

True North - South

Description of a geometrical method

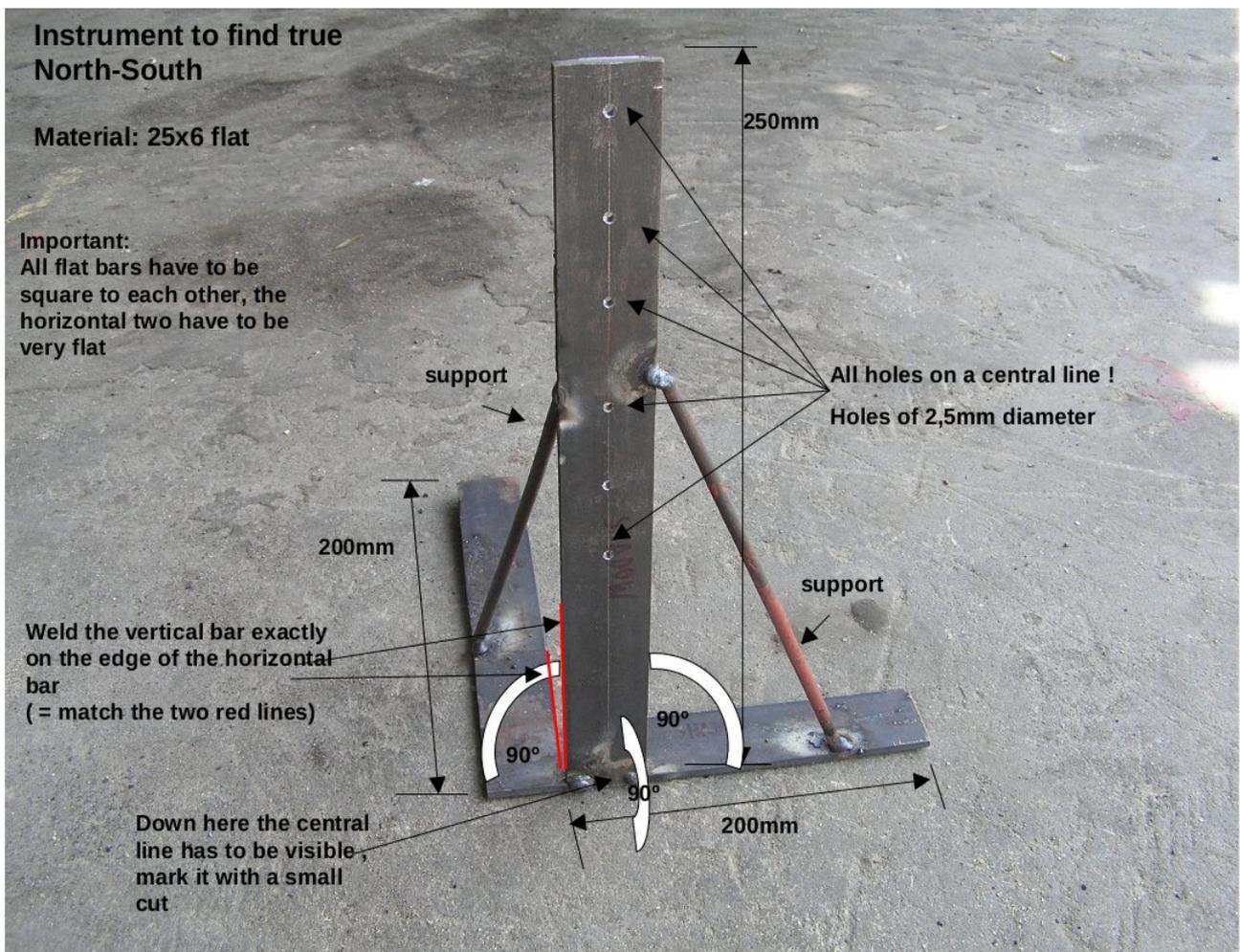
The daily movement of the sun across the sky is characterized by the symmetry between its trajectory before and after solar noon.

This symmetry can be used to find true North - South:

For a random position of the sun before solar noon the corresponding position (same height of the sun) after solar noon is found empirically.

This is a purely geometrical method to determine East and West. North-South can then be derived by as an axis perpendicular to East-West.

You need the North -South instrument described here:



Note:

Solar noon is the time of the day when the sun reaches the highest elevation angle of that day. Solar noon is at a slightly different time every day.

Step by Step instructions:



A smooth and plane surface is the base for the measurements. You can use a tile or stone-plate. Minimum size is 60cm x 60cm.

It can be helpful to create a level surface from concrete as base.

Advantage: it will not move.

Wood or ply is not suitable because it warps with the moisture coming of the ground.



Use the spirit level across and diagonally to level your surface.

Make sure you support the surface well, so that it doesn't wobble.



It is very important that this surface will not move at all during the whole day.

To guarantee this you can either work on a level and smooth concrete directly, or – in case of a tile or stone plate – hammer iron rods or pegs into the ground around the tile.



Make a mark on the surface. This will be the reference point or “center” for the measurement of the sun's position.

It helps if you make a small hole/dent in the exact center (e.g. with a nail).

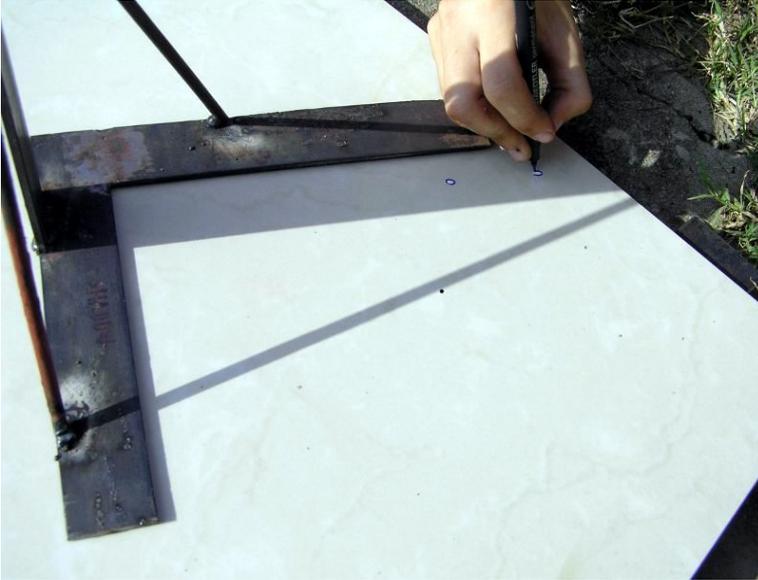
Position the North-South Instrument with its central line exactly over the “center” mark.

If you can: weld a small pin into the cut on the central line of the instrument. This pin should protrude (downwards) only slightly and sit into the hole in the tile. This really helps to assure the correct position of the instrument.

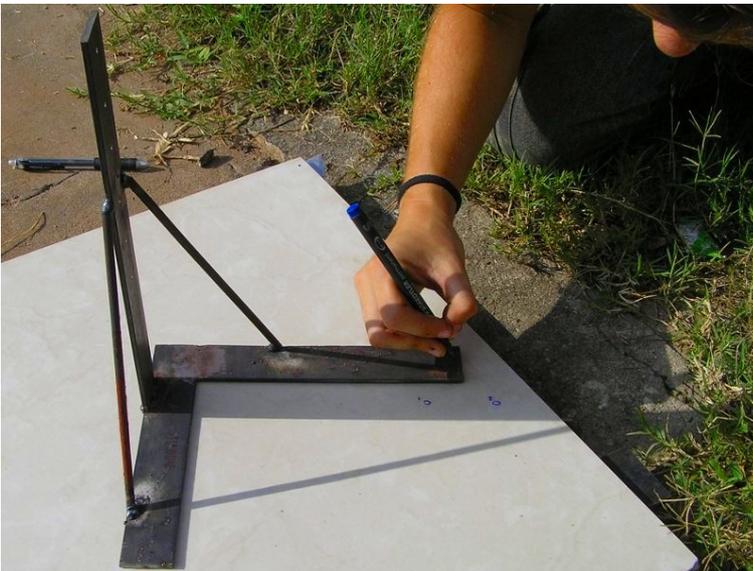
The correct position of the instrument is obtained when:

- ✓ the center line of the instrument coincides with the “center” on the tile.
- ✓ There is no gap and no overlap between the shadow and the flat iron. (see foto)





When the instrument is in correct position: mark the spots of light projected onto the surface by the wholes. Use a thin permanent marker to make the marks on the surface. Be very accurate!



Important: "name" each spot of light to avoid confusion later.

Use the number of the whole that projected this spot as name.

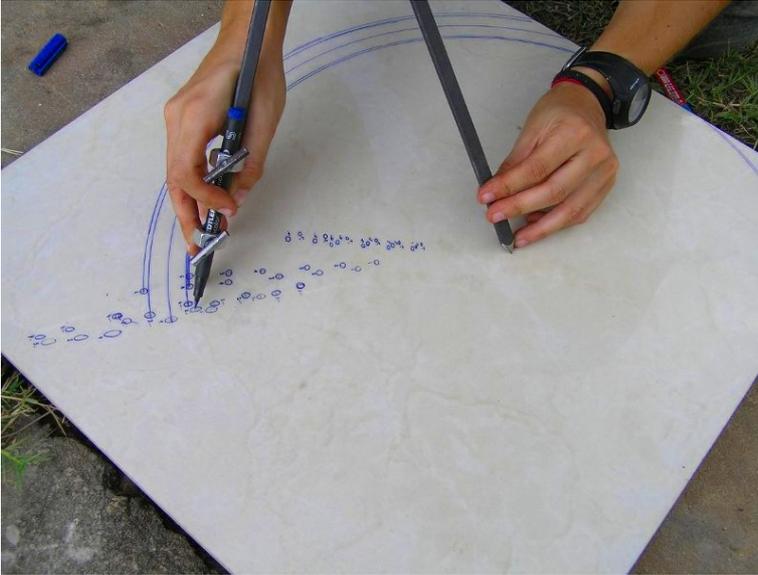
All spots of light from whole "1" will be called "1", from whole "2" "2" and so on.

Maintain the instrument properly aligned whilst rotating it.



Keep marking spots of light onto the surface. You should leave 10 to 15 minutes between each series of marks.

Don't forget to number the spots. It is no problem that you will have several marks with the same number. Mark only spots with a clearly visible outline (after 10 a.m. and with clear weather).



Find the exact center of each mark and draw a circle through it.

Center of the circles is the reference point “center” of the North-South instrument.



Now the task is to mark the same light spot again in the afternoon, when it crosses “its” circle.

Example: a spot number “2” will slowly move across the horizontal surface. You have to mark its position, when its center lies exactly on a circle that runs through a spot “2” of the morning session.



Important: check the correct alignment of the instrument before you make a mark!

No problem if you miss a few markings – that's why there are many.



The marks (projections of same hole) that lie on the same circle represent corresponding positions of the sun (symmetric to solar noon). When you connect them you get East - West lines.

- ✓ Check yourself:
 - are all East - West lines parallel?

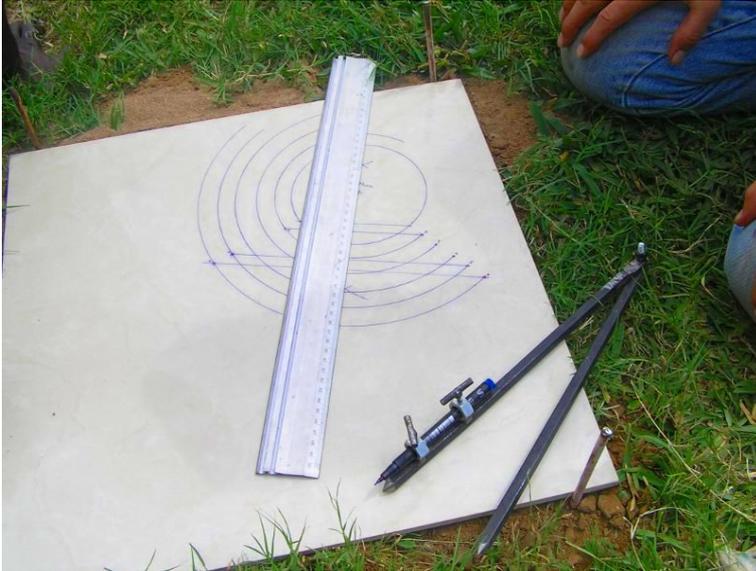


If not: repeat the measurement on an other day.

You did not work accurately enough or your base (tile etc.) has moved in between.



To obtain North-South you need to get the perpendicular line to East-West.



Find the perpendicular for all your East-West lines.



- ✓ Check: all North - South lines have to coincide and run through the "center" reference point of the instrument (= center of all circles).

Heike Hoedt

www.Solare-Bruecke.org

March 2009