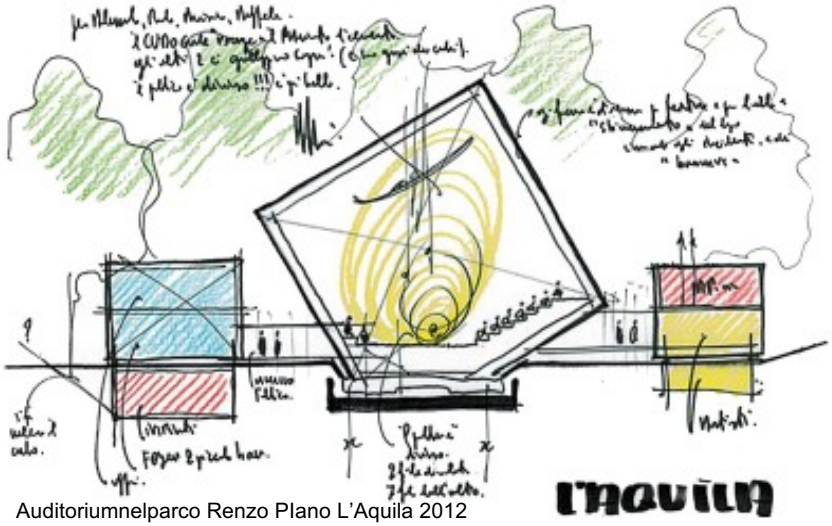
Materials for Architecture and Technological Innovation (6 CFU)

Materials Technologies for the Environment (6 CFU)

Prof. Alberto De Capua



Auditoriumnelparco Renzo Plano L'Aquila 2012

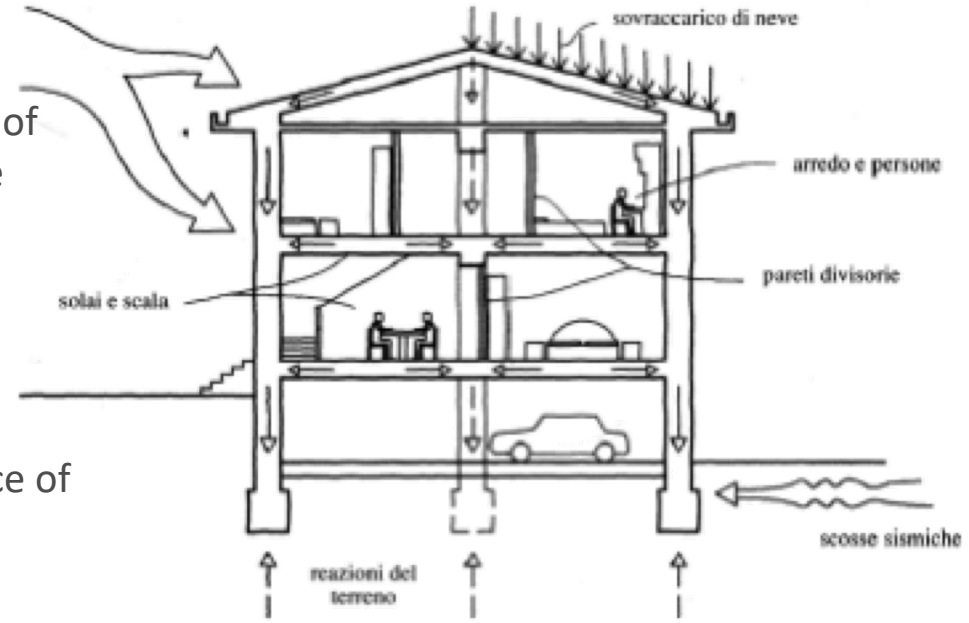
MpA 8 BEARING STRUCTURE

- Foundation structures
- Horizontal containment structures

The Load-bearing Structure is the part of the structure that is expressly designed to absorb the loads and external actions to which the structure is subjected during its entire operating life.

The tasks of the supporting structure are:

- to ensure the transmission of the loads of the various parts of the organism to the ground
- to ensure the functional and structural coexistence of the various technical elements of the building organisation
- to ensure the static and dynamic balance of the various technical elements of the building organisation in operation
- enclose or delimit a space



Preliminary concepts of mechanical safety

Loads

The structure is dimensioned according to the "static loads", normally determined by standards and conventions (statistical results, use of the building).

Permanent loads

It is made up of the weight of the structure itself and of all the elements that weigh on it permanently.

Accidental loads

These are mobile loads: people, furniture, equipment, animals, walls and other non-structural elements, rain, snow, wind pressure, the thrust of the earth.

Thermal and collapsing stresses

All structures vary their shape and size according to the temperature range, these changes result in stress; this also applies in case of subsidence of the ground or other technical parts.

Dynamic (or impact) loads

They change quickly or are applied suddenly (earthquake).

The resonance loads have a rhythmic variation and are determined by the vibrations of machines and equipment.

Balance

A structure is in equilibrium, when it reacts to stresses without having inadmissible displacements with respect to its functions (remember the "cardinal equations of statics").

Resistance

Strength is the ability of the structure to withstand stress without injury or breakage.

STRUCTURAL CONSTRAINTS

Bear or rollers

- Prevents movements perpendicular to the direction of flow of the constraint
- Allows rotation and translation movements along a parallel axis the direction of flow of the constraint

Hinge

- Only allows the rotation of the structure around it

Interlocking

- In relation to the relationship between constraints and stresses, the structure can be isostatic or hyperstatic.

Deformations

Under the action of a load, all materials are deformed. When the action ceases, the materials regain their original shape. This property is called elasticity. This behaviour is valid up to a certain limit (elasticity limit) beyond which the material tends to assume a permanent or plastic deformation.

The materials can be divided into

- Isotropes
- Anisotropes

depending on whether or not the elastic properties vary with changes in direction.

Internal stresses

Tensions are the forces inside a body that compensate for external forces. They arise as a result of deformation of the material. These reactions are opposed to variations in the state of the structure of the stressed body.

Stress

The loads applied to the structure give rise to stresses. The stresses can be of:

The loads applied to the structure give rise to stresses of:

- compression, which causes a shortening of the body;
- tensile stress, which causes the body to stretch;
- bending, which causes the section to rotate around an axis lying on it;
- cut, which causes a sliding between orthogonal sections between them;
- torsion, which causes the section to rotate around an axis orthogonal to it.

They can be present individually and/or simultaneously.

Resistant characteristics of the material

These are defined by the:

- modulus of elasticity, a parameter for assessing the ability of a material to deform elastically
- breaking load, maximum value of the load applicable to the body, i.e. its maximum resistance
- safety load, limit within which the materials can be stressed to safeguard the safety of use. (Hooke's Law)

Richiamando la classificazione UNI 8290, si propone la seguente classificazione di parti strutturali;

Classi di unità tecnologiche	*Unità tecnologiche*	*Classi di elementi tecnici*	*Elementi tecnici*
STRUTTURA PORTANTE	STRUTTURA DI FONDAZIONE	FONDAZIONI DIRETTE	FONDAZ. CONTINUE FONDAZ. DISCONTIN.
		FONDAZIONI INDIRETTE	PALI INFISSI GETTATI IN OPERA
	STRUTTURA DI ELEVAZIONE	ELEMENTI VERTICALI	MURATURA PUNTIFORME IN C.A. IN ACCIAIO IN LEGNO SISTEMIO MISTI
		ELEMENTI ORIZZONTALI E INCLINATI	TRAVI, ARCHI CAPRIATA, SOLAIO IN C.A, IN ACCIAIO IN LEGNO
		ELEMENTI SPAZIALI	PARETI / SOLAIO
	STRUTTURA DI CONTENIMENTO	ELEMENTI DI CONTENIMENTO VERTICALI	MURI A GRAVITA' MURI A SBALZO OPERE SPECIALI
		ELEMENTI DI CONTENIMENTO ORIZZONTALI	MASSETTI SU VESPAIO

Foundation structure

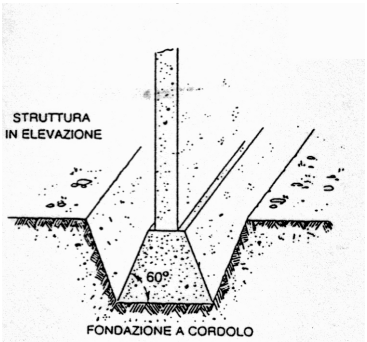
Foundations are the foundation of a building and have the function of transmitting the loads from the building to the ground, dividing them in such a way that the ground can bear them.

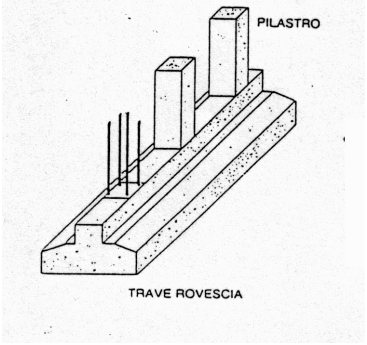
The foundations can be direct or indirect.

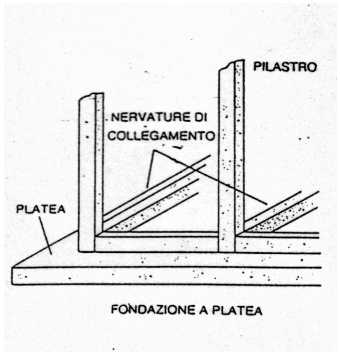
Foundations are direct when the ground capable of bearing the loads can be reached at shallow depths; the foundation, in this case, is in direct connection with the structures of the construction.

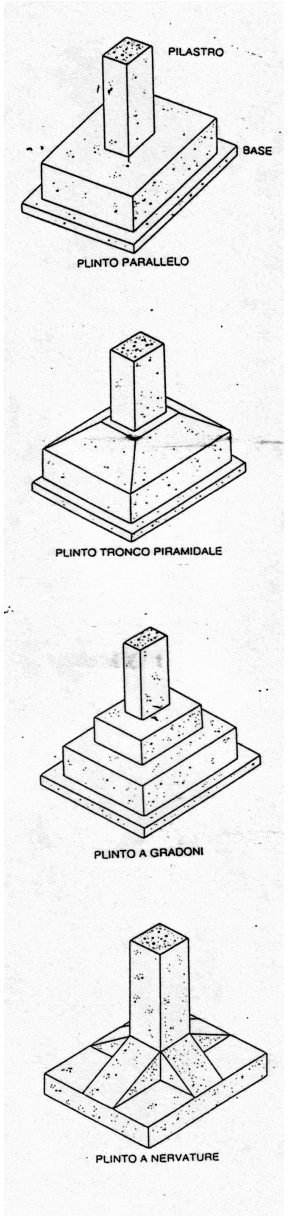
They are divided into:

- Plinth foundations
- kerbstones foundations
- Inverted beam foundation
- stalls foundation









The nature of the soil tells us how much we can load the soil. This assessment can be made by means of load tests, i.e. by loading a certain area of land in a controlled and progressive manner. The load is increased until you notice a certain sinking of the base. The calculated unit load is taken as the limit load or theoretical ground resistance. The safety load is calculated as a fraction of the limit load.

Permissible loads (Kg/cmq):

compact rocks 10

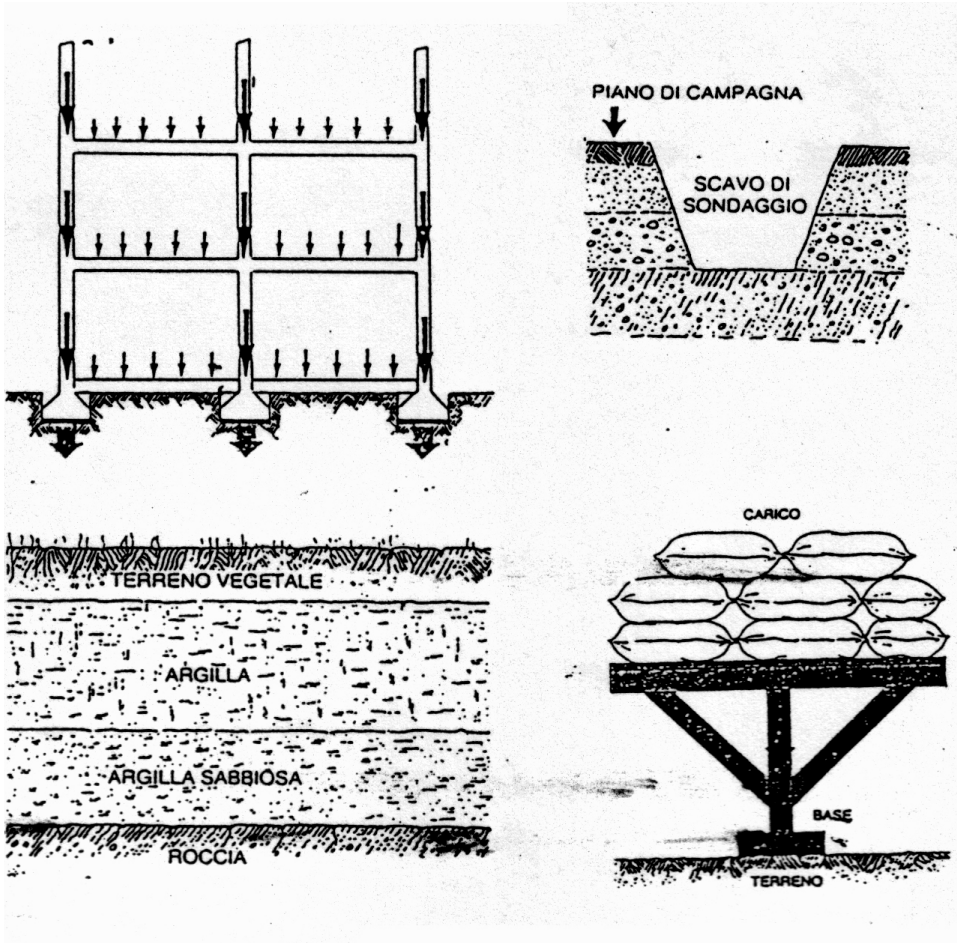
Soft rocks 5-10

gravel in benches 3-6

clay sand 3-4

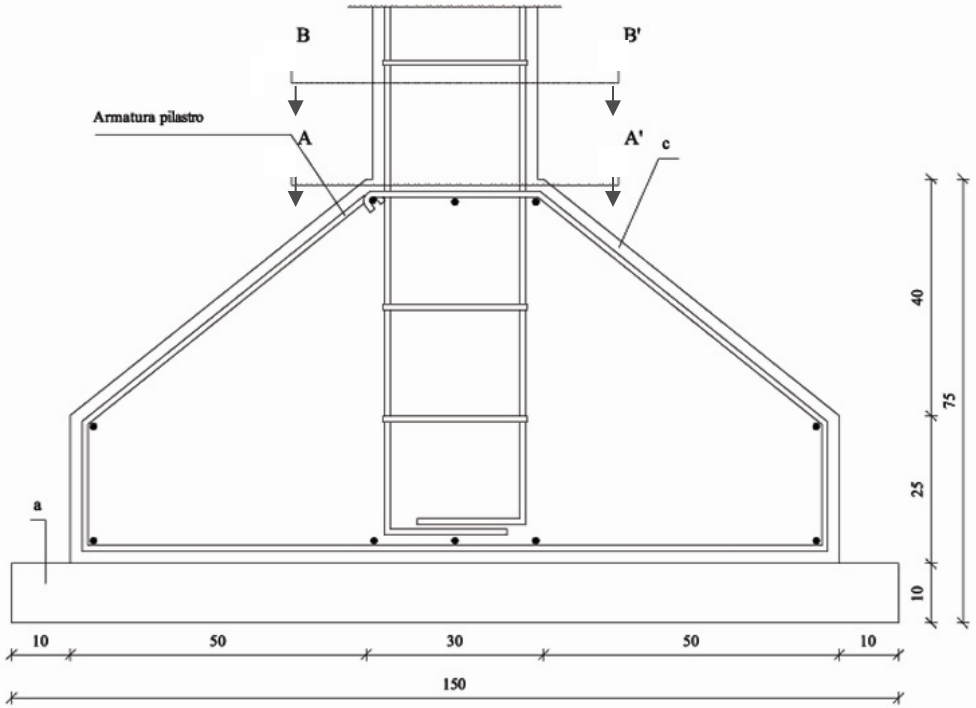
compact clay 1-2

sand 1-4

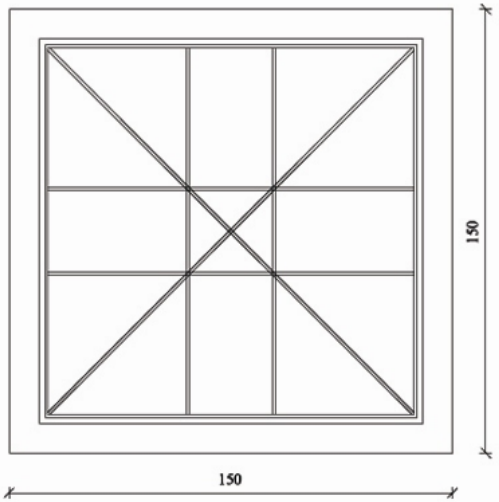


Fondazioni dirette discontinue plinto

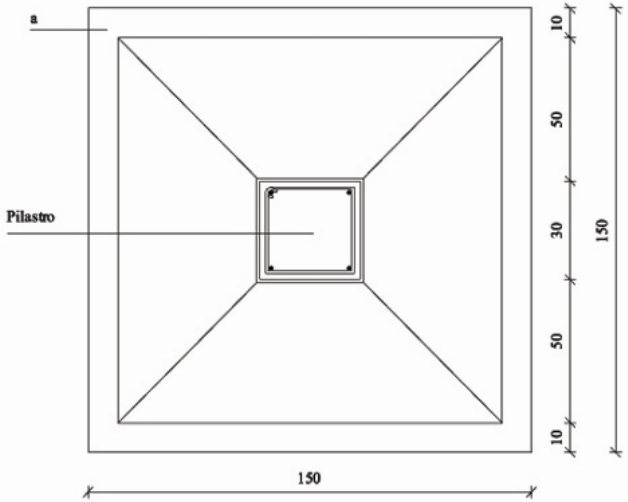
Sezione verticale con relativa armatura tipologia 1 - scala 1:10



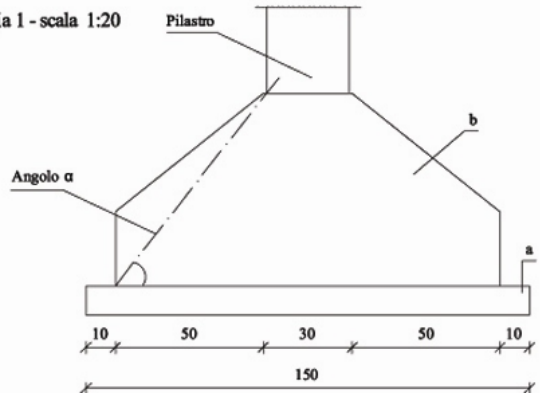
Sezione A-A' - scala 1:20



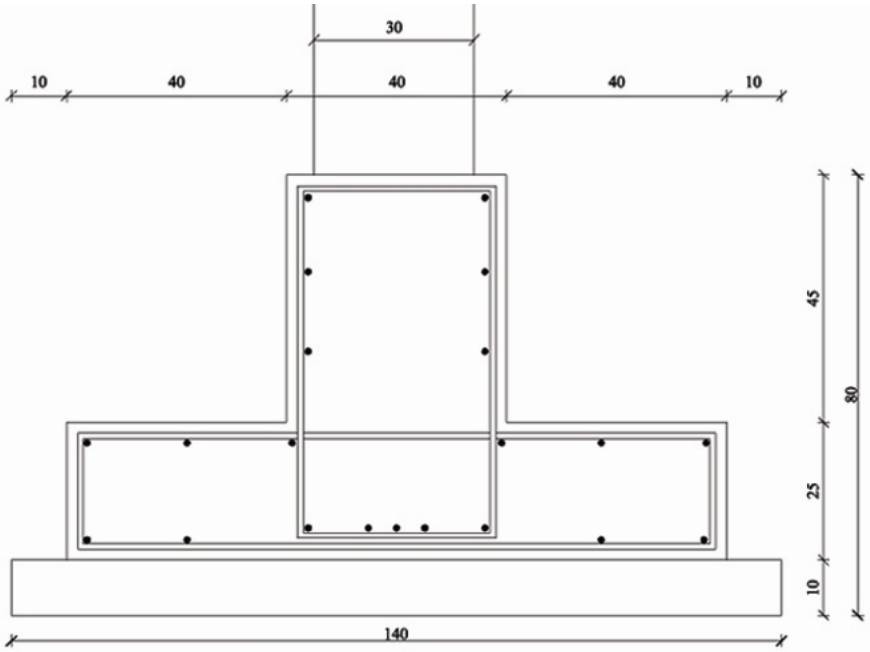
Sezione B-B' - scala 1:20



Prospetto frontale tipologia 1 - scala 1:20



Fondazioni dirette continue trave rovescia



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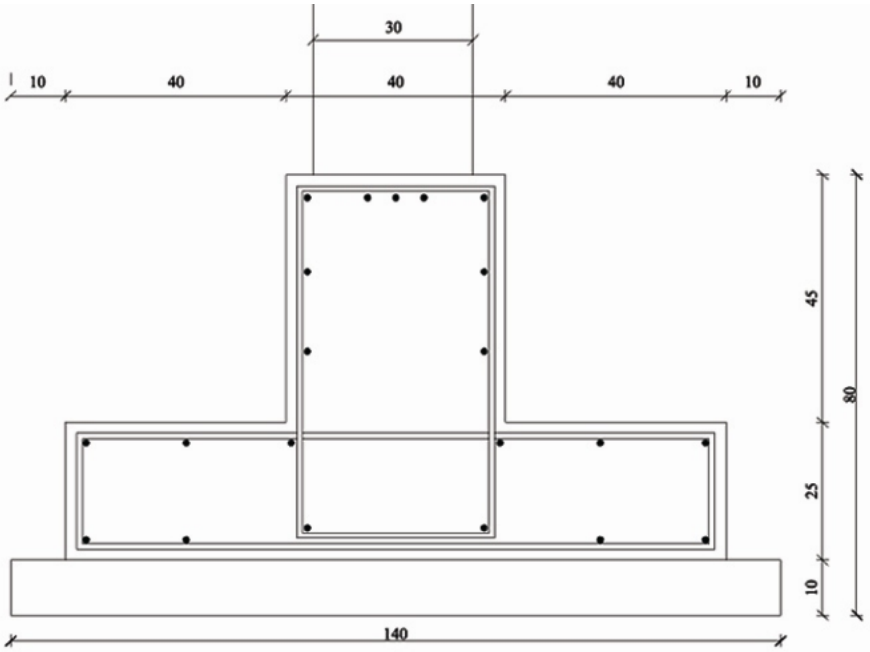

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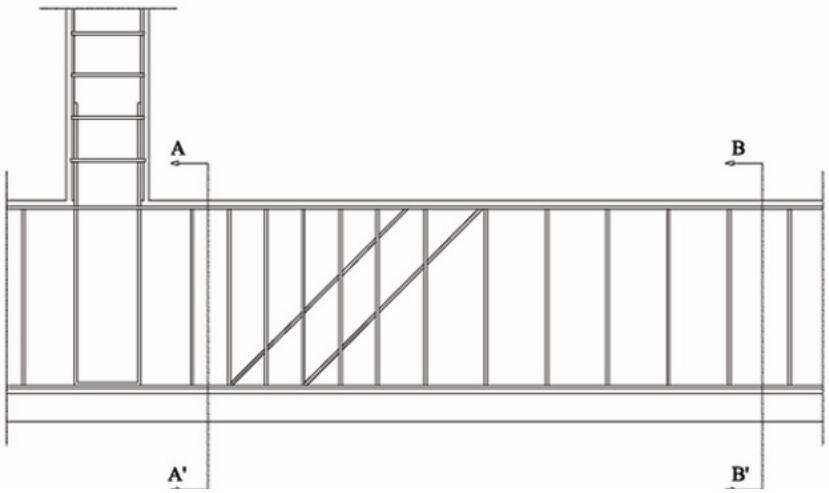
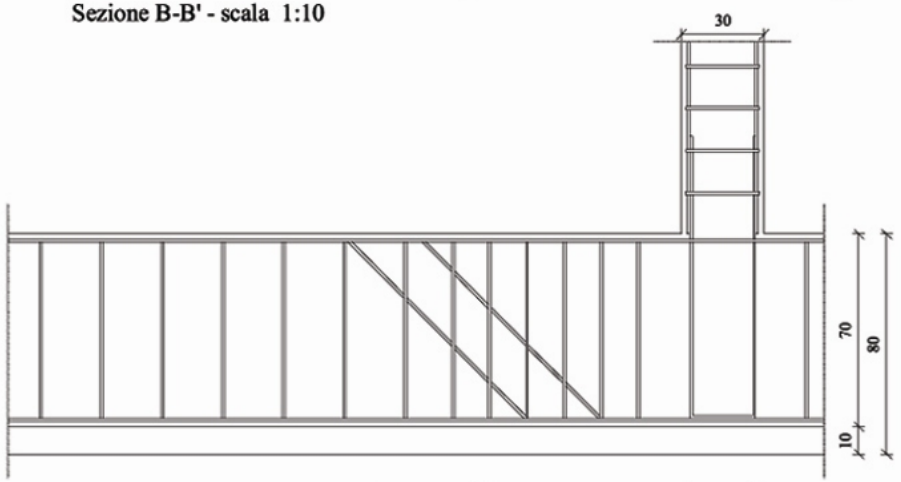


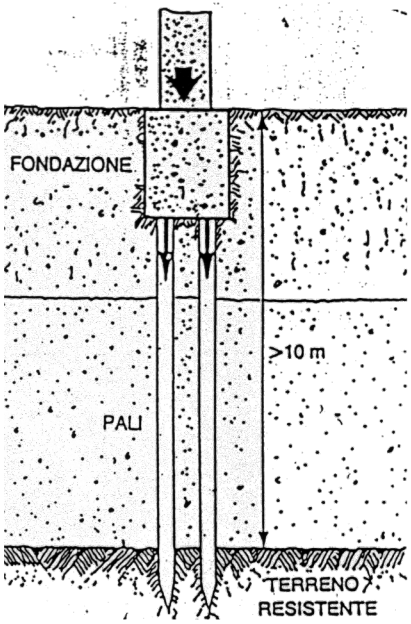


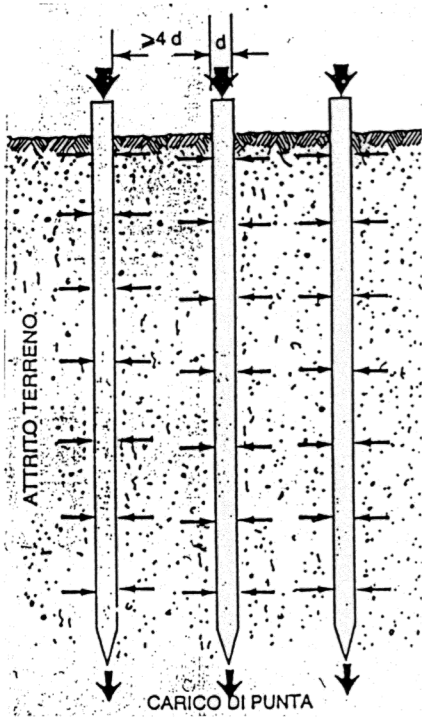
Armatura tipica per trave rovescia - scala 1:20

Foundations are indirect
when they do not directly reach
the "resistant" ground and
require the use of other
intermediate elements: the poles.
From an executive point of view,
it is possible to
distinguish in:
prefabricated frames poles
poles thrown in place

The prefabricated poles are fixed
in the ground for beating;
The poles cast on site can be
executed by means of:

- recoverable formwork
- disposable formwork
- jets without formwork





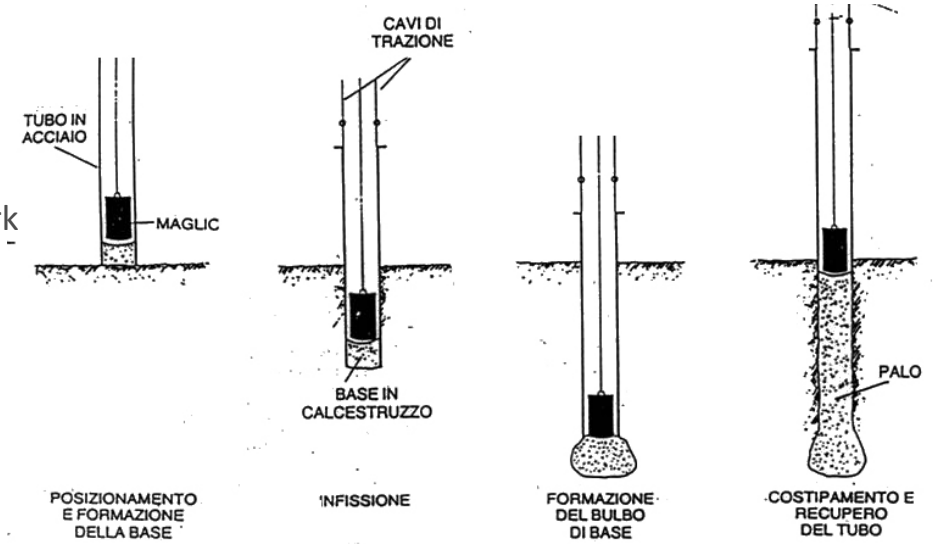
Fondazioni indirette pali infissi

Rotating frame pole

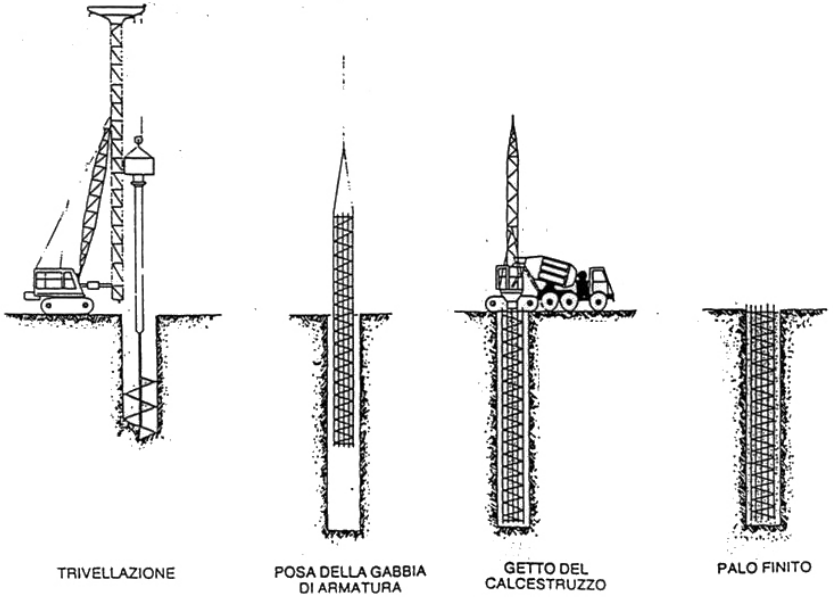
Pipe-shaped window frame pole

Indirect piles foundations thrown in place

Wrought pile with recoverable formwork



Borehole pole without formwork



Horizontal Containment Structure

Structures that contribute to evenly distributing the loads acting on the horizontal surface above evenly over the ground and that guarantee the drainage of rising damp.

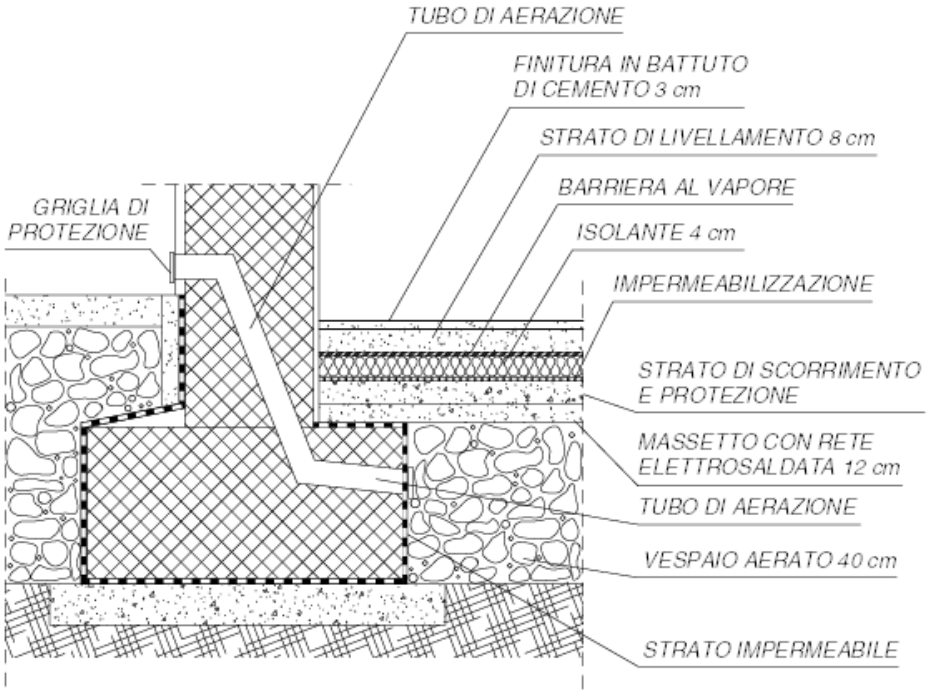
They are normally carried out by means of a crawl space made of quarry stone of large and medium size and an overhanging slab of concrete cast on site.

The floor is slightly reinforced to ensure the integrity of the structure even in cases of small settlements of the ground.

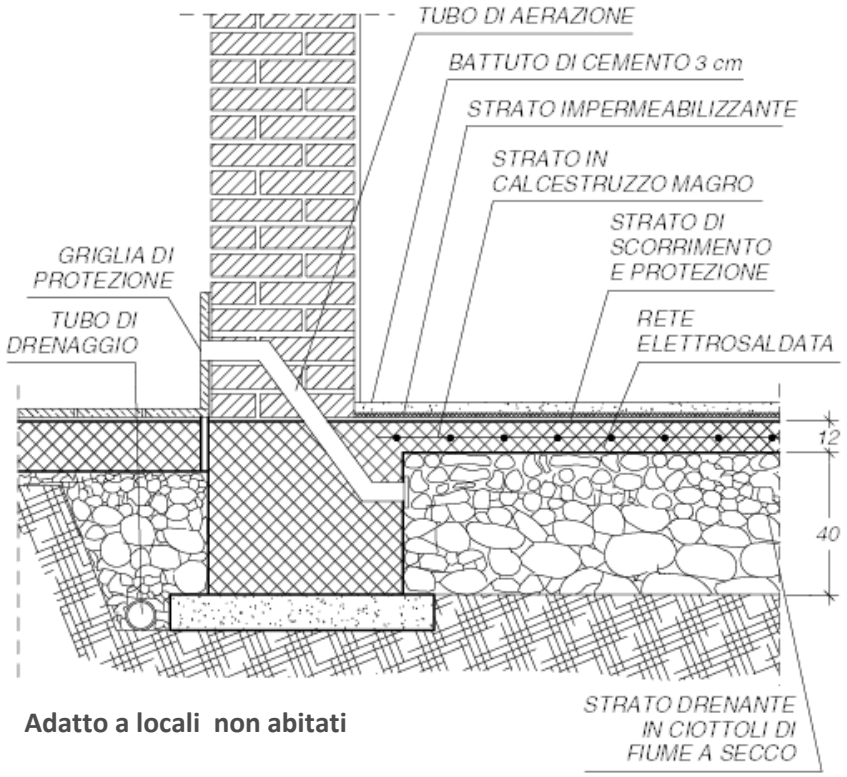
In addition to the traditional solution, PVC vaulted modular elements are used, which, when combined, determine the support for the casting.

Vertical Containment Structure

Vespaio aerato



Adatto a locali abitati

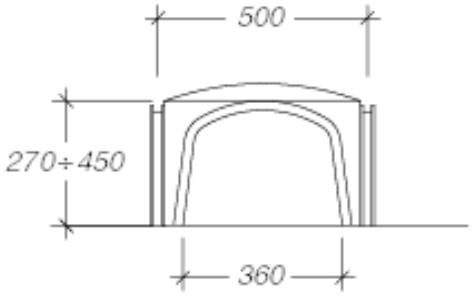


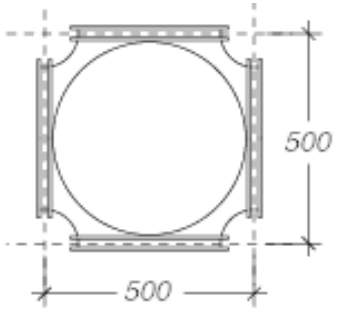
Adatto a locali non abitati

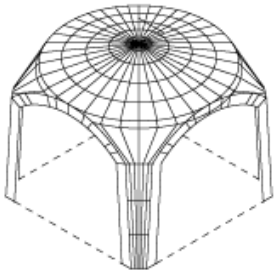
disegni tecnici da: *il Nuovissimo Manuale dell'Architetto,* Mancosu editore, pag.F144

Ventilated under-floor cavity

Modular disposable formwork in polypropylene for the realization of ventilated floors and ventilated roofs

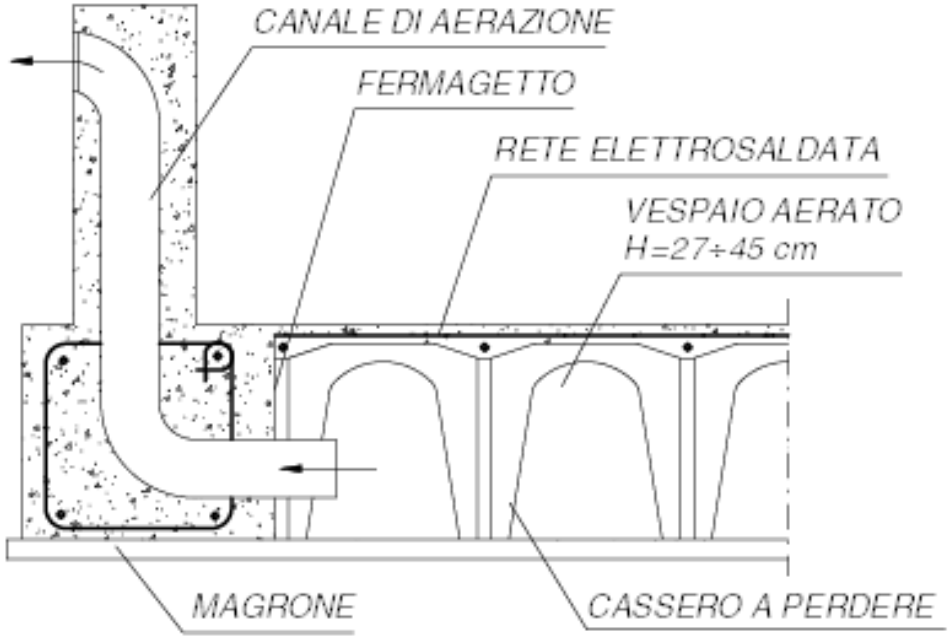






Advantages:

- Vapour barrier
- Excellent load-bearing capacity
- Ventilation in both directions
- Fast installation and execution
- Conveyance of moisture and radioactive radon gas outside
- Quick and easy installation
- High adaptability to any supporting surface



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