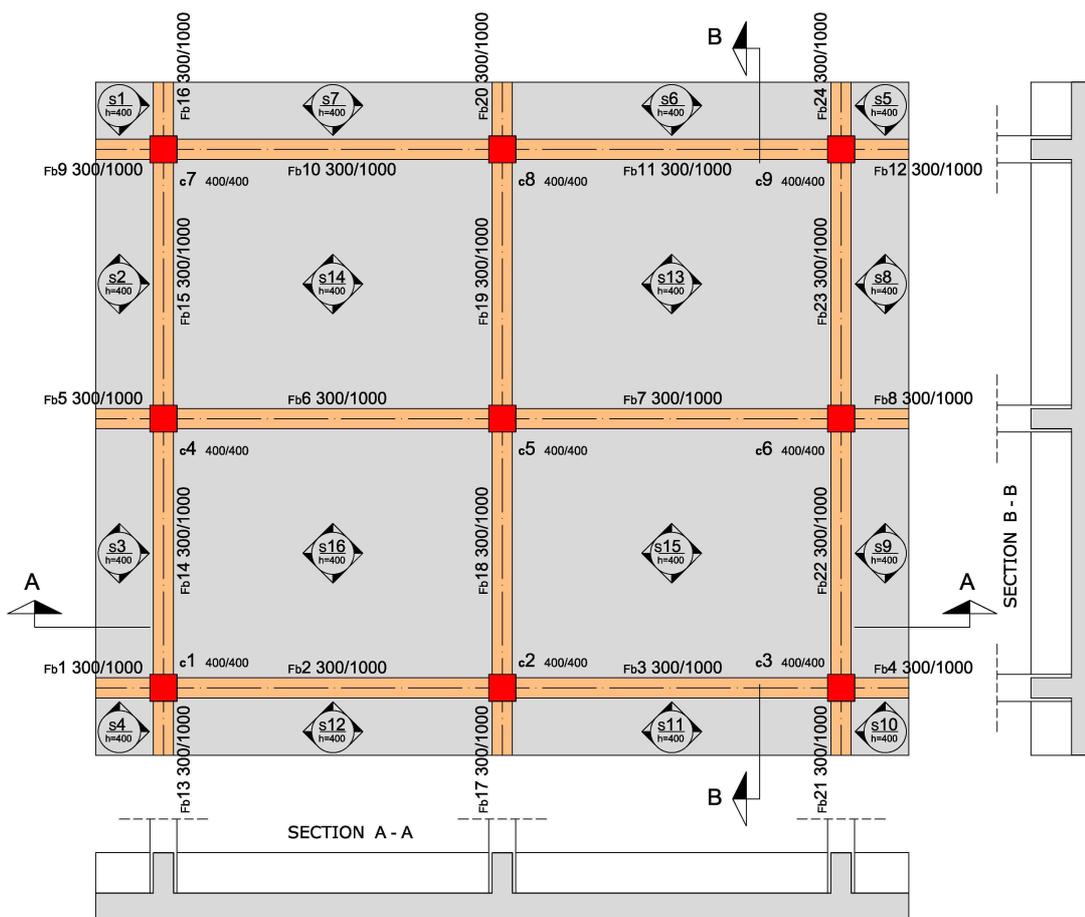
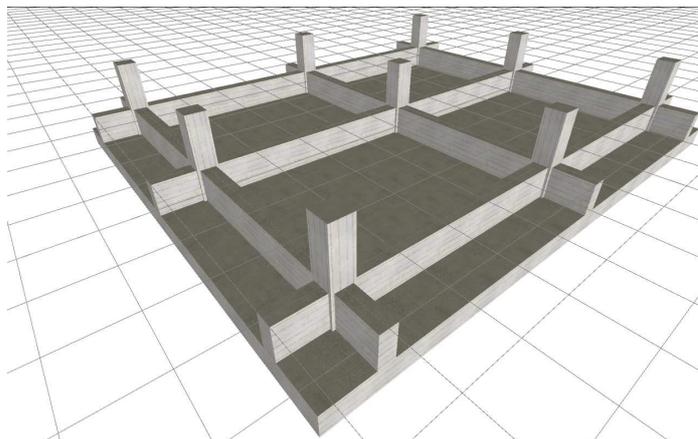


The stresses applied upon the soil are larger in the columns' area and lighter in the intermediate areas. The presence of beams acting as stiffeners helps in a more even distribution of the soil pressures between the columns' areas and the intermediate areas of the raft foundation.

The raft foundation may belong in one of the following four general categories, (1) ribbed raft foundation, (2) solid raft foundation, (3) raft foundation with hidden beams, (4) mixed raft foundation.

(1) Ribbed raft foundation

In a ribbed raft foundation apart from the unified foundation slab there are also beams which behave as stiffeners. The beams add stiffness to the foundation and apart from everything else, they level the soil stresses.



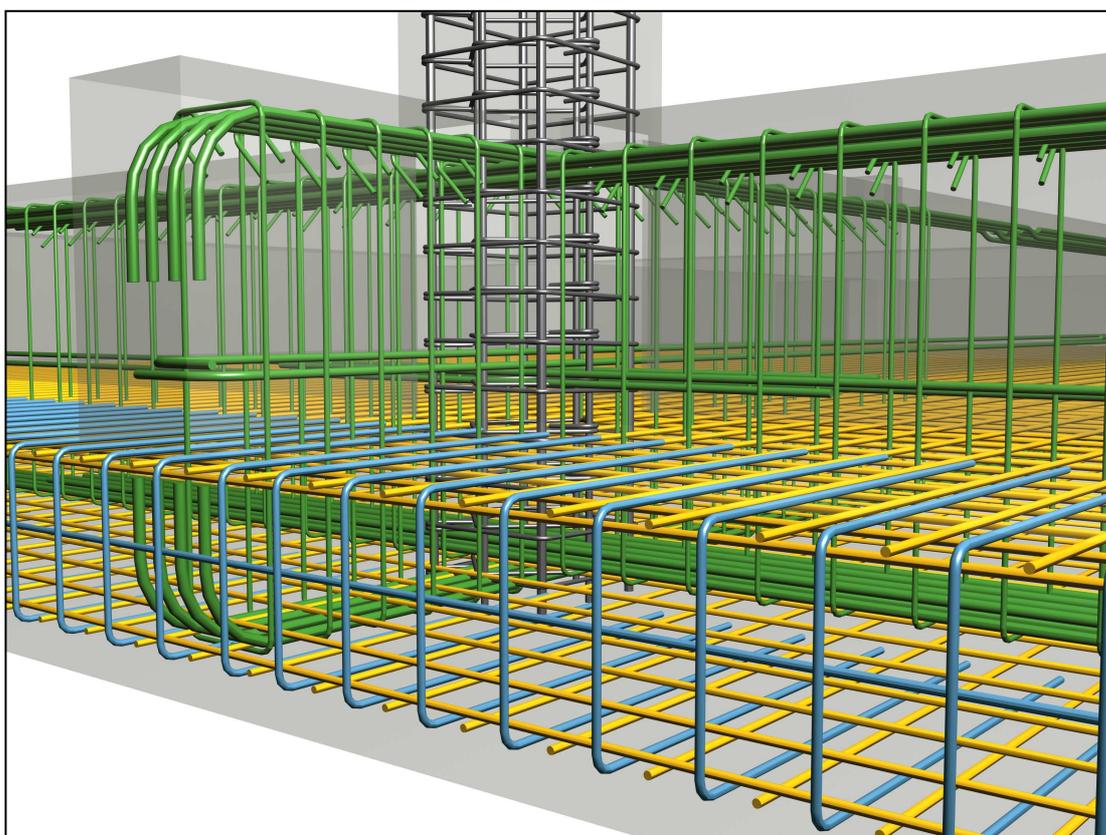
Unified foundation slab (raft foundation) with stiffeners (beams)
 <project: FoundationRough10>

The formwork's assembling and the reinforcement implementation of a raft foundation stiffened by beams are two relatively strenuous procedures.

As shown at the following figure, the ribbed raft foundation reinforcement can be separated into three categories:

- (a) slabs' reinforcement (in yellow color)
- (b) slabs' free edges reinforcement (in blue color)
- (c) beams' reinforcement (in green color)

The column rebars are in grey color.



Reinforcement of a ribbed raft foundation

The foundation slabs are reinforced with two wire meshes, one placed at the lower fibers and one at the upper fibers, by following the reinforcement rules that apply to slabs.

The beams are reinforced with strong stirrups and bars placed both at the upper and lower fibers, by following the reinforcement rules that apply to beams.

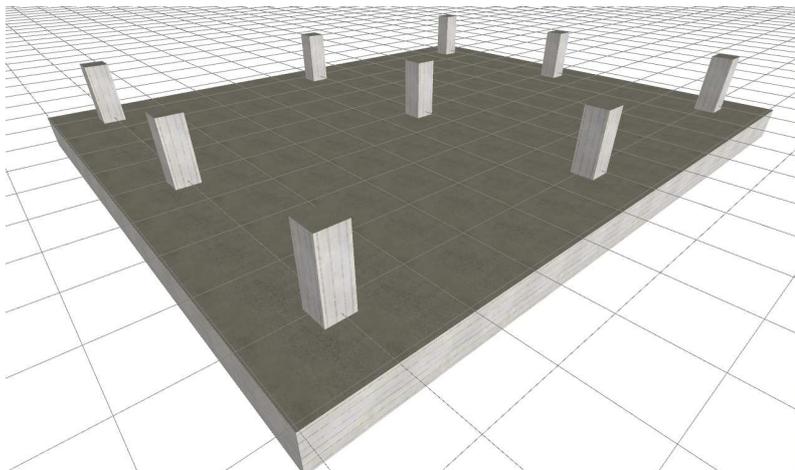
The slabs' free edges are reinforced with common hairpin bars or with a wire mesh folded like a hairpin, by following the reinforcement rules that apply to slabs.

Note:

A foundation grate can be stiffened either by beams or by walls. In the latter case, the reinforcement of the foundation slab does not depend upon the wall's reinforcement.

(2) Solid raft foundation

The unified solid raft foundation is the most simple foundation form and its formwork assembling as well as its reinforcement implementation do not require hard labor.



Solid raft foundation

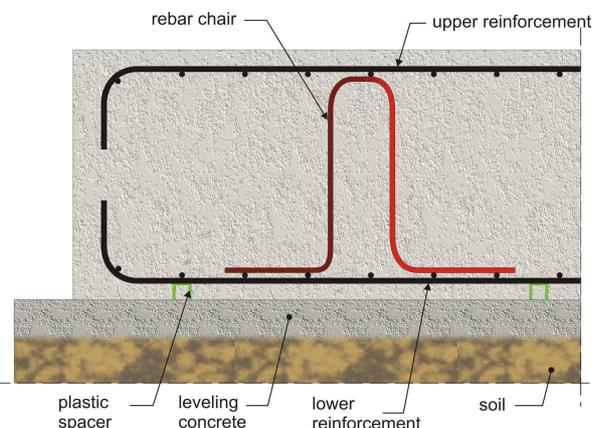
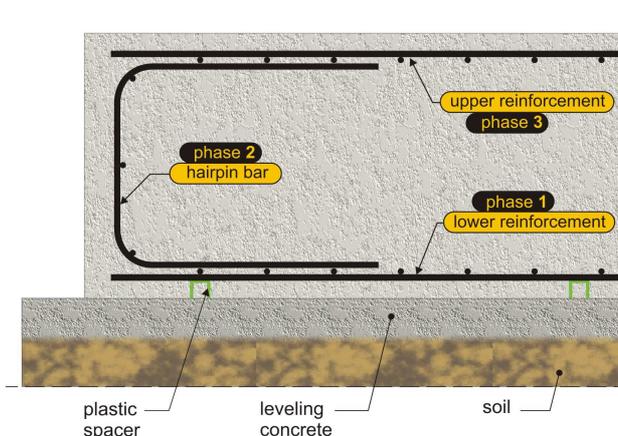
In the solid raft foundation, there is only one unified foundation slab.

The foundation slabs are reinforced with two wire meshes, one placed at the lower fibers and one at the upper fibers. Since the most intense stresses appear along the columns' axis, their surrounding areas are usually reinforced with stronger or double grates.

The slabs' free edges are reinforced with common hairpin bars or with a wire mesh shaped like a hairpin.

Notes:

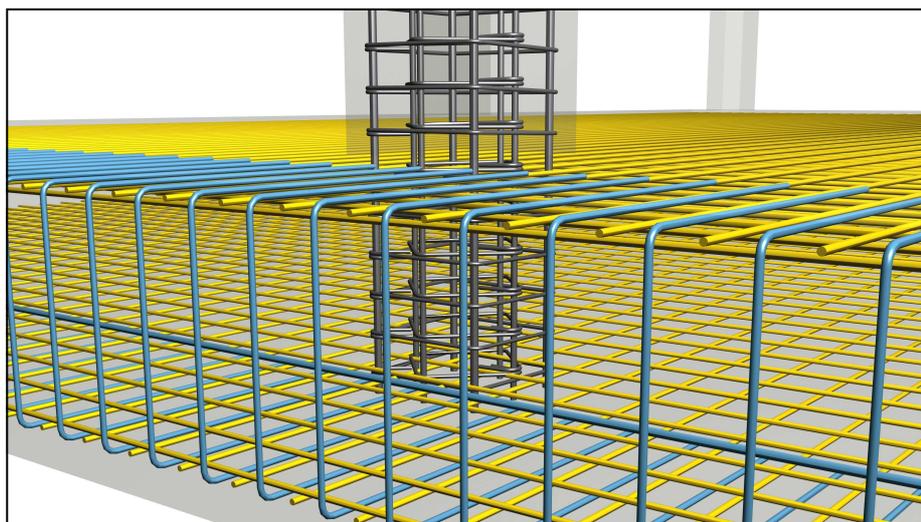
1. On a practical level and mainly when using a folded wire mesh as a free edge's reinforcement, the hairpin re-bars are positioned in the 2nd phase, as shown at the first figure.
2. The alternative solution for providing the free edges' reinforcement includes the formation of hooks at the ends of the upper and lower rebars as shown at the second figure. This solution compared to the hairpin solution, apart from everything else, has a higher shaping-cost but mainly it lacks a natural peripheral rebar chair.



The reinforcement of a solid raft foundation can be separated into three categories, as shown at the following figure:

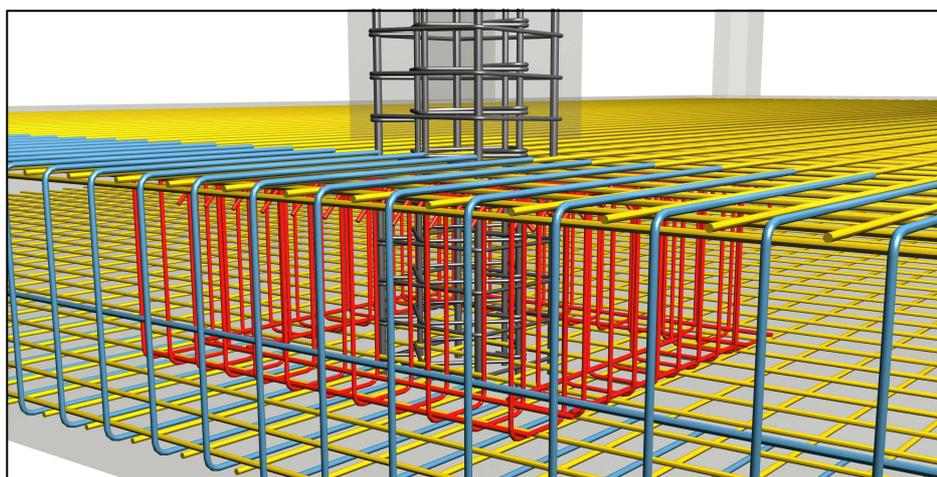
- (a) slabs' reinforcement
- (b) slabs' free edges reinforcement
- (c) punching shear reinforcement (when necessary) in the area surrounding certain columns (in red color)

The column rebars are in grey color.



Reinforcement of a solid raft foundation

The punching shear reinforcement, when it is required, is similar to the one used in the isolated spread footings of paragraph 3.7.1, as shown at the following figure.



Raft foundation with punching shear reinforcement

When the columns are subjected to large loads and the foundation slab's thickness is analogically small, it is obligatory to use punching shear reinforcement. That reinforcement can be provided by stirrup cages, as it is in this example, by bundles of properly bent rebars or by special industrial elements.