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Effective Information Management

The CHALLENGE

The challenge of sharing information can be a great one--in the Forest Service as anywhere. It seems there is always a barrier between those having information and those needing information. Among the greatest barriers we must overcome are restrictive attitudes and policies concerning information exchange--especially in-house information--and review processes that stifle creativity and mold information, over time, into obsolete data.

To create an atmosphere in which information can flow more freely, we first need to take a hard look at why the barriers exist and then how we can get rid of the unnecessary ones in our workplace.

RISK VERSUS CONTROL

First, effective management (no matter what we are managing) calls for us to examine risks and controls. Many agencies, including the Forest Service, have traditionally imposed strong internal controls (for example, review processes, the Directives System) in order to minimize risk (waste, loss, abuse).

In the present era of declining resources, however, the Forest Service is reevaluating the risk/control relationship with respect to its major activities. It is examining this relationship in order to manage <u>effectively</u> (that is, not overmanage or undermanage). As individual employees, it is just as important that we evaluate the risk/control relationship in managing our day-to-day activities, mindful of the level of risk we are willing to accept. In addition, FSM 1400 now makes it our responsibility to take a hard look at the controls we impose and to challenge them:

(1) Challenge the necessity of forms and reports.

(2) Challenge burdensome requirements imposed by external agencies.

(3) Challenge WO/RO processes that are better left up to Forest discretion.

(4) Challenge quality standards that are higher and more costly than needed.

Once we examine the controls we impose in relation to the risks we are willing to accept, we will probably find that, in many of our activities, we can reduce controls significantly--and maybe even eliminate some.

INFORMATION EXCHANGE ACTIVITIES

One example of the risk versus control relationship that all Forest Service Engineering units should examine is that of information exchange activities. With the growing importance of technology transfer throughout the Forest Service (see FSM 1320), and especially in Engineering, it is imperative that we be able to "use available technical data systems and supply input information to those systems" (FSM 7113) in as unencumbered a manner as possible. If we examine the level of control we impose on these activities, we may find that we sometimes actually hinder the fulfillment of the Forest Service technology transfer objective--"to promptly and efficiently apply," not control, "useful knowledge and technology" (FSM 1320). The many controls we impose, in relation to the few and small risks involved in exchanging Engineering information, are actually blocking the flow of the information we all need.

Having examined the risk/control relationship, we will find that we can, and should, begin to relax controls over much of the information we want to share. This should help free up those resources necessary for achieving results and making our agency more productive.

Applicability to EFN. For its part, the Washington Office Engineering Staff has examined the review process it uses for articles submitted for publication in Engineering Field Notes.

In the future, reviewers will check articles for appropriateness, policy, and accuracy as before; however, if they come upon any differences between an author's views and established policy, technical opinion, or accuracy, reviewers will simply attach an introductory paragraph explaining the WO-E viewpoint; the article will then be published with the introductory paragraph.

We believe this process will help get Engineering information into the hands of those who need it more quickly, with fewer resources being used to get it there, and, perhaps, with more than one viewpoint expressed.

SUMMARY

We encourage Forest Service Engineering units at all levels to critically examine their policies and attitudes toward controls--especially in the area of information exchange, and the systems they use for reviewing information that is to be shared--especially in-house. We will find, once we begin to impose only that control necessary to avoid unacceptable risk, that the process of exchanging information will become easier and faster, and that both the agency and the public will benefit.

D. Carroll, Editor

Removing Protruding Rocks From Roadbeds & Ditch Lines

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Forest Road No. 91 on the Monongahela National Forest in West Virginia is a 10.4-mile-long aggregate surfaced road that is designated as Maintenance Level 4. Maintenance Level 4 means that the road is designed for passenger car use and user driving comfort. Over the years, however, Forest Road No. 91 became a very rough road from frost heaves, surface erosion, increased traffic volumes, decreased maintenance, low standards of initial construction, and other contributing factors. Surface rocks and ledge outcrops protruded in many areas. The most effective way to improve the roadbed seemed to be to remove the worst protruding rocks, break up the large flat surface areas of exposed ledge, and apply 1-inch crusher-run limestone aggregate surfacing material where needed.

Three men spent 2 days walking the road and painting a green spot on the top of each rock or ledge section that needed to be removed. They numbered every tenth rock to make summarizing counts per mile and monitoring verification and removal rates easier. They identified a total of 1,405 rocks in this manner.

The contract specifications were kept as simple as possible and were only four pages long. Various methods of rock removal were initially considered feasible. Bids were expected to reflect costs involved in using a jackhammer or a hoe ram, hand tools, and possibly explosives to remove the rocks. Because the rocks had to be removed to only 3 inches below the existing surface, excavation was considered economical only for the very small rocks. An Engineer's estimate was prepared for the project that assumed that these methods would be used. Table 1 shows a list of the actual bids received with a comparison with the Engineer's estimate.

Table 1.--Bid opening results, September 21, 1984.

Source of estimate	Bid	Comparison with Engineer's estimate (percent)
Sunrise Construction Co., Inc.	$11,610.00	-45
Staunton Paving Company, Inc.	$16,500.00	-22
Sikora Construction Company	$16,695.00	-21
H. K. Belcher Contractors	$19,100.00	-9
Triple H. Construction	$20,600.00	-2
Williams & Rinker	$21,840.00	+4
Richard O. Harper	$21,986.00	+4
Rolan McQuain	$34,900.00	+66
Engineer's Estimate	$21,087.00	

The low bid originally was considered an error, but the contractor verified that the bid was realistic and that he intended to make a fair profit on the project. Because the Forest Service had no other basis for rejection, the award was made on September 28, 1984.

Michael Cunningham was Contracting Officer for the project, Thomas Sanders was the Contracting Officer's Representative, and Clarence Arbogast was designated Project Inspector. The contractor attended the prework conference on October 9 and was ready to start work the following morning. The contractor used a crew of six very hard-working and capable men. The job foreman worked along with his crew as a laborer and coordinated activities. Work progressed in a smooth and orderly manner, and all work was completed in only 6 working days. A final inspection and project acceptance was completed on October 17. The two primary reasons for the success of this project were that the contractor had his equipment, materials, and labor lined up in advance so that he did not lose any time and that he selected a mix of equipment to handle the job.

The contractor used one piece of equipment no one else had considered--a Vermeer rock cutter saw (see figure 1), which is used primarily for cutting grooves in concrete pavements. The contractor used the saw most effectively in areas with heavy rock

Figure 1.--Vermeer M-475 equipment with rock cutter saw, dozer blade, and backhoe bucket ttachments.

concentrations or ledges. Table 2 gives a breakdown of the various types of equipment actually used on the project and an estimated percentage of rocks removed with each type.

Table 2.--Breakdown of equipment and rocks removed by each type.

Equipment type	Estimated percent of rocks removed	Estimated number of rocks removed
Vermeer M-475 rock cutter saw	40	562
Jackhammer	30	422
Case 580 backhoe	25	351
Hand tools	4	56
Vermeer M-475 dozer blade	1	14
Total	100	1,405

Generally, any rocks not easily removed by hand tools or with the backhoe were broken up and removed with the jackhammer. The bigger rocks, clustered groups of smaller rocks, and most of the ledge areas were shaved to at least 3 inches below the existing grade with the Vermeer saw (see figure 2). The Vermeer front-mounted dozer blade was used in only one area of continuous ledge that was fractured enough to be rippable. A total of 78 tons of 1-inch crusher-run limestone was used to fill all the holes resulting from the rock removal process.

The Vermeer saw was rented from Rick Farrens, Manager, Vermeer Sales and Service of Southern Ohio, Inc., Washington Court House, Ohio 43160; the telephone number is (614) 335-8571. The rental rate was $1,000 per week plus the replacement cost of the cutter teeth. The 108 carbide-tipped teeth on the blade cost approximately $5.00 each, and the contractor went through about one and one-third times the life of the teeth. He completely replaced the teeth once toward the end of the project.

Although this rock-removal contract was considered successful, it was the first of this kind on the Forest and some changes should be considered for future rock-removal procedures:

(1) For esthetic reasons, green paint was used to mark the rocks. White paint would show up better.

Figure 2.--Before and after photos of the Vermeer M-475 saw cutting into a section of exposed ledge rock. The circular blade can swing sideways while rotating to gouge a wide groove.

(2) The road was closed to through traffic. For a satisfactory alternative, post signs warning of road machinery and limit traffic delays to no more than 30 minutes. (Most traffic delays would be 5 minutes or less.) Prevent persons and vehicles from approaching the operating Vermeer saw and possibly being struck by flying rock chips.

(3) The contract was awarded at the start of the fall foliage season, and partial leaf cover on the roadbed made some painted rocks more difficult to locate. Although numbering every tenth rock allowed for quickly verifying that all rocks were found, working in the spring or summer during a low-use period would have been easier.

(4) Only excavated holes were backfilled with 1-inch crusher-run limestone. The contract also should have provided for filling existing potholes as well.

(5) Several of the ditch lines had ledge outcrops that were fairly continuous for 10 to 100 feet. Although paint spots marked various sections of these outcrops and they were adequately removed, it would have been more practical to have a separate payment item for ditch excavation and pay on a linear footage basis.

(6) A few short sections of roadbed that consisted of fractured ledge were difficult to mark with the individual rock count method. A more practical approach might be stationing or road length measurement to identify the location and a contract provision to remove all rocks of a certain size or surface area within that marked section.

The average cost to remove each rock or section of ledge and replace it with suitable backfill material was $8.26 ($11,610/1,405 rocks). Considering the resulting improvement of the road surface, this appeared to be a bargain. The rock-removal procedure not only immediately improved rider comfort, it also provided the long-term benefit of a more easily maintainable surface. The road can be graded more efficiently and effectively. Better crowning or insloping and removal of rock blockages in the ditch lines will improve drainage. Future applications of surface material will stay in place because ledgy areas, where gravel has a tendency to roll off, were broken up. All things considered, this rock-removal procedure proved to be an economical way to improve the riding comfort and maintainability of a very rough road.

Side-Looking Airborne Radar in Natural Resources Management

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Project Leader
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Side-looking airborne radar (SLAR) is not commonly used by Resource Managers. The system is an advanced, complex, high-technology unit that requires users to be knowledgeable before attempting to use it. The first step in being knowledgeable is being aware. The purpose of this brief review is to inform readers that the system does exist and is being used. This article contains a review of how SLAR was used during the Mount St. Helens eruption and discusses some current applications.

Acquisition of special project imagery is complicated by the fact that the system is not in common use. However, radar sometimes may be the most efficient solution to management information needs. That determination is yours to make.

The eruption of Mount St. Helens provided a unique opportunity to apply currently available technology in a situation where accurate information was needed immediately.

For 30 days after the main eruption, weather conditions and the ash cloud presented effective barriers to gathering data by aerial or high-altitude photography. Ground hazards prevented quick assessment teams from getting data by foot or vehicle. The need for data was met within 3 days by acquiring high-altitude, side-looking radar imagery.

Active radar was chosen as the remote-sensing system because of its unique ability to penetrate clouds, haze, dust, and most materials that block the passage of light waves.

The imagery produced by a high-resolution radar system very accurately depicts ground conditions. The sensor used on the Mount St. Helens project was a modified Goodyear APQ 102 unit, which has a resolution of less than 50 feet. The reproduction of the radar image in figure 1 shows very clearly how geologic features are shown. The presence of clearcut blocks, roads, and streams are obvious even to the untrained analyst. Although the image looks like an aerial photograph, it is not--the area was completely obscured by ash, dust, and clouds when this image was acquired. Microwave pulses emitted by the radar transmitter were reflected at different angles by different materials. These reflected signals were displayed on a cathode ray tube and recorded on photographic film for interpretation and use.

Side-looking radar units can be carried by aircraft or space shuttles. At Mount St. Helens, a U.S. Air Force high-altitude reconnaissance aircraft carried the unit.

Side-looking radar imagery is available for several locations in Alaska, Nevada, New England, New Jersey, Virginia, and the central Appalachian area. This imagery was collected from 1980 to 1982 using airborne units flying at medium altitude.

The first space shuttle experiment was in 1981. Shuttle Imaging Radar-A proved that the system could be used effectively from space orbit. More recently, Shuttle Imaging Radar-B was used during the October 1984 space shuttle mission. Scientific evaluation of that data continues at this time.

The Mount St. Helens eruption provided an opportunity for the dramatic application of technology to assess damage to resources and facilities. Though less dramatic, the technology 4 years later is even more advanced and applications in resource management problems are more common. The system is especially valuable in efforts to map terrain with a nearly perpetual cloud cover. Because of image characteristics, radar is very useful in geologic studies. Tectonic features are unusually clear, especially in areas of low relief. Radar often yields more geomorphological detail than does normal aerial photography. Radar also has been used successfully for crop identification, vegetation mapping, locating clearcut areas, assessing land uses, and mapping snowfields.

The use of radar remote-sensing systems, which can be used as stand-alone systems, continues to receive increasing attention. Haack used the numerical data in much the same way Landsat data are used in investigations of urban environments. There also is a growing interest in using radar systems in conjunction with other remote-sensing systems. Rosenthal and Blanchard improved vegetation (crop) classification accuracy from 73 percent to 92 percent by using radar data combined with data in the visible and infrared portions of the electromagnetic spectrum. The use of radar remote-sensing systems, alone or with other systems, has potential in management and inventory problems faced by foresters.

Readers who want more detailed but layman-friendly descriptions of how side-looking radar systems operate should refer to "Side-Looking Airborne Radar" by Homer Jensen and others. Readers who want state-of-the-art technical information should refer to the second edition of the Manual of Remote Sensing by Robert N. Colwell.

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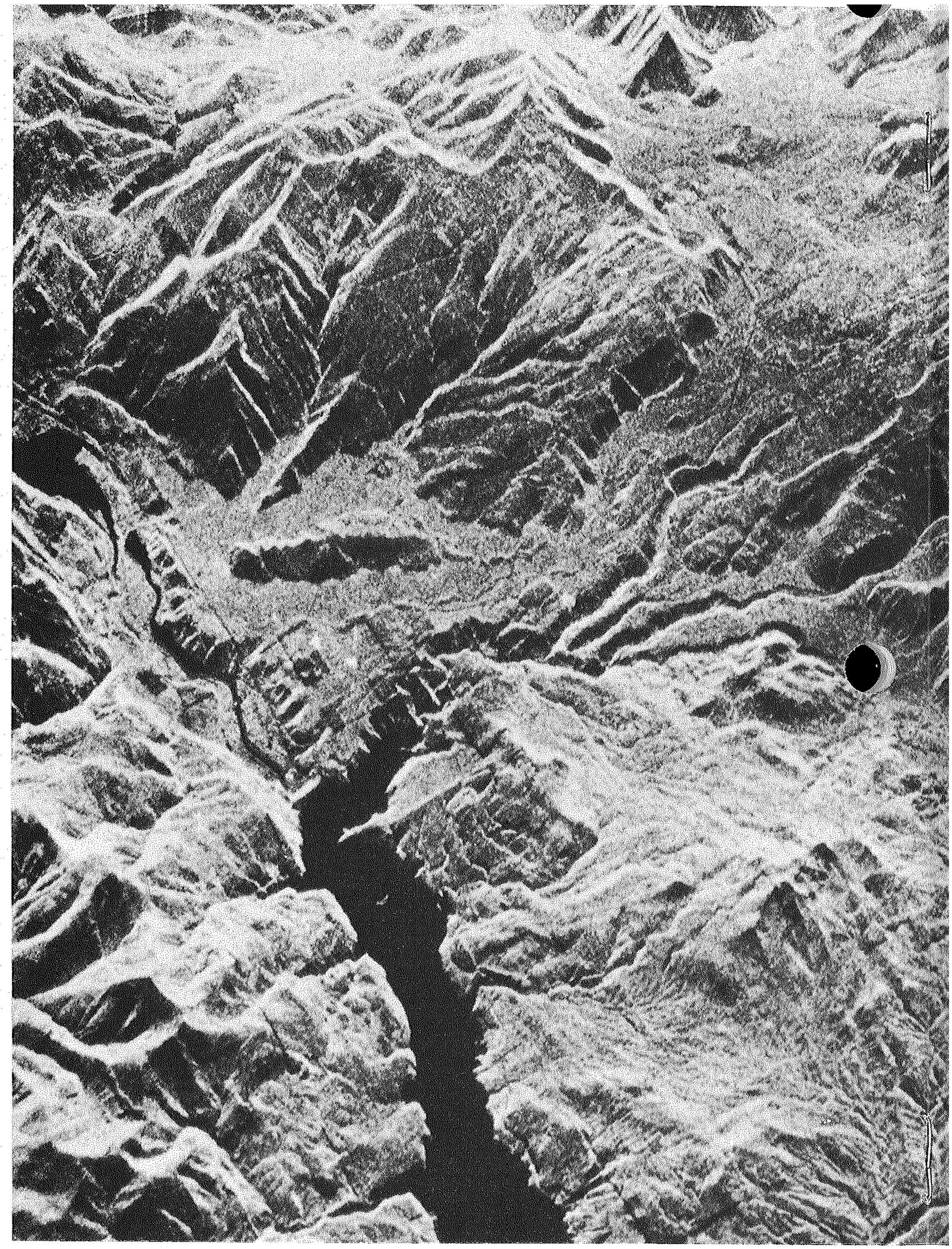
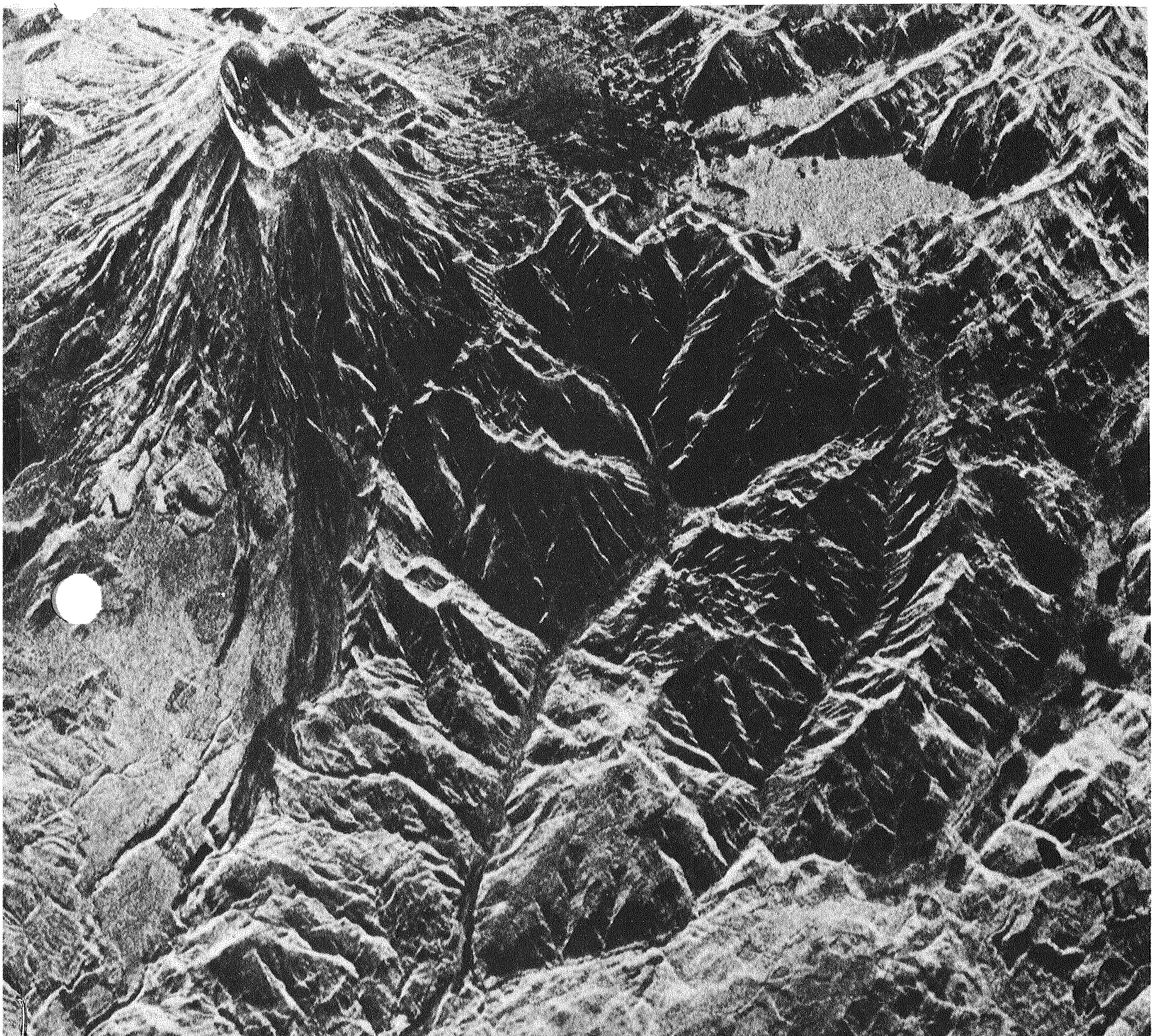


Figure 1.--Image of Mount St. Helens area made by a side-looking airborne radar unit. (Radar image by the U.S. Air Force.)



Family Curves for Estimating Single-Lane Road Capacities

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This article presents four capacity estimate family curves for single-lane roads with the general characteristics of traffic service levels A, B, C, and D. The curves depict actual volumes observed under controlled conditions and provide for extrapolation to higher volumes under the same conditions. This article describes how capacities of single-lane roads can be maximized through control techniques.

INTRODUCTION

In 1982, Region 6 and the Washington Office initiated the Mount St. Helens traffic study. The purpose of the study was to collect data from roads with heavy traffic resulting from moving salvage timber from the volcanic damage area.

The preliminary result of the study was reported in "Effect of Road Design on Timber-Hauling Speed in the United States," Transportation Research Record (898), 1983. The articles "Identifying Road Capacity & Traffic Service Level" in Engineering Field Notes, Volume 16, April-May 1984, and "Evaluating Capacities of One-Lane Roads with Turnouts" in Transportation Research Record (971), 1984, provide additional information about this study.

The purpose of this article is to develop a set of family curves for estimating single-lane road capacities under certain controlled conditions. A sample collected from four study sites in the Mount St. Helens area was used to develop the curves, which were then verified by a second sample collected from the same study area.

DATA

The April-May 1984 issue of Engineering Field Notes reported the procedure for collecting the data and the road characteristics of the study sites. The four road segments selected for this study were sites 17, 20, 26, and 33. The general road characteristics of these sites are described in table 1.

As shown in table 1, the data include traffic volume, traffic composition, and weather conditions. The duration of each traffic count was approximately 2 hours, and the average volume ranged from 13 vehicles per hour (vph) on site 26 to 39 vph on site 33. Empty and loaded log trucks accounted for approximately 50 to 70 percent of the total traffic. The portion of other trucks deviated greatly, ranging from 3 percent on site 33 to 19 percent on site 17. This discrepancy resulted from the reconstruction of a road segment near site 17 when the traffic count took place on June 17, 1982. The portion of Forest Service light vehicles varied from 3 percent on site 17 to 11 percent on sites 20 and 26. No recreational vehicles were observed because the road segments in the study area were not open to the public during the study period.

By using the data collected from each site, the duration of the traffic count was broken down into several intervals, with each interval containing an independent, continuous flow. The gaps between intervals are more than 4 minutes, and the intervals range from 5 to 35 minutes. The average hourly volume was expanded from the traffic of each interval.

The four variables for the analysis are speed, volume, general road characteristics, and the traffic directional distribution. The traffic directional distribution is the percentage of traffic in the heavy traffic direction relative to the total traffic. The ratio is 50 percent when the traffic in opposite directions is equal. On the other hand, the ratio is 100 percent if traffic flows solely in one direction. Most vehicles were equipped with CB radios. When traffic conflicts occurred, loaded log trucks had the right-of-way and other vehicles were required to yield the way by using turnouts.

Table 1.--Data characteristics.

Site	Date of observation	Duration of traffic count	Average hourly volume	Traffic composition (percent): Light vehicles	Forest Service light vehicles	Recreation vehicle with trailer	Empty log truck	Loaded log truck	Other truck	Weather conditions	Road Characteristics: Surface	Alignment[a]	Turnout	Percent grade
17	June 17, 1982	10:57 a.m.-2:00 p.m.	31	17	2	0	28	20	33	Clear-warm	Paved	20-50	Inter-visible	4.1
	August 25, 1982	10:15 a.m.-2:10 p.m.	34	29	4	0	18	49	0	Clear-warm				
	Average		32	22	3	0	24	32	19					
20	June 29, 1982	12:44 p.m.-3:20 p.m.	30	36	8	0	12	32	12	Cloudy-cool	Paved	50-100	Inter-visible	5.9
	July 28, 1982	6:20 a.m.-10:20 a.m.	16	37	16	0	13	30	4	Patchy				
	August 25, 1982	5:50 a.m.-8:20 a.m.	17	24	8	0	23	40	5	Clear-warm				
	Average		20	32	11	0	17	34	6					
26	June 30, 1982	7:53 a.m.-10:53 a.m.	10	23	10	0	30	30	7	Cloudy-rain	Gravel	20-50	Inter-visible	3.9
	July 28, 1982	12:01 p.m.-2:10 p.m.	13	41	31	0	7	21	0	Clear				
	August 26, 1982	5:20 a.m.-8:50 a.m.	17	44	1	0	29	21	5	Clear-warm				
	Average		13	38	11	0	24	23	4					
33	July 1, 1982	8:00 a.m.-11:20 a.m.	37	17	7	0	45	28	3	Cloudy				
	July 26, 1982	2:00 p.m.-3:10 p.m.	37	40	3	0	7	16	0	Partially cloudy				
	July 28, 1982	11:00 a.m.-1:35 p.m.	43	18	6	0	31	41	4	Overcast with fog	Gravel	20-50	Low inter-visible	5.8
	August 26, 1982	5:50 a.m.-8:40 a.m.	38	19	1	0	27	47	6	Clear				
	Average		39	21	0	0	32	39	3					

[a]Defined by the ratio of the average radius to the number of curves per mile.

FAMILY CURVES

Of the four variables, speed, volume, and traffic directional distribution are quantitative and were measured based on the traffic count. The following mixed-logarithmic equation was used to develop the curves:

$$Z = a_o - a_1 C' - a_2 V$$

where

Z = *a composite variable equal to U/C;*

U = *average speed (mph);*

C = *traffic distribution ratio (percent of one-way traffic on heavy traffic direction to total traffic that ranges from 50 to 100);*

C' = *logarithmic value of C;*

V = *volume (vph);*

a = *constant to be estimated.*

Figures 1 through 4 show four sets of family curves for single-lane roads with characteristics of traffic service levels A, B, C, and D. The solid line represents actual observations, and the dotted line describes the curve simulated beyond the observed conditions.

Figure 1 indicates that the effect of changing the traffic directional distribution from 50 percent to 100 percent causes the speed to vary by as much as 6.5 miles per hour in a low-volume condition (10 vehicles per hour and less). This effect tends to decrease as traffic volume increases and speed decreases. The curve characteristics of figure 1 also apply to the curves of figures 2, 3, and 4.

APPLICATION

The developed curves were applied to a second sample of five sites selected from the study area. The result was satisfactory, with an average error rate of 10.5 percent. However, the error rate of one site was nearly 25 percent because the site's design standard differed significantly from those described in table 1.

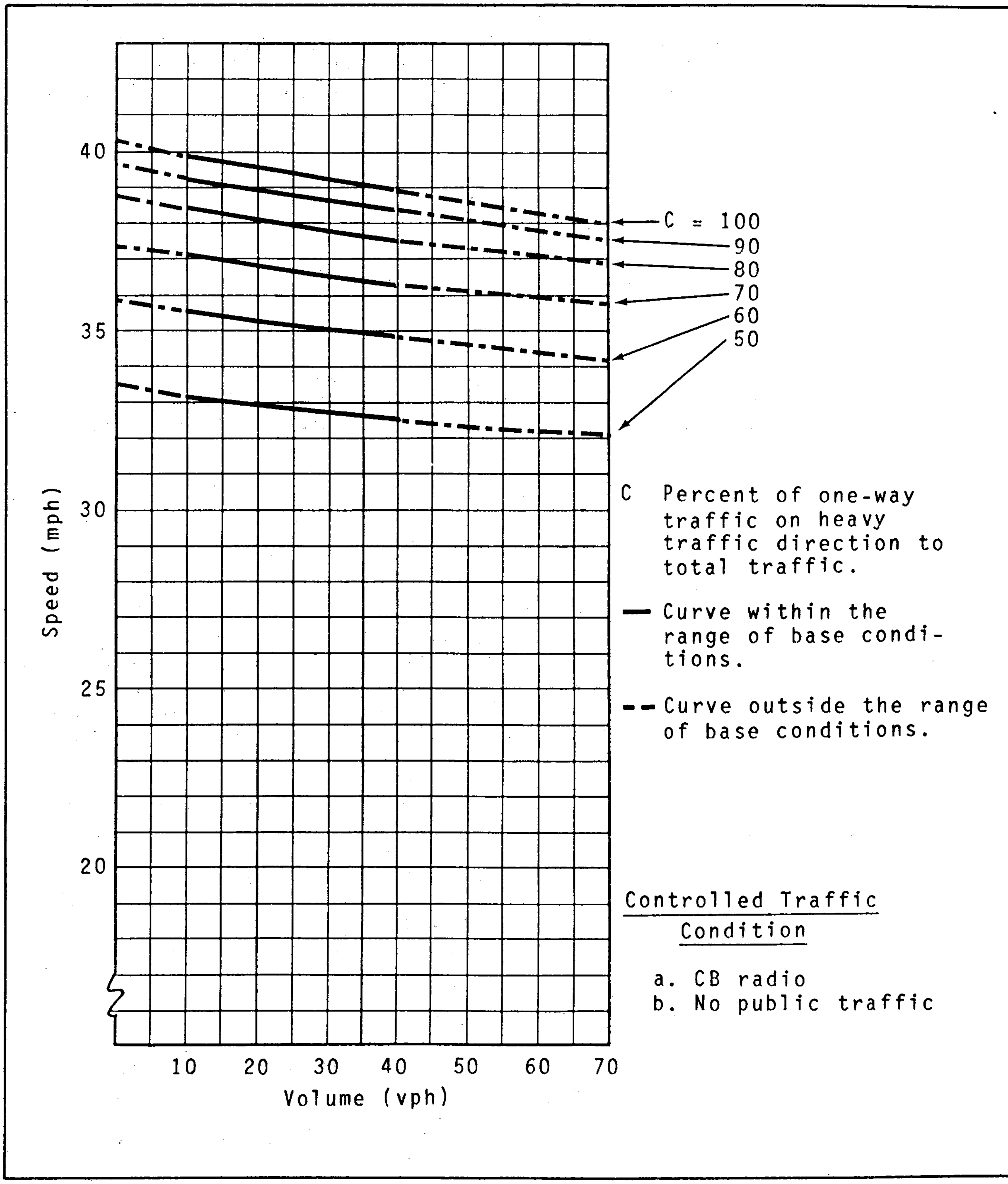

Figure 1.--Capacities of single-lane roads with characteristics generally associated with traffic service level A.

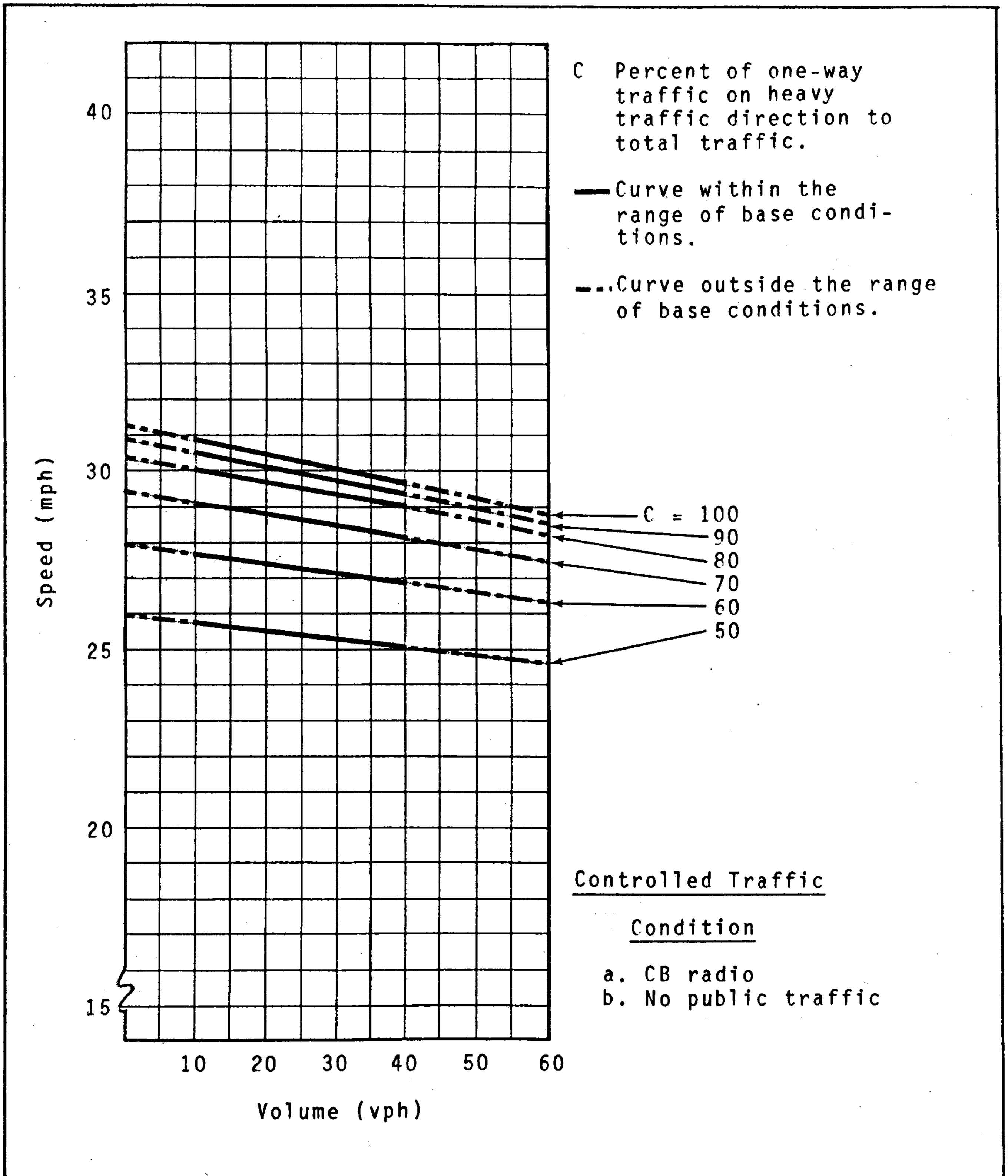

Figure 2.--Capacities of single-lane roads with characteristics generally associated with traffic service level B.

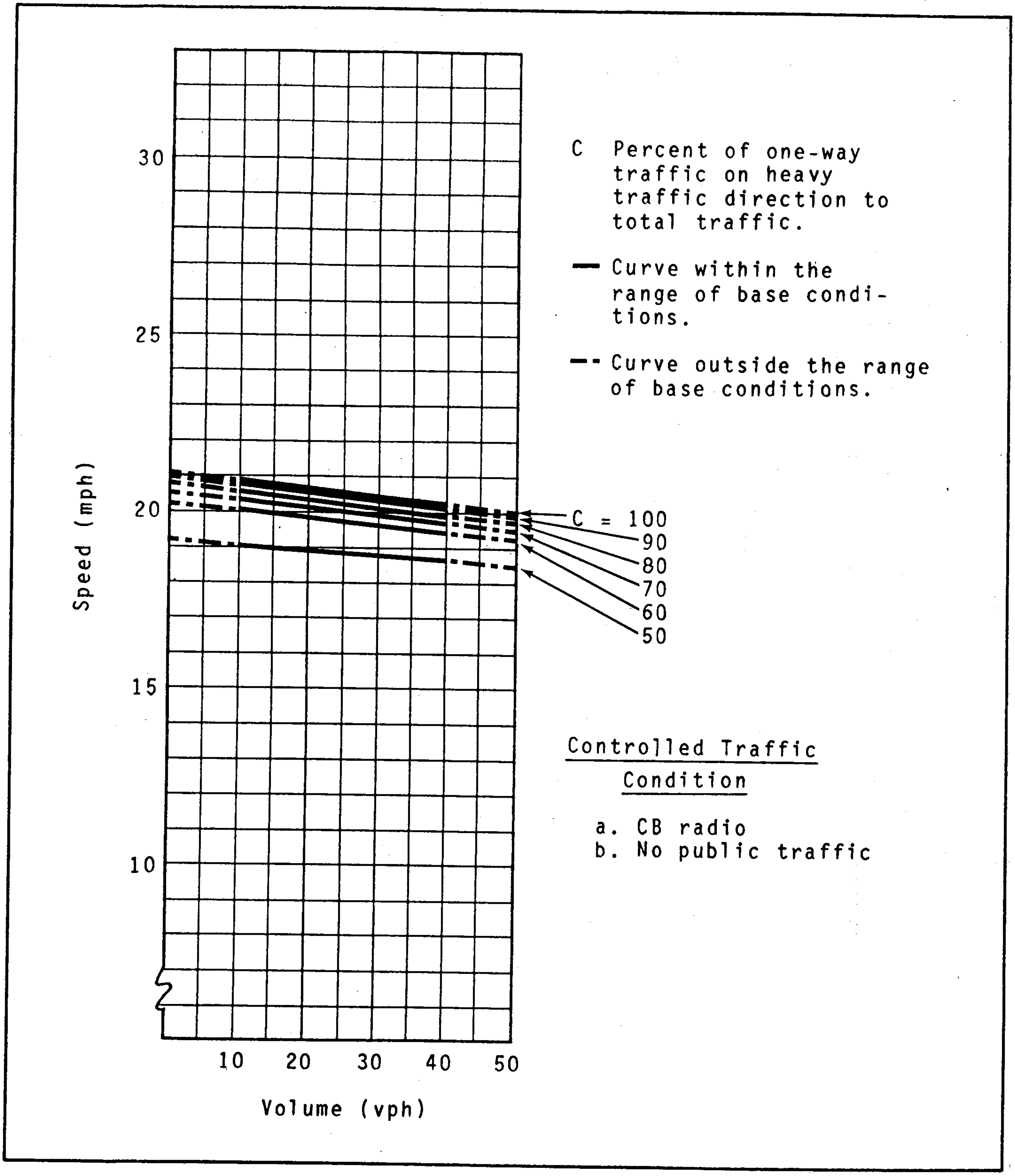

Figure 3.--Capacities of single-lane roads with characteristics generally associated with traffic service level C.

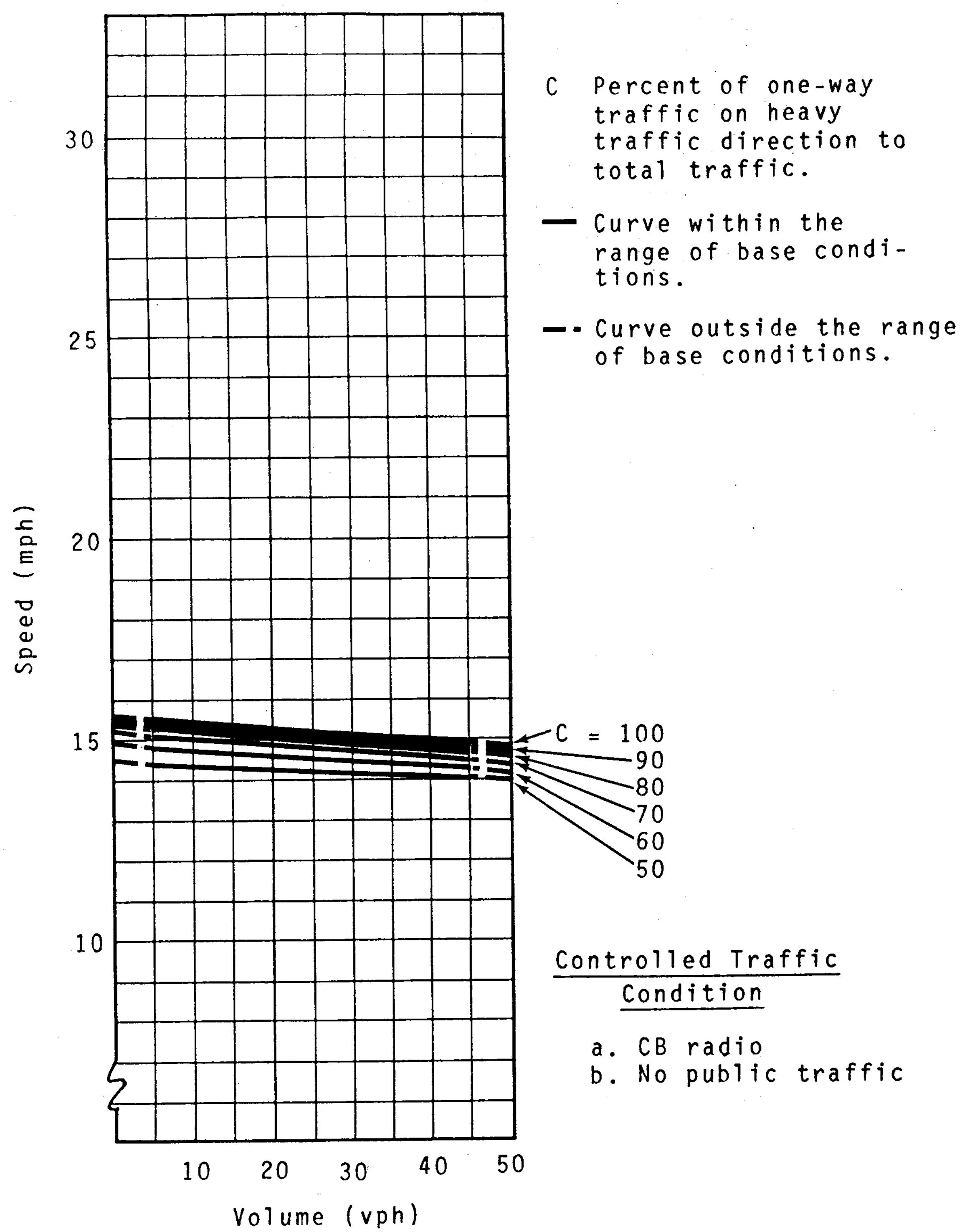

Figure 4.--Capacities of single-lane roads with characteristics generally associated with traffic service level D.

The first sample collected from the Mount St. Helens area was used to develop four sets of family curves for estimating capacities of single-lane roads. In this context, capacity was defined by speed, volume, traffic directional ratio, and general road characteristics. A second sample collected from the same study area was used to verify these curves, and the result was satisfactory. However, the curves were developed from a limited sample of the Mount St. Helens area and they have not been tested in other areas, so experimental use of these curves requires verification with local data samples.

The Slide Rule: A "Post"-Mortem

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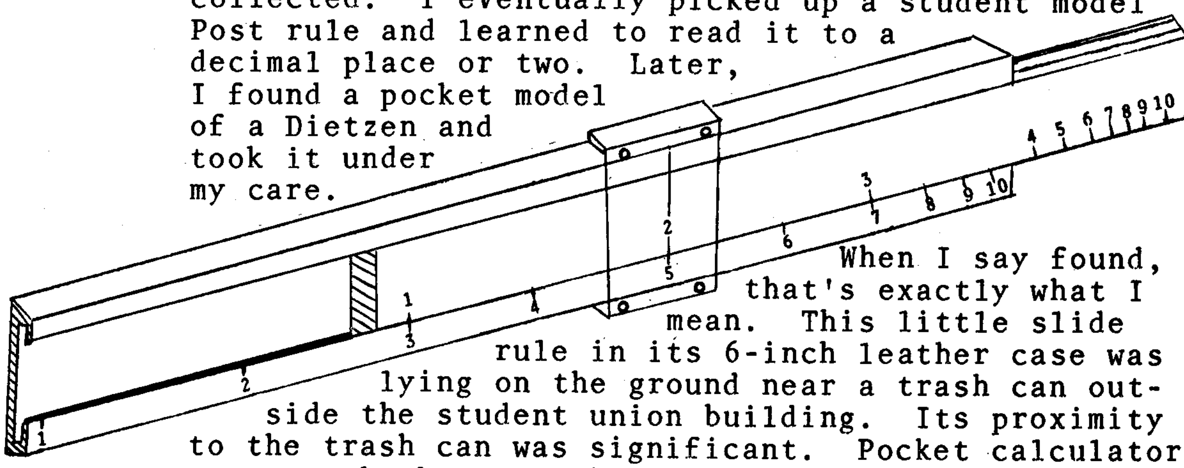
I admit to knowing less than I should about slide rules. Entering forestry instead of engineering probably had something to do with that. When I approached college, my dream was to become an engineer involved with physics and chemistry. Part of that dream was to have a duo-quad-maxi-flex-deci-duce-hex-trig slide rule in a firm leather case.

During my college years, I never obtained a slide rule like those shown in all the catalogs I collected. I eventually picked up a student model Post rule and learned to read it to a decimal place or two. Later, I found a pocket model of a Dietzen and took it under my care.



When I say found, that's exactly what I mean. This little slide rule in its 6-inch leather case was lying on the ground near a trash can outside the student union building. Its proximity to the trash can was significant. Pocket calculators were on the horizon then, and I should have seen the trend.

After graduation my fortunes improved. My income suddenly exceeded the amount I needed to live. Despite the rational, logical, and, it turns out, well-founded objections of my wife, I followed my dream and, with a sense of brash well-being, I purchased my duo-quad-maxi-flex-deci-duce-hex-trig slide rule. I got it for 20 percent off out of a special mailer that nearly pleaded with me to buy it. It was a jewel. The clean white plastic held the sharply incised lines. I could easily read the tiny numbers. The slide moved effortlessly as my hands moved the bar left and right. I rattled off tangents, products, and cubes. My 3-year-old son was impressed!

My wife, in the meantime, had acquired a small hand-held calculator. I was heartless in my criticism of its glaring, boxlike red numbers. "Where is the skill?" I asked. She informed me that skill wasn't important; results were. "Subtract these two numbers," she challenged. I grabbed my slide rule. Realizing its limitations, I then dove for a pencil and paper. "The answer is ----," she answered, and proceeded to rattle off some number with a thousand decimal places.

That's probably where my love affair with a slide rule began to fade. What was a forester doing with one anyway? It became easy to sneak into the desk drawer and use her little calculator. My slide rule lay dormant in my night stand, waiting, I suppose, for some resurrection signal. It never came.

No pun intended, but that duo-quad-maxi-flex-deci-duce-hex-trig slide rule is one of the few things I've let slip away from me. I've saved tons of other junk as mementos of my passage, but it escaped. I just don't know where it went and now it exists only as a memory.

It's probably near my abandoned typewriter. After all, this word processor did turn out better than I expected. You should have seen me knock that concept. That's another story though. Now, where is my notebook and Abney level? Take it from me, those newfangled electronic notebooks will never survive in this cold world of common sense.

WO-E NOTE

To a certain degree, we all are guilty of rejecting innovative ideas for the comfort and feeling of security of our old ways. But we must accept the fact that there is usually a better way to do almost anything, and then start looking for that better way. With the declining resources we are provided to get our jobs done, it's a must!

Engineering Technical Information System

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