



## LEVELLING APPLICATIONS

Levelling principles may be applied in various uses in construction. Some are discussed here.

### 1. Longitudinal sections of ground level in road and sewer construction

After a level survey is completed, the measured levels can be represented on paper with suitable scale. This may show the existing soil profile at ground level along a particular line, or as related to the proposed surface of a road or section of a pipeline, as shown below in Figure 1.

For the road, the existing ground levels are plotted together with the proposed surface of the road of known slope at equal distances (commonly 10m distance apart). This will immediately indicate the areas of CUT & FILL required for the ground (soil).

For a pipeline, the pipe and manhole depth from ground level may be plotted, thus representing in sections the pipe network of an area.

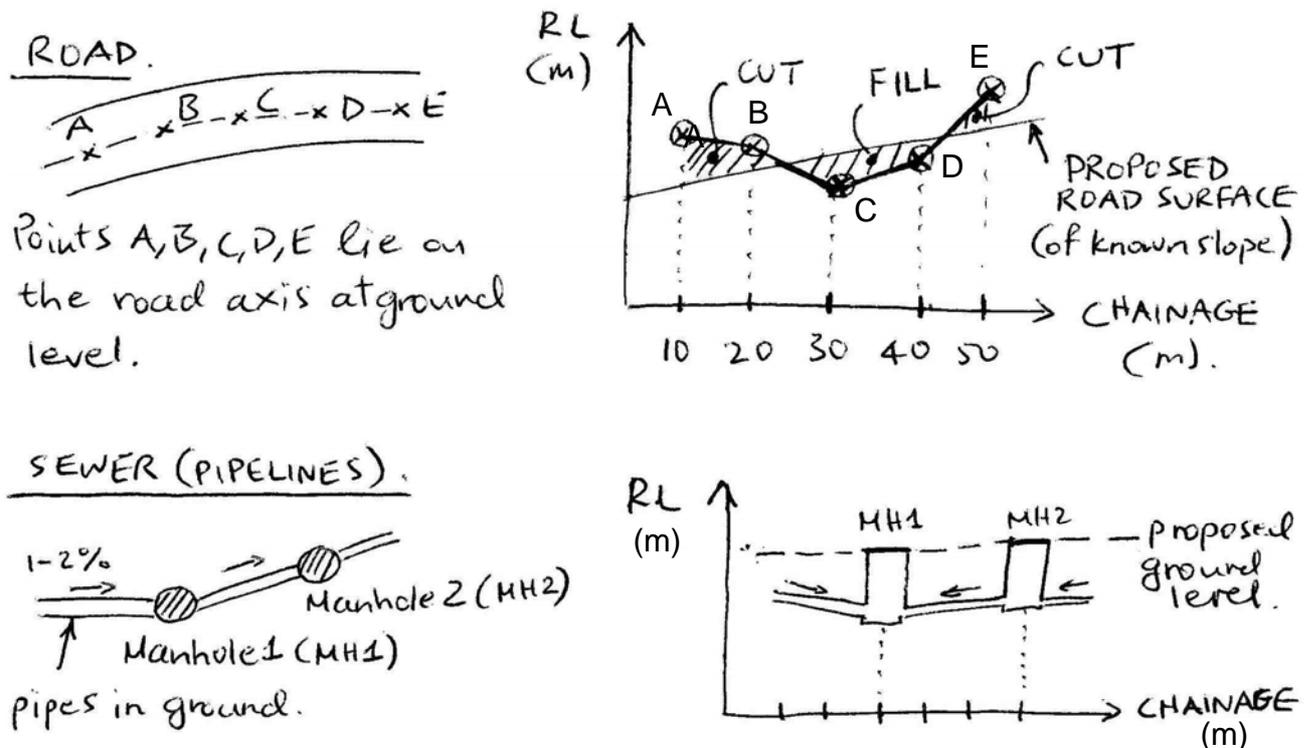


Figure 1. Use of levelling for road and sewer design

*General comment:* It is important to take levels at all slope changes or where variations in height are visible, and at least every 20m in order to be precise. It is also good practice to keep BS=FS if possible.

### 2. Traverse sections (cross sections)

Cross-sections are plotted mainly for roads, railways, tanks etc. with some width. (I.e. not relevant for sewers). A spacing of 10m or 20m is common between cross-sections. Once again there is a need to reproduce the ground level accurately in order to proceed with the road design (considerations of width, level etc.). The example of a road section is shown in Figure 2.

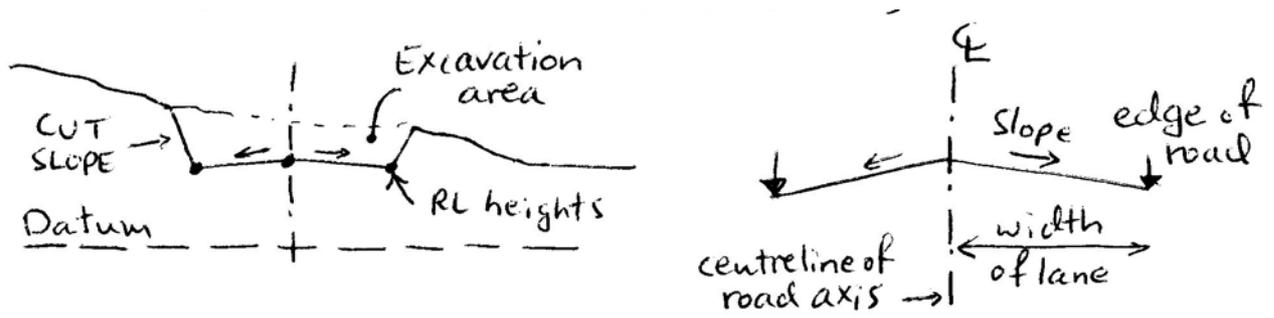


Figure 2. Traverse section of a road

### 3. Setting out

Levelling can be used for checking the accuracy of construction levels for the foundations of houses, large buildings, bridges, etc. An example is shown in Figure 3 below. The surface levels may also be set out and checked using levelling.

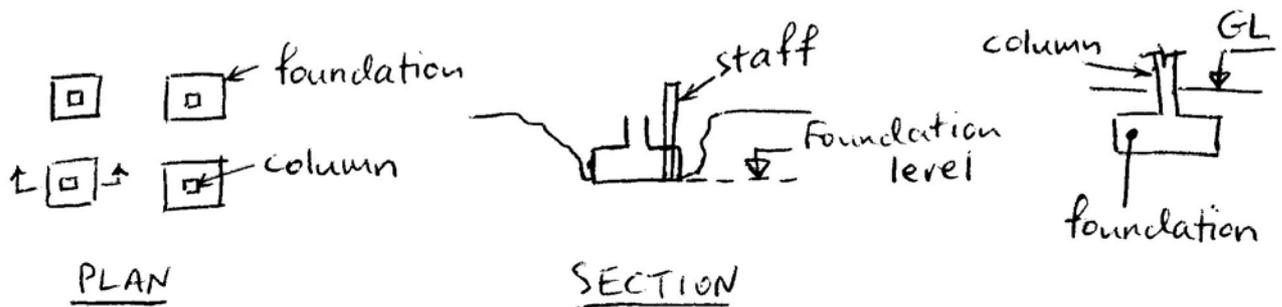


Figure 3. Use of levelling for setting out foundation level

### 4. Headroom of bridges and slabs (Clear height)

The concept of *reciprocal levelling* may be applied for measuring the clear height of slabs. This is done using the staff inverted, as explained in the example shown in Figure 4 below.

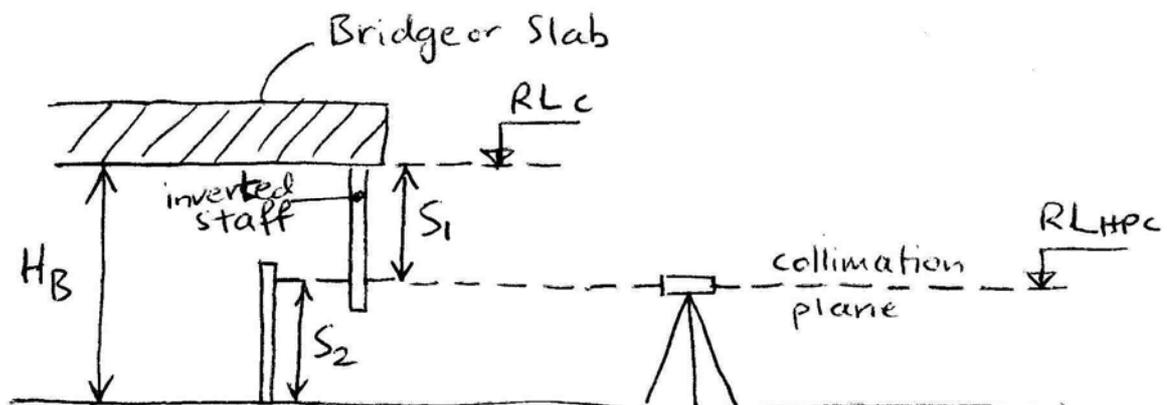


Figure 4. Use of levelling for calculating the headroom of bridges

Given data

$RL_{HPC} = +56.520\text{m}$  (remember that  $RL_{HPC} = RL_{TBM} + BS$ )

Staff readings:  $S_1 = 2.535\text{m}$  (inverted staff), and  $S_2 = 1.555\text{m}$

Solution

For headroom of bridge slab,  $H_B$

$$H_B = S_1 + S_2 = 2.535 + 1.555 = \underline{4.090\text{m}}$$

For the RL of the slab or ceiling,  $RL_C$

$$RL_C = RL_{HPC} + S_1 = 56.520 + 2.535 = \underline{59.055\text{m}}$$

**5. Formation of Contours**

Levelling can be used to form contours, with the methods of *gridding* and *radiating lines* as shown below in Figure 5.

Gridding

Spot heights are taken in a square or rectangular grid and points of equal height are joined with interpolating lines, forming the contour lines. The gridding method is more common for construction projects.

Radiating lines

Levels are taken on specific lines radiating from a centre, and contour lines are formed by joining points of equal height, in a similar way as gridding. This method is common in map contouring.

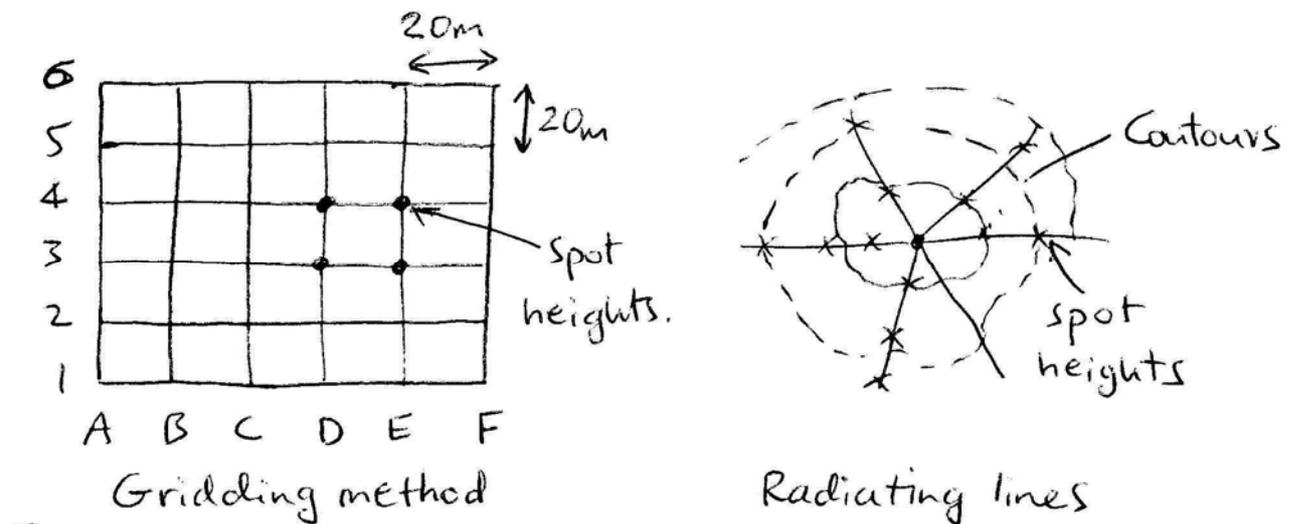


Figure 5. Use of levelling for contour formation with gridding and radiating lines