Forestry Note:

A HANDY GAUGE FOR FOREST AND FARM ROAD CONSTRUCTION MEASUREMENTS

This Forestry Note describes a simple, low-cost gauge for slope and height measurements to use when constructing dips, installing culverts and properly sloping road surfaces.

Accurate measurements are needed when constructing a forest or farm road to insure good drainage and low maintenance costs, and to minimize soil erosion (Figure 1).

Figure 1. Forest road with good surface drainage

Road Dips

Dips are used for surface drainage of outsloped roads and for cross-drainage of crowned roads. On-site measurements of height and slope are needed in constructing dips (Figure 2).

Figure 2. Dip slope and height measurements

Figure 3. Where dip height is too low, high water may flow over the berm and cause erosion

Figure 4. The trough of the dip is eroding because the slope is too steep (over 3% average)

Figure 5. The trough of the dip is filling in because of too little slope (less than 3% average)

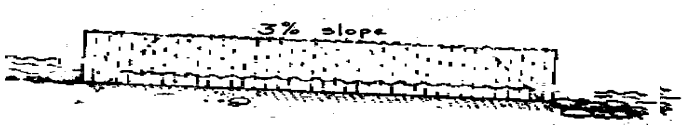


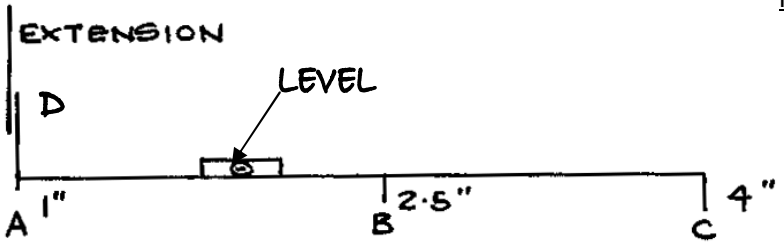
Figure 6. Proper culvert slope of 3 percent is needed to prevent plugging and to minimize erosion at the outlet.

Figure 7. Ruts will develop quickly on roads with too little crown to provide good drainage.

Constructing the Handy Gauge

A basic measuring device is easy to make that will simplify layout of road drainage practices. The "Handy Gauge" (Figure 8) is made of 1 by 2 lumber and a carpenter's hand level. It consists of a 100-inch bar of 1 by 2 with end cross pieces, a middle leg and a carpenter's level taped to the bar. The leg lengths A (1 inch), B (2.5 inches long and attached in the center of the bar), C (4 inches) and D (1 foot) provide for determining a culvert or dip slope of 3 percent and a dip height of 1 foot. A standard 8-foot length of 1 by 2 may be used for the bar. In this case, the length of leg C should be 3.9 inches.

Figure 8. The Handy Gauge



When the gauge, as constructed, is placed on the ground on the shorter end legs, the ground slope is 3 percent when the gauge is level. The middle leg B can be attached temporarily, and is used in measuring the slope of a crowned road surface.

Dip and Culvert Measurements

To measure dip height, place the long leg of the gauge in the trough of the dip, with the bar resting on the dip crest. The dip is 1 foot in height when the bar is level (Figure 9). For heights greater than 1 foot, clamp the extension (shown in Figure 8) to the long leg D with a C-clamp. Where the distance from the crest to the trough of the dip is greater than the length of the bar, the bar should be held level and the height then estimated.

Figure 9. Measuring dip height with a Handy Gauge

To measure slope, place the gauge with the end of leg C at or near the lower end of the drainage trough. The slope is 3 percent when the end of leg A rests on the ground and the gauge is level (Figure 10).

Figure 10. Measuring culvert bed slope

Measure the slope of a dip trough in the same manner described above.

Measuring Road Surface Slopes

Depending on topographical location, soils, wetness and use, road surfaces may be insloped, outsloped or crowned to facilitate drainage (Figure 11). In any case, the side-to-side slope of the surface should be about 3 percent.

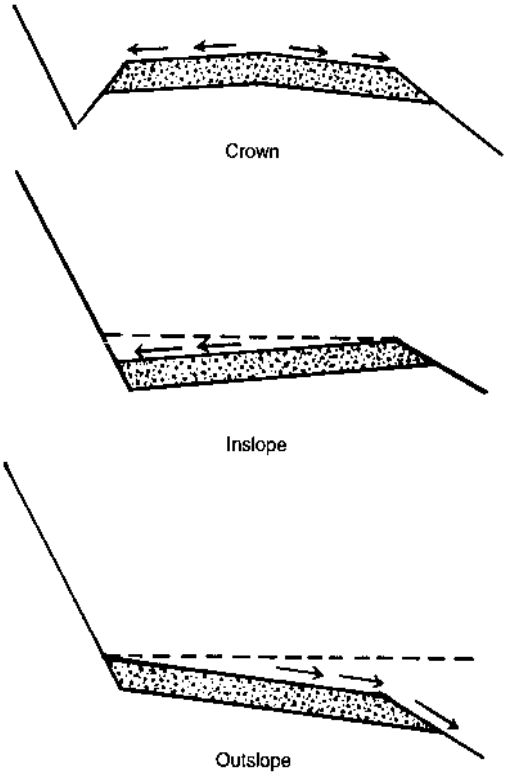


Figure 11. Typical road surface configurations

In measuring surface slope of an *insloped* or *outsloped* road, use the gauge in the same manner as when measuring the slope of a dip or culvert. Leg C is placed on the shoulder of the road with the bar across the roadway (Figure 12). The slope is 3% from leg A to leg C when the gauge is level.

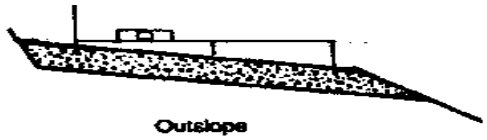


Figure 12. Measuring grade on an outsloped road

The gauge using leg B (Figure 13) is designed to measure and establish a slope of 3 percent on a *crowned* road with 10 feet of running surface. The slope is 3% from leg B to leg C when the gauge is level.

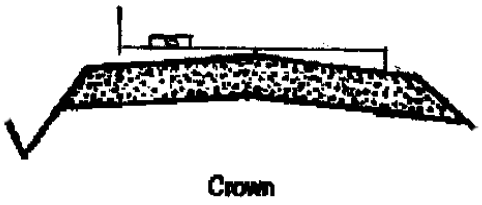


Figure 13. Measuring slope on a crowned road

The gauge can be used for slopes more or less than 3 percent by changing the length of leg C. Leg C can be lengthened by using the extension piece attached with a C-clamp. A 0.5-inch change in the length of leg C changes the slope 1 percent between leg B and leg C.

Other Information Sources

A Handy Gauge for Forest and Farm Road Construction Measurements is part of a series of Forestry Notes on stream crossings and forest road Best Management Practices (BMPs) produced by the Oklahoma Department of Agriculture, Food, & Forestry - Forestry Services Division.

.Additional Forestry Notes in this series include:

- Introduction to Road Stream Crossings
- How to Install a Forest Road Culvert
- Designing and Constructing Large Rocked Fords on Forest Streams
- Constructing Small Rocked Fords on Forest and Farm Roads in Oklahoma

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Additional information on this and other forest road BMPs is available in the other Forestry Notes of this series, in videos produced by Forestry Services and in the OSU Extension handbook *Best Management Practices for Forest Road Construction and Harvesting Operations in Oklahoma* and a publication by the USDA Natural Resources Conservation Service, *Woods Roads*. These materials may be available at local offices of Forestry Services, the OSU Cooperative Extension Service and the Conservation Districts.

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Your Number One Source for Forestry Information in Oklahoma

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