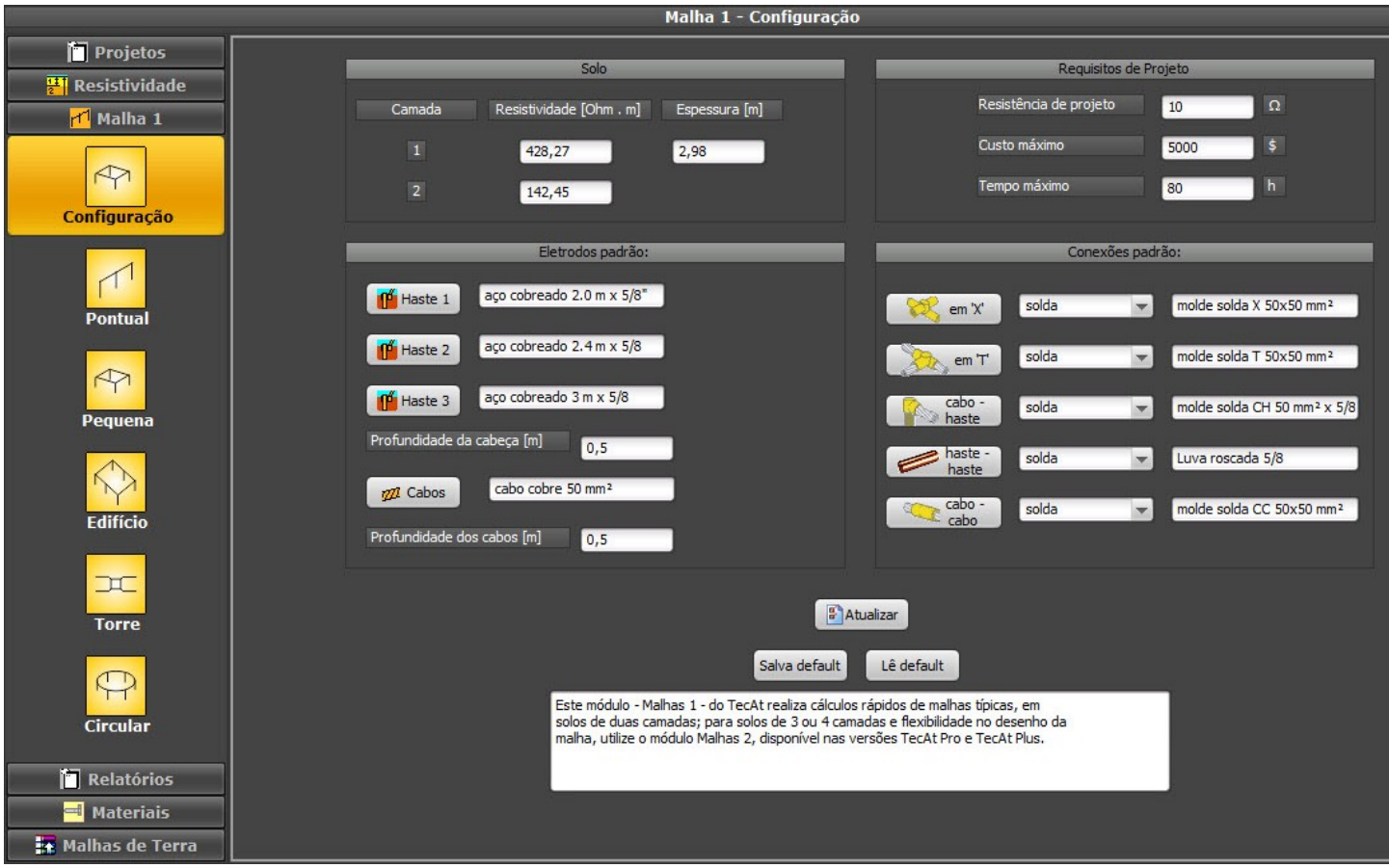
# TecAt 6 - Tutorial - Grid 1

TecAt module Grid 1 is intended to make a quick calculation of several grids of some typical configurations in a 2-layer soil; note that the item Analysis is not available on TecAt LE (the Learning Edition).

1. Configuration

At the Menu bar, select Grid 1 / Configuration:




If you already have done the Resistivity stratification, the values for resistivity and first layer thickness are already listed, otherwise you can enter them at this screen.

Note: module Grid 1 requires a 2-layer soil; if your field data only fit a 3- or 4-layer soil, you must use the module Grid 2.

You need to select one cable for the horizontal electrodes and three rod lengths for the vertical ones; chose also the connections default for each format - cable-cable, cable-rod, cabels in "T", cables in "X" and rods union.

Finally, set the desired project resistance, budget and time to build, then click on the Update button.

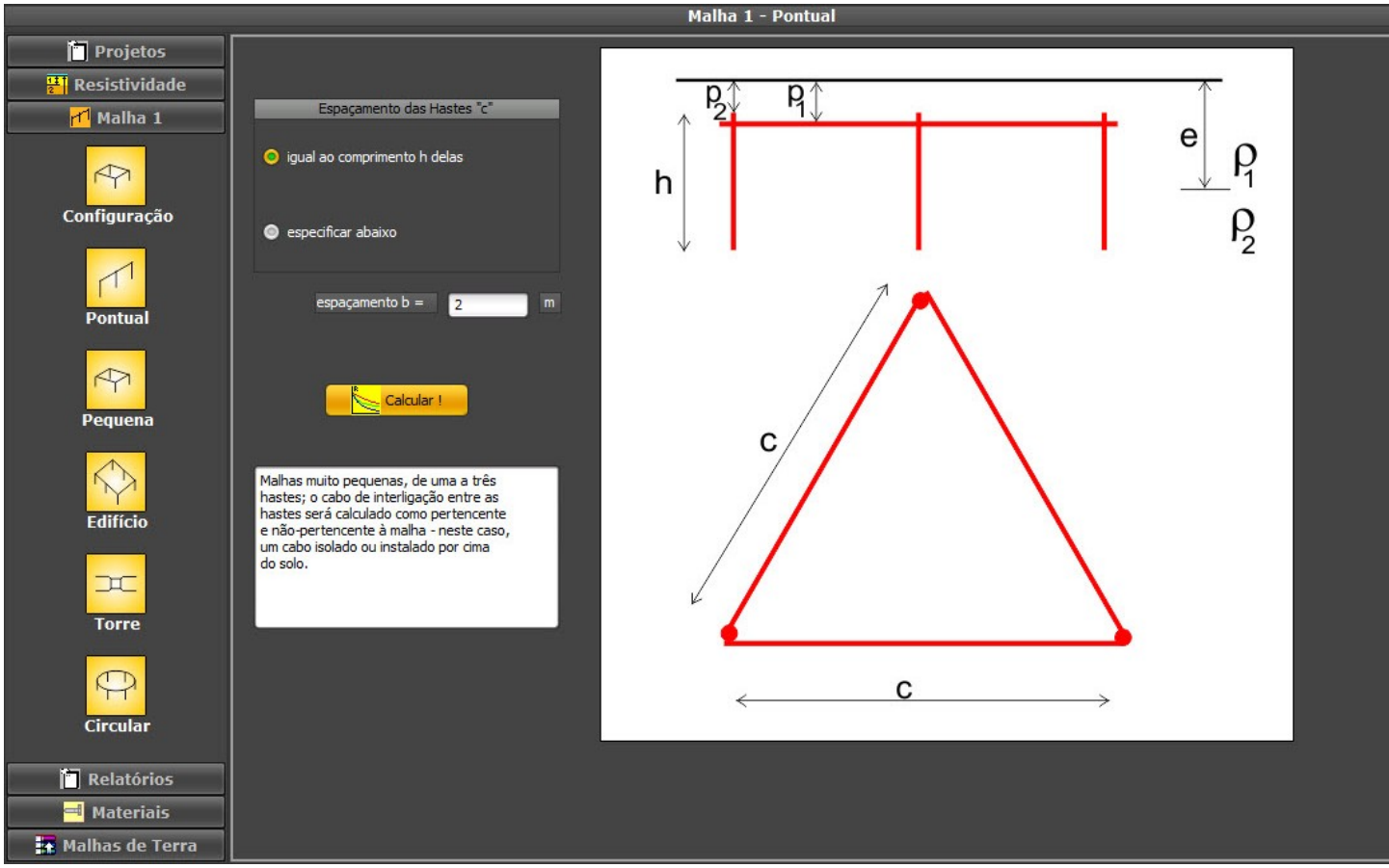
2. Selecting a grid "family"

At Menu bar, tab Grid 1, choose the item corresponding with the desired grid family (same format and components, different sizes):

- Local: 1 to 3 rods, line or triangle, with and without cable
- Small: 4 to 16 rod, in square or line formation
- Building: rectangular ring with zero to 16 rods
- Tower: one or two parallel counterpoise, with or without rods
- Circular ring: similar do Building, but a circle instead of rectangle.

3. Local grid

At the Menu bar, select Grid 1, then Local:

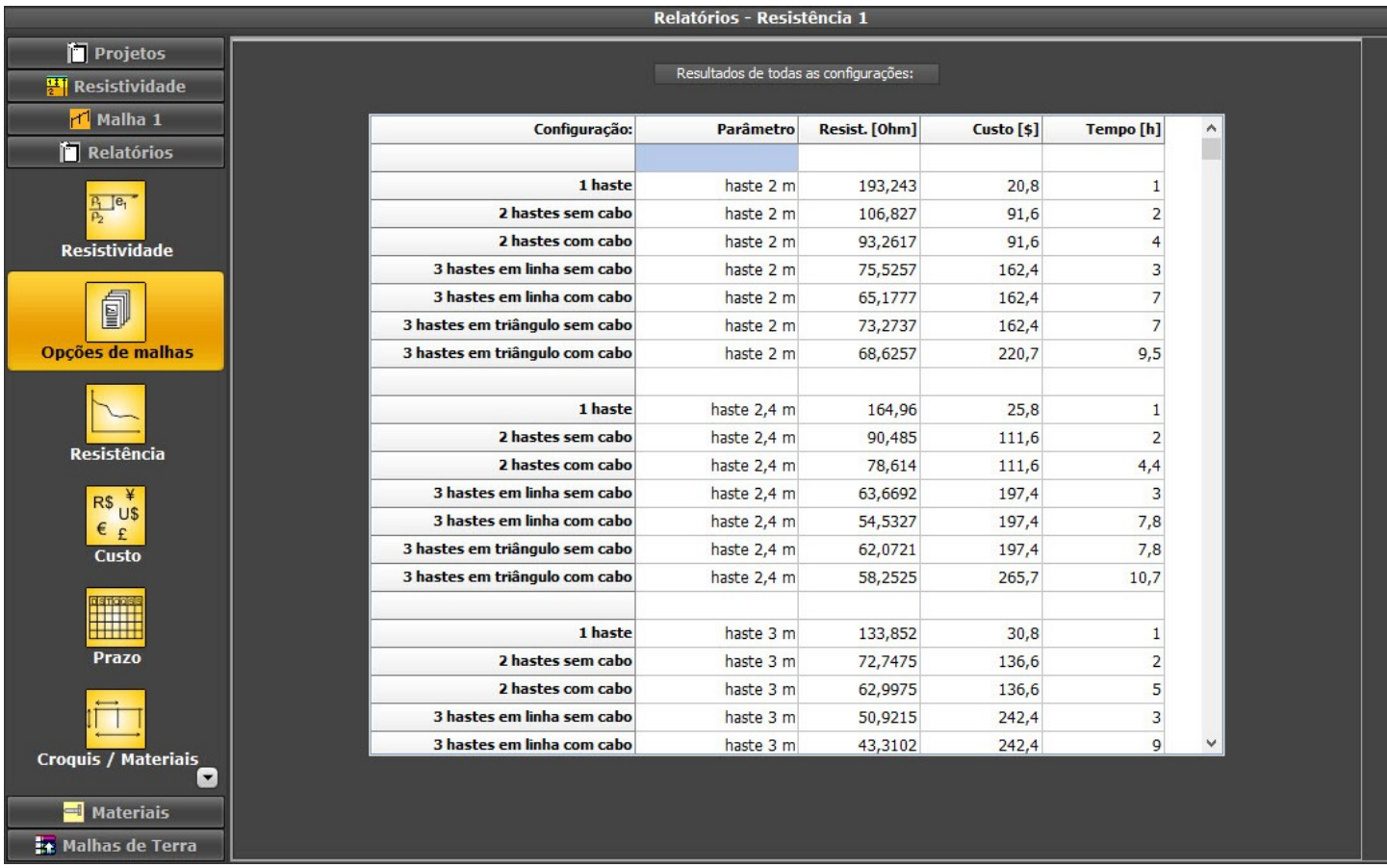



You can set the spacing between rods to be equal to their length - 2 meter rods will be spaced 2 meters, 3 meter rods will be spaced 3 meters - or you can set a fixed spacing for all configurations.

4. Report: Options Table (Local)

When you click on Calculate, TecAt does the math for 21 grids: for each rod length, grids with:

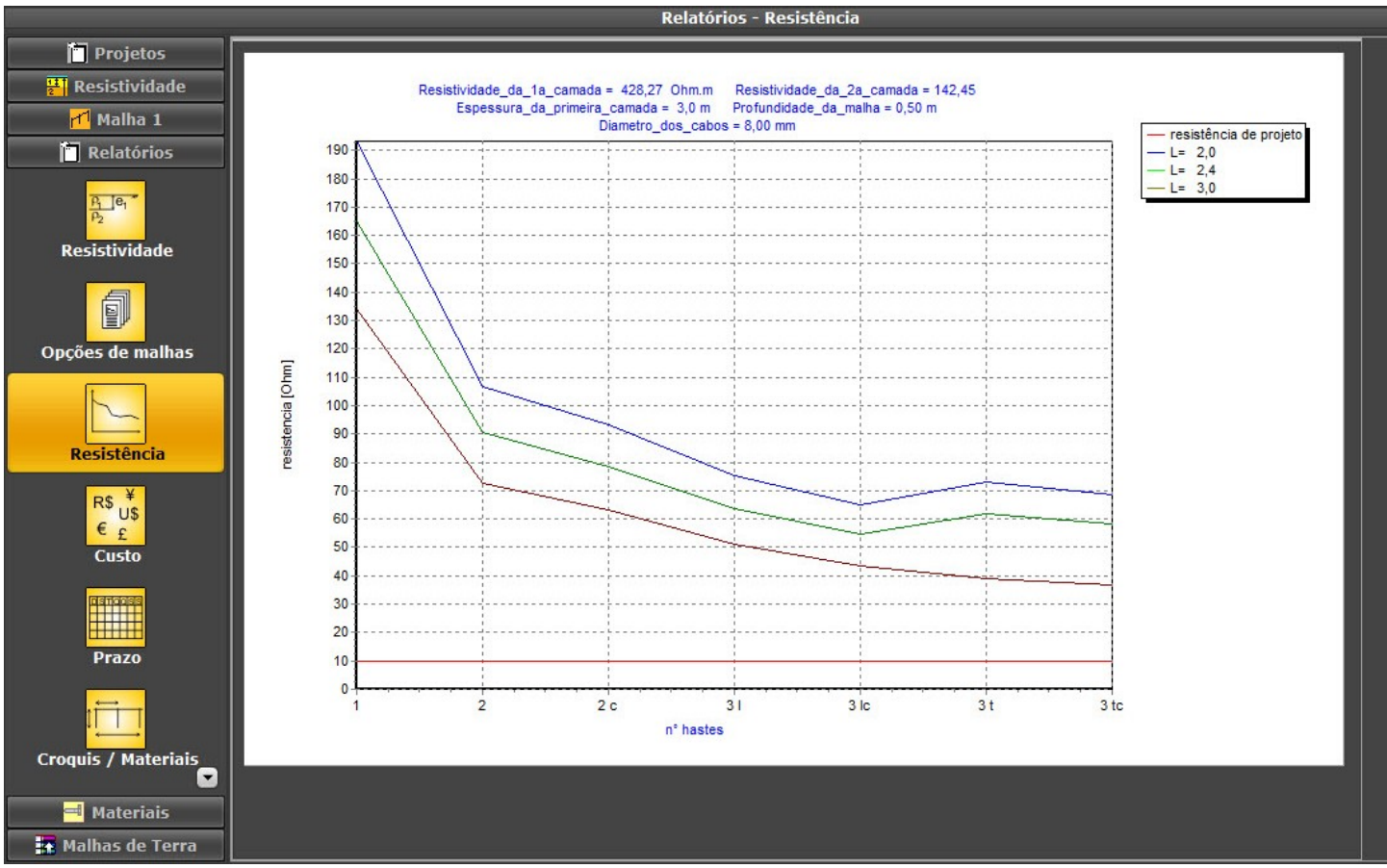
- one rod
- two rods, cable not considered
- two rods, cable considered
- three rods in line, no cable
- three rods in line, with cable
- three rods in triangle, no cable
- three rods in triangle, with cable



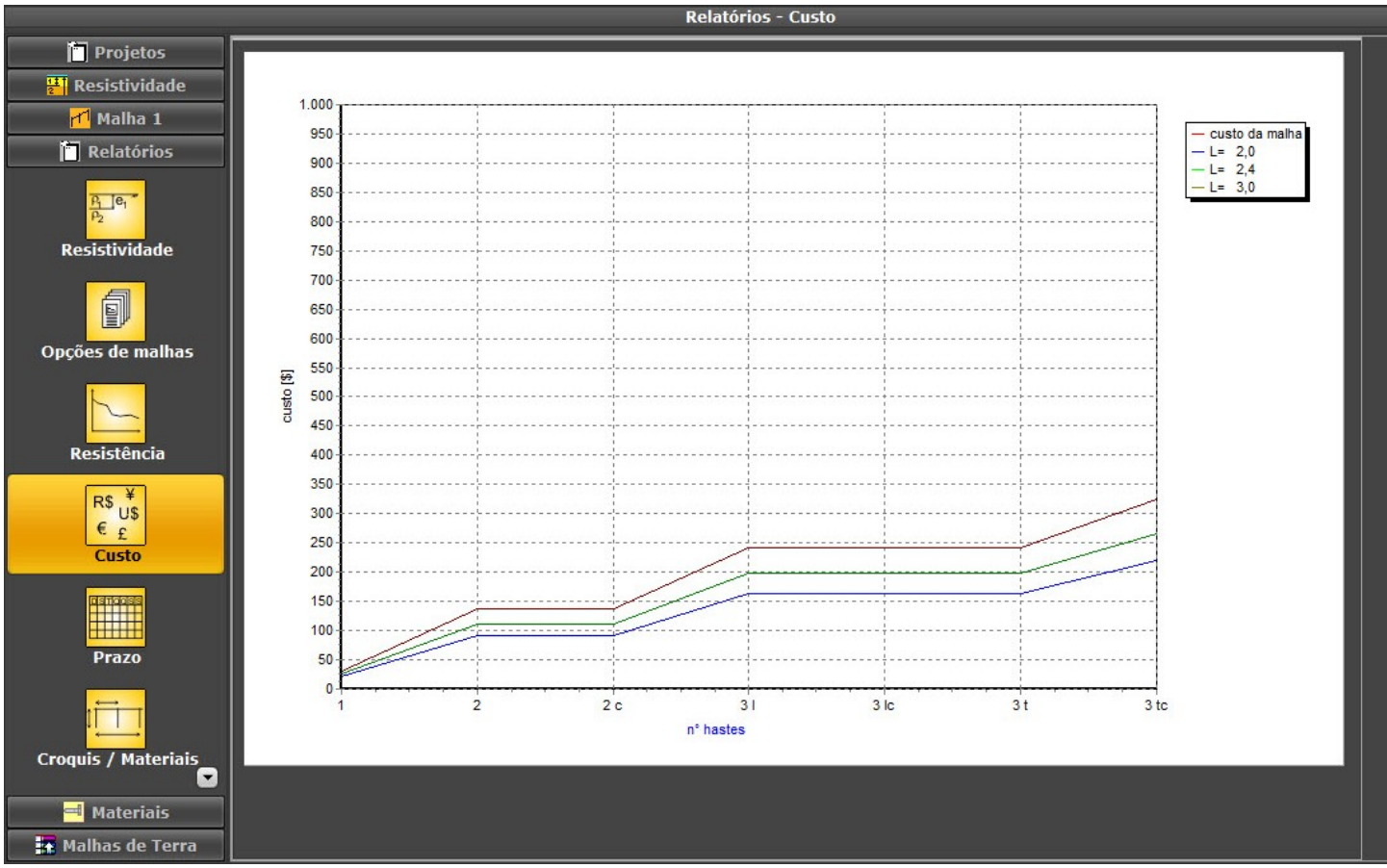

| Configuração: | Parâmetro | Resist. [Ohm] | Custo [$] | Tempo [h] |
|---|---|---|---|---|
| | | | | |
| 1 haste | haste 2 m | 193,243 | 20,8 | 1 |
| 2 hastes sem cabo | haste 2 m | 106,827 | 91,6 | 2 |
| 2 hastes com cabo | haste 2 m | 93,2617 | 91,6 | 4 |
| 3 hastes em linha sem cabo | haste 2 m | 75,5257 | 162,4 | 3 |
| 3 hastes em linha com cabo | haste 2 m | 65,1777 | 162,4 | 7 |
| 3 hastes em triângulo sem cabo | haste 2 m | 73,2737 | 162,4 | 7 |
| 3 hastes em triângulo com cabo | haste 2 m | 68,6257 | 220,7 | 9,5 |
| | | | | |
| 1 haste | haste 2,4 m | 164,96 | 25,8 | 1 |
| 2 hastes sem cabo | haste 2,4 m | 90,485 | 111,6 | 2 |
| 2 hastes com cabo | haste 2,4 m | 78,614 | 111,6 | 4,4 |
| 3 hastes em linha sem cabo | haste 2,4 m | 63,6692 | 197,4 | 3 |
| 3 hastes em linha com cabo | haste 2,4 m | 54,5327 | 197,4 | 7,8 |
| 3 hastes em triângulo sem cabo | haste 2,4 m | 62,0721 | 197,4 | 7,8 |
| 3 hastes em triângulo com cabo | haste 2,4 m | 58,2525 | 265,7 | 10,7 |
| | | | | |
| 1 haste | haste 3 m | 133,852 | 30,8 | 1 |
| 2 hastes sem cabo | haste 3 m | 72,7475 | 136,6 | 2 |
| 2 hastes com cabo | haste 3 m | 62,9975 | 136,6 | 5 |
| 3 hastes em linha sem cabo | haste 3 m | 50,9215 | 242,4 | 3 |
| 3 hastes em linha com cabo | haste 3 m | 43,3102 | 242,4 | 9 |

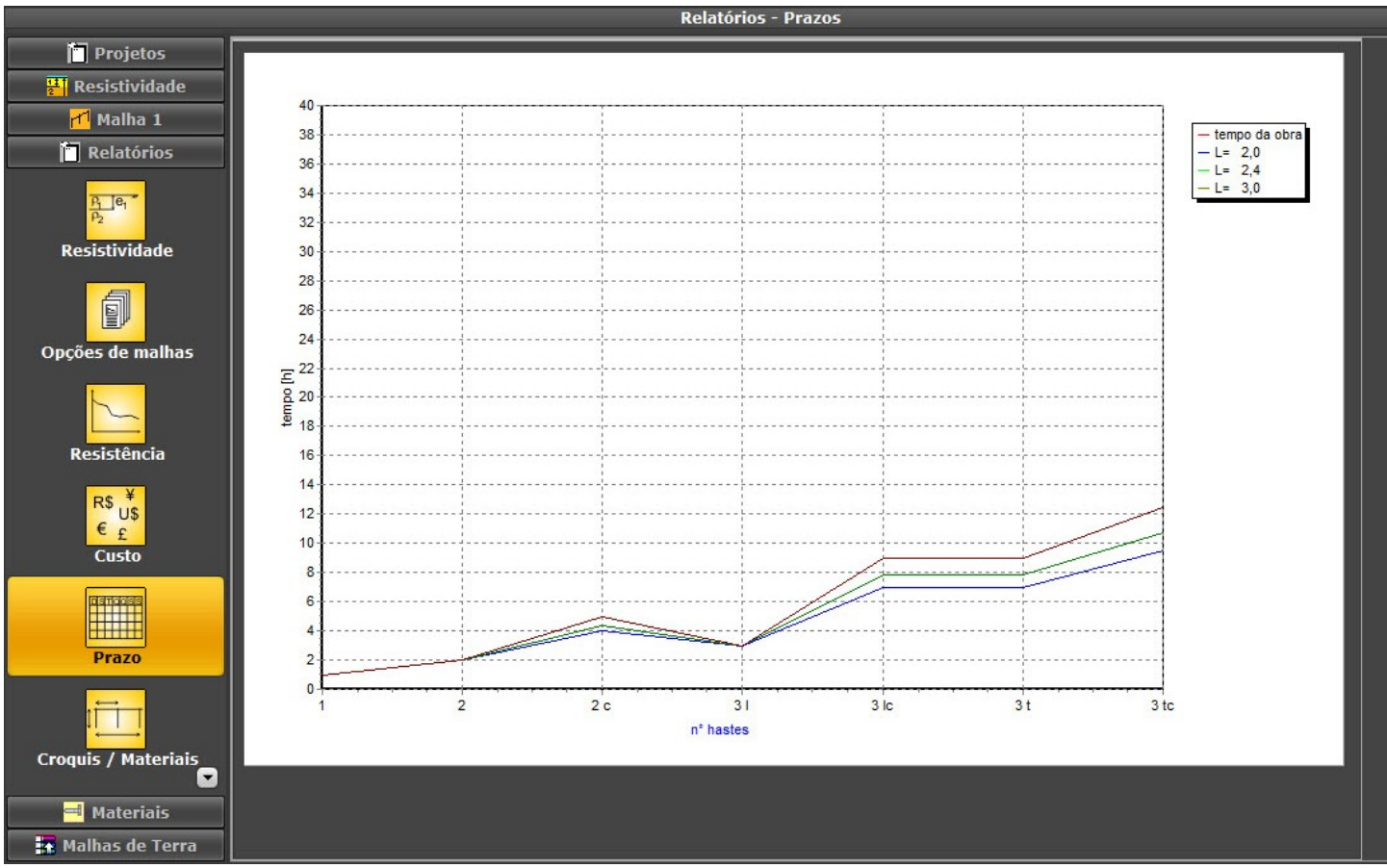
5. Chart reports

At the Resistances comparative chart, we can wee the resistance for each of the 21 grids; the project resistance is plotted as a horizontal red line (if it doesn't show up is because of the scale).

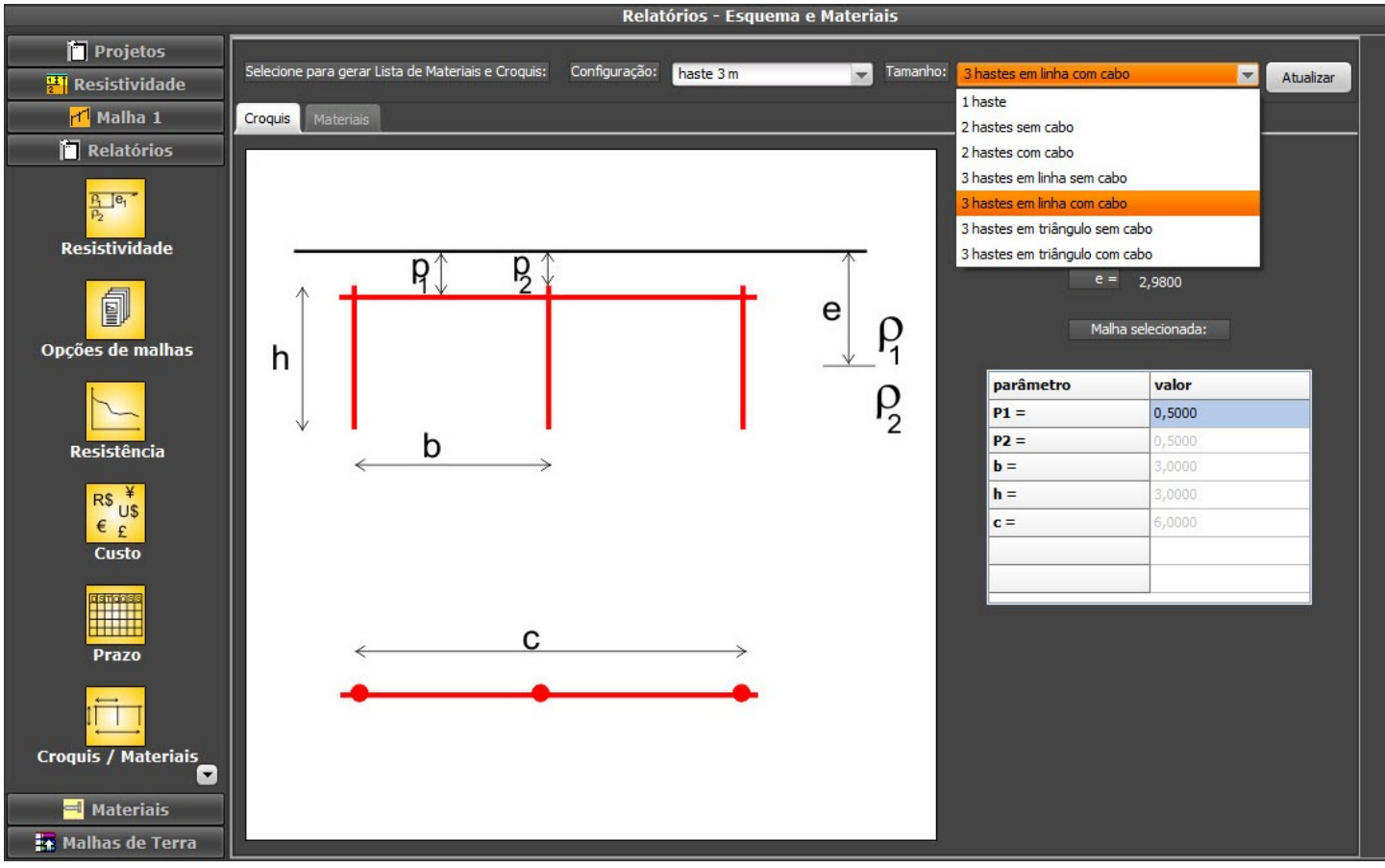


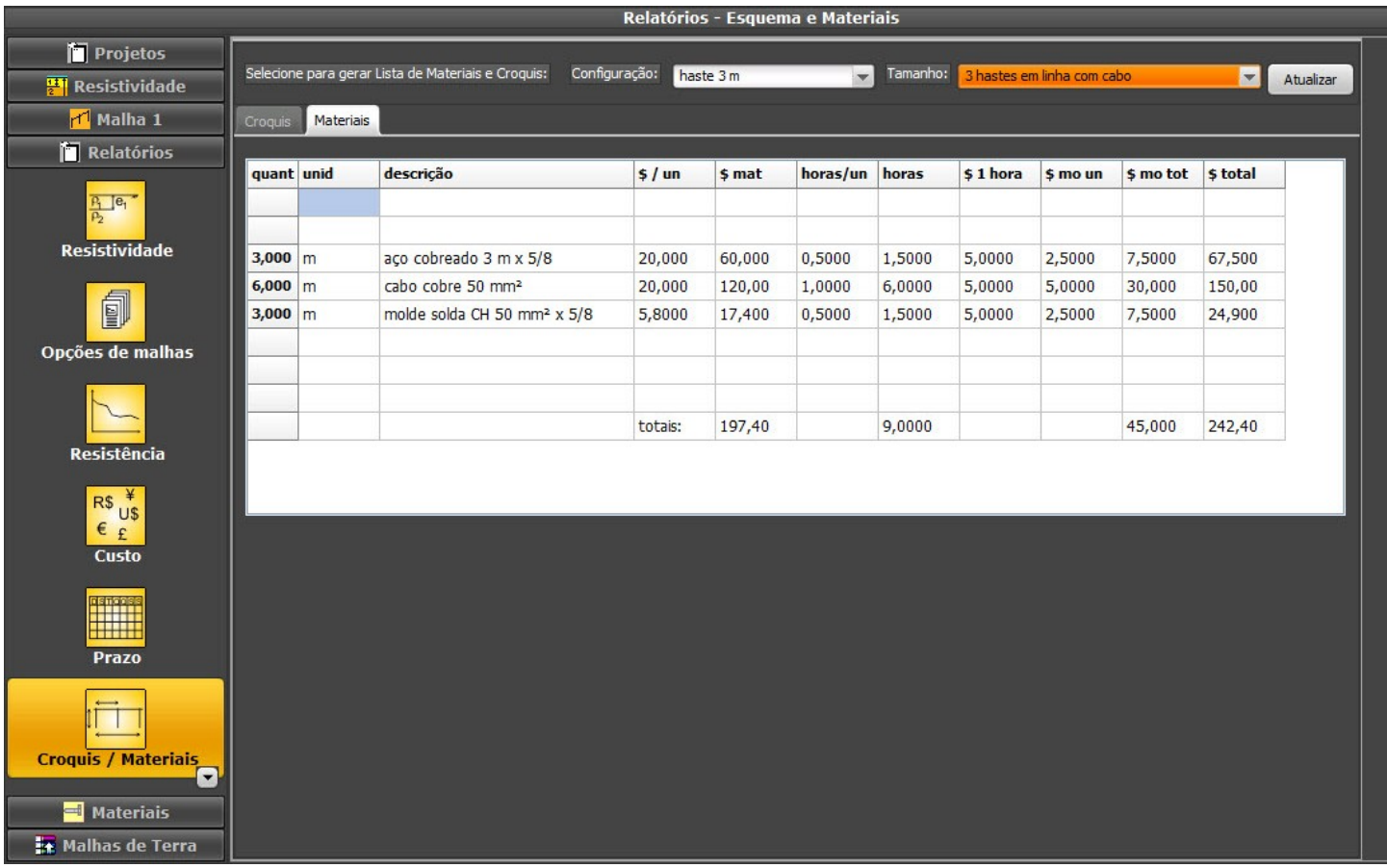

The Costs and Time comparative charts are analogous:





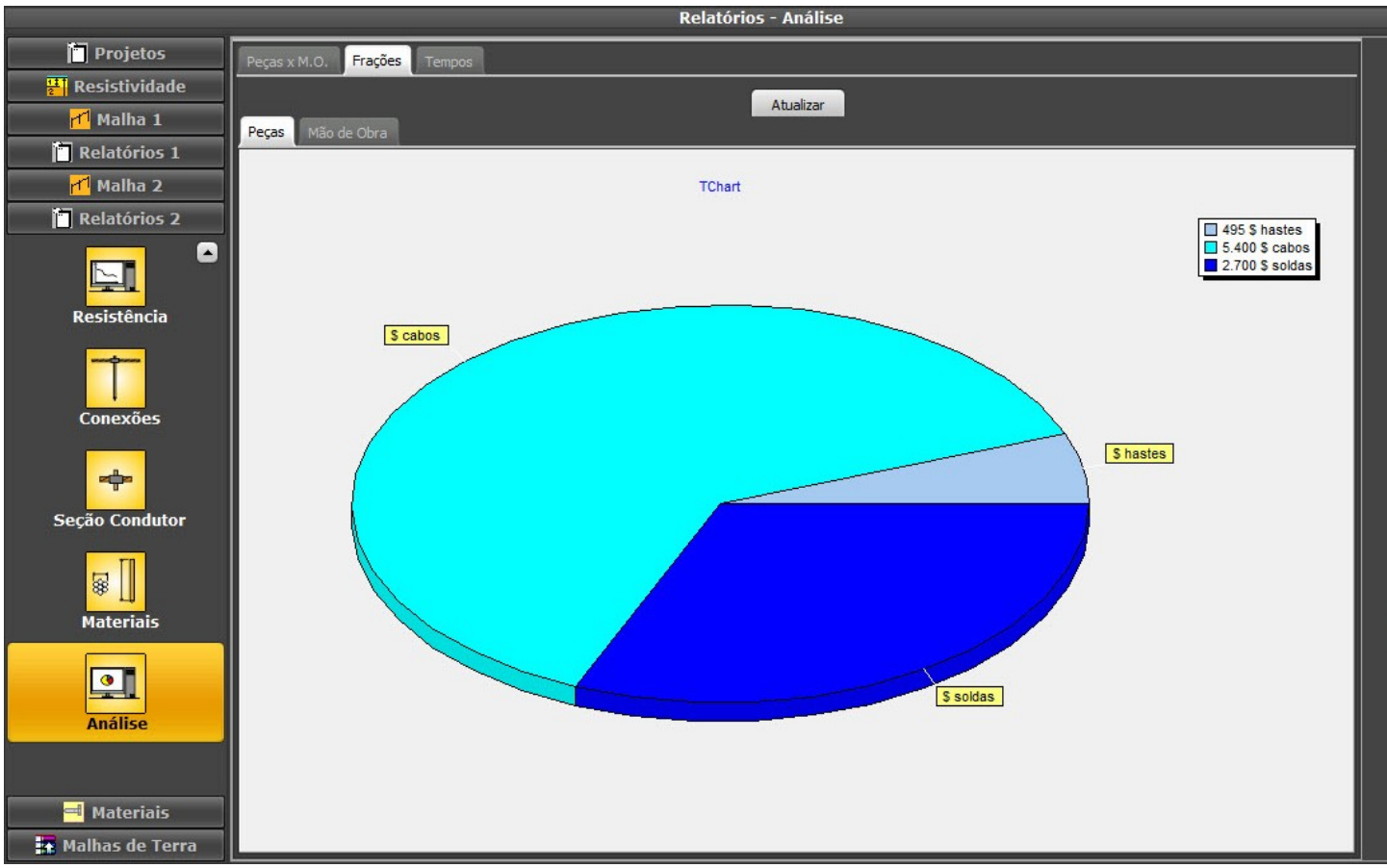

At the Menu bar, select Draft / Materials to choose one grid. Select the length and number of rods and click on Update to generate the draft and the table of materials of the chosen grid:





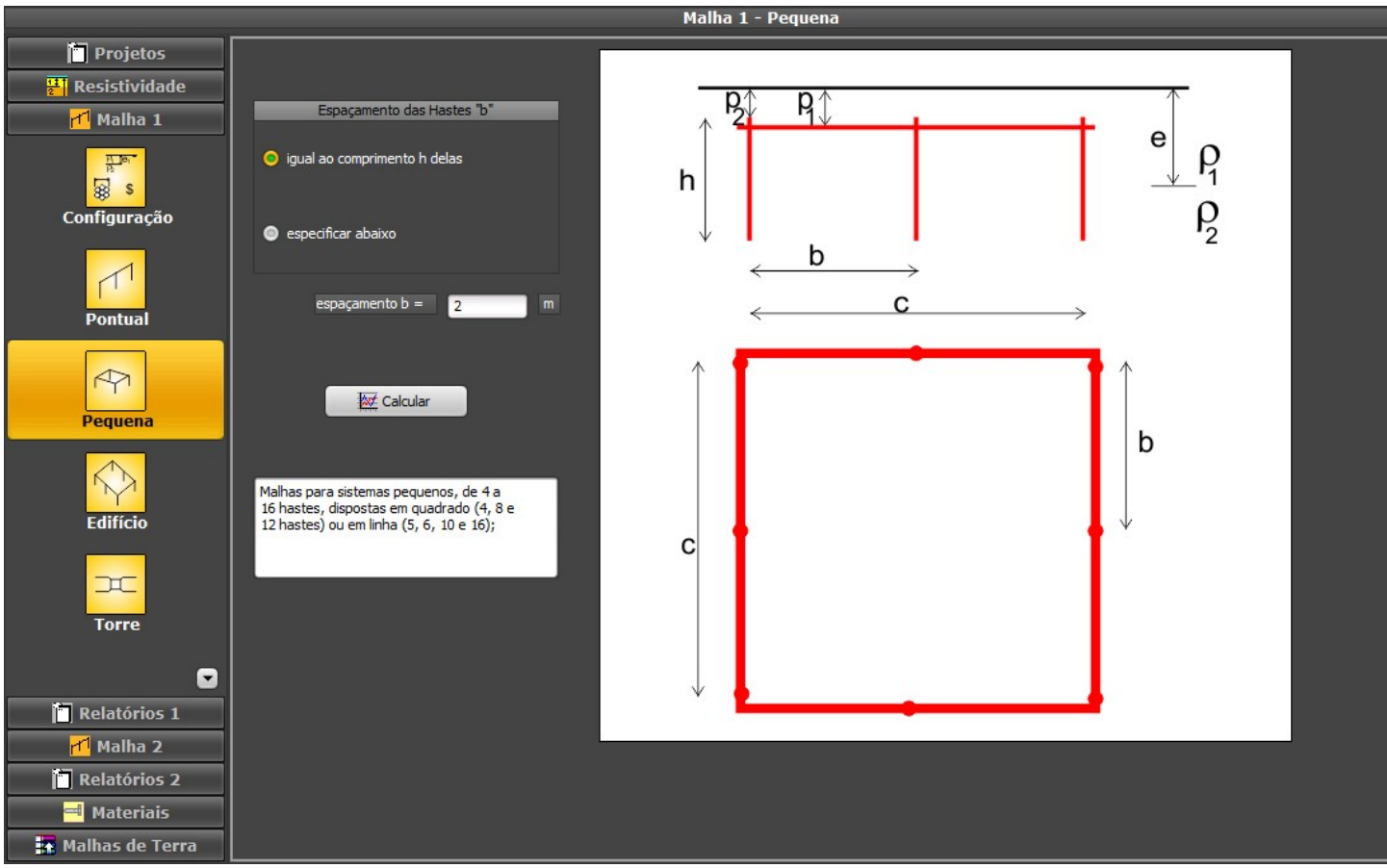

6. Costs and Time to build analysis (not for TecAt LE)

At the Menu bar, select Analysis to access the pie type charts and check how is the distribution of costs, time to build and labor - then you can see where the money and time are being used:

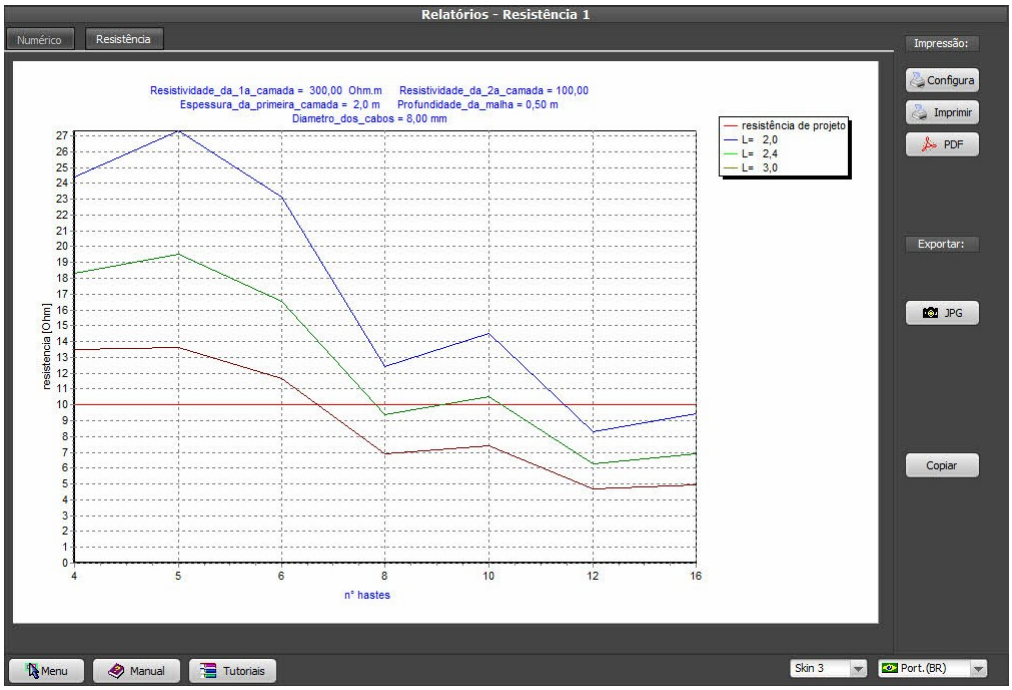



7. Small grid

With our example data, even 3 rods with 3 meters length are not enough to reach the project resistance; then, we need to recalculate with a bigger area and/or more rods. With the same soil stratification, let's try  grids with bigger dimensions - select Grid 1 / Small:



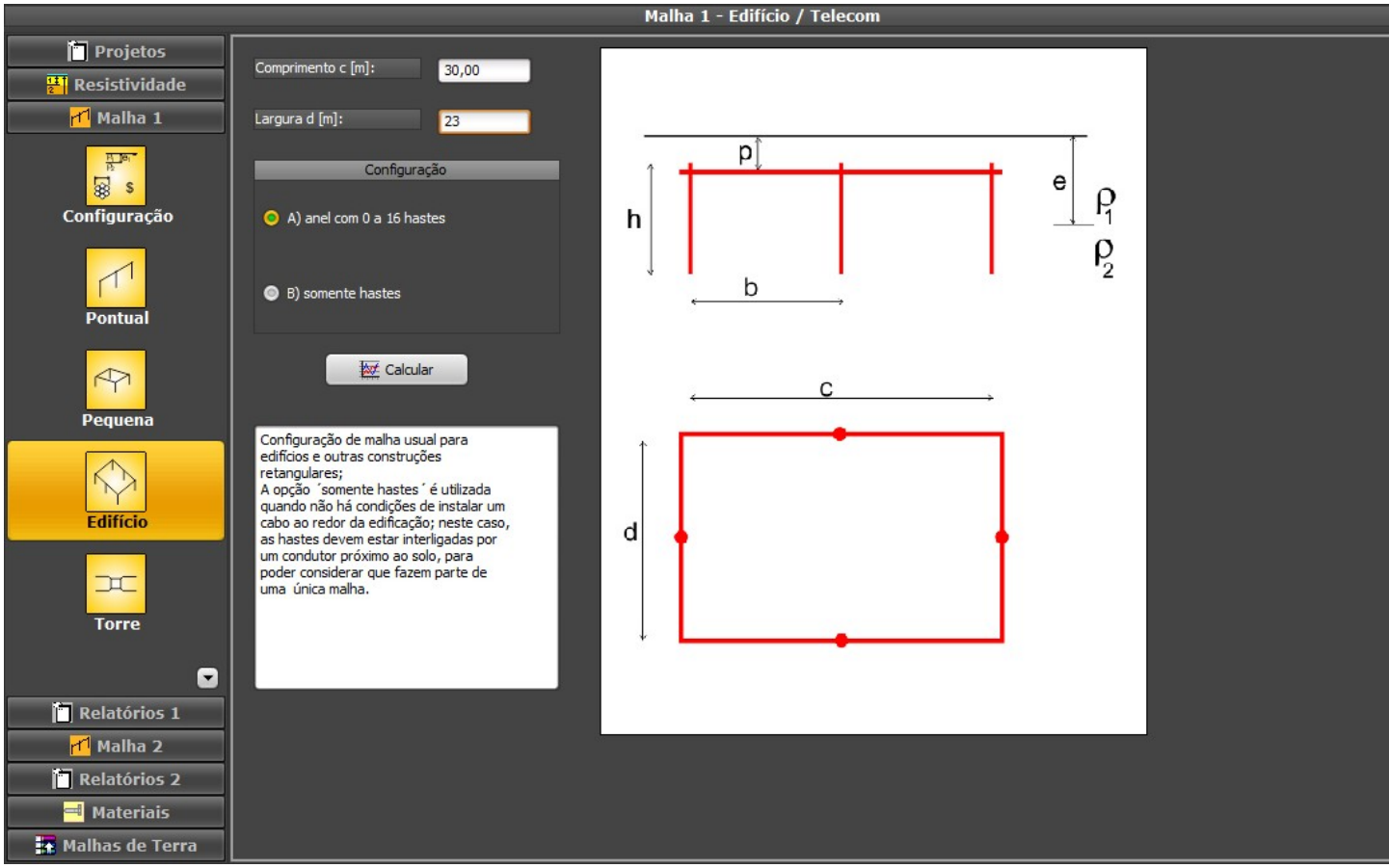

Let the spacing = length and click at Calculate:




Now we got some grid with resistance bellow the project specification! The choose between 8 rods of 3 meter length in square formation (a 6 meter square) or 10 rods in line (27 meters line) will be done according with costs and availability of space.

8. Building

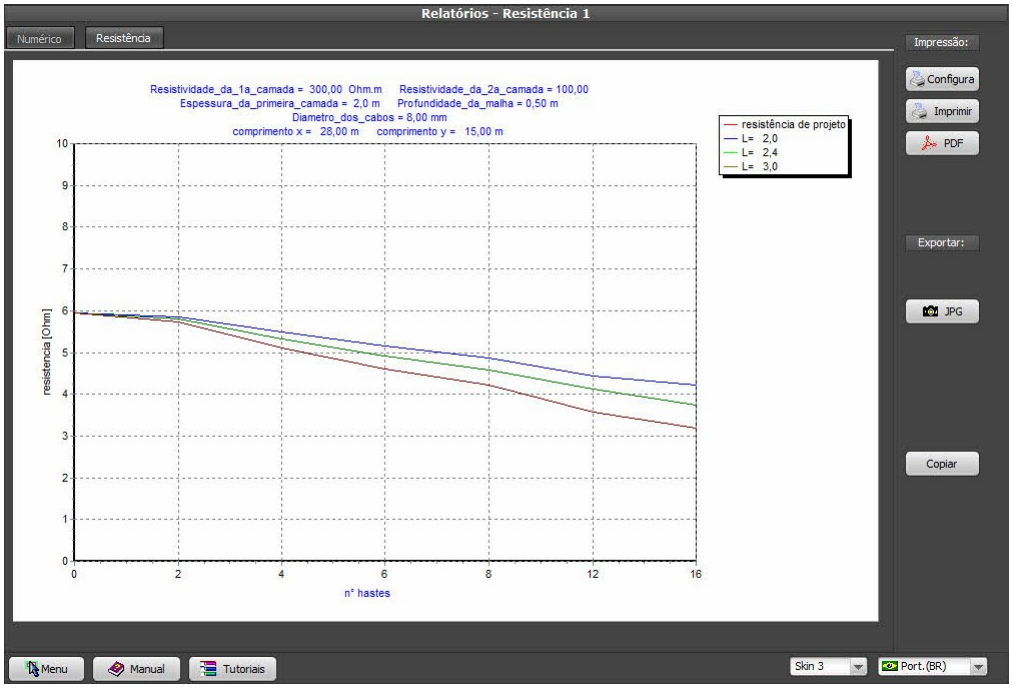
Another available family of grids is the "Building", where we have a rectangular ring with zero to 16 rods:




Note: it's called "Building" because is the logical grid for grounding the low voltage and lightning protection systems of most buildings, but, of course, it can be used anywhere.

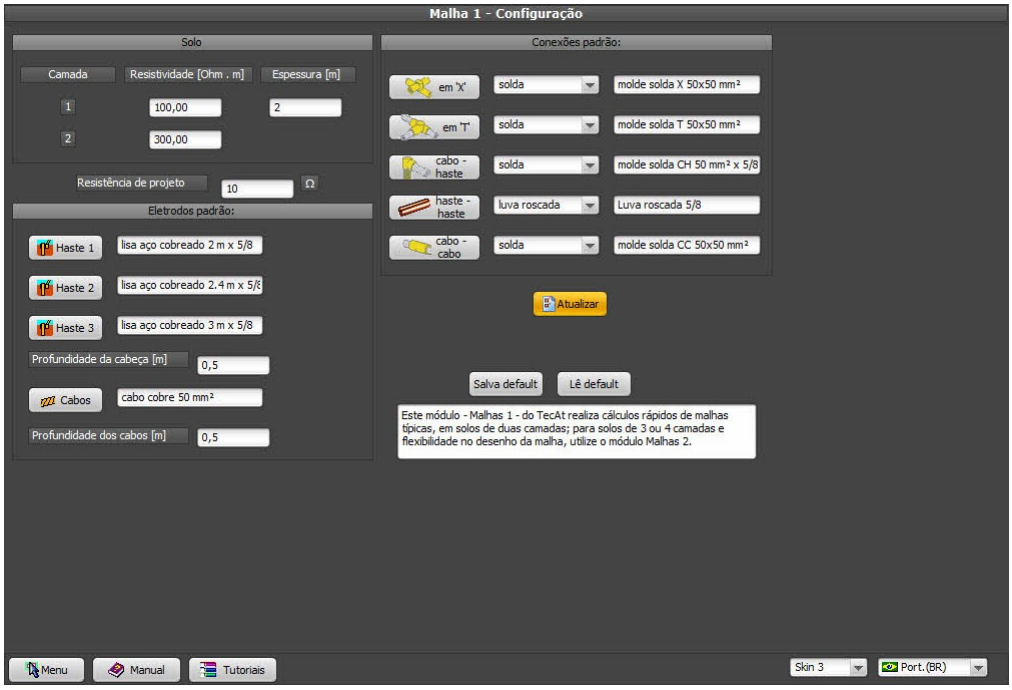
The data needed are the width and length of the rectangle. If there's no way to break the floor to install the cable at the soil, we still can calculate the grid with only the rods (configuration B)..

Keeping the soil of our example and option A (cable buried plus rods), we have:

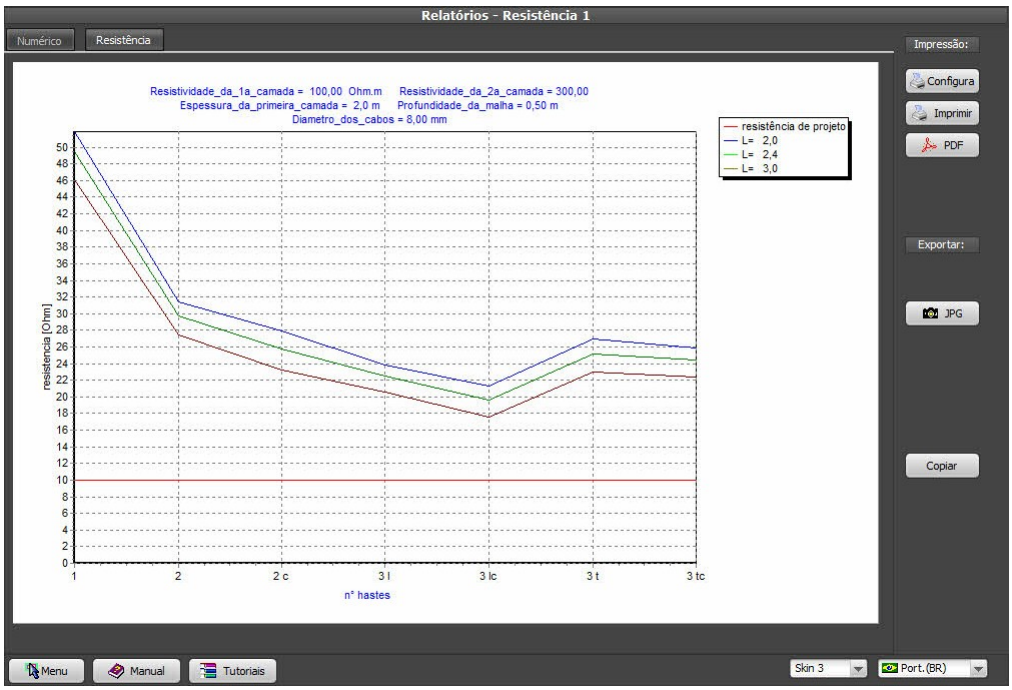



9. Influence of stratification

On the examples above, we used a soil with resistivity 300 Ohm.m at the first layer (with 2 meter depth) and 100 Ohm.m for the second layer; just to show the importance of the stratification, lets invert those values and recalculate:

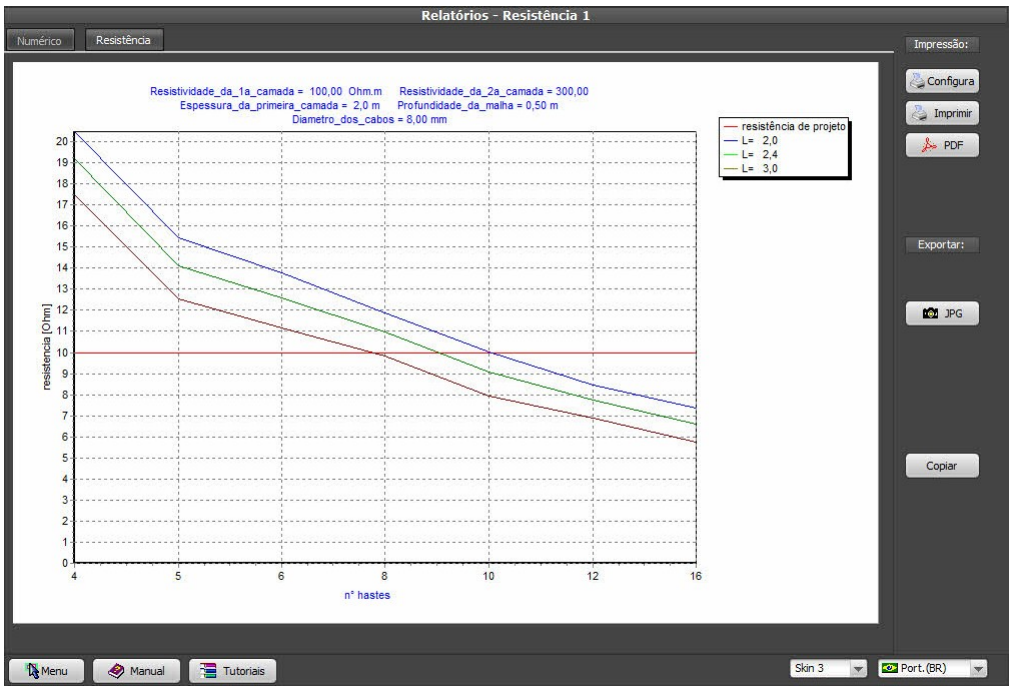



On the original example, a 2 meter rod buried at 0.5 meter depth had 3/4 of its length at the 300 Ohm.m soil and only half meter at the 100 Ohm.m; now we have the opposite, so we expect a better result - using Local model we get:

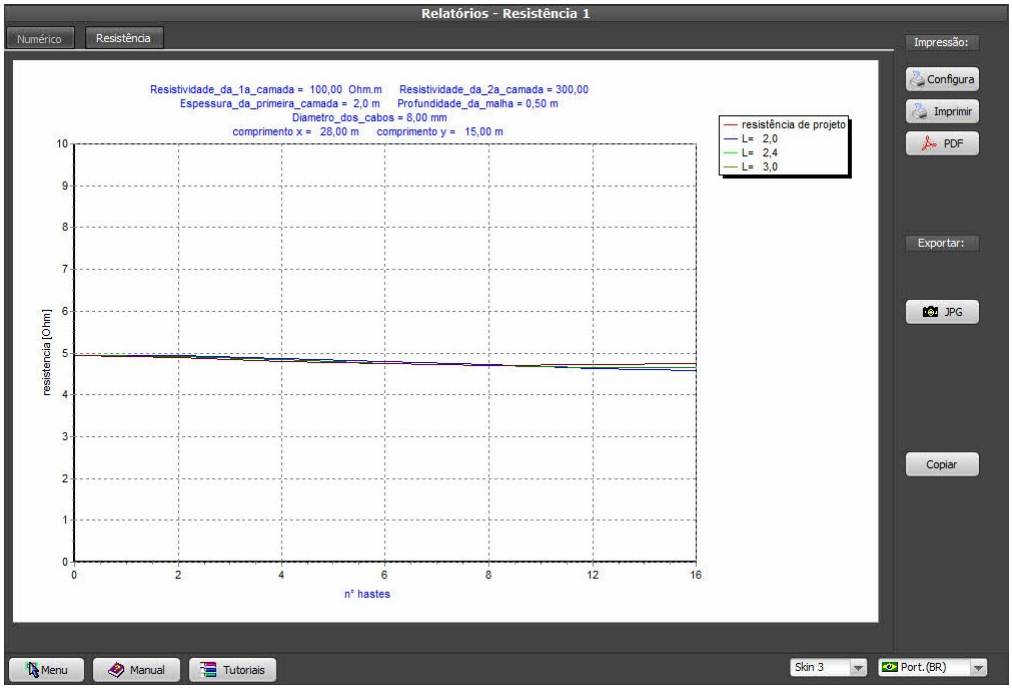



The same 2 meter rod that had over 130 Ohm resistance on the first soil, now presents 50 Ohm

Using the Small model, we have:




and, for Building:




As we can see:

- on a soil with greater resistivity on the second layer, the rods have smaller influence on big grids
- we must always run the stratification, as using an average number for the resistivity (as in manual methods of grid calculation) of the terrain will give a potentially huge error.