

**ENGINEERING
TECHNICAL
INFORMATION
SYSTEM**

FIELD NOTES • TECHNICAL REPORTS
DATA RETRIEVAL • MANAGEMENT
PROFESSIONAL DEVELOPMENT

VOLUME 12 NUMBER 4

Field **Notes**

NEW DEVELOPMENT IN CLEARING ROADS

PRACTICAL SOLAR APPLICATIONS

**IMPROVE ENERGY EFFICIENCY IN FOREST
SERVICE BUILDINGS & FACILITIES**

WASHINGTON OFFICE NEWS



FOREST SERVICE

APRIL 1980

U.S. DEPARTMENT OF AGRICULTURE



ENGINEERING FIELD NOTES

Volume 12 Number 4

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**FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE
Washington, D.C. 20013**

A NEW DEVELOPMENT IN CLEARING ROADS

*Tom L. Condos
Civil Engineer
Tahoe National Forest*

An innovative product is now on the market that can cut clearing costs and timber sale road construction time. The product is a special front-end power shovel. It is currently being used by a local road construction company on the Tahoe National Forest.

The typical clearing operation consists of a faller, a D-7 caterpillar, a choke setter, and two laborers. The people and equipment cut, fall, and remove the right-of-way timber. They remove the stumps and slash, piling it at regular intervals alongside the road, and transport it with a loader and truck, or burn it in piles on the road.

The new method still requires the faller, the caterpillar, and choke setter for right-of-way timber; however, a power shovel is also needed. Model 225, manufactured by the Caterpillar Corporation, is an example of this type of power shovel.

The power shovel bucket has been removed and replaced with a clam shell (fig. 1). Both the front and rear of the clam shell are hydraulically activated (fig. 2). The flotation-type track has a ground contact pressure of 6 pounds per square inch (0.42 kilograms per centimeter); the width of the tracks is 10 feet (3.05 meters), which minimizes ground disturbance.

The machine can be used to pioneer new roads with side slopes up to 40 percent. One way to overcome the greater slopes is to use a medium-sized caterpillar to pioneer the road for the machine (fig. 3).

How does a power shovel clear a road? The clam can remove stumps up to 24 inches (61.0 centimeters) in diameter. For larger stumps, a caterpillar with a stringer is utilized. The machine works like someone "pulling weeds from the garden." It grabs a tree (fig. 4), stump, or brush (fig. 5) with the clam shell and pulls it out of the ground. It shakes the dirt off the roots and loads the debris into a dump truck (fig. 6). It can dig out larger stumps, but the operation becomes inefficient.



Figure 1.--Caterpillar power shovel with clam shell attachment.



Figure 2.--Hydraulically activated clam shell.



*Figure 3.--Pioneered
road with cleared
side slopes.*



*Figure 4.--Clam shell
removing a tree.*



Figure 5.--Clam shell grubbing brush.

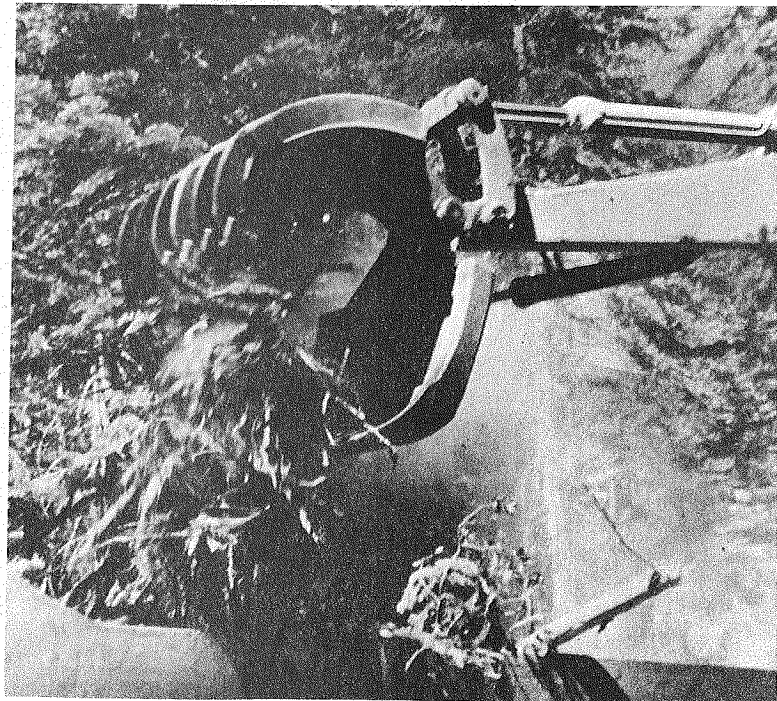


*Figure 6.--Power shovel loading debris
into a dump truck.*

This type of clearing operation is much cleaner and faster than a medium-sized caterpillar with a brushrake. There is less disturbance to the soil and, when the road has been completed (fig. 7), the clam can be replaced with the conventional bucket for the installation of culverts. Culvert installation time can be cut in half by using the machine's size and versatility.



Figure 7.--Finished road, cleared by Model 225 with clam shell attachment.

The cost to rent a Caterpillar Model 225 is \$2,000.00 per month, based upon 220 hours of operation. The cost of diesel fuel, estimated at five gallons per hour, and the \$8,000.00 cost of the clam shell attachment must be considered for a total operational investment.

The average time required to clear a 14-foot (4.27-meter) timber road with a 30 percent side slope is approximately 6 1/2 minutes per dump-truck load. Minimizing the equipment's slack time is paramount, when determining the number of trucks and the haul distance for each project.

The following compares the two methods of clearing on the Tahoe National Forest:

1. The typical clearing method is \$3,478.00 per acre (\$1,407.55 per hectare), while the cost for Model 225 is \$2,050 per acre (\$829.64 per hectare).

2. The average rate with heavy brush and medium pole is 300 feet (91.44 meters) per day for the typical clearing method and 1,000 feet (304.8 meters) per day for Model 225.

High rental rates and the initial cost of clams are economic disadvantages of this type of equipment; the physical disadvantages are its instability on steep ground while pioneering roads, and the dust it creates while loading trucks.

It is apparent that the economic benefits offered by expeditious road clearing and minimal environmental effects make this special front-end shovel a viable asset to Forest Service road building operations.

PRACTICAL SOLAR APPLICATIONS

*James M. Kocer, P. E.
Resident Engineer
R-3*

Two buildings at the Albuquerque Tree Nursery have practical solar heating systems that should be of interest to others who are designing heating systems.

The first system, completed in April 1979, is used to heat the cones in the seed extraction process. The second system, to be constructed in the summer of 1980, will be used to heat an employee lunchroom facility.

Both concepts are similar and use the sloped roof of the building as the solar collector. The collector consists of a bottom course of standard metal roofing and a 4-inch (10.16-centimeter) air space with a 5-ounce (0.14-kilogram) corrugated fiberglass top course (fig. 1).

The fiberglass panels are supported by 4-inch (10.16-centimeter) webbed holostuds on 4-foot (1.22-meter) centers. The metal panels are also supported on 4-foot (1.22-meter) centers by cross purlins. Directly beneath the metal panels, there are 6 inches (15.24 centimeters) of batt fiberglass insulation with a vapor barrier.

The 6,000-square-foot (557.45-square-meter) Extractory Building panels are enclosed on the sides and top; the south bottom line is open and screened. The entrapped heated air is drawn up the roof line, then pulled down through five separate ductworks on the north wall by 1 1/2-hp inline centrifugal fans. The cone trays are stacked 12 feet (3.66 meters) high along the north wall, and the heated air is discharged into the bottom tray. Air flow is assisted through the trays by exhaust fans located on the north wall near the top of the trays. The designer estimated a temperature differential of 35-40°F (1.7-4.4°C) between ambient and delivered air for the month of October. A table of actual differential recordings is shown on page 9. If temperatures are too warm, in excess of 110°F (43.3°C) for pine, the seeds will be damaged or killed. Therefore, at the top of each ductwork, the system has motorized dampers (fig. 2), which are operated by a remote thermostat allowing ambient air to mix with heated air when necessary. Because the system is rarely used during the summer months, temperatures in the solar cap may build to over 150°F (65.5°C). Manual dampers and another thermostat for the existing dampers are installed to allow the trapped heated air to escape.

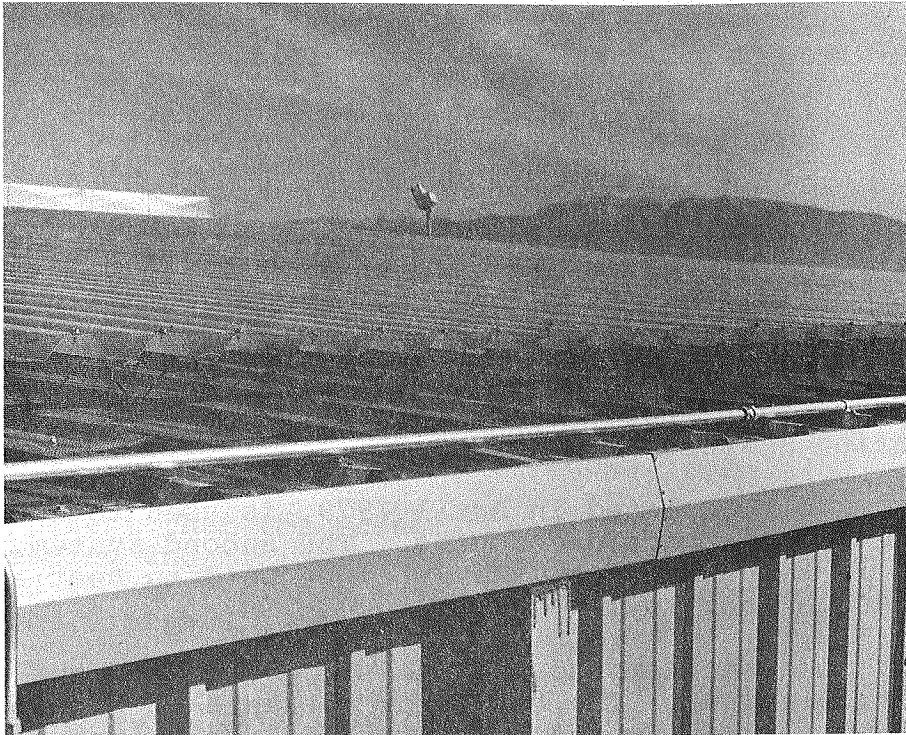


Figure 1.--Solar collector on sloped roof.

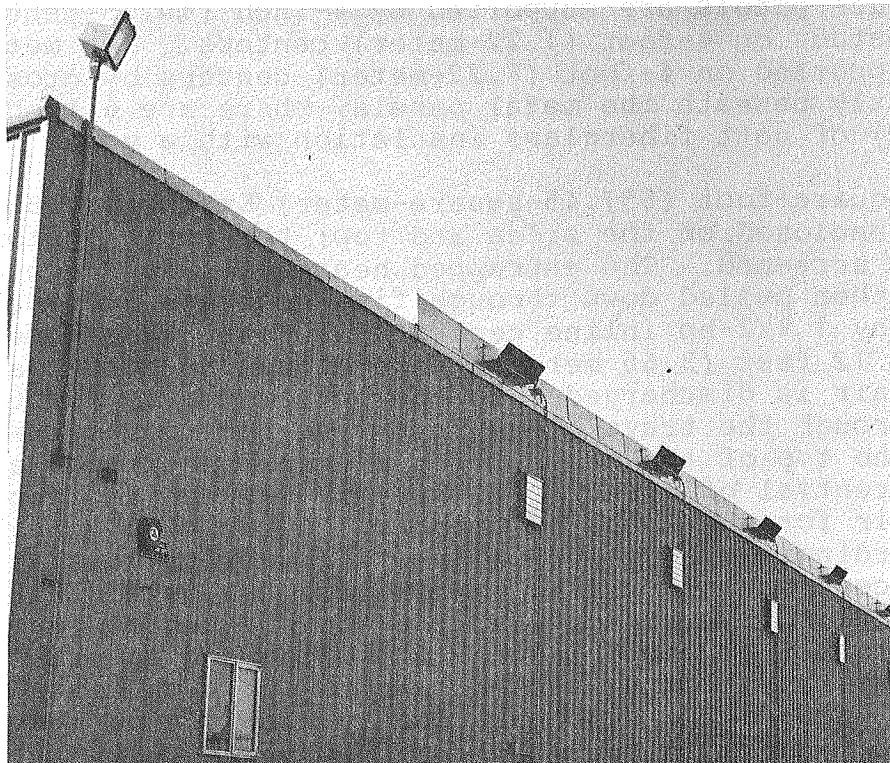


Figure 2.--Ductwork with motorized dampers.

TEMPERATURE READINGS OF SEED EXTRACTORY HEATING SYSTEM (°F)

DATE	TIME	WEATHER	MAIN CHUTE*	AMBIENT AIR
11/5/79	1400	clear	84	61
11/6/79	0840	thin clouds	58	45
	1225	overcast	75	56
	1535	thick clouds	60	58
11/7/79	0850	thin clouds, no direct sun, rain in a.m.	53	45
11/14/79	1200	clear	78	50
	1400	clear	72	55
	1600	clear	58	57
11/15/79	1010	clear	46	44
	1200	clear	81	52
	1400	clear	77	60
11/16/79	1230	clear	82	55
	1400	clear	78	60
	1600	clear	64	60
12/5/79	1000	clear	85	50
	1230	clear	83	60
	1400	clear	78	60
	1600	clear	62	57
12/6/79	1100	clear	88	48
	1300	clear	95	54
12/7/79	1000	clear	86	46
	1230	clear	98	55
	1440	clear	88	58
	1600	clear	62	58

*Air delivered at cone trays.

The employee lunchroom facility will be heated using the same system, (mechanical flow diagram, fig. 3) with two main differences:

1. The 3,180-square-foot (295.45-square-meter) solar cap is enclosed on all sides, returning air to the cap from inside the building.

2. The backup system involves electric heating elements downline from the three 3/4-hp fans.

Region 5 Architectural Section designed both systems.

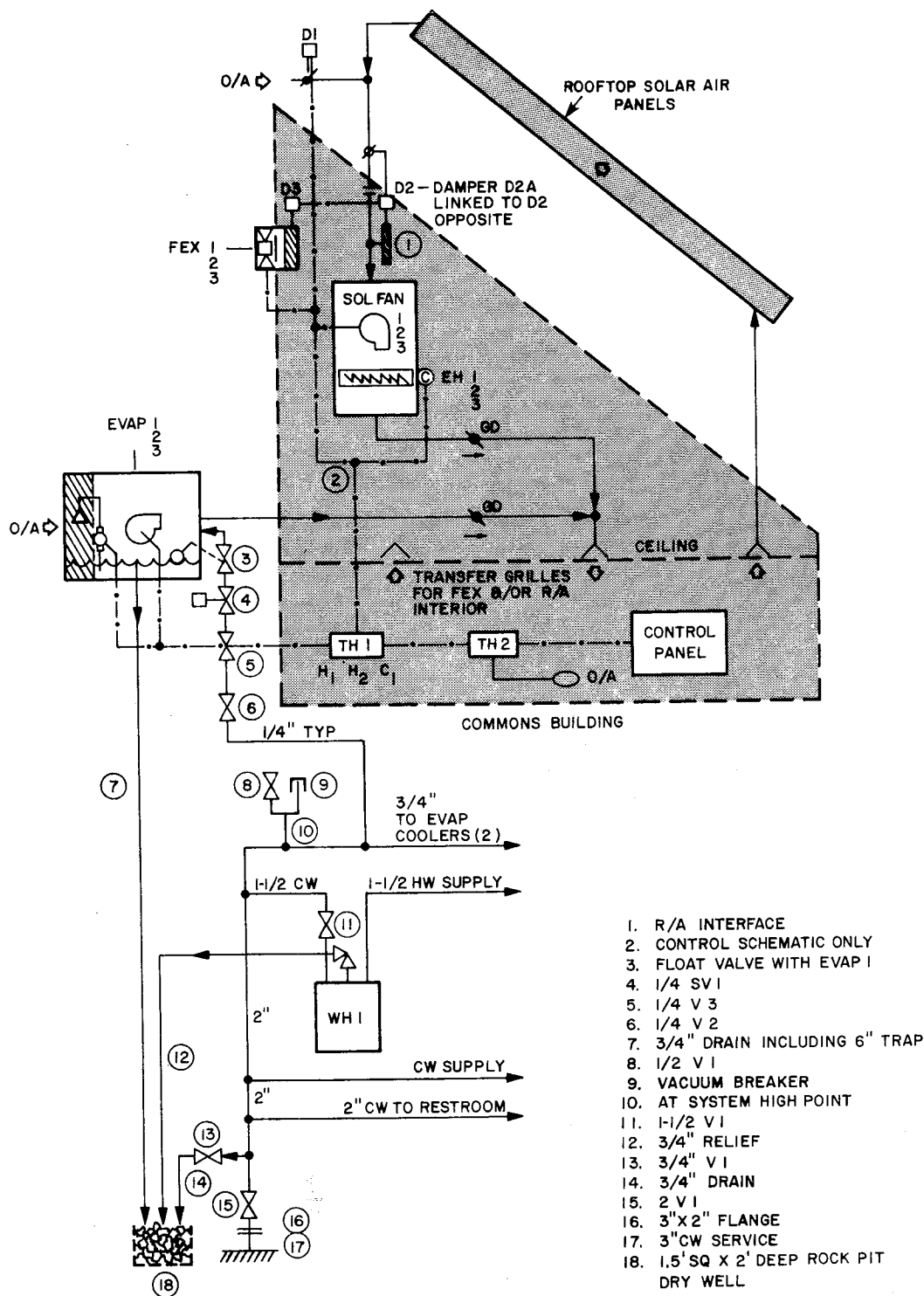


Figure 3.--Mechanical flow diagram (solar heat, evaporating, cooling, water heater, water supply).

RECENT ACTIVITIES TO IMPROVE ENERGY EFFICIENCY IN NEW CONSTRUCTION
IN FOREST SERVICE OWNED BUILDINGS AND RELATED FACILITIES

*George J. Lippert
Facilities Engineer, WO*

The following report was sent recently to all Regional Foresters and Directors for their information. We are including it here so you may also become familiar with energy conservation efforts in new constructions. Should you desire more information regarding site conditions, design parameters, and costs associated with the projects, you should contact the Regional Director of Engineering responsible for that project.

All new Forest Service buildings are being designed to ASHRAE 90-75 Standards, the most widely accepted standard in the country for energy efficient building design. Building envelope, heating, ventilation, and air conditioning energy efficiency standards are prescribed. Several units have been using this standard since 1975. In many instances, the standards have been exceeded.

BUILDING AND FACILITY DESIGN

In addition to this general treatment, several projects have had unique energy conservation design features incorporated. The following list (keyed C--completed, UC--under construction, F--funded, or P--proposed) indicates the current status of projects in this category:

Region 1

- Wise River Ranger Office, Beaverhead National Forest, Montana. Passive solar collector, Trombe Wall concept. (UC)
- Spotted Bear Range Station, Flathead National Forest, Montana. Installation of 50kW, water-driven power plant for entire administration site to replace existing diesel-powered generators. (UC)

- Red River Ranger Station, Nez Perce National Forest, Idaho. Duplex employee residences, including energy efficient architectural interior design with concentration of south-facing glass, wood stoves, masonry heat storage, and high insulation levels. (F)
- Belt Creek Work Center, Lewis and Clark National Forest, Montana. Residence of passive/active solar design. Building sited partly below grade with southwest exposure for solar passive heating. Active solar heating for hot water and partial space proposed. (P)
- Standard, 4-person Crew Quarters (modules to 12-person units). Uses active solar hot water heat. (P)
- Region 1--Recreation. Solar-heated hot water shower at a specific recreation site. (P)
- Two projects are included in the Solar in Federal Buildings Program, which is listed separately in this report.

Region 2

- Recreation Toilet Buildings. One hundred twenty-four vault toilet buildings, at various sites utilizing passive solar ventilation systems. (C)

Region 3

- Seed Extractory Building, Albuquerque Nursery, Cibola National Forest, New Mexico. Passive solar collector designed as a double roof system. Blowers distribute heated air for cone drying. (C)
- Commons Building, Albuquerque Nursery, Cibola National Forest, New Mexico. Same system as Seed Extractory Building, with exception of air returning to the solar cap and integral electric furnace auxiliary heater. (UC)

Region 5

- Arroyo Seco Fire Station, Los Padres National Forest, California. Crew quarters with passive/active solar system, utilizing black tile, double roof system as passive solar collector. Gravity ventilation circulation, shutters, and earthen berms are passive features; solar domestic hot water is an active feature. (P)

- Big Valley Ranger Station Office Addition, Modoc National Forest, California. Active solar collectors to assist in the heating of the existing building and the addition. Flat plate collectors used. Funded under DOE/ERDA Demonstration Program. (C)
- Two projects are included in the list of Solar in Federal Buildings Program, which is listed separately in this report.

Region 6

- Dispatcher's Office, Redmond Air Center, Deschutes National Forest, Oregon. Passive solar heating through Trombe Walls and thermal mass of building. Solar reflectors/shutters, roof overhangs, screens, and earthen berms are also used. (P)
- Medford Nursery, Rouge River National Forest, Oregon. Active solar domestic hot water system. (UC)
- Cone-Dryer/Seed Extractory, Dorena Seed Orchard, Umpqua National Forest, Oregon. Passive solar collector designed as a double roof system. Blowers distribute hot air to seed trays. (UC)
- Dufer Ranger Office Addition, Mt. Hood National Forest, Oregon. Passive design to obtain partial solar gain for heating and gravity ventilation to assist existing heating and ventilation systems. No thermal storage provided. YACC project. (P)
- Solar Domestic Hot Water Systems, Mt. Baker, Snoqualmie National Forest, Washington. Packaged solar assistance for existing domestic hot water systems. Active systems for installation at several locations on Forest. (P)

Region 8

- Newcastle Ranger Office, Jefferson National Forest, Virginia. Active solar space heating system using air-type flat plate solar collectors and salt storage. (F)
- Residence, Schenck Civilian Conservation Centers, National Forests in North Carolina. Hybrid active/passive solar system using hot attic air collection and rock storage, commonly referred to as the "Clemson solar attic design concept." (UC)

- Bathhouse and Four-unit Flush Toilet Buildings, Houston Recreation Area, National Forests in Alabama. Flat plate solar collectors for hot water. (UC)
- Two-unit Vault Toilets, Various Locations in R-8. Passive solar ventilation system. (UC)
- Combined Research Project Laboratory and District Rangers Office, Northeast Station and Daniel Boone National Forest, Berea, Kentucky. Active solar heating and cooling system with wood-fired boiler for backup heating and cooling. Passive design concepts are also employed, such as partial undergrounding, and placement and protection of windows to obtain winter solar gain and a percentage of summer solar gain. (UC)
- Highlands District Ranger Dwelling, National Forests in North Carolina. Multifuel furnace heating system, which can use either wood or fuel oil. (C)
- Welding Shop, Lyndon B. Johnson Civilian Conservation Centers, National Forests in North Carolina. Multifuel furnace heating system, which can use either wood or fuel oil. (C)
- Dormitory, Jacobs Creek Civilian Conservation Center, Cherokee National Forest, Tennessee. Flat plate solar collectors for hot water. (UC)
- Womble Ranger Office, Ouachita National Forest, Arkansas. Hybrid active/passive system will collect heat entering through clerestory and store it in a salt storage unit. The system will also include passive storage walls. (P)

Region 9

- Washburn Ranger Office, Chequamegon National Forest, Wisconsin. Solar hot water heating system. (UC)
- Murphysboro Ranger Office, Shawnee National Forest, Illinois. Incorporates passive solar elements and utilizes a supplemental wood burning system. (F)
- Saco Ranger Office, White Mountain National Forest, New Hampshire. Design concepts similar to the Murphysboro Office. (F)

- Administration Building, Golconda Civilian Conservation Center, Shawnee National Forest, Illinois. Will incorporate passive solar design concepts and utilize supplemental wood heating system. (P)
- Administration Building, Blackwell Civilian Conservation Center, Nicolet National Forest, Wisconsin. Same as Golconda Project. (P)

Pacific Southwest

- Fresno Laboratory, Fresno, California. This is the first phase of combined passive/active solar-assisted heating and cooling system. Passive features include solar thermal mass incorporated in the courtyard patio furniture, an atrium, windowscreens, and double roof system. Funded under DOE/ERDA Grant. (C)

The second phase is included in the Solar in Federal Buildings Program, listed separately in this report.

Northeast

- Berea Project Office. Included in R-8 report.

Southeast

- Forestry Science Laboratory/Headquarters Building, Southeast Forest Experiment Station, Asheville, North Carolina. Included in the Solar in Federal Building Program, which is listed separately in this report.

PHOTOVOLTAICS (ELECTRICAL POWER GENERATION FROM SOLAR ENERGY)

Several projects have been funded under the Federal Photovoltaics Utilization Program (PL 95-619). Approximately \$2.0 million has been provided to the Forest Service under Cycles I, II, and III of the program. Participation in two more cycles is planned.

- Telecommunications. Ninety-one projects in R-2, R-3, R-4, R-5, and R-8. These range from small repeater sites to microwave transmission. Domestic power, i.e., lighting, refrigeration, etc., was included at sites co-located at or near a lookout tower.

- Water and Wastewater Pumping. Ten projects in R-2, R-3, and R-4. These range from small wildlife water "guzzler" pumps to major water sources for recreation areas. Three range water wells are included in this category.
- Domestic Power Supplies. Eight projects including lookout tower power supplies to YACC camps, for campground lighting, boat ramps, and parking lot security lights. R-3 has five projects that will be mounted atop crew trailers.
- Ventilation Systems. Two hundred forty-six projects. Solar-powered ventilation units will be installed Service-wide. These units are similar to approximately ten units the San Dimas Equipment Development Center has been testing. The larger project is to provide further data on actual use and to demonstrate the viability of photovoltaic systems for improving conditions in recreation area toilet buildings.
- Others. Battery chargers for watershed instruments.

*SOLAR IN FEDERAL BUILDINGS PROGRAM
(THERMAL DEMONSTRATIONS)*

A decision on six applications submitted under DOE's Solar in Federal Building Program (PL 95-619) should be received in February, 1980. Some applications included completion of previously mentioned projects.

- Fresno Laboratory, Pacific Southwest, Fresno, California. The request is for completion of the solar-assisted heating and cooling system begun under DOE/ERDA Demonstration Grant.
- Big Bear Lake Visitor Information Center, San Bernardino National Forest, California. The request is for a hybrid solar system that includes passive ventilation, active solar-assisted space heating/cooling, and domestic hot water.
- Chilao Visitor Center, Angeles National Forest, California. This request is for a hybrid solar system that includes passive ventilation, active solar-assisted space heating/cooling, and domestic hot water.

- Forestry Sciences Laboratory/Headquarters Building, Southeast Forest Experiment Station, Asheville, North Carolina. This request is for installation of a solar-assisted space heating system and domestic hot water system. This is a new construction project.
- Powell Ranger Station Office, Clearwater National Forest, Idaho. This request is for installation of solar panels for a solar-assisted, air-to-air heat pump system in an existing office. The original office (1977) was designed with future retrofitting in mind.
- Wise River Ranger Station Office, Beaverhead National Forest, Montana. This project is for the instrumentation of passive solar collector (Trombe Wall).

WASHINGTON OFFICE NEWS

TECHNOLOGICAL IMPROVEMENTS

Harold L. Strickland
Assistant Director

A Look Backwards--Forest Service Impressions

LOW-VOLUME ROADS: SECOND INTERNATIONAL CONFERENCE

Adrian Pelzner
Chief Materials Engineer

The Transportation Research Board held a major conference on Low-Volume Roads, August 20-23, 1979. Because of the importance of this conference, 50 Forest Service transportation engineers attended. Following the conference, the Forest Service attendees were surveyed by means of a questionnaire to determine their impression of the conference and the conference's overall relevance to their work assignment.

Generally, the Forest Service attendees had a positive attitude toward this conference and an overall feeling that their attendance was worthwhile. Most of the engineers felt that 25-50 percent of the subject matter presented at the conference had specific application to their work. However, the attendees were unable to quantify cost savings that might be achieved as a result of something learned at the conference. The narrative comments supplied by the respondents are particularly interesting and illustrate a wide range of opinions and impressions of the conference.

We would like to thank those Forest Service personnel who took the time to complete the questionnaire. We have summarized the replies, and the summary is presented here for your information.

SUMMARY OF REPLIES
FROM
FOREST SERVICE QUESTIONNAIRE
ON
LOW-VOLUME ROADS: SECOND INTERNATIONAL CONFERENCE

1. I consider myself to be:

- a. A support specialist involved in Forest Service transportation engineering (i.e., geotechnical, computer science, signs, bridges, etc.).
- b. An engineering manager working full or part time in transportation engineering (i. e., Regional Engineer, Assistant Regional Engineer, preconstruction or maintenance engineer).
- c. Not connected in any direct way with transportation engineering in the Forest Service.

Support Specialist	14
Engineering Manager	<u>24</u>
Total Questionnaires Received	38

2. I estimate that the direct costs to the Government (including travel, per diem, salary, etc.) for my attendance at the conference were:

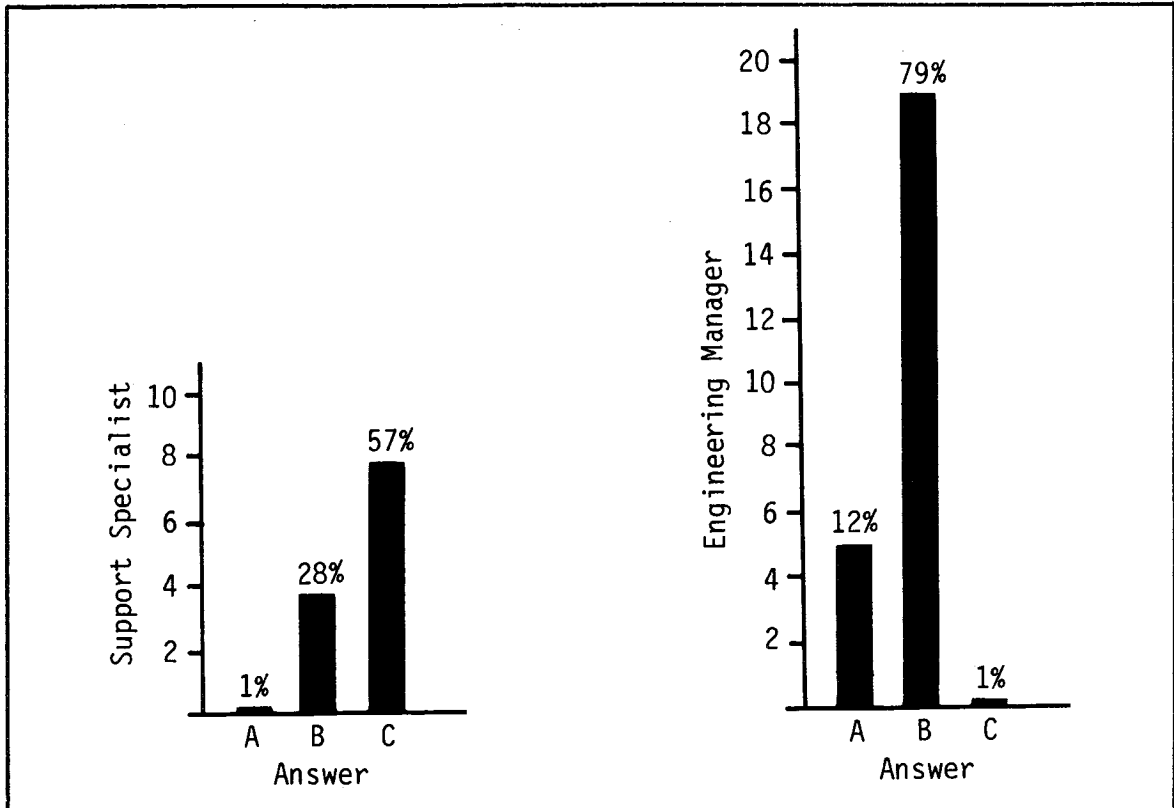
- a. \$ 700.
- b. 1,000.
- c. 1,300.
- d. 1,600.
- e. 2,000.

	<u>Range</u>	<u>Average</u>
Support Specialist	\$700-1,600	\$1,042
Engineering Manager	700-1,600	983

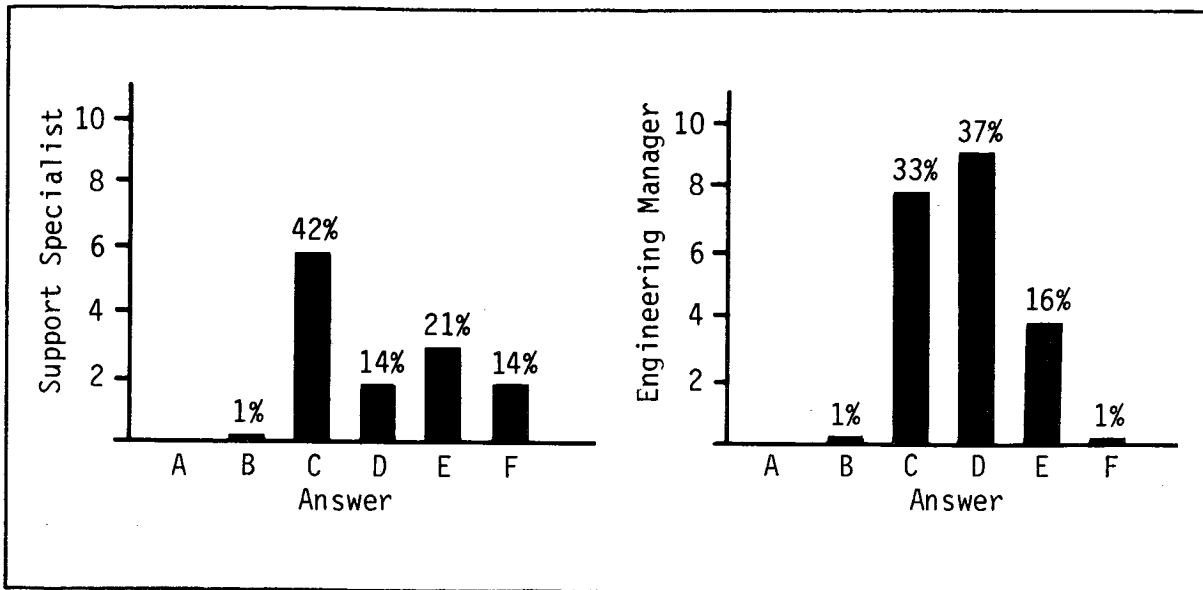
3. My overall reaction to the conference can be summed up as follows:

- a. It was worthless, boring, and had no connection or only the very remotest connection with my work. I would have been better off by not attending.

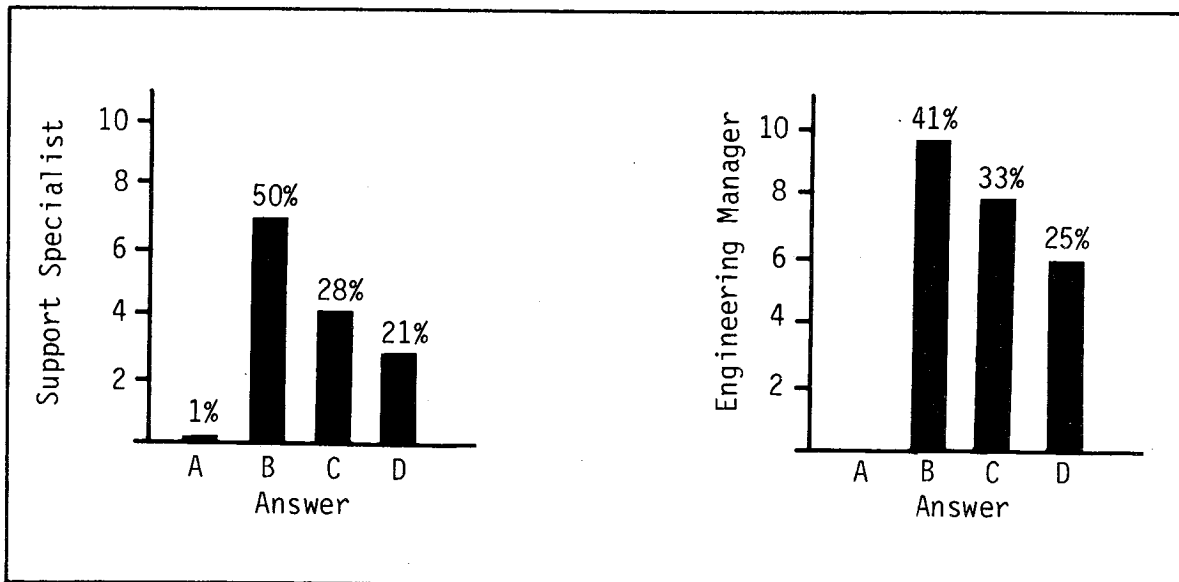
- b. It was a nice change from my regular work schedule, but there was little of value for me at the conference.
- c. It was a real morale booster. By attending the conference, I gained a better understanding of the importance of my work in low-volume roads and a better understanding of the vital role played by low-volume roads throughout the world.



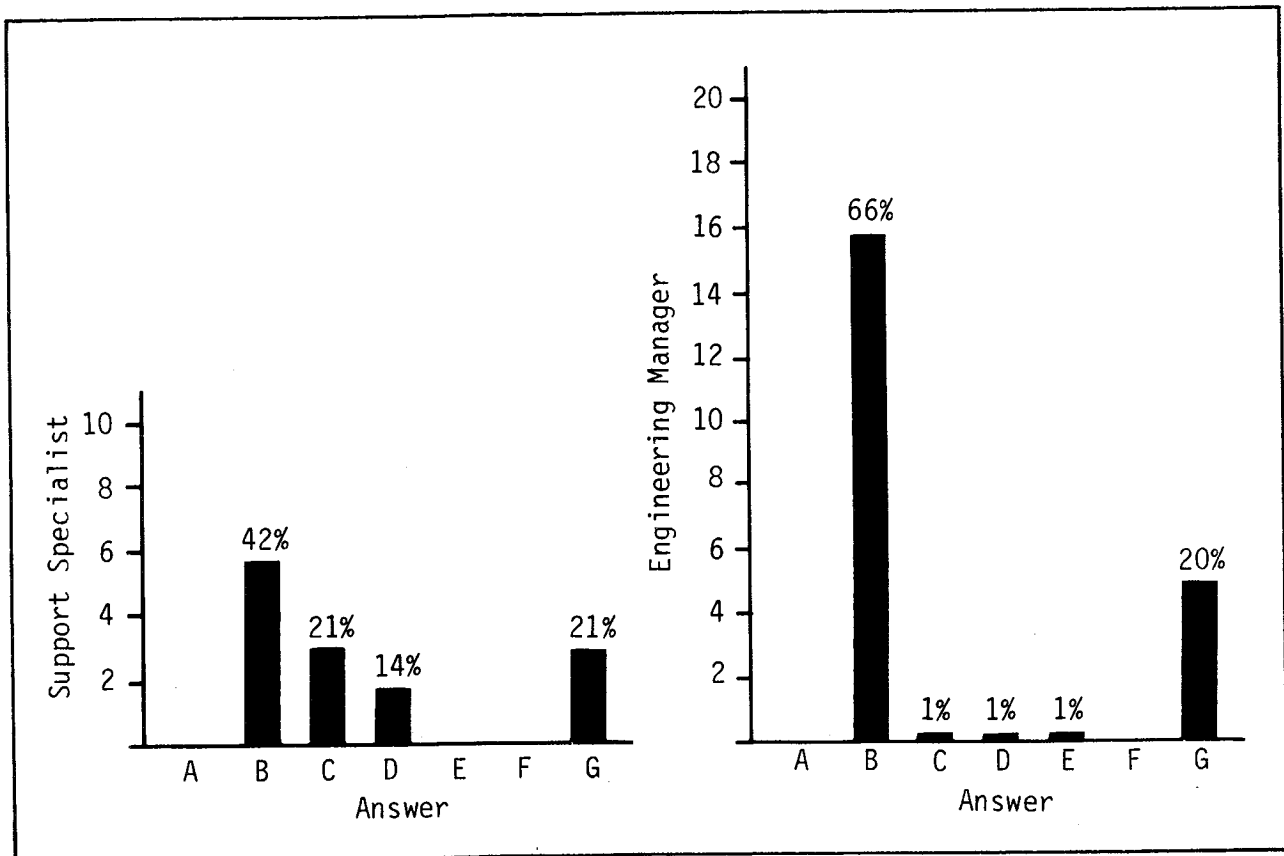
4. Insofar as specific applications to my work are concerned, I found the various papers presented at the technical sessions I attended to be relevant as follows:
- a. Not at all.
 - b. No more than 10 percent.
 - c. About 25 percent.
 - d. About 33 percent.
 - e. As much as 50 percent.
 - f. Considerably greater than 50 percent.



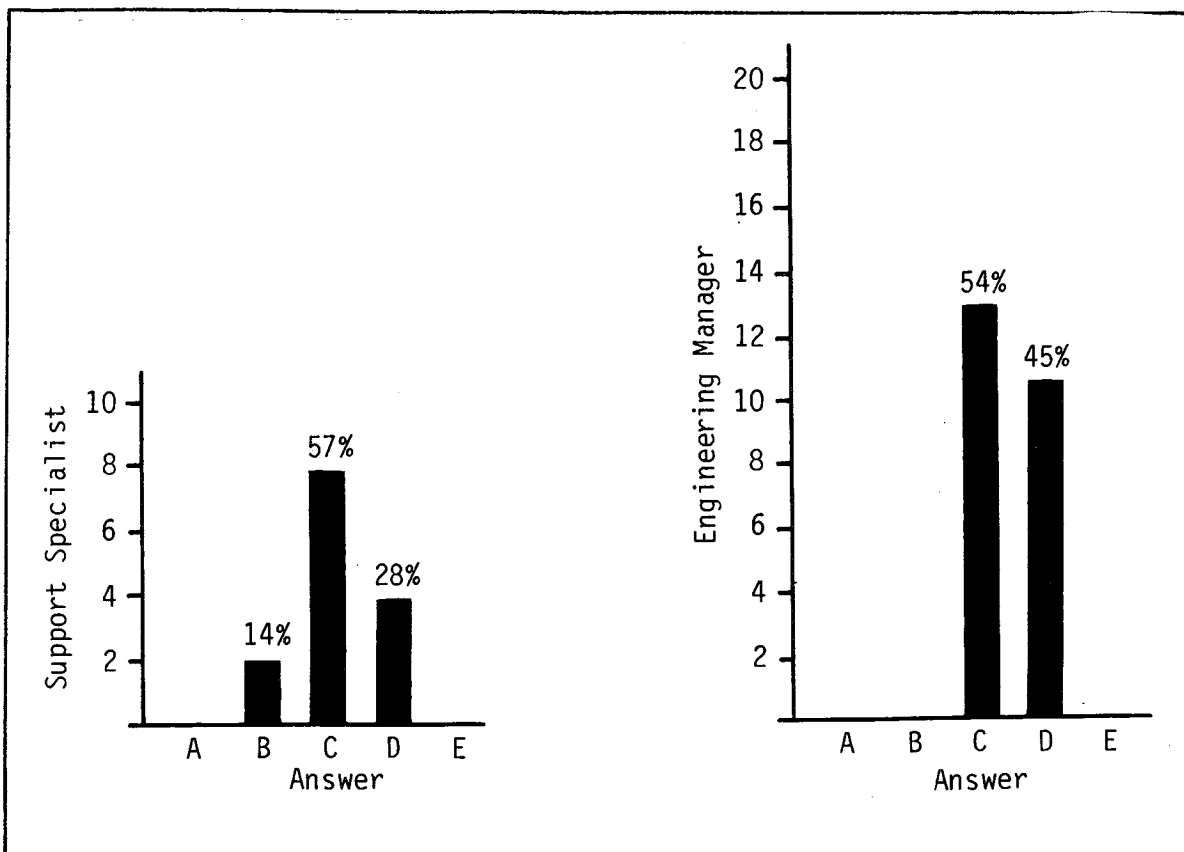
5. It has been 2 months since I attended the conference. I have:
- Already forgotten about the conference.
 - Stored the conference in my "memory bank." Perhaps in the future, a situation may arise to which I can apply some of the knowledge I gained while attending the meeting.
 - Made definite plans to make use of some portion of the information that was presented at the conference.
 - Already used some of the information and ideas presented at the conference.



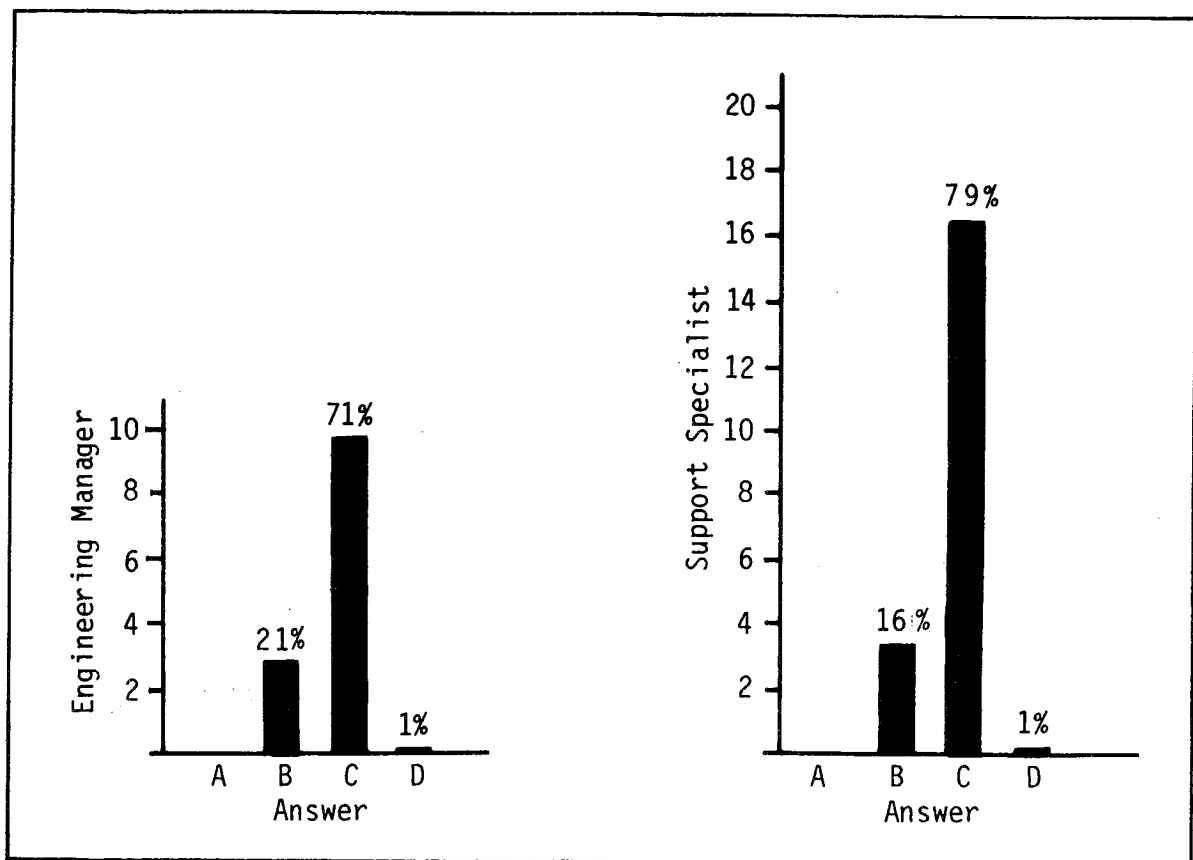
6. Because of something I learned at this conference, I believe I can make an improvement in the way I have been carrying out a particular operation. I estimate the potential savings in the next 5-year period will be:
- a. Nothing, because I did not learn anything useful.
 - b. Nothing, because what I did learn will: (1) allow me to do my job better, (2) give me more alternatives, or (3) improve my analytical capabilities--but such improvements are not possible to quantify in terms of cost savings.
 - c. Less than \$10,000.
 - d. Between \$10,000-\$50,000.
 - e. Between \$50,000-\$100,000.
 - f. Greater than \$100,000.
 - g. Considerable, but I cannot estimate the savings.



7. I received the Proceedings from this conference, which I:
- a. Took home, put away, and will probably never look at again.
 - b. Tried to read and review for potential application to my work, but I gave up. There was either nothing that applied to my work, or those papers that did apply were so technical or impractical that they were not worth my time.
 - c. Scanned or read a few of the more interesting papers. I am keeping my personal copy of the Proceedings and intend to refer to it as the need arises in the future.
 - d. Read one or more papers in detail. The paper(s) either: (1) supports what I am doing now, (2) is causing me to consider changing my operations to take advantage of what I have learned, or (3) gives me many ideas for future followup.
 - e. Read from cover to cover. I expect the Proceedings will become my most useful reference.



8. Concerning future involvement by the Forest Service in conferences of this type, I recommend:
- Against any further involvement whatsoever, either in assisting TRB plan the conference or in allowing Forest Service employees to attend.
 - Considerably reduced attendance by Forest Service employees. Require much stronger, specific justifications for attendance by Forest Service attendees, and require attendees to advise their supervisors what they learned at the conference and how they intend to apply it.
 - That the Forest Service judge each conference on its own merits. I believe the Forest Service involvement in this conference, i.e., planning, number and type of personnel attending, and postconference distribution of proceedings, was the "right response" for a major conference on a subject area of considerable importance to the Forest Service.
 - Far more substantial involvement, i.e., more announcements about the conference, more Forest Service authored papers, more Forest Service attendees, and more postconference followup.

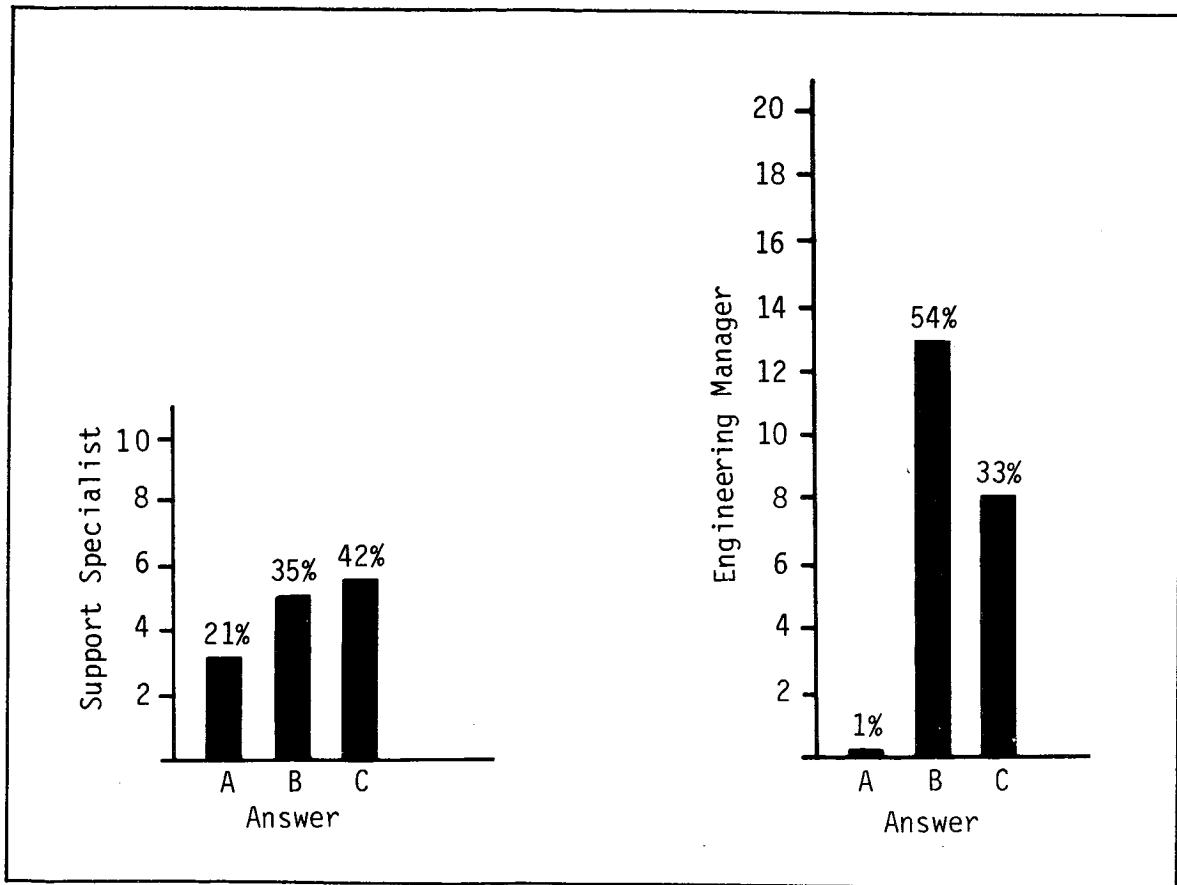


9. Evaluating the benefits of attending this conference is essentially a subjective process. The benefits depend on:

- The technical quality of the conference.
- The meeting facilities.
- The attitude of the attendee toward his work.
- The attitude of the attendee toward conferences and meetings.
- The quality of the published proceedings and reports coming from the meeting.
- An individual's ability to look objectively at his work, decide where improvements are needed, and recognize when a specific presentation or report will or will not be useful in making the needed improvements.

Insofar as this conference is concerned, knowing what I know now about the conference and the Proceedings, I believe my attendance:

- a. Was not justified. I doubt whether the benefits, if any, will be worth the cost, either now or in the future.
- b. Was probably justified. It was a good conference, and I learned something useful. I hope to be able to apply some of this knowledge both now as well as in the future.
- c. Was definitely justified. I can now do some parts of my job better because of my attendance. Furthermore, as a result of what I have learned, I am now making or plan to make changes that will have short-term and long-term benefits that far outweigh the costs of my attendance.



10. Please give us any comments you have regarding your individual attendance at this conference and the collective attendance at this conference by Forest Service employees.

COMMENTS BY SUPPORT SPECIALISTS

Supervisors may have a justifiably-negative attitude toward "meetings"; if supervisors are approached with plans for a "training session" (rather than "another meeting"), they may be more cooperative.

The quality of the papers and applicability of the information were much less than at the first conference; I hope that the presentations of future sessions will be on a higher level.

Forest Service participation in this conference was more "low key" than in the first Low-Volume Road Conference, and this is good. It seems that more interest needs to be generated for county road management agencies to participate.

There were too many Forest Service people at the conference. One or two from the Washington Office, and one or two from each Region should be sufficient.

The road roughness index and vehicle operating costs, as related to maintenance, are interesting concepts that may warrant further examination by the Forest Service.

With many of us, professional growth may tend to stagnate. In my case, I was gratified to be reawakened to a larger world of similar circumstances being resolved in innovative ways.

Some of the papers presented were too deep into research; it was difficult to determine if the results were meaningful or could be adapted to field use.

The most beneficial papers were those presented by field people who actually use the technology.

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 send it for publication in *Field Notes*.

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 Forest Service Engineers (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, ideally, all illustrations should be original drawings, glossy prints, or negatives.

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