In the USSR pile foundations have found wide use both in construction on weak soils, where they are traditional, and in the mass construction of apartment and industrial buildings under ordinary soil conditions.

Territories favorable for construction have become increasingly scarce in recent years. New remote regions are being developed at high rates. Construction is often being carried out at sites with a considerable (to 30-40 m) stratum of weak, slump-prone, and expanding soils and on undermined territories, and also in the presence in the construction region of a large number of existing or planned underground utility lines.

At the same time, there has been a trend to the construction of high-rise buildings in connection with the intense growth of cities. Twelve-story buildings have become commonplace in building up new neighborhoods of cities, and the need to economize urban lands is leading to a further increase in the height of buildings being constructed to 16 and 30 stories.

Present-day industrial construction has also changed qualitatively. New technological processes often require the use of large spans between columns of buildings, high lifting capacity of cranes within shops, and heavy equipment. All this leads to the need to transmit large concentrated loads to the foundations. In a number of cases the columns of tall buildings and shops transmit concentrated loads of the order of 100,000 kN. In connection with this the volume of using pile foundations increases each year, and presently has exceeded 5 million m³ of reinforced concrete annually. Mainly driven piles are used (up to 90%), but of late the use of bored piles has been increasing.

The experience of design and construction on pile foundations showed that the latter permit a considerable reduction of excavations and concreting, increase of the level of industrialization of substructure works, reduction of the time and cost of constructing foundations, construction any time of the year, an increase of the safety of the structure and thus an improvement of the quality of buildings and structures.

These advantages of pile foundations became practicable as a result of introducing the results of scientific investigations and improving the calculation methods which permitted transmitting considerably greater loads to piles than earlier, and also creating efficient pile designs. The NII Osnovanii, State Institute for the Planning of Bases and Foundations (Fundamentproekt), experimental design department of the Central Scientific-Research Institute of Structural Elements (TsNIISK) and other organizations developed new effective designs of driven piles. Of special interest among them are the piles without transverse reinforcement, whose special features are simplification of the designs as a consequence of eliminating the reinforcement cage and two- to threefold reduction of steel consumption.

Unlike the known prestressed piles, in the given design transverse reinforcement is provided only in the pile head and point and longitudinal reinforcement in the central zone of the pile stem.

The location of longitudinal reinforcement in the central zone, unlike its location in the corners, besides saving transverse reinforcement, effects an additional economy of metal for short piles. Simultaneously such an arrangement simplifies the technology of manufacturing the piles.

The area of use of the indicated piles with a length to 12 m is almost as wide as for the previously used driven prestressed reinforced-concrete piles. The only exceptions are cases when the piles must be driven into stiff and very stiff clays or coarse-fragmental soils with a bed thickness of more than 0.5 m, and also when considerable horizontal loads and moments must be transmitted to the piles.

The use of piles without transverse reinforcement permits reducing by half the labor intensity of works on their manufacture, saving 20 kg of metal per 1 m³ on the average in comparison with standard prestressed piles and 50 kg in comparison with unstressed piles, and reducing the cost of 1 m³ of pile by 5 rubles.
Thanks to their great economic advantages piles without transverse reinforcement have found wide use. In 1977 the volume of their use will reach almost 0.5 million m³ of reinforced concrete, which will effect an annual economy of more than 2.5 million rubles.

Among the new designs it is necessary to note also short and pyramidal piles without transverse reinforcement.

Under a number of soil conditions such piles have an increased bearing capacity in comparison with prismatic piles and permit a reduction of concrete and steel per ton of bearing capacity by 30% on the average. The technology of manufacturing pyramidal piles of the new design is quite simple owing to the absence of transverse reinforcement and differs little in labor intensity from conventional piles.

Also quite effective are driven column-piles, whose construction technology was developed by the Scientific-Research Institute of Industrial Construction (NIIPromstroi) and Central Scientific-Research Institute of Experimental Planning of Rural Construction (TsNIIÉPset' stroi). They can serve simultaneously as the above-ground structures of lightweight industrial buildings.

For bridge foundations the Central Scientific-Research Institute of Transportation Construction of the USSR Ministry of Transportation Construction (TsNIIS Mintransstroi) has developed and is using successfully tubular piles up to 5 m in diameter, which are used also in industrial construction.

Soviet specialists have created new and improved pile calculation methods. They include: 1) calculation of the bearing capacity of piles on the basis of the results of their dynamic testing with consideration of the viscous resistance of soil; 2) methods of determining the bearing capacity of piles of various shapes, including driven pyramidal piles; 3) calculation of single piles with respect to deformations on the basis of the method of iterative solution of problems of soil mechanics; 4) analytic methods of determining the settlements of pile foundations; 5) generalized method of calculating piles and tubular piles for horizontal and vertical loads.

In addition, problems of increasing the bearing capacity of piles in time after their driving and development of negative friction are being investigated, and refined values of the standard point resistance and skin friction of driven and situ-cast piles under various soil conditions, including in slump-prone and weak soils, are being established.

The proposed calculation methods have permitted a considerable increase of the design loads on piles.

As already noted, bored situ-cast piles, which were first used in the last century by the Russian engineer A. É. Straus, have found increasing use in the USSR in recent years. His proposed method of making such piles has now been developed by world foundation-engineering practice.

The presently used situ-cast piles, depending on the required bearing capacity, have a stem diameter from 50 to 150 cm and enlarged foot (clubfoot) from 150 to 250 cm. In individual cases piles with a stem diameter to 200 cm and clubfoot to 350 cm, and also with large transverse dimensions, are used. The depth of the lower ends of the piles in the case of considerable thickness of weak or slump-prone soils reaches 40-50 m. Such piles can take loads from 2000 to 20,000 kN.

Considerable progress has been made also in the area of creating equipment for manufacturing situ-cast piles.

Thus, the SO-2 and SO-1200 devices of the Kiev planning and design office of the All-Union Planning, Surveying, and Scientific-Research Institute (Gidroproekt) have made a good showing in dry clays. The SO-2 device is used when it is necessary to obtain a pile diameter to 60 cm and clubfoot to 160 cm with a length to 30 m, and the SO-1200 is used for making piles from 80 to 120 cm in diameter and up to 22.5 m long.

A specialized MBS-1.7 device was developed by TsNIIS Mintransstroi for constructing situ-cast piles with a stem diameter to 1.7 m, clubfoot to 3.5 m, and depth to 33 m.

Casings were used earlier when it was necessary for the piles to cut through unstable soils and when boring below the groundwater level. To avoid the increase of labor intensity of the works and consumption of metal associated with this, NII Osnovanii and TsNIIS Mintransstroi several years ago developed a method of drilling boreholes in the construction of situ-cast piles with the use of drilling fluid. Experience has shown that with the use of drilling fluid it is possible not only to drill successfully but also to use concrete piles, including with reinforcement and with construction of a clubfoot.

A method of constructing situ-cast piles with a clubfoot obtained by crushing the adjacent soil was also developed in the Soviet Union. The Kuibyshev Civil-Engineering Surveying Trust has proposed special equipment for constructing such piles.