DISCUSSIONS

AGAINST HASTY CONCLUSIONS (CONCERNING V. E. SOKOLOVICH'S ARTICLE
"CHEMICAL SOIL STABILIZATION AND THE ENVIRONMENT")

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Considerable attention is presently being given in our country to problems of environmental protection. Therefore, when developing new methods of chemical soil stabilization it is necessary to take into account the effect of chemical reagents on the environment.

Attempts to find reagents harmless for the environment were made at the Scientific-Research Institute of the Construction Industry (NIIpromstroi), when investigations established that when loess and clay soils interest with alkaline solutions, the sorption of the alkali has primarily a chemical character and occurs over the course of a long time.

On the basis of investigating processes of the interaction of loess and clay soils with alkaline solutions, NIIpromstroi developed the "Recommendations for Stabilization of Water-Saturated Weak Clays by Alkalization" [1].

Analyzing these Recommendations, V. E. Sokolovich in article [2] made hasty and unfounded conclusions.

1. In his opinion the recommendations require the injection of 600 liters of alkaline solutions per 1 m³ of clay soil. Yet, according to the Recommendations (Eq. 4), up to 270 liters of an aqueous alkaline solutions is injected per 1 m³ of clay soil with a porosity of 40-50%. Thus, 1 m³ of soil will contain not 240 kg, as Sokolovich indicates, but 108 kg with the use of a 10 N solution (about 40%). It should be noted that it is practically impossible to inject 600 liters of solution per 1 m³ of clay soil.

Extensive investigations on stabilization of water-saturated loess and clay soils of very soft consistency (below the water table) by means of alkaline solutions established that on treating such soils with a 5-N solution, the compressive strength of the stabilized specimens is 0.4-0.6 MPa; with 7.5 N, 0.6-1.2 MPa; and with 10 N, 1.2-2.0 MPa, depending on the composition and properties of the soils.

When reconstructing buildings and structures and also in emergency situations, most often the task is to stabilize loess or clay soils of the base with attainment of a strength of 0.5-0.7 MPa. Therefore, mainly alkaline solutions of 5 and 7.5 N concentrations with respectively 54 and 81 kg of alkali per 1 m³ of soil are used for these purposes.

Sokolovich's statement that loess and clay soils absorb only about 25 kg of alkali is not confirmed by experiments. The data given in Table 1 on the sorption of alkali by silty loam show that with an increase of the concentration of the alkaline solution, the reactivity of the soil increases. The total sorption of alkali by loam during a month of hardening is close to the amount of alkali introduced into the soil. Even the exchange capacity of the soil, determined by Sokolovich's well-known method, increases with increase of concentration of the alkaline solution and exceeds the value given by the article's author.

Thus the alkalized zone of the soil mass will not be a long source of pollution of the geological environment. The unreacted alkali in the zone of alkalization during diffusion advance will be completely absorbed by the soil beyond the limits of the zone and cannot pose a danger of environmental pollution. This is confirmed by on-site and field observations conducted for several years [3]. Pit sampling of the soil stabilization zone at one of the objects, where alkalization of the soils of the base had been carried out 5 years ago, showed that the alkali had diffused to a distance of not more than 50 cm from the zone of alkalization, and in the zone itself its concentration had decreased by 100 times and was 0.08 N.

Consequently, stabilization of water-saturated loess and clay soils by the alkalization method does not pose a noticeable danger of environmental pollution, since such soils have a unique geochemical barrier for alkaline solutions even of rather high concentrations (> 2.0 N).

2. As a result of the active irreversible chemical interaction of the alkali with soil, its content in the soil pore solution already after 1-2 months of hardening decreases by 2-3 times and the medium becomes practically noncorrosive with respect to concrete (according to Table 6 and par. 2.7 of building code SNiP 2.03.II-85). The content of alkali in the soil decreases with time.

3. Alkalization is used for stabilizing water-saturated soils, and therefore chemical heaving, which Sokolovich suggests is due to carbonization of the alkali in soils, does not occur, since crystalline hydrates of soda are absent in the pore solution.

4. The alkalization method is applicable for clay soils with a gypsum content of not more than 6%. The sodium sulfate occurring in a small amount in the alkaline medium is not a corrosive danger for concrete. Migration of the sodium sulfate that formed to concrete in the soil pore solution is limited by diffusion processes.

5. According to the Recommendations, the selection of the site of embedding the injectors should be coordinated with the electrical inspectors. It is categorically forbidden to conduct works on alkalization of soils near electrical cables and couplings in an aluminum or lead shield.

6. Problems of safety engineering during alkalization of soils are elaborated rather thoroughly in the Recommendations of NII Promstroi with consideration of the instructions on working with alkalies at chemical plants.

7. Laboratory investigations and the practice of injecting alkali solutions into soils showed that alkalization of water-saturated loess and clay soils does not lead to additional deformations, which Sokolovich fears. A day after alkalization the strength of the soil increases by 1.5 times.

The nonuniformity of stabilization of loess and clay soils along the radius of injection with the use of the alkalization method is no worse than that observed in stabilization by silicate injection. The data given above indicate a sufficient strength of soil stabilization for practical purposes.

The practical use of the method of alkalization of water-saturated loess and clay soils developed by NII Promstroi is confirmed by the practice of soil stabilization in Ufa and Volgodonsk. On the recommendations of NII Promstroi, plans were drawn up for stabilizing soils at unserviceable objects in Ust'-Kamengorsk, Orenburg, Birsk, Ufa, and Gorky. The reduction of the estimated cost and labor expenditures was as much as 50% in comparison with silicate injection and engineering methods of reinforcing the foundations.