In different periods during the past two centuries, an administrative building on Pokrovka Street has been subjected to numerous reconstructions associated with its additions and superstructures (Fig. 1). The first brick structure (1) appeared in 1802, and occupied only one-fourth the area of the modern building. In 1842, two-story tenement building (2) which was expanded in 1850-1878 by addition (3) and the superstructure of a third floor, was erected after demolition of the existing structure. At the start of the 20th century, five-story brick tenement (4) with a basement was constructed in direct contact with the building. By the close of the 1990s, the building was topped-off with a mansard story, and became a four- and three-story structure. On the side of the main facade, moreover, single-story annex (5) was built adjacent to the main entryway.

After the reconstruction, the building was approximately 25 m wide along the main facade, 20 m in the median section, and 7-9 wide and 25 and 42 m long in the wings. The height of the above-ground stories is 3-4 m, 2.5 m in the mansard, and 1.8 m in the basement.

The bearing elements consist of longitudinal and transverse walls situated every 1.8-8 m. The walls, which range from 0.72 to 0.93 m thick, and 0.52 m thick in individual cases, are built of red brick set in a limestone mortar, and possess numerous cracks that have been sealed during periodic repairs.

The ceilings in the old section are wooden and are supported on wooden beams, while those of the superstructure are formed from sectional reinforced-concrete slabs.

The strip foundations are fashioned from red brick in the upper section, and from surface-tooled and rubble quarry stone in a limestone mortar in the lower section, have depths of embedment ranging from 2.2 to 4.45 m from the surface of the first floor, and a lower-surface width of 0.7-1.65 m.

As a result of the numerous additions and superstructure enlargements of individual sections of the building (for which there was no bond between the joints in the brickwork), aging of the mortar, different foundation dimensions, frequent deployment of window and door openings, therefore, the actual three-dimensional strength of the building was found to be low, despite the significant thickness of the walls.

According to archived materials, a section beneath the building was covered with a network of channels and passageways, which had been filled-in during its occupancy.

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STRENGTHENING THE FOUNDATIONS OF AN ADMINISTRATIVE BUILDING IN MOSCOW

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Characteristic features of the construction and design of a building, the section of its location, and basic causes of deformation are discussed. The procedure used to strengthen the upper part of the foundations by the installation of tension rods consisting of vertical angle brackets, longitudinal channels, turnbuckles, and anchors, as well as reinforced-concrete belts-walls with effective longitudinal reinforcement in the upper and lower sections, and distributing horizontal and vertical reinforcement and anchors is described.

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After the reconstruction, the building was approximately 25 m wide along the main facade, 20 m in the median section, and 7-9 wide and 25 and 42 m long in the wings. The height of the above-ground stories is 3-4 m, 2.5 m in the mansard, and 1.8 m in the basement.

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As a result of the numerous additions and superstructure enlargements of individual sections of the building (for which there was no bond between the joints in the brickwork), aging of the mortar, different foundation dimensions, frequent deployment of window and door openings, therefore, the actual three-dimensional strength of the building was found to be low, despite the significant thickness of the walls.

According to archived materials, a section beneath the building was covered with a network of channels and passageways, which had been filled-in during its occupancy.
The geologic-engineering conditions in the section under consideration are characterized by laminar stratification embedded 2.8-4.4 m from the top of the fill soils, which consist of a mixture of sands, silty-clayey soils with inclusions of rubble and limestone. The fill soils are underlain by saturated silty and fine clayey sands with gravel inclusions in some areas, and by plastic and highly plastic clayey loams, and partially by sandy loams with individual layers 2-7 m thick.

The ground-water table resides at a depth of 2.2-2.95 m from the surface of the ground.

Silty and fine sands of medium and high density, which are characterized by relatively low compressibility, exist directly beneath the lower surfaces of the foundations within the bounds of the oldest section of the building (2), while primarily compressible clayey loams and sandy loams reside beneath additions (3). The foundations beneath the addition to the main entryway were built on fill soils. Check calculations indicated that the actual stresses in the bed soils beneath the foundations for the outer walls of the greater part of the building do not exceed their design comparisons calculated in accordance with Construction Rule and Regulation 2.02.01-83*, and are found to be 15-20% higher only in individual locations.

In connection with the continuous manifestation of new, and the development of previously existing inclined and vertical cracks in the outer walls of the building during the period from 23 May 2000 through 22 December 2001, four cycles of geodetic observations were conducted on settlements of the foundations, which indicated that the settlements of individual sections of the foundations amounted to 7.15-16.6 mm during this time. The maximum rate of increase in settlements of 1-3 mm per month occurred in the first period of observations, and then declined to 0.3-0.2 mm. Minimum (7.15-9.35 mm) and maximum (13.75-16.6 mm) settlements were observed within the bounds of the oldest section of the building, and under three-story section (3) of the most recent addition on the clayey and sandy loams, respectively. The measured settlements are essentially independent of the load on the foundations, and among other things, were found to be similar and equal to approximately 12 mm under the foundations of addition (5) on the fill soils, and the walls of the main facade.

It was established on the basis of analysis of all factors considered that the most probable causes of the nonuniform and long-developing settlements are: the existence in the built-over area of the filled-in channels and passageways through which ground water moves with suffosion removal of silty-clayey soil particles; the embedment of sandy and silty-clayey soils that differ in terms of variety, physico-mechanical characteristics, and, primarily, compressibility beneath the lower surface of the foundations; the different depth of the