Notwithstanding the progress achieved in the design and construction of buildings and structures sited on collapsible (prone to slump-type settlement) loess soils, cases of structural damage due to foundation collapse are still not infrequent. Distortions of structures built on loess soils whose collapsibility classifies them as Type II have been particularly serious and frequent. As a rule, the repair of such structures boils down to strengthening and replacement of components which have undergone excessive deformation, and to technical measures for protecting the collapsible loess foundation from water. However, these measures often do not preclude recurrence of foundation collapses, and eventually the building is completely destroyed.

The Engineering Construction Department of the Groznyi Petroleum Institute has, over a period of some years [1, 2], applied the organized-wetting method of eliminating collapsibility of the foundations of settlement-damaged buildings and structures. This method was used to stabilize the foundations of over 20 structures which had been taken out of service, thus effecting a saving of over one million rubles.

In what follows, the authors have attempted to cover some questions on the design and execution of this stabilization method, for the loess foundations of settlement-damaged buildings and, using the buildings of the town of Groznyi as an example, to show the effect that organized wetting has on the stressed-deformed state of a structure; also, to evaluate the limiting nonuniformity of the foundation slump-type settlement for structures of the type under examination.

We will examine an example of stabilization carried out on the foundation of School No. 46, which consists of loess-type loams 14 m thick, whose collapsibility classifies them as Type II. The collapsible loams are underlain by noncollapsible loams 6 m thick. No groundwater was encountered to depths of up to 20 m.

As the result of damage to sewerage and water-supply networks, the foundations were periodically subjected to local wetting. The nonuniform wetting and considerable collapsibility of the foundation soils at this building site caused large local settlement and deformations. The building was taken out of service, and the question of its demolition was raised.

The Department offered to stabilize the deformations of the loess foundation of the school by the organized-wetting method so as to preclude future collapse, and then, after carrying out major repairs, to reinstate the structure to full serviceability. The design was to be based on the following data: prediction of the anticipated foundation settlement caused by organized wetting and determination of its nonuniformity; assessment of the building's capability to withstand the organized settlements with minimum structural deformations; computation of the required volume of water, and selection of the soil-wetting technology.

Without dwelling in any detail on the design methodology for this measure [3, 4], we will note that the characteristic of the collapsibility properties was taken to be the coefficient of relative settlement \( \delta \), whose value as a function of the compaction pressure \( \delta = \varphi (\sigma_z) \) was determined by well-known methods. Owing to the genetic features of loess soils, the coefficient of relative settlement \( \delta \) within the given depth range (constant compacting pressure \( \sigma_z > ) \) had several values. For this reason, the index \( \delta \) was evaluated from several statistical characteristics: \( \frac{1}{n} \) — from the mathematical expectancy (mean value) of the relative settlement; \( K_\delta \) — from the coefficient of variation of the mathematical expectancy (mean value) of the relative settlement. These characteristics made it possible to determine, with the prescribed reliability, the probable range of values of the relative settlement for the given compacting pressure (within the subject depth limits).
The law of variation of the mathematical expectancy of the relative settlement and its coefficient of variation, expressed in terms of the depth $z$ and over the foundation base $x$, $y$:

$$\delta = q(x, y, z) \text{ and } K_\delta = f(x, y, z)$$

enabled the value and nonuniformity of foundation settlement to be predicted as a first approximation.

The prediction reduced to the determination, under conditions of unidimensional compaction and zero rigidity of the structure, of the possible extreme and average values of the expected collapse-type settlement by the method of elementary summation:

$$S_{\text{max}} = \sum_{1}^{n} b_i (1 - K_\delta) h_i m_i.$$

It is obvious that the coefficient of variation of the mean foundation settlement $K_\delta$ calculated in this manner is numerically equal to $K_\delta$, insofar as $h_i$ and $m_i$ are determined values (thickness of the $i$-th layer and the coefficient of the working conditions). As experience has shown, in order to evaluate the variation of settlement $K_\delta$ with area $x$, $y$, it is sufficient to process the cores from three bores drilled along the length of the structure [3, 4].

The prediction showed that, as the result of wetting, one should expect a settlement of the construction site equal to:

$$S_{\text{max}} = 700 \text{ mm}; S_{\text{min}} = 400 \text{ mm}; S = 550 \text{ mm}$$

As the result of an analysis of the $K_\delta$ values at various depths $z$, it was determined that the greatest variation of the collapse-type properties $0.23 < K_\delta < 0.40$ is observed in the first layer of 4-m depth. With greater depths the values of $K_\delta$ diminish, i.e., the collapse-type properties become more uniform. At depths of 8 to 12 m, $0.14 < K_\delta < 0.23$. With an increase in the compaction pressure with any layer, the value of $K_\delta$ diminishes. This indicates that the manifestation of natural nonuniformity of collapse-type deformations caused by wetting can be reduced by increasing the contact pressures on the foundation surface.

The school building is of brick construction, three stories high, and comprises three individual blocks divided by settlement joints (Fig. 1). The longitudinal bearing and transverse walls are of brickwork 35 cm