SECTION 51 – LOCATION MARKING PEGS AND PROFILES

1112. Figure11.1 shows the majority of marks as they appear before and after earthmoving. Pegs must be strong and substantial, preferably of 75 by 25mm timber about 0.60 m long. One end must be pointed to facilitate driving. The minimum number of pegs and amount of information on them should be used. Types of marks are:

a. Alignment of centre-line pegs. stakes.
b. Reference pegs.
c. Slope stakes.
d. Profile boards.
e. Shoulder.
f. Batter boards.
g. Finish level pegs.

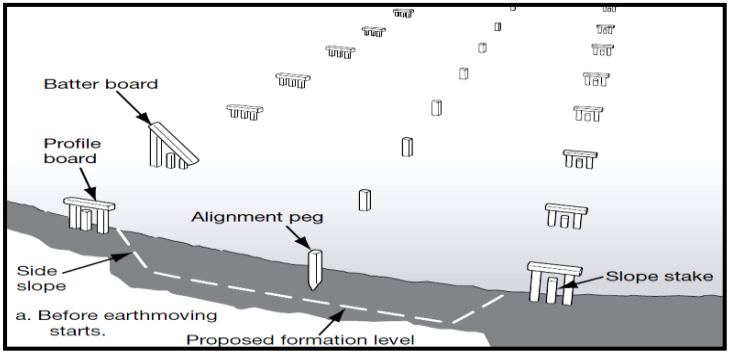

Figure 11-1(a): General View of a Pegged-out Alignment.

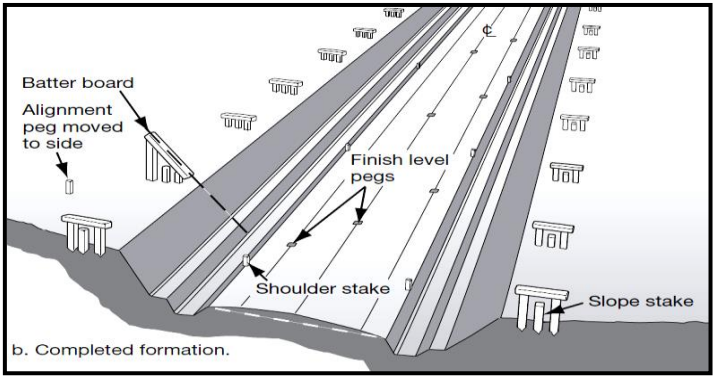

Figure 11-1(b): General View of a Pegged-out Alignment.

Alignment or Centre-line Pegs

1113. Alignment or centre-line pegs must be firmly driven and should have at least one-third of their length in the ground. At points where earthwork is involved, cross-section levels are taken at these pegs. Figure 11.2 indicates how alignment pegs should be marked. The front, ie the side facing the starting point, records the chainage and alignment changes, eg TC or CT . If no alignment change is necessary, the peg is marked with the symbol C . The back of the peg indicates the height of the ground relative to the required formation level.

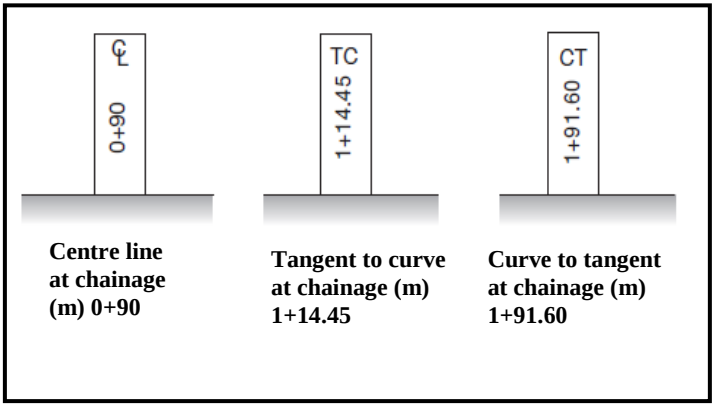

Figure 11-2(a): Alignment Pegs Front View

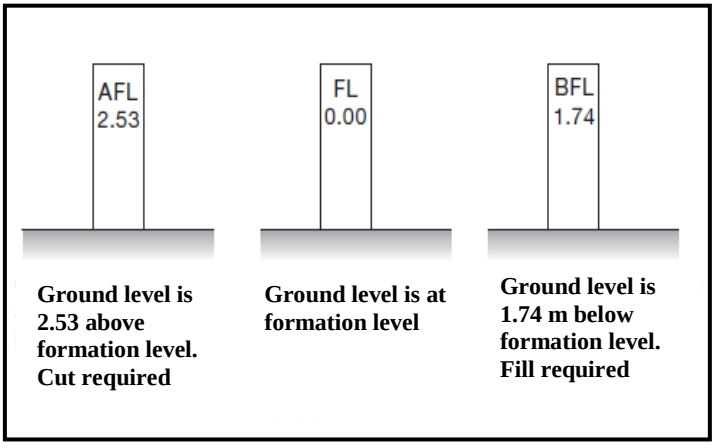

Figure 11-2(b): Alignment Pegs Back View

Reference Pegs

1114. Alignment pegs are likely to be moved when earthmoving starts and it isnecessary to replace some or all of them to establish the centre line. Therelocation is achieved by the use of reference pegs. These pegs are firmlydriven, where necessary, well clear of earthmoving at a measured distancefrom their corresponding centre line pegs. Normally, reference pegs shouldbe in a straight line on either side of the centre line and marked as follows (see Figure 11.3).

a. On the front of the peg facing the start of the alignment:

(1) Type of peg, eg REF.
(2) Chainage.
(3) Direction of the centre line.
(4) Distance of the centre line.

b. On the side of the peg facing the centre line: the serial number. The twopegs of a pair are lettered A and B respectively.

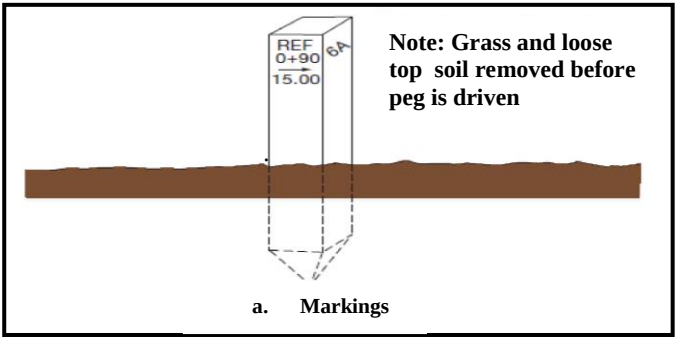

Figure 11-3(a): Reference Peg

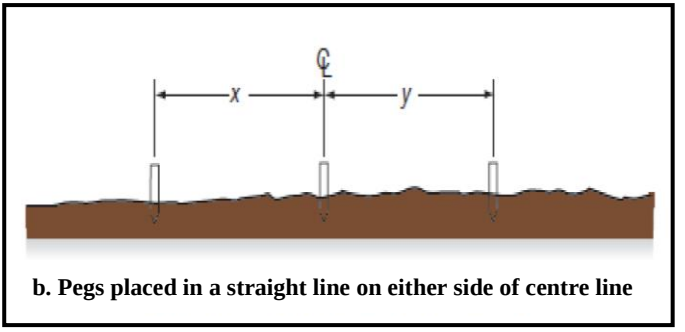

Figure 11-3(b): Reference Peg

Slope Stakes

1115. Slope stakes, which are sometimes referred to as batter pegs, indicate to plant operators the limits of cuttings and banks, ie the line at which a slope at the appropriate angle of repose from the edge of the formation would meet the natural ground. If placed at the exact top or bottom of slopes, slope stakes would be removed by plant. For this reason they are located a distance farther away from the centre line, usually 1.20 m (see Figure 11.1(a)).

1116. Slope stakes are marked from the top downwards as follows:

a. On the front of the stake facing the centre line:

(1) Type of stake.
(2) Distance of the top of the stake above or below formation level.
(3) Distance of the stake from the centre line.

b. On the side facing the start of the alignment, the slope expressed asa fraction, eg 1/1½, indicating a vertical rise of one unit in a horizontal distance of 1½ units.

1117. Number of Slope Stakes. The number of slope stakes required is:

a. In side-hill cuts – one stake at the top of the cut.
b. In embankments and through cuts– two stakes marking the outside limits of the work.

1118. Side-hill Cut. The position of the top of the cut can be found as follows (see Figure 11.4):

a. Measure the slope S1 on the ground and determine W and S2 from the design plans.

b. The horizontal distance W + x can then be calculated from the formula:
$W + x = W (1 + S1) /(S2 - S1)$
where S1 and S2 are the slopes in decimal form, eg 1 in 2 = 0.5.

c. Point D is then determined on the ground by holding a staff vertically atpoint A and measuring off a horizontal distance equal to W + x.

d. The slope stake is driven 1.20 m outside point D.

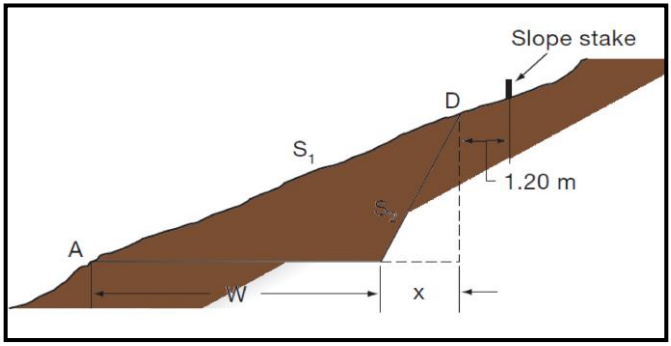

Figure 11-4: Approximate Location of Slope Stake in Side-Hill Cut.

It is better to locate point D (see Figure 7/4) too far from point A than too near.The reason for this is that plant starts cutting from the higher point. Should point D be located too near to point A, the correct formation width may beachieved only at the risk of forming a slope which has an unacceptable angle of repose.

1119. Through Cut. (See Figure 7/5). When the transverse slope of the ground is reasonably level, the distance between the top limits of cut can be calculated from the differences of levels as follows:

a. The distance between the top limits, X and Y is approximately equal to:
W + a + 1½ b.

b. If the transverse slope is appreciable, any necessary adjustment can be estimated by eye.

c. The slope stakes are driven 1.20 m outside points X and Y.

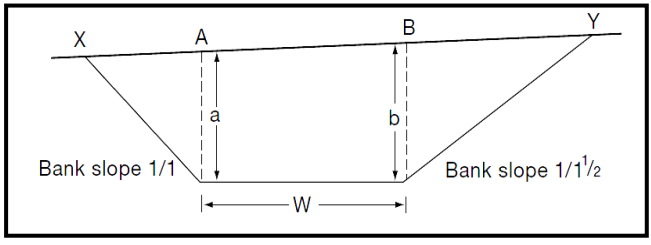

Figure 11-5: Approximate Location of Slope Stakes in Through Cut.

1120. Embankments. The outer limits of embankments (toe of bank) can be fixed by the method described in the previous paragraph.

Profile Boards

1121 . Profile boards are used to determine when cut or fill has reached the required level. This is done by lining up the tops of the profile boards with the top of a traveler. Two profile boards are erected, one on either side of the alignment, at the same spacing as alignment pegs. The boards are normally erected astride slope stakes (see Figure 11.1). Pairs of boards may be set at the same height above formation level (AFL) or each may be set at a different level to provide crossfall. Goalpost and T-type boards may be used, but the former are preferable as their disturbance by plant is more readily detected.

1122. Boards are marked indicating the distance of the top above formation level: this detail is written on the front facing the start of the alignment (see Figure11.6).

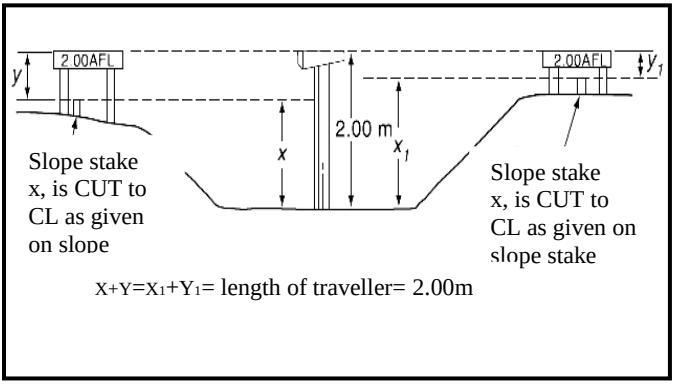

Figure 11-.6 (a): Profile Boards In Cut

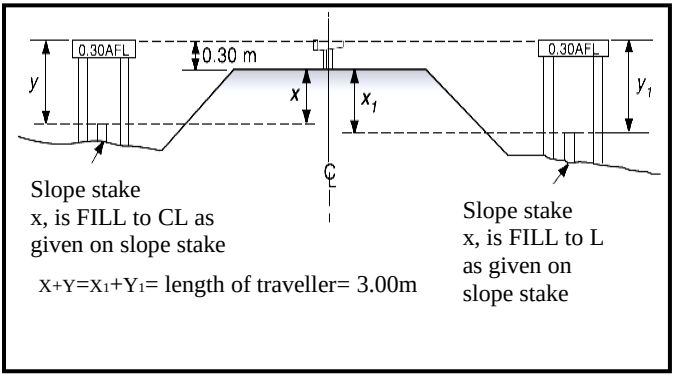

Figure 11-.6 (b): Profile Boards On fill

1123. The length of the traveler depends on the height above formation level ofthe top of the profile board: this is illustrated in Figure 11.6.

Shoulder Stakes

1124. Shoulder stakes mark the line at which the side slope and the formation edge meet (see Figure 11.7). In cuttings, where a ditch may be dug between the carriageway and the bottom of the side slope, shoulder stakes are alsoused to indicate the junction of the formation and the inner edge of the ditch, ie the shoulder line. Both functions occur at very different stages ofthe work, so there is little possibility of confusion.

1125. A trial and error method used in locating shoulder stakes to mark the line at which the side slope and the formation edge meet is illustrated in Figure 11.7.Figures 11.7(b) and 11.7(c) show shoulder stakes located at the shoulder line.

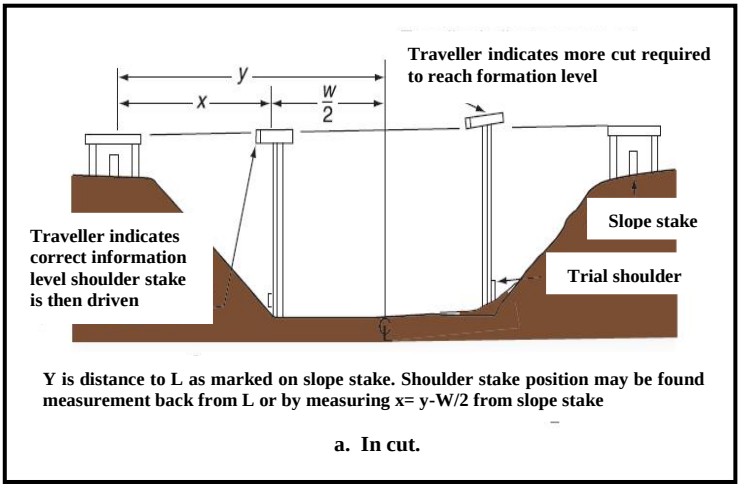

Figure 11-6: Profile Boards.

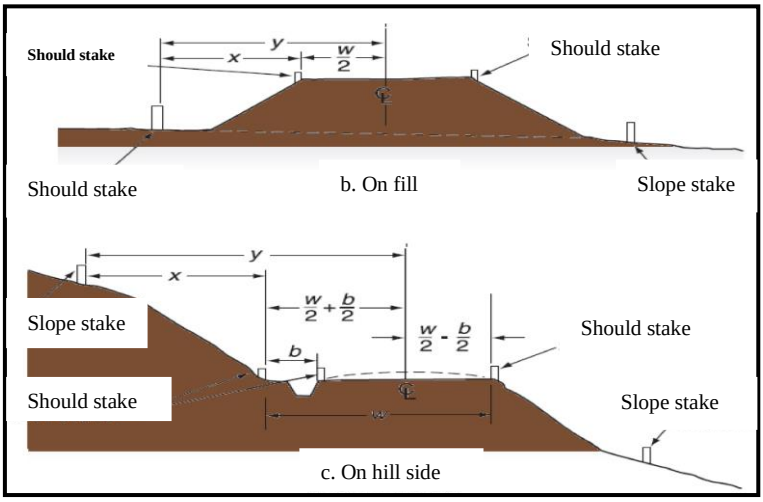

Figure 11-7: Cut Hills

1126. Trial stakes are placed when the formation is nearing completion (see Figure 11.7(a)). Their position can be determined by measurement from the centre line or from slope stakes. The height AFL or BFL of the top of as shoulder stake is determined by measurement from the related slope stake. This height may be recorded on the shoulder stake or, alternatively, a more readily visible indication of the required formation level may begiven to the plant operator by piling up a mound of earth or cutting a smalltrench to the required level near the shoulder stake. It may be necessary to relocate shoulder stakes as the final stages of cutting or filling proceed. When checking with a traveler indicates that the correct formation levelhas been reached, the shoulder stake is driven in flush with the surface. The top of the stake should then be marked with a distinctive colour.

1127. When it is required to finish the sub-grade to a camber, plant operators canbe helped to judge the amount of cut required at the edges to form the camber by driving in temporary shoulder stakes to the same level as the crown of the formation.

Batter Boards

1128. Batter boards indicate to plant operators the required angle of slope in cuttings and on banks. In cuttings, they are sited in prolongation of the required line of slope as shown in Figure 11.1(b). On banks, they are set tone side, the top of the

board being at the required slope and at a specified distance from the finished face of the slope. On rough hasty work, batter boards may not be used: in this case, knowing the slope required, the plant operator uses his own judgment.

1129. The procedure for setting up a batter board for a cutting is as follows (see Figure 11.8):

a. Point X is located on the top edge of the cutting by measuring 1.20 m from the slope stake towards the center line.

b. For a slope of 1 in 11.2, a peg is driven at Y, 1.00 m out from X, until it stop is 0.66 m above the ground level at X.

c. A peg is driven at Z, 1.00 m out from Y, until its top is 1.33 m above the ground level at X.

d. The batter board is fixed with its top edge flush with the inside top edges of the pegs at Y and Z.

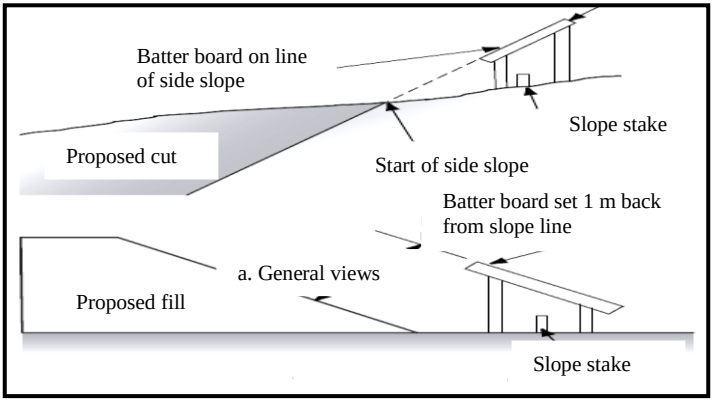

Figure 11-8(a): Batter Boards General Views

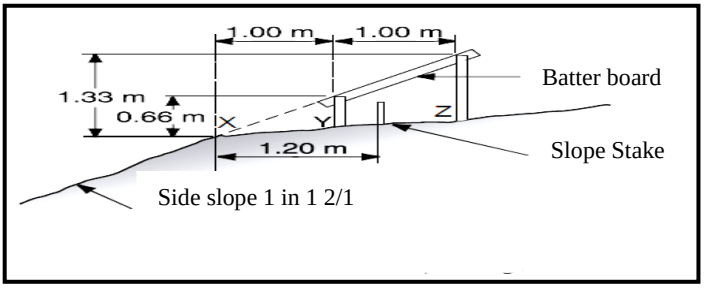

Figure 11-8(b): Batter Boards Method of Placing

Finish Level Pegs

1130. The tops of finish level pegs indicate the required finished level of the formation. They are driven at random over the formation at distances apart of about 6 m. The task of the plant operator to bring the formation to the required finished level can be simplified by building up mounds or cutting trenches to the correct level around or alongside the finish level pegs.

Setting out Curves

1131. Setting Out Horizontal Curves Using a Vehicle. The absolute minimum radius of a curve is the turning radius of the vehicles which have to negotiate it. It is sometimes possible to drive an appropriate vehicle on agradual and even turn and to use the wheel tracks for the curve location.

1132. Swinging an Arc. When the ground is unobstructed and the tangent points and centre of the circle can be located on the ground from the plan, curves of radius not exceeding 75 m may be set out by swinging a cord or wire. One soldier holds the end of the line at the centre point while another soldier, holding the line taut at the required length, walks from the TC, or CT, marking the curve as he goes.

1133. Half and Quarter Method. (See Figure 11.9). The half and quarter method is useful for short curves, especially for temporary work or for a preliminary alignment to enable clearing to be done prior to accurate setting out. The procedure is as follows:

a. The IP (I) and tangent points (A and B) are fixed.

b. The long chord AB (see Figure 11.9) is measured and its middle point Gis fixed.

c. GI is measured and its middle point H is fixed.

d. AH and BH are measured and bisected at P and S.

e. PF and SN are set off at right angles to AH and BH respectively.

f. Points F and N are fixed by measuring PF = SN = (GH /4).

g. More points can be fixed by joining AF, FH, HN, and NB, and setting upmid-ordinates as in e and f above, making them equal to FP/4.

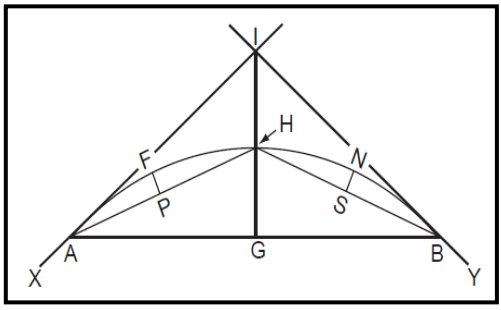

Figure 11-9. Setting Out Curves by the Half and Quarter Method.

1134. Setting Out a Vertical Curve. A simple procedure for determining the approximate formation levels on a vertical curve is as follows (see Figure 11.10):

a. On a longitudinal section of the road length concerned, the TC and C Tare fixed so that the chord joining them is equal to the sight distance required. The chord is then drawn in.

b. From the TC and CT, the tangents are produced to intersect at I.

c. From I, a perpendicular is dropped to cut the chord at P.

d. On the line IP, a point Q is fixed so that PQ is not more than 1.15 m (see Figure 7.10).

e. A curve is drawn through TC, Q, and CT, so that no point on the curve is higher than PQ.

f. The formation levels are scaled off at the required points on the curve.

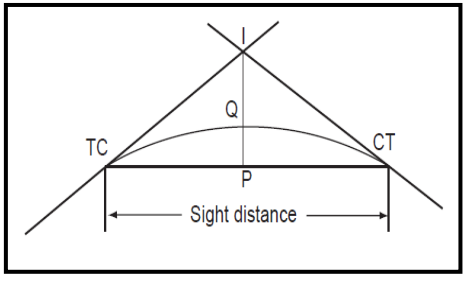

Figure 11-10: Approximate Method of Setting out a Vertical Curve

Measuring Radius of Existing Curve

1135. The radius of an existing curve can be determined as follows (see Figure11.11):

a. A chord AB is set out as shown and bisected at C, so that AC = BC = a.

b. From point C, the perpendicular offset (x) is measured to point D on the curve.

c. The radius is calculated from the formula:
$R = (x2 + a2)/2x$

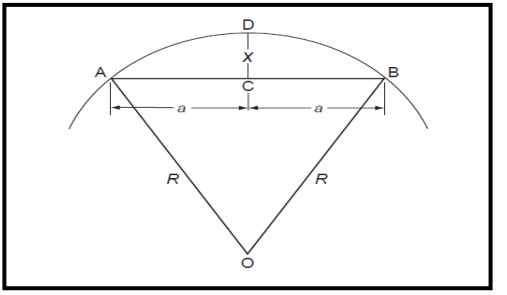

Figure 11-11. Method of Finding the Radius of an Existing Curve.

Types and Marking Of Pegs

1136. Centre line pegs normally fixed at 100-ft intervals, or closer on rough ground and of curves of small radius. Should be distinguished by a patch of color or be clearly marked “CL” Marking:- On side facing starting point- the chain age. On reverse- amount of cut or fill (marked “C” or “F”). Clearly marked special pegs ate fixed at all tangent points and intersection points.

1137. Offset (or shoulder) Pegs- These mark edge of formation (shoulder line) top or toe of bank, etc (see also para.

1138. They ate set pff at right angles to center line, with the board side canine in wards.

Marking

On face- amount of cut or fill (“C” or “F”) and horizontal distance from center line. On reverse- chain age of the center line station.

1139. Batter pegs.- These ate offset pegs marking the outer limits of bank and cuttings (and normally of clearing) and are of prticular improtance to plant operation. They should be whitened and driven at an angle leaning outwards, with the borad side cacing the centre line.

Marking

Onface- amount of cut or fill and distance from centre line.on recerse chainage of contre line station. On side slope ration on bank.

1140. Level pegs. Should be sited clear of the working area. They must be linked toa particular centre line peg and must record the difference in level from that of the finished crown of the formation. For accurate work, separate level pegs (2-inx2-inx12-in) may be required to show physically the final level of construction. These are usually coloured blue and should be protected by a pipe or a drum with its ends removed.

1141. Reference pegs. As a precaution, reference pegs should be driven well clear of the working area and at a constant distance from the centre line. They should record distance from CL, chainage of CL peg to which liked, their own level relative to that of the finished crown of the formation, and the slope ratio at the nearest batter peg.

1142. Marking pickets. Pickets 5 or 6 ft high and made conspicuous by strips of coloured cloth, are always advisable to safeguard important pegs, and they may also be needed in undergrowth or rough ground to help plant operators to find working pegs.

Approximate Methods of Flxing Batter Peg Position

1143. Side hill cut (see Figure 26). Determine the outside level of the formation (point), Hold a staff upright at this point and measure BC equal and parallel to the formation wldith. By measuring the height AB, the distance CE is readily calculated, since the required slope of the bank is known (it is usually 1/1 or $1/^{1/2}$). The horizontal distance between points E and D is estimated by eye, and point D can then be fixed with reasonable accuracy.

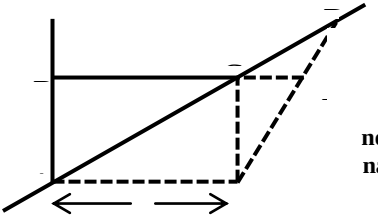

Figure 11-12 – Approximate Location of Batter Peg in Side-Hill Cut

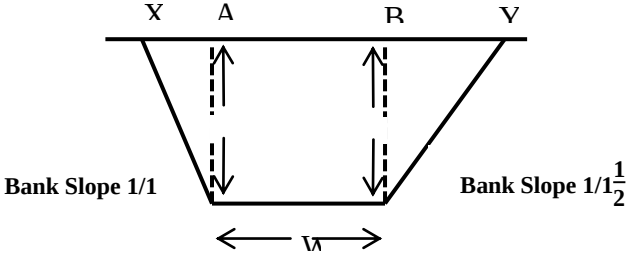

Figure 11-13 – Approximate Location of Batter Pegs in Through Cut

1144. Through cut (see Figure 11.12). If the transverse slope of the ground is reasonably level, the distance between the top limit, X and Y is readily found from the depth of cut and required side slopes. In Figure 11.12, AB-information width, AX=a, and $BY=1^{1/2}$ b.

If the transverse slope is appreciable, any necessary adjustment can be estimated by eye.

1145. Embankments. Outer limits (toe of bank) can be fixed by the same method as in para 208.

Profiles

1146. Fro setting out embankments, profiles of lath or bamboo and spunyarn may be found helpful. They should be erected at intervals of about 50 ft and must represent accurately th finished section of the bank after compaction.