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ADAPTATION OF THE URBAN SOLUTION TO THE NATURAL RELIEF FACILITATES SIMPLE STORM AND SANITARY DRAINAGE SOLUTIONS

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Abstract: The article was born as a product of a search experience for better storm drainage and sanitary designs associated with small real estate projects.

It is suggested to adapt as much as possible (and within reason) to the natural relief of the project land, obtaining benefits, of which the largest is a reduction in the earthmoving budget without harming any functional aspect of the urbanization.

INTRODUCTION

Often, the conception of urban solutions for minor and new settlements is chosen putting in first place criteria that displace storm drainage and sanitary solutions towards later interventions. In other words, drainage engineering is resolved in the next step, having offered an urban solution, to which the hydraulic engineer had no contribution.

Figure 1 shows an example of the urban solution for which a proposal has been requested to prepare the design of storm and sanitary drainage.

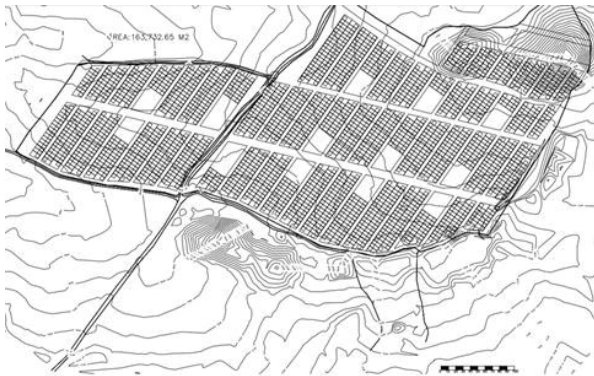


Figure 1: Urban solution for a new neighborhood
~3km from a city

THE ADVANTAGES OF ADAPTING THE URBAN CONCEPT TO THE RELIEF OF THE TERRAIN

There are several advantages of projecting an urbanization trying, as far as is rational, to coincide with the shape of the land destined for that purpose. They all add up to what is substantial for a work: cost reduction without compromising the quality of solutions.

Specifically, adapting to the shape of the land – as long as this does not imply that component parts present greater altimetric differences - it is achieved:

- *Reduction of the risk of external geodynamics (speaking of cases with pre-existing equilibrium)
- *Not having to create new ways for storm drainage or having to request permits for it
- *In the case of relatively small areas, the pluvial evacuation is resolved via surface (on pavement - without underground structures)
- * The sanitary drainage system is simplified, being possible to select the slopes close to those of the land surface and thus reduce to a minimum the depth of trenches and consequent movement of earth.

In the entire area of the urbanization, comprising surfaces occupied by residences and common areas including the transit routes for people and vehicles, a significantly lower volume of earth movement is achieved (as shown in the example presented). This facet implies mayor savings in the total cost of the work.

THE PROPOSAL

Having received the request to offer a proposal for the storm and sanitary drainage designs for the new urbanization (of the urban solution of figure 1), the author has requested the correction of the urban conception for the purpose of adaptation to the existing relief. of the land taking into account the aforementioned advantages.

The requesting company approved this action and as a result the modified urban plan was proposed based on the following principles:

- 1/. The main streets must coincide as far as possible with the existing natural drainage channels of the land.
 - 2/. Lateral or second-order roads must follow the shape of the terrain, assuming reasonable slopes for storm drainage.
- As a result, the following was proposed:

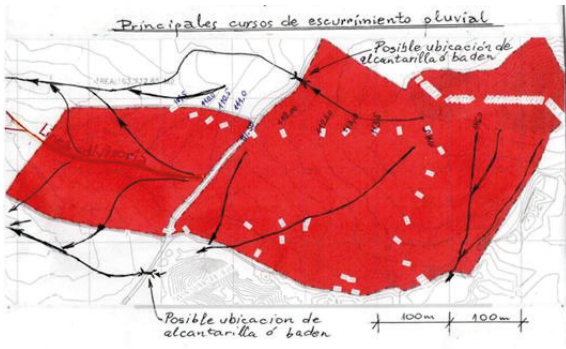


Figure 2: Natural drainage routes of the land of the new Urbanization

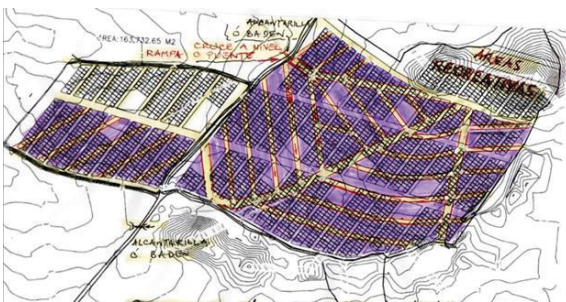


Figure 3: The proposal for a new conceptual urban solution

RESULT OF THE URBAN ADAPTATION TO THE NATURAL RELIEF

In order to evaluate possible savings in earthmoving (it does not include elimination of the soil layer with organic residues), slopes of general surface plans of the urbanization have been assigned (solution without adaptation to the relief) suitable for the runoff of rainwater, as can be seen in figure 4:



Figure 4: Plans and general slopes of the urbanization without modification of the urban conception defined with the purpose of allowing efficient storm drainage

Analyzing the volumes of earth movement for the urban solution with slopes according to figure 4 (the rainwater runoff ways are naturally the secondary roads that cross the main avenue of the area on the right side, while in left side there were no major modifications) the following results have been obtained:

Earth excavation volume (sandy clay) ~56 500 m³

Earth embankment (using excavated soil) ~ 27 900 m³

Volume of excavation to be taken to the dump ~28 600 m³

Applying local unit prices to carry out these works, an approximate cost of US \$250,000 (two hundred and fifty thousand dollars) is obtained. This cost does not include savings that would be obtained by reducing trench

excavation volume or those which would correspond to underground storm drains.

It is understood that in case of adapting to the maximum, to the natural condition of the land (as suggested in figure 3), the global costs considered would be practically null.

CONCLUSION

Using the example (figure 1) a significant reduction of the budgetary items corresponding to earth movement has been proven if adaptation to the relief of the land of the area covered is achieved (figure 3). The

rest of the benefits that were mentioned are justified by simple logic. In addition, urban solutions designed this way are considered to provide more security in extreme event circumstances. Smaller residential projects must use this methodology, especially if they are modest cost state housing projects.

In any case, good projects always imply timely participation of all specialties, implying that the urban design fully complies with the requirements of conceptual solutions for storm and sanitary drainage.

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