Annals. Food Science and Technology
2013

CHARACTERISTICS EARTH AS THE FOUNDATION SOIL AND BUILDING MATERIALS

Adelaida Cristina HONTUŞ
University of Agronomical Sciences and Veterinary Medicine - Bucharest, Faculty of Management, Economical Engineering in Agriculture and Rural Developments, No. 59, Mărăşti Boulevard, no.1 Sector, Bucharest, cod 011464, Romania, e-mail: adelaidahontus@yahoo.com

Abstract
All constructions, through their foundations, stress (require) the portion (share) of the earth's surface, on which they are placed, this zone of the earth's surface being called "foundation soil", which for keeping in time the functionality and the integrity of the construction, must carry out some technical conditions.
After on elaboration of the geotechnical study, all information and dates are systematized as a result of some activities necessary for this study, namely reconnaissance survey, soil research, small scale tests and tests in the field.
In the construction industry, of particular importance is infiltrated water that filled much of the groundwater reserves. Groundwater can fill pores permeable soil, constituting a layer aquifer. Due to the possibility of water ingress into the structure foundation landslides which are favored by a large number of factors such as topographical conditions, hydrogeological and hydrological processes altered or rocks, you need to perform before the start of construction, a geotechnical study. There are rare occasions when the landslide can be attributed to a single cause.
The soil - ground, a polyphasic and disperse heterogeneous natural body, whose characteristic and complex proprieties must be known in detail for being use both as foundation soil and as material for constructions.
These are the reasons that which are the basis of this account which include a complex characterization of natural environment, called with a frequent term, "soil" or "ground", but which constitute a system composed of the ground proper, water of soil, atmosphere and plant.

Key words: geotechnical surveying, hydraulic gradient, contraction curve, landslide, consolidation gradient

Submitted: 26.02.2013 Reviewed: 09.04.2013 Accepted: 13.05.2013

1. INTRODUCTION

All buildings through foundations, calls portion of the earth's crust which are situated. This area is called *bark soil foundation* and to maintain the functionality and integrity while building must meet two main conditions (Honţuş Adelaida, 2005):

a) deformation condition - land must also have a compressibility maximum subsidence that my record over certain values, called subsidence admissible.

b) the condition bearing capacity - the foundation soil can withstand a maximum pressure (called the carrying capacity) to which there is no danger of breaking or earth repression under the sole foundation.

These conditions are strictly determined by the nature and physical-mechanical characteristics of material foundation. Such data are obtained from a geotechnical study where systematize all information and data gained from the following activities: recognition of land, prospecting, testing laboratory and placed directly on the ground.

The contractor will be able to choose foundation system and processes most advantageous for money, only you will be able to provide the foundation soil behavior.

From the point of view of the manufacturer, the crust is the solid material mainly from rocks and soils.

Metamorphic and igneous rocks are hard and semi-hard is practically incompressible efforts provided by current building foundations (Chamayou H., Legros J.P., 1989).

Sedimentary rocks and especially land, have very different behavior as foundation soil, depending on composition, moisture and tamping state.

2. MATERIALS AND METHODS

Any building, regardless of its nature, require soil under construction, the foundation soil. Every building is required to have foundation, and for this have made a geotechnical study that examines physical and mechanical characteristics of material foundation, determine the geological and lithological layers of foundation soil composition. Also, the geotechnical study intend to determine which surface groundwater depth and groundwater level depth, so you can choose the best solution of the type of foundation to be adopted.

3. RESULTS AND DISCUSSION

1. Composition Dales

Behavior of the foundation soil land or building material is determined by the interaction between the constituent phases: solid phase (bone mineral), liquid phase (water) and gas phase (air).

Solid phase is characterized by the following main parameters: average particle diameter (d), particle size distribution (grading curve), specific weight: 2.65 t/m^3 (quartz sand) to 2.75 t/m^3 (clays) (Roger J.M. De Wiest, 1965).

Depending on the particle size and size distribution, solid phase consists of: blocks (d > 20cm), boulders (d = 2-20cm), gravel (d = 2-20mm), sand (d = 0.05-2mm) , powder (d = 5-50μm), clay (d < 5μm) (Canarache A., 1990).

The blocks and gravel are good as foundation soils, quality is improved if they are mixed with sand, clay or consist of fragments widened. These types of land forms land good foundation provided below not be found less resistant layers.

Sands under static loading action, suffering small deformations and is perfect in a short time. Dynamic loading (vibration machine, earthquakes, shocks) cause large and sudden strain, especially in loose sands. Large and medium sands form generally good foundation land, their resistance is influenced by whether they are above or below water.

Dust has not a special qualities that soil foundation. However, it can be used for this purpose, taking the best possible steps to preserve its natural status. Thus, a small increase in water content causes dust transition from solid state to the running. Permeability dust is much smaller than sand, so that deformations due to loads requires some time until the water in the pores. A piece of dry powder crumbles easily with finger pressure.

Clay deformation under the action of loads that construction takes place in a long time. The mechanical properties are influenced by the amount of water they contain - increased humidity decreases resistance clays. With very low permeability, a piece of clay left to soak in water only a small thickness, without undo. dry, hard lumps of clay are broken and the cut surface is shiny, greasy to the touch and adheres to wet bodies. By wetting becomes a characteristic odor

From sand, dust and clay soils there is a wide range of intermediate properties. In this category can be included the following: loess, marl, banks, mud and clays.

Loess is a land of color from yellow to gray, which deforms only when soaked. It is therefore only used as soil foundation when taking a series of special measures. When dried remains on the slopes nearly vertical heights. Galleries executed loess remain for a long time provided that loess is not soft. (Honțuș Adelaida, 2005)

Loess is composed of particles of dust fraction, macropores (visible to the naked eye) and sometimes limestone concretions. Its origin is generally the wind, but there are loess deposited by water. Pores form channels in all directions, the walls of which are made usually calcium carbonate.

Marls are lands consisting of a mixture of clay and limestone microscopic in different proportions. Basically, is the bridge between clay and marl limestone. The color can be gray or yellow eggplant. When the composition there and plant debris, coal or iron salts (oxidized in air), marl may be colored red, brown or black.

Banks are silty clays from deposits (unconsolidated) of rivers or lakes. Sometimes contain small gravel or sand. Are hot and dry cracks.

Sludge are banks with more than 10% organic matter. Thus by treatment with dilute HCl acquires a characteristic odor, the generation of hydrogen sulfide.

Clay is a soil containing equal parts sand, dust and clay.

Water as liquid phase, has a great influence on bodies that interact, causing building behavior, especially foundations and works out of the earth. The water acts on porous building materials, changing resistance, thermal and electrical conductivity.

When the voids between the solid particles is only water, this land is called *saturated ground*, and when in addition to water and air is, it is an *unsaturated soil* (Bear,S. Irmay, D. Zaslavsky, 1968).

In the construction industry, of particular importance is infiltrated water that filled much of the groundwater reserves. Groundwater can fill pores permeable soil, constituting a layer aquifer. A point vertically from the ground surface may encounter several layers of groundwater nearest surface called *phreatic layer*.

Groundwater level is not constant and is determined by the *following factors*:
- Alternating with dry rainy periods;
- Permeability strata penetrated;
- Distance to area food;
- Realization of works, in particular hydraulic character.

Ground water may take the following forms:

- *water as vapors* - are aeration zone (the upper permeable layer);
- *free water* - is subject only to gravitational forces action in this category may be included in land water saturated non-cohesive;
- *water held* - which can be classified into:
  - capillary water - in 2mm existing pores due to capillary forces,
  - pellicular water - retained fine particles due to adsorption phenomena (however, this water moves from one particle to another liquid).
  - hygroscopic water-wet water is absorbed from the atmosphere by dry land. Maximum humidity recorded in this way is called maximum hygroscopicity. This parameter is a measure of the activity of land.
- *solid water* - ice;
- *water of crystallization* - entering the mineral constitution, removing this water requires temperatures well above 105 °C, temperature sufficient to vaporize free water and the retained (Roger JM De Wiest, 1965).

Free water movement through soil is expressed by *equation (Darcy's law)* (Pietraru V., 1970)*:*

$$V = k\, i$$

where: *V - velocity of water through the soil;*
k - coefficient ity of the earth;
i - hydraulic gradient defined by the relation:

$$i = \frac{h}{l}$$

where: *h - difference of level;*
l - length of the path traveled by water.

Basically, *hydraulic gradient* expresses the friction forces between water and solid phase crossed.

Coefficient of permeability, k, depends on a number of factors, namely:
- Nature of the material;
- Pore size (permeability increases with the square of the pore radius);
- Presence or absence of air in the pores (air pore volume occupied by water reduced accordingly);
- Nature of the liquid;
- The temperature (temperature increase reduces the viscosity of the liquid);
- Direction of flow of liquid.

Retained water - water retention as a film around soil particles into the pores of the material leads to a lack of pressure (suction) in relation to atmospheric pressure.

Most times, the potential is higher retention forces gravitational potential. This explains why in a dry loess water migration takes place in all directions, and therefore the opposite of gravity.

The level wind suction is estimated with *sorbtional index* (*pF*), whose mathematical expression is:

pF = log h

where: *h - height of water column* [cm].

The sorbtional index has values in the range 0-7. (André Musy, Marc Soutter, 1991)

Water retention capacity of the soil is determined by the following factors:

- Temperature;
- Salinity;
- The nature of the earth;
- Constituent particle size (interaction forces increase with decreasing particle size);
- State and tamping the soil moisture.

2. Classification Index of Earth

For identification and classification of land, as well as to obtain an indication of their behavior under the action of stress, using a series of simple indices. They are determined relatively simple and usually expresses the ratios of constituent phases in practice using the following indicators:

- Porosity - degree of tamping;
- Humidity, degree of saturation;
- Changes in volume;
- Plasticity and consistency of cohesive land.

Porosity (n) is expressed by the formula*: n = (Vg / V) 100 (%)*

where: *Vg - pore volume of the earth,*

V - volume of the earth.

Humidity W, is expressed by the relation: *W = (Mw / Ms) 100 (%)*

where: *Mw - mass of sample ground water;*

Ms - the solid skeleton mass (dry land) (Harry R. Cedergren, 1977).

Changes in volume of soil is largely determined by moisture. Most common method for determining the dependence of volume changes depending on humidity, soil samples involves using a pasty which allow to dry gradually. From the graphical representation of the values of the two quantities is obtained *contraction curve*, actually consists of two straight sections connected to each other (Fig. 1).

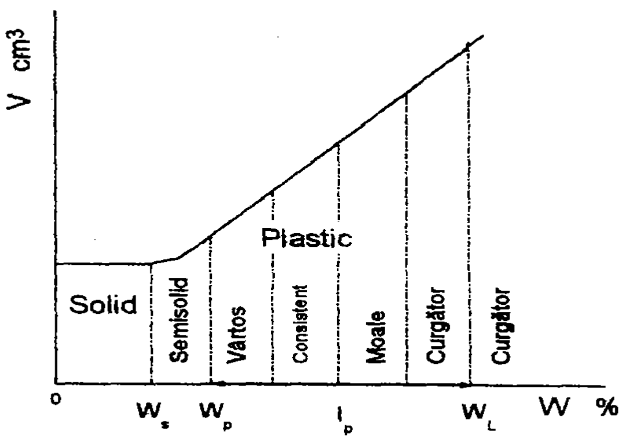


Fig. 1. Ground contraction curve
(the variation of the volume *V* depending on humidity *W*)

Moisture from the earth no longer shrink is called shrinkage limit (W_S) and separates the area where the earth is hard at it behaves like a semi. For humidity less than W_s land is colored because there air in its pores.

The size of the moisture in the soil behaves plastic (irreversible requests deform it without changing the volume) is called plasticity index, denoted by I_P. This range is bounded by the following parameters:

- kneading limit W_P - is moisture in the material can be stirred manually in the form of cylinders with a diameter of 2-3 mm. Kneading limit and lower limit is called plasticity.
- yield W_L - which is a trace moisture deep drawn with a spatula standard in the land brought pasty and placed in a special cup that is dropped from a height of 1 cm, a closed length of 12mm to 25 drops. This parameter is called the upper limit of plasticity and is practically humidity corresponding transition state land of plastics; running.

Thus, the plasticity index can be calculated using:

$I_P = W_L - W_P$

Plasticity land is even higher as these contain many fine particles and mineral assets (André Musy, Marc Soutter, 1991).

Indices W_S, W_L *and* W_P are known in the literature under the name and *Atterberg limits*.

3. Improving Properties Dales

Basically, by improving land are two objectives:

- Increase the mechanical strength of the material (decreasing deformability);
- Reduce permeability.

After how to act on the material *improvement methods* are classified as follows:

a) compaction of surface and depth;
b) deep drainage;
c) consolidation of mixing or injection;
d) thermal methods - burning or freezing.

Choice of treatment method is preceded by a techno-economic analysis that takes into account the cost of applying one of the methods, tools available, quality control methods execution.

3.1 Compaction

This involves exerting a mechanical on earth, resulting in shoving earth or decreasing porosity. Compaction parameters are set as following certain laboratory determinations on this land and the execution of test tracks.

To establish laboratory compaction characteristics of land use Proctor method. It aims to establish for a specific mechanical work (conventional) compacting *L*, the optimum moisture W_{opt} you need to have to be compacted earth so that it can be brought into the Deep obtainable for that work. Tamping state density is expressed with maximum dry weight [kN/m^3] (Honțuş Adelaida, 2005).

It builds a diagram in which the abscissa passing humidity values and the ordered volume weight values for each state of compaction (Fig. 2).

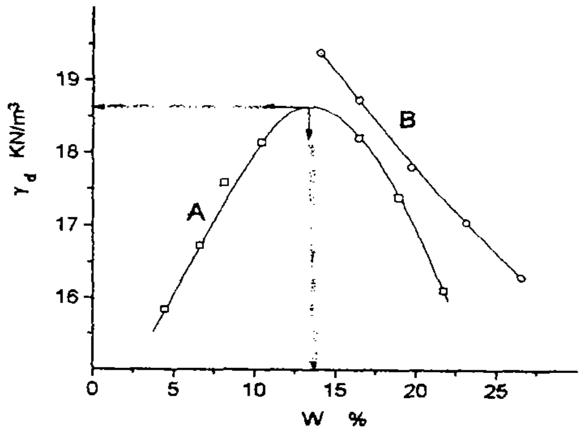


Fig.2. Proctor's compaction curve
γ_d – volumetric weight of the ground in the dry state (parched soil), W – ground humidity
A – Proctor's curve, B – ground saturation curve

Abscissa and ordinate maximum point on the curve *A* is the optimum moisture and maximum density or dry weight of the material.

Pulse control Proctor compaction curve is drawn in the same diagram the saturation curve *B*.

In the field, on the job, if the land is not close to the optimum moisture will dampen or be allowed to dry. Tamping status field is obtained by expressing the degree of compaction *D*, defined by: $D = \frac{\gamma_d}{\gamma_{dp}} \cdot 100$

Where: γ_d - volumetrically dry weight to be carried in the body of the work;

γ_{dp} - volumetrically maximum dry weight of Proctor diagram drawn in the laboratory for the same land.

Degree of compaction has values in the range 90-98%, depending on the nature, extent and purpose of earth construction. Basically, the highest values are prescribed for high earth dams with permanent retention of water.

3.2. Drainage of Deep

Accelerate the consolidation of saturated clays and the banks high porosity can be done using deep drains. These are placed mainly *in two ways*:

a) column method of granular material;

b) type method wick drains.

a). Columns of granular material used as drains must have a high permeability sidewalls. Cased columns running through drilling, extracting the material with drill pipe penetration. The distance between drains is determined by calculation, being generally a few meters.

For consolidation of saturated clays alone is not enough drainage, requiring simultaneous application of external pressures, for this purpose, the land is loaded with a load at least equal to that which will be sent to construction. Thus, the surface provided with drains to place a mound of earth upon which it is setting up a drainage layer, for vertical drains collected water discharge (Fig. 3).

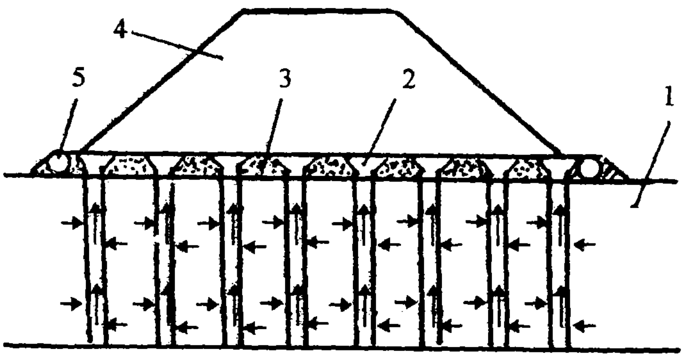


Fig. 3. Draining depth
1-ground compaction; 2-vertically drain; 3-horizontaly pad; 4-earth fill; 5-collecting tube (drain)

b). Type wick drains are in the form of cardboard ribbons woven fabric (felt), plastic pockets and so on, which are inserted into the ground with the help of special machines to depths of 25 m.

Permeability of such drainage is similar to fine sand (*k = 3 x* 10^{-4} *cm/s*). This method of drainage is characterized by fast execution and low disturbance soil structure (Honţuş Adelaida, 2005).

4. Landslide

The landslide is a natural disaster caused massive loss of soil stability. Assessing the stability of slopes and embankments of great importance for building and civil engineering, hydraulic works, roads, railways, quarries or waste dumps, stability and cultivated in regions inhabited areas with rugged terrain Landslides medium or large scale production and in Romania in the Carpathian foothills, the Transylvanian plateau and in Moldova.

The first sign of an impending landslide is the appearance of cracks at the top of the slope or slope perpendicular to the direction of movement. These cracks can be filled with water slowly seeps into the ground, weakening its resistance and increasing its weight. Also often can be observed and shear cracks on both sides of the moving mass as a slight discharge of the material at the foot of the slope.

Landslides are favored by a large number of factors such as topographical conditions, hydrogeological and hydrological processes or alteration of rocks. There are rare occasions when the landslide can be attributed to a single cause. Generally they are due to the combined action of several causes, such as:

»Construction works (cuttings or embankments for roads, railways, canals, quarries, additional requests by lifting construction, striking pilots in areas with active soft clays);

»Base erosion slopes (in thixotropic clays);

»Tectonic movements leading to increasing slope;

»Earthquakes and vibrations due to traffic or pit exploitation;

»Sudden variations in rainfall and groundwater level;

»Seepage from artificial sources of water, including lakes and ponds due to filling of reservoir.

Mass movements of earth can be traced to surface topographic means, or in depth using devices called inclinometers. To combat or mitigate loss of stability are different methods that can be grouped into the following *categories* (Honțuş Adelaida, 2005):

»*Geometry (Fig. 4)* - change profile by downloading the top (a), charging base (b) or general sweetening slope (c)

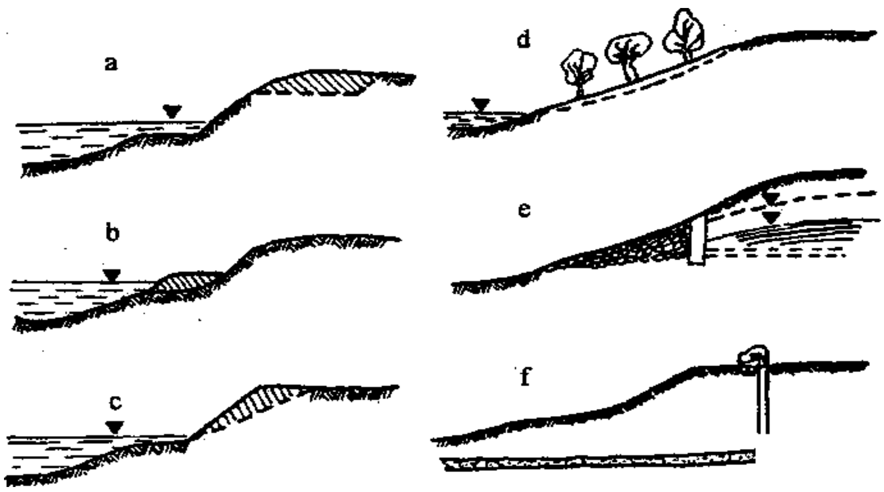
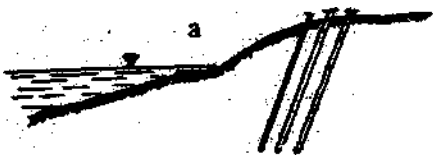


Fig. 4. Mechanical and hydrological methods for the control of the landslides

»*Hydrological processes* (Fig. 4 a, b, c) - ensure the collection and discharge of surface water and planting trees (fig. 4, d), making surface or deep drainage (Fig. 4, e) or lowering the water level in layers aquifer (fig. 4, f).



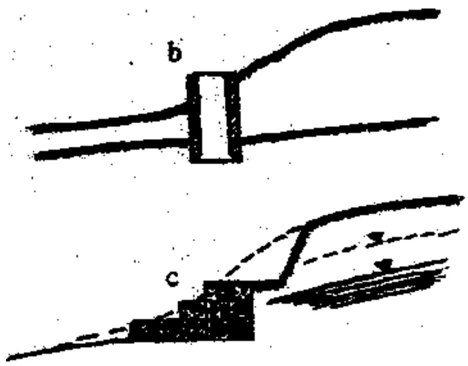


Fig. 5. Mechanical methods for the control of the landslides

»*Mechanical (fig 5)* - placing the field strength elements such as piles or buried walls (Fig. 5, a); caissons (Fig. 5, b) gabion (Fig. 5, c)

Gabion is made as a wicker or wire basket filled with earth, gravel, etc.. serves the defense and consolidation of banks by waves, building dams and others.

In general, methods are preferred acting on the causes triggering instability phenomena. Since the massive volumes unstable and landslides generating forces have considerable value, control landslides pose both technical and economic. (Honţuş Adelaida, 2005)

4. CONCLUSIONS

Foundation soil was planned to meet certain conditions for construction could begin as follows:

»To be strong enough so as not to break under the foundation, it says that the land must have a minimum load capacity;

»Foundation soil deformations remain within acceptable limits for that building.

Knowing well construction characteristics and those of the subsoil, the solution can proceed to establish the *foundation*, operation carried out at the design stage. Designer's responsibility is great, because foundations are hidden works whose behavior after execution can not be controlled directly, and if failures occur, correct them is extremely difficult. Therefore it is necessary to know all of the subsoil before starting construction.

Foundation soil characteristics are important and essential in establishing the foundation solution. They are caused by performing geotechnical investigations whose depth must include all horizons influenced by that foundation, namely: a soft, low bearing capacity, arranged in another compact and durable.

Besides land geotechnical properties which constitute the foundation soil should take into consideration other factors, such as: inundability, seismicity, gelivity (strength of rocks and soils of the foundation to the action of frost and thaw), wetting sensitivity, susceptibility to swelling and shrinkage, voids underground groundwater.

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