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Gentle-Grade Roads Mean Faster Skidding

Skidding is often an expensive operation. This is especially true in mountainous country where the terrain is difficult and skidding distances are usually long.

The customary logging practice in many parts of the Appalachian region is to run skid roads straight up and down hill. This is both inefficient and destructive. Roads wash out during heavy rains; watershed values are damaged; and shut-downs are necessary when the steep roads become slick and soft with rain or snow.

Our experimental logging operations on the Fernow Experimental Forest have yielded considerable evidence to indicate that watershed values can be preserved and logging costs can be reduced by carefully laying out the skid roads at gentle grades up the slope.¹ With such a planned skid-road system, the total mileage of road required to log a given area may be much less. Also, we believe, the total skidding time may be less than by the old straight-up-and-down methods.

In planning such a skid-road system, one of the practical questions that arise is: what is the ideal grade for skidding, considering both the incoming loaded and outgoing empty trips? That is, on what percent of grade can the skidder safely travel the fastest in terms of average round-trip speed?

To answer this question, at least for our particular skidding equipment and conditions, a time study was made on a commercial-sized logging operation on the Fernow Experimental Forest. Skidding times were recorded over bulldozed roads of various grades. These ranged from uphill grades

¹Weitzman, Sidney. Mountain logging. South. Lumberman 185 (2321): 199-202, illus. 1952.

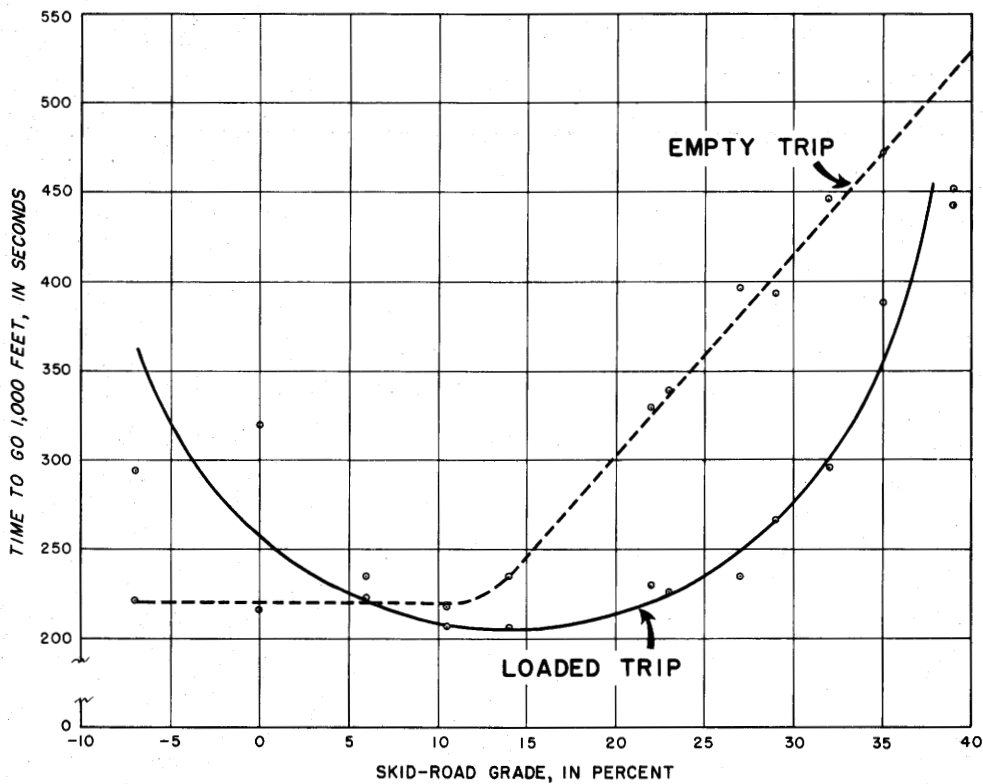


Figure 1.--Average time for tractor and sulky to travel 1,000 feet on skid roads of various grades.

(from cutting area to landing) of 7 percent to downhill grades of 39 percent. A TD-9 tractor equipped with winch and a rubber-tired sulky was used. The loads (the average run for the operation) ranged from 610 to 1,410 board feet. Times were kept separately for empty and loaded trips. A total of 78 observations on empty trips and 45 observations on loaded trips were taken. The average time required to cover a specified distance--1,000 feet--was plotted against grade percent separately for empty and loaded trips (fig. 1).

For the loaded downhill run, the most efficient grade was about 14 percent, but there was little difference in skidding time between grades of 6 and 27 percent. For grades of less than 6 percent the time increased rapidly because of increased friction. For grades of more than 27 percent, the time increased rapidly because greater care had to be taken to prevent the load from getting away.

For the empty uphill run, the tractor was able to operate at top speed on grades up to about 12 percent. For steeper grades the rate of speed decreased rapidly.

From the two curves derived from these data (fig. 1), a table was prepared listing the time required to make a round trip for various grades (table 1). Skidding was fastest when the loaded trip was on a down-grade of about 10 percent. However, there was little difference in round-trip times within the range of 5- to 15-percent grades.

Table 1.--Average time needed to skid a distance of 1,000 feet on roads of various grades

Grade of skid road (percent)	Empty trip	Loaded trip	Round trip
	<u>Minutes</u>	<u>Minutes</u>	<u>Minutes</u>
-5*	3.7	5.3	9.0
0	3.7	4.2	7.9
5	3.7	3.7	7.4
10	3.7	3.5	7.2
15	4.1	3.4	7.5
20	5.0	3.6	8.6
25	6.0	3.9	9.9
30	6.9	4.6	11.5
35	7.8	5.9	13.7

* Negative value is for grades running uphill from the cutting area to the landing.

The data presented here are averages for a range of load sizes and road conditions. Although these factors doubtless affect skidding speed, not enough observations were obtained to provide reliable quantitative estimates of their effects. Despite these shortcomings, the data provide a good general picture of how skidding speed varies with grade. They also show rather conclusively that average skidding speed over a given distance is faster on gentle grades of 5 to 15 percent (downhill with the load) than either on the level or on steeper grades.

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