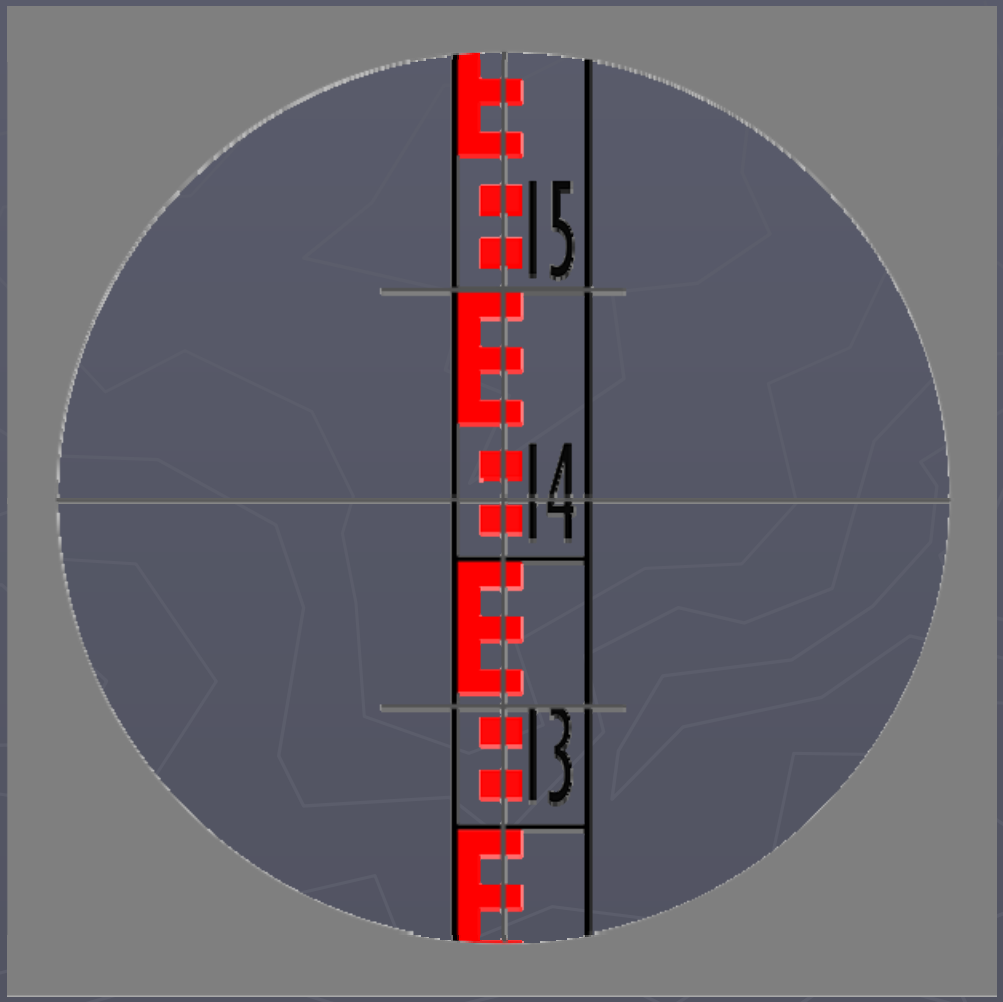
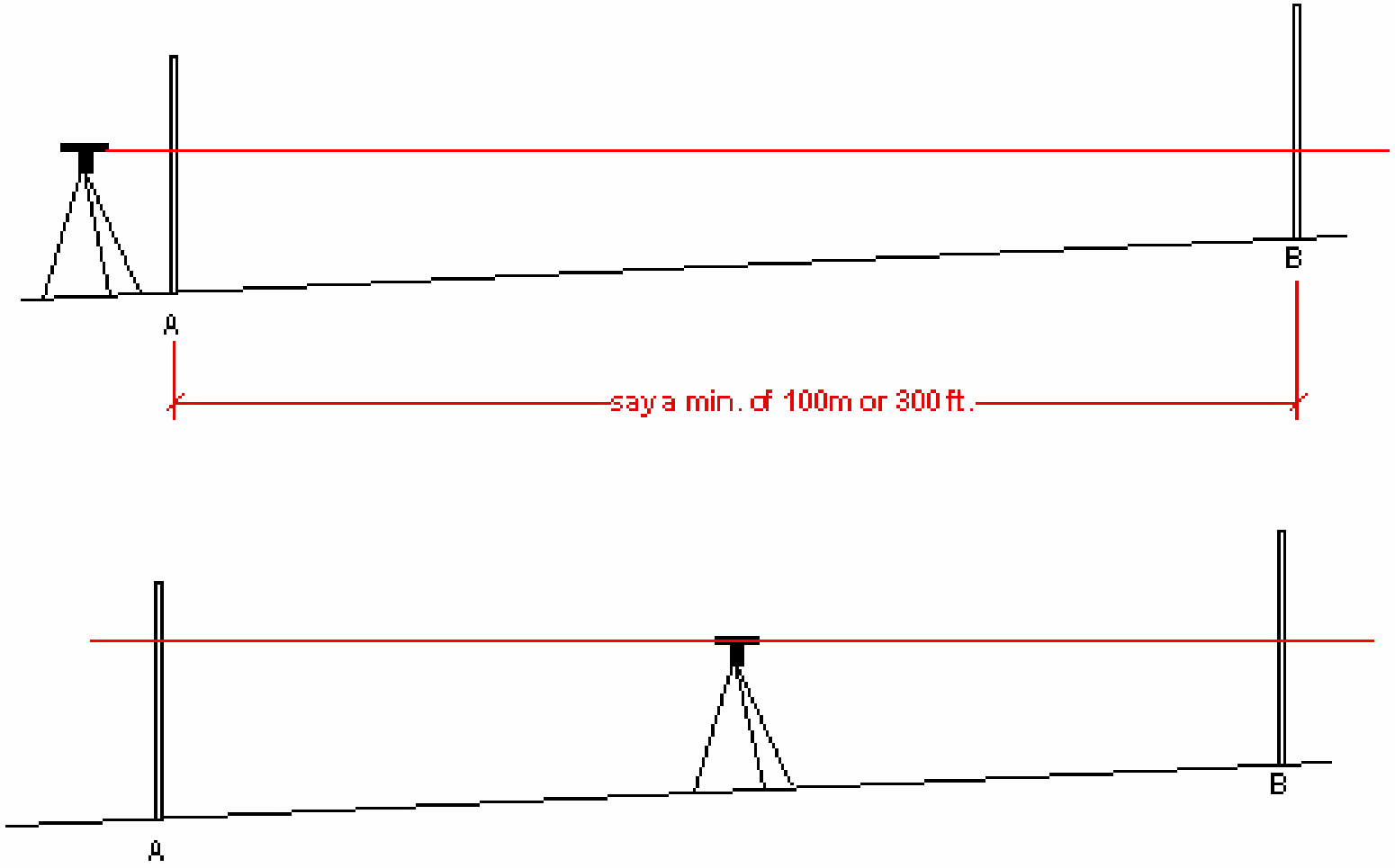
The Levelling...

Levelling Rod

View throughout Eyepiece (telescope)



Two methods of levelling...



Height Difference Between Two Points - Levelling

Basic Principals

Levelling is the process by which differences in height between two or more points can be determined.

Levels

- Levels can be used for:

- Determining the height of a particular point
- Determining differences in height between points
- Determining the contours of a land profile
- Providing data for road cross-sections
- Providing data to calculate volumes for earthworks
- Setting out level surfaces for construction
- Setting out inclined surfaces for construction

Models

- To determine the difference in height between different points it is necessary to produce a line of sight. This requires the use of an instrument. In surveying, this instrument is known as a **surveyor's level**, often generically known as a dumpy level. All of levels consist of a telescope with a cross hair or gun sight, mounted on a device that enables us to orient the device in a horizontal plane.
- There are three types of levels:

- dumpy levels
- tilting levels
- automatic levels

- The differences between the three types being in the way in which the instruments are designed to be adjusted to give a horizontal line.

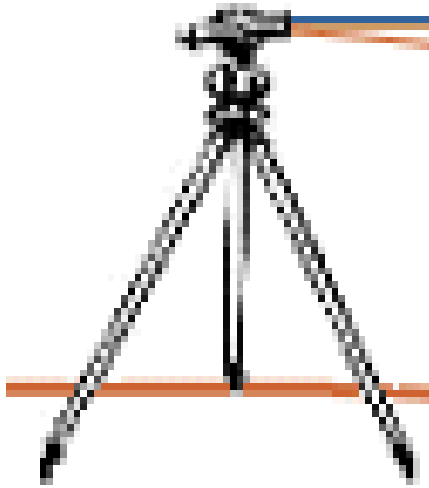
Definitions

- **A level surface**
- This is a surface such that the direction of gravity is normal to it at all points. Since gravity is variable over the earth's surface, this surface will be irregular.

- **A horizontal surface**
- This will form a tangent to the level surface at one point. For most practical purposes using sights of less than 150m the horizontal line approximates very closely to the level line, both being lines on their respective surfaces.

- **Datum surface**
- This is an arbitrary level surface to which the heights of all points are referred. This may be the National Datum (Australian Height Datum) or local datum point established on a construction site.

- **Line of Sight**
- This is the optical line produced by the telescope of the instrument used for sighting. In this particular case the line is approximately horizontal.



Horizontal Line

Line Of Sight

Level Line

Mean Sea Level

Definitions

- **Mean Sea Level (MSL)**

This is the datum most frequently used. Datum for Australia is the Australian Height Datum (A.H.D.)

- **Backsight (BS)**

The first reading taken by an observer at every instrument station.

- **Foresight (FS)**

The last reading taken at an instrument station

- **Bench Mark (BM)**

A point of known Reduced Level (R.L.). Usually a permanent stable refernce point.

Procedural Rules

- Always commence and finish a level run on a Benchmark (B.M. or T.B.M.). The Benchmark at the start may be different than that at the finish.
- The length of foresight and backsight should be as equal as is practical.
- The length of the lines of sight should be kept less than 50m and more conventionally 25m.
- Staff readings of less than 0.5m should be avoided to prevent errors due to atmospheric refraction.
- Change points should be located on suitable ground, for example the top of a pointed rock, or a nail placed in a footpath or road.

Classes of Level

- Levels normally fall into one of three classes.

Precise

- Very accurate instruments for geodetic or any other very precise levelling. It should be possible to level such an instrument to within $\pm$0.1mm.

Medium Accuracy

- These are used for engineering surveys. They may be tilting or automatic instruments capable of being levelled within the range of 1 – 5mm.

Builders

- Low accuracy, short range levelling such as setting out on building sites. Although described as being low accuracy instruments, this is relative to the other classes of levels and the results obtained with this class of instruments will be well within the tolerances required on the majority of construction sites. (10mm)

Adjustment of Misclosure

- The level run is successful if the misclosure falls within an acceptable limit. Various tolerances are used, for example in third order levelling the misclosure must fall within ✂3√n, where n=number of stations. The misclosure is then adjusted equally throughout the network, because we assume that the misclosure is an accumulation of random error and all points have as much likelihood to be in error as another.