

FIGURE 6.1 Open traverse.

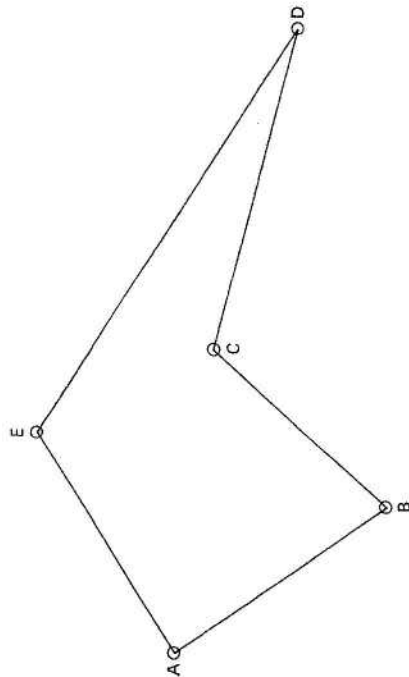


FIGURE 6.2 Closed traverse (loop).

### 6.2 OPEN TRAVERSE

Simply put, an open traverse is a series of measured straight lines (and angles) that do not geometrically close. This lack of geometric closure means that there is no geometric verification possible with respect to the actual positioning of the traverse stations. Accordingly, the measuring technique must be refined to provide for field verification. As a minimum, distances are measured twice (once in each direction) and angles are doubled.

In route surveys, positions can be verified by computation from available property plans or by scale from existing topographic plans. Directions can be verified by scale from existing plans or

by observation on the sun or Polaris. Many states and provinces are now providing densely placed third- and fourth-order horizontal control monuments as an extension to their coordinate grid systems. It is now often possible to tie in the initial and terminal stations of a route survey to a coordinate grid monument whose position has been precisely determined; when this is the case, the route survey becomes a closed traverse and is subject to geometric verification and analysis.

As was noted in Section 4.4, open traverses are tied together angularly by deflection angles, and distances are shown in the form of stations that are cumulative measurements referenced to the initial point of the survey (0 + 00). See Figure 6.3.

### 6.3 CLOSED TRAVERSE

A closed traverse is one that either begins and ends at the same point or one that begins and ends at points whose positions have been previously determined (Section 6.2). In both cases the angles can be closed geometrically, and the position closure can be determined mathematically.

A closed traverse that begins and ends at the same point is known as a *loop* traverse (see Figure 6.2). In this case the distances are measured from one station to the next (and verified) by using a steel tape or EDM; the interior angle is measured at each station (and doubled). The loop distances and angles can be obtained by proceeding consecutively around the loop in a clockwise or counterclockwise manner; in fact, the data can be collected in any order convenient to the surveyor. However, as noted in the previous chapter, the angles themselves (by convention) are always measured from left to right.

### 6.4 BALANCING ANGLES

In Section 4.4, it was noted that the geometric sum of angles in an  $n$ -sided closed figure is  $(n - 2)180$ . For example, a five-sided figure would have  $(5 - 2)180 = 540^\circ$ ; a seven-sided figure would have  $(7 - 2)180 = 900^\circ$ .

When all the interior angles of a closed field traverse are summed, they may or may not total the number of degrees required for geometric closure. As a general rule, the more precise the instrument being used to measure the angles, the less likely will it be that the sum of the angles will precisely agree with the correct geometric total