

OPR 50-43-D

Commonwealth of Massachusetts
Department of Public Works
B. F. Callahan, Commissioner

U. S. Department of the Interior
Geological Survey
W. E. Wrather, Director

Cooperative Geologic Project

Geologic Interpretation of Seismic Data

Relocation routes 15 and 20

in Sturbridge, Mass.

by



James E. Maynard, Geologist, U. S. Geological Survey

and

Rev. Daniel Linehan, S. J., Seismologist, Weston College

3 pages of text
2 plates

Boston, Mass.
April 1950

U. S. GEOLOGICAL SURVEY MASS. DEPT. OF PUBLIC WORKS
COOPERATIVE GEOLOGIC PROGRAM
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4/38/50 4/8/49
Release date: P.R.

Seismic Series # _____

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General Statement

The proposed improvements at the junction of Routes 15 and 20, Sturbridge, Massachusetts, requires a cut of considerable magnitude for the relocation of east-bound Route 20 between stations 158 and 167. Geologic and seismic studies were made of the site for the purpose of determining the position of the bedrock surface, the kinds of material to be excavated, and the relationships of these materials to each other.

The work was performed in November 1949 as a part of a cooperative program of the Massachusetts Department of Public Works and the United States Geological Survey.

Surface Geology

At this location the proposed road site crosses the frontal slope, and a segment of the relatively flat top, of a sand and gravel kame terrace. The base-line, between stations 162 and 164+50, lies near, and a short distance to the north of, the contact between the terrace and a low knob of till that is surrounded by the terrace.

No bedrock is exposed at the site or in its immediate vicinity. The geology of the region, however, suggests that the bedrock may underly part of the site or a shallow depth, and that it is composed principally of granitic rocks, largely gneiss.

From station 162+50 to station 164+50 numerous medium to large boulders of granite gneiss and granite occur on the surface or protrude from the terrace gravels. This condition, together with the nearness of the location to the till contact, suggests that along this segment of the proposed highway the terrace gravels are only a thin veneer on till.

The gravel exposed along the terrace front is of medium texture and appears to be quite thick. Where exposed, the gravel is of good quality; if not found suitable for high-grade work, it should make excellent "borrow".

Seismic Traverses

The seismic traverses, as run at this site, and their lengths are:

A-B,	165 feet long
B-C,	220 " "
C-D,	330 " "
F-G,	165 " "
G-H,	220 " "
H-I,	330 " "
G-K,	150 " "
O-N,	220 " "

The shot points for the traverses were located as follows:

A,	station	166+35	
B,	"	164+70	
C,	"	162+50	
D,	"	159+20	
F,	20 feet to the right (southeast)	of station	166+35
G,	20 " " " " " " " "	" "	164+70
H,	20 " " " " " " " "	" "	162+50
I,	50 " " " " " " " "	" "	159+20
K,	100 " " " left (northwest)	" "	164+70
N,	110 " " " " " " " "	" "	162+50
O,	110 " " " right (southeast)	" "	162+50

The plan of the traverses and locations of the shot points are shown on sheet 1.

Depths to Bedrock

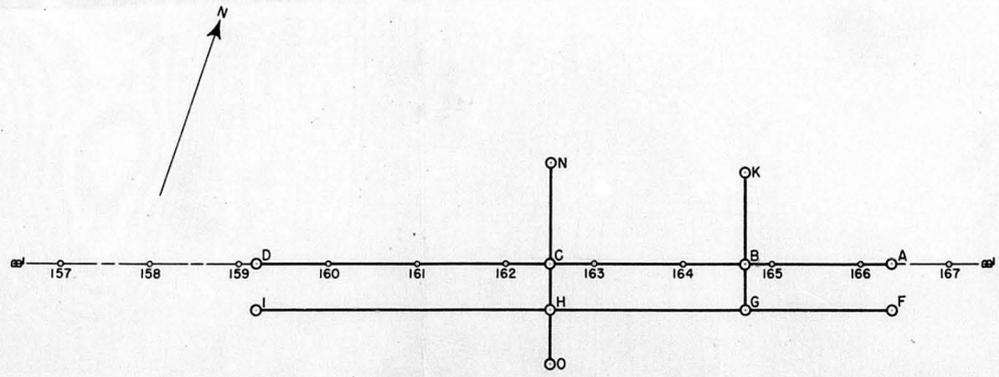
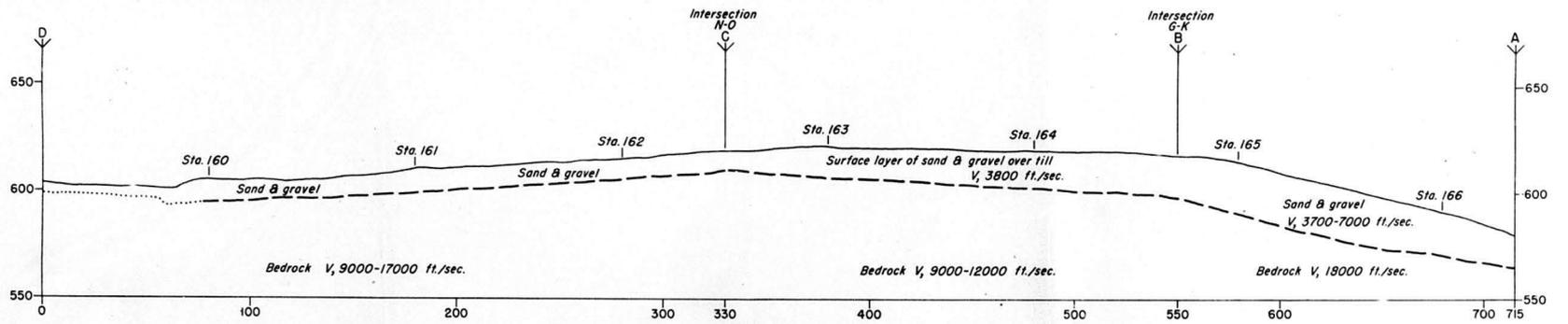
The approximate depths to bedrock at the shot points as calculated from the seismic data are:

A,	15	feet
B,	20	"
C,	9	"
D,	5	"
F,	15	"
G,	19	"
H,	15	"
I,	14	"
K,	25	"
N,	9	"
O,	10	"

Geologic Interpretation of Seismic Data

The interpreted positions of the bedrock surfaces along the seismic traverses between the shot points are shown on the geologic sections, sheet 1. The bedrock surfaces, which are shown on the sections by smooth curves, must be considered only as generalized approximations; small ridges, knobs, and depressions may occur at altitudes that are above and below these lines.

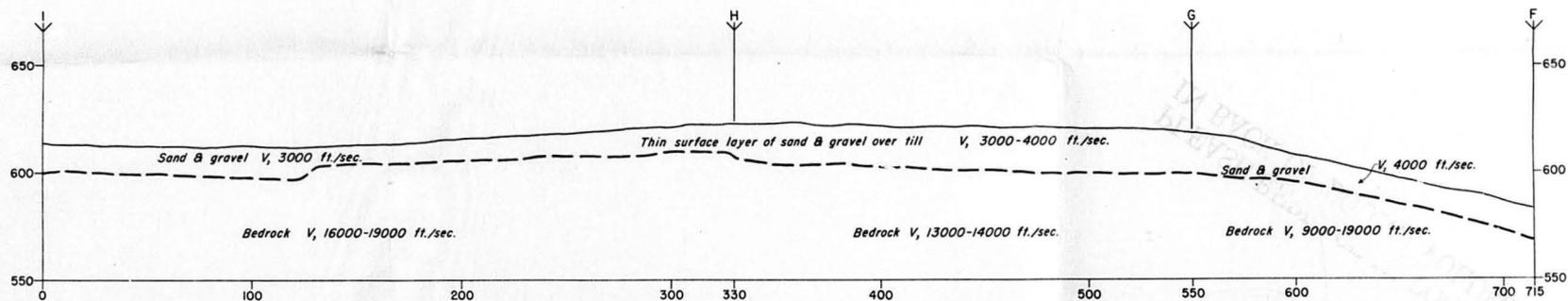
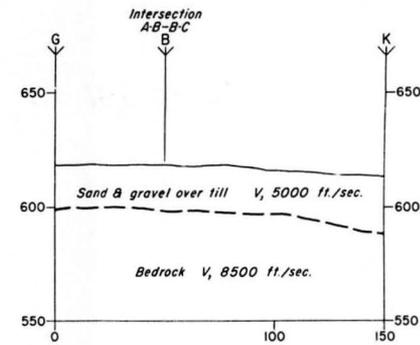
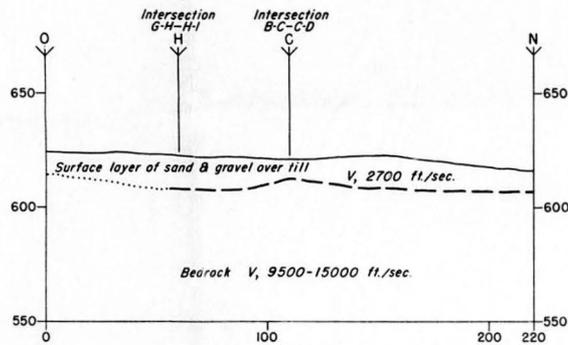
The bedrock profiles in the vicinities of shot points D and O are shown by dotted lines. These lines represent the preferred interpretations; it is possible, however, that the actual positions of the bedrock surfaces here may vary considerably from those indicated by the dotted lines.



PLAN OF TRAVERSES
 SCALE: 1 INCH = 100 FEET
 Letters refer to shot points at ends of traverses
 Numbers refer to D.P.W. stations on baseline.

NOTE:
 Dotted portion of section indicates
 inconclusive seismic data.

INTERPRETATIVE GEOLOGIC SECTIONS ALONG SEISMIC TRAVERSES	
STURBRIDGE	ROUTE NO.
RELOCATION OF ROUTES 15 & 20	
SCALE 1 INCH = 40 FEET	GEOLOGY BY: JAMES E. MAYNARD
↓ Shot point	SEISMIC DATA BY: DANIEL LINEHAN, S.J.
V- Apparent seismic velocity (ies) in feet per second.	ENGINEERING BY: W.H. STEAD-C.J. OWEN
DATE NOV. 1949	SHEET 1 OF 2



PLAN OF TRAVERSES
SCALE: 1 INCH = FEET
Letters refer to shot points at ends of traverses

NOTE:
 Dotted portion of section indicates
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V. Apparent seismic velocity (res) in feet per second	ENGINEERING BY: W.J. STEAD-C.J. OWEN
DATE NOV. 1949	SHEET 2 OF 2