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THE ENGINEERING FIELD NOTES SERIES 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.

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Regional Information Coordinators

R-1	Jim Hogan	R-4	Ted Wood	R-9	Fred Hintsala
R-2	Don Loetterle	R-5	Larry Gruver	R-10	Dave Wood
R-3	Art Marty	R-6	Bill Perry	WO	Al Colley
		R-8	Jim Gilpin		

Inquiries

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

FOREST SERVICE-USDA
Engineering Staff-Washington Office
Attn: D.J. Carroll, Editor
M. J. Baggett, Assistant Editor
P.O. Box 96090-Washington, DC 20090-6090

Telephone: (703) 235-8198

USDA Commendation for Engineering Performance & Reporting on the Forest Service Road Program

The following letter from USDA's John Fedkiw to Chief Robertson speaks of excellence that demanded teamwork and performance of Engineering personnel at all levels Service-wide. We should all feel very proud of a job well done.

United States Department of Agriculture | Office of the Secretary | Office of Budget and Program Analysis | Washington, D.C. 20250

August 22, 1988

SUBJECT: Commendation for Engineering Performance and Reporting on Road Program Effectiveness and Efficiency

TO: Dale Robertson, Chief, Forest Service

THRU: George Dunlop, Assistant Secretary, Special Services

The Forest Service 1987 Annual Report is an outstanding performance reporting document for a government agency. This note focuses on the Roads segment which epitomizes both the excellence of reporting in the 1987 Report and the performance of Forest Service Engineers throughout the National Forest System.

It not only provides one of the most effective descriptions of what the road program is trying to do as well as why and how. It also reports performance effectiveness and efficiency for the 1986 to 1987 period in clearly documented terms both nationally and by Regions, for direct costs and support costs separately. The utility of the Road Analysis and Display System for tracking costs to assure continuing managerial effectiveness and progress in maintaining and improving cost efficiency is described. The technology and development applications program also explain how the Forest Service Engineers have organized to develop or identify promising new technology that facilitates new gains in cost- effectiveness as well as efficiency. Examples are given.

The Roads reporting for FY 1987 sums up an excellent response of Forest Service Engineers to Congressional, Administration, USDA and internal Forest Service direction to improve the cost effectiveness and efficiency of the National Forest System Road Program. The 9 percent 1986-87 increase in efficiency, to which all 9 Regions contributed, in response to Congressional direction for a 5 percent reduction in unit costs, I interpret as a reaping of extra benefits from efficiency initiatives that have been underway comprehensively for several years. I observed the gains being made on the ground in R-6 on three different Forests. The Engineering Division has kept me informed on the progress of the Road Analysis and Display System. R-6 documented and demonstrated the role of technology. I reviewed documentation of gains in R-5 unit costs of engineering activities resulting from early cost tracking initiatives directed by the Chief.

Based on my associations with the Road Cost Study directed by Deputy Secretary Peter Myers, the foregoing observations and the FY 1987 Road Report, I strongly recommend special commendation of the Forest Service Engineers in the Washington Office, the Regional Offices and at the National Forests and Ranger Districts for this outstanding teamwork and performance. No doubt there are special leadership and project efforts that deserve individual commendation. I do not believe, however, that this major achievement could have been attained without a commendable teamwork response and performance from all the Forest Service Engineers. Their record is exemplary and should serve as an incentive in other functional areas of the Forest Service.

JOHN FEDKIW
Associate Director for Renewable Resources and Special Services

Road Program Costs: Continuing Efforts Addressing the Issue

Michael D. Harper
Engineering Management
Washington Office

Refinements in the ROad Analysis and Display System (ROADS) are saving the time and efforts of Regional and Forest personnel. Individuals involved in program development and budgeting (PD&B), monitoring and tracking, and the recording and reporting associated with the Forest Road Program are all benefiting from the refinements.

During the implementation and use of ROADS this year, Forest Service personnel at all levels reviewed and commented on the effectiveness of the new system and the level of effort involved in making it work. Personnel offered many suggestions on how to improve the system. In addition to many minor changes, three major changes are occurring.

The first major change relates to how outyear program information, which is required for budget development, will be reported. Last year, when the fiscal year 1990 program was developed, a Forest Road Program Investment Summary Spreadsheet was filled out and submitted for each of the five budget levels. However, the use of this summary spreadsheet has been discontinued. This year, for the fiscal year 1991 program, new codes have been added to the National Forest System template that incorporate the ROADS data into the PD&B data base. Field submissions now will be collected with other planning data that are sent to PD&B. This change will simplify data submissions for every Region.

The second major change relates to how current-year program information is to be analyzed and reported. The mandatory use of the ROADS detailed spreadsheet will be discontinued after reporting the final accomplishments and expenditures for fiscal year 1988. This spreadsheet requires much computer space and time, and many Forest personnel have worked overtime because of this. With the submissions of the fiscal year 1989 appropriated budget and the fiscal year 1990 President's budget information, the ROADS data previously analyzed by the detailed spreadsheet will be analyzed and reported using a Forms Entry System data base. This change will reduce the need for many overtime hours.

The third major change in ROADS affects all Forest Service employees who record expenditures of Forest Road Program funds. With the support and input from field units, we identified the minimum activities that must be tracked to provide managers with the means to analyze and monitor economic efficiency and to control costs associated with the Forest Road Program. Adequate reporting to the Department of Agriculture, Office of Management and Budget, and Congress was considered during the identification of these minimum activity tracking needs. In all, 32 work activity codes previously required by ROADS have been eliminated—a 47-percent reduction. The remaining work activities are those we will charge expenditures to as we fulfill our direction to "charge as worked."

Warning: GPS & NAD 83 Are Coming!

Wayne W. Valentine
Leader, Photogrammetrics Group
Geometronics Service Center

Introduction

One of the greatest advances in the history of surveying, mapmaking, and navigation is about to come into full bloom. While prior advances in technology have had major impacts on these sciences (for example, the development of the chronometer in the 17th century enabled longitude to be determined, and optical theodolites and electronic distancing devices in this century made it possible to measure location differential precisely), these and all former surveying and navigation developments are about to be eclipsed by the Global Positioning System (GPS), the dreamed-of "black box" of navigation and precise geodetic positioning.

What is this new technology? Essentially, a constellation of 24 satellites orbiting 12,000 miles above the Earth will broadcast signals that a GPS receiver will read to determine its absolute position in all three dimensions (easting, northing, and height) to an accuracy that until now has been practically impossible, even with the most sophisticated geodetic survey methods. Positions can be determined instantly to an accuracy of from 3 to 25 meters, and better precision is possible with multiple receivers, one held fixed over a known point. With this method, x, y, and z coordinates can be found to an accuracy in the millimeter range. Speed, accuracy, and the low cost of the GPS portend great changes in the way maps are made, surveys are performed, and travelers navigate.

At present, 6 of the full constellation of 24 satellites are in orbit. The other 18 were planned to be in place already, but the shuttle disaster in January 1986 set schedules behind. New launches are planned to start this fall and continue for 2 years. The present number of satellites limits "visibility" to about 4 hours per day (depending on location), but by fall of next year, enough satellites will be in orbit to permit nearly full-time operation.

Foresters mapping timber stands, burns, or clearcuts, Engineers measuring road rights-of-way, geologists plotting faults or deposits, surveyors locating property lines, and pilots navigating a spray corridor all could be using this technology in a matter of months. Anyone needing to know present field location or needing to find a spot of known location can use the GPS. Speed, accuracy, repeatability, and efficiency in performance of this most basic land management task all will be improved.

Although available receivers are too expensive for general use, models that cost less will be available soon. Unlike most sophisticated scientific and surveying instruments, the GPS has a mass market large enough to drive prices down. Remember the CB radio boom of a few years ago? It will be repeated with this equipment, because every boating, flying, or cross-country enthusiast will want one.

The GPS technology will have a dramatic effect on the way we do business in the Forest Service, perhaps even more than the advent of radio and telecommunications. GPS receivers will be nearly as common for Forest Service field workers as White boots and Filson vests in the Northwest.

So what's all the concern about, and why this article?

The GPS and GIS's

Enter Geographic Information Systems (GIS's) into the picture. GIS's use digital geographic information to work their computer magic. Geographic information currently comes from maps by digitizing (that is, converting the location of a mapped feature, such as a timber stand boundary or a river, to a series of x and y ground coordinates stored in a computer file). These ground coordinates are in a reference system known as North American Datum of 1927 (NAD 27), which is sort of an address scheme that cartographers and geodesists use to locate things for plotting on maps.

GPS, on the other hand, uses a different reference system known as NAD 83. NAD 27 and NAD 83 look alike and seem compatible, but they are not. Worse, they are not even on speaking terms with one another, which means that an "address" determined for a point in the GIS map system, NAD 27, will be completely different from the "address" for the same point in the GPS system, NAD 83.

The uninformed may ask, "So what?" The problem is that well-meaning but uninformed enthusiasts can easily contaminate GIS data bases (which will be expensive for the Forest Service to develop or acquire) with unconverted GPS numbers. A person who updates a GIS data file using uncorrected GPS coordinates will be making a serious mistake, and will be unaware of the mistake because of the similarity of the data. Do we want to risk adulterating the expensive GIS files with incompatible data that will be extremely difficult to isolate and remove once stored?

GPS will be an excellent method of locating new roads, and so on, for updating our maps, but the coordinates must be compatible with those used in the mapping system.

Differences between the two systems are significant, amounting to some 100 meters in longitude in Region 1, for example. Moreover, GPS reads heights with reference to a different datum, a geodetic elipsoid, while map elevations are referred to mean sea level. The two reference surfaces are not the same—by several (up to 20 or so) meters. Surface separation is not constant but varies—rapidly in mountainous areas.

Some knowledgeable people are wondering about "coordinate transformation," a mathematical procedure commonly used in surveying, mapping, geodesy, and engineering to convert coordinates from one system to another. Unfortunately, only *approximate* conversions can be made from NAD 27 to NAD 83; accurate coordinate transformation between systems is possible only if the two systems are free of localized distortions. NAD 83 is free of distortion, but NAD 27 is not. Only when localized relationships between the systems have been determined by measurements can coordinates be accurately converted from NAD 83 to NAD 27. And the difference between approximate and accurate conversion is significant, amounting to approximately 10 meters, depending on direction and location.

Horizontal grid distortions, such as those in NAD 27, can be visualized through the following examples. Imagine a wire mesh laid out flat on a colosseum floor. Each component square in the mesh is exactly equal to all the others, in both size and orientation. This perfect condition represents NAD 83. Now imagine the same mesh laid out over the same floor, but this time slightly misoriented and also offset, and moreover with objects of various sizes, including perhaps even a basketball player or two, between the mesh and the floor. Here the mesh touches the floor; there it drapes over a 7-foot player, then touches the floor again. Each component square becomes stretched and twisted to accommodate these irregularities. This distorted mesh represents the horizontal address system of NAD 27, to which points are referred for plotting on flat maps.

Now imagine the floor replaced by a field of small sand dunes, with characteristic undulations. The difference between dunes and flat floor illustrates the disparity between vertical datums, which are the surfaces from which measures of altitude of points are made.

These examples roughly illustrate distinctions between NAD 83 and the current mapping system (NAD 27), except of course the "floor," "dunes," and "meshes" are curved to match our planet.

Relationships of scale, orientation, and height between cognate mesh squares must be determined on a local basis before a true conversion can be made between the two. This requires that a series of points be established throughout that measure local offsets, twists, scale, and vertical datum differences between the imperfect and true grids.

How is it that a supposedly precise geodetic network like NAD 27 is really not that accurate? T. Vincenty, retired geodesist for the National Geodetic Survey, explains, "NAD 27 was originally created using the best methods that were available at that time. (The) framework was adjusted by . . . (a justifiable) approximation. The main framework was then densified by lower order nets that were forced to fit . . . so that nothing could be done about any residual errors, . . . (and) that created further local distortions." (*1*)

Very important work must be done before the full potential of GPS can be realized. A network of control stations needs to be established in each Region to measure relationships between horizontal and vertical datums, and these relationships need to be published among GPS people and GIS people to forestall mixing of incompatible data. We recommend publishing a series of isopleth maps (similar to magnetic declination charts) that show shifts in latitude and longitude between NAD 27 and NAD 83 for each Region. Another map showing height differences also is needed. Once this is done, accurate local transformations can be performed.

Look forward to GPS helping you get your job done. However, be careful not to mix NAD 27 apples with "unpeeled" NAD 83 oranges. An innocuous-looking but rather nasty salad may result.

Reference

1. Unraveling Some Mysteries About NAD 83, *P.O.B. Magazine*, June–July 1988.

Organizing Engineering Information

Loyd Dille
Forest Engineer
Gila National Forest, Region 3

Introduction

Faster, more efficient computers allow for more processing capabilities than ever before. The Forest Service has numerous systems that have been or are being implemented (ROADS, STARS, TIS, TSPIRS). These various functional systems lead to inconsistencies in the common data, which result in questions about the validity of the data. The Forest Service is a resource management agency, and it seems logical that we would have all our resources properly inventoried in an electronic mode. Through this electronic mode, all needed information would be available for people to do their jobs. We can accomplish this by implementing a corporate system, in which data with common definition are collected and stored once in one place and are available electronically for people to use. Now is the time for the Forest Service to become a wise manager of data.

What Is the Problem?

The cost and time of manipulating the data have increased to such a degree that field units have found themselves spending a disproportionate amount on information processing rather than direct land management activities. The numerous reporting and tracking systems have resulted in common data being generated independently. The independent entry of these common data has resulted in inconsistencies, placing validity of all the data in doubt. The collection, storing, and processing of data also are expensive.

Where Are We Now?

Currently, there are numerous systems in various stages—from fully implemented (RIM, PAMARS), to initial implementation (TSPIRS, ROADS, STARS), to planned (GIS, GPS), to foreseen (Range, Wildlife equivalent of TSPIRS)—that are or will be a major contributing factor to the increasing data-manipulation problem existing with the field units. Forests and Regions are working independently on ways to further manipulate the required data to create common data bases, reducing the time required to maintain the data and produce the required results (reports). This ever-increasing demand on people's time to manipulate data has become a concern at all levels of the organization. Reactions range from the traditional "we will eventually adjust to the time demands and will continue to do our job" to "the time has arrived for an organized effort to be made to deal with growing demands."

Where Do We Want To Be?

We manage information both as a fundamental necessity to the Forest Service mission and as an opportunity to learn. It seems only logical that the Forest Service would have its resources inventoried in an electronic mode and available for viewing and reporting by anyone who needs the data. The elements are here—a variety of resource records in many forms, a Data General computer system, work stations, and Geographic Information Systems (GIS's) (GIS implementation is scheduled for 1991) and other modern data base systems being explored.

STARS, TIS, CIMS, ROADS, TSPIRS, PAMARS, and RIM are some of the many individual systems and are themselves in various states of completeness and usability. All contain some data that are common to some other data bases and, in some cases, common to all the data bases. Putting all these together sounds easy; execution is more difficult. The strategy should be to perfect the system so that a "common data base" would exist that operates electronically in harmony with all the separate systems. This would eliminate duplication of data entry and common data error and thus create a data base feeding all reporting and tracking systems with the same data for like entries.

Figure 1 is a graphic depiction of data needs. As is shown, the amount of data collection necessary at the Ranger District level is very large compared to the required data needed at the Washington Office or even at the Regional Office level. At the Ranger District level, the data are collected by individual item for that District. At the Supervisor's Office, these data are aggregated for that particular Forest. At the Regional Office, the Forest data are further aggregated for a Regional response and at the Washington Office level again aggregated for a Service-wide response one more level up.

For this reason, required data for a corporate data base should be a top-down process. The Washington Office should set what the upward reporting requirements are, as well as that data needed as facilitating information. The Regional Offices should then determine what is necessary to provide the Washington Office data plus that required within the Region and so on down to the Ranger District. There, data are gathered to meet the Supervisor's Office's required reporting and management, plus those data necessary for the Districts to gather to be able to meet the Supervisor's Office needs. In addition to these data needs are the data necessary for the day-to-day management of the unit. In many instances, these data may be one and the same. Care must be exercised so that to the extent possible, daily management data are the same as those in the corporate data base. At all levels, data should not be gathered in anticipation.

Conclusion

If we are to continue to improve our productivity, we must become wise in the management of our information and have an information management system. In this electronic era, significant opportunities exist for the Forest Service to be a wiser manager of information and at the same time improve productivity. The corporate concept of information management is one of these opportunities that fit "where we want to be." This concept establishes that data are shared among systems and are commonly understood by

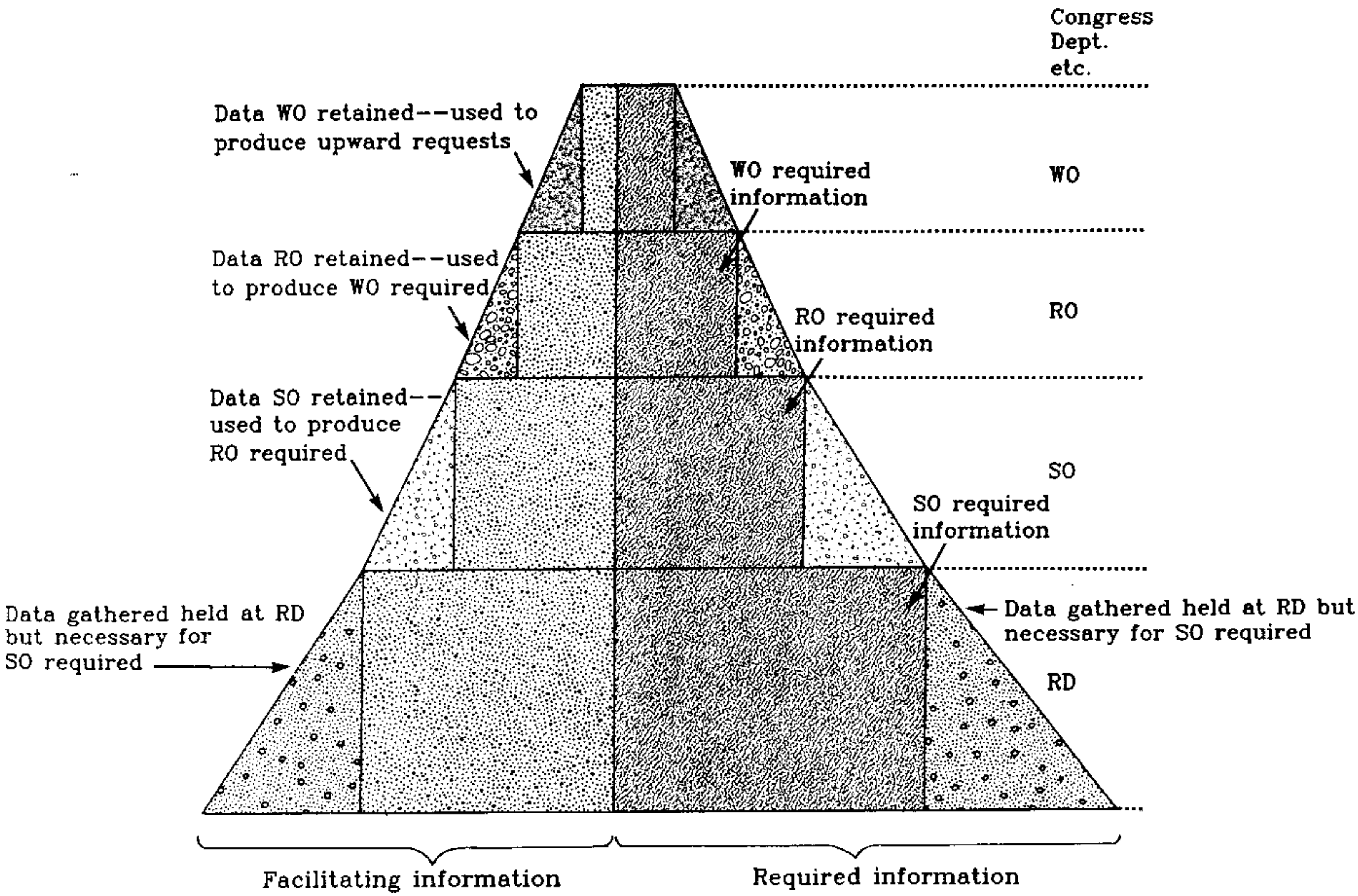

Figure 1.—Levels of information-data needs.

users, that these systems have a common data dictionary, and that the majority of the organization's personnel can use these systems through a network of electronically connected locations.

A big advantage of storing resource data in a corporate base is that data that are used by more than one application are stored in only one place, so inconsistency of data between applications is eliminated. If data are changed in one application, all other applications will view the new data. There is no longer a need for transferring data between applications. In other words, we need to collect it and store it once—in one place.

Update by Jerry Bowser, Chief of Engineering Systems Operations, Analysis, & Development

What Loyd is describing here is a significant philosophical change in our individual concepts of the ownership of and responsibility for information. If we collectively can make this transition, we are on our way to managing our information instead of it managing us.

As I see it, the payoff will be a high likelihood of a reduction in the workload for the field personnel who collect and input most of our Agency information. This should be a primary goal, along with the goal of elimination of redundant data in separate data bases.

The necessary technology is being delivered that permits us to effortlessly share our data. Relational data bases (SQL) with user friendly interfaces are being successfully used in pilot efforts across the Forest Service. Timber Management is committed to the conversion of the family of TMIS programs to the relational technology. This will put the data base overhead in place to accommodate and attach other functional data, so that eventually each Forest Service unit could have an integrated data base available to all.

Engineering is currently working with Timber Management to add the records needed for the ROADS Project Listing to STARS as it is converted to SQL.

Starting in fiscal year 1989, the ROADS national aggregate spreadsheet will be added to the Washington Office Joint Data Base (JDB). The JDB is a pilot that was developed originally to promote sharing of common data among PD&B, RPA, and LMP. Now, other Staffs are recognizing the potential, and other data, such as those used for the Report of the Forest Service, *are being added.*

The GIS implementation is one of the catalysts forcing us to organize our management of information. Out of this initiative will come a basic information structure, along with standard definitions, codes, and terms that will be used nationally in GIS. When this is in place, the information can be shared and understood (1) across functional areas, (2) across disciplines, and (3) across organizational levels.

Career Development—The Key Is Personal Planning

Chris Schwarzhoff
Assistant Director of Engineering
Washington Office

John Lupis
Director of Engineering
Region 4

Introduction

One of the reasons the Forest Service is able to attract high-quality people is the breadth of opportunity that exists within the agency. This is particularly true within the Engineering arena. Few organizations deal with the variety of Engineering activities that the Forest Service does, such as: roads, environmental, geometronics, architecture, dams, surveying, geotechnical, buildings, ski lifts, engineering systems, bridges, electrical, mechanical, fleet, and materials. And this is only a start when one considers the other opportunities for Engineers within the agency including: research, administration, unit manager (for example, District Ranger or Forest Supervisor), planning resource management program areas, and State and Private Forestry. Choosing a career path from these options can be overwhelming.

Although primary responsibility for career counseling begins with supervisors and managers, actual planning to achieve career satisfaction is the individual's own responsibility. Commitment, performance, and willingness to move and be successful in new assignments will determine career growth. During the last few years, opportunities for advancement have been at a reduced level because of age distribution and a decreasing workforce. However, during the next 5 years, it seems that many career growth opportunities will be available, especially in the ranks of Engineering supervisors and managers. Similar trends exist in other career fields within the Forest Service. Because of these factors, employees should carefully consider their career objectives. A question frequently asked is: "How should a person go about planning a career and setting objectives?" Again, because of the wealth of opportunities, this can be a formidable task. There are no magic formulas for successful career development, but there are several important factors that should be considered in career planning.

Factors to Consider in Career Planning

Vision of Career Success

Within the first few years of employment, individuals should develop a vision of long-term employment and a sense of what would constitute career success. This vision provides the individual with a sense of where his or her career is headed. These early visions of personal career success often change over time, but what is important is that the individual relate to the organization and identify satisfying career opportunities. An employee who is serious and deliberate about career planning is more likely to have a successful career.

Long-Range Goals—5 Years Ahead

An important part of career planning is setting long-range goals. For newer employees, this generally involves identifying positions that are *more than one step away* from your current position. In identifying career goals, several items must be considered.

Life Goals. It is extremely important to include personal life goals, such as family considerations and personal interests. For example, if strong personal goals restrict your availability for transfer, this should be taken into account. Some may consider the subject of salary crass, but for those with a strong feeling about the level of pay desired, this should be an important consideration.

Vocational Interests. You must decide what kind of work—technical, managerial, administrative, or supervisory—interests you the most. This may change over time, but the key to career satisfaction is making the right decision about the type of work in which you want to be involved. This is a particularly important step for individuals with technical backgrounds, because there is a natural tendency for these individuals to stay in technical career paths even though they might be well suited for other positions. For persons having difficulty deciding what interests them most, such preference tests as the Myers-Briggs can be helpful.

Analyze the Job Situation. Meeting life goals and vocational interests is very important but somewhat meaningless if there are no positions that allow them to be met. Engineering management and unit manager positions offer the greatest flexibility in this regard; however, management is a very competitive arena that often requires great personal sacrifices. Be realistic—if a job has prerequisites that you do not have, such as certain educational requirements—either eliminate the job from consideration or commit yourself to obtaining these prerequisites.

Feedback

Obtaining feedback from supervisors, managers, and mentors throughout your career is an extremely important part of achieving career goals. It is not possible for individuals to properly assess their chances for meeting career goals without some feedback from others. Self-assessment is important but generally far more meaningful when accompanied by candid input from others. Input from mentors with a personal interest in helping you is especially valuable.

Flexibility

As you move along your individual career path, you will notice many changes taking place. For example, positions you once viewed as very desirable may not seem as attractive when viewed from your present vantage point. In addition, organizational emphasis and culture may be shifting, and new technologies may change many jobs significantly in the future. Personal needs and preferences also will change over time. The key here is flexibility. Be alert to these changes and adjust your long-term goals accordingly. Blindly following a poorly conceived or unrealistic career plan is certainly not productive. Instead, consider new opportunities and alternative strategies for meeting your career objectives as they present themselves.

Performance

Some individuals become so preoccupied with long-term goals that they let their present job slide. The single most important factor in achieving career goals is your demonstrated successful performance in each job you occupy. Next is acquiring the experience, knowledge, and skills needed for future assignments. Employees should counsel carefully with their supervisors to identify what training and work experiences are important. In some cases—especially in situations when your supervisor may not seem as supportive as you think he or she should be—it is advisable to consult with others about which training and work experiences best support your goals.

Competition

Once you have decided you are ready and qualified for a new job, it is important to take the task of competing very seriously. Take advantage of opportunities to let others know you are ready and would like to compete for specific positions. Initiate discussions with key decisionmakers to let them know you are interested. If you are interested in positions not requiring promotion, investigate the possibility of a reassignment. For advertised positions, do a high-quality job of completing the application. Poorly developed and prepared job applications have eliminated many well-qualified candidates from consideration for key positions. In describing yourself, let people know what you personally have accomplished; do not merely rehash past position descriptions. In other words, do a good job of marketing yourself—this is not a time to be shy. In cases when you are not selected, seek feedback on which evaluation and selection factors you need to improve to be more competitive. Feedback is important not only in the job selection process mentioned above, but also in the adjustment of your long-range goals, additional training, and the strengthening of your current performance.

One item of special importance is exposure. In a decentralized organization such as the Forest Service it can be a challenge to establish yourself, especially when assigned to one of the more remote units. An excellent way to establish yourself and gain valuable knowledge and skills is membership on interdisciplinary teams and special task forces. This is extremely important for individuals desiring career development outside the Engineering arena.

Be resilient. Be prepared to compete repeatedly for positions, and recognize that the higher the position, the stiffer the competition. Sometimes just being at the right place at the right time makes the difference.

Jobs Outside Engineering

Some Engineering personnel have expressed interest in positions outside Engineering, especially in the unit manager-administration area. There is certainly no reason to exclude these jobs from consideration in your career planning objectives. However, it should be recognized that these jobs are highly competitive and have somewhat different skill, experience, and qualification requirements than a typical Engineering career progression might provide. Identifying your interest in these positions early enough in your career to acquire these skills and experience is very important. Again, get feedback from supervisors and mentors, and make your interest known. Also, be alert for opportunities to broaden your understanding of Forest Service policy and administration and your experience in natural resource management. While there is a wide variety of career opportunities within Engineering, there also are other very rewarding careers in the Forest Service where Engineering personnel can make significant contributions.

Meeting Long-Term Goals

It is hoped that most employees reach their career goals. For the sake of both the individual and the Forest Service, this ideally happens in the years immediately preceding retirement. When an individual comes to this realization, it is important to intensify planning for retirement and further develop interests that transcend current work activities. However, retirement planning should be an ongoing activity. A statement made by many attendees of retirement orientation training is: "I wish I had gone through this course years ago."

As a parting thought, remember the words of a wise old western cowboy who once said: "No matter where you go, there you are." Is your career headed where you want to be?

Factors Affecting Aggregate Surfacing Raveling

Stephen L. Monlux
Region 1 Engineering

Definition of Raveling

Raveling of aggregate surfacing is the separation of the largest sizes of aggregate from the rest of the material. Normally, the separated material collects along the shoulder of the road and between the wheel tracks.

Three Problems Related to Aggregate Raveling

The collection of coarse aggregate outside the wheel tracks is a safety hazard because vehicles on single-lane roads can lose control when steering out of the wheel tracks to avoid another vehicle.

Another problem is that any amount of raveling decreases aggregate thickness and structural strength of the material left in place.

A third problem arises when vehicles have to drive on raveled material; friction is reduced. This reduction in friction makes stopping distances greater and creates traction problems for trucks on steep grades.

Factors Affecting Raveling

Aggregate Size

The larger the maximum-size aggregate, the greater the potential for raveling. Gradings A, B, C, F, G, and H in Section 703.06 of the Forest Service Specifications are much more prone to raveling than D, E, J, and K. Also, gradings E and K would normally ravel less because they have the smallest top size (3/4 inch). Crushing costs are sometimes slightly cheaper for the gradations with larger top size. One additional advantage with the smaller top size is that percent fracture is normally increased. This can be very important for some river-worked deposits that do not contain much large rock.

Aggregate Gradation

Gradings A through E require 10 to 12 percent more sand-size material than gradings F through K. The additional sand fills some of the voids between the larger aggregate and helps prevent raveling. Another problem that can exist with any of the gradings is poorly graded material within the gradation band. If a single size of aggregate is missing or there is too much of one size present in the gradation, poor performance can result. A Region-1 Special Project Specification (SPS) to Section 703 was written in June 1986 to force the grading to correspond with the grading limits. This SPS uses a numerical method to control the shape of the grading curve within the grading limits.

Plasticity

The presence of a limited amount of plastic material in an aggregate gradation will help prevent raveling. Unfortunately, many of our material sources do not contain plastic material. Natural plastic material may be added during crushing, but this increases costs and must be controlled by field testing. If too much plastic material is present in the gradation, both a "slippery when wet" hazard and rutting from strength loss will result.

Percent Fracture

Aggregate fracture helps prevent reveling by increasing aggregate interlock. River-worked deposits crushed to a large gradation (gradings A, B, C, F, G, and H) usually cause the most raveling because these sources contain primarily rounded rock.

Dust Abatement

If aggregate surfacing is permitted to lose dust, raveling will result. The minus #200 material fills the voids in the gradation and helps hold moisture and dust abatement materials. These materials help hold the entire gradation together. The proper use of dust abatement materials extends the life of aggregate surfacing. For effective treatments, the aggregate surfacing gradation must contain enough sand and fines (minus #200) and be prepared according to specifications. Some dust abatement materials perform better in some areas than others. For example, chlorides perform best on materials that have a dense gradation, whereas lignins and dust oils do a better job on poorly graded materials where their binding qualities are beneficial.

Durability Index

This test indicates whether an aggregate produces claylike fines when subjected to mechanical degradation in the presence of water. A high reading of 35 or above indicates that few claylike fines are produced. A reading between 25 and 35 usually indicates that enough claylike fines will be produced to act as a plastic binder. This condition can exist with argillite-type aggregates. If aggregate does produce claylike fines, raveling would be reduced for the same reasons as explained for plasticity. Aggregates with test results below 25 normally degrade more rapidly than desirable.

Los Angeles Abrasion

This test indicates the hardness of the aggregate and how well it will resist abrasion. Aggregate with test values below 40 normally perform satisfactorily as surfacing. Test values between 40 and 50 indicate that the aggregate may be marginal, and aggregates with values above 50 are usually not satisfactory performers. However, aggregates with values above 50 have been used by crushing them to a large gradation, and then allowing traffic to degrade the material to a smaller gradation.

Other Considerations

There are several other factors to consider. Road systems that have steep grades and sharp curves normally have more extensive raveling problems. Raveling problems can be created solely by light vehicle traffic. Low-pressure tires can dramatically reduce raveling problems. Surface raveling is the primary cause for aggregate loss. Subgrade contamination of surfacing can be a significant factor in decreasing the effective thickness. Subgrade weakening from precipitation is less with dense gradations that have smaller top sizes. This is true because they have a low permeability. Even less moisture infiltration exists if the gradation contains some plasticity.

Very hard rock (that is, rock with low Los Angeles abrasion) can produce sharp aggregate that can cause flat tires. Gradations with a small top size that contain 40 to 50 percent sand do not have as much potential for causing flat tires as large open-graded materials. Grading E has the least potential for causing flat tires.

Increasing the maximum specification limit from 15 to 20 percent on the #200 material may be desirable where fines are nonplastic. This increase in minus #200 material may help prevent some raveling problems but may decrease stability.

Recommendation

Perhaps the best material to resist raveling is grading E with good levels of plasticity, fracture, durability, and Los Angeles abrasion. Regular dust abatement would extend the good performance and reduce the need for surfacing replacement.

Road Construction Special Project Specifications—Remote Access Available for Regions 1, 4, 6, & 8

John Holt
Chief Construction Engineer
Washington Office Engineering

Fong Ou
Systems Engineer
Washington Office Engineering

A discussion of the National Preconstruction/Construction Workshop held in Eugene, Oregon, from February 29 through March 3, 1988, indicated that Data General access to other Regions' Special Project Specifications (SPS's) would be beneficial.

The following instructions have been provided by Regions that have their SPS's available for remote access. Dumpfiles should be retrieved only after normal business hours because of the length of the documents.

From the IS Main Menu
Select- 3. Utilities
Select- 6. Retrieval and DCC Access
Select- 1. Retrieval

The following will appear and have to be filled in as indicated:

Location of file to be retrieved-

	REGION 1	REGION 4	REGION 6	REGION 8
HOST NAME:	RØ1A	RØ4A	RØ6C	RØ8A
LEVEL :	2. Staff	2. Staff	2. Staff	2. Staff
Staff Name:	E	E	ENG	ESU
Drawer Name:	Retrieval_ Library	Specifications	SPS 1/	SHARE
Folder Name:	Roads_ Structures	Documents	2/	RELEASES
File Name:	SPS_List or ALL_SPS.DMP or individual SPS File Name (such as 85.104.1 representing 85 SPS 104 (1))	Contents or individual SPS	(SPS# from INDEX)	R8_SPS.DMP

Location into which to put the file-

Level: (1. Public, 2. Staff)__ (Receiving unit fill in blanks)
Staff Name:____ (fill in by the system)
Drawer Name:______________
Folder Name:______________
File Name:________________

/1- The following dumpfile containing all the SPS is also available. To retrieve the dumpfile, the same process is used.

Drawer: SPS_DUMP
Folder: SPS_DUMP
Filename: SPS.DMP

/2- Folder Name for R-6 includes INDEX (for the index), 100 (for SPS to the 100 section), 200 (for SPS to the 200 section), etc.

After a dumpfile has been RIS'd, it must be loaded by your Staff Information Manager (SIM). The loading process described below will split the dumpfile into individual files.

From IS Main Menu:

Select- 3. Utilities
Select- 4. Load Dumpfiles
Select (Level)- 2. Staff
Drawer Name: ______________
Folder Name: ______________
Dumpfile Name: (dumpfile name without .DMP)

Once all desired files have been RIS'd, each file must be imported into CEO for viewing or printing. Files can be imported into any type CEO space: PUBLIC, STAFF, or PERSONAL. (PERSONAL not recommended due to space limitations.) However, before importing a file you must know the file's directory pathname (e.g. :Staff:E:Specifications:Documents:Sec.201_1 and the file type (e.g. WRD). The pathname and file type can be found by going into your IS main menu and doing an "FS" command according to the steps shown below:

Select- 1. Access Information
Select (Level)- 2. Staff
Drawer Name: ______
Folder Name: ______
Command: FS

The word "Directory" followed by the pathname will appear at the top of the screen; i.e.,:Staff:E:Specifications:Documents. The SPS name (or filename) must be added at the end of the pathname. A complete pathname is shown as [:Staff:E:Specifications:Documents:Sec.201_1]. You also can see the file type for the document to be imported on the same screen. The procedure of importing a file is described in the following:

```
From the CEO Main Menu:

Select- 5. Filing
Select- 7. Import
Filename______ (fill in the directory pathname)
File is stored as type ______
File will be imported and stored as type _____
```

If you have any questions related to retrieval of the files, contact the following:

(1) Region 1—Donna Morris, FTS 585-3163,:RO1A.

(2) Region 4—Keigh Schnare, FTS 586-5370,:RO4A.

(3) Region 6—Gorden Anderson, FTS 423-2409, :RO6C.

(4) Region 8—Leon Furnish, FTS 257-3367, :RO8A.

Technical Evaluation of Dimension-II Civil Engineering Software

Washington Office Systems Operations, Analysis, & Development Group

Four Engineering personnel—Jack Furman, Siuslaw National Forest; Tom Strassmaier, National Forests in Mississippi; Gene Thomas, Region 6 Regional Office; and John Zodnick, Walla Walla District, Umatilla National Forest—met in the Rosslyn Office of the Washington Office to test and evaluate the Dimension-II integrated civil engineering software package from Digital Software, Inc. A week was spent with individual hands-on training conducted by representatives from Digital Software followed by a week of intensive testing. A report has been prepared describing the results of the evaluation testing and contains the recommendations of the testing team.

Dimension-II is an integrated civil engineering design package from Digital Software, Inc., of Raleigh, North Carolina. It was evaluated on a Data General DS 7500 workstation from August 22 to September 2, 1988.

Digital Software, Inc., has been in business for 6 years and has sold its software to over 20 companies, including the city of Raleigh, North Carolina. The company is staffed with a land surveyor/programmer, an engineer/programmer, two full-time trainers, and a sales staff. Programmers are hired as needed on a temporary basis.

The equipment used for the test was a Data General DS 7500 workstation equipped with two D460 terminals and two Techtronix's 4111 intelligent color graphics terminals, each with 4.5 megabytes of memory. Two Data General digitizers were used for menu selections and a Calcomp 1043 for plotting.

The software includes a Plan and Profile program, a Roadway and Site Earthwork program, a Water and Sewer design program, a COGO program, a newly developed Surface Network Analysis Program, and a civil engineering CAD package. All modules are integrated through the CAD program, allowing data exchange from one module to another.

The testers worked in two teams, one with the responsibility for testing the road design program and the other for testing the water and sewer design program.

The findings of the evaluation team were that the road design package, the water and sewer design package, the COGO package, and the CAD package that tied them all together performed their functions and would be beneficial in most Forest Service engineering applications. The road design module does not have the unique features of the Forest Level Road Design System (FLRDS) or RDS, limiting its use to timber sale roads, but there is potential for integrating the Forest Service programs into this package.

The Dimension-II software is written for the Data General AS/VOS operating system, allowing the Forest Service to use the existing computer network to transmit, receive, and manipulate data files Service-wide. If the software is purchased, existing Data General hardware could potentially be used as processors, thereby saving the Government the price of new hardware.

The evaluation team is impressed with the capabilities of the system and recommends that the Forest Service implement an intensive on-site evaluation at one or two field locations. These would be selected based on their ability to test all the features of the software. The test would evaluate the potential system degradation when run with other applications and more users, the efficiency and performance of the program against the methods currently used, and the ease of learning for a larger cross section of Engineering personnel.

For further information, contact Pablo Cruz, WO1B or (703) 235-1258, or contact any of the above mentioned team members.

Bibliography of Washington Office Engineering & Technology & Development Publications

This bibliography contains information on publications produced by the Washington Office Engineering Publications Section and the Technology & Development Centers located in Missoula, Montana, and San Dimas, California. The listing is arranged by publications series and includes the title, author or source, document number, and date of publication.

This issue lists material published since our last bibliography (*Engineering Field Notes*, Volume 19, November-December 1987). Copies of *Engineering Field Notes*, *Technology & Development News*, and Engineering Management Series publications listed herein are available to Forest Service personnel through the Engineering Staff Technical Information Center (TIC). Copies of "Project Reports," "Equip Tips," and "Special & Other Reports" are available from the Technology & Development Center that is listed as the source.

Forest Service—USDA
Engineering Staff, TIC
P.O. Box 96090
Washington, DC 20090-6090

Forest Service—USDA
San Dimas Technology &
Development Center
444 E. Bonita Avenue
San Dimas, CA 91773

Forest Service—USDA
Missoula Technology &
Development Center
Fort Missoula, Building 1
Missoula, MT 59801

Engineering Field Notes

This publication is a bimonthly periodical that supplies the latest technical and administrative engineering information and ideas related to forestry and provides a forum for the exchange of such information among Forest Service personnel.

EFN by Title

New Reinforced Soil Walls & Fills	Burke, Michael. EFN 20 (September-October 1988): 19–25.
Organizing Engineering Information	Dille, Loyd. EFN 20 (November-December 1988): 9–12.
A Preventive Maintenance System at the North Central Forest Experiment Station	Helwig, Gail. EFN 20 (July-August 1988): 39–48.
A Preventive Maintenance System at the North Central Forest Experiment Station	Jakel, John. EFN 20 (July-August 1988): 39–48.
Radon Gas—An Invisible Safety Hazard	Nationwide Forestry Applications Program. EFN 20 (July-August 1988): 23–24.
Remote Water-Level Monitor	Little, Mary Denise. EFN 20 (September-October 1988): 15–17.
Reverse Photogrammetry: A Better Method of Locating Lines in the Field	Valentine, Wayne. EFN 20 (July-August 1988): 17–22.
Road Construction Special Project Specifications—Remote Access Available for Regions 1, 4, 6, & 8	Holt, John. EFN 20 (November-December 1988): 21–23.
Road Construction Special Project Specifications—Remote Access Available for Regions 1, 4, 6, & 8	Ou, Fong. EFN 20 (November-December 1988): 21–23.
Road Program Costs: Continuing Efforts Addressing the Issue	Badger, David. EFN 20 (January-February 1988): 11–15.
Road Program Costs: Continuing Efforts Addressing the Issue	Harper, Michael. EFN 20 (March-April 1988): 3–4.
Road Program Costs: Continuing Efforts Addressing the Issue	Harper, Michael. EFN 20 (November-December 1988): 3–4.
Road Program Costs: Continuing Efforts Addressing the Issue	Heck, James. EFN 20 (September-October 1988): 3–4.
Road Program Costs: Continuing Efforts Addressing the Issue	Peterson, Dale. EFN 20 (May-June 1988): 3–4.
Road Program Costs: Continuing Efforts Addressing the Issue	Reed, Billy. EFN 20 (July-August 1988): 1.

ROads Analysis & Display System (ROADS)—Its Best Use	Harper, Michael. EFN 20 (May-June 1988): 5–7.
Rottne Logging Equipment on the Black Hills National Forest	Bohls, Gregory. EFN 20 (September-October 1988): 7–13.
Safety in the Office	Nationwide Forestry Applications Program. EFN 20 (January-February 1988): 25–26.
A Ski Area Monitoring Expert System Prototype	Oxman, Steven. EFN 20 (March-April 1988): 13–21.
Space Shuttle Handheld Photography: A Unique Archive of Imagery	Greer, Jerry. EFN 20 (March-April 1988): 23–32.
Space Shuttle Large Format Camera Photography in Resource Management	Greer, Jerry. EFN 20 (May-June 1988): 15–26.
Techline Notes	Forest Products Laboratory. EFN 20 (January-February 1988): 27–30.
Techline Notes	Forest Products Laboratory. EFN 20 (March-April 1988): 41–44.
Technical Evaluation of Dimension-II Civil Engineering Software	Washington Office Systems Operations, Analysis & Development Group. EFN 20 (November-December 1988): 25–26.
Timber Bridge Technology	Weller, Clyde. EFN 20 (March-April 1988): 5–8.
USDA Commendation for Engineering Performance & Reporting on the Forest Service Road Program	Editor. EFN 20 (November-December 1988): 1.
Warning: GPS & NAD 83 Are Coming!	Valentine, Wayne. EFN 20 (November-December 1988): 5–8.

EFN by Author

Assistant Editor. EFN 20 (May-June 1988): 1.	Awards for the 1987 *Engineering Field Notes* Articles
Badger, David. EFN 20 (January-February 1988): 11–15.	Road Program Costs: Continuing Efforts Addressing the Issue
Bohls, Gregory. EFN 20 (September-October 1988): 7–13.	Rottne Logging Equipment on the Black Hills National Forest

Bowlin, Harry. EFN 20 (May-June 1988): 43–50.	Forest Inventory & Assesment With Satellite Imagery in the Western States
Bowser, Jerry. EFN 20 (January-February 1988): 7–9.	Fourth International Conference on Low-Volume Roads
Brink, Steve. EFN 20 (May-June 1988): 27–36.	National Strategy for a Geographic Information System
Brownfield, William. EFN 20 (March-April 1988): 33–40.	Facilities Training System—Sharing Our Facilities Training Resources
Brunette, Bruce. EFN 20 (September-October 1988): 29–32.	Lowered-Pressure Off-Highway Tires for Road Construction
Burke, Michael. EFN 20 (September-October 1988): 19–25.	New Reinforced Soil Walls & Fills
Coghlan, Skip. EFN 20 (March-April 1988): 9–12.	Forest Service Implementation of Federal Guidelines for Dam Safety—1987 Progress Report
Dille, Loyd. EFN 20 (November-December 1988): 9–12.	Organizing Engineering Information
Dixon, Mike. EFN 20 (July-August 1988): 31–33.	Field Design, Data Collection, & Plotting With the HP-41cx
Editor. EFN 20 (January-February 1988): 3–6.	1987 *Engineering Field Notes* Article Awards
Editor. EFN 20 (January-February 1988): 17–18.	Bob Harris—Forest Service Engineer of the Year, 1987
Editor. EFN 20 (July-August 1988): 4–7.	Employee Suggestion Bulletin
Editor. EFN 20 (September-October 1988): 1.	Honors Go to Two Regional Engineers
Editor. EFN 20 (November-December 1988): 1.	USDA Commendation for Engineering Performance & Reporting on the Forest Service Roads Program
Ellison, Rick. EFN 20 (July-August 1988): 35–38.	Low-Volume, Low-Cost Trail Bridges

Forest Products Laboratory. EFN 20 (January-February 1988): 27–30.	Techline Notes
Forest Products Laboratory. EFN 20 (March-April 1988): 41–44.	Techline Notes
Gray, Donald. EFN 20 (May-June 1988): 9–14.	Lodes, Millsites, & Yellow Jackets—The Salmon Experience
Greer, Jerry. EFN 20 (March-April 1988): 23–32.	Space Shuttle Handheld Photography: A Unique Archive of Imagery
Greer, Jerry. EFN 20 (May-June 1988): 15–26.	Space Shuttle Large Format Camera Photography in Resource Management
Harper, Michael. EFN 20 (March-April 1988): 3–4.	Road Program Costs: Continuing Efforts Addressing the Issue
Harper, Michael. EFN 20 (November-December 1988): 3–4.	Road Program Costs: Continuing Efforts Addressing the Issue
Harper, Michael. EFN 20 (May-June 1988): 5–7.	ROads Analysis & Display System (ROADS)—Its Best Use
Heck, James. EFN 20 (September-October 1988): 3–4.	Road Program Costs: Continuing Efforts Addressing the Issue
Hedman, Vic. EFN 20 (September-October 1988): 33–48.	Four Years of Using GPS
Helwig, Gail. EFN 20 (July-August 1988): 39–48.	A Preventive Maintenance System at the North Central Forest Experiment Station
Holland, Carolyn. EFN 20 (July-August 1988): 9–15.	Guidelines for Basic Data Input to a Geographic Information System
Holt, John. EFN 20 (November-December 1988): 21–23.	Road Construction Special Project Specifications—Remote Access Available for Regions 1, 4, 6, & 8
Jakel, John. EFN 20 (July-August 1988): 39–48.	A Preventive Maintenance System at the North Central Forest Experiment Station
Jasumback, Anthony. EFN 20 (May-June 1988): 37–42.	Evaluation of the Trimble Advanced Navigation Sensor

Lachowski, Henry. EFN 20 (May-June 1988): 43–50. — Forest Inventory & Assesment With Satellite Imagery in the Western States

Liggins, Rochelle. EFN 20 (September-October 1988): 5–6. — Generator-Powered Water System for a Remote Campground

Lippert, George. EFN 20 (March-April 1988): 33–40. — Facilities Training System—Sharing Our Facilities Training Resources

Little, Mary Denise. EFN 20 (September-October 1988): 15–17. — Remote Water-Level Monitor

Lupis, John. EFN 20 (November-December 1988): 13–16. — Career Development—The Key Is Personnel Planning

Monlux, Stephen. EFN 20 (November-December 1988): 17–19. — Factors Affecting Aggregate Surface Raveling

National Society of Professional Engineers. EFN 20 (July-August 1988): 2–3. — Engineer of the Year

Nationwide Forestry Applications Program. EFN 20 (July-August 1988): 23–24. — Radon Gas—An Invisible Safety Hazard

Nationwide Forestry Applications Program. EFN 20 (January-February 1988): 25–26. — Safety in the Office

Newlun, Neil. EFN 20 (September-October 1988): 29–32. — Lowered-Pressure Off-Highway Tires for Road Construction

Ou, Fong. EFN 20 (November-December 1988): 21–23. — Road Construction Special Project Specifications—Remote Access Available for Regions 1, 4, 6, & 8

Oxman, Steven. EFN 20 (March-April 1988): 13–21. — A Ski Area Monitoring Expert System Prototype

Peterson, Dale. EFN 20 (May-June 1988): 3–4. — Road Program Costs: Continuing Efforts Addressing the Issue

Peterson, Hal. EFN 20 (July-August 1988): 25–30. — Evaluation of Turnkey Contracting

Rasmussen, Richard. EFN 20 (September-October 1988): 27–28. — Electronic Notebook Program for the HP-71B Computer

Rasmussen, Richard. EFN 20 (January-February 1988): 23–24.	Green Book Survey/Design Program for the HP-71B Computer
Reed, Billy. EFN 20 (July-August 1988): 1.	Road Program Costs: Continuing Efforts Addressing the Issue
Scholen, Douglas. EFN 20 (January-February 1988): 19–22.	Modified Aggregate Surfaces & Bituminous Surface Comparisons in Region 8
Schwarzhoff, Chris. EFN 20 (November-December 1988): 13–16.	Career Development—The Key Is Personnel Planning
Valentine, Wayne. EFN 20 (July-August 1988): 17–22.	Reverse Photogrammetry: A Better Method of Locating Lines in the Field
Valentine, Wayne. EFN 20 (November-December 1988): 5–8.	Warning: GPS & NAD 83 Are Coming!
Washington Office Systems Operations, Analysis, & Development Group. EFN 20 (November-December 1988): 25–26.	Technical Evaluation of Dimension-II Civil Engineering Software
Weller, Clyde. EFN 20 (March-April 1988): 5–8.	Timber Bridge Technology

Engineering Management Series

The Engineering Management (EM) Series contains publications serving a special purpose or reader and publications involving several disciplines that are applied to a specific problem.

Asphalt Surface Treatment Self-Study Course. January 1988.	EM-7115-510-100
Concrete Inspection Self-Study Course. July 1988.	EM-7115-505-100
Employee's Guide—Washington Office Engineering Staff. March 1988.	EM-7110-2
Guide to the Identification of Bearing Tree Remains. September 1988.	EM-7150-5
A Revised Economic Evaluation Policy for Facilities. February 1988.	EM-7310-5
Road Construction in the Forest Service. February 1988.	EM-7170-10
Space Shuttle Large Format Camera Photography Cloud Cover Interference Diagrams. July 1988.	EM-7140-17
"SSIS" and "SSCHFS"—Preliminary Slope Stability Analyses with the HP41 Programmable Calculator. January 1988.	EM-7170-9
Trails Self-Study Course. January 1988.	EM-7115-506-100

Technology & Development News

Technology & Development News contains information on specific projects, new ideas, and new technologies being developed by the Technology & Development Centers to help solve many different kinds of resource management problems.

Title	*Issue*
Accessing SDTDC Aviation Data Using the DG	May-June 1988
Aircraft Overflight Noise Study	March-April 1988
Before You Buy a GPS Receiver . . .	May-June 1988
Central Tire Inflation (CTI) Implementation Planning Meeting	March-April 1988
Chip Truck Redesign	March-April 1988
Chunkwood Roads	May-June 1988
Developing New Timber Cruising Equipment	January-February 1988
Fire Management	January-February 1988
First Aid Kit Changes	March-April 1988
Firstline Supervisor Training Course	January-February 1988
GSA to Begin Stocking New Fire Handtool	January-February 1988
Latest on Substitute Earth Anchor System (SEAS) Project	March-April 1988
New Advances in Fire Chemicals and Their Associated Equipment for Fire Management Suppresion	July-August 1988
New Belt Pack Adds Versatility to Field Pack	May-June 1988
New Gelled Fuel Transfer System	July-August 1988
New Project Report Available	January-February 1988
New Publications	March-April 1988
New Publications	May-June 1988
New Recommendations for Protective Eyewear	May-June 1988

Equip Tips

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

Title	*Source**	*Number*	*Date*
Airtanker Laser Cockpit Visability Evaluation Device	SDTDC	8857 1304	6/88
Anchor Chain Scarifier	MTDC	8824 2308	5/88
The Combi—A New Firefighting Handtool	MTDC	8851-2303	2/88
A Facility for Evaluating Satellite Positioning Systems	MTDC	8871-2311	8/88
Gelled Fuel Transfer System	MTDC	8851-2302	2/88
Hammer-Action Hand Planter	MTDC	8824-2309	5/88
Improved Firefighters' Field Pack	MTDC	8851-2305	4/88
Improved Planting Auger	MTDC	8824-2307	5/88
A Portable Power Platform for Forestry Tasks	MTDC	8824-2310	6/88
Road Dust Monitor	SDTDC	8771-1303	11/87
The Salmon Blade	MTDC	8824-2306	5/88
A Satellite-Based Positioning System for Land Managers	MTDC	8871-2301	1/88
Shinguards for Forest Workers	MTDC	8851-2304	2/88
Update—Cross-Linked Polyethylene Vault Toilet 1,000-Gallon Tank	SDTDC	8823-1302	3/88
Update—Cross-Linked Polyethylene Vault Toilet Riser	SDTDC	8823-1301	3/88
Update—Toilet Paper Dispenser	SDTDC	8823-1303	2/88

* Missoula Technology & Development Center (MTDC); San Dimas Technology & Development Center (SDTDC).

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*
Engineering Analysis of Threshold Compressed Air Foam Systems (CAFS)	SDTDC	8751 1202	10/87
The Forest Safety and Health Program Coordinator	MTDC	8867 2201	3/88
National Central Tire Inflation Program—Olympic National Forest Field Operational Tests	SDTDC	8871 1201	3/88

* Missoula Technology & Development Center (MTDC); San Dimas Technology & Development Center (SDTDC).

Special & Other Reports

Special & Other Reports include papers for technical society meetings and transactions, descriptive pamphlets, bulletins, and special purpose articles.

Title	*Source**	*Number*	*Date*
Airtanker Base Planning Guide	SDTDC/ BIFC	NFES**	11/88
Central Tire Inflation . . . What's in It for Me?	SDTDC	FS-415	3/88
✓ Cleaning Recreation Sites . . . an Update	SDTDC	8823 1801	3/88
Evaluation of the NAVCORE 1 Positioning System	MTDC	8824 2805	6/88
Fences	MTDC	8824 2803	5/88
Field Operational Evaluation Test Plan for Long-Term Fire Retardants Fire-Trol PS-F	SDTDC	5100	6/88
Final Report—AGDISP Comparisons with the Mission Swath Width Characterization Studies	MTDC	8834 2801	1/88
Foam Applications for Wildland & Urban Fire Management	SDTDC	Vol. 1, No. 1	1988
Foam Applications for Wildland & Urban Fire Management	SDTDC	Vol. 1, No. 2	1988
Foam Applications for Wildland & Urban Fire Management	SDTDC	Vol. 1, No. 3	1988
✓ Handtools for Trail Work	MTDC	8823 2601	2/88
An Improved Wild Land Firefighting Tool	MTDC	8851 2802	4/88
New Resource Tools and Equipment	MTDC	8824 2806	7/88
Running the Forest Service Dispersal Code AGDISP on a Personal Computer	MTDC	8834 2804	6/88

San Dimas Technology & Development Center Fiscal Year 1987 Summary of Activities	SDTDC	8871 1801	3/88
Spark Arrester Guide	SDTDC/ BIFC	NFES 1363***	3/88
Water Handling Equipment Guide	SDTDC	NFES 1275***	6/88

*Missoula Technology & Development Center (MTDC); San Dimas Technology & Development Center (SDTDC).

**As of publication date of this EFN issue, no NFES number has been assigned.

***National Fire Equipment System (NFES) publications must be purchased from the Boise Interagency Fire Center (BIFC), Attn.: Supply, 3905 Vista Avenue, Boise, ID 83705.

*U. S. GOVERNMENT PRINTING OFFICE: 1988-201-078:80276/FS

Volume 20
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Engineering Field Notes