CULTIVATION OF TERRACE MINING

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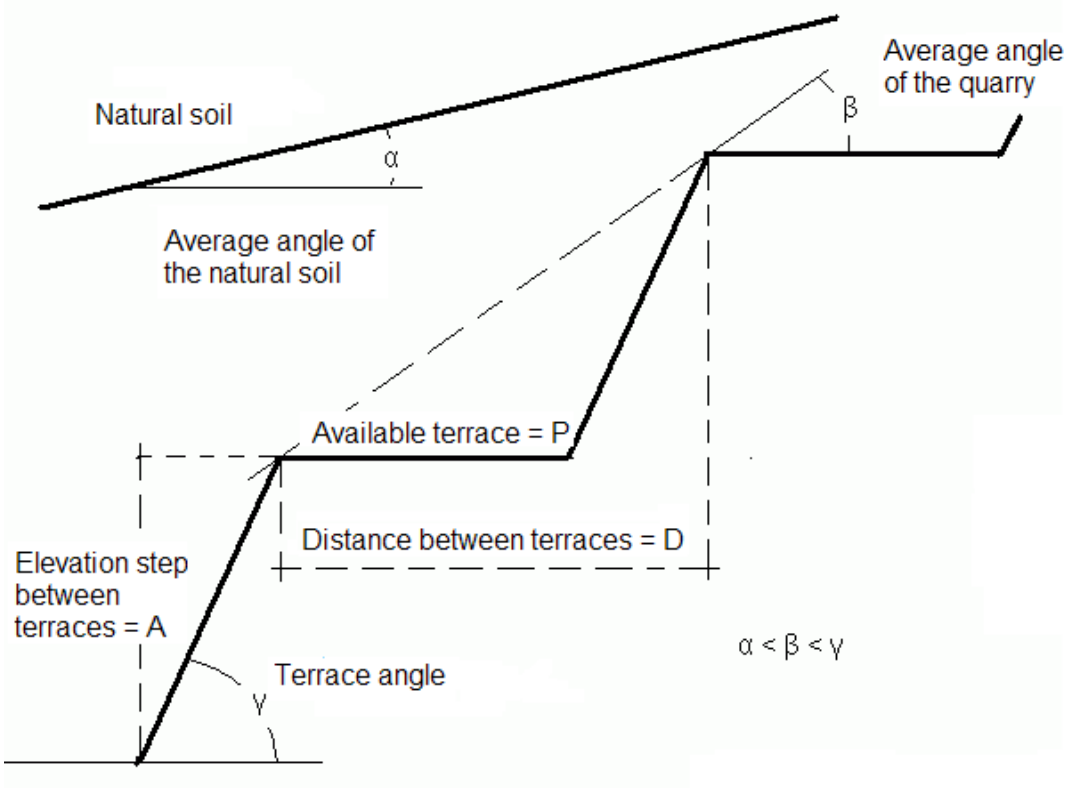
This note deals with the geometrical facet of the cultivation of a terrace quarry as performed by the software ALE Advanced Land Editor.
ALE suggests several work tools. Some of these tools are automatic up to the design of a quarry in 3d mode by a single command or "wish". Other commands allow local adjustments.

GEOMETRY

Let us suppose that the open mining is developed by horizontal terraces according to the following figure:



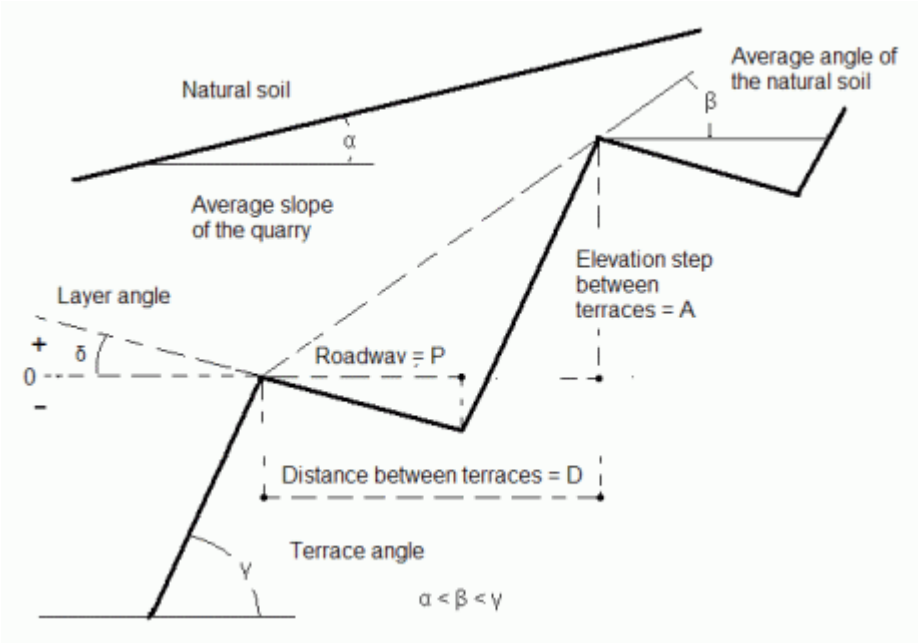
D = horizontal distance between terraces
P = available roadway of the terrace
A= elevation step between terraces
α = angle of average dip of the natural ground
β = average angle of the quarry
γ = average angle of the terrace
Clearly α < β < γ . The β and γ angles are suggested by geotechnical engineering.
You should choose an elevation step A ad verify that the available roadway P is sufficient for the pass of men and machines.
The above dimensions are bound by the following expressions:

$$D = P + A/tg\ \gamma$$
$$\beta = \arctan [1/(P/A + 1/tg\ \gamma)]$$

For instance, if you wish an available roadway of 5 meters and an elevation step of 5

meters with a terrace angle of γ = 70° , you will get a distance between terraces D = 6,82 meters and the average angle of the quarry is β = 36,25°

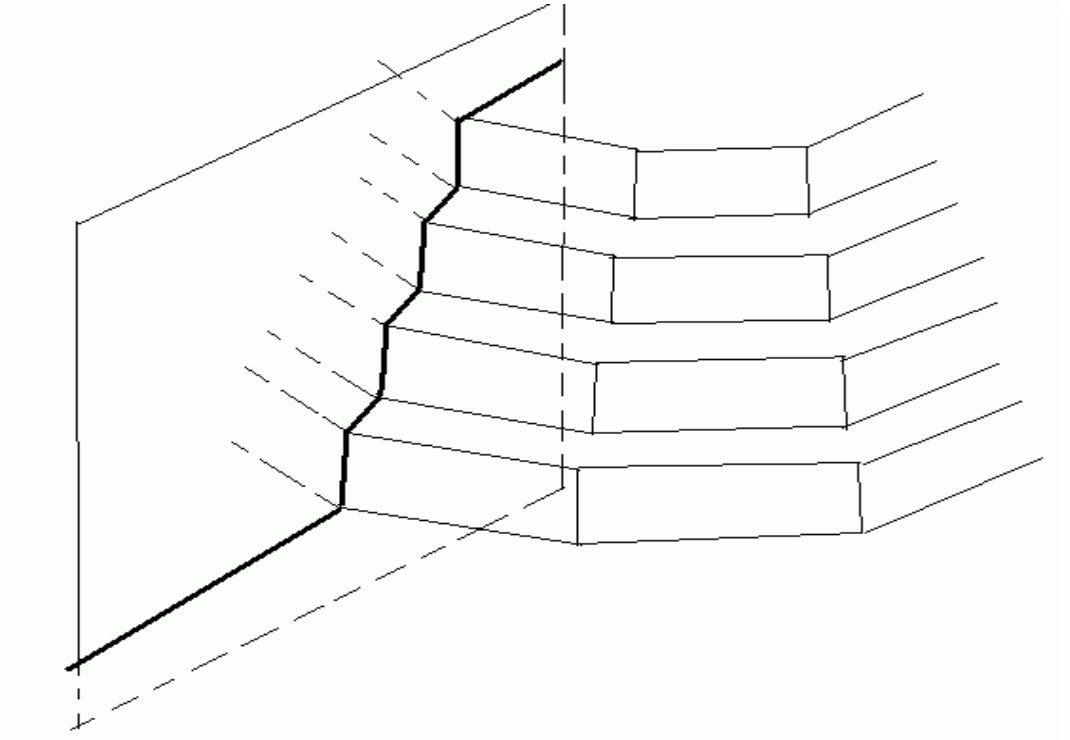
If the mining refers to inclined terraces the above definitions must by corrected and a layer angle δ must be defined.



$$D = P\,[(\operatorname{tg}\gamma + \operatorname{tg}\delta) / \operatorname{tg}\gamma\,] + A / \operatorname{tg}\gamma$$

$$\beta = \operatorname{arctg}(A/D)$$

Clearly the problem cannot be solved on a single section and therefore the work must be done several times.

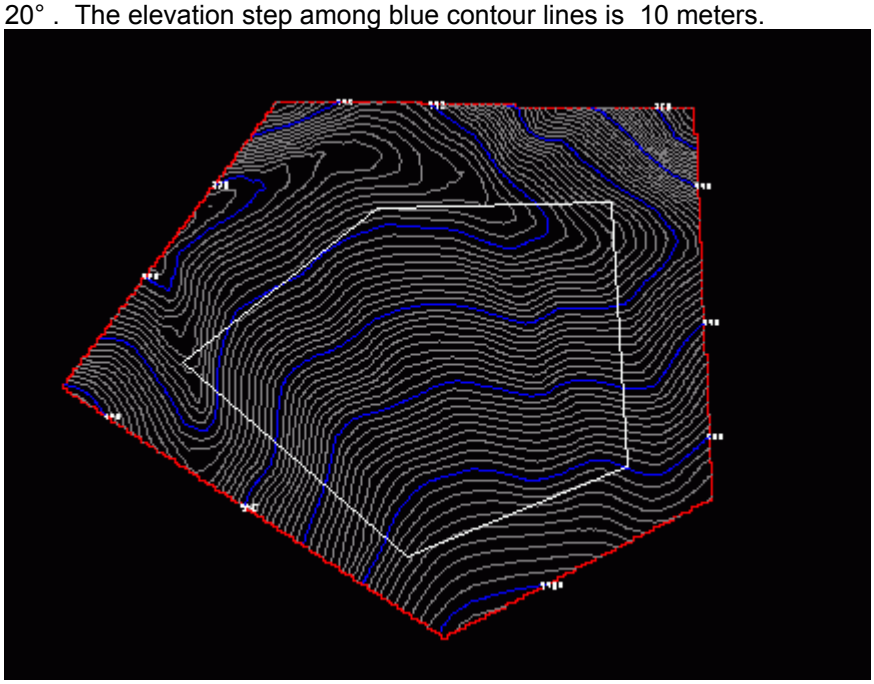


How many times ?
Th article Calculation of Volumes (on the site www.geodis.it) demonstrates that a simple

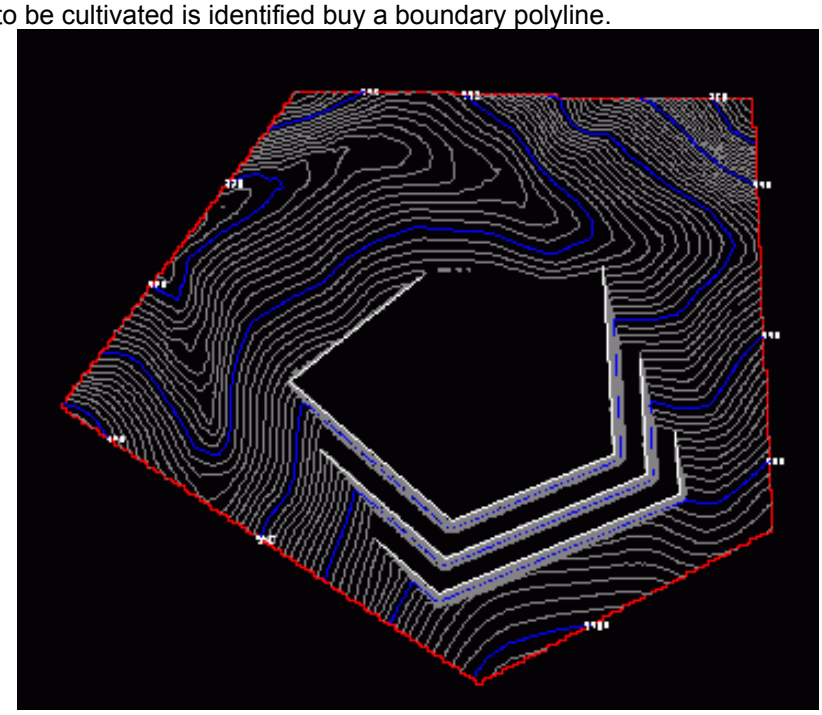
pool requires about 30 parallel sections to get a good accuracy. Therefore the matter will take time.
When this work is over you shall calculate the cut and fill areas of all the sections and sew them by the method of the cross sections to get the volumes.
Are you happy about your work ?. If you are not happy you shall start again with a new hypothesis. If you are happy you shall still face the objections of your client.
Perhaps you will try to withstand against the request of changes not related to increase of additional income. Perhaps your client will feel disappointed.

ALE AUTOMATIC METHOD

Let us start by an example shown in the following figures.
The terrain 3d model, calculated by sparse xyz points triangulation, has an average angle of about 20° . The elevation step among blue contour lines is 10 meters.



The area to be cultivated is identified buy a boundary polyline.

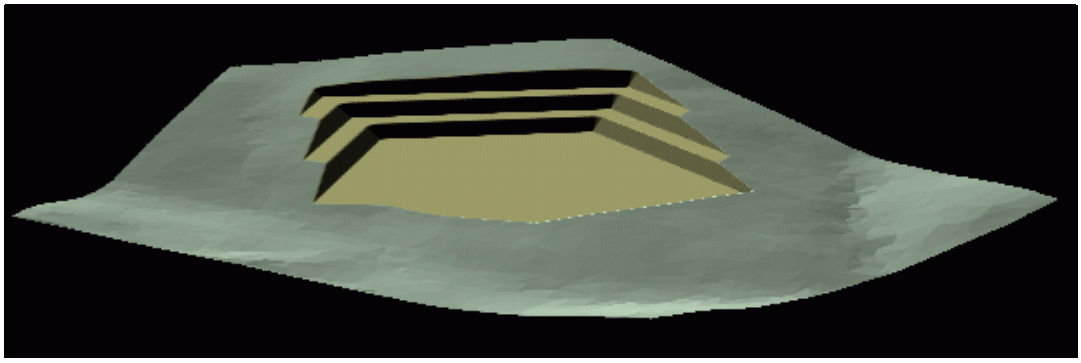


You have chosen an elevation step of 10 meters and a roadway of 10 meters with a terrace angle of 60°.
You decides to start digging from the top elevation.

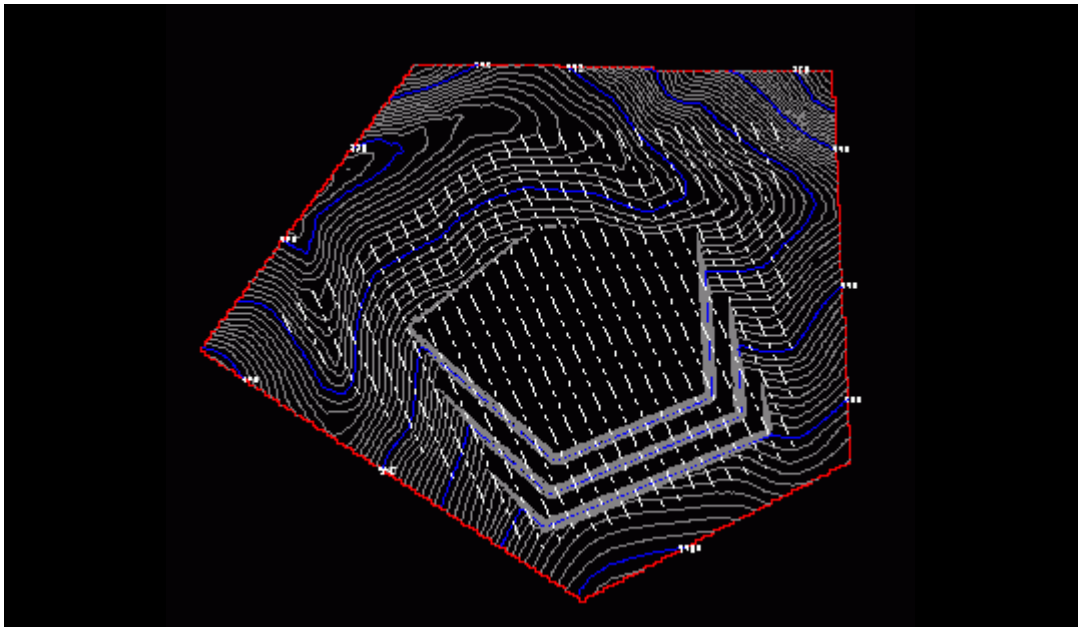
You push the command "Plain terracing by digging". The quarry is done and optimized on the area. Let us look at it on the map.

ALE in general draws everywhere contour lines. You can see (better by a zoom) the dense contour lines on the terrace slopes.
The map may be saved in DXF format.

Let us give a look to the 3d model.
The area which has been excavated has a different color.
You can fast rotate, make zoom, shift the model to observe it.
You can save the images in BMP format.



Let us draw automatically a group of cross sections by the command "Parallel section group".
You have requested 30 cross sections but could require up to 100 sections.

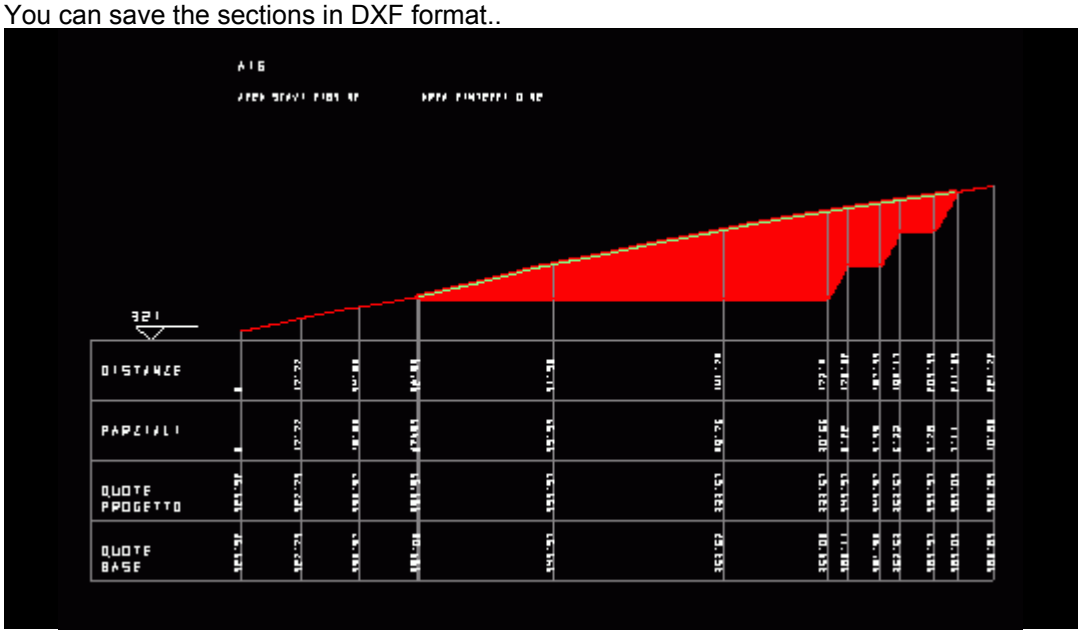


Let us look at the sections one by one. They are accurate.
The soil line is continuous.
The cut and fill areas are evidenced.
The size and elevations of the important points are already reported and we can add other points by automatic editing.
In the lower part you can read distance, partial distance, terrain elevation and design elevation.

There are 3 representation modes.
- profile
- base-design
- multi-section

Technical Note

You can save the sections in DXF format..



Let us automatically calculate the cut and fill volumes, automatically generate and save a report with detail on calculation (TXT file) and attached cross sections (DXF file)

Let us observe the progress work.
All the stages are documented by maps, sections, 3d views, volumes and technical reports.

Do you want to make changes to some progress stage ?
You can change a terrace angle or the shape of the quarry. The design is regenerated in real time and all the outputs are ready for the delivery.
How long time have you spent for the whole work ?
Less than 1 hour.
The client has additional request ? Client satisfaction is not a problem.