RATIONALIZATION AND EXCHANGE OF EXPERIENCE

CONSTRUCTION OF CONTINUOUS CUTOFF IN COHESIONLESS SOILS, EMPLOYING PRECAST REINFORCED-CONCRETE ELEMENTS *

Iordan Ganchev, Slavcho Fildishev, and Bozhidar Chochkov

The great role that lowlands adjoining the banks of large rivers play in the national economy requires the construction of protective levees to prevent their inundation during the passage of floods. From the engineering-geologic viewpoint, lowland soils commonly comprise alluvial clay strata overlying sands and sandy-gravelly interlayers, and old river watercourses are infilled by fine-grained sands. When the flood level in such rivers is high, the ground waters seep through under the levees, along the permeable layers, and onto the lowlands. These are dewatered by special drainage canals and pumping stations, because the high water levels are of a temporary nature and persist over only a few months of the year.

However, whenever dams for impounding reservoirs and levees for protecting lowlands are constructed on such rivers, these levees must possess the necessary cutoff characteristics as with dams. Such is the case with hydro-power works on the Danube River.

With a permanently raised water level in the reservoir, it is expedient to construct a continuous cutoff, under levees, to prevent the infiltration of river waters into the lowland areas. This is also an expedient provision for preventing the salination of soils located in the lowlands.

In the last few years, the Italian method called "Benoto"† has been recommended for constructing a continuous cutoff under levees and dams. With this method the continuous concrete cutoff extends to depths of up to 50 m and has a thickness of 0.50 m.

* This article has been compiled under the editorship of A. N. Adamovich (B. E. Vedeneev All-Union Scientific-Research Institute of Hydraulic Engineering).

† Apart from the Italian method of constructing continuous cutoffs, cited by the authors, other methods of providing bored concrete cutoffs are employed (Editor).

Fig. 1. Hydropile element.

Fig. 2. Design of hydropile element.

For alluvial soils, such as clay deposits with sandy or sandy-gravelly interlayers with grain sizes of up to 20 mm, the authors have developed and verified experimentally the use of a lightly reinforced sheet pile of new construction and a method of providing a continuous cutoff to large depths, employing precast reinforced-concrete elements (hydropiles) of 14-cm thickness. For this purpose, boring along the line of the cutoff is carried out by the augers of a drilling rig type USbBT-M, with a diameter of 146 mm, to form holes of up to 75-m depth, bored at a rate of 15 to 20 m/h.

Along the line thus weakened longitudinally and depthwise, an effective and economical cutoff for dam and levee foundations can be constructed for the given geologic conditions, comprising hydropiles which are jetted into position at pressures of up to 15 atm, vibrated and grouted into the soil.

The above-mentioned hydropile is a reinforced-concrete element, designed for construction, with reinforcing rods of 6-mm diam. only, since the pile is not subjected to significant dynamic loading. It is of rectangular section, 3 to 5 m long, 0.75 m wide, and 0.14 m thick. A hydropile 5 m long weighs 1150 kg (Figs. 1 and 2b). It has a longitudinal groove with a duct 11 and a tongue 12, which provide for meshing of the hydropiles during sinking. A pipe conduit 50-mm diam. is located down the center of the hydropile; it comprises two steel pipe lengths 4 and 9 and one plastic portion 3. The steel portion 4 is connected to the inclined pipe 5, fitted with five nozzles 15 mm wide (Fig. 2a). The top end of the pipe length 9 is threaded for screwing on the elbow 8, which is connected to a hose from the pressure pipeline.

For depths exceeding 5 m, the hydropiles are extended by means of a conical steel pipe segment which is fitted with rubber seals 13 and 14 and an asphalt-impregnated oilcloth located in the lower part of the second, third, or fourth pile. The vertical connection of the hydropiles is effected by two pairs of steel plates 1, 0.70 m long and 50 x 5 mm in section, and two bolts 2 (Fig. 3). A general view of driven and extended hydropiles is shown in Fig. 4.

The execution of the work and the equipment necessary therefor comprise the following:

1. Boring of the cutoff is carried out by an auger-type drilling rig, every 0.30 m along the line; at the site of two adjoining hydropiles, up to five holes are drilled down to the level of resistance to water flow, encountered at clay strata or lenses. In quicksand areas, boring is unnecessary.

2. Laying of a light rail track of 2-m gauge or of steel sleepers for each rail separately (Fig. 5). The rail track consists of three units 5 to 6 m long, for repeated use along the cutoff line.