

**CHAPTER 14**  
**DRAINAGE CONSTRUCTION**  
**SECTION 67-LATERAL DRAINAGE**

1401. Lateral drainage includes:

- a. Road surface drainage by camber or crossfall, channels and grips (see para 19).
- b. Collection and removal by side drains to transfer or relief points.
- c. Discharge at transfer points, via culverts and outfall channels, into natural waterways.

**Road Surface Drainage**

1402. Camber and crossfall are dealt with in Section 12. Recommended slopes are given in Table 3.8.

1403. Grips are cut at an angle of about  $60^\circ$  through shoulders which form a raised verge.

Width .. .. 4 to 6 ins.

Depth .. .. as required to empty roadside channels.

Gradient .. .. about 1 in 16 fall towards side drain.

Spacing .... depending on local conditions: normally at about 150 ft intervals.

**Side Drains**

1404. Side drains are cut parallel to the roadway, outside the shoulders, on one or both sides. The invert level must be not less than 18 ins below the underside of the road pavement. The longitudinal gradient is normally that of the carriage-way, but a minimum of 1 in 150 is desirable. Slopes exceeding 1 in 20 lead to scour and erosion unless check dams or cascade drainage are employed (see Figure 14.1).

1405. Typical side drains are shown in Figure 14.2. Side slopes must not be steeper than the angle of repose of the soil where saturated. The minimum practical size for ditches cut by excavator is 2 ft deep by 2 ft wide at the bottom. Trapezoidal or V-shaped drains are normally used on military roads, as they are readily cut by grader.

1406. Drainage of cutting. Effective drainage is vital. Side drains must be of ample size, with a sufficient gradient to remove water quickly.

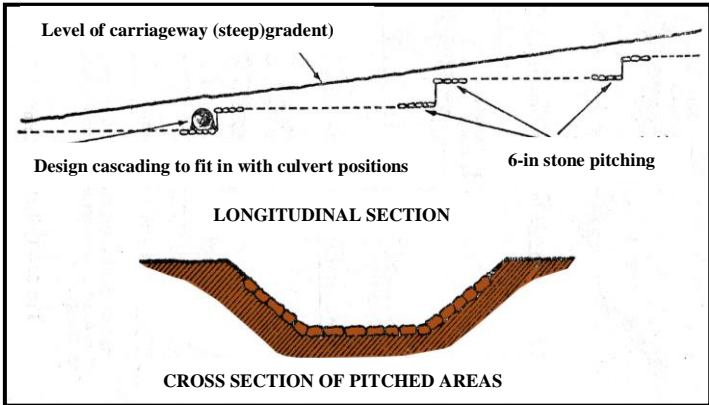


Figure 14.1: Cascade Drainage

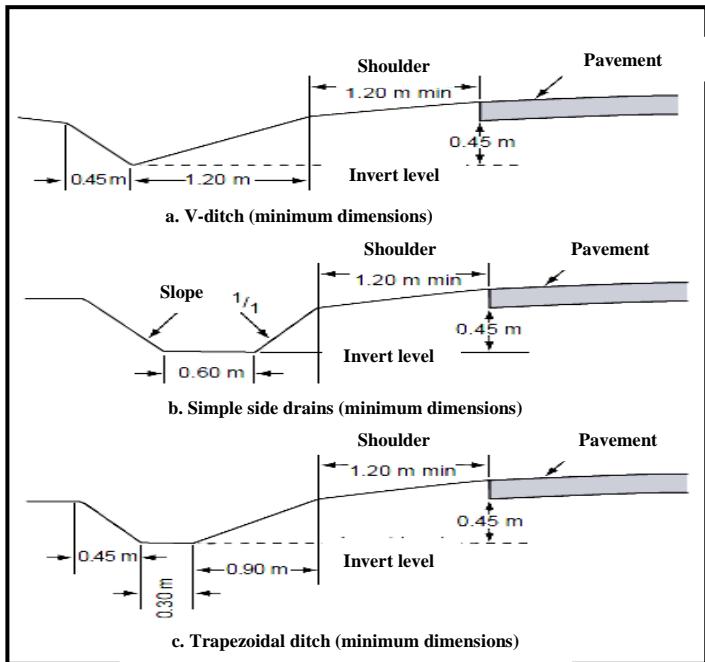


Figure 14.2 (a): Typical Side Drains

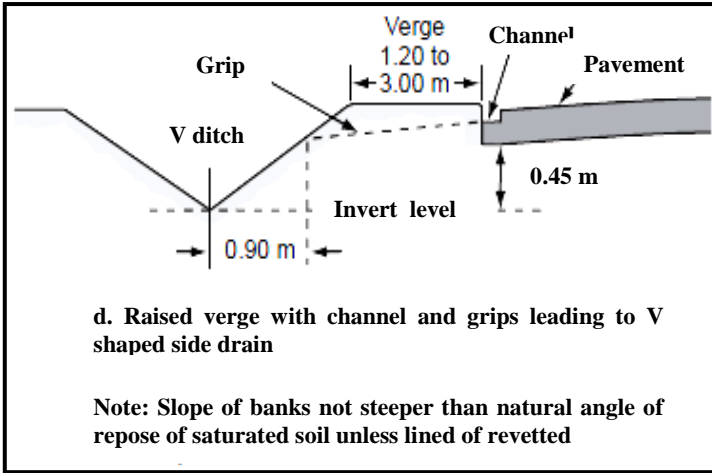


Figure 14.2 (b): Typical Side Drains

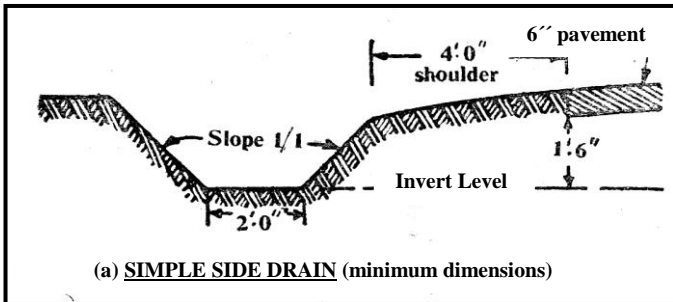


Figure 14.2(a): Typical Simple Side Drains

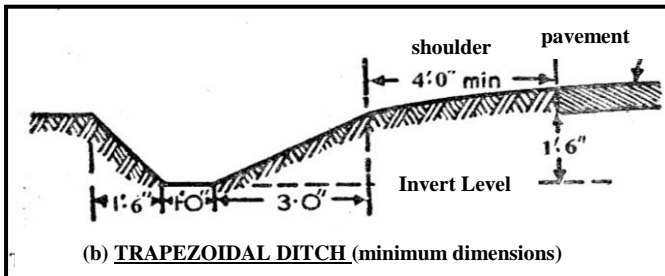


Figure 14.2 (b): Typical Trapezoidal Ditch

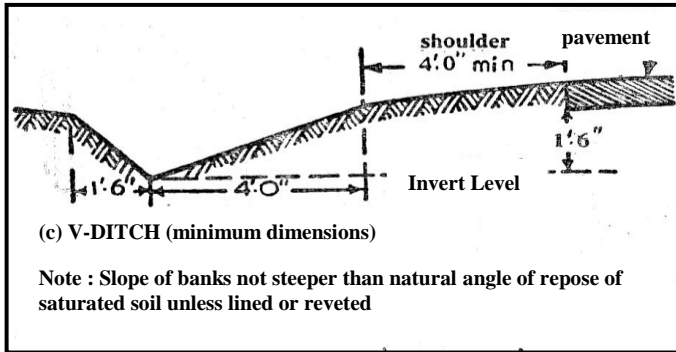


Figure 14.2 (c): Typical V-Ditch

In through cut, shoulders are sometimes omitted to reduce earthwork; side drains must then be backfilled with coarse granular material and their size must be increased accordingly. In side-hill cut, all drainage is carried on the inner side of the road, discharging through culverts under the road.

1407. **Drainage of embankments** - (see para 131) Side drains at the bottom of the bank should be not less than 6 ft from the toe of the bank. They must clear quickly to avoid percolation under the fill.

**Ditching with earth-moving plant**

1408. **Graders.** Graders are very efficient for cutting V-shaped or trapezoidal ditches in normal country. Method of operation is described in RESPB No. 5c, Section 12. The motor grader is virtually useless for trimming existing ditches which are wet or muddy, but the tractor-towed grader excels at this task.

1409. **Crawler equipment.**

a. The tractor-drawn killifer plough will cut V ditches, but hard ground should be loosened by a rooter before ploughing. The maximum size of trench cut by the killifer plough is 26 inches deep, 12 inches wide at the bottom, and 48 inches wide at the top.

b. Angledozer can also shape rough drains (see RESPB No. 5c, Section 7) but in hard ground considerable hand trimming will be necessary.

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1410. Excavators. The dragline is suitable for clearing and widening existing ditches and it can also be used to cut either shallow ditches with roughly vertical sides or deep ditches with battered sides (see RESPB No. 5c, Section 24). The back acter is best employed for deep trenches with vertical sides (see RESPB No, 5c, Section 22) and it is also useful on curves where the dragline cannot operate. Transfer points and outfalls

1411. Side drains are relieved by spilling into and outfall drain, normally at culvert sites. Advantage must be taken of all natural waterways, which may need widening and regarding to improve the rate of disposal. Catchpits are usually advisable at junctions where the direction of flow is changed. Culverts are dealt with in Section 132.