

# Equip Tips

8771 1303  
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United States  
Department of  
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Forest Service  
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## Road Dust Monitor

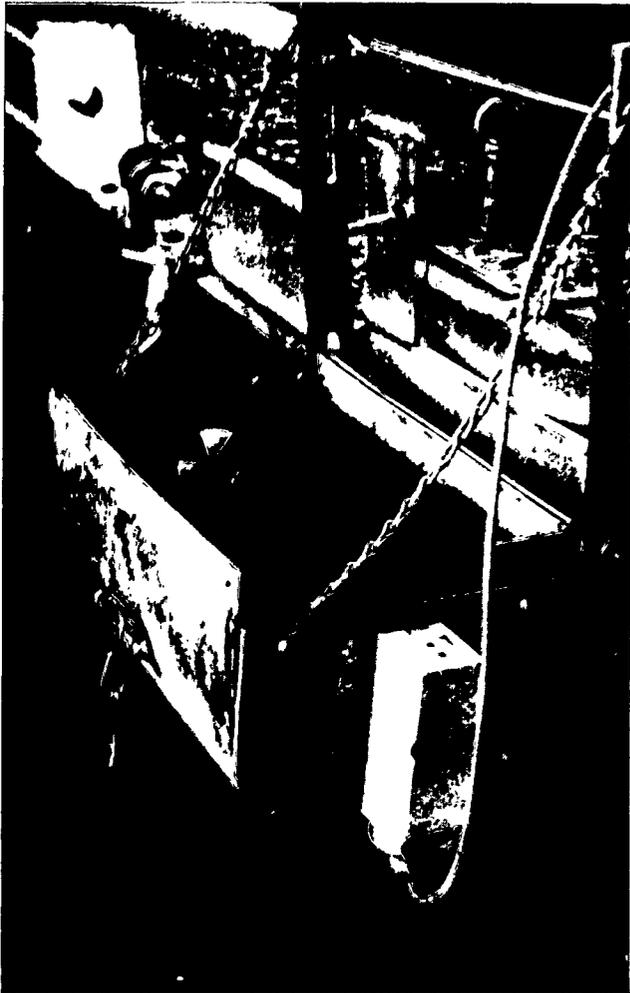


Figure 1. Road Dust Monitor mounted on pickup truck.

The Road Dust Monitor (RDM) is a device that provides a standard, repeatable quantitative method of monitoring levels of dustiness. A quantitative measure of road dustiness is a more reliable and repeatable approach to managing aggregate and native material road surfaces than the current qualitative method, which is based entirely upon human judgment and experience. The RDM consists of an 8- by 12-inch galvanized sheet metal duct, an infrared transducer mounted in the duct, and an instrument package with an indicating meter.

The duct and mounted transducer are positioned behind the rear tire of a ½-ton pickup truck (fig. 1). As the tire kicks up dust, the dust passes through the duct. The transducer

contains a light source and photoelectric sensor. The light beam shines onto a reflector and the reflected light is detected by the sensor. Dust passing through the duct scatters the light beam and reduces the amount of light reflected back to the sensor. The light that is not absorbed or scattered by dust particles is measured by the sensor and converted to a voltage displayed on the indicating meter (fig. 2).

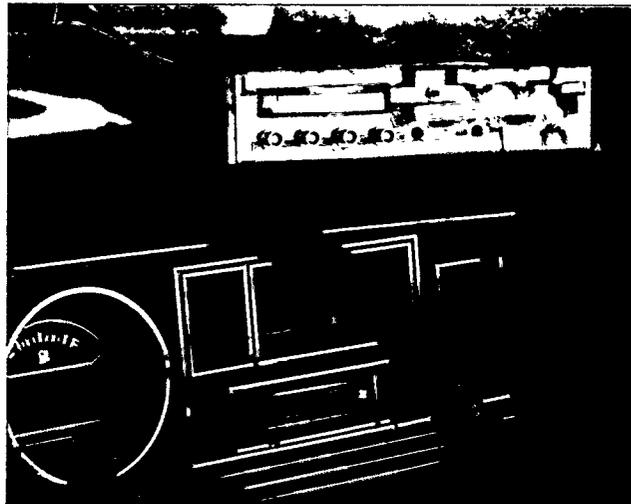


Figure 2. Voltage meter display mounted on pickup truck dashboard.

The RDM measures air opacity as the vehicle moves along the road. The instrument response curve (fig. 3) for a typical unpaved road indicates that air opacity varies from point-to-

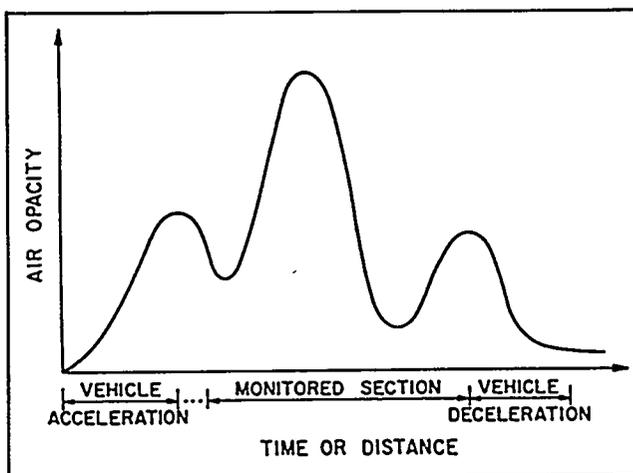


Figure 3. Monitor response.

point along the road. There are noticeable variations in the realtime readings—variable readings in spotted sunlight and shade; higher readings on curves; lower readings on upgrades—due to road variations. These inherent road variations, along with changes in surface material type, make it difficult to use a point response as a valid measure of dustiness.

Since variations along a road make a sector descriptor a better measure of road dustiness than a point response, we have defined an Opacity Index. This index is a weighted average of the dustiness for a section of road. The beginning and ending points of the section to be evaluated are defined; typically a length from ¼ to 1 mile, or so. Then, as the vehicle moves through the section, the instrument is turned on and dustiness is measured. At the end of the section, the vehicle is stopped and the Opacity Index is calculated.

Field tests on 13 National Forests revealed that people throughout the continental U.S. have different opinions regarding what level of air opacity is unacceptable. Figure 4 illustrates the range of opinion. The Opacity Index can be interpreted to represent the general acceptability of the dust level. Thus, when the Opacity Index is 10, about 10 percent of those interviewed would say the dustiness is unacceptable. On the other hand, when the Opacity Index is 90, about 90 percent of the observers would say the dustiness is unacceptable.

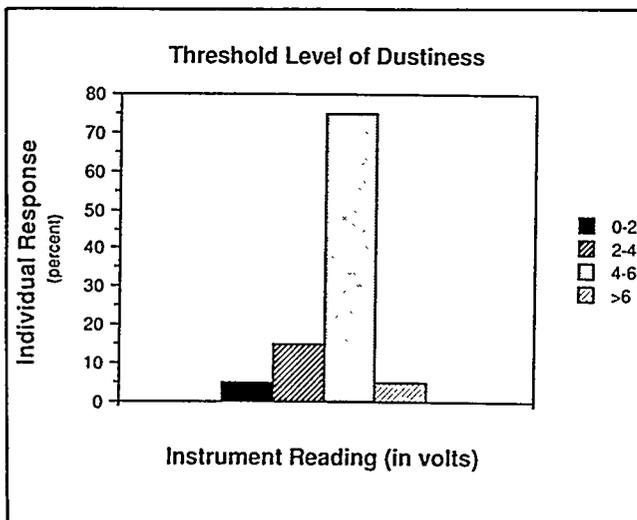


Figure 4. Individual responses to the threshold level of dustiness.

The following applications for an RDM were recognized after completion of the field tests:

- Incorporation of RDM usage into maintenance handbooks to encourage better budgeting and use of limited

available funds. Forests would be better able to determine which roads to include in the dust abatement plan. In addition, decisions could be improved as to when and where to dust abate or what speed to post when using reduced speed as a dust control method.

- Specification of a limiting Opacity Index in timber sale contracts to promote more uniform application of criteria from one National Forest to another.
- Use of the RDM could help (1) to evaluate the performance of various dust palliatives, and ultimately (2) to develop a list of recommended palliatives for a particular location.

A preliminary estimate to build the RDM's electronic box is \$1,500; an additional \$500 is the estimate for the sensor and duct work. The \$2,000 total is based on an order of 10 units. The unit costs should decrease with an increase in the quantity ordered.

Further information on the RDM can be found in the June 1987 Engineering Management (EM) report No. EM 7170-8, "A Device to Measure Road Dustiness on Aggregate-Surfaced Roads." A copy of this report can be obtained from:

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 Telephone No.: (703) 235-3111

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 Technology & Development Center  
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Direct any other inquiries you might have concerning the RDM to the San Dimas Technology and Development Center.