #1 taken in sw face which represents the only possible extension of pit.
	2	1960	0-4	0	Yes		100	100	68.0	8.75	1	—	Gran. Borrow	Test #2 taken in floor of pit. Material is fine sand and silt interbedded. Both fail for Item 202. Acceptable for 102A & 102.

SOUTH BURLINGTON GRANULAR DATA SHEET NO. 3

ent. b.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes V.H.D. Spec.	Remarks
	1A	1960	0.5-3.5	0-0.5	No		100	100	18.0	0.5	5	—	Gran. Borrow	Owner: Queen City Bowmen Club. A sand bank exposed on west side of Spear St. Possible 10-15' depth when bottom is at the elevation of road. Bank is surrounded by woods & extends to the west. Test Nos. 1 & 3 fail for sub-base of sand (Item 202). All the material tested is acceptable for Item 102A (granular borrow) & Item 102 (borrow). Sieve analysis for Test #1B: 100% passing #10, 93.3 " #40, 1.3 " #200, 0.3 " #270. Sieve analysis for Test #2: 100% passing #10, 98.3 " #40, 8.4 " #200, 2.5 " #270
	1B	1960	0.5-3.5	0-0.5	No		100	100	—	0.3	—	—	Gran. Borrow	
	2	1960	0-3	0	No		100	100	—	2.5	—	—	Gran. Borrow	
	3	1960	0-3	0	No		100	100	21.0	4.0	2	—	Gran. Borrow	
	1A	1960	1.5-7	0-1.5	Yes		100	99.2	14.9	0.9	3	—	Sand	Owner: V. A. Wheelock. This is a small sand pit on the south side of Swift St. Extension of pit possible to the west; sand extends under road to
	1B	1960	1.5-7	0-1.5	Yes		100	99.7	—	1.0	—	—	Gran. Borrow	

SOUTH BURLINGTON GRANULAR DATA SHEET NO. 4

lent. lo.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes V.H.D. Spec.	Remarks
														north also. Test #1A passes for sand, Item 202, Test #1B passes for granular borrow, Item 102A.
	1A	1960	1.5-10	0-1.5	Yes		100	99.0	5.4	0.3	1	—	Sand	Owner: University of Vermont. This is a small sand pit on the north side of Swift St. Extension of pit is possible to the north. Possible pit face of 13' if kept level with present road elevation. Test #1A passes for sand, Test #1B passes for granular borrow. Sieve analysis for Test #1B: 99.1% passing #4 screen. 1.8% passing #200 0.6% " #270
	1B	1960	1.5-10	0-1.5	Yes		100	99.1	—	0.6	—	—	Gran. Borrow	
	1	1960	3-13	0-3	Yes		100	99.4	26.8	2.8	1	—	Gran. Borrow (Sand)	Owner: Hope and Farrell. This pit is approximately 25' in depth. Floor of pit is same material to depth of 1.5'. Test #1 taken in east face. Material rejected for Item 202, passes for 102A.

SOUTH BURLINGTON GRANULAR DATA SHEET NO. 5

lent. lo.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes V.H.D. Spec.	Remarks
							1½"	#4	#100	#270				
10	1	1960	4-6	0-4	Yes		100	98.8	26.6	2.7	1	—	Gran. Borrow (Sand)	Owner: J. Nowland. Test #1 taken in floor of pit near west face. 0-4' (over-burden) represents material for which pit was worked. (Dirt with some stones and sand, also many boul-ders). Rejected for Item 202, ok for 102A.
11	1A	1960	0.5-5	0-0.5	Yes		100	100	—	0.3	—	—	Gran. Borrow Sand	Owner: M. J. Lozon. This is an extensive area of find sand covered with shallow pits. Sand is used for fill. The two samples (1A & 1B) re-present the same material which is acceptable for: Item 202 (sub-base of sand), and Item 102A (granular borrow).
	1B	1960	0.5-5	0-0.5	Yes		100	100	2.0	0.3	2	—		
12	1	1960	1-3.5	0-1	No		100	100	13.0	0.5	2	—	Sand	Owner: Church of Christ. This test re-presents a large area (owner--unknown) to the east. Water at 4' depth. Material pass-es for Item 202 & Item 102A.

SOUTH BURLINGTON GRANULAR DATA SHEET NO. 6

ent. o.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes V.H.D. Spec.	Remarks
							1½"	#4	#100	#270				
3	1	1960	0-4	0	No		100	100	41.0	5.25	5	———	Gran. Borrow (Sand)	Owner: O'Brien. Test #1 was taken in exposure of blow sand. Area covers several acres. Rejected for Item 202, passes for Item 102A (granular borrow).
4	1	1960	0.5-5	0-0.5	No		100	99.4	31.8	8.9	3½	———	Gran. Borrow (Sand)	Owner: John S. Barry. Test taken in a low ridge of fine sand in woods of old logging road. Material is too fine for Item 202 (sub-base of sand), but passes for 102A.
5	1	1960	1-10	0-1	Yes		100	99.6	—	12.8	—	———	Borrow (Gran. Borrow)	Owner: Gus Calkins. Test #1 was taken in the east face of pit. 1-4' fine sand; 4-6' coarser sand. Sieve analysis: 99.6% passing #4 24.4 " #200 12.8 " #270 Material is not acceptable Item 102A (granular borrow).
6	1	1960	0-21	0	Yes		100	99.5	44.0	26.0	2½	———	—	Owner: L. & D. O'Brien. This is an old borrow pit in the east end of a fine granular ridge. The test was

SOUTH BURLINGTON GRANULAR DATA SHEET NO. 7

lent. lo.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing 1½"	#4	#100	#270	Color AASHO T-21	Abrasion AASHO T-4-35	Passes V.H.D. Spec.	Remarks
														taken in the face of the pit and shows the material extending to the west. Material is too fine for Items 202, 102A & 102.
7	1	1960	1-8	0-1	Yes		100	95.0	1.9	0.4	2½	—	Sand	Owner: U.S. Govt. This is an old pit in the side of a granular ridge. The test was taken in the north face. 0-1' overburden; 1-8' sand; 8-20' fine sand & silt. Material passes for Item 202, (sub-base of sand).
8	1A	1960	0.5-10	0-0.5	Yes		100	100	51.0	9.8	1	—	Gran. Borrow	Owner: Allen Alfred. This is a small pit with three layers of material in it. Test hole #1 revealed these three layers which were sampled separately (1A, 1B, & 1C). The bottom layer (1C) is too fine for even borrow, but the top two are acceptable for Item 102A (granular borrow).
	1B	1960	10-13.5	--	Yes		96.1	68.9	1.0	0.5	1	—	Gran. Borrow	
	1C	1960	13.5-22	--	Yes		100	100	96.0	35.8	1	—	—	

SOUTH BURLINGTON GRANULAR DATA SHEET NO. 8

ent. o.	Field Test No.	Year Field Tested	Depth of Sample or Test (ft)	Over-burden (ft)	Exist-ing Pit	Volume Estimate (cu. yds)	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes V.H.D. Spec.	Remarks
							1½"	#4	#100	#270				
	2	1960	0.5-22	0-0.5	Yes		—	Not Sampled		—	—	—	—	Test #2 was taken in pit but not sampled.
	3	1960	0.5-10	0-0.5	No		100	100	96.0	55.0	2	—	—	Test #3 was taken north of pit, fails for both sand and granular borrow. This material covered an extensive area around pit.
9	1	1960	2-10	0-2	Yes		100	76.4	3.0	0.5	1	—	Gran. Borrow (Sand)	Owner: Allen Alfred. This was nice gritty sand taken from a very small pit at the edge of the meadow. The material is just a little too coarse for sub-base of sand, Item 202, but acceptable for Item 102A, (granular borrow).

SOUTH BURLINGTON ROCK DATA SHEET NO. 1

dent. 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	Dolomite	Yes	Chip	3.4	—	Owner: City of Burlington. This quarry has been idle for some years. The north and west faces are abutting the property of R. & E. Deslaurien. Any extension of the quarry to the west on the Deslaurien property might be restricted by the houses on Spear St. but there might be an extension to the north. The only possible extension of the quarry on the City's property would be to the south for some 150'. This source would be adjacent to the proposed interchange on the Interstate Highway; Rock type: light gray dolomite. Sample taken in south face. This is a possible source of Item 204 (sub-base of crushed rock) and Item 211 (crushed stone base coarse).
2	1	1959	Quartzite	Yes	Chip	3.2	—	Owner: Unknown (property known as Queen City Park Quarry). This is a fairly large quarry which has been idle for a number of years. There appears to be ample room for expansion here. Rock type: a hard red quartzite lying in nearly horizontal layers. Sample was taken at random. This is a possible source of Item 204 (sub-base of crushed rock) and Item 211 (crushed stone base coarse).

SOUTH BURLINGTON ROCK DATA SHEET NO. 2

dent. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T-3	Distance Between Samples (ft)	Remarks
3	1	1959	Marble	No	Chip	5.4	—	Owner: C. Economou. This is a very small outcrop of rock near the intersection of Swift and Dorset Streets. Maximum relief is 3 or 4 ft. Sample was taken at random from rock exposed. Rock type: a soft looking "sugary" white marble. This rock passes the wear requirements for Item 204 (sub-base of crushed rock), but due to the size of the outcrop this is not recommended as a source of rock.
4	1	1960	Limestone	No	Chip	5.8	—	Owner: M. Vosburg. This is a small outcrop with little relief. Rock type: massive limestone and quartzite interbedded with thin impure limestone. This rock passes the wear requirements for Item 204, but due to the size of the outcrop and the variable characteristics of the rock, this is not a recommended source of rock.
5	1	1960	Limestone	No	Chip	18.6	—	Owner: Homer Dubois. This is a fairly small outcrop with about 30' of relief. The sample was taken at random from the rock exposed. Rock type: massive limestone and quartzite interbedded with thin impure limestone which breaks into flat pieces. As the rock wear indicates (18.6%), this is not an acceptable source of rock for crushing.

SOUTH BURLINGTON ROCK DATA SHEET NO. 3

dent. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T-3	Distance Between Samples (ft)	Remarks
6	1	1960	Limestone	No	Chip	5.2	—	Owner: C. Hoskam. This is a fair-sized outcrop with good relief. Sample was taken from north end of the ridge-shaped outcrop. Rock type: massive limestone & quartzite with thinly-bedded limestone or calcareous shale. This sample passed the wear requirements for Item 204 (sub-base of crushed rock) but due to the variable nature of the rock this is not a recommended source of rock.
7	1A	1960	Limestone	No	Chip	6.2	0	Owner: A. Auclair. This is a fairly large ridge-shaped outcrop running north & south on the west side of Vt Route 116. Rock type: interbedded limestone quartzite & calcareous shale. Much of this rock is in very thin plates with evident folding. Test #1A was taken along the road cut parallel to the strike for some 120' from the north end of the cut.
	2A	1960	Limestone	No	Chip	5.0	120	Test #2A 120' south of Test 1A taken along road cut to 290' south of Test #1A.
	1	1960	Limestone	No	Chip	9.0	0	Test #1 was taken some 50' southwest across strike from Test #2A.
	2	1960	Limestone	No	Chip	8.0	75	Test #2 was taken some 75' across strike from Test #1.
	3	1960	Limestone	No	Chip	8.6	80	Test #3 was taken at a point 80' west of Test #2. Rock here is softer than at Test #2.
	4	1960	Limestone	No	Chip	6.2	250	Test #4 was taken 250' across strike (west) of Test #3.

SOUTH BURLINGTON ROCK DATA SHEET NO. 4

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	5	1960	Limestone	No	Chip	6.0	150	Test #5 was taken between Tests #3 & 4. Some 150' west of Test #3 and 100' east of #4. As may be seen by the variable wears this rock is not uniform and cannot be considered a desirable source of rock for Item 204 (sub-base of crushed rock). The rock represented by Tests 1 & 3 is too soft to meet wear requirements (8.0%) for Item 204. The present owner does not want a quarry here.
8	1	1960	Limestone	No	Chip	3.2	—	Owner: C. Economou. This is a small outcrop southwest of a much larger one. The north end of the small outcrop was sampled. Rock type: limestone and quartzite interbedded with a calcareous shale. Due to the bands of quartzite this rock has a low wear but the variable nature of the rock makes it a doubtful source of Item 204 (sub-base of crushed rock).
9	1	1960	Limestone	No	Chip	1.6	—	Owner: G. Wolf. This is a small outcrop with a low relief. Rock type: interbedded limestone, quartzite, & calcareous shale. Rock wear is low due to the bands of quartzite, but site not recommended as a source of rock for crushing due to the different rock bands. Owner does not want to sell rock.

SOUTH BURLINGTON ROCK DATA SHEET NO. 5

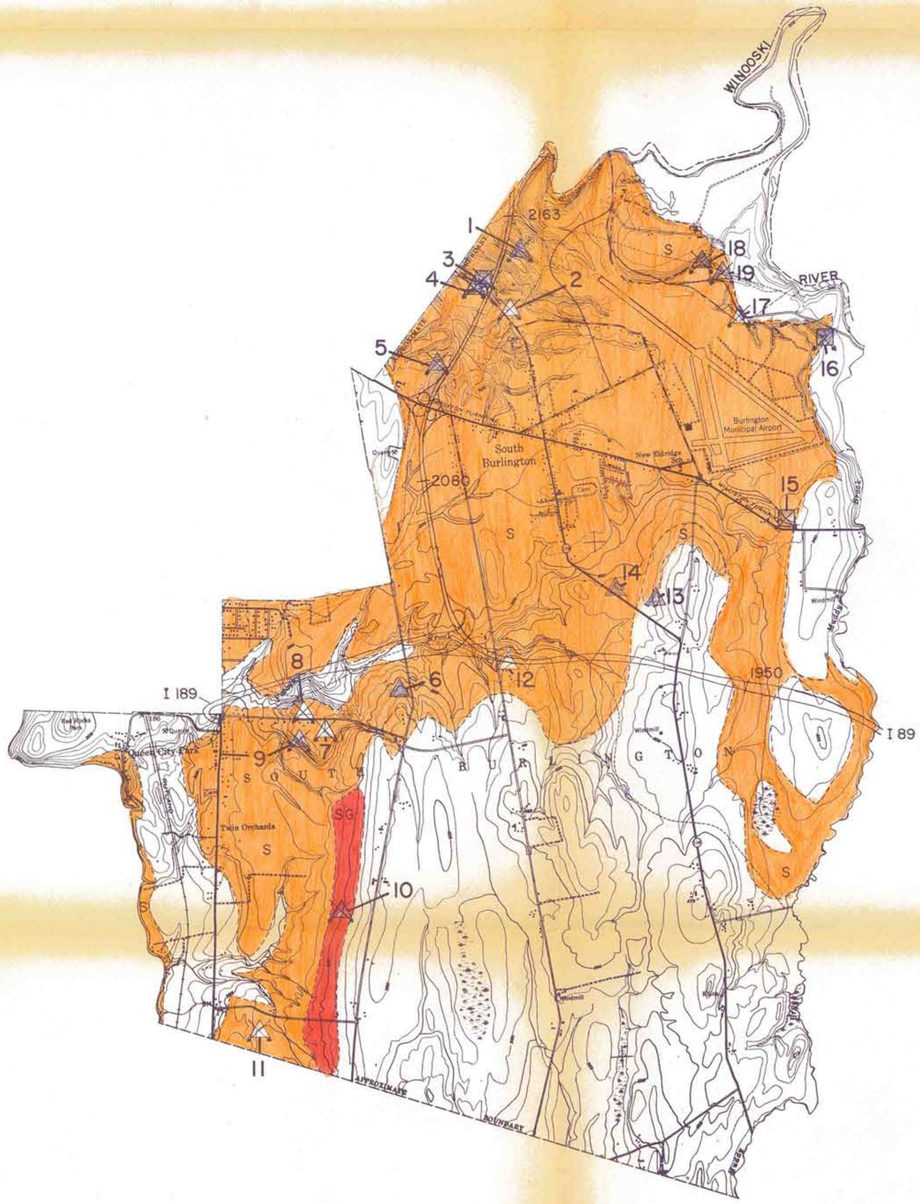
dent. No.	Field Test No.	Year Field Tested	Rock Type	Existing Quarry	Method of Sampling	Abrasion AASHO T-3	Distance Between Samples (ft)	Remarks
10	1	1960	Limestone	Yes	Chip	12.8	—	Owner: Allen Alfred. This is a small abandoned quarry. Rock was used as riprap along the Winooski River. Rock type: limestone with numerous calcite veins. Rock is too soft for use as Item 204 (sub-base of crushed rock).

SOUTH BURLINGTON GRANULAR PROPERTY OWNERS

PROPERTY OWNERS	IDENT. NO.
Alfred, Allen	18, 19
Barry, John S.	14
Calkins, Gus	15
Church of Christ	12
Deslaurier, Roland J. & E.S.	5
Dumas, Mose & Hildred	2
Hope and Farrell	9
Kirby, Madeline K.	3
Lozon, M.J.	11
Nowland, J.	10
O'Brien	13
O'Brien, L. & D.	16
Queen City Bowmen Club	6
South Burlington Town	2
United States Government	17
University of Vermont	4, 8
Wheelock, V.A.	7

SOUTH BURLINGTON ROCK PROPERTY OWNERS

PROPERTY OWNERS	IDENT. NO.
Alfred, Allen	10
Auclair, A.	7
Burlington City	1
Dubois, Homer	5
Economon, C.	3, 8
Hoskam, C.	6
Unknown (Known as Queen City Park Quarry)	2
Vosburg, M.	4
Wolf, G.	9



N

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
- □ GRANULAR BORROW, ITEM 102-A
- ▨ BORROW, ITEM 102
- ⛏ EXISTING PIT
- SG SAND & GRAVEL DEPOSIT
- S SAND DEPOSIT
- 3 IDENTIFICATION NUMBER (refer to data sheets)

SOUTH BURLINGTON

SCALE 1:31,250

1 0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1961

GRANULAR

MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

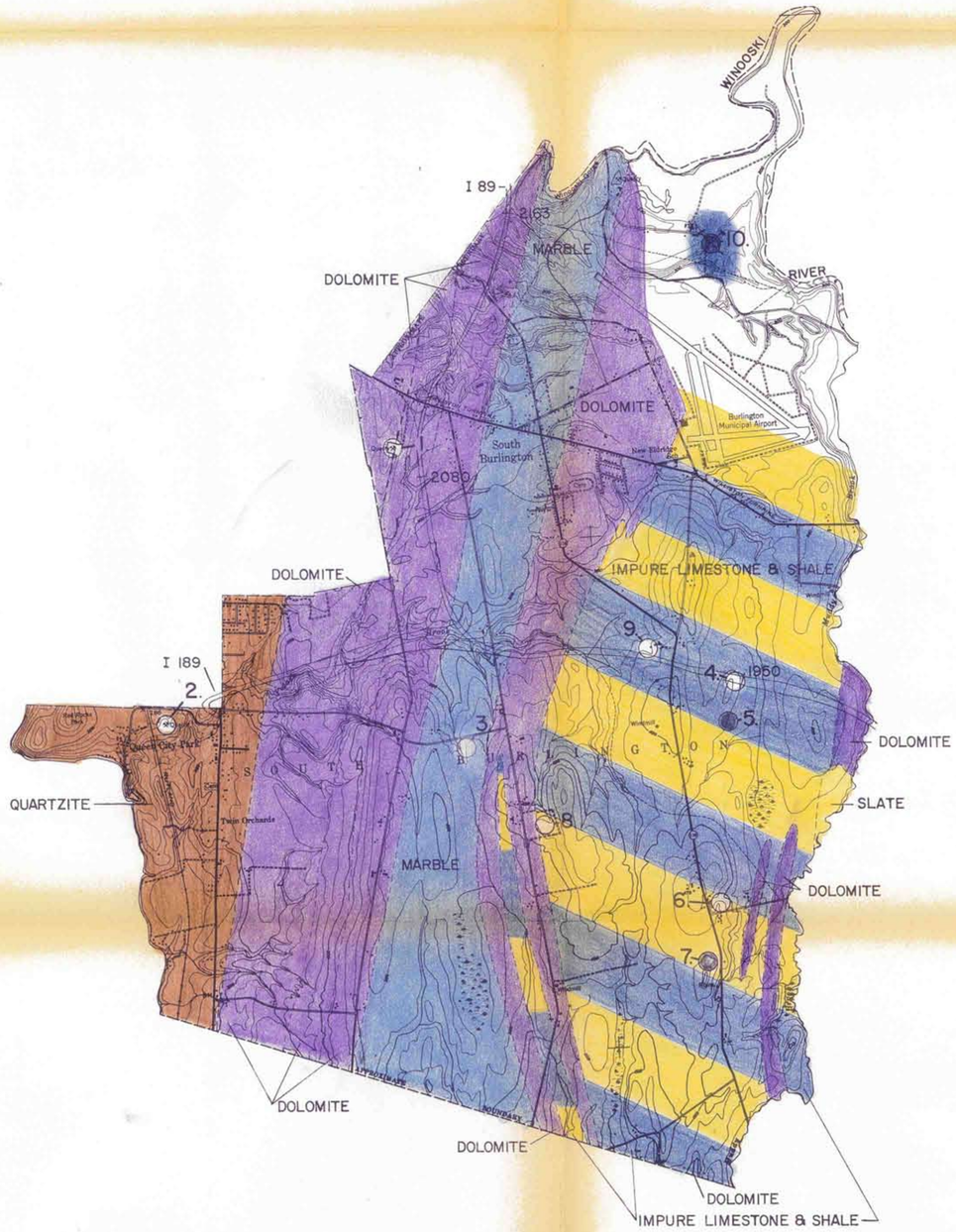
NOTE: BASED ON U.S.G.S. TOPOGRAPHIC MAPS

PLATE I GRANULAR

CHITTENDEN COUNTY VT. HWY. DISTRICT NO. 8

REVISIONS

DATE							
BY							



N

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, SHALES
- 3 IDENTIFICATION NUMBER (refer to text)

SOUTH BURLINGTON

SCALE 1:31,250

1 0.5 0 1 MILE

CONTOUR INTERVAL 20 FEET

1961

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 2

ROCK

CHITTENDEN COUNTY VT. HWY. DISTRICT NO. 8

REVISIONS

DATE						
BY						