

Equip Tips

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ENGINEERING/TRANSPORTATION SYSTEM

Roto Trimmer Mobile Rock Crusher

BACKGROUND

Description

The Roto Trimmer mobile rock crusher consists of a two-component kit—a front rotary drum attachment and a rear power pack—that mounts on any suitable loader or grader (fig. 1). This produces a piece of heavy equipment, similar to a large roto-tiller, that can be used for road reconditioning. Since the rotary drum and the power pack weigh essentially the same (approximately 12,000 lb), the machine remains balanced. The Roto Trimmer components were developed by Crude Tool Works, Kenai, AK; they presently sell the kit for approximately \$196,500. The two kit components can be mounted or removed from a loader in under 12 person-hr.

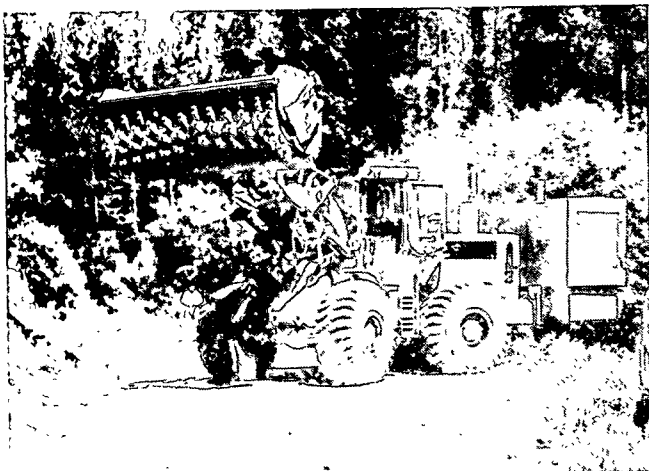


Figure 1. Roto Trimmer mounted on a "Cat" loader—rotary drum on front lift arms and power pack at rear; note the "before" condition of the road.

The rotary drum attachment has 184 carbide teeth that crush the rock and rip the earth as the drum rotates. Standard drum length is 10 ft; it can turn in the forward and fully reverse motion. Drum speed is 84 rpm forward and back. A tooth consists of a carbide tip in a knuckle holder. Teeth are easily removed with a forked tool or No. 4 rebar and hammer. A quick tap with the hammer installs a new tooth.

Teeth rotate after every strike to decrease wear. The cutter blade, used to break rock on impact, can be mounted forward or back.

Application

In Alaska, the Roto Trimmer has been both producing on-site gravel in permafrost tundra and recovering frozen oil spills. Triple Tree Inc., Missoula, MT, learned about the components and leased them from Crude Tool. They had a road maintenance contract with the Lolo National Forest, Northern Region (R-1) and utilized the Roto Trimmer on two 10-mi stretches. The Triple Tree contract cited Forest Service roads specifications sections No. 203.07 (Excavation and Embankment: Drainage Excavation) and No. 306 (Reconditioning Existing Road). San Dimas Technology and Development Center (SDTDC) personnel observed the mobile rock crusher in July 1990, during the initial stages of the Triple Tree contract. The Roto Trimmer had not been used previously as a road maintenance device.

A Caterpillar 966C front-end loader was used in the demonstration. The Roto Trimmer power pack included a Caterpillar Model 3406 (D-9) diesel engine, rated at 440 hp, and a hydraulic pump with reservoir and related hardware. The rotary drum attachment consisted of a drum with its 184 carbide teeth (fig. 2) set in a spiraled inward pattern and a 3-in, removable, solid-steel rear impact plate (fig. 3). The teeth crush the rock and rip the material as the drum rotates. The loose rock revolves counterclockwise to the impact plate, where it is smashed before landing. The drum can be raised for slope work.

DEMONSTRATION/EVALUATION Road Condition

In July 1990, work commenced on Forest Road 4249 in Gilbert Creek, Lolo National Forest. The machine required one operator. As seen in figure 1, the 14-ft wide, 0-4 percent grade, out-sloped road was in relatively good condition prior to the demonstration. The demonstration included rock types of ledgerrock, sedimentary argillite, and sedimentary quartzite; rock sizes ranged from 3-in plus to 10-in minus. Trimmer depths of 2-, 6-, 10-, and 12-in were demonstrated. The machine chewed right through all materials with

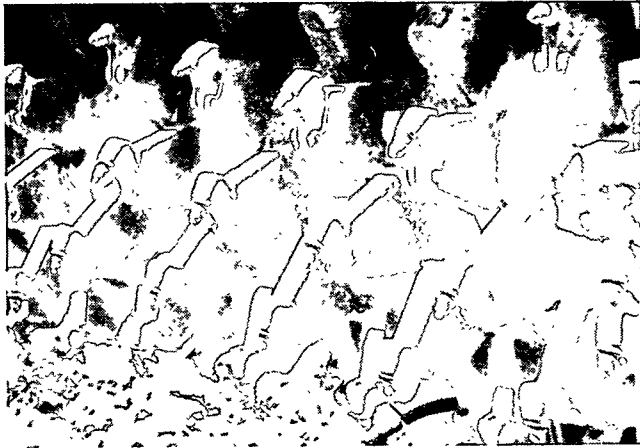


Figure 2. Rotary drum has carbide teeth in knuckle holders.



Figure 3. Rotary drum with carbide teeth and rear impact plate.

some oversize rock sidecast. Fine size will be determined from samples taken at the sites. A final surfaced road was not observed.

Operation

No preparatory work is required when using the machine, other than possible blasting of large oversize rock or outcroppings to save on machine wear. The optimal operational procedure found so far has been to drive the machine backwards downhill, virtually at idling speed, although the machine can work uphill or downhill. A 10-ft wide by 4- to 6-in deep pass is made, followed with another pass alongside for most roads over 10 ft in width. Small sidecast windrows are produced (fig. 4). These windrows are then re-ripped to produce a somewhat smaller fine size. A grader smooths the windrows, a water truck applies compaction water and controls dust, and a vibratory roller brings up fines and compacts the soil. This produced fines that met the 4-in minus fine size at 4-in depth specifications, with a few 6-in minus exceptions. The machine produced very little dust and noise and operated well in 95 °F heat, reaching only about 50 percent of system operating capacity.



Figure 4. Road after one 10-in pass; sidecasting seen to the left and windrow to the right.

Costs

Teeth are the only routine replacement item. Broken teeth are easily replaced at a cost of approximately \$2.20 per tooth. Average tooth life is 8 hr. Machine operating cost was approximately \$52 per 100 ft for the Roto Trimmer, a grader, a vibratory roller, and a water truck. The contractor is reluctant to estimate future operating costs based on their variability due to weather conditions and material hardness. However, it should be approximately \$450 per hr, with the Lolo National Forest contract running about \$4,000 per mi.

Modifications

The Roto Trimmer seems to be capable of ripping and crushing road surface rock and blending the resulting road surface material. Since this is a new application for the Roto Trimmer, it will take time to optimize the drum configuration and operational procedures. A front impact plate is being added for drum protection.

INFORMATION SOURCES

The information in this *Equip Tips* is based on limited field observation and is provided to disseminate preliminary information. For further details, you can contact:

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In the future, SDTDC and the Lolo National Forest will submit an article to the Forest Service's *Engineering Field Notes* to include sieve analyses and soil test results. SDTDC hopes to also determine productivity and efficiency for different soils. If you need further information on the progress of these efforts, contact:

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