SECTION 53 – SETTING OUT HORIZONTAL CURVES

1152. The method adopted for setting out horizontal curves depends upon site conditions, the degree of accuracy required, and the time available.

Deliberate Methods

1153. In deliberate work the best methods are:

a. By theodolite.
b. By offsets.

The general procedure used in the theodolite method can, if necessary, be adapted for work with the compass, pocket sextant, or plane table and sight rule.

1154. The following methods require no instruments and use only tapes and banderoles:

a. By offsets.
b. Half and quarter method.

Parabolic curves can also be set out without instruments.

1155. Setting out by theodolite or compass (see Figure 11.17):

a. The degree of curvature, D, must be known (see para 64 and Table 10.2).

b. Having fixed the TC and CT (see Section 52), set up on the TC (station A) and take a bearing on the IP.

c. Set off $\frac{D}{2}$ degrees and measure the first chord of 100 ft along the new bearing. Put in peg 1.

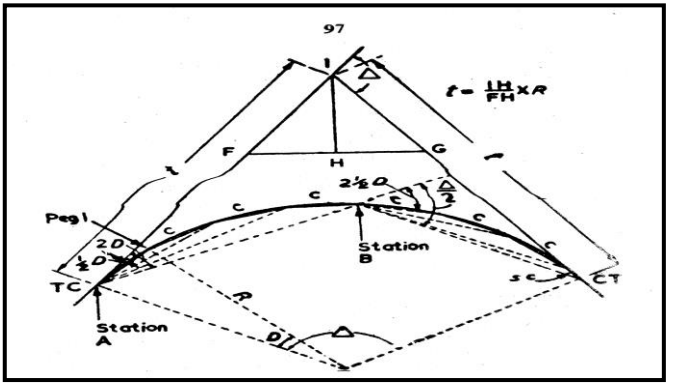

Figure 11.17 – Setting Out Simple Curves by Theodolite.

d. For each new chord set off an additional $\frac{D}{2}$ degrees, measure forward 100 ft from the previous peg, and mark the new station.

e. If the whole curve cannot be ranged from the TC, set up again at any convenient chord point, say station B in Figure 11.17. Take a backsight on the TC and traverse 180 degrees.

f. For each chord already set out add $\frac{D}{2}$ ^{o}to the new bearing, eg in Figure 31 four chords give 2D. Add $\frac{D}{2}$ ^{o}for the new chord to be set out from station B (total in Figure 31 = $2^{1/2}$D) and proceed as before.

g. The last station will be within 100 ft from the CT. To check the closing of the curve, measure the final sub-chord (sc) and compute the sub-deflection from the expression $\frac{sc}{100}$ x $\frac{D}{2}$. When this angle is set on the instrument, the plate should read $\frac{1}{2}\Delta^{o}$ and the line of sight should intersect the CT.

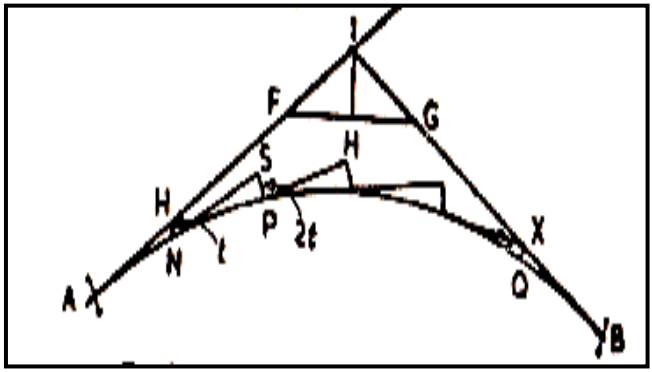

Figure 11.18 – Setting Out Simple Curves by Offsets

1156. Setting out by offsets (see Figure 11.18):

a. Fix the TC and CT (points A and B).

b. Determine the tangential offsets, t. This Figure is included, in respect of selected curves, in Table 10.2. If necessary it can be found from the formula:

$t = \frac{c^2}{2R}$

where t is the tangential offset
and c is the chord = AN = 100 it (normally)

c. From the TC (point A) measure AH=100 ft, along the tangent towards the IP. Mark point H.

d. Set out HN=t at right angles to AH. N is the first point on the curve.

e. Produce the chord AN to S, so that NS=100 ft. Tape forward from N a distance NP=100 ft and fix point P so that the distance PS=2t. P is the next point on the curve.

f. Continue fixing points on the curve, as in (e), until the last full station at Q is fixed.

g. Check the position of Q by measuring the sub-chord QB, calculating t for this length, and checking against the offset QX as measured on the ground.

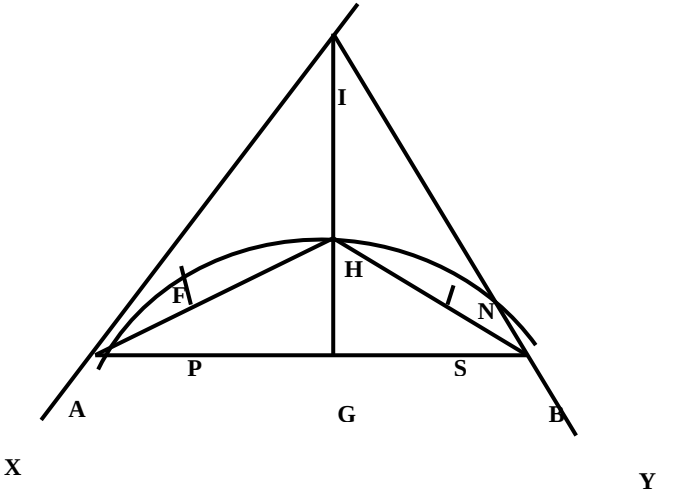

Figure 11-19: Setting Out Curves by the Half and Quarter Method.

1157. Setting out by half and quarter method (see Figure 11.19). This 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:

a. Fix the IP (point) and tangent points (A and B).

b. Measure the long chord AB and fix its middle point G.

c. Measure GI and fix its middle point H.

d. Measure AH and BH and bisect them at P and S.

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

f. Measure $PF=SN=\frac{FP}{4}$ to fix points F and N.

1158. Setting out parabolic curves. The parabolic curve is suitable for short road curves, and can be out quickly using only a tape and banderoles. It is particularly useful when the tangent lengths are necessarily unequal (see Figure 11.20).

a. Fix the tangent points A and B.

b. Divide each tangent length into the same number of equal distances and number them as shown in Figure 11.20

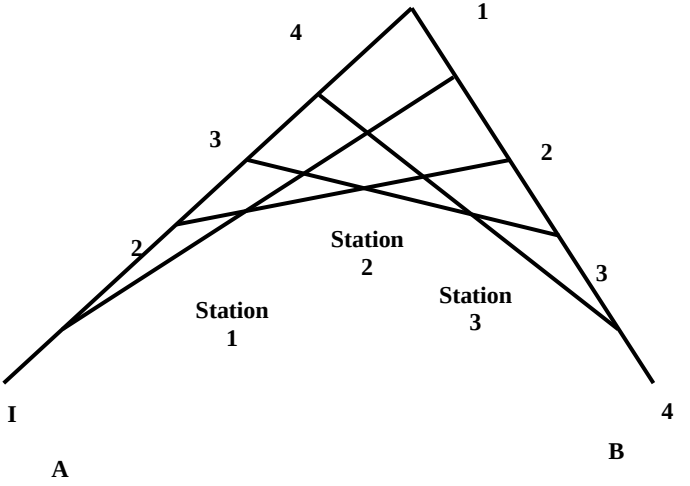

Figure 11-20: Setting Out a Parabolic Curve

c. Points on the curve are fixed on the ground by lining in with banderoles.

Station 1 is at the intersection of 1-1 with 2-2
Station 2 is at the intersection of 2-2 with 3-3
Station 3 is at the intersection of 3-3 with 4-4

Hasty Methods

1159. In hasty work curves must be fitted to the ground, largely by eye. It is more important to reduce earthwork than to lay out an accurate curve.

1160. Offsets from half tangent (see Figure 11.21). When only the direction of the straights (tangents) is known, and the position of the curve is restricted by bad ground, this method will help to get the curve in the right place. It should only be used if the angle is between $40^{o}$and 90^{o}

a. Fix the IP on the ground (point I).

b. Select on the ground a point X, where it is judged that the mid-point of curve should lie, in view of site conditions and the approximate radius required.

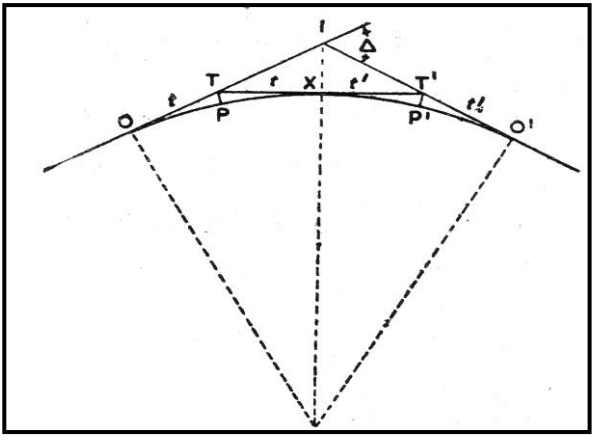

Figure 11.21: Rapid Setting Out by Offsets From Half Tangents.

c. From the IP measure IT and IT' along tangents, such that IT=IT' and that T, X and T' are in line.

d. Measure TT and adjust point X to its exact center.

e. Measure IX.

f. Fix points O and O'such that TO=T' O'=TX (or T'X). O and O' are the tangent points of the curve, which can be aligned by eye through the three points O, X and O'.

g. If required intermediate points on the curve can be fixed by bisecting the angles OTX and O'T'X and measuring the offsets TP and T'P', both being made equal to 0.22 IX.

1161. Swinging an arc for sharp curves. If the tangent points and the centre of the circle can be located on the ground from the plan, curves of radius not exceeding 250 ft can be set out with a cord or wire, if the ground is reasonably clear. One man holds one end of the line at the centre point, while another man, holding the line taut at the required distance mark, walks from the TC to the CT, marking the curve as he goes.

1162. Using a vehicle. It is sometimes possible to drive a truck or grader on a gradual and even turn to use the wheel tracks for the curve location.