CONSIDERATIONS REGARDING THE FOUNDATION SOLUTIONS IN BLANKED HOLES

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INTRODUCTION

Two solutions are presented, about industrialization through mechanization and prefabrication of continuous foundations for the buildings with S + P + 4E.

The studied solutions are destined for application in foundation of buildings, with bearing walls, in high-conditions regime.

The analyzed infrastructure alternatives consist in its realization with the following elements: lean elements, with antipressing plate, on a tronconic shape, monolith or precast realized using vibro-repouss and big built-up ferro-concrete panels of 16 centimeters-bulk.

In order to realize this solutions it is considered the discontinuous lean of elevations on the conoid dormer form with antipressing plate, which represents important technico-echonomical advantages and the possibility of discontinuous lean solution application and also in case of weak surface grounds.

1. SOLUTIONS FOR REALISATION OF THE INFRASTRUCTURE FOR BUILDINGS WITH BEARING BUILT-IN WALLS

Both infrastructure studied solutions below are integrated in the group of solutions with a high – degree of basement works realization. The news consist in usage of some tronconic dormer forms as discontinuous leans and also in their possible usage as well in normal grounds as in weak or improved ground either, because the solutions realized until present time are dedicated to be used only on good foundating grounds or on difficult improved in different ways grounds. Therefore, it will be synthetically presented the infrastructure conceived alternatives.

1.1. Infrastructure from elements of conoidal lain ($h \leq 1$ m) with antipressing plate and prefabricated elevations

For finishing off and materialization of presented solution, we start from the idea of removing the dormer (beam) on which the elevation is beared on, considering this may lay directly on isolated bearers (dormer elements).For that it's necessary that bearers should be able to take over the charges brought by bearing walls (so they have to have a carrying capacity big enough both for a normal bearer capacity ground or a difficult one), and the walls (elevations) must have insured an enough bearer capacity, respectively to be realized a combination of elevations with dormer elements able to avoid losing infrastructure of stability (respectively for the whole structure, in general).

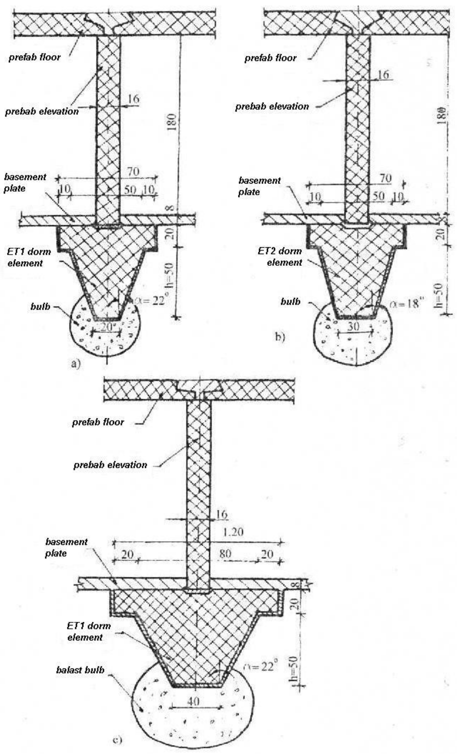


Figure 1. Prefab infrastructures with tronconic dorm elements and antipressing plate.

In this case, the infrastructure ensemble (Fig. 1) is composed in principle by conoid dormer elements with its height $h \leq 70$ cm, filled with antipressing plate and prefab elevations, the solution being dedicated to execution of infrastructures in normal of improved grounds by different procedures.

The dorm of the foundation is composed by conoid discontinuous elements with circular antipressing plate on its superior side. The dorm elements are positioned at the crossing axis of the building, but in case of transversal shields (more loaded) it was supplementary predicted a dorm element at the middle of aperture, too.

The dorm elements positioned at the crossing axis of the building there were predicted mustaches made by concrete steel crossbeams in order to realize vertical little sticks for monolithying the prefab elevations. The dorm elements

Positioned in panels field are not provided with mustaches. To arrange elevations on the dorm elements there were provided ditches with trapezoidal section (Fig. 1).

1.2. Tronconic dorm elements infrastructures (h=2…3m) with antipressing plate and prefab elevations

The way the solution in paragraph 1.1. presents, the infrastructure ensemble is composed by tronconic dorm elements with antipressing plate and prefab elevations also, the difference between both solutions being that dorm elements have got a bigger length (2…3m), taking part in the category of middle deep foundation elements, which allows foundations in case of difficult grounds with reduced depths (3…4m).

The way of placing dorm elements is similar to the previous solution, the current solution being certified for achieving infrastructures of buildings S+P+4E on weak grounds.

In case of dorm elements there are possible many alternates (including the dimensions of transversal section and the dimensions of antipressing plate). Figure 2 is showing us two elements (ET4 and ET5) feasible by vibration or vibra-percussions with tools as ABVP-1 or AVPP-1, made in Romania. The dimensions of tronconic small base and of antipressing plate are established according to bearer capacity of the foundation ground and the technological means of the tool used for blanking.

1.3. Aspects studied in order to realize conceived solutions

To create designing and finishing possibilities for previous presented solutions, the author proposed to study a lot of constructive theoretical and technological aspects, mentioning:

- study of dorm elements under form optimization (generator leaning, the bigness of antipressing plate, etc.), the calculation of portent capacity and the calculation of slump;
- the study of prefab elevations as plane elements under the constructive mood and of calculation, consulting the way of leaning and realization of vertical and horizontal combination;
- study of equipments and technology of achieving the infrastructure in the conceived alternates, including the way of presentation and execution details;
- techno-economical study of proposed solutions, comparing to other structure type applicable solutions and in comparable foundation conditions.

The presented solutions are appreciates as registered in the global general trend of industrialization of foundation works, as well as in structures realized with ferro concrete monolith shield.

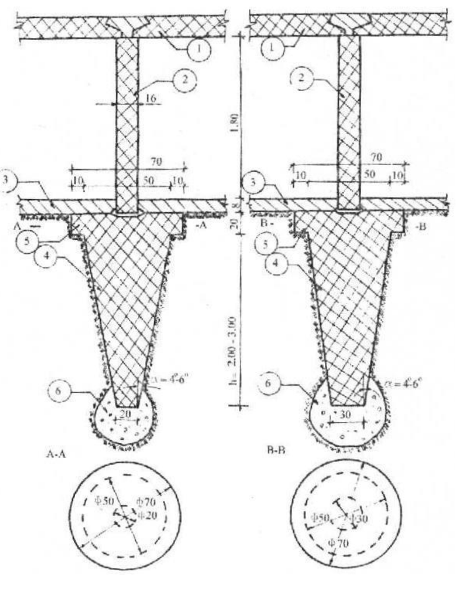


Figure 2. Tronconic dorm elements infrastructures with antipressing plate achievable by vibra-percutions. *1 - prefab floor; 2 - prefab elevation; 3 - basement plate; 4 - ET4 (ET5) dorm element; 5 - antipressure plate; 6 - bulb.*

2. RESEARCH UNDER INDIRECT BEARER ELEMENTS

Considering the previous chapter conclusions, the author proposed to have a study for indirect leaning elements. There was studied tronconic shape leaning elements in the variant of antipressing plate necessary for discontinuous leaning of elevations. From author’s investigation it results that these elements were experimented in the

Department of Roads and Foundations in Timisoara, considering achieving vibra-blanking technology, as well as regarding the establishment of bearer capacity, appreciating as necessary another additional studies, few of them made and presented further.

2.1. Studies about tronconic dorm element with antipressure plate

The elevations bearer elements (bearer walls) for the alternative of achieving an infrastructure have the general shape of tronconoid with antipressure plate at the head part (ETP).

Dorm elements may be executed in monolith way or prefab way using blanking technologies.

The constructive systems blanking-attainable are different and they may be applied for foundation of civil and industrial buildings with frame structures, shield or mixed, in good foundation grounds and especially in weak foundation grounds with reduced bulk.

The foundation blanking execution method consists in forced introduction into the foundation ground of a equipment in shape of dorm element and creation of a void in foundation ground where the concrete is circumfused or the prefab is introduced for the already mentioned dorm shape. The main blanking operation may be achieved in two technological ways:

- by wobbling, which consists in dropping equipment from a height of about 4…6m;
- by vibro or vibra-percutions – introduction of mallet is being made under vibrations or vibra-shock action (vibra-percusions).

After the blanking process there is tightened the ground under and around blanked foundation and apparition of a tightened ground area in which limits there are reduced the properties of compressibility and there are raising the mechanic resistances of the ground. Following these tightening phenomena, the foundations in blanked holes have a much superior carrying capacity for vertical and horizontal actions for classical foundations, which allows reduction of dimensions, foundations, and therefore a lot of economic advantages. Classifying foundations in blanked holes may be made involving next criteria:

- geometrical shape;
- depth of foundation;
- way of making blanking elements.

Dorm elements presented in Chapter 1 (ET1…ET3) are part of category of blanked foundation elements small in depth, with $h/d_{med} \langle 1,5$, and the dorm elements ET4…ET6 in the category of middle depth with with $h/dmed \rangle 1,5$.

Dorm elements with antipressure plate including outfit (Fig. 3) and their usage as foundation elements for civil buildings with prefab carrying walls with height working conditions S+P+4E have a conoid shape and they are destined for foundation on superior mechanic feather grounds, as well as in weak grounds in surface for a bulk of 3-4m. The superior part plate has got as effect:

- obstruction for ground-pressing that follows bulking process, which contributes to the bearer capacity improvement;
- prefab panels bearer surfaces improvement'
- foundation stability raising.

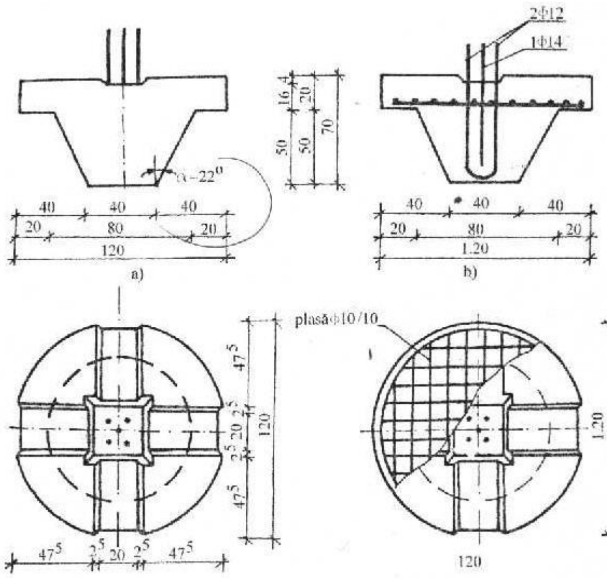


Figure 3. Dorm element with h=70 cm: a) sight; b) outfit

Antipressure plate contributes to inspissation area raising having a favourable effect, considering that discontinuous elements foundation solution is acting like a continuous foundation by interpenetration of insipissation areas. It has an especial importance the bigness of insipissation areas in positioning dorm elements (Fig. 4). Analyzing figure 4, it results compact extended areas following of the dorm element shape, as well as the presence of antipressure plate, which leads to bearer capacity important adds, executed in this way.

Bearer elements used for foundation realization on difficult grounds in shapes with depth of 3…4m are commonly made by vibra-blanking.

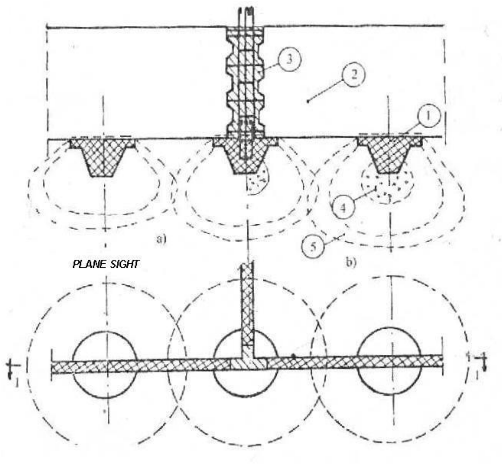


Figure 4. Dorm elements influence areas: a) No bulb dorm elements; b) bulb dorm elements. *1 - dorm element; 2 - prefab elevation; 3 - monolithizying; 4 - bulb; 5 - inspissation area.*

3. STUDIES REGARDIND CARRYING CAPACITY ESTABLISHMENT OF THE ANTIPRESSURE PLATE TRONCONIC BEARER

About carrying capacity of foundations executed by blanking, there appear two distinct elements which we need to pay attention to and which contribute to obtaining a bigger carrying capacity in abidance by classical foundations executed by digging.

First of these elements is constituted by insipissation effect of the ground, obtained by technology of building a foundation hole itself.

The second refers to executing stamps with lateral lean surface insure an important carrying percent to the transfer of foundation ground by lateral sides. Obtaining an even bigger carrying capacity may be achieved with the same technology of bulking the stamp, by attaching a ballast tube or another addition granular material which is insipissated by beating or vibration (vibra-percussion) in previously stamped bulks, followed by concrete infusion for foundation execution or there is introduced the prefab element.

Considering these bulking executed foundations particularities, there were made a lot of calculation methods for their carrying capacity, each of them starting from different theories, respectively a different calculation methodology.

Finalizing these different calculation methods, we may try their classification, as it follows:

a) theoretical methods;
b) semi-empiric methods;
c) empiric methods.

It is presented two calculation methods in case of these groups in order to establish the carrying capacity of dorm element, starting from different calculation theories:

- the first method is considering a classical behaviour of the ground by using bad coefficients k_z, respectively k_x, (Winkler) and which establishes dorm element equilibration conditions, starting from a distribution of pressures proportionate to foundation displacements;
- the second calculation method follows development of a plastic area of the ground around the element of foundation, in the same time with charge growing, which allows a charging curve protraction-deformation because of whom we can establish carrying capacity on maximum slump admitted or undertaking slumping proportionality area in report with the charge.

3.1. Studies regarding calculation of carrying dorm elements capacity from the ground deformation condition

The determination of carrying capacity of dorm elements by this method is based on pressure effect that get birth on the foundation ground after its charging. Considering distribution of these pressure on ground, respectively ground deformations, imposing admitted maximum slump, it is determined the carrying capacity.

The scheme of ground pressure distribution, which always appears on ground charging with vertical burdens, is presented in figure 5.

Calculation after this method supposes two steps:

- pre-dimensioning dorm element;
- verifying chosen dimensions;
- pre-dimensioning dorm element that consists in establishment of its dimensions.

The criteria that stay at the base of choosing dimensions of foundation elements are: ground bedding, building plain dimensions, the level of phreatic water, volumic height, (γ) of the ground, its porosity, bigness of its charges sent to building.

After dorm elements dimensions establishment, we cross to second step at calculation of their carrying capacity with the charge delivered to the building, by impose of general condition.

The necessary data for calculation of carrying capacity by this method are: dorm element

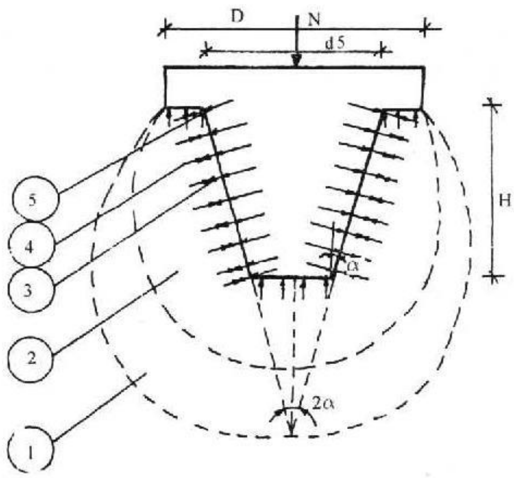


Figure 5. Distribution of pressures on ground after charging with vertical burdens.
1 - active area; 2 - deformation ground area; 3 - pressure born on ground; 4 - ground reaction pressure; 5 - pressure born on the lateral surface following N force charging.

geometric dimensions while pre-dimensioning stage and the volumic height in dry conditions of the natural ground (γ_d). In order to determine volumic weight on dry condition of ground (γ_{d1}), it may be used the graphic presented in literature for pyramidal pilots calculation by bulking.

The charges will be transferred by dorm element through the lateral surface through base and antipressure plate on the ground in inspissation condition characterized by (γ_{d1}), carrying capacity (P_1) of tronconic part. The inspissation ground (V_1) is determined according to the reduced void volume (V_2).

The reduced void volume is calculated by relation:

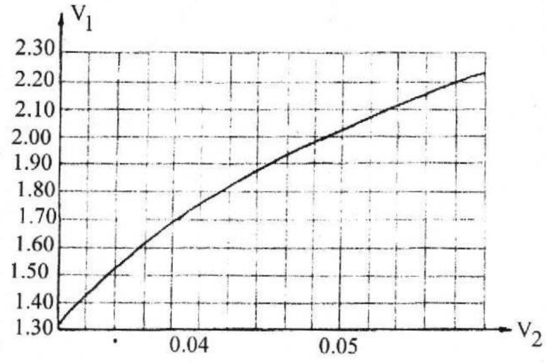
$$V_2 = S_1 S \sin\alpha \quad (1)$$

where: α - leaning angle of cone generator; S_1 - tronconic part lateral surface; S - admitted inspissation which is considered 8 cm for non-cohesive grounds and 5 cm for cohesive grounds.

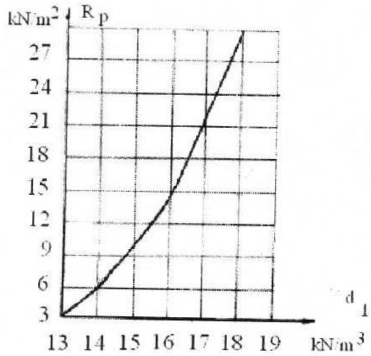
Admited reaction pressure (maximum) which may appear on ground (R_{p1}) is obtained by graphic in figure 6,b.

Vertical burden carrying capacity P_1 of the tronconic part will be determined due to relation:

$$P_1 = \frac{R_{p1} - V_1}{S} \quad (2)$$



a.



b.

Figure 6. Graphic for determine: a) volume for inspissation ground; b) reaction admitted pressure.

In order to determine carrying capacity due to small base (P_2) and antipressure plate console (P_3), we do as it follows:

- starting from volumic weight on dry conditions and knowing the surface of element base (A_1) and of antipressure plate console

$$A_c = \pi \frac{D^2 - d_s^2}{4}$$

there are calculated volume reduction:

a)

$$V_j^2 = S \frac{\pi d_j^2}{4} \quad (3)$$

(corresponding to foundation dorm element inspissation with the proportion of admitted inspissation)

b)

$$V_2^c = S\pi \frac{D^2 - d_s}{4} \quad (4)$$

(corresponding to antipressure plate inspissation with the proportion of admitted inspissation S).

- volumes V_2^i and V_2^c represent void reduction volume in the area where there is felt the pressure transferred by dorm element, respectively the antipressure plate. Knowing volumes V_2^i and V_2^c there is determined compact ground volume after foundation inspissation V_1^i and V_1^c.

The proportion of admitted reaction pressure in the compact ground afferent to base respectively to antipressure plate console is determined using graphics from the specialty literature.

The proportion of admitted reaction pressure in the compact ground afferent to base respectively to antipressure plate console is determined using the graphic in the figure 6b, knowing the volumic weight on dry conditions of natural ground (γ_d).

Taking notes of reaction pressures R_{p2} (corresponding to base) and R_{p3} (corresponding to antipressure plate) there are determined carrying capacities:
- on base:

$$P_2 = \frac{R_{p2} V_1^i}{S} \tag{5}$$

- on the antipressure plate:

$$P_3 = \frac{R_{p3} V_1^c}{S} \tag{6}$$

Carrying capacity of the dorm element will be given by relation:

$$P = P_1 + P_2 + P_3 \tag{7}$$

Carrying capacity calculation methodology from the foundation ground deformation condition is the following:
(a) Initial calculation data: V, S, A_i, A_c, γ_d, s;
(b)There are determined:
- starting from dorm element volume (V) and the volumic weight on dry condition (γ_d) of the natural ground there is determined (γ_{d1}) of the imspissation ground;
- there is calculated the initial volume brought after dorm element inspissation with the amount S and relations 1, 3, 4;
- there are determined from figure 6a the inspissation ground volumes V_1, V_1^i and V_1^c;
- due to inspissation ground volumic weight (γ_{d1}), there is determined in the graphic from figure 6b, the reactive calculate pressures R_{p1}, R_{p2} and R_{p3}, which appear on ground after dorm element filling and inspissation with value S;
- there are determined carrying capacities P_1, P_2 and P_3 with relations 2, 5, 6;
- there is determined the carrying capacity (P) of the dorm element with relation 7;
- there is verified condition $P \geq N$ (N - building transferred charge attached to a dorm element).

Antipressure plate console is calculated as a ferro-concrete element built-in tronconic element.

4. CONCLUSIONS REGARDING TECHNICO-ECHONOMIC ASPECTS

By getting out the infrastructure solution made by prefab dorm elements, discontinuously mounted in blanking holes and plane prefab elevations, the author has proposed and solved the following aspects:
(a) Achieving of an infrastructure type meant to ensure building resistance, stability and long lasting in optimal conditions;
(b) Raising the degree of industrialization on execution and mounting for zero cote works of the residences building and, through this, to the reducing of delay due to technical and economical progresses recorded on super-structures execution;
(c) Adopting an infrastructure system to lead for economies as well of value and also under main material consumption, of infrastructure solutions adopted until present time and acres to be applied in author’s origin country, too.

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