RANGING

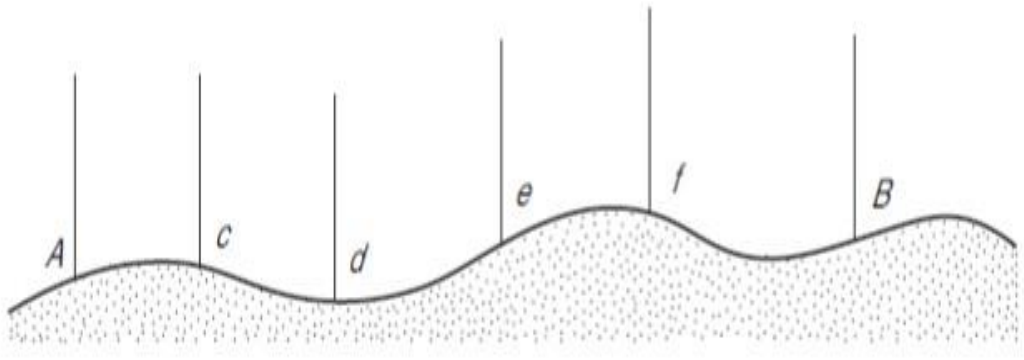
When the distance to be measured with the chain, between the two stations, is less than chain length and the ends are visible. But when the distance is too long and ends are not intervisible due to intervening ground, obstruction, etc., a number of intermediate points are established with the help of ranging rods. The process of establishing intermediate points on a survey line joining two stations in the field, so that the length between the stations may be measured accurately is known as ranging.

Ranging is of two kinds:

1. Direct ranging
2. Indirect ranging

Direct ranging

When ranging rods are placed on intermediate points along the chain line by direct observation from either end stations, the process is known as direct ranging (Fig.).



Direct ranging

Let A and B be two end stations and c, d, e, etc., be the intermediate points to be established. The procedure for marking the intermediate points is as follows.

Procedure

1. Ranging rods are erected vertically behind each end of the line.

2. A surveyor stands behind the ranging rods at the end stations A and B of the line.

3. One of the surveyors, say the surveyor at A, directs the assistant to hold a ranging rod vertically at arm's length from the point where the intermediate point is to be established.

4. The assistant is directed to move the rod to the right or left until the three ranging rods appear to be exactly in a straight line.

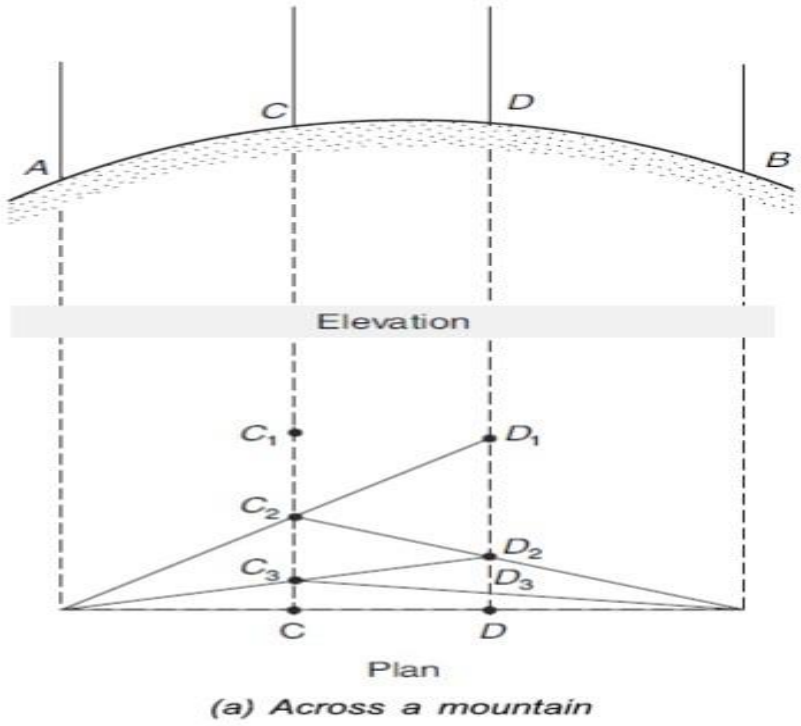
5. The surveyor at A then sits down and ensures that the bottom of all the three ranging rods are in the same line.

6. The surveyor then signals the assistant to fix the rod.

INDIRECT RANGING

When the end stations are not intervisible due to rising ground between them, or due to long distance between the ends, indirect ranging is done. The given points are inaccessible or are separated by an elevation making it impossible for one to be visible from the other, the following procedure is adopted:

1. Let A and B be the two end stations of a line with a rising ground between them and C and D the two intermediate points to be established on the chain line (Fig. (a)).
2. The two chainmen stand at C_1 and D_1, the chainman at C_1 can see both the ranging rods at D1 and B, and the chainman at D_1 can see both the ranging rods at C_1 and A.
3. Now the chainman at D_1 directs the chainman at C_1 to move to C_2 so as to be in line with A.
4. Then the chainman at C_2 directs the chainman at D_1 to move to D_2 so as to be in line with B.
5. By successively directing each other, the two chainmen proceed to the line AB and finally come at C and D exactly in the line AB.
6. C and D are the required intermediate points between A and B.



(a) Across a mountain

Indirect Ranging

LINEAR MEASUREMENT WITH CHAIN

On Smooth Level Ground

In measuring a distance that is longer than one chain length, it is necessary to mark chain lengths at intermediate points, and if the total measured distance is to be accurate, it is imperative that these intermediate points be on the line.

The following steps are followed in chaining a line longer than one chain length:

1. The follower places one of the handles of the chain in contact with the peg.
2. The leader takes the other handle of the chain, ten arrows, ranging rods and moves forward along the line.
3. After the chain is stretched completely along the line, the follower stands on one side of the line with the ranging rod touching the handle.
4. The follower directs the leader to come exactly in line. This can be achieved ensuring that the lower ends of all the three ranging rods are in same line.
5. The leader puts a scratch at the position of rod and inserts an arrow. He then moves forward with the chain handle, the remaining nine arrows, and the ranging rod, till the follower reaches the next peg point.
6. The follower places the handle of the chain in contact with the peg and the entire procedure is repeated till the line is chained.
7. In the end, if some fractional length remains, it is measured by counting the links.
8. During the process, the leader inserts the arrows and the follower picks them up at every chain length. After every tenth chain length the follower erects a ranging.

ON SLOPING GROUND

There are two methods by which the actual horizontal distance can be obtained.

Direct Method

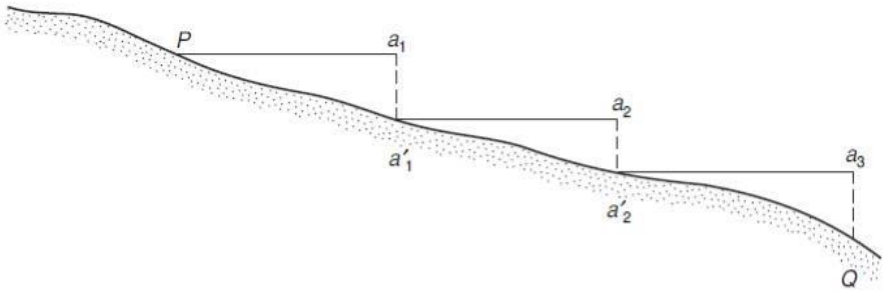
The process of chaining a line on sloping ground is as follows.

1. The follower holds the zero end of the chain at P on the ground while the leader holds its broken end a1 at a suitable length (say 20 or 30 links) horizontally, as shown in Fig.
2. The follower then ranges the leader in line with Q.
3. The leader transfers the end a1 to the ground by means of a plumb bob and marks the point a1 on the ground with an arrow.
4. The follower moves to a1 and holds the zero end of the chain at that point.

5. Steps 1 to 4 are repeated until the end Q is reached.

6. The horizontal distance PQ is the sum of all such measured distance:

PQ = Pa1 + a1 a2 + a2 a3 +……



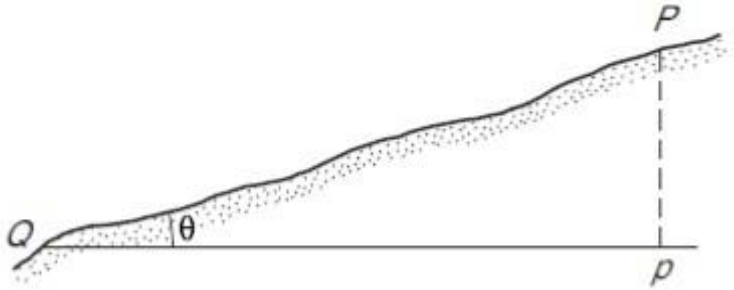
Direct Method

Indirect Method

Wherever the chain can be conveniently held on ground, it may be easier to measure a slope distance PQ as shown in Fig. 2.20 and then the corresponding horizontal distance PQ can be computed.

First Method

The angle PQp (Fig. 2.20) can be measured by a clinometer or on the vertical circle of the transit. Then, pQ = PQ cos θ



Second Method

The horizontal distance pQ may be found by applying hypotenusal allowance (Fig.) derived as follows.

Let = angle of slope of the ground.

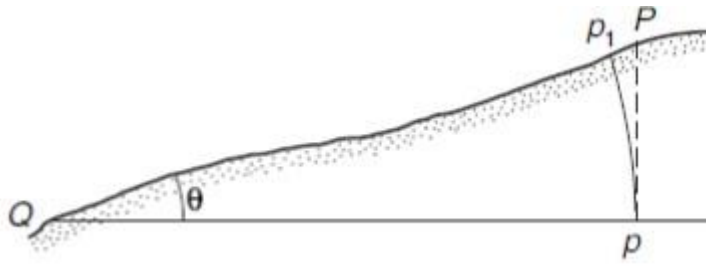
pQ = p_1Q = 1 chain length

PQ = chain length sec θ

Hypotenusal allowance,

Pp_1 = chain length (sec θ – 1)

Therefore, for measuring a distance on slope by this method, the chain is stretched in position p1Q with the arrow placed in advance by an amount Pp1. The next chain length starts from P.



Third Method

Another method of measuring horizontal distance consists in measuring the slope distance l (PQ) and the difference in elevation h (Fig.) between the two points by a level. Required horizontal distance is pQ = $\sqrt{L^2 - h^2}$ and, slope correction = $h^2/2L$