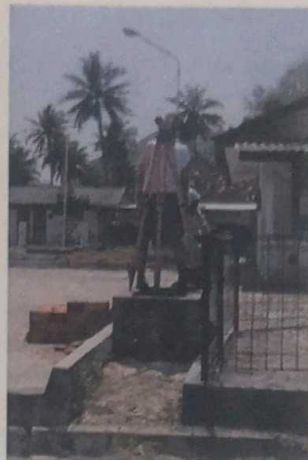


Equipment: Tripod

- Wooden design or aluminum
 - From "easy to sit" to "ops, this is high"



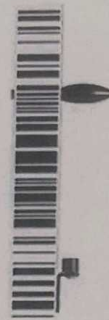
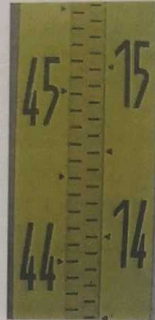
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Equipment: Staff/Pole

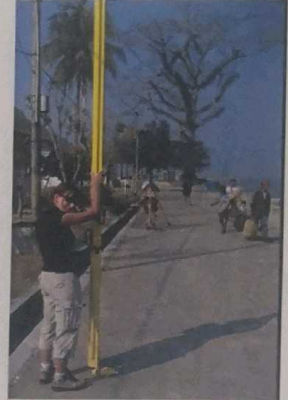
- Wood, aluminum
- INVAR type for high precision leveling



Conventional ("E"-type)



Barcode
for Digital Levels



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Equipment

- Level Instrument
- Tripod
- Staff/Pole
- Change plate (German: Frog/Frosch)
- Pole staff bubble (bull eye)
- Marker

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Equipment: Change Plate

- For long survey lines
- Allows change of instruments
 - Best is a metal change plate
 - Screws e.g. at fences
 - Sharp stones or nails
- Beware of dark colors



It's not the
Indonesian-
German Dictionary,
It's the nail!



Equipment: Bubble

- Keep the pole upright
 - Any tilt will disturb your readings



Survey Markers

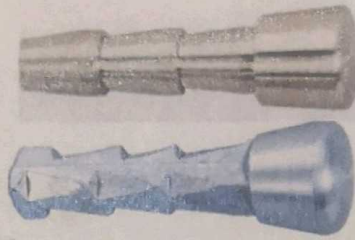
- Gives you a fixed point

- Should be of good quality

- Should be long-term

- Preferable in bedrock, settled buildings, or bridges

- Do not use fences or walls



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Introduction to Leveling

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Some Basic Definitions

- **Level surface (e.g. the geoid)**

- A water surface with no motion
- Gravity gradient is the normal to the level surface
- The Instrument's Bubble is in the normal (!)

- **Horizontal surface**

- At the instruments axis, the *horizontal* surface is tangent to the *level* surface
- Over short distances (<100 m) the horizontal surface and the level surface will coincide
- For long leveling lines the effects of the gravity field must be considered