Seltzer

ENGINEERING TECHNICAL INFORMATION SYSTEM

FIELD NOTES • TECHNICAL REPORTS
DATA RETRIEVAL • MANAGEMENT
PROFESSIONAL DEVELOPMENT

VOLUME 8 NUMBER 5

Field Notes

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Washington Office News

FOREST SERVICE

MAY 1976

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FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE
Washington, D.C. 20250

HYDRAULIC HANDTOOLS FOR ROAD MAINTENANCE

Robert M. Gallup, P.E.
Civil Engineer
Equipment Development Center
San Dimas, California

Manufacturers' representatives frequently visit the Equipment Development Centers in San Dimas, California (SDEDC) and Missoula, Montana (MEDC) to discuss equipment and materials. One representative brought to our attention certain hydraulic handtools that were available which could prove beneficial to Forest Service road maintenance crew. The tools were demonstrated on the Angeles National Forest, California, and they performed very efficiently.

Many maintenance people have stated that overhanging limbs in the roadways were breaking the warning lights mounted on top of the cabs of their motor graders, and are damaging motor homes as well as other high-profile vehicles. These limbs are generally removed manually by pruning saws, or the trees are cut down with chain saws. Hydraulic handtools, now available, can remove these limbs swiftly and easily.

The harried swamper who accompanies the motor grader, whose task it is to remove limbs, also cleans culverts, rolls boulders out of the way, cuts brush, repairs or replaces road signs, cuts downed or hazard trees, maintains the motor grader, provides transportation for the motor grader operator, and does whatever else is needed to be done. The work that he does not complete becomes "special projects", or just does not get done. Most of the tools that the swamper uses are manual and somewhat primitive. Power tools will enable the swamper to accomplish more tasks, thereby reducing the number of "special projects" and, in turn, this will allow road maintenance funds to go further.

Hydraulic-powered handtools available are breakers and clay spades, tampers, impact wrenches, chain saws, cut-off saws, pruners and saws, and sump pumps (fig. 1). All of these tools can be powered from a central hydraulic system which can be run from a power take-off, a hydraulic system on a vehicle, or a portable power pack (fig. 2).

Long life, dependability, and low maintenance costs more than preempt the high initial purchase cost of the tools. The cost of the power unit is less than that of an air compressor. Many municipalities and utility companies have tried these tools on a limited basis, and are now expanding the purchase of this equipment because of the cost savings.

The California Division of Forestry (CDF) has been working on the development and testing of hydraulic tools for clearing firebreaks and trails.

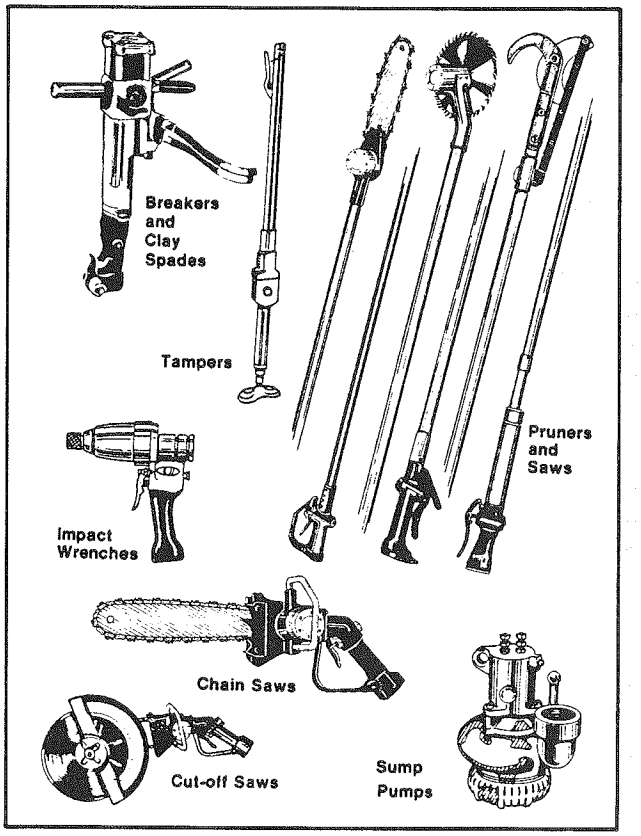
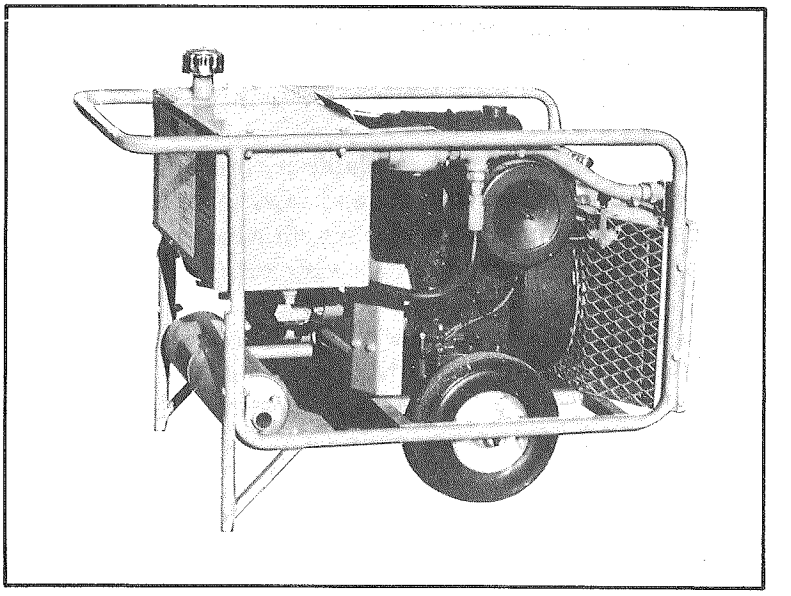


Figure 1. – Hydraulic handtools.

Figure 2. – Portable hydraulic power pack.



They are now in the process of developing a 48-inch wide tracked vehicle that is driven hydraulically. It will supply power for ten tools at one time. With the hydraulic pruners and pole chain saws, the crew members can cut brush and small trees while standing back in a stable position, rather than being in awkward positions, such as with axes and brush hooks.

These long-reach tools also allow brush or limbs to be cut back where the stubs are hidden by other brush or limbs, leaving a more aesthetically pleasing appearance. The CDF will be conducting tests comparing production rates of manual tools versus hydraulic tools; SDEDC has been invited to observe or participate in these tests. MEDC Fire Management also proposed a project for FY 76 to evaluate hydraulic handtools for fireline use.

Hydraulic tools not only reduce costs, but reduce storage space as well. The tools and the power pack can easily be carried in a pickup truck. Hydraulic tools run quietly, and operate below the maximum level of 80 dBA established by OSHA regulations.

Hydraulic tools are lightweight. For example, a 5½-lb hydraulic impact wrench is equivalent to an 11-lb air impact wrench, and a 27-lb hydraulic tamper is equivalent to a 45-lb air tamper. The hydraulic chain saw with a 24-inch bar weighs 15 lb.

Suggestions have been made to propose a road maintenance Equipment Development project for the purchase of a set of these tools, and then conduct in-house and field tests to determine the overall benefits to the Forest Service. Comments on this idea are invited and may be made by contacting the author direct on FTS 793-8236, or off-net through the Center switchboard, area code 213/332-6321 or 712/599-1267.

EQUIPMENT REPLACEMENT DECISIONS

Ollie Broadway
Equipment Management Engineer
Washington Office

The following material was extracted from a publication by the Caterpillar Tractor Company entitled, "Optimum Replacement Time for Planned Tractor Trading." We have changed some of the terms to make it applicable to the motor grader, since this is our major piece of maintenance equipment.

TO REPLACE OR NOT TO REPLACE

Would you be money ahead if you traded your present motor grader now? Or would you be better off holding onto it for a while?

There's a method for figuring the answers to those questions. You can determine the most profitable course of action at any given time by a system called Optimum Replacement Time.

Optimum Replacement Time is the point at which a motor grader's operating cost per unit of work (lane mile) exceeds its average operating cost per unit of work (lane mile) to date. When a forecast of cost per lane mile exceeds that average, that is the time to consider trading the motor grader. The object is to keep your cost as low as possible.

This example describes a simple, accurate method for determining the Optimum Replacement Time of a motor grader (or any other piece of construction machinery). You can determine your average cost per lane mile for this year or next year for a new machine or for one you bought years ago. And you can establish a planned equipment replacement program that will help keep your machine costs at a minimum, and benefit your long-range production cost.

OWNERSHIP COST FACTORS

Four factors determine the costs to work a machine at any particular time:

1. **Depreciation** — The loss of machine value. This is most rapid the first year you own the machine, then it gradually slows down.
2. **Price Increases** — The loss of money value due to inflation. A motor grader like yours costs more to buy today than it did a few years ago.
3. **Maintenance and Repairs** — The older your machine gets, the more it will cost you to keep it operable. These costs vary from year to year, but they follow a predictable pattern, generally increasing.

4. **Downtime** — This is what it costs you in lost yields, extra labor and missed production time because your machine was being repaired and unavailable when needed for a critical maintenance task.

We will consider each factor separately, then combine them into a method for figuring and forecasting the overall average cost per lane mile for any piece of construction equipment of any age.

THE PURPOSE OF OPTIMUM REPLACEMENT TIME

The Optimum Replacement Time method is aimed at keeping the average machine cost per unit of work as low as possible over long periods of time. This cost will, of course, vary from year to year. However, you're in business for the long pull, and it makes little difference to your long-term profit and loss whether individual costs such as major repairs or machine replacement are absorbed in one year or another. By following the Optimum Replacement method and replacing on a planned program basis over the years, you will average out with the lowest machine costs possible.

DEPRECIATION

There are several reasons why a machine depreciates in value. Age, of course, is important. So is the amount and type of use, the kind of maintenance, and the overall condition of the machine.

But it all boils down to the amount of money the machine will bring on the used equipment market. And that is determined by the law of supply and demand. There's an average price for each machine. But under certain circumstances, a machine may go for a better than average price . . . or a below average price. You should always know the current trade-in values of each piece of equipment your Region owns.

A motor grader with a lot of hours on it, or one poorly maintained, will probably follow the bottom of the curve. A well-maintained machine with a low number of hours on it will follow the top of the curve. Other motor graders, of course, fall somewhere in between.

PRICE INCREASES

As long as inflation is with us (and it's likely to be for a long time), a motor grader comparable to the one you buy today will cost more a few years from now.

And whether you buy a new machine now or not, you've got to figure this price increase as a real cost of operation. Because sooner or later you're going to have to replace your grader, and that's when the price increase will hit you. And, of course, the longer you postpone buying a new motor grader, the higher the price will be.

MAINTENANCE & REPAIRS

Good preventive maintenance will both decrease and delay major repairs. But no matter how well you maintain a motor grader, as the numbers on the hour meter climb and as the machine gets older, repairs will become necessary with increasing frequency.

Repair costs, of course, are not spread evenly over the life of the motor grader. Rather they tend to come in cycles, usually with the highest peak cost during the fifth and ninth year, and will continue such cycles during the life of the motor grader.

DOWNTIME

What could be more costly than to have your motor grader suffer a major breakdown during road blading season? If you don't get your roads maintained at the right time, you end up with a curtailment of usage and added operating costs to those potential users. Actual cost values must be established for downtime, whether the curtailed usage involves Forest Service vehicles or vehicles used by logging contractors.

PRACTICAL APPLICATION

Up till now, we have considered how depreciation, price increases, repairs, and downtime affect cost per hour for average machines under average conditions. *But what you need to know is cost per lane mile for your machines under your conditions.*

If you have reasonably good cost records, you'll find that figuring optimum replacement time for any machine you own a rather simple procedure.

1. First, compute the average cost per lane mile for the total time to date that you've owned the machine.
2. Then project the cost per lane mile for the coming year.
3. If your projected cost is lower than your average cost to date, keep the machine because its cost curve is still going down. But if your projection is higher than the average cost to date, you've already passed the low point of the curve and you should trade the machine in.

The following forms apply to any machine used to maintain any number of miles of roads. To show you how they work, we've computed a sample cost per lane mile for an eight-year-old motor grader used to maintain 2,000 lane miles per year.

FIGURING MACHINE COSTS/LANE MILE

INFORMATION SHEET Date 4-1-76

I. Motor Grader

Model Type I, size V Year 1966 Serial No. 12345

Age of Motor Grader Now 8 years

II. Motor Grader Use

Hour Meter Readings:

When purchased 0 Now 4,000

Average hours used per year 500

Lane Miles prepared each year 2,000 lane miles

III. Price Information

Prices of this model motor grader:
(Use new machine prices only)

(a) Original purchase price	$14,000
(b) New today	$32,000
(c) New machine in year the motor grader was acquired used	

IV. Trade Allowance

Trade allowance is	$ 5,000
Cash difference to trade this motor grader for new one today	$27,000

WORK SHEET I (Use applicable blanks)

Figuring Machine Costs/Lane Mile

I. Depreciation & Price Increase

A. Find Depreciation

1. Original motor grader price	$14,000
2. Trade allowance	5,000
3. Cash difference (This is depreciation cost)	9,000

B. Find Price Increase

1. Current new motor grader price	$32,000
2. Original motor grader price	14,000
3. Difference (This is price increase cost)	18,000

ADD

ITEMS A		+ B		=	
	$9,000		$18,000		$27,000
	Depreciation		Price Increase		TOTAL DEPRECIATION & PRICE INCREASE

II. Repair Costs

If exact amount is known, enter here $14,000

III. Costs of Delays in Work

Multiply REPAIR COSTS by 30%. . . .enter here $ 4,200

IV. Total Machine Costs

Add costs of depreciation & price increase, repairs, and delays in work (total of I, II, & III) $45,200

V. Lane Miles Maintained

Lane miles prepared per year x years motor grader owned 16,000 lane miles

VI. Machine Cost/Lane Mile

Divide IV by V $2.83

WORK SHEET II

One-Year Projection of Machine Cost/Lane Mile

1. Age of motor grader now: 8 years

2. Purchase price of this motor grader when new: $14,000

Percentages (Assumed)

Item	At this Motor Grader Age	At this Motor Grader Age +1 year	Difference
Depreciation	55%	57%	2%
Price Increase	120%	125%	5%
Repairs	50%	64%	14%

Cost of delay in work (Repairs x 30%)		4%
3. Total		25%
4. Item 2 x Item 3 = Projected Costs for coming year	$3,500	
5. Lane miles	2,000	
6. Projected machine cost per lane mile Item 4 ÷ Item 5 =	$1.75	

The projected cost per lane mile, $1.75, does not exceed the cost per lane mile to date, $2.83 (Work Sheet I, Item VI). Therefore, the machine should not be replaced now.

RESEARCH NEEDS FOR LOW-VOLUME ROADS

Adrian Pelzner
Washington Office

The article in the Washington Office News — Technological Improvements, discusses research needs for low-volume roads. These research needs will be published in a TRB Circular this Fall. The Circular will list high priority research needs that have been identified by the Board's various task forces and technical committees. The publication is aimed at potential sponsors and research contractors for the needed research. Because the statements of research needs are very relevant to the Forest Service Transportation System, they are reproduced here in their entirety.

TITLE

Design Standards for Low Volume Roads

THE PROBLEM

The design standards for low volume roads are frequently inappropriate, quite subjective, and cannot be defended scientifically. Most of these standards are extrapolated, projected and rationalized from information developed for and from higher type roads. There is an urgent need to develop standards and criteria that specifically relate to the design of low volume roads.

There are over 2 million miles of roads in the United States carrying less than 400 ADT. Each year many thousands of miles of low volume roads are added to this extensive system. There are over 30,000 agencies in the United States that are involved with low volume roads. Because of this extreme decentralization, it is difficult, if not impossible, to reliably estimate the total investment or annual expenditures for low volume roads. Nevertheless the United States already has a multibillion dollar investment in its low volume road system. Each year, a significant portion of the country's gross national product is committed to the design, construction and administration of low volume roads. It is alarming to contemplate the continuing development of a low volume road transportation system in this country may be based on extrapolated and sometimes irrelevant design criteria and standards. Appropriate design standards should fully recognize the extreme cost sensitivity of low volume roads. The standards need to be not only technically sound but cost effective as well. For example, the following research needs have been identified that relate to design standards. These needs are by no means meant to be all inclusive or comprehensive. They are but the "tip of an iceberg" of research needs for appropriate, technically sound and cost effective design standards for low volume roads.

Level of Service:

1. There is a need for a methodology that relates the selection of the level of service and design speed for a low volume road with the related costs and benefits associated with the selected design speed and service level.

Geometry:

1. There is a need for determining an optimum turn-out spacing for single lane roads which would be consistent with safety and economy.

2. There is a need for identifying and quantifying the parameters, such as traffic volume and geometrics which require changing from a single lane design to a double lane design.

Hydraulics:

1. There is a need to develop a systematic approach for selecting the design flood frequency for low volume roads which would consider the interrelationship of the costs of various size drainage structures and the costs of interfering with traffic.

Materials:

1. There is a need to evaluate existing highway material specifications to determine whether they are appropriate, relevant and economically feasible for low volume roads.

Pavement:

1. There is a need to develop a pavement thickness design method for specifically determining the thickness of aggregate surfacing and other low type pavements for low volume roads.

2. There is a need for procedures to (a) evaluate the remaining structural pavement capacity in existing low volume roads and (b) design cost effective surface overlays for such roads.

OBJECTIVES

1. To analyze commonly used design standards for low volume roads with respect to their applicability, technical soundness and cost effectiveness for the low volume road situation. All standards that govern or control low volume road design should be examined, including but not limited to, the standards that affect design speed, road geometry, capacity, surfacing thickness, drainage and materials.

2. To identify those standards that are inappropriate for the low volume road situation.

3. To prepare a systematic approach and methodology for accumulating the necessary information and data base from which new and revised standards can be developed for those present standards that are deemed inappropriate for the low volume road situation.

CURRENT ACTIVITIES

1. Highway Research in Progress.
   Areas 15, 22, 23, 25, and 26 have been scanned in preparing this statement.

2. Suggested key words: Low volume roads, design standards, design criteria, design speed, design capacity, traffic, road geometry, surfacing thickness, drainage design, and construction materials.

3. Related research activities: No known research activity that is making a unified assessment of the applicability of commonly used standards for low volume roads.

URGENCY

The overwhelming majority of roads in the United States are low volume roads. Every day, many more miles of low volume roads are being designed, and built and added to this system. It is urgent that the standards that control or govern the design of these roads be appropriate and cost effective. The existing standards should be analyzed to determine their appropriateness and cost effectiveness. For those standards found to be lacking, steps should be taken to develop the necessary data base and information so that more realistic standards can be developed.

TITLE

Safety Criteria for Low Volume, Low Speed Roads

THE PROBLEM

In the United States, the safety criteria for low volume, low speed roads are directly or indirectly traceable to four publications—(1) A Policy on Geometric Design of Rural Highways, AASHTO, 1965, (2) Highway Design of Operational Practices Related to Highway Safety, AASHTO, 1974, (3) Manual of Uniform Traffic Control Devices, FHWA, 1971 and (4) Geometric Design Guide for Local Roads and Streets, AASHTO, 1971. The safety criteria contained in these publications may not be applicable or relevant because low volume, low speed roads are extremely cost sensitive. There is a need to specifically consider the safety requirements for roads carrying very low volumes of traffic at very low design speeds. For example, for a road with a design speed in the range of 10 - 15 mph and a projected traffic volume of around 100 ADT, a series of simple, direct questions could be asked:

1. How much, if any, clear roadside recovery area is needed?

2. Assuming the road is aggregate surfaced, what factors should be used in determining stopping distances, resistance to skidding and superelevation requirements?

3. What effect, if any, will a rough riding, aggregate surface have on vehicle control and driver safety?

4. What are the warrants and design criteria for installing guardrail, guide posts, and bridge railing? Should they be installed at all? Where?

5. What should the requirements be for installing signs containing warning and regulatory messages? How high should they be? What size? Should break-a-way signs be required?

Ignoring safety requirements for low volume roads has the potential of wasting the greatest resource of all — human lives. On the other hand, to impose safety requirements on low volume roads that may be only applicable to higher type roads is wasteful of another important resource — dollars.

OBJECTIVE

1. To analyze the commonly used existing safety guidelines, standards and requirements with respect to their applicability and relevancy for roads having extremely low design speeds and traffic volumes. Existing safety guidance will be analyzed to determine whether such guidance is delivering the desired safety performance in a cost effective manner.

2. To identify those safety guidelines, standards and requirements that are deemed inappropriate for low volume, low speed roads.

3. To prepare a systematic approach for accumulating the necessary information and data base from which new or improved safety guidelines, standards and requirements can be developed.

4. To recommend interim safety guidance criteria appropriate for low volume, low speed roads. Final safety guidance criteria will be developed from the analysis of information collected over a long time basis as shown in Number 3 above.

CURRENT ACTIVITIES

1. Highway Research in Progress.
   Area 51 was scanned in preparing this statement.

2. Suggested key words: Low volume roads, low speed roads, safety standards, safety criteria, design speed, stopping distance, sight distance, driver response, guardrail, guide posts, bridge railing, fixed objects, roadside recovery area.

3. Related research activities: There is no known research activity which makes an overall assessment of the applicability of present-day safety guidelines, standards and requirements for low volume, low speed roads.

URGENCY

Imposing high type safety guidelines standards and requirements on roads carrying extremely low volumes of traffic at very low speeds results in expenditures of public funds that may not be cost effective. At the same time, the expenditures may not result in a road having any increased safety history or performance. Yet frequently legal restrictions prevent Federal and State participation in low volume road construction or maintenance unless the existing safety standards and requirements are met.

It is probable that many millions of taxpayer dollars have been and are continuing to be spent needlessly to achieve inappropriate safety requirements for low volume, low speed roads. It is urgent that this situation be thoroughly analyzed to prevent continued loss of these dollars and to take the necessary steps to produce cost effective safety benefits for low volume, low speed roads.

CASE STUDIES OF TRANSPORTATION ANALYSIS USING FOREST SERVICE COMPUTER MODELS

Abstracts of three presentations given at the October 1974 National Transportation Planners Meeting in Concord, California, are given below. These are being presented now for field review because the Timber Transport Model is available for use at the Fort Collins Computer Center and a user guide described below is now available.

Network Analysis User's Guide by Edward C. Sullivan — Institute of Transportation & Traffic Engineering University of California, Berkeley, California. Dec 1974. (Distributed to all Forests)

"New Chapters I, II & III to Network Analysis User's Guide" (This incorporates operation procedures for the Ft. Collins Computer Center) — USFS Transportation Analysis Group, Berkeley, California. Feb 1976. (Distributed to Regional Offices)

You can obtain a copy of the complete paper and the user's guides by contacting your Regional Transportation Planning Engineer.

COMPUTERIZED TRANSPORTATION ANALYSIS, KETCHIKAN AREA, TONGASS NATIONAL FOREST

Dick Wilson
Forest Supervisor

On Prince of Whales Island near Ketchikan, computerized Timber Transport Analysis was used in 1972 to investigate 160,000 acres of land with over 1 billion board feet of timber available for harvest. This activity was done as a part of the development of a 5-year action plan for an existing 50-year sale.

The analysis studied routes over land and water, and included the cost of building and operating sites for land-to-water log transfer as network nodes.

Investment costs for the alternatives ranged from $14 million to $19 million. Effort required to make the study included 60 man-days for field data collection. Computer costs of the study are not available.

The computerized study provided:

1. A documentation of the analysis of alternatives. This process is essential with the involvement of conflicting interests in the decision-making process.

2. A method for proposals by conflicting interests to be included in the alternatives studied.

3. Quantified variables which reduced the discussions of generalities by conflicting groups.

A limitation in the use of the computer tools included a substantial cost in dollars and manpower for data collection and computer time. The Forest also needs to gain more experience in use of computers, programs, and accuracy requirements. The Forest plans to develop experience with small projects, including the Karta and Long Island planning units.

Computerized programs in Resource and Transportation Planning should be placed on line and the information systems of INFORM should be made available as soon as possible.

THE MALHEUR NATIONAL FOREST EXPERIENCE

Dave Nordengren
Forest Transportation Analyst

Wallace R. Cox
Assistant Forest Transportation Analyst

Intensive Transportation Planning began on the Malheur National Forest in November of 1972. At that time, the Transportation Planning team developed an "appraisal" log haul cost map for use in timber sale work. Two-thousand miles of roads were logged using 4 man-months of labor. Grade, distance, travel time, surfacing condition and road class data were collected and placed on a Wang computer. Hand "shortest route" calculations were made as described in ETR-7700-4e, "A Longhand Approach to Transportation Analysis Using a Link-Node Network." Districts were very active in using the "appraisal" map.

The TAG Timber Transport Model was initiated for analysis in the winter of 1973-1974. After several false starts, the Transportation Planning group arrived at a reliable method.

The model has been used to analyze single sale alternatives on areas where a group of sales occurred. The Transportation Planning team uses the data from the road logging project and makes repeated runs of the Timber Transport Model using various networks. The process usually consisted of repeated deletions of lightly used routes as shown by the runs until a minimum cost network is achieved.

Analysis is done by a multidisciplinary crew including the District Sale Designer, Forest Logging Specialist, Preconstruction Engineer, and the Timber Project Coordinator. Several District Rangers say this team makeup is the key to success.

The studies to date have involved decision consequences of up to $200,000 which would not have been recognized through intuitive analysis. The computer speed, which allowed study of many alternatives, was the prime reason for the new insight.

The Forest plans to train four to five preconstruction engineers to do this sale haul analysis and the transportation planning team will then work with the land use planning team in using the model for analysis on a 628,000-acre planning unit.

The model has also been used in the study or road closures and obliteration and will be used for this more in the future.

In closing, it is pointed out that land managers consider that this is a fast and efficient tool, if used with display systems, for decision-making.

(Note: No costs were included in this paper.)

USE OF TIMBER TRANSPORT MODEL ON THE SOUTH FORK SAN JOAQUIN TRANSPORTATION STUDY, SIERRA NATIONAL FOREST — REGION 5

Roy E. Droege
District Ranger

The study was made to select a transportation system in a lightly roaded area of 37,000 acres with 1,500 MMBF of timber. The area is bordered by wilderness and high mountain peaks, and requires a road and logging system compatible with recreation needs. The proposed transportation system has about 300 miles of road and 4,000 feet of cable.

The study investigated haul over four access roads and the network within the area. The Timber Transport Model was used to investigate seven alternatives for each proposed sale. Alternatives included: assuming all proposed roads in place, optimizing the system, forced split haul, and forced haul over selected proposed roads.

Advantages of using the model include documentation of the decision process, and ability to minimize the road system to fit recreation needs.

Costs to date include 40 man-hours to learn the program, 80 man-hours data gathering, 200 man-hours of data analysis and computer program review, and 40 man-hours of consultant/specialist time. Computer costs were $3,300, but if run again would be $2,000.

The computer program would be more helpful with a user's guide for nontechnical people, expanding the different construction projects above 25 and expanding the time periods available.

The District plans on using it again.

CONSULTATION & STANDARDS

Charles R. Weller
Assistant Director

ROAD MAINTENANCE MANAGEMENT

The National Forest road system of roughly 206,000 miles is currently being maintained at an annual cost of $60,000,000. Each year, the maintenance job continues to grow in size and complexity. Recognizing this, emphasis on maintenance management needs and activities have increased.

Recent efforts which illustrate the new emphasis are:

The Chief's committment of the Washington Office to develop a maintenance management system for use in planning, scheduling, performing, and evaluating maintenance of Forest Development Roads (FSM 7726.04).

Maintenance of Forest Development Roads, Chapter 10 of FSH 7709.15, published in November 1975, contains a maintenance management system adaptable to all National Forest situations.

Project No. 2521, Practices and Equipment Problems in Road Maintenance is being completed by the Equipment Development Centers.

The programing and budgeting process beginning with FY 1977 utilizes road maintenance levels from the maintenance management system. Hopefully, this will result in more realistic maintenance funding levels to accomplish management objectives and funded resource activities.

The Chief also directed Regional Foresters to ensure that a maintenance management system was implemented by all Forests. The development of that system would better enable the Forest Service to meet its objectives for road maintenance which include the following.

1. Perpetuate the Forest Development Road to serve its intended management purposes.

2. Protect the investment, environment, and resources along the road.

3. Provide for user safety.

4. Meet applicable air and water quality standards.

5. Provide for users access, economy, and convenience.

It is also anticipated that implementation of a good management system will enable Forests to save money and manpower Service-wide; increase productivity; improve overall quality of work; and conserve energy.

The objective of Project 2521 is to improve the Forest Service Road Maintenance Program by identifying problems, and applying new ideas and technology. Field inputs were received through a survey on 40 National Forests, in which numerous problems were identified and summarized in each Region.

At the January 1975 meeting in Denver involving personnel from the Equipment Development Centers, Regions, and Washington Office, the major problems needing Service-wide action were selected from the survey data. Many of the problems relate to equipment; however, some of the more pressing ones are administrative and organizational.

The outputs of this meeting will be published in an ED&T Report in the Spring of 1976. Recommended solutions to problems are not within the scope of Project No. 2521; therefore, development of action plans will be necessary.

Efforts in the Washington Office to increase emphasis on the program are continuing. Interest shown in the new maintenance management system thus far by Regional and Forest personnel has been very gratifying. In April 1976, a new position in transportation system maintenance was filled by Dave Badger from Region 5. His principal mission will involve working closely with Regions, Centers, WO Staff Units, and various agencies. Dave will appreciate hearing your ideas, questions, and problems to provide assistance or pass information on to others.

OPERATIONS

Harold L. Strickland
Assistant Director

EQUIPMENT ENGINEERS WORK CONFERENCE

The biennial Equipment Engineers Work Conference was held February 9-13, 1976, in Denver, Colorado. The meeting was attended by all Regional Equipment Engineers.

The following goal was established at the outset of the conference:

"The objective of this meeting is to reach an agreement among ourselves that there are enough variances between Regions in the way we provide equipment service to justify our spending time and effort to work together this week to develop a systematic approach to increase project efficiency and save money. We know this is a tall order, easier said than done, but for this week

we have chosen two areas which we feel present the best opportunities for improvement. These areas are vehicle selection and maintenance."

In keeping with the established objectives of the meeting, two areas of primary concern and most promising for improvement were chosen for work group action. These assignments were to develop a systematic approach to the problems of (1) selecting the type and size of equipment best suited to program needs and (2) identifying high maintenance cost areas and recommend action for improvements.

Another important subject discussed at this meeting was the transition of the working capital fund management and accounting system into the National Finance Center by the end of FY 1977. In doing this it will be necessary to develop a standard vehicle classification system Service-wide. Previous input from all Regions will be summarized by the WO and circulated for field review. In development of this standard class code system an exerted effort will be made to minimize vehicle classes which serve no significant economical or management value.

TECHNOLOGICAL IMPROVEMENTS

Heyward T. Taylor
Assistant Director

The Technological Improvements section of the Washington Office News for March carried a description of some of the projects that were worked on during 1975 at the San Dimas Equipment Development Center (SDEDC). That article was not intended to be a description of all of the work of the SDEDC, or the work being done at the Missoula Equipment Development Center. The last sentence should have been written as follows:

"I've presented the important pursuits *only* at San Dimas in 1975; now is the time to let us know, through regular channels, where we should focus our efforts in the upcoming fiscal years."

LOW-VOLUME ROADS — REVISITED

In June 1975, the Transportation Research Board held a workshop on low-volume roads. The workshop has been acclaimed as the single most important meeting for "technology transfer" in the subject area of low-volume roads. For the first time in the United States, a group of engineers, representing widely different geographic areas and diverse employers, assembled in one location for the common purpose of sharing information and concerns on low-volume roads. The Forest Service was well represented at this workshop — both in terms of attendees and in the number of papers that were presented. In addition, one day of the workshop was devoted to a field trip to the Boise National Forest where attendees observed and held discussions on an array of roads on the Forest Service Transportation System. From the feedback we have received, the workshop was a definite success. Two of the more important developments evolving from the workshop are:

Special Report 160, Low-Volume Roads
This proceedings volume from the workshop contains 38 papers in its 396 pages. The papers are grouped into the following categories (1) Philosophies and Design (2) Planning, Construction and Design Strategies (3) General Design, (4) Pavement Design, and (5) Planning, Economics and Operations. Of the 38 papers in the report, 16 were either authored by Forest Service personnel or pertain to Forest Service projects. Special Report 160 may very well become a monumental work on low-volume roads. Collectively and individually, the papers represent innovative thinking, originality and considerable expertise in low-volume roads. Over 800 copies of the report have been distributed by M. R. Howlett's memorandum of March 17, 1976 (To: Regional Foresters, Station Directors, and Area Directors; Subject: TRB Special Report 160, Low-Volume Roads; File Designation: 1630 Written Information.) We urge Forest Service personnel with job related duties in the Forest Service Transportation system to obtain Special Report 160, and to read and use it.

Research Needs Statements
Periodically the Transportation Research Board publishes a listing of research needs that the Board's various task forces and technical committees have identified. The publication is aimed at potential sponsors and contractors for the needed research — such as State and Federal agencies, industry, associations, research institutions and the academic community.

Adrian Pelzner of this office served as Chairman of a TRB group that prepared the statements of research needs for low-volume roads. The statements are titled:

1. Design Standards for Low-Volume Roads
2. Safety Criteria for Low-Volume, Low-Speed Roads.

The statements reflect the needs that were expressed at the Boise Workshop. The statements will appear in a Fall TRB Circular on Research Needs. Since these statements also reflect many of the needs of the Forest Service Transportation System, we have reproduced them in their entirety in an accompanying article in this issue of FIELD NOTES.

Perhaps the single most important development from the workshop is that a forum and focal point has been established for low-volume roads. The Transportation Research Board recognized that the Board itself is the proper forum for the continual development of low-volume road technology. A resolution has been adopted affirming that the subject of low-volume roads be continued to be addressed within TRB. The TRB Task Force on Low-Volume Roads has been given the following assignments:

1. By mid-1978, plan, organize and produce the Second International Conference on Low-Volume Roads.

   Note: We will furnish more information on this conference when the plans and arrangements for the conference are further developed by the Task Force.

2. Coordinate and interact with the other standing committees of TRB on mutual areas of attention on low-volume roads.

3. Develop research needs statements for low-volume roads.

   Note: TRB allows two research needs statements per task force or committee. Research needs statements on (1) Design Standards and (2) Safety Criteria have been accepted by TRB and will be published in the Fall. Thus the Task Force's assignment No. 3 has been completed.

While all of us would prefer to have a completely rational methodology in the design and construction of low-volume roads, the next best approach is to ask the right questions and have a proper forum for presenting information and sharing knowledge on low-volume roads. The Workshop in Boise and the subsequent developments are just the beginning — but nonetheless an important beginning. From the start, the Forest Service has been very much involved with this effort on low-volume roads and will continue to support its further development.

CHANGES TO APRIL FIELD NOTES

Volume 8 Number 4

SURFACING TREATED DECKS WITH BITUMINOUS MATERIALS

Correct page 1, last paragraph, fourth sentence to read as follows:

It has been prepared in consultation with the *Asphalt Institute*, the *American Wood Preservers' Institute*, and the *American Institute of Timber Construction.*

RESISTIVITY METHOD FOR PREDICTING THE SERVICE LIFE OF CORRUGATED METAL PIPE CULVERTS

Correct the author's name and professional title lines to read as follows:

Robert M. Gallup, P.E.
Civil Engineer

GPO 902-990

INVITATION TO READERS OF FIELD NOTES

Every reader is a potential author of an article for FIELD NOTES. If you have a news item or short article you would like to share with Service engineers, we invite you to submit it to FIELD NOTES for publication.

Material submitted to the Washington Office for publication should be reviewed by the respective Regional Office to see that the information is current, timely, technically accurate, informative, and of interest to engineers Service-wide (FSM 7113). The length of material submitted may vary from several short sentences to several typewritten pages; however, short articles or news items are preferred. All material submitted to the Washington Office should be typed double-spaced, and all illustrations should be original drawings or glossy black and white photos.

Each Region has an Information Coordinator to whom field personnel should submit both questions and material for publication. The Coordinators are:

R-1	Bill McCabe	R-4	Ted Wood	R-9	Norbert Smith
R-2	Allen Groven	R-5	Jim McCoy	R-10	Frank Muchmore
R-3	Bill Strohschein	R-6	Kjell Bakke	WO	Al Colley
		R-8	Ernest Quinn		

Coordinators should direct questions concerning format, editing, publishing dates, and other problems to:

Forest Service, USDA
Engineering Staff, Washington Office
Attn: Gordon L. Rome or Rita E. Wright, Editorial Services
Washington, D.C. 20250

Telephone: Area Code 703-235-8198

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