

Surveyor's Levels

Keeping your projects in line

You don't need a degree in civil engineering, a special license or even an orange vest to use a surveyor's level. Also known as a builder's level, dumpy level or Y level, this tool is easy to use, takes only a few minutes to set up and allows you to accurately determine elevations over large areas.

If you've built a retaining wall, established the grade of a path or hung a suspended ceiling, you could have used a surveyor's level. Line levels or water levels are often used in these situations, but they must be set up and disassembled in the work area. A surveyor's level provides

equal if not better accuracy and can be set up and left just off the work site — never underfoot.

How does it work?

A surveyor's level is simply a telescope with a level attached. Through the telescope, it extends a sight line that is level in all directions, providing a consistent reference point from which to measure elevations. Newer models have replaced the telescopes with lasers, which project a visible point or line on the target (see "A New Light on Levels," p. 24).

The first and most important step is setting up the instrument. Choose a location near the work site that allows you to see all of the points you

will be sighting but is out of the way of traffic. Set up the tripod so that the top plate is close to level in all directions. If you are on dirt or grass, force the end point of each leg into the ground to anchor the tripod in position.

Mount the level on the top plate by inserting the tripod mounting screw, usually 5/8 in. dia., into the base of the transit. Do not overtighten the mounting screw. Next, adjust the leveling screws so that each screw touches the top plate.

You will level the sight in two perpendicular directions. Align the sight with one set of opposing screws and level it by turning the leveling screws (see "Leveling the Instrument," photos p. 24). The simple rule for quick leveling is to simultaneously and evenly turn both screws in a "thumbs in" or "thumbs out" direction. Once the sight is level in the first direction, turn it to align with the second set of screws and repeat the leveling process. Rotate the sight to test that it is level in all directions.

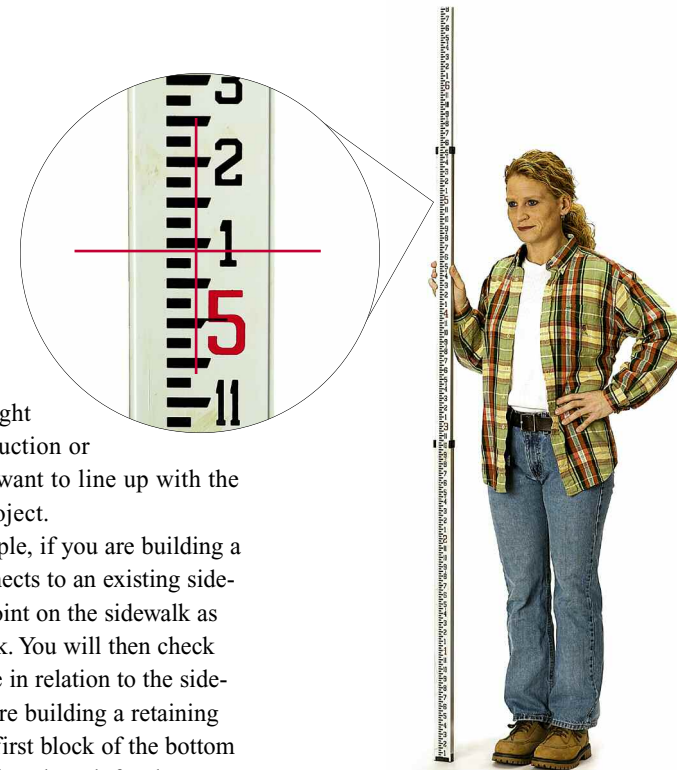
Once you've leveled the sight, it is important to avoid bumping the tripod or instrument to prevent inaccurate readings. If you move the instrument, you will need to relevel it and take new readings.

Taking readings

After you've set up the instrument, taking readings is easy — just point and focus. If you are taking elevation readings, you will need an assistant to hold a target, usually a leveling rod, for you to focus on.

Begin by choosing a reference (or "benchmark") location. Choose a position that will not

Most leveling rods will extend to 8 or 16 ft. Red numbers indicate feet and black numbers indicate inches.



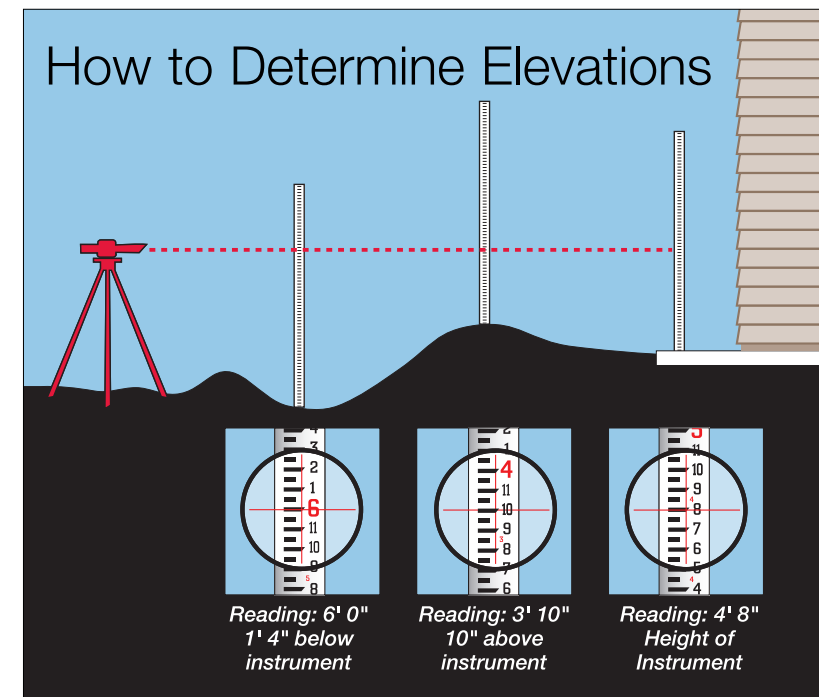
change in height during construction or one that you want to line up with the rest of the project.

For example, if you are building a path that connects to an existing sidewalk, use a point on the sidewalk as the benchmark. You will then check the path grade in relation to the sidewalk. If you are building a retaining wall, use the first block of the bottom course as the benchmark for the rest of that course. Keep the height reading for each block the same and you'll know the wall is level.

Refer to the reading you take at the benchmark position as the "height of instrument." Think of it as your zero elevation or eye level. All other locations on the work site will be considered in relation to — above or below — the height of instrument.

Professional surveyors often work from established benchmark locations to find the actual height of instrument above sea level. This ensures that surveyors working in different areas are using a consistent point of reference.

Take each reading by focusing the instrument on the leveling rod. The measurement at the crosshairs is the



PHOTOS BY MARK MACEON; ILLUSTRATION BY MIKE ANDERSON

leveling the instrument



Align the sight with one set of screws. Turn the screws evenly to level the sight.



Turn the sight to align with the second set of screws and adjust for level again.

height reading (photo, above). Record all readings on paper — don't try to keep them in your head. Take a reading from another location in the work site. The difference between the height of instrument reading and the second location reading is the change in elevation or amount you will need to cut or fill to reach a level grade. If the

reading is less than the height of instrument, the location is above the benchmark. If the reading is greater than the height of instrument, the location is below the benchmark (see illustration, p. 23). Repeat this process for all additional locations.

You will quickly become so comfortable taking readings that you may

even find it fun. Because the tool is so easy to use, many people check elevations more often than they might with other methods, resulting in more accurate projects.

Where to get one

Surveyor's levels are not inexpensive. They range in price from \$100 for a basic level to more than \$1,000 for a self-leveling rotary laser. Unless you do a lot of landscaping, this is a tool that makes more sense to rent than to own. Most rental centers offer them for \$30 to \$50 a day. By renting, you'll save enough money to buy your own orange vest.

SOURCES

- Checkpoint**
www.checkpoint3d.com
- GST/Berger**
www.cstsurvey.com
- David White Co.**
www.davidwhite.com
- DeWalt Tools**
800-433-9258, www.dewalt.com
- Leica Geosystems**
www.leica-geosystems.com
- Nikon**
www.nikonusa.com
- PLS**
www.plslaser.com
- Porter-Cable**
800-321-9443, www.porter-cable.com
- Stabila**
800-869-7460, www.stabila.com
- Toolz**
800-984-0404, www.robotoolz.com
- Zircon**
www.zircon.com

Laser technology has simplified operation to the point that you no longer need a second pair of hands to work efficiently. Instead of looking through a telescope, you can see a laser beam shining on the target. Many of these

levels feature rotating beams that are visible for as far as 100 ft. and beyond with the use of special receivers. They also have sensors that will alert you if the instrument is knocked out of alignment. Rotating laser levels are especially effective for indoor projects such as plumbing stud walls, hanging cabinets and trim or installing suspen-

