SOME PROBLEMS OF ENGINEERING GEOLOGY IN THE VICINITY OF CHICAGO*

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ABSTRACT

Most of the problems in engineering geology encountered in the vicinity of Chicago are consequent upon (1) the character and succession of the glacial and interglacial deposits, (2) the character and succession of materials deposited by glacial Lake Chicago, or (3) the topographic expression of the deposits.

Gravel, sand, silt, muck, and peat may occur irregularly between till-sheets and with each till may be gravel, sand, and silt. The bedrock surface on which the drift lies is irregular, cropping out at some places and elsewhere being buried as much as 300 feet. The deposits of Lake Chicago are very inconsistent; they lie on an irregular surface of glacial drift and include deposits of peat and muck. Although considerable data on these conditions have been accumulated they are not yet sufficient.

Progressively more elaborate procedure to assure foundations sufficiently firm and stable to support the skyscraper structures in Chicago involved first, the deepening of excavations for footings, second, the use of piles, and third, the construction of caissons, all of which practices encountered difficulties consequent upon the geologic situation. Excavations for sewers, water and gas mains, conduits, subways, and other utilities encounter problems not only of geology but also of urban restrictions. Some test-pits and test-borings have already been made for the proposed subways and more will be made to determine just what geological conditions will be encountered along the proposed routes.

Most of the other problems of engineering geology in the vicinity of Chicago relate to paved highways and may be classified as (1) selection of the most favorable route, (2) selection of material for fills and pavements, (3) location and type of grade-separation, (4) location and construction of bridges, (5) location and construction of subways, (6) irregular heaving of pavements, (7) face-slump and sod-creep on cuts, and (8) bogs.

In northeastern Illinois the highways should be routed so that they cross no bogs, parallel no slopes, and require no cuts more than a few feet deep. For fill material, firm clayey till or gravel is most desirable; sand may be used, but it requires a broad base; silt, silty till, and similar material should be avoided.

The abundance of gravel and limestone in the Chicago area leaves little to be desired for pavement material although in some gravel there is too much shale, chert, or other deleterious substances and some limestone includes too much chert and other types are too argillaceous to be satisfactory. The locations of grade-separations are nearly fixed, but local conditions may determine whether an underpass or an overpass is most practical.

Generally the location of a bridge is determined by other factors, but in a few instances the topographic and geologic conditions control, to a greater

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degree they influence the type of construction, and they are certainly the prime consideration in determining the location, depth, and size of the supporting piers and abutments.

The variety and succession of glacial drift in the Chicago region has caused some instances of irregular heaving of pavements during freezing weather, due to the fact that the material in the subgrade is so porous that water seeps through it or is adsorbed by it. Some of the glacial drift in the Chicago region is silty or sandy and so loosely compacted that it tends to slump and flow whenever saturated by water. The logical consequences along highway cuts can be easily conceived, but fortunately they can be largely prevented by emplacement of drains at critical locations.

Many of the depressions which are characteristic of glacial deposition in northeastern Illinois are now occupied by bogs in which the usual sequence of materials is a superficial layer of matted peat, then a layer of marl, and then muck to the bottom, but in some there is sand and silt and in others there is a complex succession. Construction of highways and highway fills across bogs without regard to their character and material content has commonly resulted in serious trouble and disaster, so that engineers prefer to route a highway around a bog if possible. At numerous places not only have the highways across bogs sunk almost below water-level but also the culverts under them have entirely disappeared.

In order to obtain exact knowledge concerning conditions in bogs, the need for test-borings, accurate samples of materials, and accurate location of different strata before, during, and after construction of fills is becoming better recognized. At present, explosives are used (1) to break up the surficial peat-mat and (2) to assure displacement of muck from beneath a fill and to hasten settlement of the fill. This is satisfactory for deep bogs, but for shallow bogs it seems more practical to remove the unstable material by some mechanical means and then replace it with stable material. Care must be exercised that a fill across a bog does not become a dam. In a few instances they have been purposely planned as such but otherwise passages through the fill must be provided. One of the most interesting problems in connection with peat-bogs is their utilization for parks and playgrounds.