Survey – Establishing a TBM (Temporary Bench Mark) by Levelling

Taking the levels on an archaeological site requires a reference point. Where possible, this should be an **Ordnance Survey (OS) benchmark (BM**) and these are shown on all large scale OS maps. In most cases the nearest **OSBM** is some distance from the site and a **temporary benchmark** (**TBM)** has to be created on the site.

To create this **TBM,** a chalk or paint mark is made on a wall or post on the site or the top of a specifically driven post or peg is used. The height (or depth) of this in relation to the **OSBM** is established using a simple **level** (Dumpy) or by more sophisticated means (Electronic Distance Measuring – EDM etc.) **Establishing the site TDM is the first action for the levelling technique detailed below.**

Note: It may be necessary to establish a series of intermediate TBMs to achieve the transfer of levels from the OSBM to the site TBM. The details given here assume a single transfer is adequate.

The following equipment is required: **Measuring staff(s)**
Levelling device (dumpy) with its tripod
Recording material

2 - 3 people are needed.

1. <u>TBM creation</u>

Create the TBM(s) as described above

2. <u>Positioning the level</u>

The level on its tripod is set up in a location where both the **OSBM** and the **TBM** are visible with no obstructions. It is essential that the **level** is itself level. This is achieved by means of the thumbscrews under the level and by adjusting the tripod leg lengths. The bubbles on the spirit levels attached to the level's platform are used to establish this.

*Note: OS BMs are usually seen as a ¯Λ¯ symbol carved into the brick or stonework of a long-standing building e.g. a church or an OS triangulation point. OSBM locations are marked on all OS maps. The height of these locations above (below) the national OS datum (***OD***) at Newlyn is given in metres (feet on older maps).*

3. <u>Back sight reading</u>

The measuring-staff is held vertically with its base on the OSMB mark. When level, the hairlines viewed through the level eyepiece are aligned with the scale of the staff and the measurement recorded. This is termed the **back sight** reading (**BS**).

Note: To ensure the correct reading the staff should be tilted towards and away from the level observer and the correct value is the lowest observed during this tilting.

4. <u>Front sight reading</u>

The staff is transferred to (or a second staff is used at) the TBM and the **level** rotated on its platform, without altering any of the levelling systems, and the height/depth of this TBM mark is measured by observing the eyepiece crosshairs and the staff scale. This **front sight** reading is recorded (**FS**).

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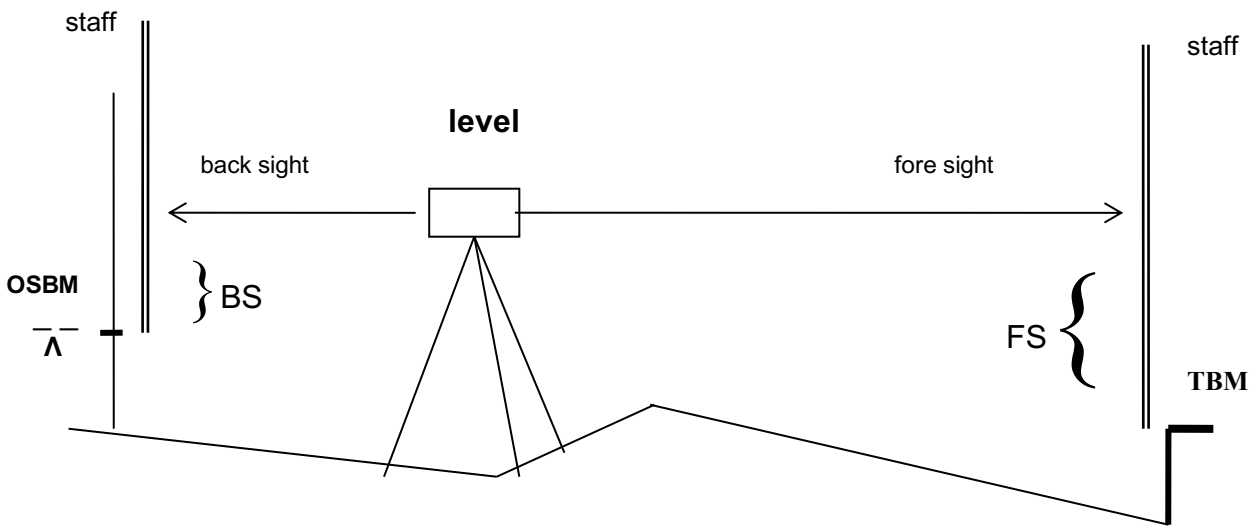
5. <u>TBM level</u>

You now have enough information to work out the TBM level above or below OD using the formula below.

(OSBM + BS) – FS = TBM (usually in metres)



SURVEYING: Using a temporary benchmark to establish the levels of features on an archaeological site.

The levelling instrument is erected and levelled at a location where a measuring staff held on the TBM and each of the features to be levelled can be seen through the eyepiece.

1. A measuring staff is held vertically on the TBM and the back sight reading observed on it is recorded (BS).

2. The level is rotated horizontally without altering any of the levelling adjustments and the reading of the foresight is measured and recorded (FS).

3. The measuring staff is then moved to all other features required to be levelled on the site and the FS reading for each is recorded on the record sheet.

4. The OD height of all points can then be calculated using the formula:

TBM+BS–FS = height above OD.

Notes:
1. Sometimes it is impossible to establish the relationship between an OSBM and the site TBM. The <u>relative</u> levels of all features on the site can, however, be established using the levelling technique and this is better than nothing.

2. Where the OSBM is not available, it is normal to establish a relationship between the TBM and a structural feature of some assumed permanence e.g. a building, gate-post, or electricity tower (pylon), for possible future reference. Such a relationship must be recorded in all relevant reports.