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).

**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 1. Forest road with good surface drainage

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)
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.

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).
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.

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.

![Outslope](image)

**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.

![Crown](image)

**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

This Forestry Note was originally produced as an output of Oklahoma's Water Quality Program, under the oversight of the Oklahoma Office of the Secretary of Environment and the U.S. Environmental Protection Agency. Its revision was partially funded by a Section 319 Clean Water Act grant provided by the Oklahoma Conservation Commission. The primary authors were John Norris, Staff Forester and Dr. Robert Miller, Forest Hydrologist.

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.

www.forestry.ok.gov
Your Number One Source for Forestry Information in Oklahoma

Forestry Services Division
Oklahoma Department of Agriculture, Food, & Forestry
2800 North Lincoln Boulevard
Oklahoma City, OK 73105-4298
405-522-6158


500 copies of this publication were printed and distributed at a cost of $250 in February 2009 by the Oklahoma Dept. of Agriculture, Food, & Forestry as authorized by Terry Peach, Commissioner. Copies have been deposited with the Publications Clearinghouse of the Okla. Dept. of Libraries.