

United States  
Department of  
Agriculture

Forest Service

Technology &  
Development  
Program

7700—Transportation Systems

June 1998

9877 1202—SDTDC



# FRONT RUNNER

## An Evaluation of a Front-Mounted Rock Rake



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## **An Evaluation of a Front-Mounted Rock Rake**



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**June 1998**

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## INTRODUCTION

In 1996 the San Dimas Technology and Development Center purchased four Front Runner front-mounted rock rakes for evaluation under actual working conditions on National Forest roads to see if the rake could be used for some road maintenance tasks previously done by a motor grader. The rakes were installed using a snowplow attachment on vehicles currently in service on the participating forests. The participating forests were not given any instructions on anticipated usage. Their only requirement was the trial period be documented; from initial installation to final removal at the end of the evaluation period.

The purpose of this report is to summarize the results of the evaluation and does not compare the rake to other road maintenance equipment previously tested. Manufacturer specifications are included in the appendix.

The Forests participating in this evaluation were:

Region 1	Idaho Panhandle NF, Idaho	Priest Lake Ranger District
Region 5	Angeles NF, California	Tujunga Ranger District
Region 6	Umpqua NF, Oregon	North Umpqua Ranger District
Region 8	G. Washington and Jefferson NF, Virginia	Mt. Rogers National Rec Area

## INSTALLATION

The rake installs to the front of a vehicle using a snowplow attachment (figure 1). The vehicle specifications, including snowplow attachments by Region, are included in table A.1 of the appendix. The instruction manual provided by the manufacturer is helpful and should be read prior to starting the installation. The rake weighs 600 to 850 pounds and therefore requires two people to perform the work safely. One test Forest used a hoist and fork lift to facilitate removal and mobilization of the attachment. A level area is needed to facilitate easy installation and removal of the blade. Problems encountered by the test Forests include; replacement of coil springs to increase the GVWR, replacement of a failed hydraulic pump with a larger size, resizing of an attachment to the rake. All problems were considered as minor.



*Figure 1. The rake installs to the front of a vehicle using a snowplow attachment.*

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## **PLANNED USE**

Each forest had planned to use the rake for specific tasks. Table A.2 in the appendix presents the proposed usage for the rake and tasks the rake actually performed during field evaluation. The actual usage varied in three out of four regions compared with the planned use.

## **FIELD EVALUATION SUMMARY**

The rake was assessed by the test Forests as an effective piece of equipment to supplement their road maintenance operations. It does however have limitations that need to be considered. A summary of the rake's performance and operation is shown below.

### **Road Surface Grading**

The effectiveness of the rake when grading the road surface depends largely on the moisture content and parent material of the road template. The rake worked well on native roads consisting of decomposed granite and other surfaces devoid of large embedded rocks (figures 2 and 3). Roads with very hard surfaces or moderately embedded rocks results in the tines "bouncing" over the surface. The rake's tines are spaced to allow passage of leaves, twigs and other small debris but effectively grades rocks and material larger than 1.5 inches in diameter (figure 4). The rake does not have the ability to shape road dips since it cannot "dig" deep into the subgrade nor does it have the mobility requirements necessary to shape the traveled way. It can do minor reshaping however, and is especially useful when a motor grader is unavailable.

The rake performed best when the road surface was damp. The strength of the tines is not sufficient to cut into hard and dry surfaces or when the surface is frozen. Additionally, the tines of the rake generate excessive dust when the road is worked in a dry condition resulting in reduced driver visibility and increased dust into the vehicle air intake system possibly creating reduced vehicle life (figure 5). Conversely, using the rake on road surfaces that have excessive moisture causes ruts from the weight of the truck. In one instance, the rake was used to eliminate deep ruts but consequently developed even deeper ruts after the vehicle passed over the wet surface.

### **Moving Large Material**

The rake could successfully move rocks with four- to five-inch diameters that were on the roadway. Rocks up to ten-inch diameter could be moved short distances and swept to the shoulder.

### **Equipment Operation**

Vertical movement and hydraulic angling of the rake are controlled from within the cab of the truck (figure 6). The controls are part of the snowplow attachment and can be electronically or hydraulically powered. The response rate to the controls is quick but does not have the smooth controls of a motor grader or other construction equipment.

*Figure 2. Road condition prior to use of rock rake.*



*Figure 3. Road condition after use of rock rake.*



*Figure 5. Dusty conditions encountered on dry road.*



*Figure 4. Leaves and debris on road.*



*Figure 6. Control panel in cab of vehicle.*

The rake is not visible from the cab of the truck. Markers on either side of the rake (figure 7) assist the operator in knowing where the rake is in relationship to the task at hand. The operators reported that the rake was easier to manage mounted on the front of the vehicle rather than on the rear of the vehicle.



*Figure 7. Marker on right-hand-side of rock rake as viewed from cab of vehicle.*

Effective use of the rake requires the enhanced traction and power offered by a 4-wheel-drive vehicle. One test Forest used a 2-wheel-drive vehicle instead of the recommended 4-wheel-drive vehicle and was unable to rake in the uphill direction on a moderately steep section of road. As a result, the operator was required to drive on the left side of the road to completely grade the road.

### **Work Force Application and Scheduling Flexibility**

Each forest reported that the rake fit their current needs; personnel who used the rake said they would continue its use. It is an inexpensive piece of equipment that does many things well and is a good fill-in between traditional maintenance equipment contracts. The rake is cost effective and available when needed.



*Figure 8. Raking horse trail.*

District personnel like getting jobs done without having to schedule heavy equipment. Road managers see some cost savings using the rake; however, the rake will not take the place of a grader when heavy work must be done.

Other tasks mentioned for the rake were: the removal of debris from horse trails (figure 8); landscaping; grading heliports; cleaning ditch lines; and opening roads after winter closure.

### **OPERATIONAL SAFETY**

The weight in the truck bed must be sufficient to offset the additional weight of the rake. Normal precautionary measures should be observed when doing any road maintenance work including warning signs and a pilot car if the road is heavily traveled. Rocks may inadvertently be kicked forward while the rake is working. Cross mirrors may help with the visibility of the tines and road shoulder when working near the edge of the road. The number of crew members depends on the vehicle operator. The use of a 2-wheel-drive truck by Region 8 was a concern due to lack of traction while working uphill and having to work facing on-coming traffic while making one of the two required passes to complete the job. The manufacturer states: Never travel on the highway with the wheels attached.

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## **COST OF OPERATION**

The cost of operating the rake varied between the forests testing the equipment. A general cross section of cost is provided in table A.3 in the appendix. This cost does not include the initial cost of the rock rake or the snowplow attachments which are about \$2,500.00 and \$2,300.00 respectively. Overall, the rake is 70 percent less costly to operate than a motor grader. However, the performance of the two pieces of equipment should not be compared. If the job to be accomplished does not require a motor grader, then the rake might be a viable solution.

## **RECOMMENDED MODIFICATIONS**

The following modifications were suggested by the test Forests to enhance the usefulness of the rake in a forest environment:

- Adjustable widths by adding or removing tines, or fold the extension when not in use.
- Longer tines on the ends to facilitate ditch cleaning.
- Two-stage pump on the snowplow for smoother controls. This could aid in grading dips.
- Lateral pitch adjustment while operating.
- Eliminate the H-frame to make the conversion from travel to operational mode easier.

## **CONCLUSION**

The test evaluations concluded that the rake was a good lightweight piece of maintenance equipment that has a place in most typical road maintenance operations. Although the rake can not be seen from the vehicle, the driver does not have to look back to monitor operation thereby improving safety and simplifying use. The control mechanism was rough but was sufficient to do the tasks required. Operational costs of a rake are 70 percent less than costs associated with a grader. However, the two pieces of equipment perform different functions and are therefore not directly comparable. The rake performed well on small tasks and repairs. There were no apparent adverse effects to the vehicle. The rake should only be used on roads with sufficient moisture. This is needed to reduce excessive dust which could cause damage to the vehicle air system and to facilitate easy penetration of the tines into the road surface.

## **ACKNOWLEDGMENTS**

The author would like to thank the following Forest Service personnel for their time and effort in evaluating the Front Runner. Without their input, effort, and review there would not be a final product.

Jerry Van Dyne, Tujunga Ranger District, Angeles National Forest, Region 5.

Paul Dore, Mt. Rogers National Recreation Area, George Washington and Jefferson National Forest, Region 8.

Dale Schrempp, Priest Lake Ranger District, Idaho Panhandle National Forest, Region 1.

Terry Dean, North Umpqua Ranger District, Umpqua National Forest, Region 6.

## MANUFACTURER INFORMATION

The rake used for this evaluation was the Front Runner.

### **Front Runner Corporation**

RR176 Trasker Hill Road

Conway, NH 03818

603 447-1811 or 800 447-2811

Available in three widths for truck mounted applications:

8 feet 1 inch

8 feet 6 inches

11 feet

An eighteen-inch extension is available that fits on either end of both eight-foot models.

Tines: 1.5-inch high carbon spring steel with one-inch spacing.

Weight: 600 to 850 pounds, depending on width.

Attached to vehicle by snowplow mounts.

# 8 TABLES

Table A.1. Configurations of test vehicles.

Region	Forest	Vehicle/Series	4WD	GVWR	Snowplow Attachment Used
1	Idaho Panhandle	Dodge 2500	yes	8510	Meyers E-Z Mount
5	Angeles	Dodge 2500	yes	8800	Fisher Minute Mount
6	Umpqua	Chevrolet 3500	yes	12000	Meyers E-Z Mount
8	Wash/Jeff	Chevrolet 3500	no	11000	Fisher Minute Mount

Table A.2. Planned vs actual usage by Region.

REGION	PLANNED USAGE	ACTUAL USAGE
1	Rock raking after blade grading; removing road and ground debris	same
5	Maintain 19-mile government residential road-residence vacated. Remove small rocks on paved and dirt road	Smooth dirt roads; removing ground debris; removing rock on paved and dirt roads. Grading parking areas
6		Grading and maintaining Level 2-3-4-roads and improving recreational sites.
8		Used on Level 2-3-4-roads for grading; lightly scarifying, repairing potholes; restoring road crowns. Remove debris; leaves; rocks from trails and access road to oil and gas leases.

Table A.3. Comparison of costs between front-mounted rock rake and motor grader.

<b>PARAMETERS</b>	<b>CONSTANTS</b>	<b>RAKE</b>	<b>MOTOR GRADER</b>
Work Day	10 hours		
Time to Complete	7 hours		
Total miles for task	40 miles		
Total miles completed with rake	5 miles		
Vehicle Operator (WG8)	\$20.00 per hour	\$200.00	\$200.00
4WD vehicle cost per mile	\$0.40	\$16.00	
4WD vehicle cost per day*	\$15.00	\$15.00	
Grader cost per mile	\$14.00		\$560.00
Grader cost per day**	\$45.00		\$45.00
<b>TOTAL</b>		<b>\$231.00</b>	<b>\$805.00</b>
Cost per mile		\$46.20	\$161.00
Cost per hour		\$23.10	\$80.50

Note: \*based on a fixed ownership rate (FOR) of \$300.00 for the 4WD vehicle.

\*\*based on a FOR of \$900.00 for the grader and 20-day work month for both.

**PROJECT PROPOSAL**  
**USDA Forest Service**  
**Technology and Development Program**

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Project Originator: \_\_\_\_\_ Name \_\_\_\_\_ Date \_\_\_\_\_

Title \_\_\_\_\_

Unit \_\_\_\_\_

Mailing address \_\_\_\_\_

DG address \_\_\_\_\_ Telephone \_\_\_\_\_

**Project Title:** \_\_\_\_\_

**Current Problem/Need**

Describe how work is currently being done; current problem/need, location; why improvement is needed.

**Proposed Solution**

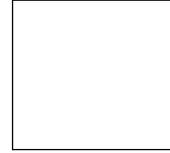
Describe your concept of the end product, i.e., new equipment design, video production, handbook, etc.

**Potential Benefits**

Describe how this product will improve safety, resource management; increase efficiency, customer satisfaction, productivity; reduce cost, time.

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Benefits	YES	NO	Amount
Improves safety	_____	_____	_____
Saves money	_____	_____	_____
Saves time	_____	_____	_____
Increases efficiency	_____	_____	_____
Other	_____	_____	_____

How effective or relevant is this information?

What would you change?

General comments: