



# Surveying laboratory No. 1

2<sup>nd</sup> Stage

Remote Sensing  
department

## Linear Measurements

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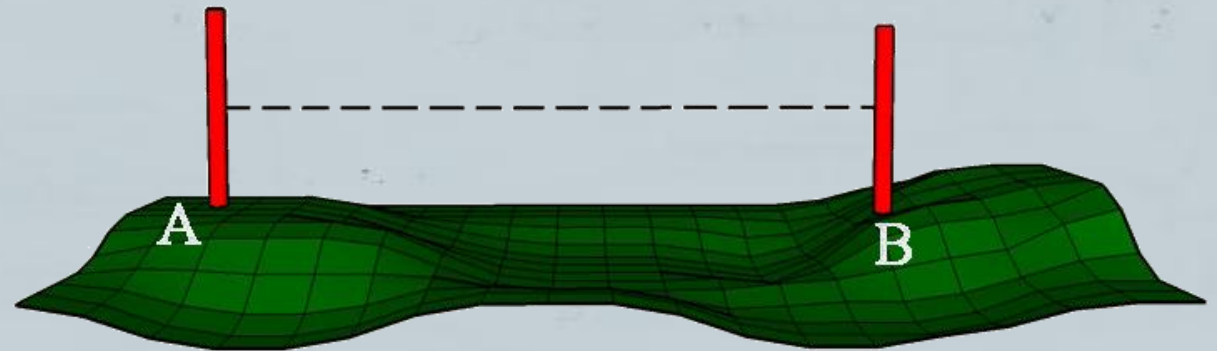


# Linear Measurements



## Linear Measurements

- Measurement of **distances** between **two or more points** on the **surface of the earth**.

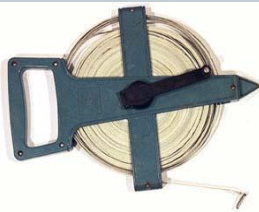




# Linear Measurements

Linear Measurements

Direct measurements



By optical means



Indirect measurements

Electronic methods





# Linear Measurements



## Distance Measuring Methods

**A.** Pacing

**B.** Taping or (Chaining)

**C.** Measuring Wheel

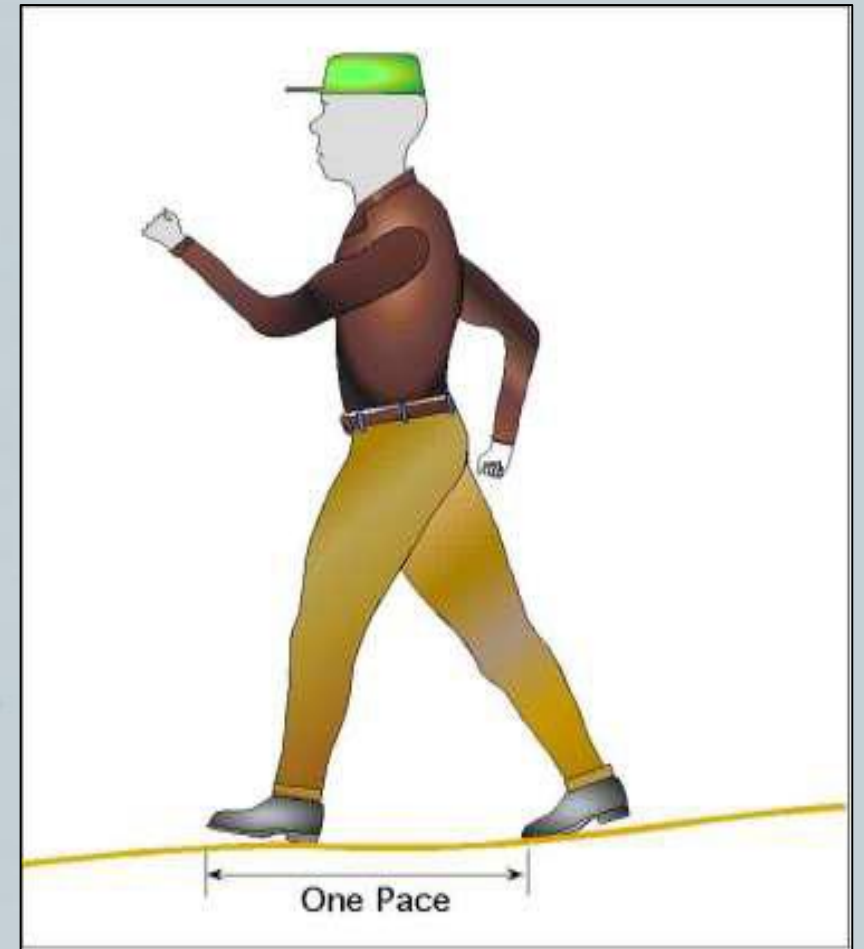
**D.** Electronic Distance Measurement (Disto)



# Linear Measurements

## A. Pacing

A distance between two points can be approximately be determined by counting the **number of paces (steps)** in a required distance and multiplying it with **average length of the pace**. The natural pace normally varies **from 75 to 90 cm**. with an accuracy is about **2% of distance paced**.





# Linear Measurements

## Procedure

1. Choose a flat ground and **measure a distance between two designate points** by using **tape**. Mark the end points A and B.
2. **Walk** forward over this distance and **count your paces** made from point A to B, then B to A, until you reach three trials.
3. Compute the average length of the natural pace by dividing the distance walked by the number of paces.

$$\text{Pace Length} = \frac{\text{Distance walked}}{\text{Number of Paces}}$$

4. Then, calculate the required **distance** by multiplying **Pace Length** with **number of paces (steps)**.

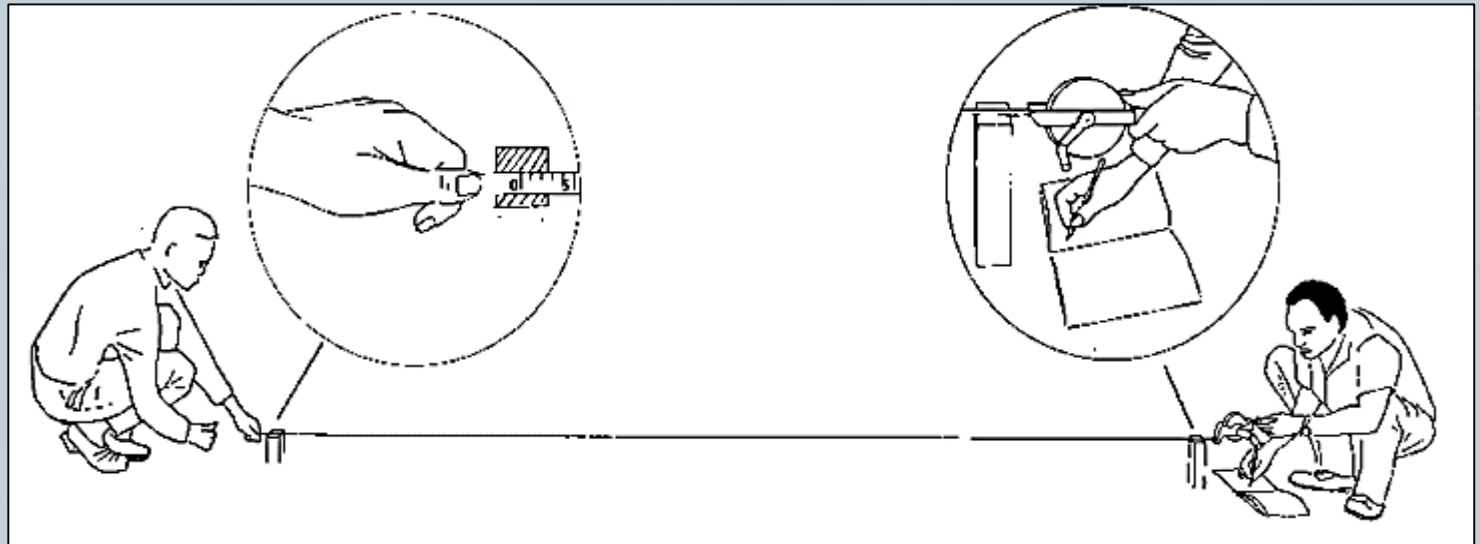


# Linear Measurements

## B. Taping (Chaining)

The common method of determining distance between two points is by direct measurement with a **tape**. The distance measured with a steel tape is much **more precise** than the distance obtained by **pacing**.

**Error 0.1% of distance**



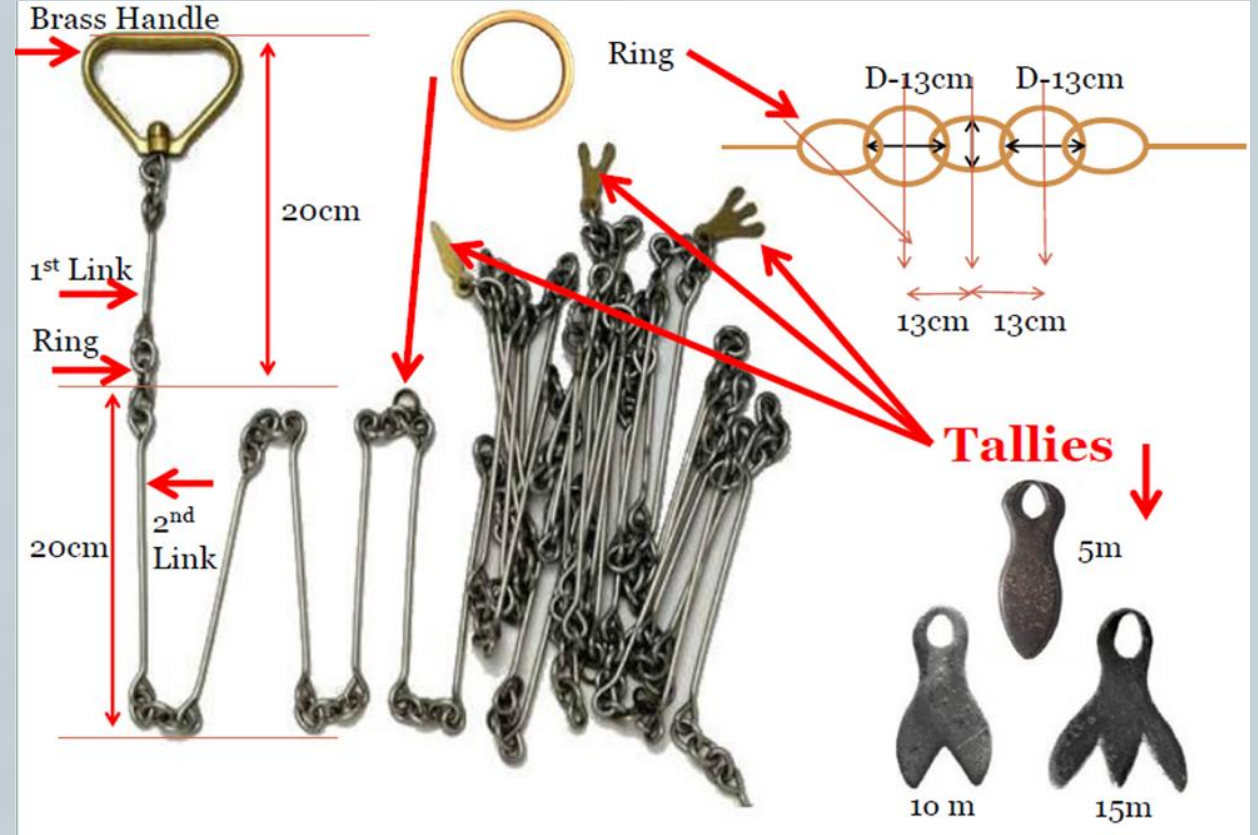




# Linear Measurements

## Chain

- One of the **first chains** used in the U.S. It was designed in **1620**.
- The Surveyor's chain was a series of **links** attached to a handle which included an adjustment for wear.
- Made from **galvanized mild steel** wire 4mm in diameter called links.
- The chain was 30 m long.







# Linear Measurements

## Type of Measuring Tapes

- Cloth or Lenin tape
- Metallic tape
- Steel tape
- Invar tape (Alloy of nickel 36% & steel)



Cloth Tape



Metallic Tape



Steel Tape



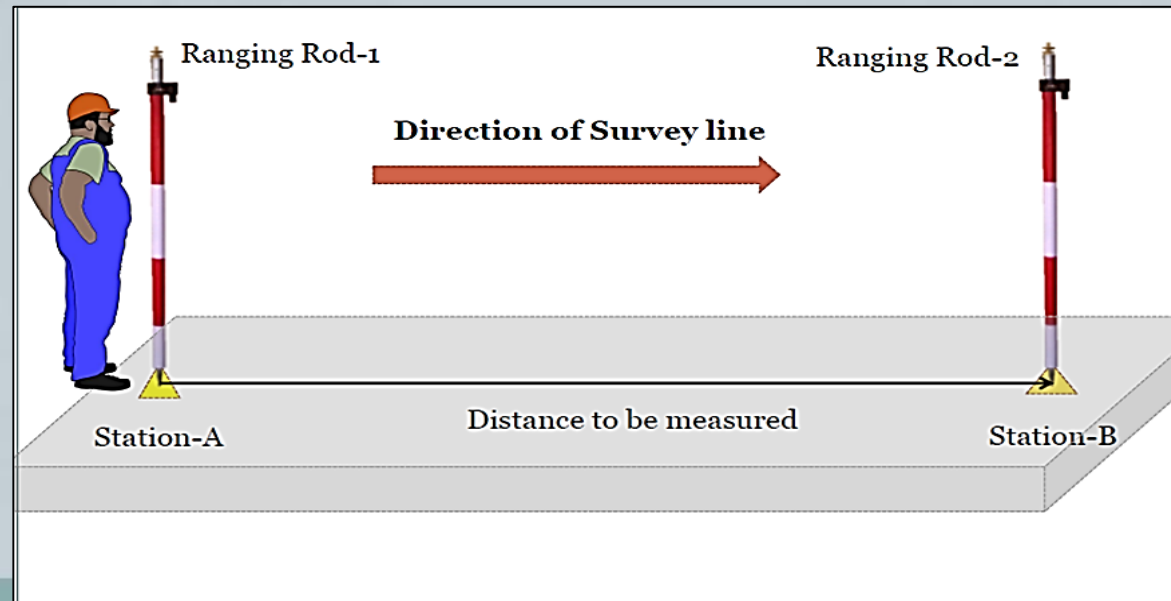
Invar tape



# Linear Measurements

## Procedure:

- **The distance AB is shorter than one tape length.**
  1. Selecting two points , letter A for the first point and B for the second point.
  2. Unreel (open) the tape and straightening it along the line between the rods at A and B.

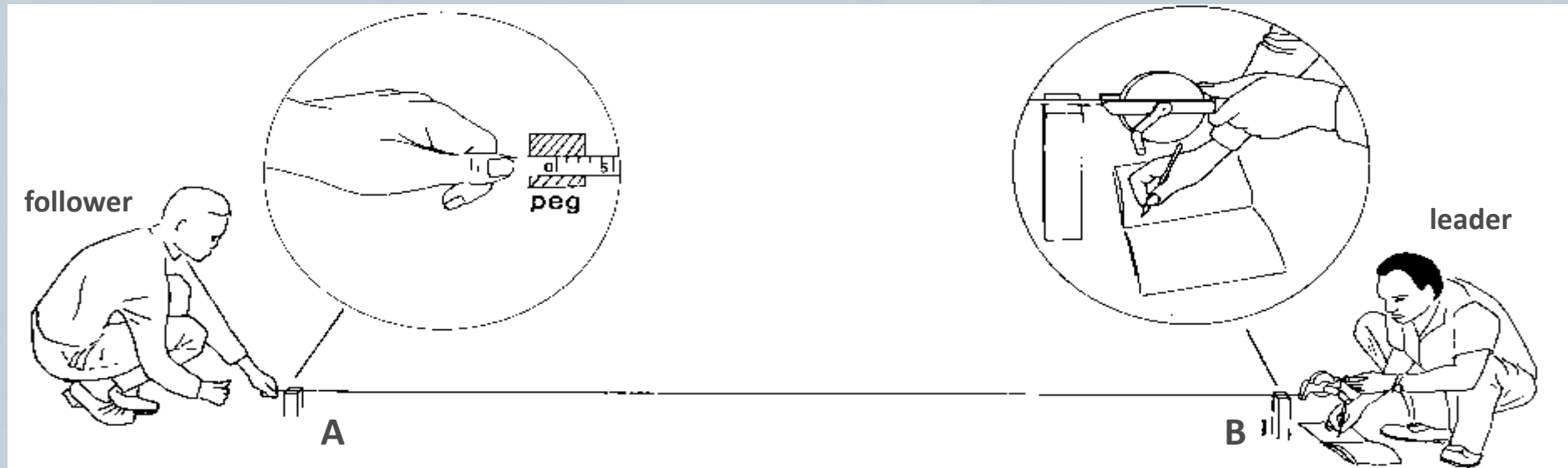




# Linear Measurements



3. The **zero point** of the tape is held against **station A** by the rear tape person (called the **follower**).
4. The forward end of the tape is read against **station B** by the forward tape person (called the **leader**) after it has been carefully tightened.



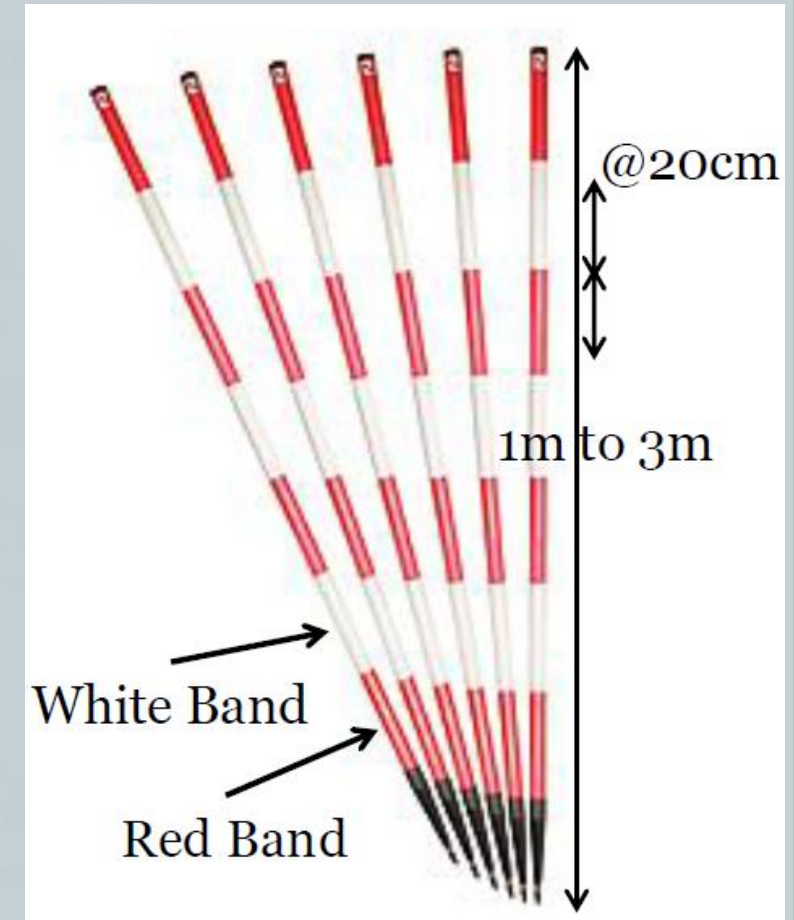


# Linear Measurements



## Ranging rods

- made of wood, steel, or aluminum
- round or hexagonal in cross section with thick about 2-3 cm
- Length 2 m ( very common) or 3 m
- Bands of 20 cm painted alternate colour ( red & white, black & white)
- They are shod at bottom with a heavy iron point.
- Used to range intermediate points on survey line and for making the positions of stations .





# Linear Measurements



## Procedure:

- The distance AB is longer than one tape length and a *sound operational technique* is required.
1. The follower holds the zero end of the tape against station A and the leader pulls the tape towards station B.
  2. When the tape has been laid out the leader holds the ranging rod vertically approximately on the line at new station.

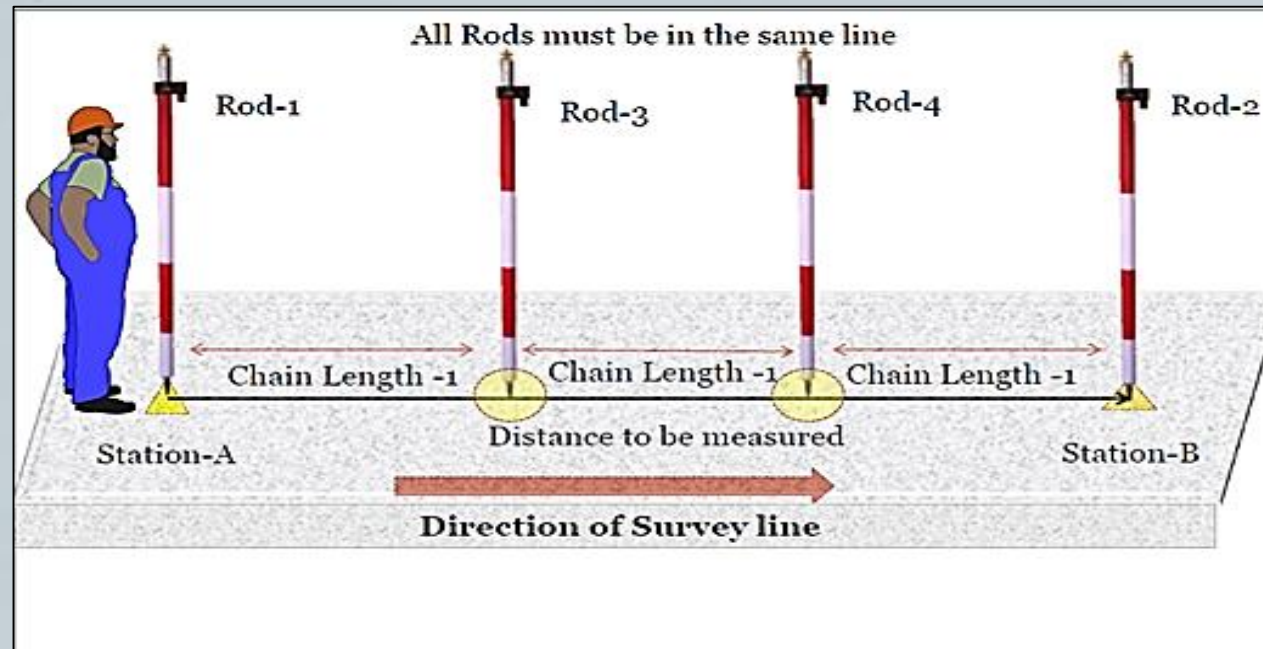




# Linear Measurements



3. The tape is tightened between the newly erected rod at station C and station A.
4. The follower moves forward to this new point and the whole procedure is repeated for the remainder of the line until station B is reached.







# Linear Measurements

## C. Measuring Wheel

A simple mechanical device consist of **wheel** mounted on a **rod**.

Used to determine distance by count the **number of rotations of the wheel** along the line to be measured.

**Error 1% of distance.**





# Linear Measurements



## Procedure:

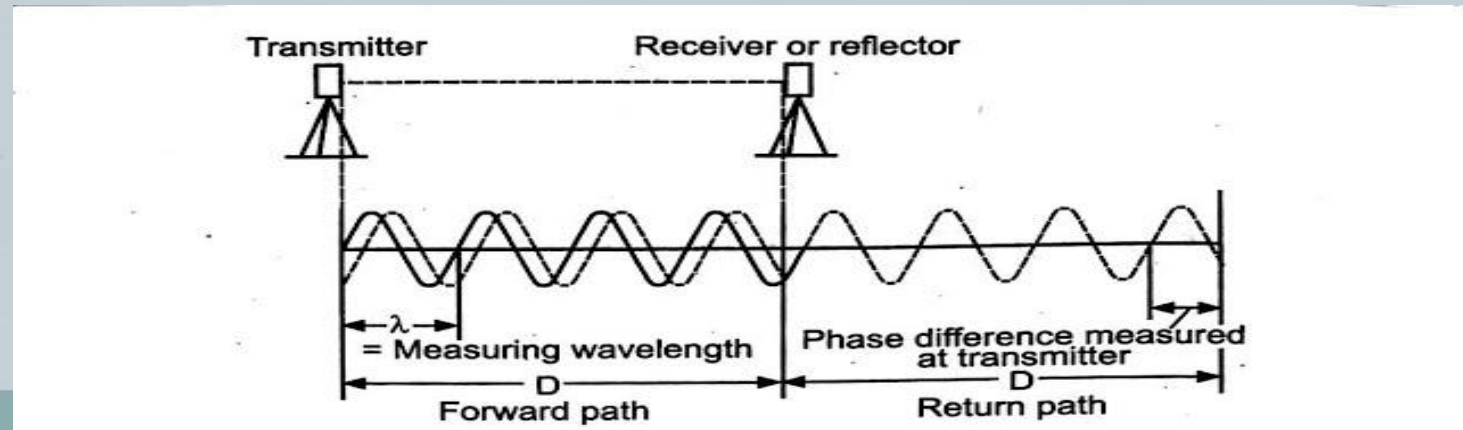
1. Place the tool exactly where the measurement starts.
2. Start walking by rolling the device wheel.
3. When you reach your ending point, pick the device up. This avoids any further wheel rotation.
4. Take your measurement.



# Linear Measurements

## Electronic Distance Measuring (Disto)

- is very useful device that use to measure distance by using an **electronic signal**.
- Its work by measures **the time required for a wave to sent to a target and reflect back**.
- Capable of measuring **long distances** or **difficult** to access





# Linear Measurements

## Procedure:

Place the device on one **end** of what you want to measure, and then aim the **laser beam** so that it hits an object at the other end. **Press** the measure button, the device **calculates the distance and displays** it on its screen.

