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Cooperative Geologic Project

File Report

Geologic reconnaissance along proposed relocation of route 2 in Maynard, Westford, and Ayer quadrangles

and

Occurrences of granular materials in vicinity of route 2 in Maynard, Westford, and Ayer quadrangles

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To be returned to Boston office.

Geologic Reconnaissance along Proposed

Relocation of Route 2 in Maynard, Westford, and Ayer Quadrangles

(A) Maynard quadrangle

by

W. R. Hansen

(a) West Concord Circle to Nashoba Brook

Proceeding northwestward from the rotary traffic circle at the Concord reformatory, the proposed highway base line crosses a terrane of sand and fine gravel for a distance of about 500 feet. It then rises onto an area of bedrock knolls that are partly veneered with gravel and boulders (sr). This bedrock terrane extends as far as Nashoba Brook, and any appreciable excavations in it will penetrate bedrock.

(b) Nashoba Brook to point 1700 feet west of Hosmer Street

Between Nashoba Brook and Hosmer Street several types of material will be crossed. The first 1500 feet along the base line west of Nashoba Brook consists of terrace materials lying at two different levels. The lower level, nearer to the brook, is composed chiefly of sand (d); the upper level (c) is somewhat coarser and is composed chiefly of mixed sand and pebble gravel. West from this terrace margin (about 1500 feet from Nashoba Brook), the base line rises onto a hill of bouldery till (t) and continues westward across the till terrane for about 3000 feet, passing between a small sand terrace to the south and a small swamp to the north. Bedrock is not exposed along the base line on this hill, but it crops out as near as five hundred feet to the north. It is possible, therefore, that bedrock may be reached by excavating in this hill, so that seismic tests are suggested for this locality. The base line crosses

a till-gravel contact a few hundred feet east of Hosmer Street. From this contact an area of hummocky gravel knobs extends westward to a point about 1700 feet west of Hosmer Street; the gravel in these knobs is mostly rather coarse and includes many pebbles and cobbles larger than 3 inches in diameter. Boulders also are fairly common in this area.

(c) Point 1700 feet west of Hosmer Street, to swamp east of Charter Road

On both sides of Taylor Road, and for a distance of about 1700 feet, the base line is on a southward sloping sand and gravel terrace. About 800 feet west of Taylor Road, the line enters a till-bedrock terrane that extends northwestward for 3000 feet to the swamp between Hayward Road and South Main Street (Rte. 27). Bedrock is exposed in many places and over rather wide areas in this segment of the line, and it probably will be penetrated in any appreciable excavations.

(d) Swamp east of Charter Road to Fort Pond Brook

Between the intersection of Hayward Road with Charter Road and the swamps to the east and southeast, the lowland is composed of pebble gravel. The small swamps in this vicinity seem to be shallow and to rest on till. Northwestward from the point where it crosses Charter Road, the base line rises upon a hill of till, and for a distance of about 1400 feet the line traverses this till terrane. If excavation into this hill is planned, seismic studies are recommended.

The base line crosses Arlington Street at the east edge of a long, narrow swamp on both sides of which are narrow sand-gravel terraces; in this swamp, peat and muck appear to be rather thick. About 800 feet northwest of Arlington Street the base line crosses another area of till for a distance of

about 800 feet; seismic studies should be made here if appreciable excavation is planned, for the till cover may be thin, although no bedrock is exposed within 700 feet. Continuing northwestward from this till area toward Nashoba Road, the base line first crosses two low sand terraces, separated by a narrow swamp (200 feet wide), and then rises onto a till-veneered bedrock hill. Bedrock is near the surface along this segment, and any excavation at the Nashoba Road crossing will be in bedrock.

(e) Fort Pond Brook to quadrangle boundary

Northwest of Nashoba Road, near the Acton-Littleton town line, the base line crosses Fort Pond Brook. Swampy ground extends for two or three hundred feet on both sides of the brook. Foundation conditions here are uncertain but the presence of many rather large boulders in the swamp suggests that it is firmly bottomed on till. Northwest of Fort Pond Brook and east of Littlefield Road, the base line lies on a gravel terrace and hummocky gravel knobs, and enters a till-bedrock area at the quadrangle boundary. Bedrock is exposed in this general area, and if deep cuts are planned, seismic studies are desirable.

(B) Westford quadrangle
by
M. E. Willard (geology) and L. W. Currier (text)

The proposed base line crosses the southwest corner of Westford quadrangle for slightly more than 1½ miles. Throughout this distance the line is on till and till-bedrock terranes.

For about 3000 feet, from the southern boundary of the quadrangle, north-northwest to point about 700 feet north of Boxboro Road, the terrane has many rock exposures, and excavation would be in bedrock or would reach bedrock within very shallow depths. The southernmost 1500 feet of this segment lies near the base of the western slope of the till-bedrock hill so that the bedrock surface is covered by soil materials and rock fragments that have in part worked down the slope; nevertheless it is probable that the east side of a wide cut in this part of the segment would penetrate bedrock. The northern 1500 feet of the segment traverses an area in which bedrock exposures are numerous.

From a point about 700 feet north of Boxboro Road to the west boundary of the quadrangle the base line traverses a till area of moderate ridges and knobs. It is probable that the relief here is in large measure determined by the underlying bedrock surface. In the central part of this segment the line crosses a narrow ridge in which bedrock is probably very near the surface and would be penetrated by a cut of moderate depth. Elsewhere in the segment the till cover is probably thicker, in general, but may be very thin in places, and cuts in excess of 10 feet might be expected to reach or penetrate bedrock.

(C) Ayer quadrangle
by
R. H. Jahns (geology) and L. W. Currier (text)

(a) East boundary of quadrangle to gap near Whitcomb Avenue

From the east boundary of the quadrangle northwesterly for about 1300 feet the base line crosses a till-bedrock area in which there are numerous small exposures of bedrock. Northwest from Foster Street for about 1¼ miles the line traverses gravel and sand knolls (kames), kame terraces, kame plains, and ridges (eskers), and wide areas of swamp land. Bedrock may be reached by cuts in the gravel-sand areas between Foster and Taylor Streets. The swamps may give some trouble as they are likely to contain a considerable thickness of peat and muck, probably resting in part on sand and gravel.

The valley of Beaver Brook contains considerable deposits of coarse to medium gravel as steep, narrow ridges (eskers), and of fine gravel and sand in the kame areas (kames, kame terraces, and kame plains). It is probable that considerable granular material for sub-grade can be obtained in this valley.

(b) Gap near Whitcomb Avenue to Littleton Road

The narrow gap near Whitcomb Avenue through which the base line passes (0.4 mile west of Beaver Brook) cuts through a bedrock ridge. Thence westerly the line crosses a narrow swamp for a distance of about 500 feet and thence rises on the steep slope of a broad, high ridge. This ridge (Oak Hill) is composed predominantly of bedrock with a thin, discontinuous cover of till; exposures are numerous in this ridge and the bedrock is everywhere so close to the surface that it will be penetrated by very shallow cuts. In both these ridges the bedrock is a micaceous schist, in which the layers are thin and steeply inclined, and the truncated edges of which trend parallel with the

axis of the ridge. This rock is moderately hard, in general, but will break readily along the layers, which provide natural cleavage planes. The rock in Oak Ridge, however, is more thinly foliated and more easily cleavable than the rock in the narrower ridge to the east.

(c) Littleton Road to Boxboro Road

A short distance west of Littleton Road the base line crosses a narrow, rock-walled valley for about 0.6 mile and thence traverses the south slope of a large bedrock hill. Cuts in this hill will penetrate bedrock. This rock is granitic, and hence harder and more massive than that in the Oak Hill ridge, and, unlike the schist of Oak Hill, lacks well-developed cleavage planes.

(d) Boxboro Road to railroad crossing southwest of Harvard Station

In the vicinity of Boxboro Road, just west of the bedrock hill mentioned above, the base line crosses a gravel-sand terrace; this gravel-sand deposit is probably thin and resting on bedrock, for scattered small exposures appear in a small area north of the line and in another small area about 600 feet west of Boxboro Road. On the west side of this terrace area the line crosses a narrow swamp along a small brook. The thickness and character of the swamp deposits here should be carefully investigated, for the bedrock floor of the small valley in which the swamp lies may be fairly deep and the valley fill probably constitutes an active locus of subsurface drainage.

West of this swamp the base line crosses a general hilly area for about 1-3/4 miles. From the swamp on the east to Ayer Road, a distance

2000 feet, no bedrock is exposed, and although this area is doubtless underlain by bedrock at moderate depths, shallow cuts in it may not reach ledge. On the west side of Ayer Road, however, and for a distance of nearly 3500 feet bedrock exposures are numerous and cuts in this segment would be in ledge; the bedrock in this segment is granitic, is quite hard and massive, and lacks well developed natural cleavage planes. Southwest and west from this segment to the Boston and Maine Railroad the base line traverses a till-covered bedrock area, except for a strip of about 1300 feet in length in the vicinity of the intersection of Depot and Old Mill Roads ($\frac{1}{4}$ mile south of Harvard Station) where the surface is underlain by thin deposits of sand and gravel. The thickness of the till deposits in this segment cannot be estimated; the till is probably thin in general, so that the site of any appreciable cut should be investigated in detail.

(e) Railroad crossing, southwest of Harvard Station to west boundary of quadrangle

From the Boston and Maine Railroad half a mile southwest of Harvard Station the base line extends northwesterly for 4000 feet across low areas of sand and gravel, and swamps. The sand and gravel areas are well-drained for the most part. The swamp areas should be investigated carefully for they lie in a broad poorly drained area once occupied by a glacial lake, and the soft swamp deposits may be thin but they probably rest on lake clays and silts; the possibility that they are partly floating bogs should be studied.

For a distance of 1000 feet from the swamp area just mentioned to the boundary of the quadrangle the base line crosses an area of bedrock with a thin discontinuous cover of sand and gravel that represent shore deposits of the glacial lake.

From the quadrangle boundary westward in Shirley quadrangle the geology along the base line has been described in an earlier report (Hansen: Geologic reconnaissance of a proposed highway segment between Leominster and Harvard, Mass., November 1947).

Part 2.

Occurrences of granular materials in vicinity of relocation of route 2 in Maynard, Westford, and Ayer quadrangles

text by

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The geologic map that accompanies this report shows the locations, areal extents, and general characteristics of sand and gravel deposits that occur in the vicinity of the projected relocation of route 2 between West Concord and Fort Devens. The data so represented and described herein are intended to serve as a guide in searching for available sources of granular materials to be used for fill and foundation purposes in the construction of the highway segment. Gravel and sand pits that were existing at the time the survey was made are also shown by an appropriate symbol.

The field work upon which this report is based was performed in 1941 (Ayer and Westford quadrangles) and 1948 (Maynard quadrangle) under a cooperative agreement between the Massachusetts Department of Public Works and the United States Geological Survey. The detailed geologic mapping of these quadrangles was completed and the maps are in process of preparation for publication; they are temporarily available for reference in room 802, 100 Nashua Street, Boston, Mass.

No attempt was made to sample or make mechanical analyses of the deposits, nor to judge of the availability of the deposits for use by contractors. It is obvious that some of the areas indicated lie within developments that preclude use of the materials. Such situations can be readily determined in the field. Commonly the pit symbols will show deposits that are available. On the other hand, many large deposits that have not been used heretofore appear to be possible sources of supply that might well be investigated, as for example the ridges (eskers) and hillocks (kames) that occur for a distance of more than 2 miles along and within the valley of Beaver Brook, southwest of Littleton station, Ayer quadrangle.

The basis of classification (see explanation on map) is the predominant textural character of the deposits. Thus, all areas indicated by shades of green are generally underlain by the coarsest materials, those indicated by orange are predominantly sand, with prominent amounts of medium to fine gravel, and those indicated by yellow are sand with relatively little gravel. Areas of fine sand, silt, and clay are shown in a gray color. Each color symbol, however, is further identified on the map by letter symbols, as a, b, c, sr, t. etc.

It should be understood that the textural characteristics as indicated by the color and letter symbols are generalized and that the areas of coarsest material may contain much sand matrix with the cobbles and pebbles, and that the areas of predominantly sand locally may contain thin beds of coarse gravel. Deposits of the kinds that occur in this region are not ordinarily susceptible to close classification in sharply defined categories. Boulders, too, may be found in deposits of all types but for the most part they are rare in the predominantly sand or sand-silt deposits, though even

nests of boulders have been found locally in the lower parts of sand terraces and sand plains and are to be discovered only during excavation of such deposits. It is believed, however, that the classification used here will be a practical guide to the occurrences of granular materials of different prevailing textures.

It is clear that the granular materials suitable for porous fill are all represented by shades of green, orange, and yellow, the coarsest (predominantly gravels) being indicated by the green shades, the next finer (predominantly sand, subordinate gravel) being indicated by orange, and the still finer sands (with little gravel) by yellow. Gray (fine sand, silt, clay), generally indicates areas of material unsatisfactory for porous fill.

Till, an unconsolidated heterogeneous mixture of boulders, cobbles, pebbles, and materials of sand, silt, and clay sizes, is indicated by a brown color and the letter symbol t. The components of till are not separated in layers or sized, as are sand and gravel. Till is commonly compact, lumpy, and harder to excavate than sand and gravel. Most of the till is brownish. Some of the till, however, is gray, comparatively loose and gravelly, and contains less of the silt and clay sizes than does the brown till; in a few places the gray till has been used for road fill.

The symbol r is used in places for single exposures of bedrock. The symbol sr indicates sand and gravel areas with numerous bedrock exposures. Thus, the sand and gravel in an area marked sr would probably be difficult to excavate in large quantities owing to the close spacing of bedrock exposures and the general thinness of the deposits.

From the geologic map the following localities appear to be the most favorable for obtaining new sources of granular materials; the areas colored

in shades of green are recommended for the coarser gravels and sands.

(1) south, west, and northeast of Annursnack Hill (Maynard quadrangle).

(2) about midway between Acton, South Acton, and West Concord, between Parkers Pond and Woodlawn Cemetery (Maynard quadrangle).

(3) the valley of Heathen Meadow Brook, about midway between Stow and West Acton (Maynard quadrangle).

(4) north and northeast of West Acton, between Arlington Street and Nashoba Road (Maynard quadrangle).

(5) the valley of Guggins Brook (Maynard quadrangle).

(6) the valley of Beaver Brook, southwest of Littleton station (Ayer quadrangle).

(7) north of Littleton station and New Estate Road, bordering and in New Estate Swamp (Ayer quadrangle).

(8) south of Pingryville, in the valley leading south from Bennetts Brook.

(9) the vicinity of Old Mill Pond, just west of Boxboro Road (Ayer quadrangle).

Deposits around and east of Hell Pond between Harvard station and Camp Devens would furnish excellent material but may be unavailable because of the military establishment.

The limited time available has not permitted the making of volume estimates for the individual deposits. Except in rare instances, however, the volume of gravel and sand in a ridge or hillock composed of coarse materials (green

shades on the map) may be considered as including all material above the general base of the land form. Narrow terraces of sand and gravel (orange) may be considered as triangular prisms, the bases of which are continuations of the hill slopes against which they lie, although pinnacles and buried terraces of bedrock are fairly common within them. Broad terraces that extend well out from the bordering hill slopes, and especially those that lie at lowest levels, approach the form of a rectangular prism, as do also the low, flat-topped sand and gravel hills that lie within the broad valleys.