Polski Komitet Narodowy
Międzynarodowej Rady Ochrony Zabytków
ICOMOS

FONDAZIONE ROMUALDO DEL BIANCO

SAPIENZA
UNIVERSITÀ DI ROMA

POLITECHNIKA LUBELSKA

UNIVERSIDAD POLITÉCNICA MADRID

SAPERE AUDE
VILNIUS GEDIMINAS
TECHNICAL UNIVERSITY

FONDAZIONE FLAMINIA
PER L'UNIVERSITÀ
IN ROMAGNA

Sustainable
Urban
Rehabilitation in
Europe

GENERAL BUILDING ENGINEERING

FOUNDATIONS IN HISTORICAL AND MODERN BUILDINGS

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FUNCTIONS OF FOUNDATIONS

The foundation as the structural element of the object is to transfer loads to the ground. The work of the foundation takes place in conditions of constant or variable moisture, for this reason it must be made of high strength materials and resistant to water. [1] [3] [5]

The foundation should meet the following requirements:

- Ensure minimal and even settlement of the building
- Achieving the right foundation depth
- Ensure ease of erection and stability of walls
- Protect the building against moisture and freezing

THE FOUNDATION GROUPS

- **Tile foundations.**

These are foundations whose cavity is smaller than the width. They are usually made at a depth that does not require special precautions to protect the walls of the excavation against slipping or inflow of groundwater. It is conventionally assumed that this depth does not exceed 4 m. These are usually foundations of the direct type. [3]

- **Deep foundations.**

They transfer loads to lower bearing layers. They require reinforcement of the excavation walls and usually an artificial lowering of the groundwater level during construction. The depth of the foundation is above 4 m. These are usually foundations of the intermediate type. [3]

DIRECT FOUNDATIONS

Direct foundations transmit the construction load directly to the building site. The direct foundation of the building is carried out in an open excavation, it is characterized by simplicity and a relatively low cost of implementation. Static work of such a foundation consists in transferring loads from the building to the ground.

Direct foundations have various constructional forms. You can perform their contractual classification due to the construction:

- Foundation feet
- Foundation footings
- Grates
- Plates
- Boxes

FOUNDATION FOUND

They have the form of regular geometric solids, usually distributed at fixed intervals. Each foot transfers the load from the construction pole to the ground. In case of foundation loading only axial vertical force, the feet are formed as square. Very polished feet have a polygonal shape. In vertical section, the foundation footings assume a rectangular shape, in case the height of the foot exceeds 50 cm a trapezoidal or stepped cross-section is designed. [1] [3] [5]

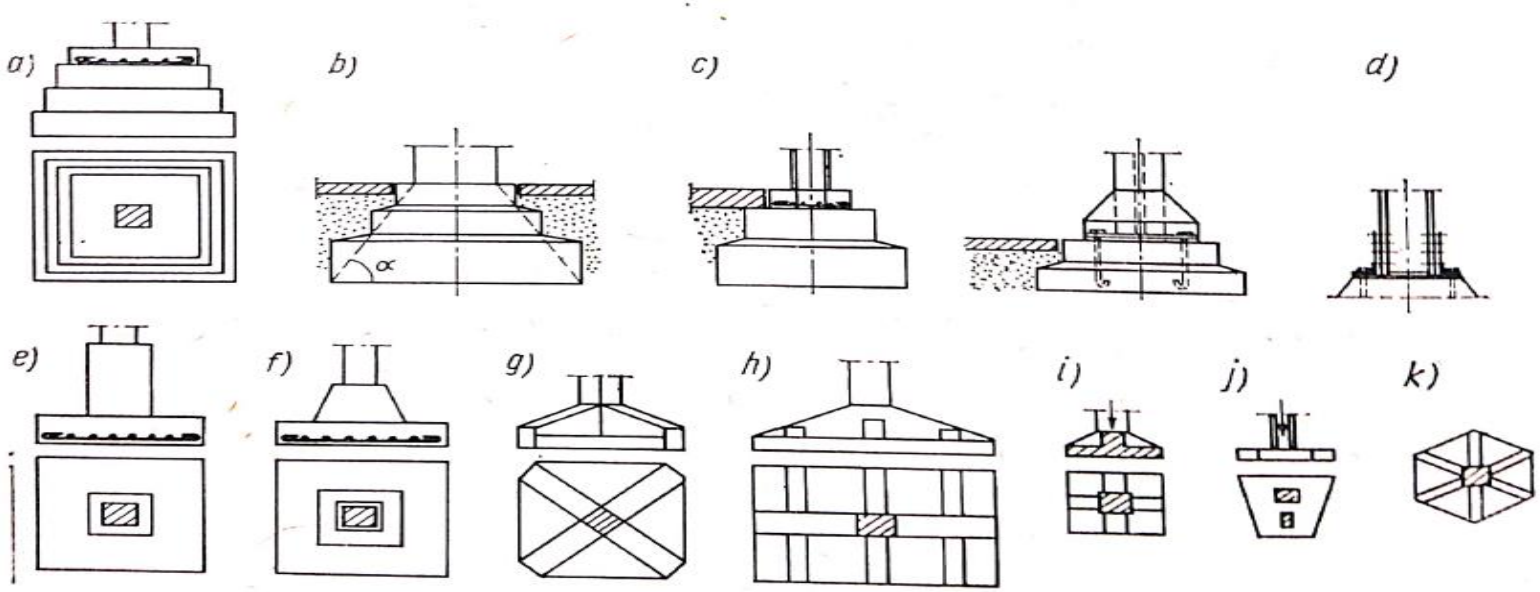

Fig. Types of foundation found [3]

FOUNDATION FOUND

Fig. Prefabricated found [6]

Fig. Monolithic found[6]

FOUNDATION FOOTING

They are the simplest and most commonly used type of foundation. They can be made of brick, stone, concrete or reinforced concrete. They are used under load-bearing and stiffening structural walls, and their length is much larger than the width. [3] [5]

The height of the bench should be chosen in such a way that the foundation presses against the ground with its entire foundation and it depends on the angle of propagation of stresses. In the cement mortar, this angle is about 60º and in the masonry mortar about 70º. [5]

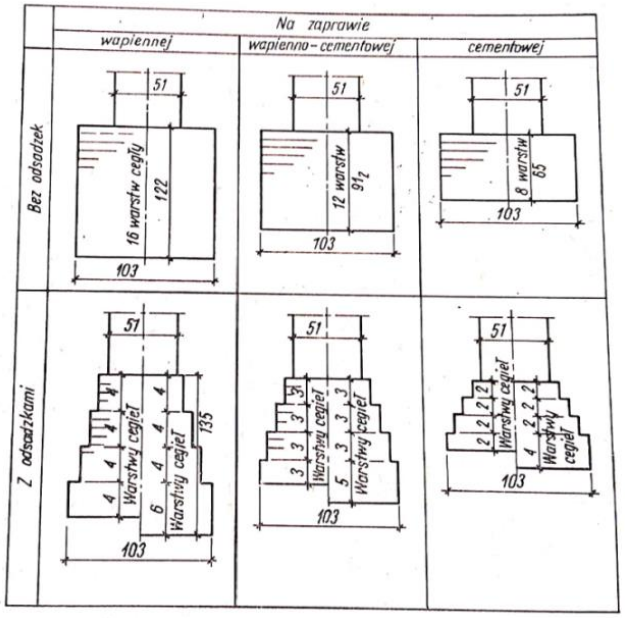

Fig. Sections of masonry foundations[3]

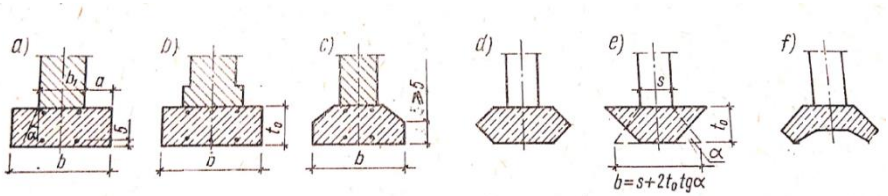

Fig. Sections of concrete foundation foundations [3]

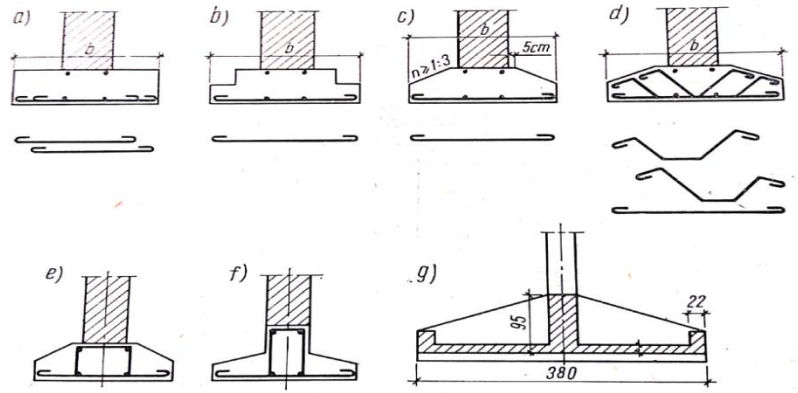

Fig. Sections of reinforced concrete foundation [3]

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FOUNDATION FOOTING

Fig. Monolithic reinforced concrete footbridges [6]

Fig. Reinforced concrete footbridges with formwork [6]

FOUNDATION PLATE

They transfer the loads on them resting directly on the construction site. Due to the low thickness in relation to the dimensions in the plan and the ability to transfer loads by bending the plates are often an economical solution to the foundation on weak soils. In terms of construction, it is an inverted ceiling loaded with ground buoy and based on poles or walls.

Due to the construction, the slab foundations can be divided into:

- plate - made as a plate with a constant thickness of 40 to 140 cm, used at small distances between the walls or pillars of the building.

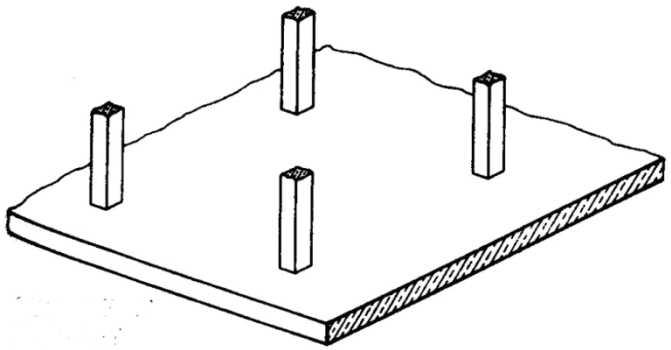


Fig. Foundation plate [3]

FOUNDATION PLATE

- plate and ribbed with ribs from above or below - performed at larger distances between walls or columns; the use of additional load-bearing elements allows to reduce the thickness of the boards. The thickness of the boards is generally from 30 to 40 cm and the height of the ribs is 15% of their span. The arrangement of plates with ribs from the top is more favorable in terms of static, and laying the insulation under the plate is easier, however, to use the surface of the upper slab as the basement floor must be filled with intercostal spaces, which increases the weight of the structure. The plate system with ribs from the bottom allows for direct use of the upper surface, while it causes difficulties in making the insulation.

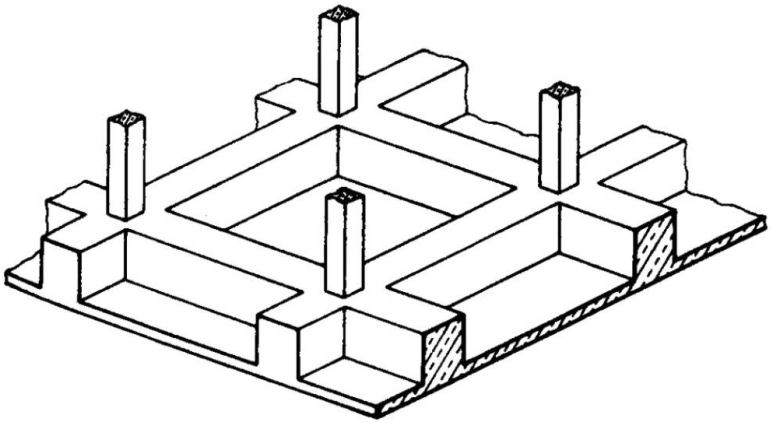


Fig. Foundation plate and ribs with ribs from above [3]

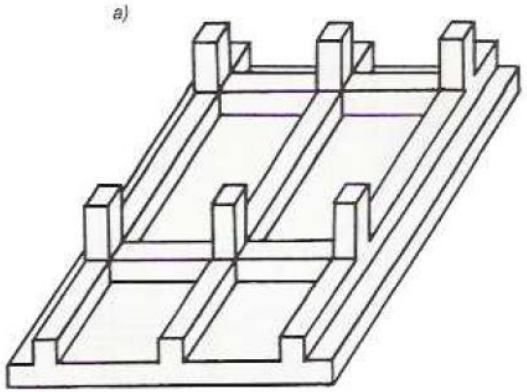


Fig. Platelet-ribbed foundation with ribs from above [3]

PŁYTY FUNDAMENTOWE

Photo. Reinforcement of the foundation plate [6]

Photo. Reinforced concrete foundation plate [6]

INTERMEDIARY FOUNDATIONS

Intermediate foundations transfer the construction load to lower parts of the ground, which are able to transfer loads using additional structural elements.

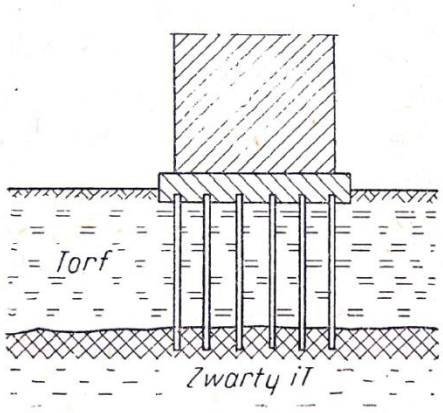
Intermediate foundations can be divided into three main groups:

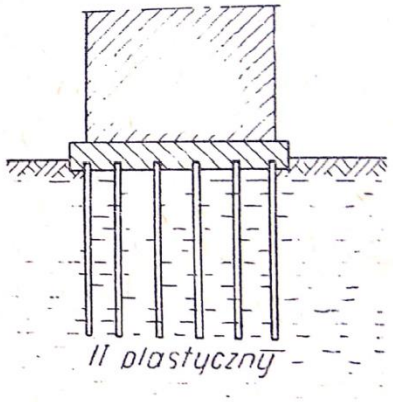
- pale
- wells
- caissons

FOUNDATIONS ON PILES

In case when the foundation level is not suitable for direct foundation, it is recommended to make foundations on stilts. The lower end of the pile is called a blade or base, depending on its shape: pointed or enlarged, while the upper end - usually blunted - is called the head. Depending on the percentage contribution to the load transfer, the pile may be suspended or standing.

In the case when the resistance on the side surface exceeds the resistance based on the pile, we call it suspended, otherwise it is a standing pile.





FOUNDATIONS ON PILES

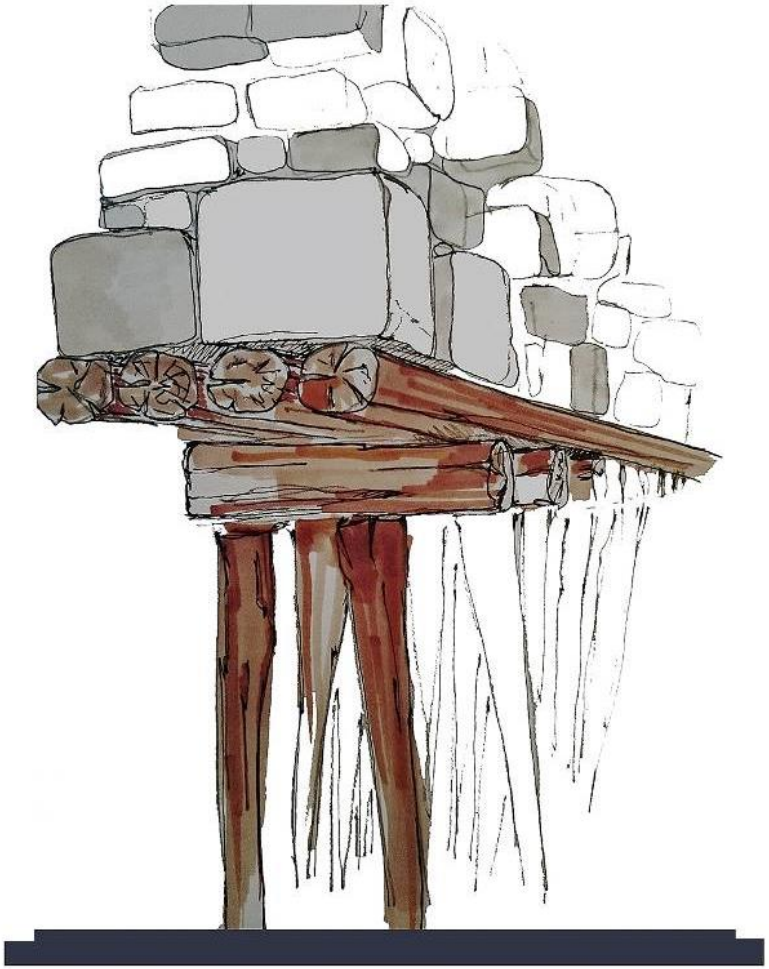
Pile division due to the method of penetration into the soil:

- Hammered - with the help of a pile driver, a steel structure with vertical guides, on which a hammer is pulled up; after reaching the required height, the hammer detaches from the lifting rope and falls on the pile head; the weight of the hammer is from 400 kg to 5 t, and the height of the fall reaches 15 m
- Vibrated - on the pile head a vibratory hammer is placed, which oscillates due to the rotating weight into the soil; this method of penetration is recommended in loose soils
- Rinsed - by the current of water supplied under pressure to the pile's blade. The laundering should be applied in loose soils, in which the soil structure is reconstructed after completion of the washing
- Inverted - concrete or reinforced concrete piles are usually formed in the hole drilled in the ground with a drill pipe

FOUNDATIONS ON PILES

Photo. The process of introducing wood piles into the soil by vibrating [6]

FOUNDATIONS ON PILES



Source: „Wzmacnianie i naprawy fundamentów murowych i kamiennych” dr inż. Stanisław Karczmarczyk

FOUNDATIONS ON PILES

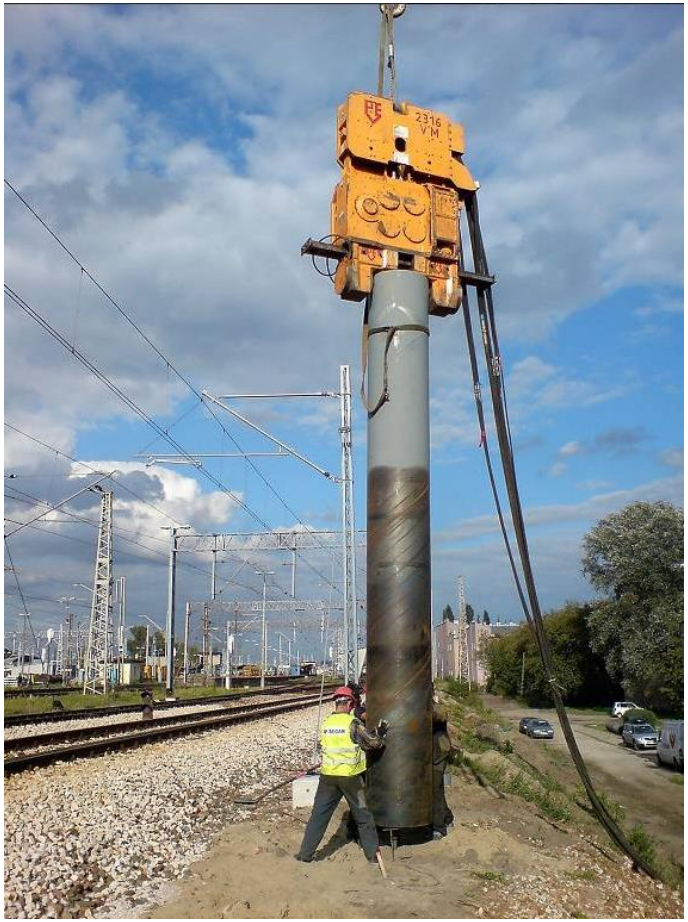


Photo. The process of introducing steel piles of considerable diameter into the soil [6]

Photo. The process of introducing steel piles for the construction of a fishing pier [6]

FOUNDATIONS ON PILES

Photo. Introducing reinforced concrete piles into the ground by driving technique [6]

Photo.14 Placing piles in the ground by pressing [6]

FOUNDATIONS ON PILES

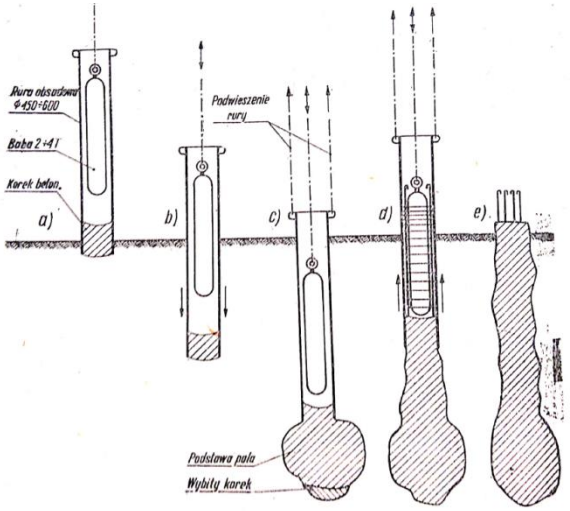


Fig. Schematic diagram of the Franki pile [3]

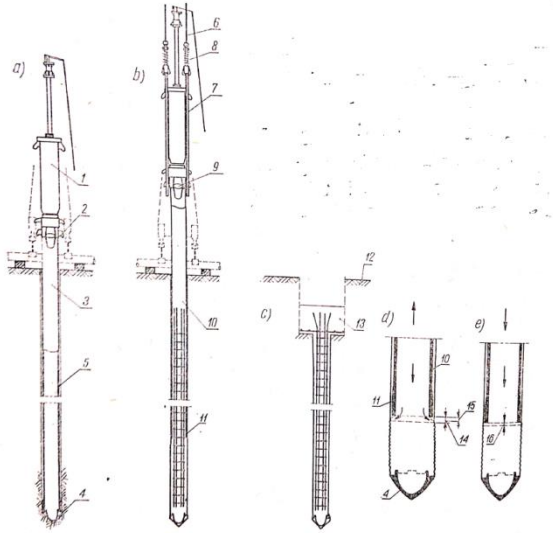


Fig. Schematic diagram of the Vibro pile [3]

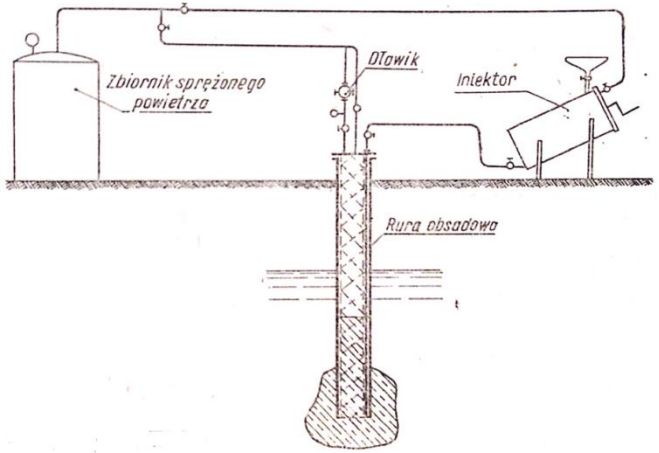


Fig. Schematic diagram of the Wolfsholz pile [3]

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