CONSTRUCTION OF A MEMORIAL CENTER IN UL'YANOVSK

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A memorial complex, including a Memorial Center, pedagogical institute building, regional museum, and tall hotel, is to be built in Ul'yanovsk by the 100th anniversary of the birth of V. I. Lenin. The Memorial Center building on Ul'yanov Street is to be architecturally in the form of an enormous parallelepiped raised on columns (Fig. 1). The small homes where Il'ich spent his childhood will be located in its interior courtyard.

The entire structure stands on a granite platform and in plan has the shape of a square with 110-m sides.

The Memorial Center building, 34 m high in its tallest part, will house a branch of the V. I. Lenin Central Museum with halls for exhibits, an auditorium with 1400 seats, October Hall, House of Political Enlightenment with a 550-seat lecture hall, and many other rooms.

Decorative facing materials are being used extensively in the construction of the Memorial Center: white marble for the front of the building, columns, and interior; granite and mosaic slabs for the platform; and new building materials, for example, the acoustic carpeting Kovral. In the main rooms the ceilings are to be lined with Akmiyigran acoustical boards and suspended ceiling with indirect lighting are planned.

The display windows in the vestibule and branch of the museum are to be of showcase glass with casings of colored metals. Air conditioning is to be provided.

The Memorial Center is a frame-type building with an open first floor and 14.5 × 14.5 m network of columns. The loads on the main columns of the building reach 650-700 tons and on the column of the October Hall, 1000-1200 tons.

The soils of the construction site are composed of made ground (a mixture of chernozem and construction rubbish) 1.6-2.9 m thick, then a layer of loose, severely weathered marl 1.9-4.6 m thick, which is underlain by fissured clays with lenses and interbeds of sand. The thickness of the clay layer is 11-13.5 m. Under the clays is a layer of very clayey, fine, saturated sands 1.1-2.0 m thick. Then come intercalating layers of clays and sands. Artesian water with a piezometric head 2.85-13.0 m below surface was found in the sand layers. The main artesian horizons are at a depth of 16-18 m and lower. According to the available data the construction site of the Memorial Center can be subjected to landslide phenomena.

The possibility of slides and the uniqueness of the structure resulted in the selection of large-diameter, situ-cast piles for the foundations of the Memorial Center, since the method of constructing the piles precluded disturbance of the soil mass. The pile diameter was determined by the available equipment and was taken to be equal to 1200 mm. The pile length was designated to be 13 m in order not to penetrate the layer of sandy soils with artesian waters, which can complicate construction and cause movement of the soil mass.

Thus, depending on the loads the foundations were planned in the form of groups of two to four piles connected by a monolithic reinforced-concrete grillage. While designing it was necessary to determine the magnitude of the permissible load on one pile. At present there are instructions for the calculation of situ-cast piles only in SN 200-62. However, this method of calculation does not take into account the special working conditions of situ-cast piles in the ground and, in particular, gives underestimated values of skin friction.

Therefore, the Research Institute of Bases (NII Osnovanii) used another method of calculation based on the formula proposed by K. Terzaghi [1].
Fig. 1. General view of the Memorial Center building.

\[ P = P_p + P_s = \frac{1}{K} \left[ F \left( 1.3 \sigma_c N_c + \sigma_p N_p + 0.6 \gamma_s \frac{d}{2} N_l \right) \right] + U I \left( \lambda_0 \sigma_i \tan \delta + c \right), \]

where \( P, P_p, \) and \( P_s \) are, respectively, the bearing capacity of a situ-cast pile, point resistance, and skin friction, tons; \( K \) is the factor of safety; \( c \) is cohesion of the supporting soil, tons/m²; \( \sigma_s \) is the natural pressure of the soil at the level of the pile point, tons/m²; \( \gamma_s \) is the unit weight of the support soil, tons/m³; \( d \) is the pile diameter, m; \( U \) is the pile perimeter; \( \lambda_0 \) is a pure number depending on the lateral earth pressure coefficient and equal to 0.5; \( I_i \) is the thickness of each soil layer, m; \( \sigma_i \) is the average natural pressure in each soil layer, tons/m²; \( \delta \) is the angle of skin friction, taken to be equal to the angle of internal friction for a Benito-type pile; \( F \) is the cross sectional area of the pile, m²; \( N_c, N_p, N_i \) are dimensionless coefficients depending on the angle of internal friction of the soil.

The right side of the formula concerning the bearing capacity of the point of a situ-cast pile is set out as a formula for calculating the limiting load on a continuous footing, where in place of the unit area of the foundation we have substituted the area of the pile base and introduced correction factors. The left side of Terzaghi's formula represents a modified Coulomb formula. The factor of safety is taken to be equal to 2.3.

Calculations after Terzaghi showed that a load of 400-450 t can be permitted on one pile for the soil conditions at the construction site of the Memorial Center. However, the lack of experimental verification of the calculation methods for clays necessitated the conduction of field tests of situ-cast piles for a vertical load.

To establish the effective bearing capacity of piles and the deformability of the soil, the laboratory of deep supports of NII Osnovanii conducted static tests of an individual 13-m-long pile. A stand consisting of the experimental pile, four anchor piles, and a reinforced-concrete support structure was manufactured for the tests. The experimental pile was made in the same manner as the working piles, but its top was reinforced by five meshes for uniform distribution of stresses in the pile head. A 30-mm-thick steel sheet, fastened by a rod into the pile body, was placed on the top of the pile. Before the tests the sheet was covered with a steel plate 20 mm thick.

The anchor piles were more heavily reinforced than the working piles. The reinforcement projections of the anchor