In reinforcing the foundations of architectural stone monuments, overlaying of white-stone walls and foundations located above the basement floor is inadmissible. All work should be carried out from the basement, and below the floor of the first story in the absence of a basement. The punching of holes in white-stone walls and ceilings, which violates the integrity of the stone, is also prohibited. When the walls and ceilings must be strengthened, a cement-like-artificial pozzolana milk is injected into them. The injection tube should have a diameter no greater than the thickness of the joint and should be placed only in the joints.

The 1981 underpinning of foundations and reinforcement of the walls and ceilings in the basement of a deformed building of the Amusement Palace, which is a monument to 17th century architecture, may serve as an example of these operations. Since the walls and ceilings of the basement in this building are white stone, the foundations were underpinned only below the basement floor.

Beginning in the 18th century, the Amusement Palace has been repeatedly altered, and at the present time has from three to six stories with a height from 14 to 29 m (Fig. 1).

The Amusement Palace, which has been in existence for more than 300 years, has settled more than 1 m, and has experienced significant deformations. Through cracks up to 40 mm wide have formed in the cornices, roofs, window and door archways, and partitions. The vaulted roofs of the basement rooms, where stones have fallen from the ceilings, have sustained the greatest damage.

To prevent cracks from propagating in the walls and ceilings, deep recesses have been blocked up in the basement walls in past years, and brick walls were additionally constructed in separate areas. On one internal wall under a load of 920 kN/m, the white-stone facing was vented, and, evidently, at the outset of the 20th century, this wall was given a steel frame.

A study of the palace building and underlying soils was begun in 1936. The absolute elevations of the surface of the plot are 142.85-144.70. The height of the basement is 4 m and greater (see Fig. 1). The strength of the stone in the walls is 1.0-1.5 kN/cm², the mortar being grade 40.

The foundations beneath all walls are continuous and are embedded 0.6-0.8 m below the basement floor. Recesses have formed below the foundations due to rotting pile heads. The walls below the basement floor consist of broken limestone set in a limestone mortar, while above the floor, the construction is "in a basket" and rubble work containing broken stone and a brick face set in a lime mortar is built in its walls between openings. The pressure on the soil ranges from 0.3 to 0.7 MPa. The load per 1 m of wall varies from 400 to 920 kN. The thickness of the walls in the basement is 1.4-1.9 m. The interstory floors are vaulted and partially wooden.

The plot occupied by the Amusement Palace is situated on an ancient alluvial terrace sloping toward the Neglinki River Valley. The greatest thickness of fill (more than 15 m below the basement floor) has a section situated close to the Kremlin Wall.

The soils in this layer of the stratum are represented by the following varieties.

1. Sands of different grain sizes, which are choked with stone facing, clayey particles, humus, and vegetative fragments with sandy-loam and clayey-loam interlayers of small thickness. The thickness of this layer varies from 1.5 to 7.0 m.

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2. Sandy loam contaminated with clayey loam and limestone and brick facing. The thickness of the layers ranges from 1.5 to 4.5 m with the roof lying at a depth to 9 m.

3. A black-soil mass with a porosity of up to 51-53%; it is a humus contaminated with sand, silty loam, clayey loam, and vegetative remnants. The permeability of these soils is 0.1-0.15 m/day, and the clayey loam interlayers found here are virtually impermeable. The maximum depth of embedment of the black soil is 7 m.

4. Clayey loams contaminated with humus, sandy loam, and limestone and brick facing. The layer is up to 3 m thick and lies at a depth of 16-18 m.

Laboratory analyses indicated that contaminants of humus and vegetative remnants exist in all soil varieties and amount to from 13.9 to 22%. The fill soils are dense with a specific gravity of 15.5-17.0 kN/m³ at the natural moisture content; the specific gravity for the skeleton ranges from 11.4 kN/m³ after roasting to 12.9 kN/m³ at the maximum porosity of 52%. The water table, as established in 1961, was at an elevation of 122.9-162 m below the basement floor. Surface water was detected at a depth of 5-6 m. The fills are underlain by deposits of the Carboniferous System.

The palace deformations are caused primarily by compaction of the sandy and humus soils. The settlements have amounted to from 118 to 126 mm over the last 35 years. Deformations of the Amusement Palace were activated during construction of the Palace of Congresses. This occurred due to the continuous dewatering, which had caused the overall lowering of the water table in a large area of the Kremlin Hill, and in this connection, additional consolidation of the soils.

The average rate of settlement of the palace during the entire observation period since 1936 has fluctuated from 1.5 to 4 mm per year. In this case, the dimensions and settlement rate of building sections adjacent to the Kremlin Wall exceed the settlements of those sections on the opposite side.

Underpinning work on the foundations beneath the Amusement Palace was begun in 1978. Strangely enough, the building's maximum settlement occurred where the humus layer was thinnest, and means that the hypothesis concerning the basic effect of decay or organic contaminants on settlement is not confirmed in this case.