



SETTING-OUT CONSTRUCTIONS ON THE TERRAIN

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Abstract

This paper covers the stages of setting-out the construction on the terrain. The required appliances are presented and also the staking and marking phases of the building contour and of the main axes. This paper also describes how to place the landmarks that are essential for vertical and horizontal angle measurement and other dimensions.

Keywords: setting-out constructions, measurement instruments, landmarks, continuous profile board method, discontinuous profile board method.

INTRODUCTION

Setting-out constructions on the terrain means plotting them on the place specified in the technical project, taking into consideration the zone's architectural and urban planning landmarks. No construction, regardless of its size or destination, can be executed without prior setting-out.

To materialize constructions on the terrain, the following steps must be observed [2]:

- Drawing up the plotting documentation - the design;
- Setting the plotting grid on the terrain;
- Setting-out the construction on the terrain;
- Inspection and acceptance of the plotting works.

On smaller or less important projects, the graphical elements of the setting-up are highlighted directly on the site plan, where the coordinates inventory is also recorded, as presented below (Fig. 1).

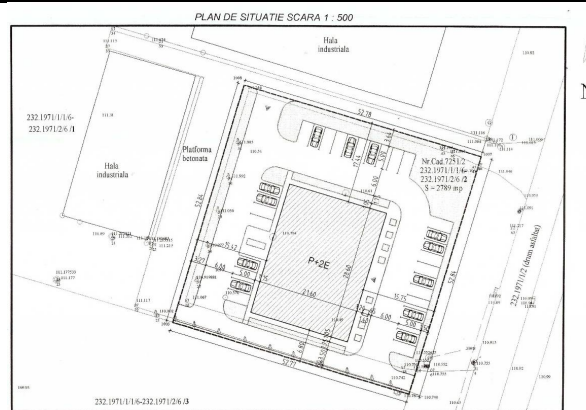


Fig. 1 Site plan and coordinates inventory

Nr. pct.	Coordonatele punctelor de contur		Lungimi laturi
	X [m]	Y [m]	
1080	525511,508	219673,882	52,782
1007	525496,394	219724,454	52,839
1002	525445,768	219709,323	52,768

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1003	525460,878	219658,765	52,839
$S(232.1971/1/1/6-2321971/2/6/2)=2788,56m^2;$ $P=211,23m$			

Detailed setting-up of the constructions on the terrain is done using the execution scheme correlated with the elevation markings.

To correctly position constructions on the terrain, according to the technical documentation, a series of level and altitude control points and pegs are laid out on the ground which highlight the outline and/or the main axes.

For the control points placed in the setting-out phase to be useful throughout the execution phase, and in horizontal and vertical dimension checks, they must be materialized by pegs (Fig. 2) placed so as they cannot be deteriorated or destroyed. As a rule, they are placed outside the construction perimeter at a distance of 2/3 of its height.

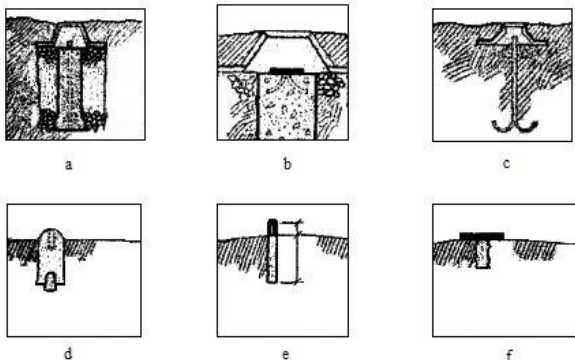


Fig. 2 Landmarks; a – peg embedded in concrete; b – steel plate embedded in concrete; c – peg embedded in hard ground; d – metallic piece with landmark, embedded in hard ground; e – metallic peg embedded in hard ground; f – steel plate with pegs, embedded in hard ground.

2. DEVICES AND APPARATUSES USED IN SETTING-UP [1]

- Instruments and devices for plotting angles: tachometer theodolites, centered at the station using the plumbline; they use different staffs for sighting;
- Instruments and devices for plotting lengths: steel bands with 10 m to 100 m length, 10 m or 50 m steel tape measures; also, measuring length can be done indirectly, using tachometers or theodolites and horizontal staffs, using precision electro optical instruments;

- Instruments and devices for vertical transmission of points;
- Other devices: prism or mirror squares, cloth tape measures, metal tape measures, folding rulers, plumbines, ranging poles, steel or wooden survey stakes.

New and recent instruments on the market are seeing increasingly larger-scale use:

- Electro optical tachometer (total stations) which automatically store the measurement readings in the built-in memory and can be downloaded on a computer. They measure horizontal or slope distances, horizontal angles, differences in elevation, rectangular coordinates, etc.;
- Electronic or laser levelers, use the same principle of storing and downloading readings on a computer;
- GPS instruments.

3. GROUND TRACING THE CONSTRUCTION ON THE TERRAIN

As outlined, this is a very important and high responsibility operation. The layout plan on which the new objective is placed must have the "endorsed to be unchanged" stamp placed by the Construction Authority, bearing the reference number and issue date, which shows the utmost importance of this phase in accomplishing the investment.

With the express purpose of correlating the data in the plan with the data on the terrain, to this important operation the following must attend: the beneficiary, the site supervisor, the designer, representatives of the local authorities, which have tenure of the utilities in the area and issued the placement permissions (representatives of water supply and sewage, electricity, gas, telephone, heating and of other companies).

The actual tracing is executed by a topographic company or by an authorized topographer.

The tracing is carried out as follows:

- The plot is identified on the ground based on the coordinates of the outline points and are materialized on the ground using survey stakes; distances between the stakes are measured and then compared with those from the chart;
- Distances are being measured from these sides to the exterior outline of the new building; at the intersections, a rectangle is yielded, in which the new construction is situated;
- The exact shape of the building and its corners are traced respective to the buildings in the area or landmarks provided by the designer;



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- Distances on the terrain are cross-checked with those from the plans and schemes and, if they are identical, the next phase follows. The same steps are taken if the discovered differences fall within the accepted tolerances. In case the differences are bigger or in case a utility line is found, of which the owners had no prior knowledge, an accepted on-site solution is sought. When all these operations are carried out, according to the scheme, and the unforeseen problems are satisfactorily resolved, the handover report is drawn up.

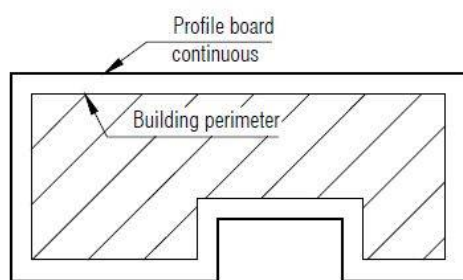
To actually begin the construction works, the main axes of the building need to be drawn.

In case of a regular shaped construction, the main axes are traced (longitudinal and transversal) using theodolites for determining directions and tape rulers to measure lengths.

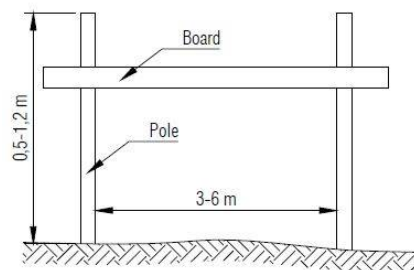
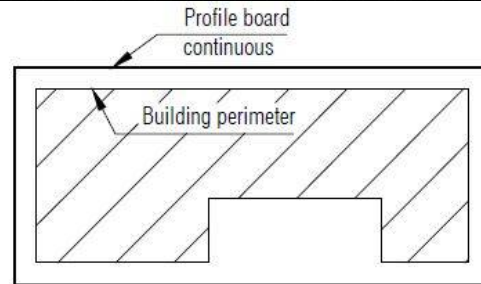
The materialization of the axes on the terrain is done using permanent ground markers that can be used during the entire execution of the construction; steps are taken to protect and preserve these landmarks.

If, in turn, the axes are being marked on the profile board (continuous or discontinuous), placed parallel with the construction edges, at a sufficient distance as to not be destroyed by the trenching works, these axes must be designed and executed so as to allow tracing of all the necessary points. In practice, two methods are being used:

- The continuous profile board method, uses a continuous profile all around the building outline (Fig. 3);
- The discontinuous, corner profile board method; fences are placed only at the corners (Fig. 4).

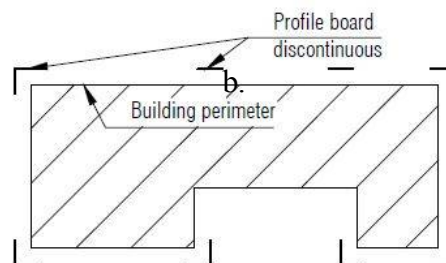


a.

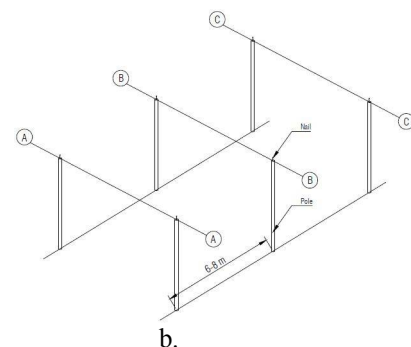


c.

Fig. 3 Continuous profile board; a, b – top view; c – side view.



a.



b.

Fig. 4 Discontinuous profile board; a – top view; b – side view.

In both methods, wooden fences are used: wooden offset pegs are set on the ground, then a horizontal



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plank is applied (usually at the +1.00 m elevation). On this plank, the axes are materialized through nails, notches, markings etc.; around them, paint circles are traced and the number of the axis or row is marked. On each offset peg, the height reference is marked, which must be the same. The vertical transfer of all the main lines (perimeter, corners) is done referencing the wires laid as axes in the area, using the plumbline.

With respect to the "tracing table" thus obtained, all the works necessary to the execution of the construction can be traced.

The tracing of the elevation lines of any construction is done with reference to the ± 0.00 elevation of the building (usually the one of the ground level finished flooring).

4. REMARKS ABOUT THE TRACING OPERATIONS [2]

1. On executing the tracing operations, only verified calibrated instruments and devices are to be used, with their parameters inscribed, without breakings, chippings or repairs, such as riveting the tape for measurements.
2. The position of the points in the support grid in reference to which the tracing is done must be verified (level and altitude).
3. A great attention will be dedicated to marking the pegs and the landmarks.
4. Conservation and protection measures will be ensured both for the traced points and the reference points.
5. After the reference ground markers are set on the ground, each and any tracing operation will be verified according to them.
6. Results of the tracing will be marked in the tracing report which comprises:
 - Traced objects;
 - The means of determining the tracing elements;
 - The results of the verifying operations: angles, distances, elevation differences
 - Found deficiencies;
 - All required signatures.

REFERENCES

- C 83-75 Îndrumător privind executarea trasării de detaliu în construcții
Doandș V. Topografie aplicată, Editura Politehnica, Timișoara, 2007