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

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

Cooperative Geologic Project

Geologic Interpretation of Seismic Data

Projected Northern Circumferential Highway, Route 128

Cut, Stations 69-77

in Waltham, Mass.

by

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and

Rev. Daniel Linehan, S. J., seismologist, Boston College

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General Statement

The layout of the Massachusetts Department of Public Works for the construction of the Northern Circumferential Highway, Route 128, Waltham, Mass. shows a cut between stations 69 and 77. The geology of the site indicates that bedrock may be near the surface along this segment of the proposed road. For the purpose of obtaining more accurate information on the depths to bedrock and the position and form of the bedrock surface, a seismic study was made in June and July, 1949. The work was performed 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 base-line of the proposed roadsite crosses the lower part of the eastern slope of a prominent till-bedrock hill. The bedrock (medium to finely crystalline melanite, with some trap rock) is exposed abundantly on the upper flanks and top of the hill. No exposures occur along the projected right of way, but numerous single boulders or

nests of boulders of medium to large size protrude from the till that overlies the bedrock. The till is rather loose and should yield relatively low seismic velocities.

Seismic Traverses

The layout of the seismic traverses is shown on sheet 2. They were located as follows: L-A_1, A-B, B_1-C, each 220 feet long, were run along the base-line between stations 70+5 and 76+73. Shot point A was located at station 74+50; B at station 72+30; B_1 at station 72+25; C at station 70+5; A_1 at station 74+53 and L at station 76+73. Two consecutive 165-foot traverses O-P and P-Q were run approximately parallel to the base-line and approximately 45 feet to the west of it. Shot point O was located 45 feet to the left (west) of station 74+27; P 46 feet to the left (west) of station 72+62 and Q 50 feet to the left (west) of station 70+97. Four 105-foot transverse traverses - M-N, J-K, H-I, and F-G were also made. Shot point M was located 105 feet to the right (east) of station 73+74; N 60 feet to the left (west) of station 73+74; K 93 feet to the right (east) of station 72+90; J 72 feet to the left (west) of station 72+87; H 120 feet to the right (east) of station 72+23; I 45 feet to the left (west) of station 72+30; F 105 feet to the right (east) of station 71+46; G 50 feet to the left (west) of station 70+97.

Depths to Bedrock

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

A,	5 feet		J,	8 feet	
A_1,	7 "		K,	25 "	
B,	8 "		L,	5 "	
B_1,	8 "		M,	4 "	
C,	8 "		N,	4 "	
F,	18 "		O,	6 "	
H,	23 "		P,	7 "	(estimated)
I,	6 "		Q,	6 "	

The depth to bedrock at shot point P is only an approximation as the 3 detectors nearest to P failed to register when the line was shot from P to O.

Geologic Interpretation of Seismic Data

The geologic sections as interpreted from the seismic data and the geology of the site are shown on sheet 1. The bedrock surfaces are shown by smooth curves on the sections. It is probable that those surfaces are more irregular than these curves indicate as the detectors were too widely spaced to pick up minor ridges and points. The positions of the bedrock surfaces in the vicinity of shot points F, H, and K may be closer to the surface than has been indicated on the sections, because the data for the depths at these shot points could be interpreted in two ways; the most logical interpretation is shown by the dotted lines. The depth to bedrock at shot point H may be much deeper than shown. The preferred interpretation is shown, however, by the dotted lines. The position of the bedrock surface in the vicinity of shot point C has also been dotted. A tie line C-D was run from C, but poor energy and an indefinite time break made it impossible to interpret the data. The geologic section C-P-Q must be considered only as a very generalized approximation for the complete time-travel data could not be obtained from the seismograms. The depth values for O and Q are reliable, and that for P should be reasonably close. The position of the bedrock surface between O and P has been located from rather good but incomplete time-travel data; between P and Q the surface indicated is only an assumed position, as no time-travel data were available.