# SURVEY OF HIGHWAY CONSTRUCTION MATERIALS
# IN THE TOWN OF FRANKLIN, FRANKLIN COUNTY, VERMONT

prepared by

Engineering Geology Section, Materials Division

Vermont Department of Highways

in cooperation with

United States Department of Transportation

Federal Highway Administration

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Acknowledgements

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

1. Various departments and individuals of the Vermont State Department of Highways, notably the Planning and Mapping Division and the Highway Testing Laboratory.

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

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

4. United States Department of Commerce, Bureau of Public Roads.

History

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

on materials sources available beforehand. Prior knowledge of locations of suitable material is an important factor in planning future highways.

The sources of construction materials are located by this Project through ground reconnaissance study of maps and aerial photographs, and geological and physiographic interpretation. Maps, data sheets, and work sheets for reporting the findings of the Project were designed with their intended use in mind. These maps and data sheets were devised to furnish information of particular use to the contractor or construction man. For maximum benefit, the maps, data sheets, and this report should be studied simultaneously.

Inclosures

Included in this folder are two surface-geology maps, one defining the location of tests conducted on bedrock sources, the other defining the location of tests conducted on granular materials. These maps are derived from 15-minute or 7½-minute quadrangles of the United States Geological Survey enlarged or reduced to 1:31250 or 1" = 2604'. Delineated on the Bedrock Map are the various rock types of the area. This information was obtained from numerous sources: Vermont Geological Survey Bulletins, Vermont State Geologist Reports, United States Geological Survey Bedrock Maps, and the Centennial Geological Map of Vermont, as well as other references.

The granular materials map depicts areas covered by various types of glacial deposits (outwash, moraines, kames, kame terraces, eskers, etc.) by which potential sources of gravel and sand may be recognized. This information was obtained primarily from a survey conducted by Professor D. P. Stewart of Miami University, Oxford, Ohio, who had been mapping the glacial features of Vermont during the summer months since 1956. Further

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

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

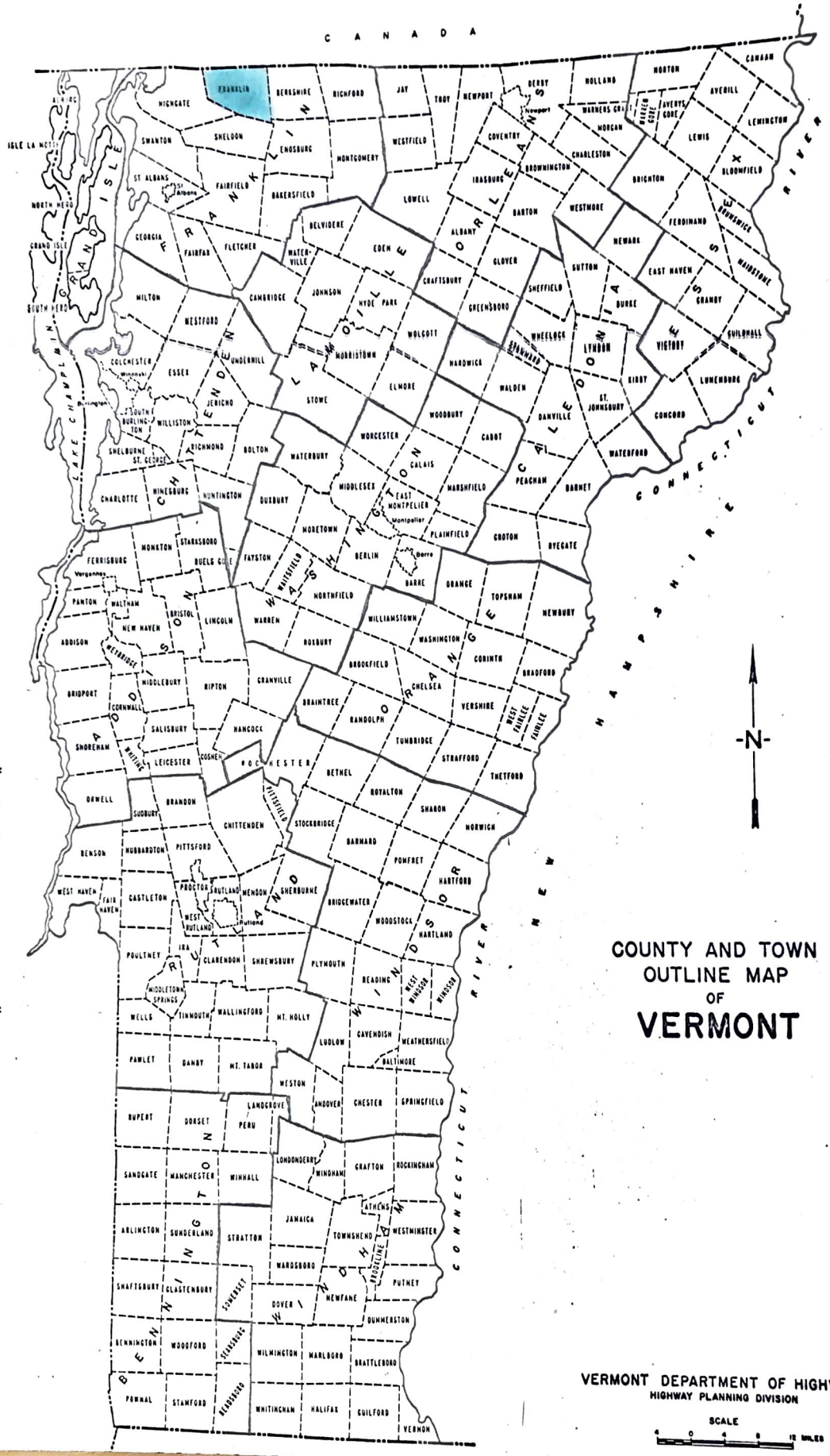
Work sheets contain more detailed information on each test and a detailed sketch of each identification Number Area. The work sheets and laboratory reports are on file in the office headquarters of this Project.

## LOCATION

The town of Franklin is situated at the north end of Franklin County in the northwest corner of Vermont; and is bounded on the north by the Province of Quebec, Canada; on the east by Berkshire and Enosburg, on the south by Sheldon, and on the southwest by Highgate. (See County and Town Outline Map of Vermont on the following page.)

Franklin lies within the Champlain Lowland Physiographic Subdivision of the Sedimentary Appalachians. The town is underlain by mostly sedimentary rocks which have produced a low rolling topography with scattered hills, only two of which have as much as 400 feet of relief. The hills trend northeast-southwest, with a maximum elevation of 940' on a hilltop about one and one-tenth miles northwest of the southeast corner of the town. The lowest elevation is less than 240' where the Rock River crosses the Highgate Town Line.

Principal drainage is westward, via the Rock River, and southward, via McGowan Brook and other unnamed tributaries of the Missisquoi River. The most notable body of water in Franklin is Lake Carmi in the east-cental part of the town.


CANADA
NEW YORK
NEW HAMPSHIRE
CONNECTICUT RIVER
LAKE CHAMPLAIN
ISLE LA MOTTE
NORTH HERO
GRAND ISLE
SOUTH HERO
FRANKLIN
GRAND ISLE
LAMOILLE
ORLEANS
ESSEX
CHITTENDEN
WASHINGTON
CALEDONIA
ORANGE
ADDISON
RUTLAND
WINDSOR
WINDHAM
BENNINGTON
-N-
COUNTY AND TOWN
OUTLINE MAP
OF
VERMONT
VERMONT DEPARTMENT OF HIGHWAYS
HIGHWAY PLANNING DIVISION
SCALE
4 0 4 8 12 MILES
AUGUST, 1967

# SURVEY OF ROCK SOURCES

## Procedure for Rock Survey

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

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

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

## Discussion of Rock and Rock Sources

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

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

The rocks in Franklin trend between north-south and northeast-southwest. Of the four outcrops sampled from a band of rocks near the central part of town, two were in the Cheshire quartzite and two were in the Bridgeman Hill dolomite.

Progressing from west to east, the rock formations are: Morses Line and the Sweetsburg slates (which were too thin-bedded to sample); the Bridgeman Hill dolomite, which yielded acceptable rock at Map Identification Numbers 3 and 5; the Cheshire quartzite, which yielded acceptable rock at Map Identification Numbers 1 and 2; and quartzose phyllite of the Cheshire formation at Map Identification Number 4, which yielded no fragments large enough to test.

Lake Carmi lies within a large mass of the Fairfield Pond phyllite member of the Underhill formation; no outcrops yielded fragments large enough to test.

The southeast corner of the town is underlain by schistose graywacke of the Pinnacle formation. The rock breaks angularly and is too thin-bedded for testing.

Minor zones of dolomite of the White Brook member of the Underhill formation

are mapped along the inferred contact between the Fairfield Pond member of the Underhill formation and the Pinnacle formation to the east; but this survey was unable to find any outcrop that was not close to houses. Three bands of the Tibbitt Hill Volcanic member of the Pinnacle formation are mapped as occurring in the southeast corner of town. One outcrop was found east of Town Highway No. 32 but was not sampled because of very low relief and rounded surfaces.

# SURVEY OF SAND AND GRAVEL SOURCES

## Procedure for Sand and Gravel Survey

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

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

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

## Discussion of Sand and Gravel Deposits

According to Stewart and MacClintock, most of the marine sands and pebbly sands deposited during the invasion of the Missisquoi Valley lowlands by the Champlain Sea have subsequently been removed by erosion, and only boulder-strewn till remains. All three of the areas sampled by this survey were outside of the four remnants of lake sediments mapped in Franklin. No sources of Gravel for Sub-base were located, and only Map Identification Number 3 had material suitable for Sand Borrow and Cushion.

One remnant was mapped east of Town Highway No. 37 in the southwest part of town, but was heavily wooded and showed much evidence of bedrock control. It should be noted that a pit does exist in Highgate, about .3 mile south of the town line. Another remnant mapped as occurring north of State Aid Highway No. 3 about one-half mile west of its junction with Town Highway No. 37, is at the same location as rock Map Identification Number 5. This area is woodland bounded on the east by a low marshy clearing. No evidence of granular material was found. South of Town Highway No. 27, about one mile south of Lake Carmi, a remnant of lake sediments has been mapped. There is a filled-in and smoothed-over old dump near a new house which has access through the dump area. Some thin patches of silt show near the access road and the surface had standing water. The fourth remnant is in the village of East Franklin in the northeast part of town. A wet cornfield was impassable, and thus not sampled. Permission to sample a small pasture within this remnant in the village was not obtained. This survey found no good granular sources in Franklin. The town is nearly void of granular material and obtains what it requires from the towns of Berkshire and Highgate.

## SUMMARY OF ROCK FORMATIONS IN THE TOWN OF FRANKLIN

Bridgeman Hill formation: Undifferentiated dolomite, slate and conglomerate on east limb of Saint Albans synclinorium, about equivalent to Dunham, Parker, Rugg Brook, and Saxe Brook formations.

Cheshire quartzite: Very massive, white to faintly pink or buff vitreous quartzite near the top in west-central and southwestern Vermont; predominantly a less massive-appearing mottled gray, somewhat phyllitic quartzite; dolomite sandstone and conglomerate near the base of the formation in west-central Vermont apparently grades southward into the Dalton formation.

Fairfield Pond member of the Underhill formation: Greenish quartzitic schist (quartz-sericite-albite-chlorite-biotite): sericite-quartz-chlorite phyllite, locally purple or red, common in lower part.

Morses Line formation: Calcareous and non-calcareous slate; local lenses of thin-bedded limestone, limestone conglomerate, and dolomite; in Saint Albans syclinorium.

Pinnacle formation: Schistose graywacke, gray to buff, commonly striped, quartz-albite-sericite-biotite-chlorite rock predominates; quartz-cobble and boulder conglomerate is common, chiefly near base.

Sweetsburg formation: Black, carbonaceous, well-cleaved slate with characteristic thin (1-5mm) whitish silty bedding laminae; in Saint Albans and Hinesburg synclinoria and Cambridge syncline.

Tibbit Hill volcanic member of Pinnacle formation: Chiefly brown-weathered, whitish, tan and gray sandy dolomite, locally only a hematite zone; includes carbonaceous crystalline limestone in Cambridge syncline.

# GLOSSARY OF SELECTED GEOLOGIC TERMS

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

Albite - The sodium end member of the plagioclase feldspar group, light-colored and found in alkali rocks.

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

Bedrock - The more or less solid, undistrubed rock in place either at the surface or beneath superficial deposits of gravel, sand, or soil.

Bedrock Control - Land features which show bedrock on or close to the surface. It is used in description of part of the topography.

Biotite - A silicate mineral commonly known as black mica.

Block:- A large angular rock fragment showing little or no modification by transporting agencies. May be nearly in place or transported superglacially or by gravity or other agencies.

Carbonaceous:- Containing carbon.

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

Conglomerate - The consolidated equivalent of gravel. The constituent rock and mineral fragments may be of varied composition and of a wide size range. The matrix of finer material between the larger fragments may be sand, silt, or any of the common natural cementing materials such as calcium carbonate, silica, clay, or iron oxide.

Crystalline - Of or pertaining to the nature of a crystal; having a regular molecular structure.

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

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

Epidote - A calcium aluminum iron silicate mineral that usually occurs in rocks as formless grains and masses. The color is usually some shade of green, -pistachio-green or yellowish-green being the most characteristic.

Graywacke - An old rock name loosely applied. Most writers now apply it to a dark-colored, hard sandstone consisting of angular grains of quartz, feldspar, and rock fragments embedded in a fine, compact matrix composed of micas, clay minerals, and chlorite.

Greenstone - A field name for rocks that have been so metamorphosed or otherwise so altered that they assumed a distinctive color owing to the presence of chlorite, epidote, or actinolite.

Hematite - A common iron ore mineral, $Fe_2O_3$, occurring in steel-gray to black crystals and in red earthy masses. It has a distinctive cherry red to reddish brown streak. It alters principally into limonite on exposure to weather.

Joint - A fracture or parting plane along which there has been little, if any, movement parallel with the walls.

Lamina - A thin layer of stratified rock; specifically, 1 cm. or less in thickness. (Plural: laminae)

Ledge - A shelf-like ridge or projection of rock, usually horizontal and much longer than high.

Marine Deposits - Sedimentary deposits laid down in the sea.

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

Phyllite - A fine-grained, foliated metamorphic rock intermediate between the mica schists and slates into which it may grade. The foliation is made possible by the development of a large amount of potash mica, sericite, which gives the rock a distinctive silvery appearance.

Physiographic - Pertaining to the physical divisions of the earth.

Pillow Structure - The structure of pillow lavas. Lava, usually basaltic, that has congealed in rounded masses resembling a pile of pillows... The pillows range from a few inches to several feet in diameter and the spaces between may be filled with volcanic ash, clastic sediments, or mineral deposits. Most pillow lavas are thought to have been formed through the chilling of lava flows by water.

Quartzite - A compact metamorphic rock composed of quartz grains so firmly cemented that fracture takes place across the grains and the cementing material with equal ease.

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.

Schistose - Of or pertaining to, schist; having a tendency to split along the foliation because of parallelism of platy or needle-like grains.

Sedimentary Rock - Rocks composed of sediment; mechanical, chemical, or organic. They are formed through the agency of water, wind, glacial ice, or organisms and are deposited at the surface of the earth at ordinary temperatures. The materials from which they are made originally come from the disintegration and decomposition of older rocks, chiefly igneous.

Sediments - All kinds of deposits from the waters of streams, lakes, or seas, and in a more general sense to deposits of wind and ice.

Sericite - A mineral very similar to muscovite mica. It occurs in small flakes and scales in metamorphic rocks such as sericite schists and sericite gneisses.

Slate - A very fine-grained homogeneous metamorphic rock which splits smoothly along parallel cleavage planes and yields roughly similar slabs.

Synclinorium - A large composite fold of the earth's crust consisting of a series of anticlines and synclines which, taken together, have the general form of a syncline. The term is reserved for folds of relatively large dimension having a width of at least several miles.

Undifferentiated - The specific rock types within a formation are not distinguished.

Vesicular - A texture of rocks which are full of air bubbles, which may be almond-shaped, rounded, ellipsoidal, or tubular. They are due to the expansion of the gases of the lava, and their shape is due to movement in the still liquid lava.

Volcanic rock - An igneous rock that has reached or nearly reached the earth's surface before solidifying.

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# PARTIAL SPECIFICATIONS FOR HIGHWAY CONSTRUCTION MATERIALS

Listed below are partial specifications for Highway Construction Materials as they apply to this report at date of publication. For a complete list of specifications see Standard Specifications for Highway and Bridge Construction, approved and adopted by the Vermont Department of Highways in July, 1971.

## DIVISION 700 - MATERIALS

### Section 703.03, Soils and Borrow Materials

703.03 Sand Borrow and Cushion

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

Table 703.03A - Gradation Requirements

| Sieve Designation | Percentage by Weight Passing Square Mesh Sieves Total Sample | Sand Portion |
|---|---|---|
| 2" | 100 | |
| 1½" | 90-100 | |
| ½" | 70-100 | |
| No. 4 | 60-100 | 100 |
| No. 100 | | 0-30 |
| No. 200 | | 0-12 |

703.05 Granular Borrow

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

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

Table 703.05A - Gradation Requirements

| Sieve Designation | Percentage by Weight Passing Square Mesh Sieves Total Sample | Sand Portion |
|---|---|---|
| No. 4 | 20-100 | 100 |
| No. 200 | | 0-15 |

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

### Section 704, Aggregate

704.05 Gravel for Sub-base

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

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

Table 704.05A - Gradation Requirements

| Sieve Designation | Percentage by Weight Passing Square Mesh Sieves | |
|---|---|---|
| | Total Sample | Sand Portion |
| No. 4 | (20-60) | 100 |
| No. 100 | | 0-18 |
| No. 200 | | 0- 8 |

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

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

704.06 Crushed Stone for Sub-base

Crushed Stone for Sub-base shall consist of clean, hard, crushed stone, uniformly graded, reasonably free from dirt, deleterious material, pieces which are structurally weak and shall meet the following requirements:

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

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

Table 704.06A - Gradation Requirements

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

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

(d) Thin and Elongated Pieces
Not more than 30 percent, by weight, of thin and elongated peices will be permitted.
Thin and elongated pieces will be determined on the material coarser than the No. 4 sieve.

(e) Filler

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

(f) Leveling Material

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

This material shall meet the requirements of the following table:

Table 704.06B - Gradation Requirements

| Sieve Designation | Percentage by Weight Passing Square Mesh Sieves Total Sample |
|---|---|
| 1" | 100 |
| 3/4" | 90-100 |
| 1/2" | 50- 90 |
| No. 4 | 30- 70 |
| No. 100 | 0- 20 |
| No. 200 | 0- 10 |

704.07 Grushed Gravel for Sub-base

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

(a) Grading

The crushed gravel shall be uniformly graded from coarse to fine and shall meet the requirements of the following table:

Table 704.07A - Gradation Requirements

| Grading | Sieve Designation | Percentage by Weight Passing Square Mesh Sieves Total Sample | Sand Portion |
|---|---|---|---|
| | 4" | 100 | |
| Coarse | No. 4 | 25- 50 | 100 |
| | No. 100 | | 0- 20 |
| | No. 200 | | 0- 12 |
| | 2" | 100 | |
| | 1½" | 90-100 | |
| Fine | No. 4 | 30- 60 | 100 |
| | No. 100 | | 0- 20 |
| | No. 200 | | 0- 12 |

(b) Percent of Wear

The percent of wear of the parent gravel shall be not more than 20 when tested in accordance with AASHO T 4, or the crushed gravel a percent of wear of not more than 35 when tested in accordance with AASHO T 96.

(c) Fractured Faces

At least 30 percent, by weight, of the stone content shall have at least one fractured face.

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

704.09 Dense Graded Crushed Stone for Sub-base

Dense Graded Crushed Stone for Sub-base shall consist of clean, hard, crushed stone, uniformly graded, reasonably free from dirt, deleterious material and pieces which are structurally weak, and shall meet the following requirements:

(a) Source

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

(b) Grading

This material shall meet the requirements of the following table:

Table 704.09A - Gradation Requirements

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

(c) Percent of Wear

The percent of wear of the parent rock shall be not more than 8 when tested in accordance with AASHO T 3, or the crushed stone a percent of wear of not more than 40 when tested in accordance with AASHO T 96.

(d) Thin and Elongated Pieces

Not more than 30 percent, by weight, of thin or elongated pieces will be permitted.

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

704.10 Gravel Backfill for Slope Stabilization

Gravel Backfill for Slope Stabilization shall be obtained from approved sources, consisting of satisfactorily graded, free draining, hard, durable stone and coarse sand reasonably free from loam, silt, clay, and organic material.

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

Table 704.10A - Gradation Requirements

| Sieve Designation | Percentage by Weight Passing Square Mesh Sieves | |
|---|---|---|
| | Total Sample | Sand Portion |
| No. 4 | 20-50 | 100 |
| No. 100 | | 0- 20 |
| No. 200 | | 0- 10 |

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

704.11 Granular Backfill for Structures

Granular Backfill for Structures shall be obtained from approved sources, consisting of satisfactorily graded, free draining granular material reasonably free from loam, silt, clay, and organic material.

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

Table 704.11A - Gradation Requirements

| Sieve Designation | Percentage by Weight Passing Square Mesh Sieves | |
|---|---|---|
| | Total Sample | Sand Portion |
| 3" | 100 | |
| 2½" | 90-100 | |
| No. 4 | 50-100 | 100 |
| No. 100 | | 0- 18 |
| No. 200 | | 0- 8 |

Franklin Granular Data Sheet No. 1

| Map Ident. No. | Field Test No. | Year Field Tested | Depth of Sample (Ft) | Over-burden (Ft) | Exist-ing Pit | Sieve Analysis % Passing 2" | 1½" | ½" | #4 | #100 | #200 | Abrasion AASHO T-4-35 | Passes VHD Spec. | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1973 | 1-10 | 0-1 | Yes | 88 | 79 | 65 | 52 | 16 | 9 | 38.4% | Gran. Borrow (Gravel) | Owner - Almon Richard<br>Area is an active pit northwest of Town Highway No. 9, about 0.1 mile south of its junction with Town Highway No. 10. Floor of pit measured 160' by 60'.<br>Test No. 1 was in 12-foot northwest face. Material was: 1'-7', silt, sand and gravel; 7'-10', sand with small gravel layers; bottom, sand or fine sand. |
| | 2 | 1973 | 1-10 | 0-1 | No | 94 | 84 | 62 | 47 | 20 | 15 | 36.4% | Gran. Borrow (Gravel) | Test No. 2 was in field about 280' northwest of Town Highway No. 9. Material was: 1'-10', coarse sandy gravel; bottom same. |
| 2 | -- | 1973 | ---- | ---- | Yes | ---NOT SAMPLED--- | | | | | | | | Owner - Almon Richard<br>Area is a small (155'x80'), inactive pit northwest of Town Highway No. 9, about 0.4 mile south of its junction with Town Highway No. 10.<br>Floor of pit and adjacent hillside are wooded. Owner claims that ledge is near surface.<br>No samples were taken. |

Franklin Granular Data Sheet No. 2

| Map Ident. No. | Field Test No. | Year Field Tested | Depth of Sample (Ft) | Over-burden (Ft) | Exist-ing Pit | Sieve Analysis % Passing | | | | | | Abrasion AASHO T-4-35 | Passes VHD Spec. | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 2" | 1½" | ½" | #4 | #100 | #200 | | | |
| 3 | 1 | 1973 | 1-9 | 0-1 | No | 90 | 90 | 82 | 65 | 37 | 29 | --- | ----- | Owner - Thomas Messier<br><br>Area consists of several small pits in woodland, about a mile southeast of the junction of Town Highway No. 15 with State Aid Highway No. 1.<br><br>Private drive to area is about 0.67 mile south of the junction.<br><br>Test No. 1 was in a field 0.42 mile from Town Highway No. 15. Materials was: 1'-9', silty pebbly sand; bottom, silty sand. |
| | 2 | 1973 | 0.5-4.5 | 0-0.5 | Yes | 100 | 93 | 86 | 74 | 25 | 10 | --- | Sand | Test No. 2 was northeast of small pit, 230' north of Test No. 1. Material was: 0.5'-3', pebbly sand; 3'-4.5', sand; bottom ledge. |
| | 3 | 1973 | 1-8 | 0-1 | Yes | -- | 100 | 95 | 74 | 12 | 10 | --- | Sand | Test No. 3 was in 7' face, 380' north of Test No. 2. Material was: 1'-5', pebbly sand; 5'-5.5', silt; 5.5'-8', sand; bottom, sand and water. |

TABLE I
SUPPLEMENT

| Franklin Property Owners - Granular | Map Identification No. |
| --- | --- |
| Messier, Thomas | 3 |
| Richard, Almon | 1, 2 |

FRANKLIN ROCK DATA SHEET NO. 1

| Ident. No. | Field Test No. | Year Field Tested | Rock Type | Existing Quarry | Method of Sampling | Abrasion AASHO T-3 | Abrasion AASHO T-96 | Remarks |
|---|---|---|---|---|---|---|---|---|
| 1 | 1A | 1973 | Quartzite | No | Chip | 4.5 | 17.1 | Owner - Robert Horskin<br><br>Area has some steep ledges in woodland about 0.45 mile east of Town Highway No. 9. Access road leads east from the Town Highway about 0.31 mile north of its junction with State Aid Highway No. 1.<br><br>It would be necessary to improve the access road and remove large blocks of rock at the foot of the ledges to develop the area.<br><br>Rock is a very hard, gray quartzite of the Cheshire formation that is brittle where weathered. Bedding strikes about N.50°E. and dips about 50° to the southeast. Fragments tend to be very sharp.<br><br>Test No. 1A was sampled from random blocks along the foot of the ledges, for 75' from the north end. |
| | 1B | 1973 | Quartzite | No | Chip | 5.3 | 16.8 | Test No. 1B was the southward continuation of Test No. 1A from 75'-150'. |
| 2 | 1A | 1973 | Quartzite | No | Chip | 4.8 | 18.0 | Owner - Rodney Machia<br><br>Area is a series of outcrops in a pasture northwest of Town Highway No. 6 about 0.7 mile northwest of its junction with State Aid No. 1. The long low outcrops are separated by partly wooded and marshy places.<br><br>Rock is gray-green to gray, impure Cheshire quartzite that, in places, looks like a fine-grained metamorphosed amphibolite.<br><br>Test No. 1A was sampled for 75' from southeast to northwest |

FRANKLIN ROCK DATA SHEET NO. 2

| Ident. No. | Field Test No. | Year Field Tested | Rock Type | Existing Quarry | Method of Sampling | Abrasion AASHO T-3 | Abrasion AASHO T96 | Remarks |
|---|---|---|---|---|---|---|---|---|
| | 1B | 1973 | Quartzite | No | Chip | 4.3 | 16.5 | Test No. 1B was a northwestward continuation of Test No. 1A from 75'-150'. |
| 3 | 1A | 1973 | Dolomite | No | Chip | 3.4 | 19.4 | Owner - Robert Horskin<br><br>Area consists of bedrock exposed in the northeast corner of a field about 0.15 mile east of State Aid Highway No. 1, and 0.7 mile north of the junction of Vermont Route 120 and State Aid No. 1. Outcrops occur on a wooded knoll that has a 50 foot high escarpment on its west side.<br><br>Rock is a mottled gray and light gray dolomite of the Bridgeman Hill formation, and has milky quartz veins in places. Bedding strikes N.45°E. and dips about 42° southeast. Several joint systems were noted.<br><br>Best place for development would be from east to west.<br><br>Test No. 1A was northwestward for 75 feet across the strike, from the east side of the field. |
| | 1B | 1973 | Dolomite | No | Chip | 3.5 | 18.0 | Test No. 1B, 75'-150', extended from Test No. 1A to top of the knoll. |
| 4 | --- | 1973 | Phyllite | Not Sampled | --- | --- | | Owner - Jane Wheelwright<br><br>Area has a 60 foot high scarp, 50 feet east of Town Highway No. 37, about 0.1 mile south of its junction with Town Highway No. 25.<br><br>Rock is a brown-weathering, gray, slaty phyllite phase of the Cheshire quartzite formation. Because it is thin-bedded, shatters easily, and was thought to be incompetent as a source of crushed stone, it was not sampled. |

FRANKLIN ROCK DATA SHEET NO. 3

| Ident. No. | Field Test No. | Year Field Tested | Rock Type | Existing Quarry | Method of Sampling | Abrasion AASHO T-3 | Abrasion AASHO T-96 | Remarks |
|---|---|---|---|---|---|---|---|---|
| 5 | 1A | 1973 | Dolomite | No | Chip | 3.5 | 15.9 | Owner - Howard Gates<br><br>Area consists of woodland on the southeast slope of Bridgeman Hill with outcrops of dolomite occurring in steplike ledges with a maximum height of 50'. Location is about 100' northwest of State Aid Highway No. 3, about 0.65 mile west of its junction with Town Highway No. 37.<br><br>Development could be easily started near the highway. Bedding appeared to strike N.25°E. and questionably dipped 48°. There are several well developed joint sets.<br><br>Test No. 1A was northward for 100' from a point near the highway. |
| | 1B | 1973 | Dolomite | No | Chip | 3.8 | 32.0 | Test No. 1B was a continuation from 100'-200' northward from Test No. 1A. |

TABLE II
SUPPLEMENT

| FRANKLIN PROPERTY OWNERS - ROCK | MAP IDENTIFICATION NUMBER |
|---|---|
| Gates, Howard | 5 |
| Horskin, Robert | 1, 3 |
| Machia, Rodney | 2 |
| Wheelwright, Jane | 4 |


N

## LEGEND

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

# FRANKLIN

SCALE 1:31,250

CONTOUR INTERVAL 20 FEET

1973

## GRANULAR MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

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

PLATE I

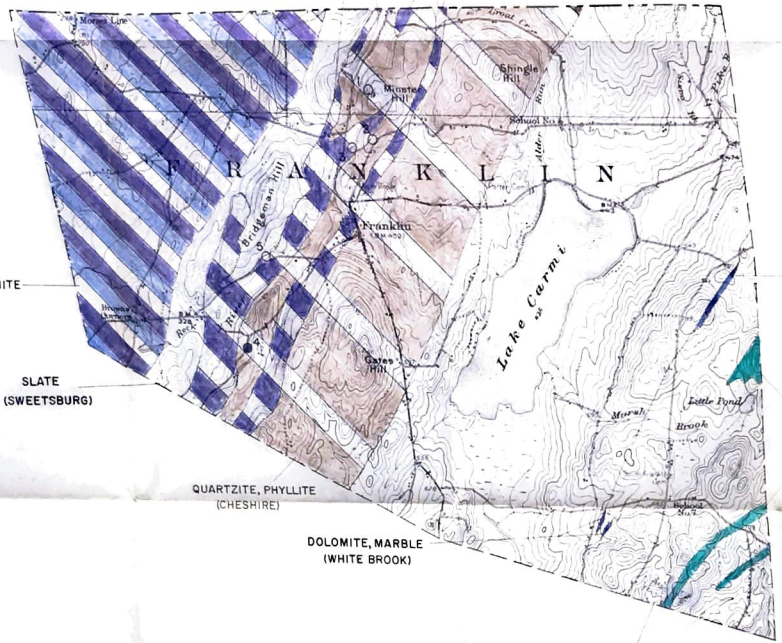
GRANULAR

FRANKLIN COUNTY VT. HWY. DISTRICT NO 8

REVISIONS

| DATE | | | | | |
|---|---|---|---|---|---|
| BY | | | | | |

FRANKLIN




## LEGEND

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

# FRANKLIN

SCALE 1:31,250

CONTOUR INTERVAL 20 FEET

1973

## ROCK MATERIALS MAP

BY

VERMONT DEPARTMENT OF HIGHWAYS

IN COOPERATION WITH

U.S. BUREAU OF PUBLIC ROADS

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

PLATE II

ROCK

FRANKLIN COUNTY VT. HWY. DISTRICT NO. 8

REVISIONS

| DATE | | | | | | |
|---|---|---|---|---|---|---|
| BY | | | | | | |