The investigations and observations carried out in recent years of settlements of buildings and structures constructed on soils of type II collapsibility have shown that a complete penetration of the collapsible layer by piles, supports, or the compacted mass does not always prevent significant settlement of the foundations, particularly associated with the collapse of the surrounding soils due to their own weight [1-3, etc.]. This is confirmed by the service performance and observed settlement data of the foundations of several buildings: the covered trestle and the Palace of Culture of the Zaporozhe Transformer Plant (ZTZ) in the city of Zaporozhe, and also the nine-story community housing in the city of Dneprorudnoe.

The covered single-span trestle is an annex to the fabrication-welding shop No. 1 of ZTZ and was built during operation of the main building (Fig. 1a). Its span is 24 m, the column spacing in line is 6 m, and the overall dimensions in plan are 132 × 24 m.

The site soils up to depths of 22-25 m comprise loesses underlain by sandy-clayey deposits. The collapsible (subject to slump-type settlement) soils occur to a depth of 16-18 m and belong to type II with respect to collapsibility, with a possible self-weight collapse settlement of 40 cm. The water table is located 17-19 m below the natural surface.

The trestle building was built on cast-in-place piles of 500-mm shaft diameter with pedestals of 1600-mm diameter bearing onto saturated loess-type loams. Each column is supported on four piles arranged in a square pattern at 2100-mm centers. The bearing capacity of the piles according to the results of static-load tests, with the surrounding soil wetted experimentally and no manifestation of collapse due to its own weight, was 1800 kN. The design load on the foundation piles was taken as 600 kN. The underloading of the piles was built into the design to allow for possible collapse of the surrounding soils due to their own weight and the manifestation of friction forces due to the loading.
According to observed data, settlement of the building's foundations commenced practically from the moment of placing it in service (see Fig. 1b). Their most intensive rate of increase was observed during the period 1971-1974. During this period the settlement of individual foundations reached 95-180 mm. Subsequent observations showed that the trestle settlements had practically stabilized. Thus, for the period June 1, 1974, to Jan. 14, 1977 they amounted to only 5-10 mm. Settlements along axes 1A and 2A are characterized by a considerable nonuniformity. The reason for the increased settlements of the foundations was the rise in the water table, which caused collapse due to self-weight, and so the cast-in-place piles of the trestle received a supplementary surcharge due to the friction forces developed by this additional loading.

The Palace of Culture built in 1970 is a framed building with longitudinal and transverse load-bearing walls. The foundations are of the strip-footing and column types, with loadings of, respectively, 250-540 kN/ln. m and 600-2650 kN/column. The loading on the foundation soils does not exceed 0.25 MPa.

Down to the depth of 25 m the site comprises a layer of loess soils of type II collapsibility, with a possible slump-type settlement of 50 cm due to its own weight. The loess soils are underlain by clay deposits.

The adopted design provided for preparation of the foundation base by deep compaction with soil piles using BS-1 drilling rigs. The soil piles were spaced at 1.5-m centers and compaction was carried out to a depth of 21 m with the achievement of a unit mass of dry soil in the base of not less than 1.65 g/cm³.

The observed building settlements from the time of commissioning (Fig. 2) showed that foundation settlements due to building loadings stabilized during the first year of service and amounted to 5-20 mm. There was practically no nonuniformity of settlements. Subsequently, the settlement rate increased substantially and amounted to an average of 86 mm/yr during the period Apr. 28, 1971, to Feb. 2, 1973, and averaged 32 mm/yr during 1974-1976.

The total settlement of the building as of 1977 amounted to 120-180 mm and is characterized by a relatively uniform distribution in the plane of the main-facade wall; however, it can be seen from the settlements of the wall along axis 19 that a general tilting of the building had occurred. The nonuniformity of settlement here reaches 12-22 mm. Inside the building cracks have formed, narrowing in the upward direction, with a width of 2.5-5 mm. Between columns 9 and 10 an outward bulge of the cellar wall has occurred, with a maximum deflection of 50-100 mm. In addition, the framework columns tilted from the vertical due to their bases being displaced horizontally from the plane of the wall. The horizontal displace-