

Michigan has an extensive system of OHV trails. Most of the trails originated as motorcycle paths specified to be 24 inches (60 cm) wide on the ground and 40 inches (102 cm) clear at handlebar height. Michigan's soil is generally light and sandy. Under heavy use, OHV trails tend to form whoop-de-doo. With the increasing numbers of ATV's, many trails have been widened to 50 inches (127 cm) clear from the ground up. To a large extent, they retain the tight turns and steep slopes of the original paths.

The Cycle Conservation Club of Michigan is a user group with great involvement in developing and maintaining OHV trails. When funds became available from OHV license fees, club chapters under contract with the Michigan Department of Natural Resources developed and marked many more loops and connecting trails.

By 1989, it became apparent that the whoop-de-doo were a threat to the future of the trail system. Club members began developing trail-grading equipment suited to Michigan. To meet the specifications for motorcycle trails, they chose a compact diesel four-wheel-drive tractor under 40 inches (102 cm) wide and built a grader box and roller that were just 24 inches (61 cm) wide. The grader box is carried between a centerpoint hitch on the lower links of the tractor and a ballast-filled roller in the back. The box has a cutter blade in front as well as a scraper blade in back. The box is suspended like a landplane between the back wheels of the tractor and the rear roller. When the tractor and the roller drop down into hollows in the trail, the grader box cuts into the hump between them. The roller is also steered by a master cylinder-slave cylinder system so that it follows in the tracks of the tractor around tight turns. The complete machine is called a TrailPlane.

In addition to the original 24-inch (61-cm) TrailPlane, the club has developed a 39-inch (99-cm) unit pulled by a 43-inch (109-cm)-wide tractor for motorcycle trails that have begun to be used by small ATV's. For trails that have been officially widened for 50-inch (127-cm) ATV's, the Michigan Department of Natural Resources Forest Fire Experiment Station built a 46-inch (117-cm)-wide unit.

The Michigan DNR's version (Figures 23a and 23b) is towed by a four-wheel-drive Ford Model 1715 tractor. This tractor was selected because it provided the most power for tractors that could be reduced to a width of about 50 inches (127 m) wide. A front-mounted electric winch and limb risers were added to the tractor.

The DNR's system consists of a box grader, followed by a roller. The box grader is coupled to the tractor's three-point hitch with a torsion dampener arm. Adjustable root cutters are located on the box's front corners. An operator-controlled

hydraulic cylinder above the roller changes the box grader attack angle. Depth of cut is controlled by setting the hitch height. The minimum inside turning radius of the system is 48 inches (122 cm). The system's path width is 68 $\frac{1}{4}$ inches (2 m) for that turning radius.

On the trail, each TrailPlane requires a helper on an OHV (usually a motorcycle) to scout ahead for blowdowns and other obstacles. The helper can trim brush, replace signs, and assist the operator if the tractor gets stuck. Speeds average about 4 miles per hour (6.4 kilometers per hour).

Trail grading is always done in round trips, giving the trail at least two passes as the TrailPlane returns to the unloading point. The worst whoop-de-doo cannot be completely cut down in two passes. In such cases, the unit is turned around in the woods to give them extra passes. The best grooming is often done late in the fall, allowing the graded trailbed to consolidate over the winter.

The TrailPlane does not disturb the trailbed below the average grade, so it minimizes areas of deep loose sand, found frequently on Michigan's snowmobile trails that are leveled with road-grading equipment.

Cultipacker

The cultipacker (Figure 24), used in agricultural applications, was too heavy to be pulled by an ATV. It can be used with a tractor such as the SWECO 480. It can push small rocks down into the trail tread, and breaks up highly fractured or soft rocks. It provides very little compaction.



Figure 24—The cultipacker does not rate as a “must have” trail implement.

Box Scraper

Landscaping box scrapers (Figure 25) generally are too heavy to be pulled by an ATV, but can be pulled with a small tractor. With a skilled operator and several passes up and down the trail, the box scraper does a good job of leveling whoop-de-dos. Cutting the mounds and filling the depressions does not happen automatically as the machine goes down the trail. Constant monitoring and adjustments by the operator and frequent back-and-forth motions are needed.



Figure 25—This box scraper, cut down to a width of 3 feet (0.9 m), does a good job of removing whoop-de-dos, but requires a skilled operator and a tractor.

Rock Rake

A rock rake (Figure 26) cut down to a width of 3 feet (0.9 m) and mounted on a utility tractor worked well on the Wambaw Cycle Trail.



Figure 26—A 3-foot (0.9-m) rock rake proved to be another good tractor accessory.

provides fast and excellent grooming when pulled behind the tractor. A tine harrow can be attached behind the heavy-duty drag for a smooth finished trail.



Figure 27—Dick Dufourd inspects “Big Bertha.” Its aggressive cutting action and weight are too much for an ATV to handle, but it works great in sandy soil when towed by a tractor.

Heavy-Duty Drag

A John Deere 855 four-wheel-drive tractor pulls this heavy-duty drag (Figure 27) on straighter trails in open country on the East Fort Rock OHV area. Its weight and aggressive cutting action were too much for an ATV to handle, but it

Vibratory Roller

A compacted, groomed trail will last two to three times longer than one that has not been compacted. Dick Dufourd has found that a tandem drum vibratory roller (Figure 28) works best for compaction. The process is slow, and there must be adequate soil moisture for it to work well.



Figure 28—This Bomag walk-behind vibratory roller provides excellent compaction but is slow.

Sources and Contacts

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- MTDC engineering drawings: *MTDC-968, Trail Rake;*
 and *MTDC-969, Deschutes Trail Drag:*
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About the Authors

Brian Vachowski is a Project Leader specializing in recreation, trails, and wilderness projects at Missoula Technology and Development Center since 1993. He received a bachelor's of science degree in forestry from the University of Massachusetts in 1974 and a master's of science degree in outdoor recreation from Utah State University in 1976. He has worked for the Nez Perce, Bighorn, Winema, and Routt National Forests. Before coming to MTDC he was an assistant staff officer for wilderness and recreation on the Nez Perce National Forest.

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Appendix A—Equipment Checklist for the East Fort Rock OHV Area

EQUIPMENT CHECKLIST

Equipment Make/Model: _____

Operator: _____ Date: _____

In an effort to keep the equipment maintained, serviceable, and safe, operators should do a pre-ride and post-ride inspection and make a note of items that are loose, broken, malfunctioning, strange noises, etc. Except for tightening loose bolts before they fall off or obvious preventative maintenance, DO NOT make any adjustments or repairs to the equipment—especially carburetor, electronics, and transmission.

The following items should be checked daily:

• **ATV/Motorcycle**

Pre	Post	Remarks
_____	_____	Injector oil level (if applicable) or engine oil _____
_____	_____	Coolant level _____
_____	_____	Proper tire pressure (ATV 3-5 psi), and rim condition _____
_____	_____	Smooth, efficient operation of throttle and brake levers _____
_____	_____	Steering and suspension _____
_____	_____	Brake operation _____
_____	_____	Parking brake operation _____
_____	_____	Chain tension and drive train _____
_____	_____	Headlights, brake lights, and indicator lights _____

• **Trailer and miscellaneous equipment**

Pre	Post	Remarks
_____	_____	Tire pressure and wear _____
_____	_____	Bent axles, fenders _____
_____	_____	Spare tire _____
_____	_____	Trailer lights _____
_____	_____	Worn or broken tie-downs _____

• **Drags or other equipment**

Pre	Post	Remarks
_____	_____	Loose bolts _____
_____	_____	Loose or broken couplers _____
_____	_____	Broken welds or cutting edges _____
_____	_____	Loose or broken electronics _____

NOTES: _____

Appendix B—Trail Grooming Procedures for the East Fort Rock OHV Area

TRAIL GROOMING PROCEDURES

Trail grooming is a critical part of East Fort Rock trail maintenance. Due to our soft soils, moguls develop very rapidly. Once they reach a certain depth, not only is riders' experience decreased, but they will ride the edges of the trail and control of trail width is lost. Regular grooming will slow the development of the moguls and reduce the interval between reconstructions.

Equipment

- Fill out the Equipment Checklist before and after operating equipment.
- All quads use premium unleaded fuel.
- All quads must be operated in **4WD LOW RANGE** when dragging.
- The most effective combination to date is to groom with three drags in the following order:
 - First—grader bit, cutting bit, or other hard drag
 - Second—electric hard drag
 - Third—pasture drag (tine harrow)
- The objective is to move dirt, not make time. The most effective speed is about **3 to 5 mph** with a maximum speed of 7 mph. **Any faster than this will reduce effectiveness and tear up the equipment.**
- Dragging is tough on the equipment—if the quads get hot, stop and let them cool off.
- The Polaris quads are belt-driven. If a belt gets excessively worn, stretched, or burned, the quad will lose power, vibrate, or get very hot (or all three). To prevent this:
 - Engage the throttle gradually. Do not “grab a handful” or drag race.
 - Operate in **4WD LOW RANGE** when dragging.
 - Be sure the parking brake is off before accelerating.
 - If the drag gets hung up on a rock or stump, do not “gas” it to try to dislodge it. This can seriously burn the belt.
- **Do not** operate the quads with the headlights on, especially if towing the electric drags. It will drain the batteries.
- It is best to run four quads together so that the last one can help lift the pasture drag over obstacles or remove large rocks that are rolled up and may become a hazard.

Grooming Techniques

- Do not drag across gravel or paved roads. Raise the drags before getting to the road so that material is not deposited in the road. Creating a groove or leaving material in the road could become a liability concern. If there are extra people for rakers, rake in the groove in all nonpaved roads.
- Do not drag across cattle guards or grates, especially those used as trail counters. Raise drags before reaching cattle guard so there is not a mound before or in the cattle guard. Take a reading of trail counters before and after crossing.
- Drag slowly. Keep an eye on how well the drags are working and do not overwork the quads.
- Adjust the tongue and wheels so that material is cut off the top and deposited in the bottom of the moguls. The wheels on the electric drags should be down a little at all times.
- Raise the drags when crossing rocky or cobble areas to avoid damage to the drags.
- We do not want to over-maintain the trail. We want a trail experience, not a highway experience. It is important not to alter the intended difficulty level of the trail. Rocks add difficulty and interest to a trail, do not remove all of the rocks (or any of the rocks in some trails), only a rock that creates an unusual or unexpected hazard.
- If a rock or stick gets caught in a drag, stop and remove it so that a groove is not made in the trail, or equipment gets damaged.
- Avoid turning around and raise the drags if turning is necessary. Turning with the drags down can create a confusing “spur” for the riders and you may unknowingly be impacting a sensitive plant or cultural site.
- Your work is important and will be appreciated by hundreds of riders. Take the time and effort to do it right and be proud of what you've done.
- Just in case no one else says it: **Thanks for your help!**

Library Card

Vachowski, Brian; Maier, Neal. 1998. Off-highway vehicle trail and road grading equipment. Tech. Rep. 9823-2837-MTDC. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Development Center. 23 electronic p.

Describes light-duty grading equipment that can be pulled by an all-terrain vehicle to maintain wide trails and roads. Three pieces of equipment were tested on a sandy motor-cycle trail and a trailhead access road in the Francis Marion National Forest in South Carolina: a modified trail rock rake, a trail drag, and a commercial product, the Ultra Light Terrain Grader. All three pieces of equipment removed the washboarded "whoop-de-doo" in the sandy soil. Narrower equipment would have worked better on trails. The equipment worked very well on roads and offers an affordable alternative to heavier graders for light-duty use. Other trail-grading accessories and drags for small tractors are also described.

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