

SURVEY OF HIGHWAY CONSTRUCTION MATERIALS  
IN THE TOWN OF BROOKFIELD, ORANGE COUNTY, VERMONT

prepared by

Engineering Geology Section - Materials Division  
Vermont Department of Highways

in cooperation with

United States Department of Commerce  
Bureau of Public Roads

Montpelier, Vermont

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### Acknowledgments

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 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 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 were surveyed and no over-all 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 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. 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.

#### Incllosures

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 Geological 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, 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, etc.) by which potential sources of gravel and sand may be recognized. This

information was obtained primarily from a survey being conducted by Professor 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 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, 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. 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 Brookfield is located in Orange County in the central portion of the State, approximately 25 miles west of the New Hampshire border. It is bounded on the north by the Towns of Williamstown and Northfield, on the west by the Town of Roxbury, on the south by the Towns of Braintree and Randolph, and on the east by the Town of Chelsea. The region is characterized by a broad U-shaped valley of the Second Branch of the White River. To the east and west of the valley, the altitude rises rapidly and steep ridges are common. Transverse valleys of post-glacial origin are V-shaped. Altitudes of 1500 to 1800 feet are not uncommon on the highest ridges, while the altitude along the White River is about 700-750 feet.

Drainage is into the numerous ponds, and Ayers Brook along Northfield Gulf, in the western part of the town. In the east, streams and brooks flow into the Second Branch of the White River, which flows southerly into the White River at Bethel.

### 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. 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, accessibility, 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. When deemed necessary, further samples are taken by drilling to a depth of approximately 3 feet and blasting across the strike or trend of the outcrop. When the material is uniform, and

satisfactory tests result from the chip samples, no further drilling, blasting, or sampling is done and the material source is included as being satisfactory.

#### Discussion of Rock and Rock Sources

It will be observed that the information on the surface-geology bedrock map in regard to rock type is simplified. For a more detailed description of the respective rock formations, a summary is included in this report. It is apparent from this summary that each formation may not be composed of one distinct rock type, but may be a complex mixture of rock types blending into one another. For this reason, the data sheets may describe the rock tested as differing from the designation on the map.

The rocks of the town of Brookfield are mainly metamorphic, consisting of schists, quartzites and limestones. The Gile Mountain formation includes gray quartz-muscovite phyllite or schist, with quartzite and some limestone. These were originally siliceous and calcareous sediments of marine origin.

The Waits River formation includes limestones weathered to a brown, earthy crust, with gray phyllite or schist. The Barton River Member of this formation includes siliceous limestones and phyllites.

Outcrops of any type rock in the town are extremely scarce. The few outcrops that do occur in the town, upon investigation, proved to be so limited and variable in character, that they were not sampled for highway usage.

### 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 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 to a depth of approximately 11 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 Brookfield are of glacial

origin. They occur along Vermont Route 14, in the broad U-shaped valley, as kames, kame terraces and outwash. There are outwash areas in the vicinity of West Brookfield, also.

The only material tested and found acceptable for highway usage occurs south of East Brookfield along Vermont Route 14. Acceptable gravel occurs here in Identification Numbers 5, 7, 8 & 9. Acceptable sand occurs south of South Branch School as shown by Identification Numbers 12 & 13.

It is possible that additional sources of acceptable material may be found other than those tested by the survey.

## Glossary of Selected Geologic Terms

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.

Fluvial - Pertaining to streams or stream action.

Gradation - As used in connection with sedimentation and fragmental products the term gradation refers to the frequency distribution of the various sized grains that constitute a sediment, soil, or other particulate material. The limits of each grain size are arbitrarily chosen.

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

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

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.

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.

Phyllite - A fine-grained foliated metamorphic rock intermediate between the mica schists and slates, into which it may grade. The cleavage is made possible by the development of a large amount of the potash mica, sericite, which also gives the rock a distinctive silvery appearance. Between the cleavage planes minerals other than mica usually predominate and garnet and pyrite may occur in visible crystals. Phyllite is usually light in color but various darker shades, even black, are found. Practically all phyllites are derived from fine-grained sedimentary rocks by mechanical deformation and recrystallization. The fracture is intermediate between the smooth, even cleavage of slate and the rather splintery fissility of schist; the rock is not as tough as slate.

Physiography - Broadly, it designates the study of the physical divisions of the globe-lands, seas, and atmosphere. Insofar as it applies to land forms, it is being replaced by the word geomorphology.

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.

Siliceous - Containing or pertaining to silica (Silicon dioxide,  $\text{SiO}_2$ ) or partaking of its nature.

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.

## Summary of Rock Formations in the Town of Brookfield

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

Waits River Formation - Gray quartzose and micaceous crystalline limestone weathered to distinctive brown earthy crust; interbedded and intergradational with gray quartz-muscovite phyllite or schist. Where more metamorphosed the limestones contain actinolite, hornblende, zoisite, diopside, wollastonite, andalusite, kyanite, or sillimanite.

Barton River Member of the Waits River Formation - interbedded siliceous crystalline limestone and sericite-quartz-chlorite phyllite in northern Vermont; diopsidic limestone and cordierite hornfels at contacts with granitic dikes and sills.

## Bibliography

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13. "Geology and Petrography of Randolph, Vermont", Charles H. Richardson and Charles K. Cabeen, Vermont State Geologist Report, Vol. 13, 1921-1922.
14. United States Department of The Interior, Geological Survey, Barre. Quadrangle, Vermont.
15. United States Department of the Interior, Geological Survey, Randolph Quadrangle, Vermont.

Partial Specifications for Highway Construction Materials as they apply to this report at date of publication. (For complete list of Specifications see "Standard Specifications for Highway and Bridge Construction" approved and adopted by Vermont Department of Highways).

Item 102A, Granular Borrow.

"The granular borrow shall be obtained from approved sources and shall consist of satisfactorily graded, free draining, hard, durable stone and coarse sand practically free from loam, silt, clay, and organic matter.

"The sand portion (material passing the No. 4 screen) shall have not more than ten per cent (10%) passing the No. 270 mesh sieve and shall show a color of not more than three and one-half ( $3\frac{1}{2}$ ) as determined by the colorimetric test described in the A.A.S.H.O. Method of test, Designation T-21.

"When used in connection with fine grading or in fills where piling is to be driven, the granular material shall all pass the nine (9) inch square opening screen."

Item 201A, Sub-base of Gravel.

"The gravel shall consist of material free from silt, loam, or clay. It shall be obtained from approved sources and meet the following requirements:

"Not less than forty (40) per cent stone shall be retained on No. 4 sieve.

"The percent of wear shall be not more than twenty-five (25) when tested by laboratory methods, using Method A.A.S.H.O. T-4.

"The stone portion of the gravel shall be uniformly graded from coarse to fine and the maximum size particles shall not exceed six (6) inches in diameter.

"The sand portion, when tested by laboratory methods using Method A.A.S.H.O. T-27, shall meet the grading requirements set up in the following table:

Minimum Per Cent of stone	Per Cent Passing Square Openings No. 100	Per Cent Passing Square Openings No. 270
40%	0-15	0-3
50%	0-15	0-4
60%	0-15	0-5

"The sand shall show a color of not more than three and one-half ( $3\frac{1}{2}$ ) as determined by the colorimetric test described in the A.A.S.H.O. Method of test, Designation T-21."

Item 202 Mod., Sub-base of Sand.

"The sand shall consist of material free from silt, loam, clay, or organic matter. It shall be obtained from approved sources and meet the following requirements:

"The sand, when tested by laboratory methods, using Method A.A.S.H.O. T-27, shall meet the grading requirements set up in the following table:

Square Openings	Per Cent Passing
$1\frac{1}{2}$ "	95-100
$5/8$ "	85-100
No. 4	70-100
No. 100	0-18
No. 270	0-5

"The sand shall show a color of not more than three and one-half ( $3\frac{1}{2}$ ) as determined by the colorimetric test described in the A.A.S.H.O. Method of test, Designation T-21."

Item 204, Sub-base of Crushed Rock.

"The percent of wear shall not be more than eight (8) when tested by laboratory methods, using Method A.A.S.H.O. T-3."

BROOKFIELD GRANULAR DATA SHEET NO. 1

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Overburden (FT)	Existing Pit	Sieve Analysis % Passing					Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						1 1/2"	5/8"	#4	#100	#270				
1	1	1963	1-10	0-1	Yes	-	-	66.9	39.0	12.0	2	-	-	Owner: Oscar Lamson. This was an old pit, just off Vt. Route 12, now used as a dump. Depleted. Testhole #1 dug 20' west of edge of pit. Material is till; with large flat stones in silt matrix. Fails for Item 201-A, sub-base of gravel. Contains only 33.1% stone. Minimum allowed is 40%. Has an excess of material passing #100 & #270 mesh sieve. Rejected for Item 102-A. Has 12% passing #270 mesh sieve. Maximum allowed is 10%.
2	1	1963	1-10	0-1	No	-	-	99.6	20.0	7.75	2	41.4%	Gran. Bor. (Grav.)	Owner: Harold Gage. A long field, with knolls, along-side Vt. Route 14. Test #1 dug 12' west of fence along road, Granular material, with sharp pointed rocks. Rejected for Item 201-A, sub-base of gravel. Has an excess of material passing #100 & #270 mesh sieves. Has percent of wear 41.4%. Maximum allowed is 25%.
	2	1963	1-9	0-1	No	100	100	99.6	77.0	16.0	1 1/2	-	-	Test #2 dug 400' north of Test #1 on slope of higher knoll. Fine sand; a small

\* Percentane of Total Sample.

BROOKFIELD GRANULAR DATA SHEET NO. 2

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis					Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						% Passing								
						1 1/2"	5/8"	#4	#100	#270				
														band, near top, of stony material. Rejected for Item 202 Mod., sub-base of sand & Item 102-A, granular borrow. Has an excess of material passing #100 & #270 mesh sieves.
3	1	1963	1-10	0-1	No	-	-	57.3	21.0	11.25	1 1/2	-	-	Owner: Arthur Sprague. Test #1 dug 60' west of fence at foot of hill. Till, with large flat stones. Rejected for Item 201-A, sub-base of gravel & Item 102-A, granular borrow. Has excess material passing #100 & #270 mesh sieves. Insufficient proper size stones for abrasion test.
	2A	1963	1-4	0-1	No	-	-	41.3	23.0	8.5	2	45.6%	Gran. Bor. (Grav.)	Test #2 taken across Vt. Route 14 from schoolhouse. Top of hole is coarse gravel (some stones over 6"); lower portion is medium sand, with silt & water at 10'. Top portion rejected for Item 201-A, sub-base of gravel. Excess passing #100 & #270 mesh sieves. Percent of wear 45.6%.
	2B	1963	4-10	-	No	100	100	100	97.0	45.0	1	-	-	Lower portion fails for Item 202 Mod., sub-base of sand & Item 102-A,

BROOKFIELD GRANULAR DATA SHEET NO. 3

Ident. No.	Field Test No.	Year Tested	Depth of Sample (FT)	Over-burden (FT)	Existing Pit	Sieve Analysis % Passing					Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						1 1/2"	5/8"	#4	#100	#270				
														granular borrow. Excess passing #100 & #270 mesh sieves.
4	1	1963	1-10	0-1	No	-	-	63.7	18.0	5.75	1 1/2	-	Gran. Bor. (Grav.)	Owner: John Wheatley. Test #1 taken behind vacant house, on knoll. Fine gravel on top getting coarser with depth. Contains only 36.3% stone. Minimum allowed is 40%. Has an excess of material passing #100 & #270 mesh sieves. Acceptable for Item 102-A, granular borrow.
	2	1963	1.5-10	0-1.5	No	-	-	46.2	18.0	6.75	2	36.8%	Gran. Bor. (Grav.)	Test #2 dug 485' north of vacant tenant house, 65' left of Vt. Route 14 centerline. Gravel, with quite a few soft stones. Rejected for Item 201-A, sub-base of gravel. Has percent of wear 36.8%. Maximum allowed is 25%. Acceptable for Item 102-A, granular borrow.
5	1A	1963	0.5-7	0-0.5	No	-	-	55.5	12.0	6.5	1 1/2	38.8%	Gran. Bor. (Grav.)	Owner: Albert Martin. Test #1 dug on knoll west of pasture alongside Vt. Route 14. Dirty gravel, with few stones. Clean Sand at 7'. Top portion fails for Item 201-A, sub-base of gravel,

BROOKFIELD GRANULAR DATA SHEET NO. 4

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						% Passing							
						1 1/2"	5/8"	#4	#100	#270			
1B	1963	7-9	-	No	93.8	93.8	74.9	6.0	2.0	2 1/2	-	Gran. Bor. (Sand)	on the #270 mesh, and has percent of wear 38.8%. Acceptable for Item 102-A, granular borrow. Lower portion rejected for Item 202 Mod., sub-base of sand. Has 93.8% passing 1 1/2" screen. Minimum allowed is 95%. Acceptable for Item 102-A.
2	1963	1-10	0-1	No	-	-	49.3	16.0	7.0	1	22.4%	Gran. Bor. (Grav.)	Test #2 dug in flat at foot of knoll, behind house. Has slight excesses passing #100 & #270 mesh sieves. Rejected for Item 201-A.
3	1963	1-10	0-1	No	-	-	55.9	28.0	12.5	1 1/2	-	-	Acceptable for Item 102-A, Test #3 dug on knolls west of pasture north of house. Material is bouldery till, with ledge or boulders at 10'. Very hard digging. Rejected for Item 201-A, sub-base of gravel & Item 102-A, granular borrow.
4	1963	0.5-10	0-0.5	No	-	-	32.9	25.0	9.0	1 1/2	-	Gran. Bor. (Grav.) (Sand)	Test #4 dug 410' east of and downhill from, Test #3, in knoll. Rejected for both Item 201-A, sub-base of gravel & Item 202 Mod., sub-base of sand. Too much stone for sand; too much material passing #100 & #270 sieves. Acceptable

\* Percentage of Total Sample...

BROOKFIELD GRANULAR DATA SHEET NO. 5

Ident. No.	Field Test No.	Year Tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis			Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks	
						% Passing	#100	#270					
5	1963	1-11.5	0-1	No	-	-	39.7	10.0	5.0	1	31.2%	Gran. Bor. (Grav.)	for Item 102-A, granular borrow. Insufficient proper size stone for the abrasion test. Test #5 taken 570' southwest of Test #4. Gravelly material, rejected for Item 201-A. Has percent of wear 31.2%. Maximum allowed is 25%. Acceptable for Item 102-A, granular borrow.
6	1963	1-7	0-1	No	87.8	83.1	71.2	46.0	17.25	3	-	-	Test #6 dug 430' south of Test #5. Poor material. Dirt, with what looks like broken ledge-flat stones, (soft & shaly). Rejected for Item 201-A, sub-base of gravel, Item 202 Mod., sub-base of sand, & Item 102-A, granular borrow. Has excess passing #100 & #270 mesh sieve. Contains only 28.8% stone. Minimum allowed is 40%. Insufficient stone for abrasion test.
7	1963	0-7.5	Stripped	Yes	-	-	43.6	15.0	5.0	2	53.4%	Gran. Bor. (Grav.)	Test #7 dug in northwest end of pit (in floor). Possible extension of pit is to the north. Coarse gravel, with water at 7.5'. Rejected for Item 201-A, sub-base of gravel.

\* Percentage of Total Sample.

BROOKFIELD GRANULAR DATA SHEET NO. 6

Ident. No.	Field Test No.	Year Tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis % Passing			Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks		
						1 1/2"	5/8"	#4						
	3	1963	1-11	0-1	Yes	-	-	38.2	11.0	5.0	1	26.2%	Gran. Bor. (Grav.)	Has percent of wear 53.4%. Maximum allowed is 25%. Has a slight excess of material passing #270 mesh sieve. Acceptable for Item 102-A, granular borrow. Test #8 dug 120' north of pit, 140' east of road. Gravel here resembles that in pit. Coarse on top, finer (with nice cobble stones) at depth. Variety in stone size from "pea-stone" to over 6". Slightly "dirty" matrix. Rejected for Item 201-A, sub-base of gravel. Has percent of wear 26.2%. Maximum allowed 25%. Acceptable for Item 102-A, granular borrow.
	9	1963	2-12	Stripped	Yes	-	-	32.6	6.0	2.0	1	17.8%	Gravel	Test #9 dug in north face of pit. Coarse gravel; sampled 2'-12', unable to reach top 2'. Presently being used by town. Acceptable for Item 201-A, sub-base of gravel & Item 102-A, granular borrow.
6	1	1963	1-10	0-1	No	-	-	41.2	9.0	3.0	1 1/2	26.4%	Gran. Bor. (Grav.)	Owner: Fred Holmes. Test #1 taken 175' west of brook, 55' south of fence. Knoll resembles an esker. At 10' turns into dirt

BROOKFIELD GRANULAR DATA SHEET NO. 7

Ident. No.	Field Test No.	Year Tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis					Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks	
						% Passing									
						1 1/2"	5/8"	#4	#100	#270					
	2	1963	1-11	0-1	No	-	-	24.0	12.0	4.0	1 1/2	31.6%	Gran. Bor. (Grav.)	with a few flat, small stones. Rejected for Item 201-A, sub-base of gravel. Has percent of wear 26.4%. Maximum allowed is 25%. Acceptable for Item 102-A, granular borrow. Test #2 taken 500' south of test #1 along knoll. Rejected for Item 201-A, sub-base of gravel. Has percent of wear 31.6%. Maximum allowed is 25%. Acceptable for Item 102-A, granular borrow.	
7	1	1963	1-10	0-1	Yes	-	-	58.2	17.0	6.5	1 1/2	43.2%	Gran. Bor. (Grav.)	Owner: Seward Osha. Test #1 on knoll across Vt. Route 14 from pit. Material is dirt, with large coarse, sharp rocks; some flat, "slaty-type" stones. Rejected for Item 201-A, sub-base of gravel. Has an excess of material passing #100 & #270 mesh sieves. Has percent of wear 43.2%. Maximum allowed is 25%. Acceptable for Item 102-A, granular borrow.	
	2	1963	1-10	0-1	No	-	-	70.8	44.0	20.5	1 1/2	-	-	-	Test #2 dug 310' east of test #1. Dirty till, with silt & clay bottom. Has excess material passing

BROOKFIELD GRANULAR DATA SHEET NO. 8

Ident. No.	Field Test No.	Year Tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis					Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						% Passing								
						1 1/2"	5/8"	#4	#100	#270				
3	1963	0.5-10.5	0-0.5	No	100	100	90.9	73.0	35.0	1 1/2	-	-	#100 & #270 mesh sieves. Insufficient proper size stone for abrasion test. Rejected for Item 102-A, granular borrow. Has 20.5% passing #270 mesh sieve. Maximum allowed is 10%. Test #3 dug 300' northeast of test #2, near brook. Sand, with silt & clay. Water at 10'. Rejected for Item 202 Mod., sub-base of sand & Item 102-A, granular borrow. Has an excess of material passing #100 & #270 mesh sieves. Test #4 dug in floor of pit. Sharp, angular stones with dirty, silt matrix. Pit is depleted. Some boulders over 2'. Rejected for both Item 201-A, sub-base of gravel & Item 102-A, granular borrow. Has excess material passing #100 & #270 mesh sieves. Insufficient proper-size stone for percent of wear test. Sample contains only 34.2%. Minimum allowed 40%.	
4	1963	0.5-7.5	0-0.5	Yes	-	-	65.8	54.0	18.5	1	-	-	Test #5 taken in east face of pit, where extension lies, (uphill). Alternate	
5	1963	0.5-10	0-0.5	Yes	-	-	70.6	12.0	3.25	1 1/2	-	Gran. Bor. (Grav.)		

\* Percentage of Total Sample.

BROOKFIELD GRANULAR DATA SHEET NO. 9

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Overburden (FT)	Existing Pit	Sieve Analysis					Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						% Passing								
						1 1/2"	5/8"	#4	#100	#270				
														layers of fairly coarse sand & Gravel. Layers 6"-1' thick. Rejected for Item 201-A, sub-base of gravel. Contains only 29.4% stone. Minimum allowed is 40%. Insufficient proper size stone for percent of wear test. Acceptable for Item 102-A, granular borrow.
8	1	1963	1.5-11.5	0-1.5	No	-	-	41.3	14.0	5.75	2 1/2	32.8%	Gran. Bor. (Grav.)	Owner: Dudley Nichols. A large field across from house, 170' from fence along road, 150' from fence to the north. Nice looking gravel, rejected for Item 201-A, sub-base of gravel. Has percent of wear 32.8%. The maximum allowed is 25%. Has excess material passing #270 mesh. Acceptable for Item 102-A, granular borrow.
	2	1963	1-11	0-1	No	-	-	46.8	12.0	5.0	1 1/2	29.4%	Gran. Bor. (Grav.)	Test #2 dug 240' south of test #1, across from house. Gravel, rejected for Item 201-A, Has percent of wear 29.4%. Maximum allowed 25%. Has excess passing #270 mesh. Acceptable for Item 102-A, granular borrow.

BROOKFIELD GRANULAR DATA SHEET NO. 10

Ident. No.	Field Test No.	Year Field tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks	
						1 1/2"	5/8"	#4	#100					#270
3		1963	1-11	0-1	No	-	-	49.7	10.0	3.5	1 1/2	24.2%	Gravel	Test #3 dug south of test #1 & #2, along Vt. Route 14. Good-looking gravel, acceptable for Item 201-A, sub-base of gravel & Item 102-A, granular borrow.
4		1963	1-10.5	0-1	No	-	-	39.8	6.0	3.0	1 1/2	23.2%	Gravel	Test #4 dug 48' west of fence along brook. Beautiful looking gravel, acceptable for Item 201-A, sub-base of gravel & Item 102-A, granular borrow.
5		1963	1-8	0-1	No	100	100	100	82.5	71.2	-	-	-	Test #5 taken in depression north of test #4. Apparently out of the gravel, now. About a 10' depression, water at 8'. Rejected for Item 202 Mod., sub-base of sand & Item 102-A, granular borrow. Sieve Analysis-Total Sample. Sieve Size      % Passing 3"                100.0 1"                93.0 3/4"             91.4 3/8"             84.2 No. 4             79.8 No. 10            76.0 No. 40            71.2 No. 100          65.8 No. 200          60.2 No. 270          56.8 Soil Type A-4.

BROOKFIELD GRANULAR DATA SHEET NO. 11

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Overburden (FT)	Existing Pit	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks	
						1 1/2"	5/8"	#4	#100					#270
	6	1963	2-11	0-2	No	-	-	43.9	20.0	6.5	2	47.8%	Gran. Bor. (Grav.)	Test #6 taken north of depression, in field. Gravel, with more soft, flat stones than previous tests. Rejected for Item 201-A, sub-base of gravel. Has excess passing #100 & #270 mesh sieves. Has a percent of wear 47.8%. Maximum allowed is 25%. Acceptable for Item 102-A, granular borrow.
	7	1963	2-10	0-2	No	-	-	47.3	17.0	5.25	1	56.6%	Gran. Bor. (Grav.)	Test #7 taken in field west of test #6. Gravel (not many stones and soft). Water at 10'. Rejected for Item 201-A, sub-base of gravel. Has excess material passing #100 & #270 mesh sieve. Has percent of wear 56.6%. Maximum allowed is 25%. Acceptable for Item 102-A, granular borrow.
	8	1963	1-10	0-1	No	-	-	61.5	12.0	4.5	1 1/2	52.2%	Gran. Bor. (Grav.)	Test #8 dug 560' south of test #7, to check cut extension of test #4. Gravel contains only 38.5% stone. Minimum allowed is 40%. Has percent of wear 52.2%. Maximum allowed is 25%. Has slight excess passing #270 mesh sieve for this stone content (38.5%). Acceptable for Item 102-A, granular borrow.

BROOKFIELD GRANULAR DATA SHEET NO. 12

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks	
						1 1/2"	5/8"	#4	#100					#270
	9	1963	1-10	0-1	No	100	100	98.8	23.0 *22.7	5.0 *4.94	1 1/2	-	Gran. Bor. (Sand)	Test #9 taken on knoll southeast of house & barn. Good-looking sand, apparently limited to knoll itself. Rejected for Item 202 Mod., sub-base of sand. Has excess passing #100 mesh sieve. Acceptable for Item 102-A, granular borrow.
9	1	1963	0-6	Stripped	Yes	-	-	36.0	8.0	3.75	1	13.0%	Gravel	Owner: E & R. Montgomery. A large pit behind house & barn. Extension of pit remains to the north & west. Gravel, nice rounded stones. Water at 4.5'. Acceptable for Item 201-A, sub-base of gravel & Item 102-A, granular borrow.
	2	1963	0-12	Stripped	Yes	-	-	33.3	9.0	3.0	1 1/2	21.6%	Gravel	Test #2 dug in north face of pit. Gravel face of 12'. Plenty of nice round stones. Acceptable for Item 201-A, sub-base of gravel & Item 102-A, granular borrow.
	3	1963	1-10	0-1	Yes	-	-	28.4	20.0	7.5	2	24.8%	Gran. Bor. (Grav.)	Test #3 dug 225' west of pit in large field. Good-looking gravel, rejected for Item 201-A, sub-base of gravel. Has excess passing #100 & #270 mesh sieves. Acceptable for Item 102-A.

\* Percentage of Total Sample.

BROOKFIELD GRANULAR DATA SHEET NO. 13

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Overburden (FT)	Existing Pit	Sieve Analysis					Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						1 1/2"	5/8"	#4	#100	#270				
	4	1963	0.5-10	0-1	Yes	100	100	100	54.0	12.0	1 1/2	-	Gran. Bor. (Sand)	Test #4 dug 325' southwest of test #3. Bands of sand & silt. Rejected for Item 202 Mod., sub-base of sand & Item 102-A, granular borrow.
	5	1963	1-11	0-1	No	100	100	98.1	54.0 *53.0	6.0 *5.8	3 1/2	-	Gran. Bor. (Sand)	Test #5 dug on knoll east of Vt. Route 14 and house. Large sand area, rejected for Item 202 Mod. sub-base of sand & Item 102-A, granular borrow.
10	1	1963	1-10	0-1	Yes	100	93.1	86.8	79.0 *68.6	31.25 *27.13	1-	-	-	Owner: Walter Wheatley. An old depleted pit along-side Vt. Route 14. Sandy silt. Extension is to the north, where test #1 is dug. (110' north of pit).. Rejected for Item 202 Mod. sub-base of sand & Item 102-A, granular borrow. Has an excess of material passing #100 & #270 mesh.
11	1	1963	0-8	Stripped	Yes	-	-	37.3	9.0	4.0	1	28.0%	Gran. Bor. (Grav.)	Owner: Wayne Wheatley. This pit is uphill (east) from Walter Wheatley's pit. At present, pit is being used by town. Good-looking gravel, with water at 7'. Rejected for Item 201-A, sub-base of

\* Percentage of Total Sample.

BROOKFIELD GRANULAR DATA SHEET NO. 14

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks	
						% Passing								
						1 1/2"	5/8"	#4	#100					#270
	2	1963	1-10	0-1	Yes	100	100	100	71.0	22.0	1	-	-	gravel. Acceptable for Item 102-A, granular borrow. Test #2 taken northeast of pit, on ridge. Bands of fine, medium & coarse sand. Rejected for Item 202 Mod. sub-base of sand & Item 102-A, granular borrow. Has an excess passing #100 & #270 mesh sieves.
	3	1963	1-10	0-1	Yes	100	100	100	14.0	3.75	2 1/2	-	Sand	Test #3 dug in depression along top (east) of pit. The material is sand, acceptable for Item 202 Mod. sub-base of sand & Item 102-A, granular borrow.
	4	1963	2.5-17.0	Stripped	Yes	-	-	50.6	12.0	4.75	3	32.0%	Gran. Bor. (Grav.)	Test #4 dug in east face of pit, by handshovel. Gravel, fine on top, coarser with depth. Rejected for Item 201-A, sub-base of gravel. Has 32% wear. Maximum allowed is 25%. Has 4.75% passing #270 mesh. Maximum allowed is 3.0%.
12	1	1963	0.5-11	0-0.5	Yes	100	100	91.0	2.0	1.0	1	-	Sand	Owner: Wayne Wheatley. A large pit, south of house. Test #1 taken in floor of pit. Good, clean sand all the way, (fairly coarse). Acceptable for Item 202 Mod. sub-base of gravel

\* Percentage of Total Sample.

BROOKFIELD GRANULAR DATA SHEET NO. 15

Ident. No.	Field Test No.	Year Tested	Depth of Sample (FT)	Overburden (FT)	Existing Pit	Sieve Analysis					Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						% Passing								
						1 1/2"	5/8"	#4	#100	#270				
2		1963	5-20	Stripped	Yes	100	94.0	84.2	9.0 *7.6	3.0 *2.5	1 1/2	-	Sand	& Item 102-A, granular borrow. Test #2 dug in south face of pit. Sloughed in. Gravel on top, for about 5'. Sampled sand portion, (5'-20'). Acceptable for Item 202 Mod. sub-base of sand & Item 102-A, granular borrow.
3		1963	1-10	0-1	Yes	100	100	85.7	8.0 *6.9	3.0 *2.6	2	-	Sand	Test #3 dug 330' south of pit in field. Stony, coarse sand, sand bottom. Extension of pit into this large field. Acceptable for Item 202 Mod. sub-base of sand & Item 102-A, granular borrow.
13	T	1963	0.5-10	0-0.5	No	100	100	99.2	9.0 *8.9	3.0 *2.98	1 1/2	-	Sand	Owner: E & R. Montgomery. Test #1 taken 160' north of pit in huge field planted to oats. Medium sand, all the way. Acceptable for Item 202 Mod. sub-base of sand & Item 102-A, granular borrow.
2		1963	0-6	Stripped	Yes	100	100	90.7	10.0 *9.1	3.0 *2.7	1 1/2	-	Sand	Test #2 taken in floor of old sand pit. Pit is now quite overgrown and sloughed in. Medium sand, with silt bottom. Acceptable for Item 202 Mod.,

\* Percentage of Total Sample.

BROOKFIELD GRANULAR DATA SHEET NO. 16

Ident. No.	Field Test No.	Year Tested	Depth of Sample (FT)	Overburden (FT)	Existing Pit	Sieve Analysis % Passing				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks	
						1 1/2"	5/8"	#4	#100					#270
													sub-base of sand & Item 102-A, granular borrow.	
14	1A	1963	1-4	0-1	Yes	100	98.6	97.2	19.0	2.5	1	--	Gran. Bor. (Sand)	Owner: Mrs. Jarvis Kibby. Test #1 dug in floor of small pit along Vt. Rte. 14. Top of hole is coarse sand, gravel bottom. Test #1A rejected for Item 202 Mod., sub-base of sand. Has an excess of material passing #100 mesh sieves. Acceptable for Item 102-A, granular borrow.
	1B	1963	4-10	0-1	Yes	--	--	51.0	10.0	3.5	1 1/2	27.8%	Gran. Bor. (Grav.)	Test #1B represents bottom of hole. Gravelly material rejected for Item 201-A, sub-base of gravel. Has per cent of wear 27.8%. Maximum allowed is 25%. Has a slight excess passing #270 mesh sieve. Acceptable for Item 102-A, granular borrow.
	2	1963	1-9	0-1	No	--	--	49.9	7.0	3.25	1	35.0%	Gran. bor. (Grav.)	Test #2 dug on knoll above pit. Gravelly material, rejected for Item 201-A, sub-base of gravel. Has percent of wear 35%. Maximum allowed is 25%. Acceptable for Item 102-A, granular borrow.

\* Percentage of Total Sample.

BROOKFIELD GRANULAR DATA SHEET NO. 17

Ident. No.	Field Test No.	Year Tested	Depth of Sample (FT)	Overburden (FT)	Existing Pit	Sieve Analysis					Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						1 1/2"	5/8"	#4	#100	#270				
15	1	1963	2-10	0 2	No	100	100	100	88.0	66.0	1	-	--	Owner: Harold Lamson. A large knoll above field alongside Vt. Route 14, about the same level as knoll containing Kibby & Montgomery pits. Silty sand, rejected for Item 202 Mod., sub-base of sand & Item 102=A, granular borrow. Has excess passing #100 & #270 mesh sieve.
16	1	1963	0.5 10	0 0.5	No	100	100	97.8	73.0	41.0	1	-	-	Owner: Harry Dunham. A large field north of house. Test #1 dug on knoll in north end of field, 163' west of brook. Sandy material, rejected for Item 202 Mod., sub-base of sand & Item 102=A, granular borrow. Has excesses passing #100 & #270 mesh sieves.
17	1	1963	2.5-9.5	0-2.5	No	79.7	74	66.9	14.0	5.0	1 1/2	--	Gran. Bor. (Sand)	Owner: Arthur Gaylord. Test #1 taken on ridge tight up against Vt. Rte. 14. Stony sand, rejected for Item 202 Mod. sub base of sand. Acceptable for Item 102=A, granular borrow.
18	1	1963	1-4	0=1	No	73.3	60.6	54.7	40.0	16.25	2			Owner: Kenneth Tabor. A large field east of Tabor

\* Percentage of Total Sample

BROOKFIELD GRANULAR DATA SHEET NO. 1

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Overburden (FT)	Existing Pit	Sieve Analysis				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						% Passing 1/2"	5/8"	#4	#100				
													house. Test #1 dug 45' east of Sta. 1987+00 centerline Med. Dirt with some boulders & broken ledge. Ledge at 4'. Rejected for Item 102-A, granular borrow. Has 16.2% passing #270 mesh sieve. Maximum allowed is 10%.
19	1	1963	1-6	0-1	Yes	--	29.7	12.0	5.0	2	34.2%	Gran. Bor. (Grav.)	Owner: Alan Maloney. A small pit, behind barn, off Vt. Route 12. Pit bottom is 'wet looking'. Any extension would be southerly, but Test #1 taken 35' south of pit, poor material. Quite a variety of sizes & shapes of stones. Water at 6'. Also, sand in bottom. Rejected for Item 201-A, sub base of gravel. Has percent of wear 34.2%. Maximum allowed is 25%. Acceptable for Item 102-A, granular borrow.
20	1	1963	1-10	0-1	No	--	41.0	27.0	14.75	1 1/2	40.2%	--	Owner: Sanford Small. A large field across road from old overgrown pit. Stony till; many flat stones, dirty matrix.

**BROOKFIELD GRANULAR DATA SHEET NO. 19**

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Overburden (FT)	Existing Pit	Sieve Analysis				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks	
						1 1/2"	5/8"	#4	#100					#270
													Rejected for Item 201-A, sub base of gravel. Has excess passing #100 & #270 mesh sieves. Has percent of wear 40.2%. Maximum allowed is 25%. Rejected for Item 102-A, granular borrow. Has 14.75% passing #270 mesh. Maximum allowed is 10%.	
21	1	1963	1-8	0-1	No	-	-	48.0	42.0	21.25	2	-	-	Owner: Mrs. Gladys Wiggett. A large pasture along Vt. Route 12. Test #1 dug 625' south of barway. Stony till, & dirt with broken ledge. Rejected for Item 201-A, sub base of gravel & Item 102-A, granular borrow. Has excess passing the #100 & #270 mesh sieves.
									*20.16	*8.67				
22	1	1963	1-0	0-1	No	-	-	52.6	46.0	22.5	2 1/2	-	-	Owner: Lloyd Dupras. A large hill with ledge showing. Test #1 dug on top of hill, south of house. Huge boulders in sandy dirty matrix. Had to quit digging at 6'. Rejected for both Item 201-A, sub base of gravel & Item 102-A, granular borrow. Excess passing

\* Percentage of Total Sample

BROOKFIELD GRANULAR DATA SHEET NO. 20

Ident. No.	Field Test No.	Year Field Tested	Depth of Sample (FT)	Over-burden (FT)	Exist-ing Pit	Sieve Analysis				Color AASHO T-21	Abrasion AASHO T-4-35	Passes VHD Spec.	Remarks
						1 1/2"	5/8"	#4	#100 #270				
													the #100 & #270 mesh sieves. Insufficient proper size stone for percent of wear test.

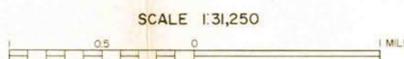


APPROXIMATE LOCATION 

### LEGEND

-  GRAVEL, ACCEPTABLE FOR ITEM 201-A (sub-base of gravel)
-  GRAVEL, DEPLETED OR NOT ACCEPTABLE FOR ITEM 201-A
-  SAND, ACCEPTABLE FOR ITEM 202 (sub-base of sand) Mod.
-  SAND, DEPLETED OR NOT ACCEPTABLE FOR ITEM 202 Mod.
-  GRANULAR BORROW, ITEM 102-A
-  MATERIAL NOT ACCEPTABLE FOR ITEM 102-A
-  EXISTING PIT
-  SAND & GRAVEL DEPOSIT
-  SAND DEPOSIT
-  IDENTIFICATION NUMBER (refer to data sheets)

## BROOKFIELD



CONTOUR INTERVAL 20 FEET

1964

## 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

DATE				
BY				

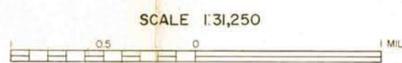


APPROXIMATE LOCATION

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, SHALES, CONGLOMERATES
- 3** IDENTIFICATION NUMBER (refer to data sheets)

BROOKFIELD



CONTOUR INTERVAL 20 FEET

1964

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

DATE					
BY					