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TRAIL TRAFFIC COUNTERS AND DETECTORS

by David B. Trask, WO

A project was established in 1968 at the Equipment Development Center at Missoula to develop a trail traffic and detector counter. At about the same time, we found that the *General Electric Company had been working with the application of solid state electronic principles to detector devices and the company showed an interest in working with us in developing a reliable device for measuring trail use.

In the summer of 1968, a *G. E. pilot model was tested on the Teton National Forest and at the Equipment Development Center at Missoula. The counter works on the principle of a light beam which is reflected back across the trail to the sending unit. Beam interruption advances a counting mechanism.

The light beam is pulsed very rapidly—10,000 Hz. By tuning the sensor to respond only to this frequency the light intensity may be very low, virtually invisible, without interference from other light sources. Thus, a long-life solid state light source may be used which requires little energy and has a very rapid response time. Results of the field test and examination were promising. There were bugs in the pilot model and G. E. and the Equipment Development Center at Missoula will continue efforts this year to perfect the device.

As a part of this effort, 20 units have been constructed by G. E. for our use during the summer of 1969. Nine units were shipped to the San Bernardino National Forest, R-5, for developing a sampling model to measure use in the San Gorgonio Wilderness. The remaining eleven counters were shipped to the Equipment Development Center at Missoula for inspection. Eight of these were then shipped to National Forests for field installation and performance tests to determine suitability for meeting trail transportation engineering requirements. The Equipment Development Center at Missoula is coordinating the testing and evaluation of all units.

Depending on field tests and evaluation, we may be in a position to consider this counter for Forest Service use.

"Watts" Happening in Energy Conservation: Tips for Saving Energy in Vehicles

Shelly LeClaire, Equipment Management Specialist, Washington Office

> ***Editor's Note:*** *Energy efficiency in government buildings and vehicles are two of the primary points of the Energy Policy Act of 1992. In addition to the energy tips included in "Watts Happening," we encourage more articles from you that showcase energy efficiency and promote innovation in energy management.*

In the last issue, the focus of *"Watts" Happening in Energy Conservation* was on facilities. For this issue, the focus shifts to the area of Equipment Management. Under the Executive Order (E.O.) 12759, energy use must be reduced for both facilities and vehicles. According to the E.O., agencies which operate 300 or more vehicles must reduce the amount of gasoline and diesel fuel consumed by 10 percent. This reduction, as compared with the base year figure from fiscal year 1991, must occur by the end of fiscal year 1995.

As in the facilities focus, following is a list of basic common sense ideas that anyone operating a vehicle can put to immediate use.

- Eliminate unnecessary weight from truck beds and trunks. Every extra 100 pounds can result in a loss of 1 percent or more in fuel economy.
- Don't let engines idle for long periods of time. The "break-even" idle time point for most vehicles is about 1 minute.
- Once cruising speed is reached, maintain it steadily. Changing lanes or changing speed as little as 5 mph can waste 10 to 15 percent of fuel.
- Avoid sudden bursts of speed, tailgating, and pumping the accelerator while the vehicle is not in motion.
- Use the most fuel-efficient vehicle feasible for the job.
- Adhere to the manufacturer's recommended preventive maintenance schedules.

- Keep the vehicle's windows rolled up, allowing air to flow over the body, rather than drawing it inside which slows down the vehicle. Driving at higher speeds with your windows open creates air drag, causing your engine to use as much as 10 percent more fuel.

- In cooler conditions, keep the heater off until the engine is warm to keep the engine from losing heat trying to warm up the interior of the vehicle.

- Use fuel with the minimum octane, recommended by the vehicle manufacturer, that will not result in engine knock.

- Use ethanol-blended fuel whenever possible. This will reduce our dependency on imported oil, as well as increase the market for American farm products.

- Encourage ridesharing and combining trips. These save both fuel and budget dollars.

- Refuel vehicle during the early part of the day to minimize evaporation loss. Avoid over-filling the fuel tank to prevent spillage.

Keep in mind that most of us deal with equipment on a daily basis and, with little effort from each of us, we can achieve the required reduction.

March: National Women's History Month – Three Who Jumped the Gender Gap

As part of our continuing effort to emphasize diversity in the Engineering and the Forest Service workforce, we publish informative articles that draw attention to the considerable contributions made by diverse individuals in the past. As we celebrate National Women's History Month, we remember three important female scientists who jumped the gender gap.

Grace Murray Hopper, 1906–1992, Mathematician and Computer Programmer. Grace Hopper was born in 1906. As a child, she was encouraged to try anything. She graduated from Vassar with degrees in math and physics, then completed a master's degree and Ph.D. in math at Yale.

When the U.S. entered World War II, Hopper joined the Navy. She was introduced to a "computing engine"—the world's first large-scale automatically sequenced digital computer, the 51-foot-long Mark I. Hopper's first assignment was "to have the coefficients for the interpolation of the arc tangent by next Thursday." She completed her assignment and, 7 years later, she was able to program a computer to do anything she could define.

As computer development progressed in the 1950's, there was competition to create a computer language using English-like sentences. Hopper was on the leading edge, and eventually was able to demonstrate a version of COBOL (COmmon Business Oriented Language) on two computers in late 1960.

One of her other notable achievements was her role as the first and only female admiral in the U.S. Navy, from which she retired in 1986.

Barbara McClintock, 1902–1992, Geneticist. Barbara McClintock was born in 1902 and overcame many obstacles to reach her goals. Chief among these barriers was her mother's objection to spending good money to send a girl to college. McClintock, however, was determined to attend Cornell University, where she earned a Ph.D. in botany, and remained there to teach until 1931.

She then spent 30 years doing research in genetics, first at the University of Missouri, later at Cold Springs Harbor Laboratory in Long Island, NY. Working with plant chromosomes, she discovered the process known as "jumping genes," the natural transposition of genetic elements, either from one chromosome to another, or from one site on a chromosome to a different one.

As a result of her pioneering research, scientists now understand considerably more about genes and how they work. She is the first woman to receive the Noble Prize in medicine for work accomplished without a collaborator.

Rosalyn Sussman Yalow, 1921–, Research Nuclear Physicist. Rosalyn Yalow was determined to have both a career and a family, an uncommon ambition among her young female friends in the Bronx during the 1920's and 1930's.

She became interested in physics after hearing noted physicist, Enrico Fermi, speak about the then-new field of nuclear physics. After graduating from Hunter College, Yalow became the only woman among 400 graduate students at the University of Illinois College of Engineering Physics.

At Illinois, she earned a Ph.D. in nuclear physics. In the 1950's, she discovered how to use radioisotopes to measure hormones in the human blood system. She then won the Nobel Prize in medicine in 1977.

Ground-Coupled Heat Pump Installations in Region 8

Randy L. Warbington, Mechanical Engineer, Southern Region Regional Office

The first closed-loop, ground-coupled heat pump system to be installed in the Southern Region, serving the Morehead Ranger District Office and Visitor Information Center, Daniel Boone National Forest, has now been in operation for approximately 1 year. Installation of a second system at the Cradle of Forestry Visitor Center, Pisgah National Forest, is underway. These systems were selected to satisfy the heating and cooling needs at the two sites because they show promise of providing comfort in an energy-efficient and cost-effective manner, while not detracting from the aesthetics of the buildings and surrounding grounds. They should also be simple to operate, require minimal maintenance, and be environmentally safe. So far, our experience with the system at Morehead has been encouraging. This article has been prepared to disseminate information about this unique type of heating and cooling system. It provides a quick overview of typical ground-coupled systems which might be used to serve ranger offices, visitor centers, and similar facilities and discusses some factors which influence the selection of the system for a particular application. It points out some advantages, disadvantages, and typical costs and lists some good sources of design and installation information. Also integrated into the report are some of the Southern Region's experiences with regard to the installations at Morehead and the Cradle.

System Overview

Ground-coupled heat pump systems have been referred to as a variety of names, including geothermal heat pumps, earth energy systems, ground-source systems, etc. Several of these names are not accurate because they imply that the source of energy is the earth's molten core. Actually, ground-coupled systems harness the energy of the sun, stored near the earth's surface by its vast mass, and transfer this heat energy back and forth between the building envelope and the earth's surface. A typical system consists of a closed-loop network of plastic tubing, mostly 3/4-inch or 1-inch diameter polybutylene or polyethylene, either buried in the ground in 4-inch diameter vertical boreholes or placed horizontally in narrow trenches. Through this network of piping, a heat transfer fluid is circulated via a small centrifugal pump. The fluid may be water, but more often it is a nontoxic antifreeze solution. Early systems utilized alcohol or brine. Modern systems, however, employ either glycol mixtures, of which certain propylene glycol formulations are most common (used at the Morehead site), or aqueous solutions of potassium acetate (to be used at the Cradle of Forestry), which were recently developed to be less viscous at lower temperatures while also being noncorrosive and environmentally safe. Connected to the pipe network within the building are extended range water-to-air heat pumps (see photographs, figure 1) designed to operate with entering water temperatures between about 20 and 100°F. These units extract heat from the circulating fluid during the winter and transfer it to the airstream where it is distributed through the building via ductwork. In the summer, the system is reversed. The heat is transferred by the units back into the fluid and subsequently dissipated into the ground. This is similar to an arrangement which has been widely used in commercial buildings, consisting of water source heat pump units connected to a water loop with temperatures maintained between 60 and 90°F through the use of a boiler and a cooling tower. In some situations, hybrid systems are constructed utilizing auxiliary boilers and cooling towers on a ground-coupled loop. Also similar to ground-coupled systems are open groundwater systems, which pump water from an aquifer or other water source and reject it back via an injection well or through surface or subsurface discharge. Groundwater systems have the disadvantage of either wasting large amounts of

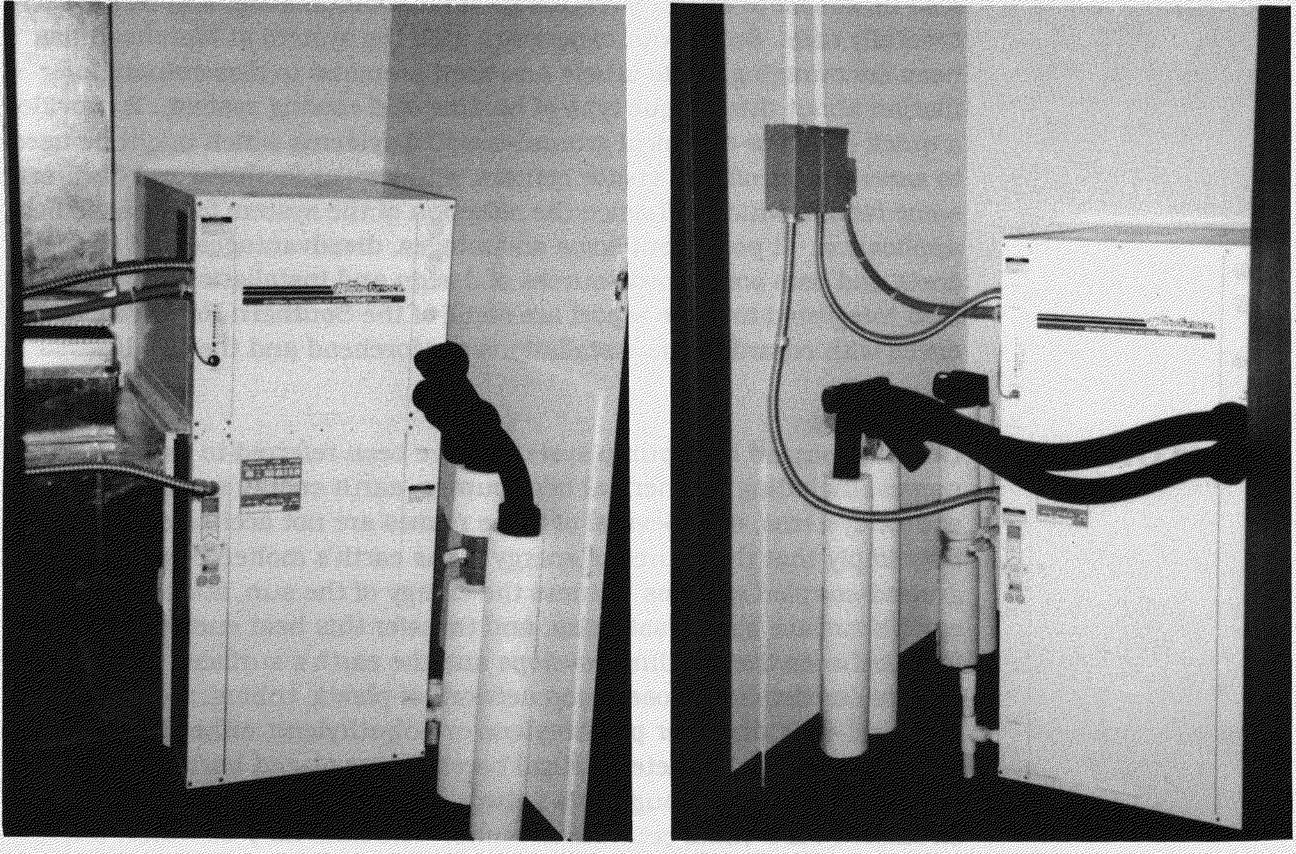


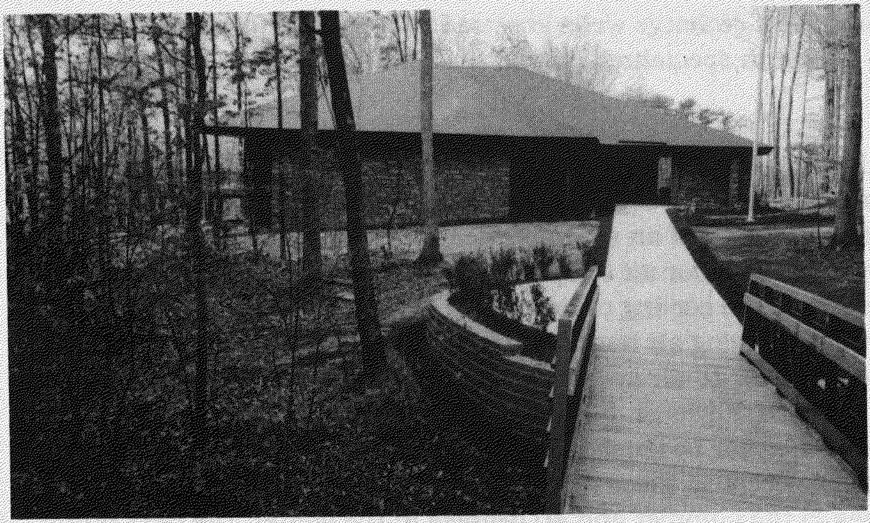
Figure 1.—Extended-range water source heat pump units installed at the Morehead Ranger District Office and Visitor Information Center. (Photographs by Mike Tripp.)

groundwater (surface or subsurface discharge) or of possibly contaminating the aquifer if recharge wells are used. They, therefore, are not recommended except in specialized cases.

Advantages and Disadvantages of Ground-Coupled Systems

One of the advantages of ground-coupled systems over typical air-to-air heat pump systems are their high seasonal efficiencies. Both the capacity and the efficiency of an air-to-air heat pump system decrease dramatically when outdoor air temperatures drop in the winter. Similarly, in the summer, the cooling capacity and efficiency of an air-to-air system drops with increasing air temperatures. In other words, when you need them the most, air-to-air systems are the most ineffective. Ground-coupled systems, however, function with relatively uniform efficiencies throughout the year because they work with more uniform temperature differentials. Because these differentials seldom range more than about 20 degrees in the summer and 40 degrees in the winter, the heat pump units are able to achieve high seasonal efficiencies. This is because, while outside air temperatures may range from below 0°F during the winter to over 100°F in the summer, ground temperatures a few feet below the surface remain relatively constant throughout the year. Summertime energy efficiency ratios (EER's) up to 15 or 20 are typical, with average wintertime coefficients of performance (COP's) running about 3.0. These improved efficiencies translate into lower operating costs when compared to most other heat pump systems. Unlike many air-to-air systems, ground-coupled systems operate with improved part-load efficiencies compared to their full-load efficiencies. In terms of life cycle costs, ground-coupled systems have the potential to outperform air-to-air systems, LP gas heat/DX cooling systems, and hydronic systems utilizing a boiler, chiller, and cooling tower, depending upon site conditions. The logical competitor to a ground-coupled system might be high-efficiency natural gas, but natural gas is not often available in remote areas.

Another advantage of ground-coupled systems—one that strongly influenced their selection at both Morehead and the Cradle of Forestry—is the lack of a need for visible equipment such as cooling towers and condensing units around the perimeter of a building or on a roof which detract from the setting and/or create noise. All components which are not buried may be located within the building structure in closets, mechanical rooms, attics, plenum spaces, etc., where they can be easily serviced during inclement weather. The photographs of the Morehead Office and Visitor Information Center (figure 2) illustrate the aesthetic benefits of not having outdoor equipment. With an attached deck on the rear of the building overlooking Cave Run Lake, the approach from the visitor's parking lot on one end, the employee entrance on the other, and the building fronting on the highway, there really is no location available for mechanical equipment. As shown in figure 3, the 2-horsepower circulating pump and expansion tank serving the nominal 18-ton system there are located within the crawl space under the building. Inside the building, there are six air handling units with integral compressors (figure 1).



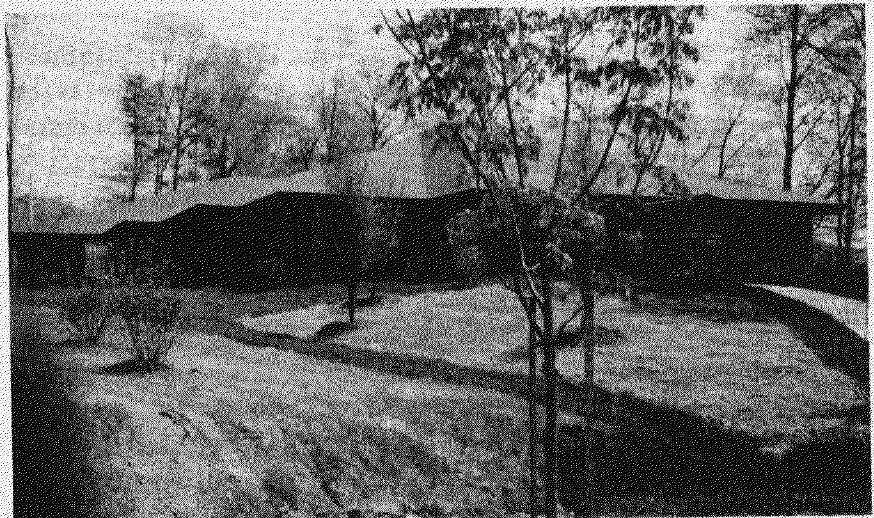


Figure 2.—East, south, and west views of the Morehead Ranger District Office and Visitor Information Center. (Photographs by Mike Tripp.)

What are the disadvantages of ground-coupled systems? Probably the number one barrier to increased use is the higher system installation cost versus air-to-air heat pump systems and more typical water loop systems with boiler and cooling towers. For example, preliminary estimates have indicated that at the Cradle of Forestry site, total labor and material costs for the ground-coupled system will run about $180,000 versus approximately $135,000 for a water source heat pump system with an LP gas boiler and a 60-ton closed circuit cooler. This equates to about an $815 per ton cost premium. This cost premium is within the $600 to $1,000 range quoted in the literature for vertical systems. When related to the estimated annual operating and maintenance costs of $9,500/year for the ground-coupled system versus $16,850/year for the water source system, a simple break-even period of just under 7 years is anticipated. The system being installed at the Cradle of Forestry (as well as at Morehead) consists of approximately one 4-inch diameter vertical borehole, 200-foot deep per ton of cooling capacity. Contained within each borehole are two 3/4-inch diameter polybutylene tubes joined together at the bottom of the hole with a heat fusion U-bend. Boreholes are backfilled with sand and pea gravel below the water table and grouted above the water table. Photographs in figure 4 show the installation of the ground-coupled heat exchanger in progress at Morehead. Notice the boreholes were drilled directly under the building after the foundation was constructed, but prior to installation of floor joists. Had

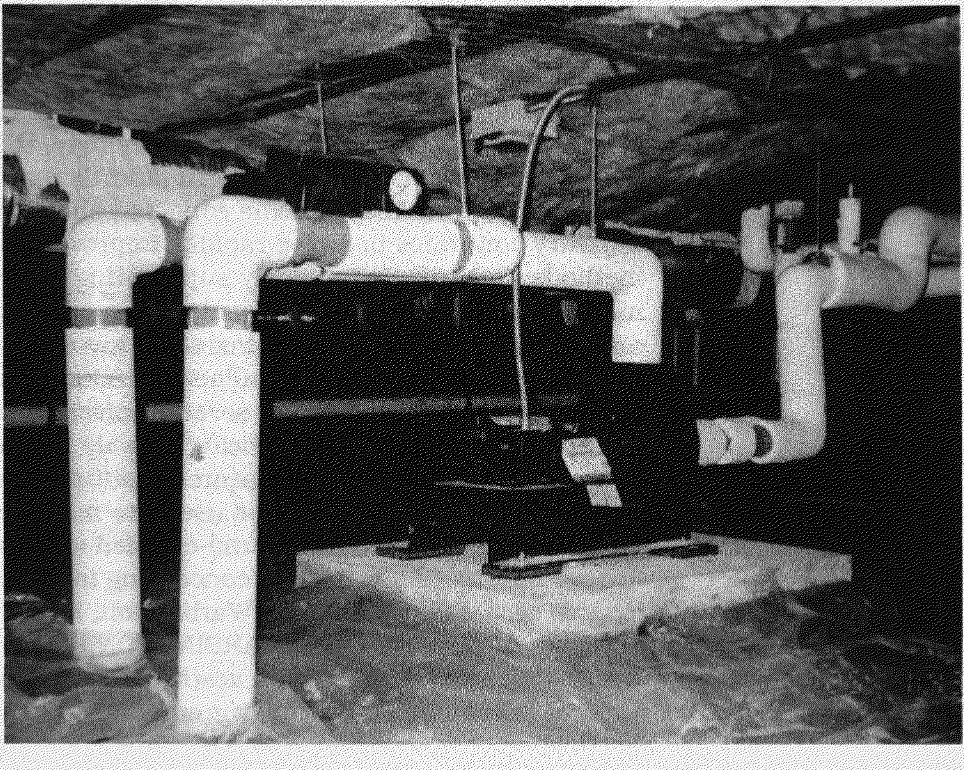


Figure 3.—Circulation pump and piping located in crawl space. (Photograph by Mike Tripp.)

more open land been available for trenching, a horizontal arrangement (tubes buried in narrow trenches instead of boreholes) might have been chosen instead, because the cost premium for horizontal systems is sometimes less.

Another disadvantage to ground-coupled systems is varying local groundwater regulations and the fear of contaminating aquifers from intruding surface water or leaking pipes. For example, at the time the Cradle job was advertised, there had never been a similar installation in western North Carolina, and, due to their uncertainty in interpreting State environmental regulations, the State Environmental Protection Division (EPD) was considering requiring that the drilling contractor line all boreholes with steel well casing. This requirement was eventually waived, however. It is believed that with implementation of industry recommendations, such as proper sealing and grouting around the top of the borehole and the use of nontoxic heat transfer fluids, contamination of groundwater should not be a problem.

Other disadvantages of ground-coupled systems relate to the youth of the technology, the lack of available data about the thermal characteristics of various soils and underlying strata (conductivity, heat capacity, thermal diffusivity, and seasonal moisture contents), and the unknowns which influence drilling conditions at a given site (presence of hard rock, boulders, sand, karst, etc.). Because these factors are the major variables affecting the cost of the system, some risk is involved, which requires careful consideration of the factors at any specific site, as well as good judgment prior to implementation. There are only a small number of firms across the country that are experienced in the design and installation of ground-coupled systems. Heating, ventilation, air conditioning (HVAC) installers, as well as well-drillers, often are not familiar with proper installation procedures, and they may, therefore, be reluctant to bid on the work. Code enforcement officials may hesitate to approve installations until they become educated about the technology. As the industry continues to evolve rapidly, improved materials, equipment, and methods are surfacing, quickly supplanting yesterday's designs. This may be seen either as a detriment or as a challenge, depending upon the mindset of the engineers and installers involved. It should be noted, however, that design and installation guides are now available, and related research is ongoing at several universities across the country. Ground-coupled systems are being actively promoted by organizations such as the Electric Power Research Institute in many parts of the U.S. Some literature which might be useful to managers or designers who want to know more about ground-coupled systems is listed below. If further information is desired concerning installations in the Southern Region, please contact Randy Warbington, Facilities Group, Atlanta, GA, at (404) 347-2552 or DG:R.WARBINGTON:R08B. With rising energy costs, increasing emphasis on aesthetics, and fewer operating and maintenance personnel on board, ground-coupled heat pump systems are a worthwhile consideration for a wide range of Forest Service facilities located throughout the country.

Figure 4.—Installation of ground-coupled heat exchanger under Morehead Ranger Office and Visitor Center. (Photographs by Mike Tripp.)

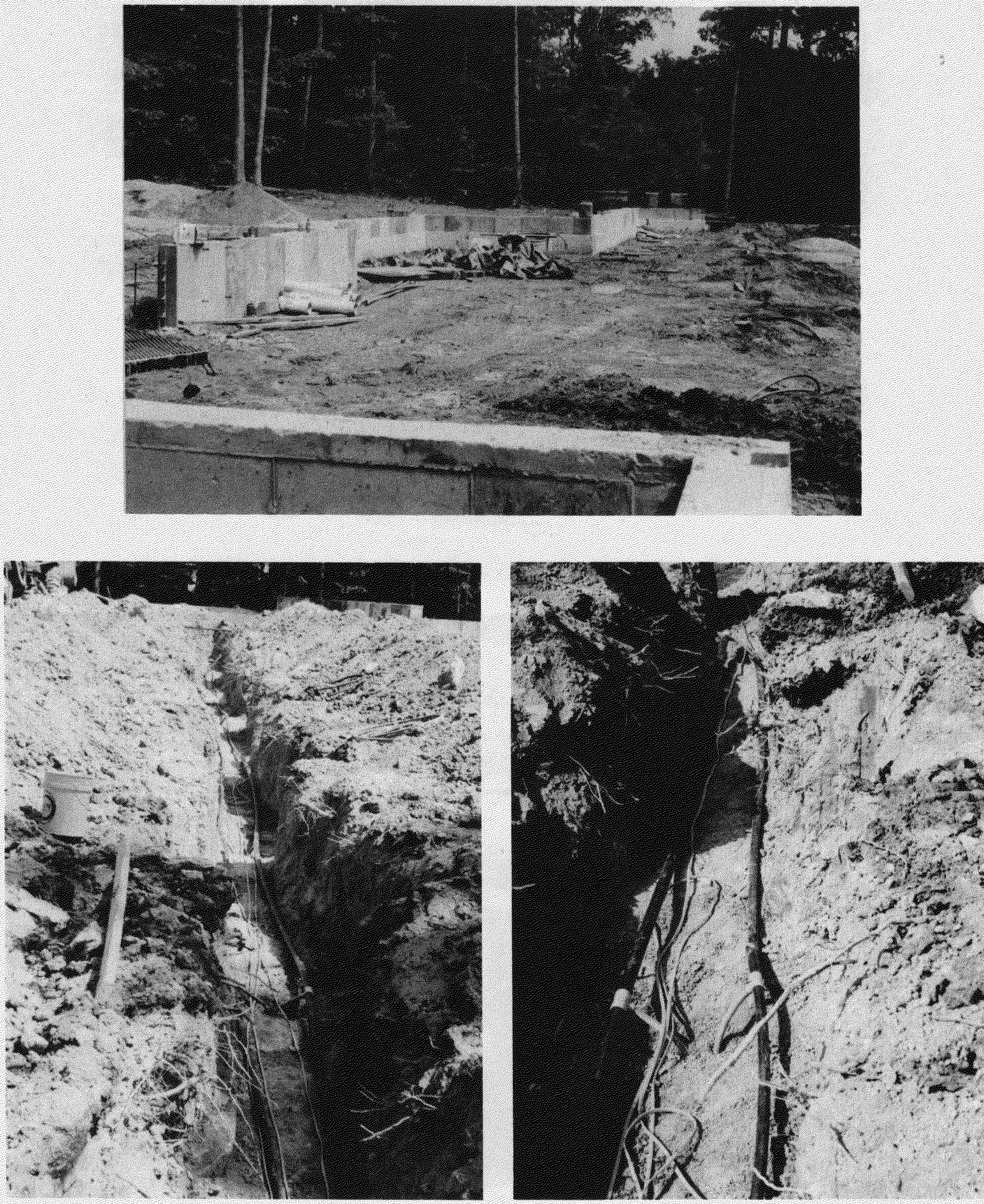


Figure 4.—Installation of ground-coupled heat exchanger under Morehead Ranger Office and Visitor Center (continued). (Photographs by Mike Tripp.)

Additional Sources of Information

(1) Bose, J., J. Parker, F. Mcquiston. 1985. *Design/Data Manual for Closed-Loop Ground-Coupled Systems.* American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Atlanta, GA.

(2) Bose, J. 1988. *Closed-Loop/Ground Source Heat Pump Systems.* Stillwater, OK: Oklahoma State University.

(3) Eckhart, F. 1991. *Grouting Procedures for Ground-Source Heat Pumps.* Stillwater, OK: Oklahoma State University.

(4) Kavanuagh, S. 1992. *Ground and Water Source Heat Pumps.* Tuscaloosa, AL: The University of Alabama.

(5) Pietsch, J. 1988. *Water-Loop Heat Pump Systems: Assessment Study.* Palo Alto, CA: Electric Power Research Institute.

(6) Various design guides and installation instructions available from the following equipment manufacturers:

Bard Manufacturing Co.
P.O. Box 607
Bryan, OH 43506

Command-Aire, Division of American-Standard, Inc.
P.O. Box 7916
Waco, TX 76714

Florida Heat Pump, Division of Harrow, Inc.
601 NW., 65th Ct.
Ft. Lauderdale, FL 33309

WaterFurnace International, Inc.
4307 Arden Dr.
Fort Wayne, IN 46804

1992 Forest Service Engineers of the Year

Three outstanding individuals have been selected as the 1992 Forest Service Engineers of the Year. There was an excellent list of nominees from the National Forest System and Research from which to choose. These nominees included:

Technician	*Management*	*Technical*
John Barksdale	Norbert Boe	Fred Bloom
David Bormett	Richard Farrington	William H. Clerke
Joe Costa	Jim Fischer	Gary Heezen
Thomas J. Gibson	Rodney Mendenhall	Jim McKean
Victor Hager	Ruben Natera	Elizabeth McMullen
Jackie C. Myer	Vaughn Stokes	Russel Moody
Kenneth Pence	Ron Van Natta	Greg Porter
Harry Riffel	Ken Vaughan	John Reese
Bill Savage	Glenda Wilson	

Congratulations to our three 1992 winners: James P. Brazil (Technician), John Youngquist (Management), and Mark A. Truebe (Technical). In recognition of their achievements, Sterling Wilcox, Director of Engineering, presented each with a plaque and a cash award in the Washington Office on February 16. Brief summaries about the winners and a photo of them with Mike Espy, the Secretary of Agriculture, follows.

(left-right) Jim Brazil, Mark Truebe, Mike Espy (Secretary of Agriculture), and John Youngquist

James P. Brazil
Engineering Technician of the Year

As the Geotechnical Team Leader for the North Engineering Zone of the Gifford Pinchot National Forest, James Brazil has played a significant leadership role in the Forest Service by establishing the Geotechnical Section's roles and responsibilities in engineering and resource geology.

Brazil's motivation and initiative have been repeatedly recognized over the past 22 years through cash awards, quality step increases, sustained superior performance, as well as letters of appreciation from throughout the Forest Service.

During his 21 years with the Forest Service, Brazil has been a leader of the development, testing, and use of new technology. He has always maintained an open mind and a willingness to find a better way of getting the job done. He has played a key role in the development and advancement of the Geotechnical Engineering program in the Pacific Northwest Region. He continues to facilitate technology transfer by maintaining an open line of communication with other geotechnical personnel throughout the Region and other parts of the country.

Brazil is highly regarded by his co-workers at all levels of the organization. He has developed and fostered a strong working relationship with other engineering units and ranger districts in the Forest Service. In addition, he has served as acting Zone Engineer on several occasions, sometimes for extended periods of time. In this position, Brazil exercised a determination to improve or deal with situations in his zone. He never assumed a passive role, recognized what needed to be accomplished, and got the work done. He also served briefly as acting Assistant Forest Engineer.

Brazil approaches engineering problems from a multidisciplinary standpoint, consciously evaluating the engineering, economic, environmental, and social aspects of each project. His concern for proper land and resource management is reflected in the projects with which he has been and continues to be involved. In addition to his usual engineering workload, he routinely works on a variety of projects including: cultural resource protection, fisheries and wildlife issues, rehabilitation projects, developed and undeveloped recreation sites, flood repair, and streamside management. Brazil has participated in the Interdisciplinary Team (IDT) process for over 10 years. He is the Engineering National Environmental Policy Act (NEPA) Coordinator for the north end of the Forest Service. In addition, he has laid the foundation for the development and management of the Resource Geology Program in the Forest Service.

While Brazil has displayed a number of skills and abilities that are worthy of merit, it is in the role of employee development that he makes his most outstanding contribution to the Forest Service. It is a tribute to his success as a leader and mentor that the majority of his former employees have proceeded to acquire advanced degrees or positions of greater responsibility. By expending the extra time and energy to foster his employee's development, Brazil has made every possible effort to ensure that leaders of the same caliber and professionalism will be available to the Forest Service for many years to come.

John Youngquist
Managerial Engineer of the Year

As the Project Leader for Performance Designed Composites in Pulp Paper and Composite Research at the Forest Products Lab (FPL), John Youngquist provides administrative and scientific leadership to a group of 12 research scientists, professional support persons, technicians, and other support staff.

His history of pioneering research and strong leadership are reflected by 12 years of superior performance ratings and annual awards for sustaining high levels of performance.

Special awards have included:

(1) USDA Superior Service Award in 1982.

(2) Outstanding Federal Supervisor of the Year and Federal Employee of the Year for Dane County, WI, in 1991.

Youngquist has formed linkages with other research work units within the FPL, most notably, Wood Adhesives Science and Technology, Fiber Processes and Products, and Fiber Product Design Criteria. Under his administrative and scientific leadership, research has been redirected into the area of high-performance, wood-based composites.

In cooperation with the University of Wisconsin-Madison, Youngquist is currently taking a lead role in organizing the *Second International Conference on Wood Fiber-Plastic Composites*. The first conference, in 1991, established the FPL as the "center of excellence" in this area and served to focus international attention on using postconsumer waste materials as key ingredients in composites for value-added applications. The second conference, now in the planning stages, will focus on FPL research programs on composites from both recycled materials and agricultural residues.

Research led by Youngquist has had far-reaching and practical results. The patented powered backup roll system for peeling veneer is currently used by hundreds of U.S. and international companies. Technology has been developed for producing hardwood and softwood laminated veneer lumber (LVL) as a structural lumber substitute for solid-sawn engineered building components. Compared to solid-sawn lumber, the advantages of LVL are:

(1) Virtual elimination of warping and checking.

(2) More uniform mechanical properties.

(3) 15 to 30 percent increase in product yields.

(4) Receptivity to preservative treatment.

The LVL research has resulted in a data base that has been used extensively by U.S. industry to make a wide array of products.

Similarly, research on wood composites is leading to a new generation of high-performance, low-cost composite materials. The potential applications for these products range widely, from building components to automobile parts.

Youngquist has been extremely effective in managing his research work unit in an effort to take full advantage of the opportunities afforded through workforce diversity. Currently, 14 of the 26 people in his work unit are from equal employment opportunity (EEO) target groups. He has also provided educational, teaching, and training opportunities for graduate students and visiting scientists from around the world. During the past 12 years, Youngquist's research team has worked with scientists from the People's Republic of China, the United Kingdom, Germany, Denmark, Sweden, Finland, New Zealand, France, Italy, and Japan.

Following this teaching role, Youngquist's unit became the site for a continuous flow of graduate students; at any given time, several Ph.D. and master's degree candidates are completing research on their thesis projects in his laboratory.

Along with these major accomplishments, Youngquist continues to develop his professional and managerial skills. He has completed 40 postgraduate semester hours in law, 20 hours in statistics and advanced calculus, and 20 hours in accounting business management and personnel management. In 1982, he received Professional Development Certification from the American Institute of Chemical Engineers. In addition, he has completed 17 short courses in research management, strategic planning, problem analysis and decisionmaking, engineering project management, equal employment opportunity, scientific writing, Forest Service management policies, and management of high technology programs.

Mark A. Truebe
Technical Engineer of the Year

As the Supervisory Geotechnical and Materials Engineer for the Willamette National Forest, Mark Truebe provides technical expertise on foundations, slope stability, retaining walls, rock resource management, pavement structures, and surfacing to seven ranger districts on the Forest. He is responsible for 16 professional engineers, geologists, and technicians who work at dispersed sites throughout the Forest Service.

Truebe is known nationally throughout the Forest Service, as well as in the profession in general, as one of the top geotechnical engineers. Because of his expertise, he is often called upon for advice and consultation. He is continually engaged in increasing the level of state-of-the-art technology and spreading it to individuals and groups throughout the Forest Service.

During his 15 years with the Forest Service, Truebe has been consistently recognized for his outstanding technical achievements and professionalism.

Truebe's technical endeavors include playing a key role in developing and transmitting new technologies throughout the Forest Service. During the early 1980's, he pioneered a Pavement Management System (PMS) for the Forest Service, which has resulted in a successful permanent program. He also implemented Resilient Modulus testing equipment and procedures for elastic theory pavement design for the Forest Service with Oregon State University.

In response to shrinking budgets which have reduced training opportunities for the Willamette National Forest and several surrounding forests and agencies, Truebe initiated an annual technology transfer workshop 7 years ago. It has gained wide support from representatives from 12 forests, 4 Regional Offices, 2 other Federal agencies, and 2 State agencies in attendance in 1992. He is also organizing a basic electronics and instrumentation construction workshop for 1993.

In 1989, Truebe designed the load frame and directed a pile load test for a proposed deep bridge foundation which resulted in significant cost savings for the project.

During the first half of 1992, he designed and directed the installation of several subgrade deflection monitoring devices for the Commensurate Share Project with the San Dimas Technology Development Center which will be used nationally to validate the Surfacing Thickness Program (STP) for the Forest Service.

Truebe is one of the Region's retaining wall "Master Performers" and will be working on the revision of the retaining wall design guide. This will be a national effort led by the Pacific Northwest Region with Coordinated Technology Implementation Program (CTIP) funding.

Truebe's experience, specialized expertise, and understanding of the Forest Service mission and engineering's "interdisciplinary" role has enabled him to make innovative and cost-effective contributions to the overall program. His decision to maintain a dispersed group, rather than centralize, has helped maintain a constant interaction in the everyday affairs and crises that face the district managers. Understanding of problems and response time have remained clear and timely, and a higher level quality of customer service has been achieved. His support from the district rangers has enabled him to maintain a respected, cohesive group which can function and communicate well within wide ranges of interdisciplinary skills.

His contributions to the STP will have national consequences that will enable road designers to more accurately calculate aggregate thickness needs and reduce overdesign tendencies due to uncertainties. The economic results will be significant Service-wide.

Truebe is a member of the American Society of Civil Engineers. He has authored or co-authored several professional papers at national symposia and has taught pavement design classes at Oregon State University. He continues to interact and support his peers in several State and Federal agencies. He has been a Registered Professional Engineer in Oregon since 1976 and has strongly encouraged all of his employees to obtain state registrations in engineering and engineering geology.

Bibliography of Missoula Technology and Development Center

This bibliography contains information on publications produced by the Missoula Technology and Development Center (MTDC). This listing is arranged by publication series and includes the title, author or source, document number, and date of publication.

This issue lists MTDC material published in 1992. Copies of the "Tech Tips," "Project Reports," and "Audiovisuals" listed herein are available to Forest Service personnel from MTDC.

USDA Forest Service
Missoula Technology and Development Center
Fort Missoula, Building No. 1
Missoula, MT 59801

Tech Tips

Tech Tips are brief descriptions of new equipment, techniques, materials, or operating procedures.

Title	***Source***	***Number***	***Date***
Portable Power Platform	MTDC	9224-2301	October
Forest Service Explosives	MTDC	9271-2309	January
How to Submit Proposals to the Technology and Development Centers' Recreation Programs	MTDC	9223-2311	January
Global Positioning System Improvements	MTDC	9224-2312	January
Making Your Poster Program Work For You	MTDC	9223-2313	January
Maintaining and Inspecting your Hardhat	MTDC	9267-2323	April
Fire Entrapment Video Available	MTDC	9251-2325	April
Crib Walls for Mountain Bike Trails	MTDC	9223-2336	July
New Mountain Bike Trail Guide Available	MTDC	9223-2341	August
Scarifiers for Shelterwoods	MTDC	9224-2343	December
Handtool Sharpening Gauge	MTDC	9251-2332	July
Captioning for Forest Service Videos	MTDC	9223-2333	July

Project Reports

Project Reports are detailed engineering reports that generally include procedures, techniques, systems of measurement, results, analyses, special circumstances, conclusions, and recommendations rationale.

Title	Source	Number	Date
Sudan Reforestation and Anti-Desertification Project (Trip Report)	MTDC	9224-2804	October
Progeny Seeder Operator's Manual	MTDC	9224-2806	October
Insect Sting Card	MTDC	9267-2807	October
1991 RTEC Annual Report	MTDC	9222-2309	January
Guide for Using, Storing, and Transporting Explosives and Blasting Materials	MTDC	9271-2815	December
Forest Product Tracking Equipment	MTDC	9224-2817	July
Program Summary—Nurseries	MTDC	9224-2818	March
Program Summary—Reforestation	MTDC	9224-2819	March
Program Summary—Forest Product Sales	MTDC	9224-2820	March
Health Hazards of Smoke, Winter/Spring	MTDC	9267-2824	April
Program Summary—Fire and Aviation	MTDC	9251-1816	June
Program Summary—Recreation	MTDC	9223-2828	August
Recreation Information Management Questionnaire Results	MTDC	9223-2831	July
Tree Shelters for Seedling Protection	MTDC	9224-2834	July
The MTDC Tree Harvester	MTDC	9251-2835	July
Satellite Tracking of Log Rafts (Alaska Trip Report)	MTDC	9253-2837	July

Title	Source	Number	Date
Pack Stock Gear Drawings	MTDC	9223-2838	August
Bareroot Nursery Equipment Catalog	MTDC	9224-2839	September
Mobile Cooler for Transporting and Storing Seedlings	MTDC	9224-2840	September
1992 Annual RTEC Report	MTDC	9222-2842	September
Health Hazards of Smoke, Summer/Fall	MTDC	9267-2844	October

Audiovisuals

Title	**Type of Media**
The Diversified Forest	slide, tape, and video
Wenatchee Heights Burnover	video
Tree Marking Paint	video
Surface Water Control Trails	video

Engineering Field Notes

Administrative Distribution

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Submittals — Field personnel should send material through their Regional Information Coordinator for review by the Regional Office to ensure inclusion of information that is accurate, timely, and of interest Service-wide.

Regional Information Coordinators

R-1	Jim Hogan	R-4	Ted Wood	R-9	Fred Hintsala
R-2	Don Loetterle	R-5	Rich Farrington	R-10	Betsy Walatka
R-3	Dave Erwin	R-6	Bob Yoder	WO	Vacant
		R-8	Gary Murphy		

Inquiries — Regional Information Coordinators should send material for publication and direct any questions, comments, or recommendations to the following address:

FOREST SERVICE—USDA
Engineering Staff—Washington Office
ATTN: Mary Jane Senter, Editor
Sonja Turner, Asst. Editor
201 14th Street, SW
Washington, DC 20250

Telephone: (202) 205-0820
