

PennDOT LTAP  
**technical**  
INFORMATION  
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## GRADER OPERATION AND SAFETY TIPS

A good operator takes care of his or her machinery to ensure personal safety and maximize the service life of the machine. The following actions should occur:

- Make a walk-around inspection of the machine.
- Perform regular lubrication and maintenance.
- Confirm the fire extinguisher is properly charged.
- Keep all warning devices operational and in good condition.
- Inspect under and around the machine for such items as loose or missing bolts; trash build-up; cut or gouged tires; damaged hydraulic lines or hoses; and oil, fuel, or coolant leaks.
- Inspect the condition of the moldboard.

**Think of the roadway as a work site.** A safe operator will wear all required personal protective equipment when in the field, including:

- Hard hat
- ANSI-certified high-visibility safety garment
- Long pants
- Lightweight shirt with 6-inch sleeve
- Boots with safety toe\*
- Hearing and eye protection\*
- Rain or cold-weather attire\*

\*As required

**A professional operator is prepared for the job,** carries a level and a shovel in good condition, and knows how to use them.

In addition, a qualified operator is properly trained to perform his or her duties:

- Reads the operator's manual.
- Always performs a pre-trip inspection.
- Cleans windows, lights, etc. and any debris from floor of grader.
- Does not let anyone ride along (inside or outside).
- Looks, then checks again, before backing up.
- Drives at a slow speed in congested areas.
- Gives the right-of-way to loaded vehicles.
- Watches for overhead dangers.
- Knows the work area: checks weight limitations, types of surfaces, and clearances.
- Reports defective equipment immediately.
- Stays focused on the job.
- Selects a safe parking area.
- Wears seatbelts.
- Wears proper personal protective equipment (PPE).
- Removes ignition key when leaving equipment.
- Grounds the blade when leaving the grader unattended.
- Uses colored flags at each end of moldboard when blading.
- Shifts the blade to center and locks it when parking.
- Is aware that boarding and exiting grader may put the operator in danger of slipping, tripping, or falling. Uses a three-point (two feet and one hand or one foot and two hands) approach when entering or exiting the cab.
- Communicates with traffic:
  - Uses flashing safety lights when blading.
  - Keeps headlights on whenever operating.
- Is alert to traffic waiting to pass, and provides the driving public with passing opportunities.
- Is alert to pedestrians and other traffic, including horse-drawn, bicycles, motorcycles, farm machinery, etc.



A good grader operator takes care of his machinery, thinks of the roadway as a work site, and is prepared for the job.



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- Erects all required work zone traffic control as outlined in PennDOT Publication 213, prior to conducting any work.

A courteous operator should always keep in mind that working on the road is for the benefit of the traveling public using it. Be courteous and a good-will ambassador for the municipality, appreciative of the fact that most drivers don't understand how difficult it is to do what you're doing.

## GRADING TIPS

- Remember, the end result is more important than the number of passes.
- Determine the desired result: Is the whole road being cut or only spots with potholes?
- Determine how many passes will be necessary to cut. This depends on moldboard length and width of road.
- Try to visualize where each windrow is going to end, so that material will not end up too far from the centerline. If too far from the centerline, material is difficult to get back without losing off toe or leaving too much in the middle for the next pass.
- Keep blade angle sharp enough to keep windrow closer to the middle.
- Set blade to desired crown and angle and then use blade pitch (roll) to control depth.
- If machine is spinning or taking too much material, roll back. If going too easy or not cutting enough material, roll forward. (Scarifier blades require a specific angle to keep teeth revolving.)
- Avoid a high shoulder or secondary ditch. Leaving a farrow in the travelled way will keep water on the road. Smooth the surface to the ditch line. Grade from the outside to the center.
- Try to cut berms and blend; don't blend sod and grass.
- Avoid leaves and pine needles etc. in the fall since they can cause problems by balling up.
- If too high on either side or unable to cut berm (too much undesirable material), shift blade to side for a few feet, then back, to cut through the berm, giving water an escape route.
- Work gravel surfaces when moist or after a light rain.
- If a beginner, use the simplest method: finish all cutting passes with the windrow as close as possible to center line; then, make a pass down the middle, distributing material as close as possible to equal on both sides of centerline, and then one pass each way to distribute the material across the roadway, feather the edge, and leave the cross-slope.
- Keep 4 inches of daylight visible on the outside edge of the moldboard. Maintaining this daylight will prevent a high shoulder (secondary ditch).
- If material isn't spreading wide enough (near desired edge), revolve moldboard slightly (while moving) to the outside.
- If material is spreading too wide (leaving a berm) revolve to the inside or roll moldboard back.
- If leaving too much material inside (too thick), roll moldboard back. This may make it necessary to turn the blade to outside to achieve desired width.
- Visualize what you want to achieve. If blade (moldboard) is set up

For more information or technical assistance on grader operation and safety, contact LTAP at 1-800-FOR-LTAP (367-5827) or [www.ltap.pa.us](http://www.ltap.pa.us).

*Information in this tech sheet is from the University of New Hampshire T2 Center.*

properly, only minor adjustments will be necessary.

- Know the controls of the grader so you can take advantage of its capabilities. Experiment with controls in areas where possible to do so.
  - Control speed. Going too fast will cause the grader to be unstable (chattering/hopping), which leaves corrugations. If you feel chattering, immediately change the angle for a few feet so blade can correct.
  - Use blade pitch (roll) to make feathering up to a bridge or pavement or ending a spreading pass much easier than trying to lift both ends of the blade and steer at the same time.
  - Raise or lower one end of the blade to create a slight opposite effect on the other end.
  - Shift table to the outside to lower outside edge and raise inside edge. Sometimes this can be useful and only requires moving one lever.
  - Try to minimize a hollowed-out blade, which makes cutting but especially laying out difficult.
  - Try to keep equal lengths of blade, regardless of length, outside the tires. This allows more equal distribution and prevents obstacles for passing motorists.
  - Keep in mind that the best time to use a York rake for removal of large stones is when traffic volume is low.
  - Recognize that most washouts occur because of improper drainage.
  - Make layers of gravel at least twice the thickness of the largest stone size. For example, if you add a 6-inch gravel course, the largest stone should be 3 inches.
  - Use high-quality crushed gravel to minimize problem washboard areas and achieve a tight, strong surface. Also, check soil quality in the base as well as the need for proper drainage.
  - During the spring or in wet weather, use quality gravel instead of sand to correct problem wet areas.
  - Remember that an unpaved or gravel roadway requires additional cross-slope to facilitate water movement across the rougher surface than a paved roadway. The typical cross-slope of an unpaved or gravel roadway is 4 to 6 percent or  $\frac{1}{2}$  to  $\frac{3}{4}$  inch per foot in contrast to 2 percent or  $\frac{1}{4}$  inch per foot for a paved road.
  - Instead of disturbing the entire roadway to correct occasional potholes on an otherwise sound gravel surface, patch with a 50/50 mixture of crushed gravel and calcium chloride, sprinkle with water, and tamp.
  - Establish a schedule for periodic inspection and resurfacing to all gravel roads.