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Earth Slides in Winnipeg Aqueduct Construction

Description of the Principal Methods Used by the Contractors in Dealing with the Sloughs and Slides—Bearing Tests Demonstrated Instability of the Soft Dark Clay, Analysis of Which Showed 15% of Moisture and Water of Combination

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EARTH slides in the open trench used for the construction of Winnipeg's 100-mile aqueduct were of such magnitude as to impede seriously the progress of the work. Considered by themselves, they afford an interesting study in the flow of clay under pressure and in the effect of water on the movement of large masses of earth; but viewed together with the other phases of the work, they appear as an index of the difficulties that had to be overcome in order to construct safely the aqueduct through the 10 miles of summit cut where peat bogs, 6 to 14 ft. deep, covered fine

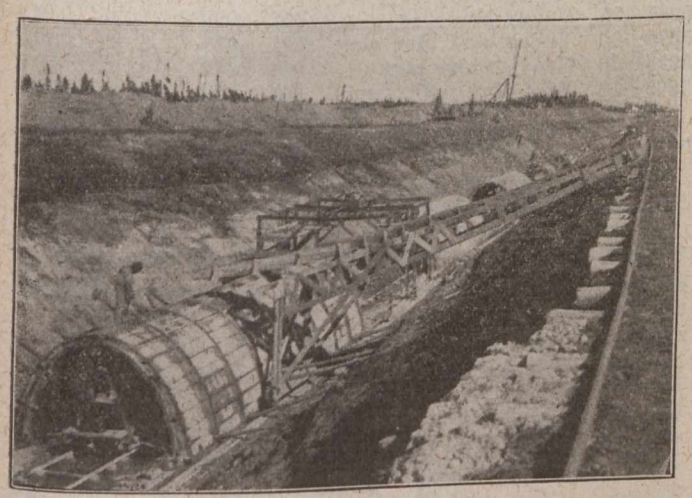

FIG. 1—INDICATING OPERATIONS IN BUILDING AQUEDUCT UNDER NORMAL CONDITIONS

sand, sandy clay and blue clay, which moved readily under comparatively light pressures.

Under normal working conditions, the water of the peat bogs was drained away along the centre line by means of a pilot ditch constructed by the contractor during the first years of his work. The Water District Railway's side-ditches to the south, and protective drainage ditches to the north, of the aqueduct line, also aided in the disposal of surplus surface waters. With the main volume of the water removed by these drains, the contractor's regular program of work was as indicated in Fig. 1.

First, the main trench, about 20 ft. deep, with 16 to 20-ft. base, was excavated with side slopes of 1:1, by means

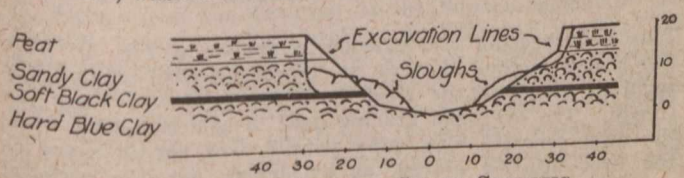

FIG. 2—DIAGRAM SHOWING SMALL SLOUGHS

of a Class No. 24 Bucyrus drag-line excavator, which placed the material removed into spoil banks 75 to 100 ft. on each side of the trench centre line.

With the spoil at such distances, there was ample room on the north for the travelling derrick, which was used to remove the final trimming taken out by hand labor just before the fresh invert concrete was placed; and room

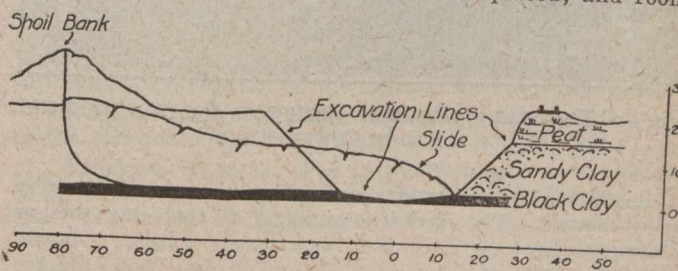

FIG. 3—DIAGRAM SHOWING SLIDE

was also left for the narrow-gauge railway which was used to transport the concrete from a central mixing plant to the forms used for moulding the aqueduct.

Pumps were spaced at intervals, depending upon the quantities of ground water that escaped into the trench, and, by aid of box-drains, kept the foundation in shape for final trimming and permitted the invert concrete to be placed in the dry. The concrete invert, or floor of the structure, was poured in 15-ft. sections, while the arch, or horse-shoe-shaped portion of the concrete pipe, was moulded in

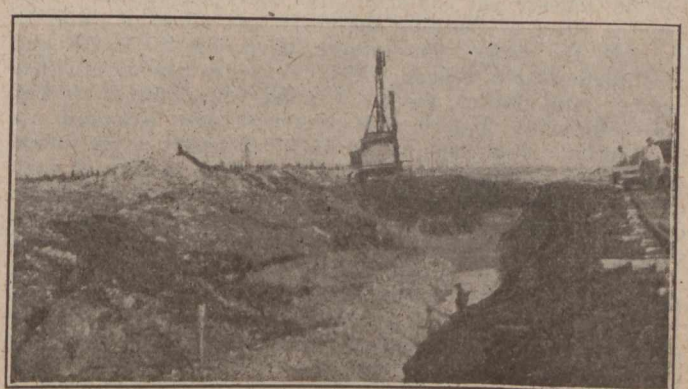

FIG. 4—SLIDE—NOTE SETTLEMENT OF SPOIL BANK

45-ft. lengths by use of steel forms. Reinforcement was placed in the invert where soft foundation was encountered. As soon as the concrete had been properly cured, the pipe was backfilled by the same drag-line that was used for the excavation.