

## Machine Operations on Slopes

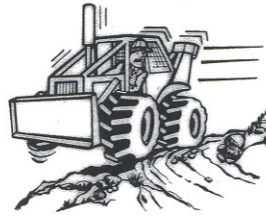
All machines have limits for the slopes on which they can safely operate. The limits are measured as “percent slope” which is a ratio of the difference in elevation divided by the horizontal distance and then multiplied by 100%. For example, a ground slope with a difference in elevation of 21 feet over 50 feet of horizontal distance would yield a 42% slope.

The effective slope felt by the operator and machine is influenced by the surface conditions of the terrain. In soft soils, one side of the machine may sink into the ground and steepen the effective slope. Likewise running the machine onto a log, stump or rock on the upslope side may increase the effective slope of the machine. Weak soils, icy or frozen soils limit the traction of machines and could restrict how machines travel on the slopes, perhaps creating hazardous machine positions.

The stability of machines depends on how the machines are constructed: tracks are generally more stable than wheels. Stability is affected by the attachments on the machines, eg, boom with circular sawhead, and the type and size of loads handled, eg, tall, heavy trees.

Machine purchasers will need to determine how the overall machine performs on slopes, including the attachments. Oregon’s Forest Activities Safety Codes call for guarding on forest machines and vehicles to protect operators (using seat belts) from the hazards they are exposed to in their work (437-007-subdivision H).

The hazards of operating on slopes include completely overturning the machine or tipping the machine on its side. The speed of operations influence how likely accidents might happen and the seriousness of the accident. The way loads are handled, carried or pulled also makes machines more or less stable.



Guidelines for slope limits are below and when necessary to operate on slopes steeper than recommended, safety precautions are outlined (from OAR 437-007-0935).

- (1) Machines must not be operated on slopes in excess of the following limits unless specified by the manufacturer.
  - (a) Rubber-tired skidders – 30 percent.
  - (b) Crawler tractors, tracked feller bunchers, tracked excavators and loaders – 40 percent.
  - (c) Forestry equipment designed for steep slopes – 50 percent.
- (2) Operation in excess of the limits may be permitted for specific limited application or in identified small areas provided the operator and the competent person plan how to safely operate on the steep slopes considering the:
  - (a) Experience of the operator.
  - (b) Limitations of the machine, the soil conditions.
  - (c) Direction of travel (traveling straight up and down the slope).
  - (d) Requirements for turning the machine or vehicle on the slope.
  - (e) Weather.
  - (f) Load sizes.
  - (g) Any other adverse conditions.

Safe operation on slopes is the overall goal!

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