United States
Department of
Agriculture

Forest Service

Engineering Staff

Washington, DC

Engineering Field Notes

Volume 25
January–February
1993

Engineering Technical Information System

EFN

Anniversary

1969-1993

HAPPY 25TH ANNIVERSARY!

It is hard to believe, but 1993 marks 25 years of publishing the *Engineering Field Notes*. And after all these years, *Field Notes* continues to keep Forest Service engineers informed of what other Forest Service engineers are doing, problems they are faced with, and solutions they have tried.

In celebration of this event, throughout 1993 we will dig into the archives and pull out articles from 25 years ago. We will publish one of these articles in each issue of *Field Notes*. Comparing what was happening then with what is taking place now should prove interesting. Some of our readers may have even written one of the "historical" articles, and many others will probably remember reading them the first time around.

To start us off, we have reprinted the first article ever to appear in *Engineering Field Notes*. It just so happens that it describes the development of the Engineering Technical Information System, which included, among other things, *Field Notes*.

Join us in our trek down memory lane.

Field Notes

U. S. DEPARTMENT OF AGRICULTURE . FOREST SERVICE . Division of Engineering
Volume 1 Number 1 May 1969

THE TECHNICAL INFORMATION SYSTEM

by Norman G. Sears, WO

A Technical Information System has been established in the Washington Office, Division of Engineering. It will be used to coordinate and stimulate the flow of information among Forest Service engineers and architects, and help them develop as experienced professional employees.

The objectives of the Technical Information System are:

1. To provide Service-wide guidance in engineering methods and procedures.

2. To provide Service-wide exchange of information and knowledge.

3. To support engineering training effort in the development of professional engineers.

4. To make Forest Service engineers and architects aware of new developments and technical literature.

5. To assist engineers and architects in answering questions concerning technical problems.

In accomplishing these objectives, the Technical Publications System will contribute greatly to maintaining and improving competence of Forest Service engineers as the level of engineering technology rises.

The Technical Information System consists of three programs: Engineering Technical Publications, Information Retrieval System, and the Current Awareness Program. Each program will function as a separate unit within the Technical Information System.

Engineering Technical Publications, the program first developed, is designed primarily to improve lateral communications among Forest Service engineers and architects. This program consists of Engineering Field Notes and Engineering Technical Reports. This issue of the Field Notes is the first material to be issued as part of the Engineering Technical Publications Program.

The Field Notes will keep engineers informed of what other engineers are doing. Some issues will be similar to this one but many will contain short articles dealing with engineering activities and/or problems.

Field personnel should be the prime contributors of material for the Field Notes to make it effective. The procedure for submitting material for publications in the Field Notes may be found in FSM 7113.

Engineering Technical Reports are designed to help the field engineer publish his ideas on engineering problems and procedures. For this publication to be effective, field personnel must contribute to it. FSM 7113 contains procedure for submitting material for publication. Technical Report No. 1, "Allocating Road Construction and Maintenance Costs to Major Vehicle Classes using the Forest Service Transportation System," issued in September 1968, is an example of the type of material we hope to publish as an Engineering Technical Report. This report was issued prior to the formulation of the system. However, we plan to incorporate it into the system. We have four other Technical Reports now being prepared for publication.

The Information Retrieval System and Current Awareness Program are now in the process of being developed. Our first efforts will be directed towards coordinating the use of existing systems. When these programs are developed, we will keep field engineers aware of current engineering literature and developments. We will also use the existing information systems to provide literature searches for field engineers.

FSM 7110 established the Technical Information System. This manual material gives the objectives of the system and establishes the procedures for field participation in the Technical Publications Program. When you receive FSM 7110 we hope that you will read it and actively participate in the programs.

1991 *Engineering Field Notes* Article Award Winners

Happy New Year! Hope you had a fine '92. *Engineering Field Notes* did!

In fact, we had a great year—publishing Engineering folk's experience in such diverse fields as: remote sensing, reinforced walls, budget, barrier-free structures, central tire inflation, laser tree measurement, administration, and roads technology.

Engineering Field Notes is pleased to have provided a means for Forest Service engineers at all levels and in all Regions to share their experiences. We feel that this sharing is vital to doing more with less, and we applaud each of our authors.

It is now time for you to tell us which 1992 articles you feel were most informative, beneficial, and interesting, which helped your office save money, and which helped you develop more effective ways of getting your work accomplished.

Once you have chosen 1992's top three articles, please complete the rating sheet on the following page. Rate only three articles. Rate them from 1 (best) to 2 (second best) to 3 (third best). And if you feel that an article has helped or will help the Forest Service save money or other resources, please let us know. Remember, with *Engineering Field Notes* it is one person/one vote—so your vote counts!

After you have voted, cut out the rating sheet along the dotted line, fold it, staple it closed, and mail it back to us at *EFN*. (For your vote to count, we must receive your rating sheet by March 31, 1993.)

Contests aside, we would like to thank each and every *EFN* author, as well as all *EFN* readers, who made 1992 a great year. Each one of you deserves a pat on the back for helping to foster an environment where information and experiences are viewed as valuable resources and are shared accordingly.

We would also like to encourage you to start thinking of your own *Engineering Field Notes* article. Why not share your experiences through *EFN* in 1993?

1992 *Engineering Field Notes* Awards

ARTICLE	AUTHOR	CHOICE (1, 2, 3)	$ SAVED
January-February/March-April			
Barrier Free Horse Ramp	Deborah Dorman and Jill Bard	___	___
Being More Effective	John Zirkle	___	___
Building Bridges	Lee Collett	___	___
Functionalism, Professionalism, and the New Middle	John Lupis	___	___
Laser Tree Measurement	Tony Jasumback and Bill Carr	___	___
Portable Power Platform	Keith Windell	___	___
May/June			
The Changing Role of Engineering in Region 4: A View	Larry Gorringe	___	___
Impact Tests on Road Delineator Posts—The Bradystake and Three Carsonite Marder Designs	James R. Bassel	___	___
NFAP Light Aircraft Airborne Video System with Real-Time Differential GPS	Jennifer Alban, Paul Ishikawa, and Michael Hoppus	___	___
Partnerships—A Philosophy	Clyde Lay	___	___
A Summary of Roads Technology and Development Projects	John E. Steward	___	___
July/August			
Asphotac, A Demonstration of a Dust Palliative	James R. Bassell, Joe Acosta, and John Crumrine	___	___
Checklist for Users of Remote Sensing Data	David J. Born, Henry Lachowski, and Vaughan Landrum	___	___
Data Storage Needs for Remotely Sensed Digital Data	Henry Lachowski, Vaughan Landrum, and John Steffenson	___	___
Integration of Remote Sensing into Resource Data Collection: An Overview	Henry Lachowski and Doug MacCleery	___	___
Joint Global Positioning System—Aerial Triangulation Project Final Project Report	Lee Whitmill and Phil Floor	___	___
Networking Geometronics Style	K.D. Vest	___	___
Why I Did It	Wendy S. Bertrand	___	___
September/October			
Have Some Fun While Learning (and Teaching)	Gary Murphy and Les Pence	___	___
History of Reinforced Walls in the USDA Forest Service	John E. Steward	___	___
MTDC Seedling Counter Field Tests	Dave Gasvoda and Diane Herzberg	___	___
Update on the Soil Nail Launcher Demonstration Project	John E. Steward	___	___
November/December			
Beyond "Empowerment Versus Constraint"	Gerald Coughlan	___	___
Central Tire Inflation: The USDA Forest Service Program	Paul H. Greenfield	___	___
An Engineering Survey Method for Use with the Laser Technology, Inc., Tree Laser Device	Jeffry Moll	___	___
Icicle Necklace Revetment	Cal Blackburn	___	___

TEAR ALONG THIS LINE ⟶

COMMENTS: _____

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Name _____
(OPTIONAL)

(FOLD HERE)

Forest Service-USDA
Engineering Staff
201 14th Street, SW
Washington, DC 20250

Forest Service-USDA
Engineering Staff
ATTN: M.J. Senter
201 14th Street, SW
Washington, DC 20250

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TEAR ALONG THIS LINE ⟶

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

George Kulick, Civil Engineer, Washington Office

Editor's Note: *"Watts" Happening will be a series of articles on energy conservation. We hope facility and equipment managers will use this forum to share their own tips on this subject. Submit tips to George Kulick, WO Engineering, 201 14th Street SW, Washington, DC 20250 or G.Kulick:W0lA.*

Introduction

Energy awareness has been taken from the back burner of the mid-1980's and placed squarely in front in terms of Federal programs. Events of the 1990's—such as the Gulf War, the recession, recycling, the Exxon Valdez oil spill, and other environmental concerns—have reminded us, once again, that our precious energy resources are not limitless and we must conserve them. In response to a renewed energy awareness, Executive Order No. 12759 and the subsequent Energy Policy Act of 1992 call for 10 percent energy use reductions in Federal buildings (from 1985 levels) by fiscal year 1995 and 20 percent by the year 2000.

The 1970's and 1980's produced numerous cost-effective energy retrofits and ideas still in use in many Forest Service structures. Today, new structures are built to higher efficiency standards, as are many appliances. But, the "energy" behind energy conservation has waned since the 1980's. The Forest Service and the Department of Agriculture, in conformance with current direction, have developed new plans for documenting and reporting energy reduction accomplishments. Now we must put new vigor into looking at how we can meet these new energy reduction targets.

To help the facilities manager begin a comprehensive energy conservation program, we would like to share a list of energy conservation tips. These tips will be given in a series of *Engineering Field Notes* articles, beginning with this issue. They are basic common sense ideas that managers can immediately put into use. In addition, we ask our readers to submit their own energy-saving tips, including those related to vehicles. We will compile these tips for future energy-saving articles to be shared with you.

Please submit your tips to George Kulick, USDA Forest Service, 201 14th Street SW, Washington, DC 20250 or via DG, to G.Kulick:W0lA.

Now, on with the tips!

Existing Buildings

Occupant Energy Conservation Actions

(1) Turn lights off when not in use.

(2) Reduce use of elevators. Walk down two flights or up one flight of stairs instead of using elevators.

(3) Turn office equipment off when not in use.

(4) Keep windows and doors shut in areas that are being heated or cooled.

(5) Close blinds, shades, and drapes at night during the heating seasons to reduce heat loss through the window area. Open them during the day to use the sun for heating the rooms.

(6) Close blinds, shades, and drapes during the day in summer. These interior shading devices can reduce heat gain in the room as much as 50 percent.

(7) Minimize overtime work. Consolidate work areas of after-hours workers to minimize the amount of space that must be heated, air conditioned, and lighted.

Facility Energy Conservation Actions

(1) Institute and emphasize energy conservation awareness programs for building occupants, promulgating actions indicated above.

(2) Perform inspections of the facility to determine compliance with temperature and lighting criteria; condition of equipment, piping, and controls; and need for repair.

(3) Keep the building envelope, equipment, and systems properly maintained to promote efficient operation of HVAC systems.

(4) Keep temperatures between 65 and 70 °F in the heating season and between 76 and 80 °F in the cooling season, where practicable (41 CFR 101).

(5) Don't add heat to keep buildings warmer than 55 °F when unoccupied in the heating season.

(6) Don't cool buildings when unoccupied, except as required to achieve target temperature ranges during occupied hours in extreme weather conditions.

(7) Review building operating plans and tailor startup and shutdown times of HVAC systems so that target temperature ranges are met within 1 hour of occupants arriving and departing the building, taking into account outdoor temperatures.

(8) Reduce operating hours of HVAC systems, ventilation systems, water heating systems, lighting systems, escalators and elevators, and equipment and machines.

(9) Lower humidification and raise dehumidification setpoints.

(10) Install locking thermostats to prevent unauthorized settings.

(11) Reduce water temperatures to lavatories.

(12) Install timers to cut off lights and equipment automatically.

(13) Schedule cleaning services during normal working hours or daylight hours to minimize need for excessive lighting operation after hours.

Energy Conservation Retrofit Actions

(1) Survey facilities to identify possible energy conservation retrofit actions.

(2) Prioritize retrofits based on life cycle cost procedures of NIST Handbook 135 and savings-to-investment ratios (SIR).

(3) Allocate funding for projects based on life cycle cost effectiveness and SIR's, within approved budget totals. Take advantage of utility rebates, shared energy savings contracting methods, and other private sector energy management services.

(4) Ensure that ***all*** repair and construction projects utilize energy conservation technologies where appropriate.

(5) Reduce heat conduction through ceilings, roofs, floors, and walls by installation of insulation and vapor barriers.

(6) Reduce solar heat gain through roofs by installing reflective roof surfaces.

(7) Reduce heat conduction and long-wave radiation through glazing areas by installing storm windows or multiple-glazed windows, by insulating movable windows, or by installing operable windows.

(8) Control solar heat gain through glazing areas by use of shading or plantings, tinted or reflective glazing or films, or by installing airflow windows.

(9) Reduce infiltration by caulking and weatherstripping doors and windows or constructing vestibules.

(10) Reduce ventilation energy use. To permit this, reduce the generation of indoor pollutants, install air-to-air heat exchangers or air cleaners, or install local ventilation systems.

(11) Reduce energy used for tempering supply air by installing variable air volume systems or by resetting supply air, hot water, or chilled water temperatures.

(12) Reduce HVAC distribution system energy losses by repairing duct and pipe leaks, maintaining steam traps, and insulating pipes and ducts.

(13) Reduce system resistance by cleaning or rebalancing pipe and duct systems or installing booster pumps.

(14) Preheat feed water for hot water systems with reclaimed waste heat.

(15) Insulate hot water systems and storage tanks.

(16) Install energy-efficient water heating systems, such as heat pump water heaters or photovoltaic systems.

(17) Install energy-efficient lighting system improvements, such as high-efficiency fluorescent lighting, high or low pressure sodium lighting, reflectors, or new lenses.

(18) Install daylighting controls or motion sensors.

(19) Reduce power system losses by correcting power factors or installing energy-efficient transformers.

(20) Install energy-efficient motors.

References

Federal Property Management Regulations, 41 CFR 101-20.107, Energy Conservation.

Federal Energy Management Improvement Act of 1988, PL 100-615.

Executive Order on Federal Energy Management, E.O. 12759, April 17, 1991.

Architect's and Engineer's Guide to Energy Conservation in Existing Buildings, DOE/RL01830P-H4, April 1990.

Life-Cycle Costing Manual for the Federal Energy Management Program, NIST Handbook 135

Energy Coordinators List

The following are the current energy coordinators for each Region and Station. To date, some units have not officially designated energy coordinators, so this list is subject to change. In addition to Regions and Stations, each forest and laboratory will designate a local energy coordinator to facilitate on-the-ground activities.

Unit	*Name*	*DG Address*
WO	Terry Gossard	W01A
Region 1	Jim Hogan	R01A
Region 2	Dave Faulk	R02A
Region 3	Robert Bye	R03A
Region 4	Clyde Lay	R04A
Region 5	Mike Alaux	R05D
Region 6	Dan Helm	R06C
Region 8	George Palmer	R08B
Region 9	John Graber	R09A
Region 10	Don Schultz	R10A
INT	Dave Kimbrough	S22A
NC	John Jakel	S23A
NE	Steve Oravetz	S24A
PNW	Sally Sullivan	R06A
PSW	Liz Exter	S27A
RM	Sue Janzen	S28A
SE	Jim Holbrook & Tom Chappell	S29A
SO	Darryl Landeau & Tom Chappell	S30A
FPL	Larry Anderson	S32A

Environmental Roads Initiative Project

Walt Brooks, Transportation Maintenance and Operation Engineer, Washington Office
Jeff Moll, Civil Engineer, San Dimas Technology and Development Center

The Washington Office Engineering Staff is undertaking an environmental roads initiative project located at the San Dimas Technology and Development Center (SDTDC). The project has been approved by the Roads Technology and Development Steering Committee and by Sterling Wilcox, Director of Engineering. This project is an outreach effort to discover and promulgate good ideas for enhancing the environment on our road projects. Employees from all disciplines are encouraged to participate.

The Forest Service has done a lot of good work over the years enhancing and caring for the environment on our road projects. We know that many of these "good ideas" have not been transferred so others can benefit. Examples include wetlands creation with road embankments and small structures, adjacent riparian area improvements, fish habitat enhancements, meadow restorations, visual treatments, vegetative projects, wildlife habitat creation, interpretive projects, use of recycled materials, and stabilization innovations (figures 1 through 3).

Figure 1.—Raising water table with culvert inlet structure, Watershed/ Meadow Enhancement Project, Apache-Sitgreaves National Forest.

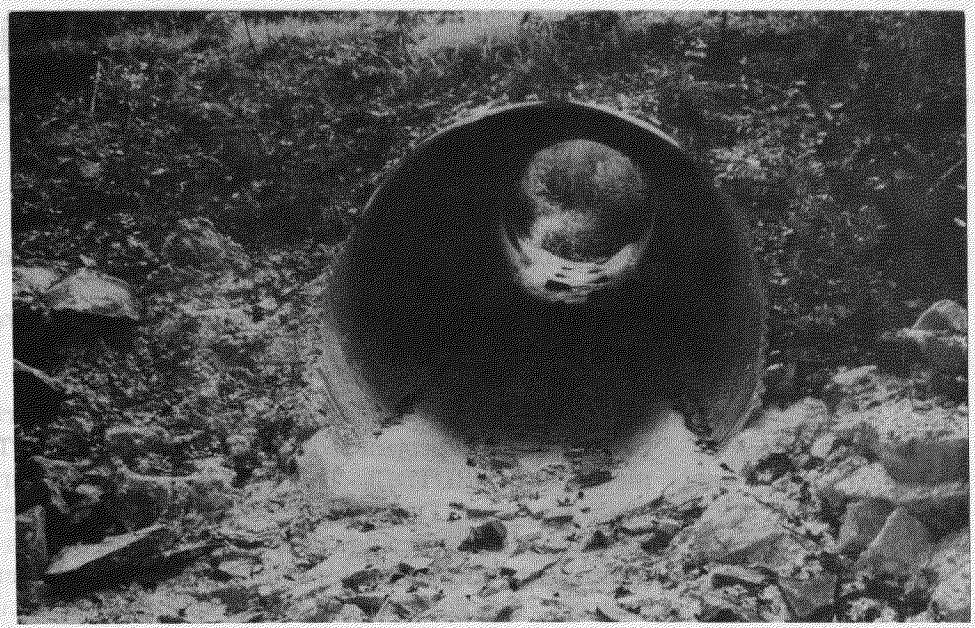

Figure 2.—Closeup of culvert inlet structure under construction.

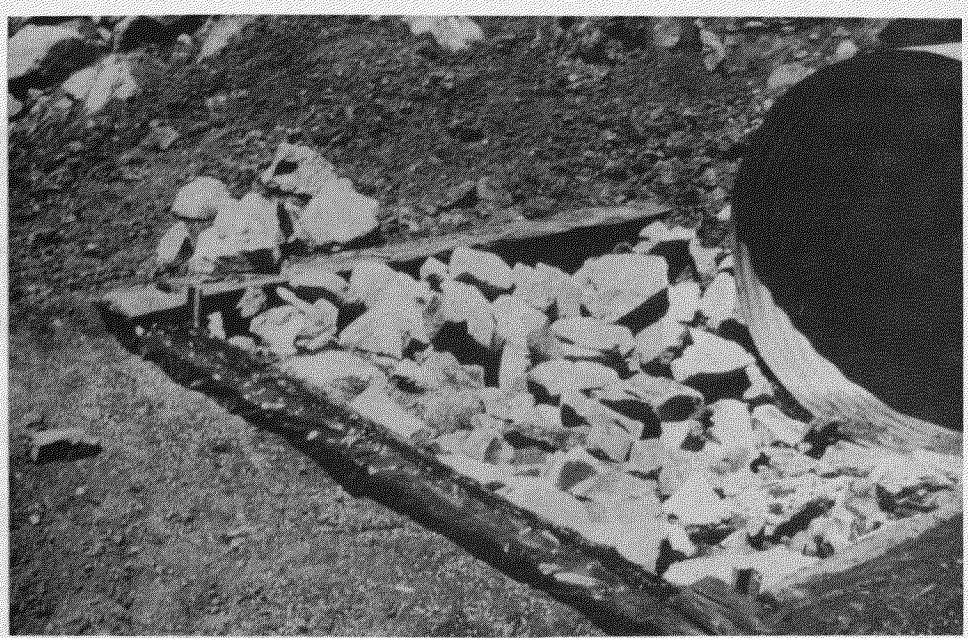

Figure 3.—Concrete paving of worn culvert invert forestalls replacement. (Note: rock embedded in concrete to aid fish passage.) Ouachita National Forest.

We have designed this project for outreach with minimal impact to the field. We will simply locate the projects and collect whatever information exists. SDTDC will develop the additional information needed, including photography or video. We will compile project drawings, details, and recommendations to share the technology so that design personnel can build on an idea and modify CADD drawings to adapt to local needs. We expect this to become a continuing multiyear project, so publications will be designed with the flexibility to add new ideas.

A focus on environmental enhancement projects will be an inspiration to our engineers, wildlife biologists, hydrologists, landscape architects, and all of our various staff groups that depend on roads. This project will make them more comfortable with what may appear to be nontypical applications of new technology. Management's decisions will be strengthened, and they will be able to point to environmental enhancement innovations.

The Environmental Roads Initiative (ERI) presents an outstanding opportunity for Forest Service employees to showcase their efforts at enhancing the environment through road projects and to contribute to future enhancement efforts across the country. Please forward your ERI projects to your regional environmental roads coordinator:

Region	*Coordinator*	*DG Address*
1	Donna Sheehy	D.Sheehy:R01A
2	Bill Cassells	B.Cassells:R02A
3	Dave Erwin	D.Erwin:R03A
4	Dave Neeley	D.Neeley:R04A
5	Mel Tiegen	M.Tiegen:R05D
6	Carl Wofford	C.Wofford:R06C
8	Ed Tarver	E.Tarver:R08B
9	Bill Rees	B.Rees:R09A
10	Ron Skillings	R.Skillings:R10A

Walt Brooks is the Washington Office Engineering staff coordinator for this project. He may be contacted at (202) 205-1023 or W.Brooks:W01A for further information. Jeff Moll is the SDTDC coordinator for this project. He may be contacted at (714) 599-1267 or J.Moll:W07A.

Using the Global Positioning System to Locate Genetic Trees for a Geographic Information System

Thomas Howie, Land Surveyor, Siskiyou National Forest

Introduction

The Siskiyou National Forest has identified over 4,000 genetically superior trees for their tree improvement program. Currently, any information on these trees is kept in paper form. Their location has been accomplished by estimating the positions on forest maps, the accuracy of which varies widely. The forest is in the process of implementing a geographic information system (GIS). Some of the information is being gathered and input on a basin-wide basis to facilitate specific project planning efforts.

Aurelia Hadley, a forester in the silviculture department of the Gold Beach Ranger District, approached me about the possibility of using the global positioning system (GPS) to collect information on genetic trees in the Lawson Planning Basin. This inquiry resulted in a pilot project to gather data on the genetic trees in the basin. The goal of the project was to record accurate positions and information on the trees in the planning basin and to develop a process and establish standards for gathering the data on the remaining trees on the forest for assimilation into the forest-wide genetic tree layer.

I was using the Trimble Navigations Pathfinder Professional with a polycorder data collector for corner search and wilderness boundary locations. I was aware that Trimble offered an MC-V data collector, available from Corvallis Micro Technologies (CMT), which had the ability to collect feature and attribute data directly to a position file and could interface with many types of GIS systems. I suggested we use this system in a limited project to see if it could be utilized on a district- or forest-wide basis.

After discussions with the foresters in the Gold Beach silviculture department, we established the following needs:

- Obtaining position data to at least mapping accuracy (±40 feet), which could be output in UTM-NAD 27 datum in PC Moss format.
- Collecting the following genetically superior tree information: species, tree number, breeding zone, slope, aspect, azimuth to tree (if GPS signal at tree was not feasible), distance to tree, cone crop forecast, clearing needs, and pole step.

- Collecting road location and Forest Service road number in order to query the distance along a road to the tree location.

Once the data needs were identified, our next step was to contact the forest GIS coordinators to check on the status of the data dictionary for the genetic tree layer. At this point, the forest data dictionary for this layer had not been established. This gave us the task of setting up a data dictionary for the Lawson area genetic tree layer. The data dictionary for any GIS layer establishes the format in which features, attributes, and/or attribute values will be gathered, sent to, and read by the GIS software. The data dictionary for this project was created on Trimble's preliminary release of PFINDER 2.01-09 software. This software is for use with the PathFinder Professional with the CMT MC-V Datalogger.

In setting up the data dictionary, we used codes for the information to be collected, for example, Douglas-fir = 205. This was needed in order to support PC Moss format. The final version of PFINDER software allows for both codes and descriptive names to be used. You can choose to send either codes or names to the GIS when running the conversion program.

After we completed the data dictionary, we printed out barcode sheets to be used in the field for data collection. The MC-V data collector is equipped with a light pen barcode reader that reads barcode data directly into the position files. Because the data was coded, we had to set up a master barcode booklet. The booklet consolidates the barcodes into fewer pages with descriptive titles under each barcode (figure 1). We also

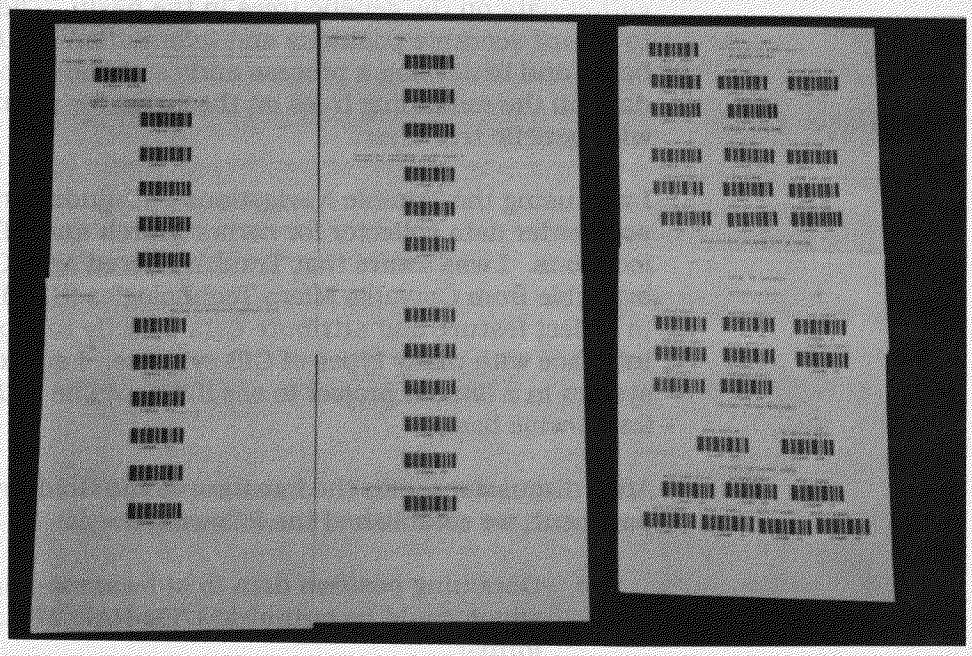

Figure 1.—Sheets on left have been printed from software. Sheets on right have been consolidated and have descriptions added for field use.

added a line on the barcode sheet when the field operator needed to add data that did not have a barcode. This consisted of the tree number, slope, azimuth, and distance to the tree. These lines helped the operators to remember that they needed to type in data as a note.

Position Standards

The positional accuracy goal was ±40 feet, which is equal to U.S. Geological Survey (USGS) quad mapping accuracy, the base layer for the Lawson GIS. With this in mind, the following standards were used:

- Positions are differentially corrected using either the Westside Zone Base or the Regional Office Base. Both bases were established using survey grade GPS receivers.
- Roads are three-dimensional (3D) manual files.
- Tree positions have a minimum of 180 3D differentially correctable positions. We did some testing with two-dimensional data mixed in with 3D fixes. This allowed for quicker file acquisition in the field, but postprocessing time was significantly increased.

Settings in GPS parameters:

Elevation mask..... 15

Signal level mask 6

Position dilution of precision (PDOP) mask 12

PDOP switch 8

We experimented with higher PDOP allowances (to 15 PDOP), but the data was extremely noisy and we did not gain very much additional field time. We decided to stay with the manufacturer's recommended settings.

Field Preparation and Testing

All machines were set to the established parameters. The data dictionary was loaded on the MC-V and the barcodes were tested at the office. A test file was sent to the GIS.

Jay Esperance, a forest technician on the Gold Beach Ranger District, Robert Gardner, an engineering technician, and I were the initial field personnel. After three field sessions of on-the-job training, I was no longer needed for field data gathering. We decided to go to the night shift for field work to make use of the best satellite availability. This worked well, because data would be downloaded and processed during the day, and any work to be redone was identified before the following night gathering commenced.

Planning and Field Operation

Once we decided on how the data would be gathered, we used Trimble's Proplan software to decide when. We uploaded a new almanac from the CMT receiver and converted it for use in the Proplan software. We considered satellite availability and PDOP values. In order to work during daylight hours, we initially looked at 6 a.m. to 6 p.m. for satellite availability. The satellite window in January and February was best from 6 a.m. to 11 p.m., with a few periods of high PDOP. We planned to arrive on the job site at 6 a.m. and begin data collection. After the satellites were no longer visible to the receiver, we laid out the next day's points. After a few days, we worked in the evening in order to take advantage of the longer satellite window.

For ease of data analysis and processing of statistics, we opened a separate file for each tree or road segment. This is not necessary when gathering data as features due to the software's ability to separate features within one file. We set up file names that identified them as tree or road files and the day they were logged. Keeping separate data files cost some time in performing differential corrections, because they had to be corrected one at a time. The software does not allow for selecting more than one file while processing. However, time was saved when troubleshooting data that was not collected properly in the field. Dealing with the omission of feature start and stop barcodes was easier with separate files.

Two-person crews seemed to work best for data collection. When logging road files, one could operate the data collector and light pen while the other drove (figure 2). An extra person was still needed at the trees. One

Figure 2.—Jay Esperance uses a light pen to read coded attribute data into tree position file.

person could barely handle a range pole, clipboard, data collector, and light pen. A frame pack with a telescoping antennae pole might be worthwhile. I have seen numerous home remedies, such as cruiser vests adapted with antenna pole mounts, but all have been lacking.

Data Processing

Downloading files is easy on the PFINDER 2.0 software. Multiple files can be selected and downloaded in one step. The differential corrections had to be done one file at a time if you operated within the software. This was time consuming due to reselecting at the base file for each file. It would be much easier if multiple files could be selected and a COR extension placed on the output files automatically.

Observations

The GPS receivers, which have the ability to collect data as features, have great potential and many applications with GIS data gathering efforts. Although the systems are relatively easy to master, training and practice will save lots of time in processing the data. Designing the data dictionary to group the hand note and barcode inputs separately can save potential omissions or input errors in the field. Our pilot project yielded 65 tree locations and approximately 10 miles of road in 7 field days with a 2-person crew. For locating positions and information on features not visible on existing photography, this is a great tool.

Note: For additional information on this project and process, please contact Tom Howie at the West Engineering Zone in Gold Beach, Oregon. T.Howie:R06F11D08A.

Federal Energy Efficiency Award Presented to USDA Forest Service

Pamela J. Finney, Public Affairs Office, Washington Office
George Kulick , Civil Engineer, Washington Office

A new national forest campground and boating site in Arizona is running on the sun. The Department of Energy selected the Tonto National Forest to receive one of four Special Federal Energy Efficiency Awards this fall for their outstanding contributions toward increased efficiency in the use of energy. Three employees on the Tonto National Forest will receive this prestigious award for implementing these model solar projects in the Cholla Recreation Site on Roosevelt Lake in central Arizona.

Using photovoltaic (PV) technology, solar thermal exchange, passive infrared sensing, and compost toilet technology, recreation services are offered in unique ways to the numerous people visiting these facilities on the Tonto National Forest. The Cholla Recreation site near Phoenix, Arizona, is the largest all PV-powered recreation site in the U.S.

These technologies are saving hundreds of thousands of dollars and serve as a recreation model for water and energy conservation at a time when these issues are foremost in the minds of many Americans. Visitors can enjoy lighting, electricity for recreational vehicles, forced air ventilation, evaporative cooling, hot showers, and sweet-smelling toilets, all provided with energy from the sun.

With the success of this project, the Tonto National Forest staff has been contacted by other parks, national forests, and countries (as far away as Iran) about how to adapt this new energy-saving technology to their campgrounds and visitor sites.

Standalone, roof-mounted solar arrays provide electrical power for lighting, forced air ventilation, evaporative cooling, and several other electric requirements at 13 toilet and shower buildings, an entry station, and a fish cleaning station.

The team adapted a solar thermal exchange process—which uses a downward pumping "geyser type" solar collector, called the "Copper Cricket"—to produce hot water for showers at no monetary or nonrenewable resource cost. Potable water is provided from a 165-foot-deep well

with a specially designed jack pump powered by a large solar array mounted on three tracking devices that follow the course of the sun. Well water is disinfected utilizing a PV-powered ionization process which converts common table salt to free chlorine and ozone.

Where water-saving flush toilets cannot be used because of limitations on the disposal of waste water, composting toilets have been installed, containing the waste in specially designed composting chamber. An organic bulking agent, such as wood shavings, is occasionally added to the compost pile to aid in decomposition and help eliminate odors. A forced air ventilation system also aids the decomposition process, removing any remaining odors. The result is a toilet that is very well received by the public and has a minimum impact on the environment.

These Tonto National Forest employees have made unusual achievements in the application of solar and other energy-saving technology in the delivery of recreation services to the public. Based on their contributions in the area of solar energy, Fred Bloom, Gordon Cates, and David Killebrew received a special 1992 Federal Solar Energy Award from the Department of Energy in late October.

☆U.S. GOVERNMENT PRINTING OFFICE: 1993 - 717-076/60944

Engineering Field Notes

Administrative Distribution

The Series

THE ENGINEERING FIELD NOTES is published periodically as a means of exchanging engineering-related ideas and information on activities, problems encountered and solutions developed, or other data that may be of value to Engineers Service-wide.

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-2 Don Loetterle
R-3 Dave Erwin
R-4 Ted Wood
R-5 Rich Farrington
R-6 Bob Yoder
R-8 Pauline Cahill
R-9 Fred Hintsala
R-10 Betsy Walatka
WO Terry Harwood

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

Volume 25
January-February 1993