



Engineering Field Notes

Engineering Technical Information System

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Road Program Costs—Continuing Efforts Addressing the Issue

Meeting for the Southern Rockies ROADS Group

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In January 1989, representatives from each of the National Forests in the Southern Rockies ROADS Group held a meeting. There are 10 Forests in this group—all 5 National Forests in New Mexico and 5 National Forests in western and southern Colorado. The broad objective of this meeting was to use information from the ROad Analysis and Display System (ROADS) to help improve the effectiveness of Engineering support on each Forest.

Paul Anderson, Transportation Planner for Region 3, agreed to facilitate the meeting. Paul helped refine the following three objectives for the meeting:

- (1) Make group members more effective using the ROADS program.
- (2) Share techniques and tools to improve Engineering efficiency.
- (3) Identify some recommendations for Timber and Forest Road Program improvement.

The group gathered information to show every ROADS indicator for each Forest as accomplished in fiscal year 1988 and what they were projected to be in fiscal year 1989 based on each Forest's final allocation. Mike Clinton, Transportation Development and Management Engineer for Region 2, supplied the information for the Colorado Forests, and Loretta Banta, Program Analysis Engineer for Region 3, supplied the information for the New Mexico Forests. Loretta compiled all the information for the 2 years and presented it in an easy-to-use table. Collecting the information was time consuming because it was stored in several files and there is no feature within the ROADS program that allows direct compilation of all the indicators.

On March 1 and 2, the Forest Engineers and Assistant Forest Engineers from 8 of the 10 Forests in the Southern Rockies ROADS Group met in

Albuquerque to identify and share ideas to improve Engineering effectiveness on each Forest by analyzing information from ROADS.

The first morning of the meeting involved validating the grouping of the 10 "comparable" Forests by similar elements, such as logging methods, transportation systems, timber type, topography, seasonal access, and overall program development/management needs and opportunities. In reviewing the fiscal year 1988 indicators, specific Indicator 3A shows that the Southern Rockies Forests' average timber road costs per mile are similar and well below the national average. On each of these Forests, it was noted that recreation emphasis currently is as strong as the timber emphasis and will probably be so in the future. Engineering support needs to be effectively responsive to both programs.

During the afternoon of the first day, the group identified major problems and barriers that need to be solved to improve effectiveness and efficiency. These problems and barriers are as follows:

- (1) The instability of, or changes in, the timber sales planned for offer within the "out" 2 years results in wasted funding and personnel allocations.
- (2) Timber and Engineering need comparable ways to measure accomplishments (projects offered versus projects awarded).
- (3) There is not a strong enough commitment to ROADS by some Forest people, including some Engineers.
- (4) ROADS does not address nontimber (recreation and general purpose) efficiencies adequately.

During the second morning, there was an exchange of new ideas and tools that the different Forests were using to improve engineering support. This portion of the meeting was helpful because of the high quality of the ideas and tools presented and because they had been used successfully on comparable Forests. From this portion of the meeting, each Forest selected and committed to using one or more of these ideas or tools in the next field season.

Next, the meeting separated into State groups to develop recommendations for improving the effectiveness of the Forest Road Program activities in each Region. During the afternoon, these recommendations were presented to a representative of the Regional Engineer for each Region. The New Mexico Forests made the following three recommendations:

- (1) Each Forest should be more accountable for the stability of timber sales planned for offer for at least 2 years into the future (Indicator 1C).
- (2) The emphasis for the timing of having sales through Timber Gates 2 (NEPA) and 3 (SFP) should be continued and strengthened. Indicator

1A (Region 3 was near lowest for fiscal year 1988) should be monitored to measure planning efficiencies.

- (3) Each Forest should display the combined "lost" costs (engineering, timber, cultural resources, biological, etc.) of program changes.

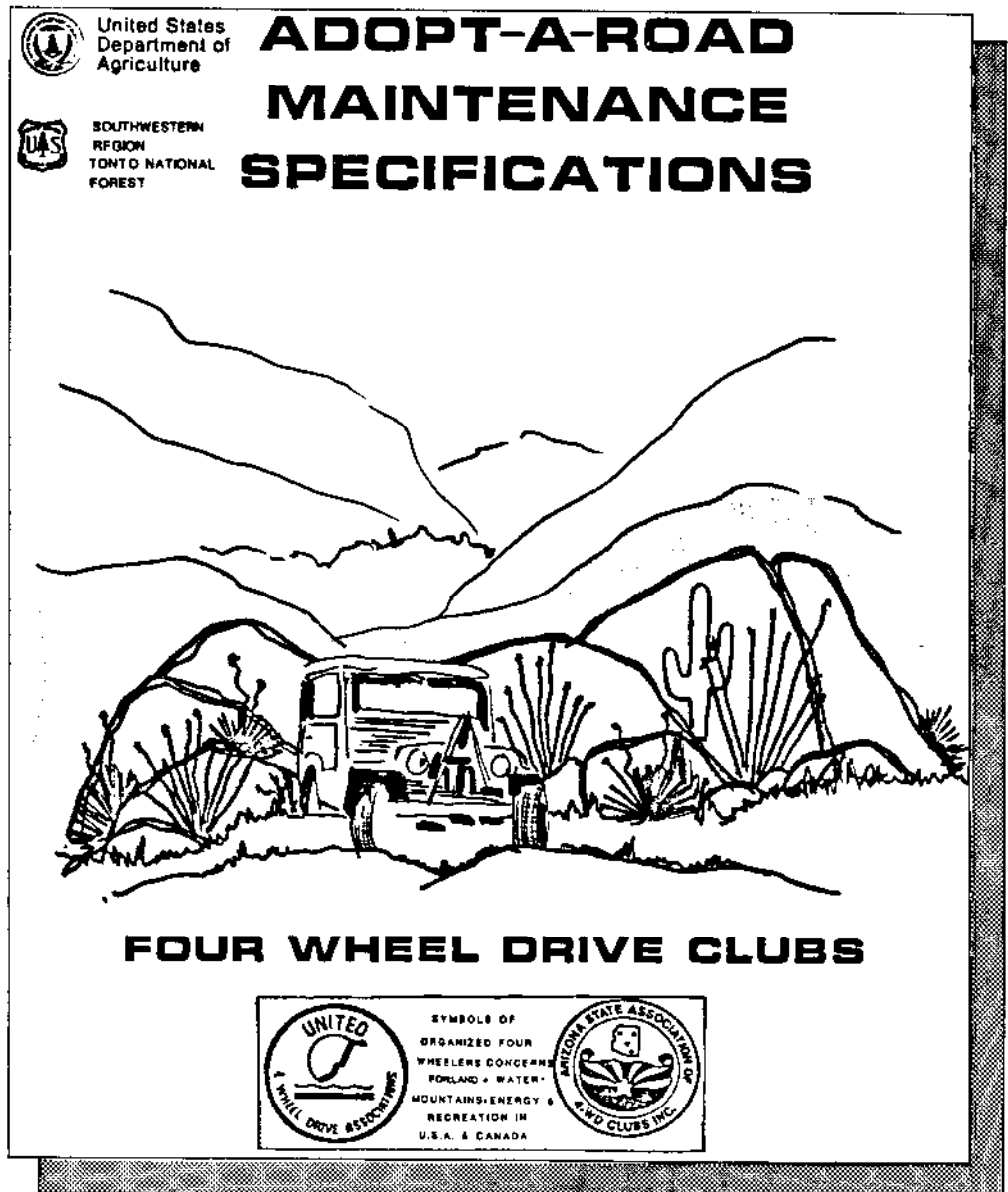
This meeting increased the commitment to using the ROADS program to improve Engineering on the Forests. At the end, all the participants agreed the meeting had been very worthwhile. Plans were made to have another meeting of the Southern Rockies ROADS Group next year—in Colorado.

Adopt-a-Road Maintenance Specifications for Four-Wheel-Drive Travel

Preface

As we hear about innovative ideas for stretching our dollars further and about ways to have "Challenge Cost Share" opportunities in the Roads Program, we like to share them with others around the Service.

The following is an example of how the Tonto National Forest, Region 3, is implementing its "Adopt-a-Road" program, which begins by completing an "Agreement for Sponsored Voluntary Services" (figure 1), and maintaining



USDA - Forest Service AGREEMENT FOR SPONSORED VOLUNTARY SERVICES (Act of May 18, 1972, P.L. 92-300, as amended)																							
1. Name of Sponsor/Organization (Print)																							
2. Address (Street, City, State, ZIP Code)																							
3. We desire to make available the volunteer services of the following person(s) to assist with Forest Service work (If more space is needed, use reverse)																							
4. Description of work to be performed: 																							
5. The above-described work will be contributed to the Forest Service. Except as provided below, the work performed by the participants will not confer on them or on our employees, or officers, the status of federal employees. 6. We will provide the Forest Service with a list of participants and man-hours contributed to accomplish the work in item 4 above. 7. We will obtain parental or guardian consent for each individual under 18 years of age and will comply with child labor laws. 8. _____ is hereby designated to serve as our liaison with the Forest Service in day-to-day operations under this agreement. 9. We understand that either the Forest Service, or we, may cancel this agreement at any time by notifying the other party. 10. Remarks: (If more space is needed, use reverse)																							
11. Signature (Designated Liaison for Sponsored Group/Organization)			12. Date																				
ACCEPTANCE FOR THE FOREST SERVICE																							
The Forest Service agrees, while this agreement is in effect, to: 1. Provide such materials, equipment, and facilities as are available and needed in performing the work described above. 2. Provide necessary incidental expenses of sponsored participants to the extent such expenses cannot be borne by the sponsor, and to the extent Forest Service funds are available. The maximum Forest Service funding of such incidental expenses shall be set forth on the reverse of this form or in an accompanying plan for each fiscal year or portion of a fiscal year. 3. Consider the participants as federal employees for the purpose of tort claims and compensation for work injuries, to the extent not covered by the sponsor. 4. Authorize sponsored participants to operate federal motor vehicles when necessary, provided participants are licensed to operate a motor vehicle.																							
5. Signature (Forest Service Officer)	6. Title	7. Unit	8. Date																				
Forest Service reimbursement for sponsored participants' necessary incidental expenses are as follows: <table style="width: 100%; font-size: small;"> <thead> <tr> <th></th> <th>Yes</th> <th>No</th> <th></th> </tr> </thead> <tbody> <tr> <td>a. Subsistence</td> <td>()</td> <td>()</td> <td>(amount if yes) _____ remarks: _____</td> </tr> <tr> <td>b. Transportation Allowance</td> <td>()</td> <td>()</td> <td>(rate if yes) _____ remarks: _____</td> </tr> <tr> <td>c. Provide Lodging</td> <td>()</td> <td>()</td> <td>remarks: _____</td> </tr> <tr> <td>d. Other:</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>					Yes	No		a. Subsistence	()	()	(amount if yes) _____ remarks: _____	b. Transportation Allowance	()	()	(rate if yes) _____ remarks: _____	c. Provide Lodging	()	()	remarks: _____	d. Other:			
	Yes	No																					
a. Subsistence	()	()	(amount if yes) _____ remarks: _____																				
b. Transportation Allowance	()	()	(rate if yes) _____ remarks: _____																				
c. Provide Lodging	()	()	remarks: _____																				
d. Other:																							

Previous edition is obsolete.

(OVER)

FS-1800-9 (5/88)

Figure 1.—Agreement for Sponsored Voluntary Services (front).

TERMINATION OF AGREEMENT						
1. Agreement Terminated on (Month, Day, Year):			2. Signature (Forest Service Officer)			
3. Remarks:						
ACCOMPLISHMENT*						
RESOURCE CATEGORY (a)	NIRP CODE (b)	UNIT OF MEASURE (c)	AMOUNT ACCOMP. (d)	HOURS CONTR. (e)	COST TO GOVMT (f)	APPRAISED VALUE (DOLLARS) (g)
Additional Space (Please specify the section and item no. using this space):						

*Collection of Accomplishment information on this form is optional.

Figure 1.—Agreement for Sponsored Voluntary Services (back).

several four-wheel-drive facilities. We recognize that not all processes in this example will aid all situations, but we hope they might stimulate some thoughts elsewhere, perhaps helping others start and establish similar programs.

Thanks, Region 3, for sharing this with us.

Ted Zealley
Operations and Maintenance Engineer
Transportation System
Washington Office

Description

The specifications described in this article are designed to make the travelway safe for use by high-clearance four-wheel-drive vehicles and to provide for drainage, signing, and litter cleanup. These specifications also require reporting heavy work needed for protecting Forest resources. Maintenance of these roads for low-clearance vehicles or passenger cars is *not* a consideration.

Maintenance Requirements

General

Maintenance consists of cleaning drainage structures; removing objects from the roadbed; removing limbs, logs, and windfalls from the travelway; installing and maintaining water bars; repairing stock gates; and installing and maintaining signs. Maintenance also consists of hand filling eroded shoulders to make the travelway safe for vehicle passage.

Upon completion of maintenance, no objects hazardous to a four-wheel-drive vehicle shall remain above the road surface inside the travelway. Figure 2 is an example of travelway maintenance requirements.

Objects on the Travelway

Objects obstructing the travelway include large rocks, logs, stumps, or other debris. Objects shall be selectively removed or repositioned to provide an 8-foot travelway and the clearance required for high-clearance vehicles. Rocks and other objects along the travelway may remain if good drainage is provided and they are not a safety hazard.

Logs and fallen trees shall be cut to provide a 10-foot opening for vehicle passage. The cutoff log ends should be on the ground and must not interfere with drainage. The sections removed may be cut into chunks or left as single pieces and placed in a stable position where they will not restrict use of the opening. Logs or fallen trees that could roll onto the travelway shall be repositioned or otherwise treated to make the travelway safe.

Do *not* place objects in drainage ways. This causes severe erosion.

Brush and Vegetation

Plants on the travelway that are more than 2 inches in diameter or 12 inches high shall be removed and disposed of by scattering off the travelway on the downhill side of the road. Avoid concentrating the slash to prevent a fire hazard. Plants shall be cut flush to the ground with either a saw or pruning shears.

Limbs that may damage vehicles or injure vehicle occupants shall be removed. Limbs to be trimmed from standing live trees shall be sawed or pruned flush with the tree trunk, leaving no stubs or "hat racks." *Axes will not be permitted for this work—use power saws or pruning saws or shears.* Live trees shall be pruned without tearing the bark.

Grubbing hoes may be used for clearing cactus plants from the travelway. Small limbs and brush that are not hazardous may remain. See figure 3 for an example of clearing limits.

Installing Water Bars

Log Construction. Logs shall consist of peeled, sound, native timber. The logs used shall be no less than 8 inches and no more than 12 inches in diameter. The logs should be long enough to reach across the travelway at a 45-degree angle with 12 inches buried in the cutslope and extend 6 inches beyond the lower edge of the road. Two or more logs butted together may be necessary for the required length.

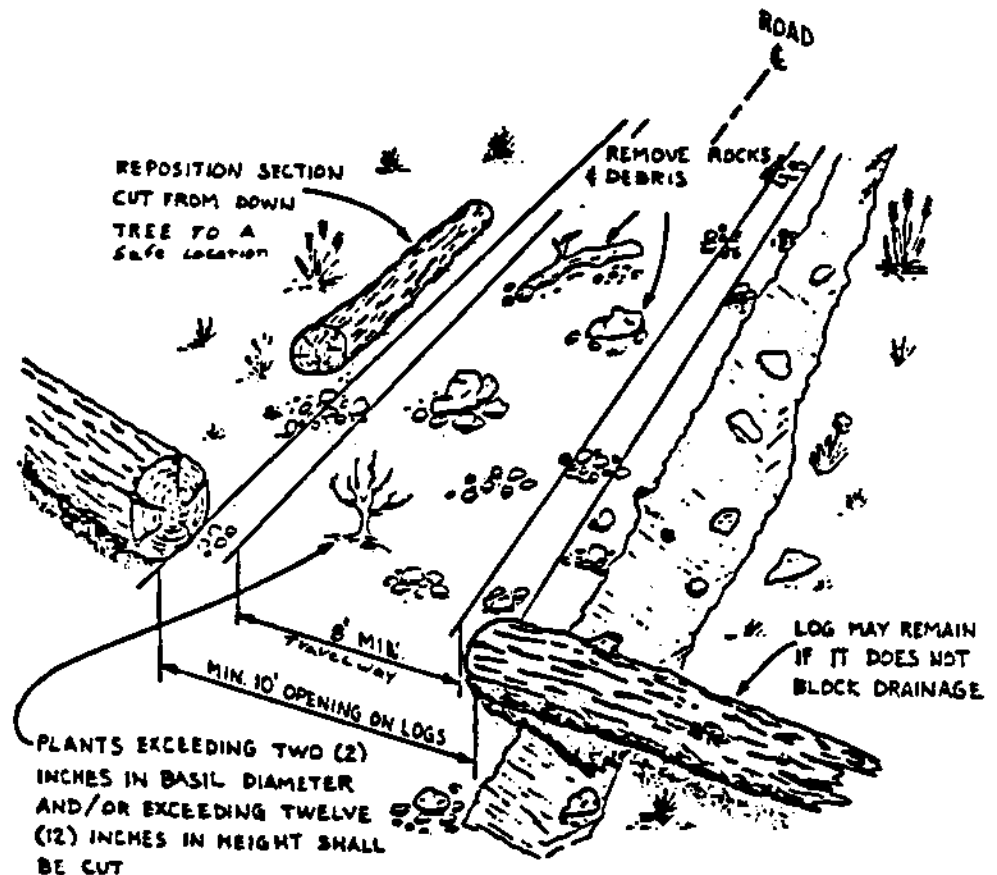


Figure 2.—Travelway maintenance requirements.

Brush extending into the clearing limits that is over 12 inches in height and 1/2 inch in diameter shall be cut flush with the main stem at a branch fork or at ground level if a fork main stem is nonexistent.

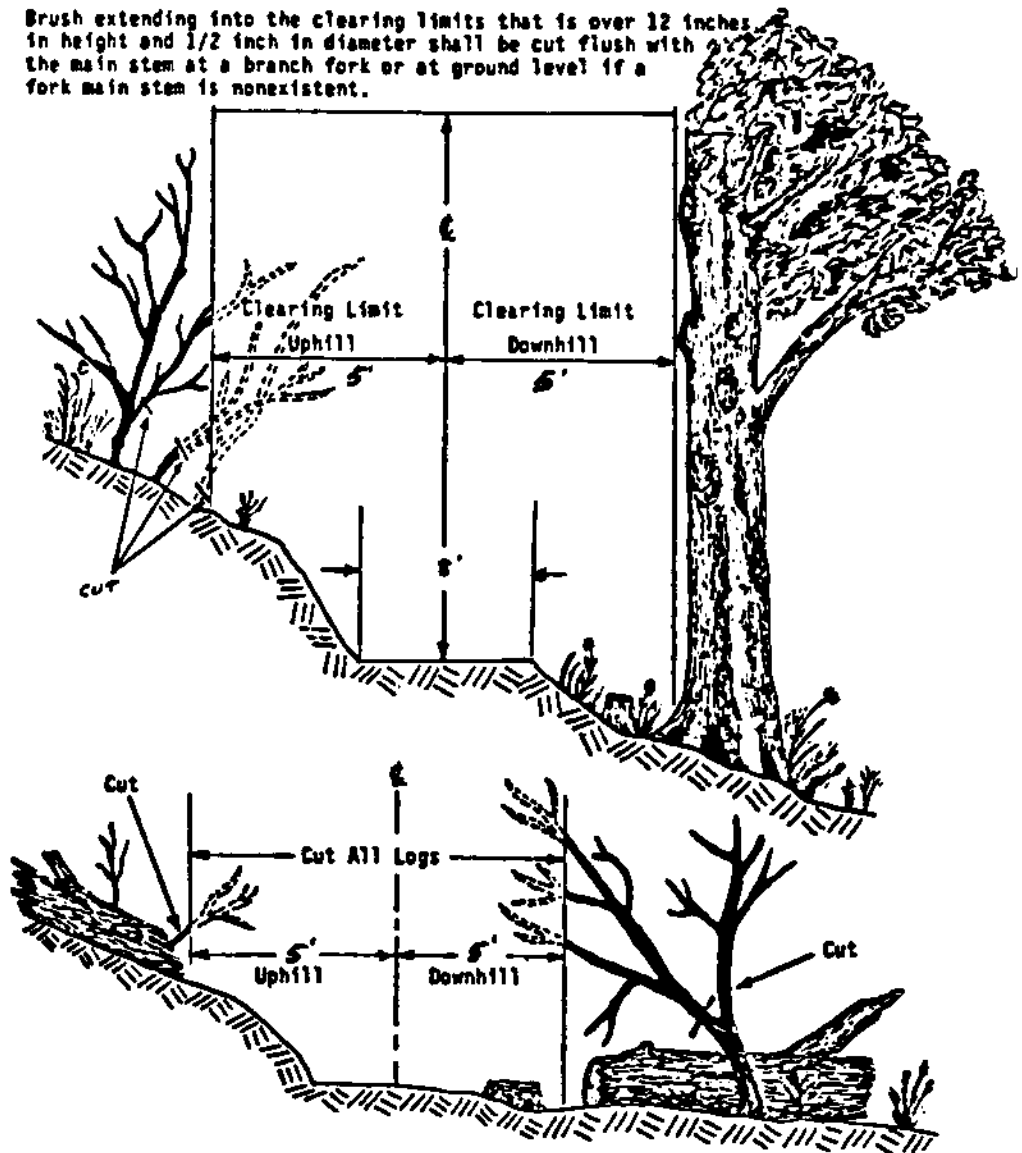


Figure 3.—Clearing limits.

Logs for water bars may be cut adjacent to and out of sight of the travelway. Pinyon, cedar, juniper, or oak logs are preferred, but pine or fir logs may be used if the preferred logs are not available.

Installation. One-half the diameter of the log should be buried below the tread to ensure that water is diverted off the travelway.

The roadbed shall be excavated and outsloped upgrade of the water bar as shown in figure 4.

Logs should be secured to the roadbed as follows:

- (1) A 7/16-inch hole should be drilled vertically at 6 inches from each end of each log.
- (2) A steel rod (1/2-inch minimum diameter, 18-inch minimum length) shall be driven through the hole into the ground until flush with the top of the log or as far as possible in hard ground (refusal).
- (3) The bar shall then be cut off flush with the top of the log, if needed.
- (4) Fill material shall be placed against the downgrade side of the log to allow traffic to cross without disturbing or moving the log.

An 8-inch-deep ditch shall be excavated and extended to daylight (if needed) to ensure proper drainage from the water bar. Rock spillways shall be constructed at outlets subject to excessive erosion.

Rock-Barrier Construction

Rocks shall be sound, durable, approximately 8 to 12 inches in diameter, and preferably elongated in shape.

Rock barriers shall be bedded similar to log barriers and set shingle fashion to shed water. Careful placement near the wheel tracks resists damage to the rock barriers by travelers. Figure 5 is an example of rock-barrier placement.

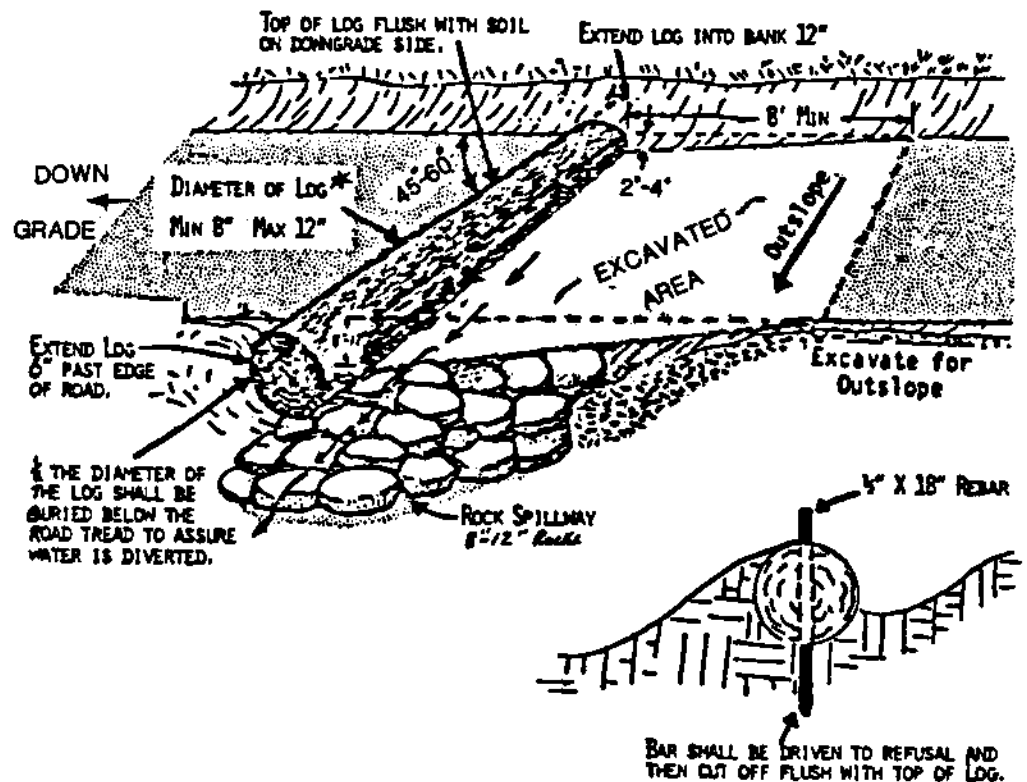


Figure 4.—Roadbed excavated and outslope upgrade of the water bar.

Gates

The gates discussed here are (Texas) stock gates (see figure 6).

Attached fences and wire gates within and adjacent to the travelway shall be maintained by tightening or splicing the wires as necessary. Wire splices shall have at least 2 feet of overlap on each wire. Wire sag shall be eliminated between posts. The closing device to be installed must make opening and closing the gate easy for an average person.

Litter

Litter is an ever-increasing problem, even in remote areas of the Forest. The primary goal of four-wheel-drive groups is to clean up travelways, remote camp areas, and trail heads adjacent to the adopted road. Litter bags are available at the District Ranger offices.

Cleaning Culvert Structures

There may be culvert structures along the four-wheel-drive travelway (see figure 7). These important drainage structures protect the travelway, and they need careful maintenance.

The inlet and outlet channels shall be cleaned to prevent plugging and provide free flow of water through the structure. The transition from the ditch-line to the inlet shall be cleaned a distance of 10 feet. Outlet channels and leadoff ditches shall be cleaned a distance of 6 feet. Debris and vegetation shall be removed and placed where they will not reenter the channel or ditch or obstruct vehicle travel.

Rock headwalls shall be constructed or reconstructed as necessary to prevent erosion into the travelway.

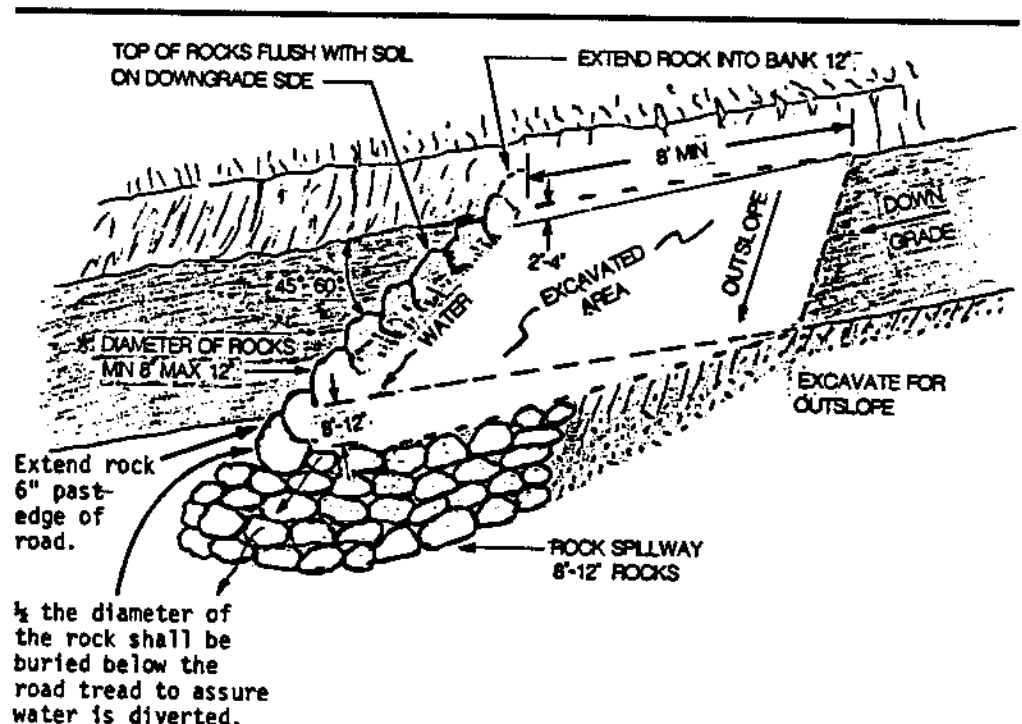


Figure 5.—Placement of rock barrier.

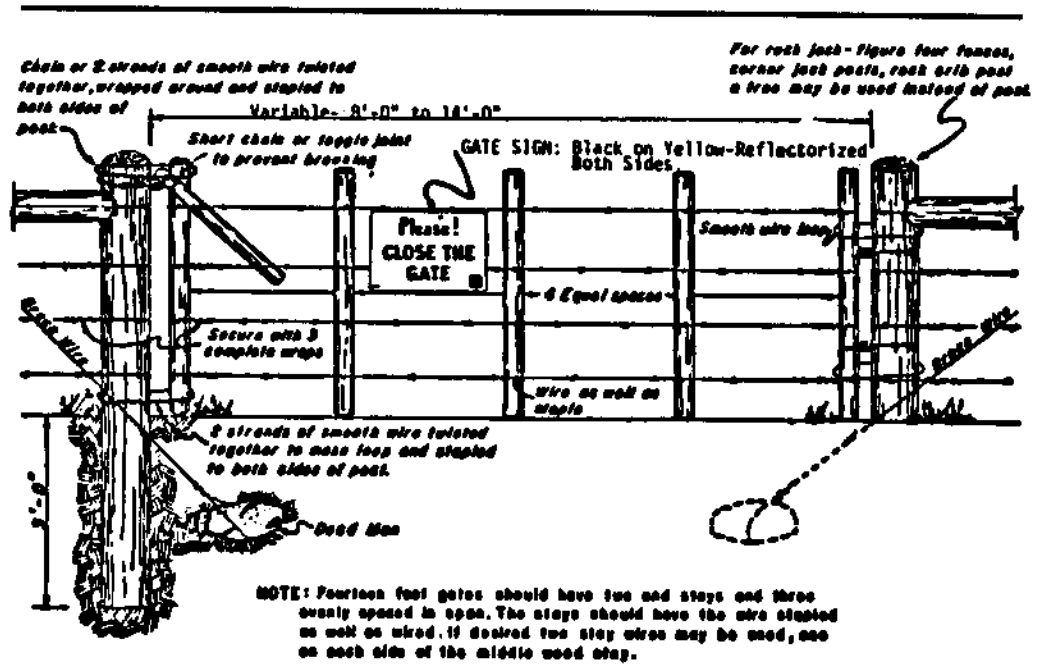


Figure 6.—(Texas) stock gate.

Signs

Sign work includes installing, maintaining, or replacing signs (for example, roadway entrance signs, route markers, and gate closures). Signs, posts, and hardware (except for club logos) will be furnished by the Government. See figures 8 and 9 for examples of Government-furnished signs. Figure 10 is an example of a signing plan.

Road signs shall be placed on the right side of the road, approximately 5 feet from the right edge of the travelway where possible. They should be in clear view and leave no doubt about the route or routes they are designating. (See your map for sign plan of locations.)

Obstructions (for example, brush) should be cleared from in front of the sign as necessary.

Requesting Heavy Maintenance or Supplies

Heavy maintenance is work that requires the use of large equipment for repair—work that *cannot* be done by hand. Items in need of heavy maintenance create driving hazards or unacceptable resource damage. Heavy maintenance items include the following:

- (1) Large rocks or stumps blocking the travelway or causing traffic to detour that cannot be removed with a winch.
- (2) A segment of severely outslopped or eroded roadway that requires a bulldozer to correct.
- (3) A travelway popular to four-wheel-drive clubs where drainage maintenance is impossible to accomplish by hand.

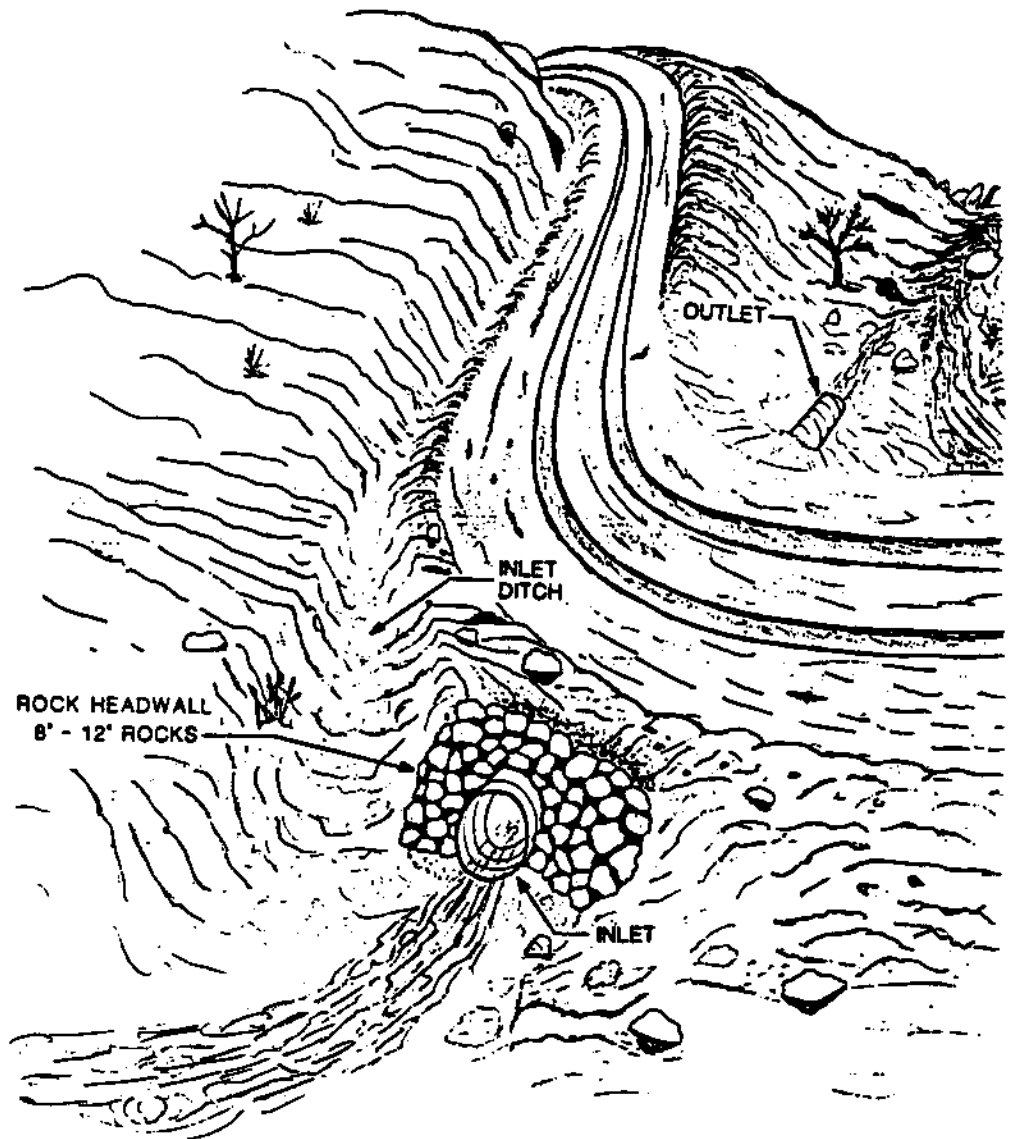
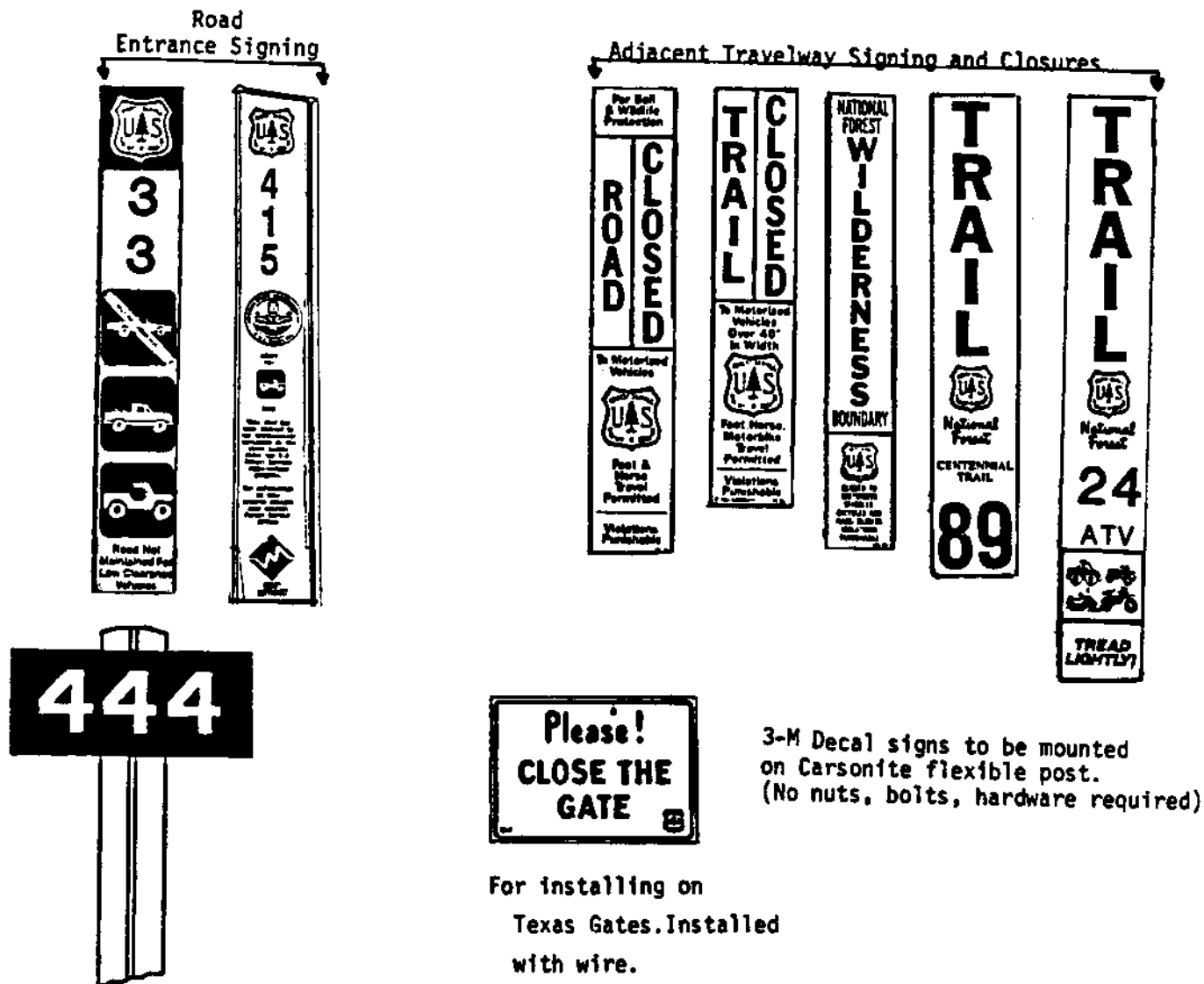


Figure 7.—Culvert structure with inlet and outlet channels.

Requests for heavy maintenance and supplies should be mailed or delivered to the District Ranger on the form provided (figure 11), with the designated liaison coordinating the request. The District Ranger will coordinate any supplies or necessary additional information with the club.



Typical Forest Service
Horizontal Route Marker.
mounted on steel post. Requires
nuts, bolts, washers.

Figure 8.—Various Forest Service signs.

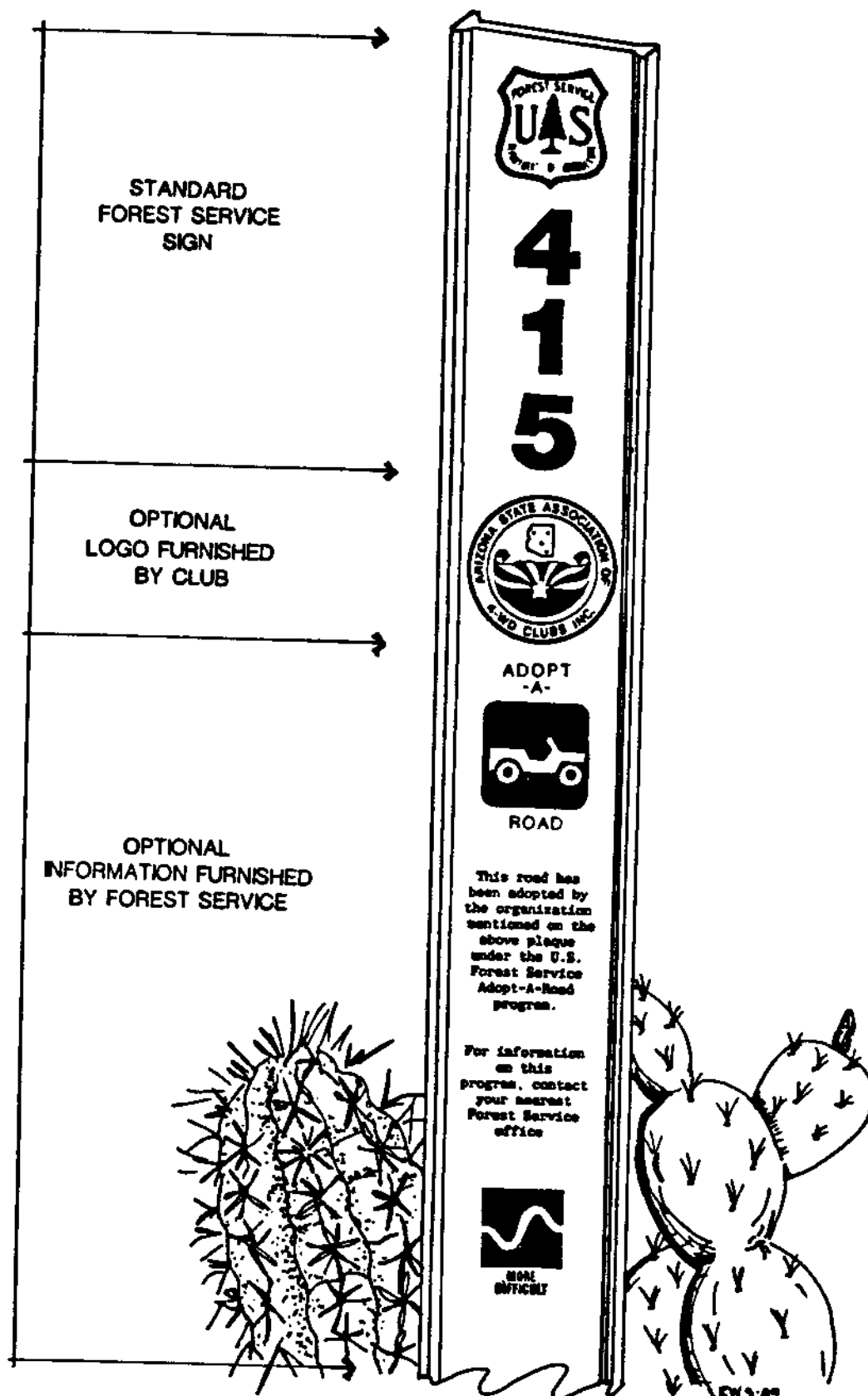


Figure 9.—Tonto National Forest Forest Service entrance route marker.

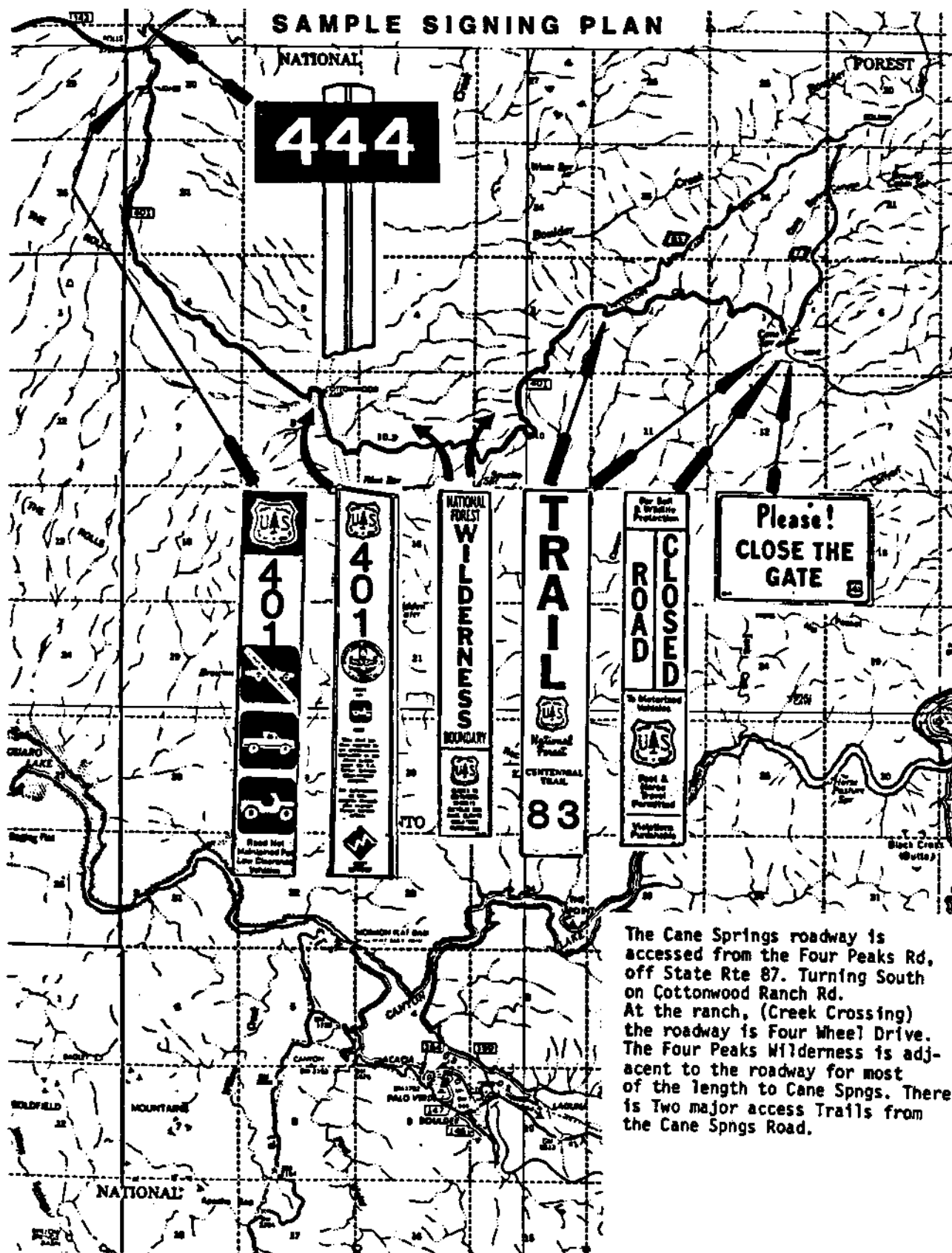


Figure 10.—Sample signing plan.

ROAD MAINTENANCE CONDITION SURVEY—SUPPLY ORDERING FORM

ROAD # AND/OR NAME Cane Springs # 401

DATE _____

LOCATION OF SITE:

Between Cottonwood Ranch and Cane Springs
on Mesa Ranger Dist.

REQUESTED BY:

NAME _____

PHONE # _____

ADDRESS _____

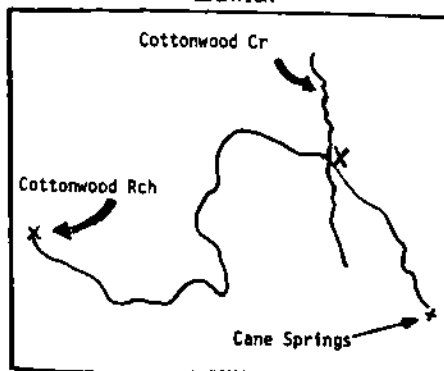
NARRATIVE DESCRIPTION OF CONDITIONS, DEFICIENCIES, WORK NEEDED, AND SPECIAL INSTRUCTIONS.

High water has washed out the road at creek crossing. There is a gap in the roadway

Ten feet deep and approx Sixty feet wide. Could use a dozer to re open the roadway.

fold here

LOCATION



SUPPLY ITEM NEEDS

65 litter bags
Dozen 1/4" X 18" Re Bar
Roll of # 9 wire (soft)

Figure 11.—Road maintenance condition survey and supply ordering form.

Forest Sign Plan Using CAD/DBMS

Chuck Ritter, Engineering
Paul Flanagan, Land Management Planning
Bill Renison, Engineering
Deschutes National Forest

Introduction

A sign plan guides the proper placement of signs for a road, trail, recreation site, or other resource activity. The plan may vary considerably in format, but it must at least convey adequate and clear information to managers regarding existing sign installations. A complete plan will include information describing the condition of existing signs and the changes needed to keep up with management objectives.

All National Forests have sign plans. Some plans are sketches of intersections filed in looseleaf books, while others are photographs of signs stored in road files or sign books. Some more recent plans use computer files or data base programs. The Deschutes National Forest currently is converting from a combination of these methods to the Computer Aided Drafting/Data Base Management System (CAD/DBMS).

Sign Plan Using CAD/DBMS

About 3 years ago, the Deschutes National Forest received its first microcomputer, complete with CAD software. The system was quickly used for architectural and engineering work, primarily drawings for buildings and water and sanitation projects. Within a short time, Forest personnel realized that CAD software could provide a graphic display of signing on the Forest with easy updating capability. In addition, the color graphics offered an excellent method to inform managers of existing and planned signing needs. As soon as some preliminary drawings were completed, CAD software was capable of transferring information specific to each sign (attributes) to a DBMS, providing the capability to display information graphically and write standard or custom reports from the attributes.

The beginning stages involved considerable trial and error. Higher priorities and a lack of time for computer work made progress slow. Today, standards to be used for reports, including map scale, sign sizes, colors, print size, attributes, and so on, are established, and sign plans are being transferred from sketches and photographs to the CAD/DBMS.

The decision to limit the development to signing was difficult because it would be easy to acquire more information than can be managed effectively. The possibilities are endless when considering gates, entrance management, road templates, striping (passing/no-passing zones), road surface types,

accident history, road management objectives, and so on. Developing sign plans only makes CAD/DBMS an effective tool for office and field use.

Sign symbols (colors and shapes) that best represent the actual sign are created and stored in a CAD directory. To place a sign on the road network, the CAD operator selects the symbol from a custom menu, rotates the sign for the best orientation, and completes the list of attributes for that sign. CAD attributes can include such details as road number, milepost, sign material, cost, and so forth, and can be moved electronically to the DBMS. The DBMS can then query the data using standard or customized reports.

Deschutes National Forest Plan

Almost any size drawing can be displayed as a sign plan on CAD. For convenient field use, Forest personnel selected a notebook-sized format. Each drawing covers one township (a basic unit familiar to all Forest personnel), and the scale displays signing throughout most of the Forest. Areas within the township that are too congested with signs are expanded in scale on separate drawings to provide the necessary detail (for example, a campground will normally be a separate drawing expanded in scale enough to show signing, striping of parking areas, pavement arrows, parking spurs, and information boards).

Figure 1 is a CAD drawing of signing for a township. In the upper left area of the drawing is Dusty Lake with the letter C shown in a box, indicating that an expanded-scale drawing has been made for Dusty Lake campground (figure 2). The page numbers of drawings are the township descriptions (Township and Range), with letters attached for the expanded scale drawings.

The road network was digitized as a base layer using a different color and line width according to the assigned maintenance level. All signs were placed on one CAD layer. Alternatively, a series of related signs, such as warning signs, can be placed on a separate layer. This would provide the option of showing only those particular signs as an overlay on the road network. CAD layers improve the versatility of the plan.

The selection of the following 16 attributes for each sign installation was based on the minimum information necessary for management of a sign plan on a Forest:

No. of Posts	Jurisdiction
Type (MUTCD Code)	Material (Alum, etc.)
Size of Sign	Vandalism History
Condition	Design Speed of Road
Region	Color of Sign
District	Status (Plan, Remove)
Road Number	Value (\$)
Milepost	Letter Size

These attributes are transferred to the DBMS for processing in standard or customized reports. A standard report could be simply an inventory of all

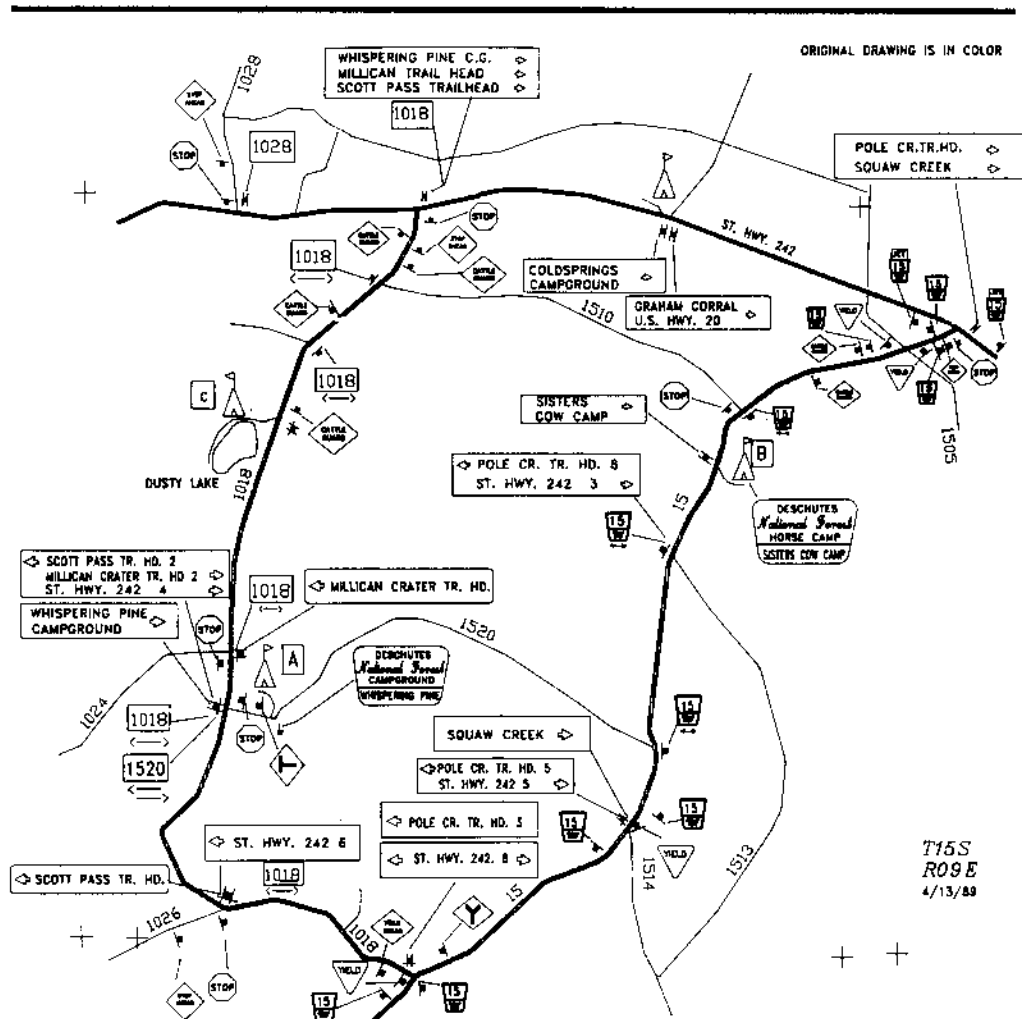


Figure 1.—CAD drawing of signing for a township.

signs (figure 3); a custom report could list signs within a specified District that need immediate replacement and the associated cost for replacement.

Software

The Forest has the software (5 1/4-inch floppy) available for use on most microcomputers with AutoCAD (Release 10) and dBase IV. Custom menus and numerous sign symbols created from the *Forest Service Sign Handbook* and the Federal Highway Administration's *Manual on Uniform Traffic Control Devices* are included. Contact C. Ritter:R06F01A for information.

What's Next?

Combining CAD and the DBMS results in a miniature Geographic Information System (GIS) that can be used for numerous engineering applications. When the Forest Service completes its purchase of GIS, sign plans and other road management applications probably will be given some level of priority for placement on the system. The amount of data that can be placed on a Forest GIS is extensive. Creating a sign plan on CAD/DBMS showed that establishing standards for graphics is complex and requires considerable time.

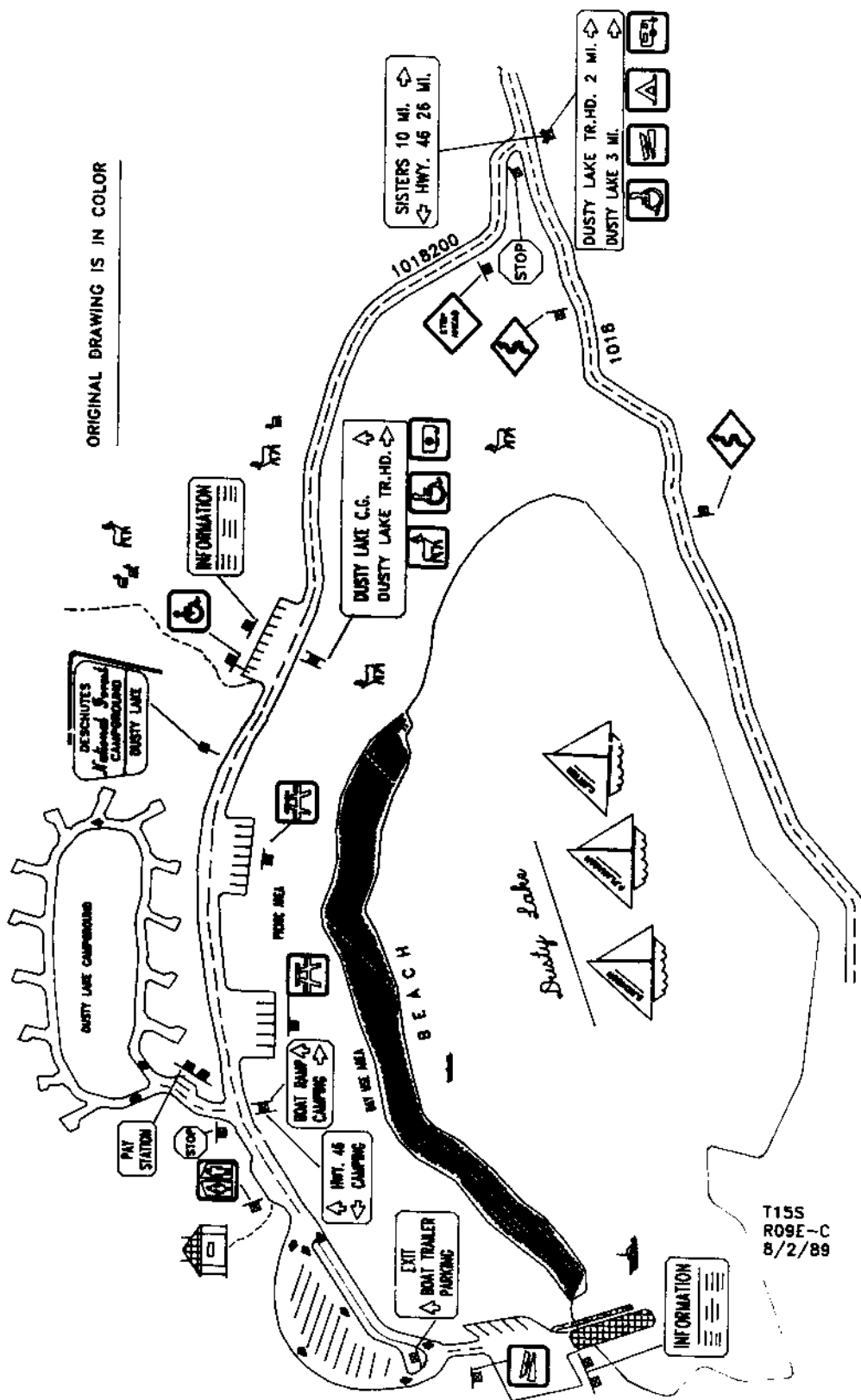


Figure 2.—Expanded-scale drawing for Dusty Lake campground.

If one considers this minor effort as a prelude to GIS, it is clear that nationwide planning and coordination on standards for data and graphics will improve efficiency at the Forest level.

The authors wish to thank Steve Sichau and Jack Snyder, Region 6 Electrical Engineering, and Ernie Bergan, Ochoco National Forest, for their assistance with CAD development.

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08/28/89

REGION	DISTRICT	ROAD	MILEPOST	POSTS	TYPE	SIZE	CONDITION	LOCATION	COLOR	STATUS	VALUE	VANDALISM	JURISDICTION	MATERIAL	LETTER	SPEED
0	0	0	0.00					0	0		0.00	0				
6	5	15	1.00	1-4"X 4"	R1-27	36"X 36"X 36"	1	1	RED	R	145.00	0	P.S.	ALUMINUM	4"	25 MPH
6	5	15	1.00	1-4"X 4"	R1-27	36"X 36"X 36"	1	1	RED	R	155.00	0	P.S.	ALUMINUM	4"	15 MPH
6	5	15	1.00	1-4"X 4"	R1-27	36"X 36"X 36"	1	1	RED	R	165.00	2	P.S.	ALUMINUM	4"	25 MPH
6	5	15	1.30	1-4"X 4"	R1-7	10"X 7"	1	1	BROWN	R	75.00	1	P.S.	WOOD	4"	25 MPH
6	5	15	1.40	1-4"X 4"	R1-27	36"X 36"X 36"	1	1	RED	R	125.00	0	P.S.	ALUMINUM	4"	25 MPH
6	5	15	2.10	1-4"X 4"	R1-27	36"X 36"	1	2	RED	R	75.00	0	P.S.	ALUMINUM	6"	25 MPH
6	5	15	2.40	1-4"X 4"	IMP01	4"X 36"	1	2	BROWN	R	75.00	0	P.S.	WOOD	4"	25 MPH
6	5	15	3.20	1-4"X 4"	W3-1	36"X 36"	1	3	YELLOW	R	150.00	0	P.S.	ALUMINUM	8"	25 MPH
6	5	15	3.40	1-4"X 4"	W3-2	36"X 36"	1	3	YELLOW	R	150.00	0	P.S.	ALUMINUM	8"	25 MPH
6	5	15	4.20	2-4"X 4"	IMP01	10"X 52"	1	4	BROWN	R	125.00	1	P.S.	WOOD	2"	25 MPH
6	5	15	4.20	2-4"X 4"	IMP01	24"X 52"	1	4	BROWN	R	85.00	0	P.S.	WOOD	2"	25 MPH
6	5	15	4.21	2-4"X 4"	IMP01	20"X 36"	1	4	BROWN	R	125.00	2	P.S.	WOOD	2"	25 MPH
6	5	15	4.25	2-4"X 4"	IMP01	36"X 52"	1	4	BROWN	R	135.00	4	P.S.	WOOD	2"	25 MPH
6	5	15	4.50	2-4"X 4"	IMP01	24"X 36"	1	5	BROWN	R	125.00	4	P.S.	WOOD	2"	15 MPH
6	5	15	5.20	2-4"X 4"	IMP01	10"X 36"	2	5	BROWN	R	128.00	0	P.S.	WOOD	2"	15 MPH
6	5	15	5.40	1-4"X 4"	R1-1	36"X 36"	1	5	RED	R	150.00	0	P.S.	ALUMINUM	6"	25 MPH
6	5	15	5.60	1-4"X 4"	W3-2	24"X 24"	2	6	YELLOW	R	150.00	1	P.S.	ALUMINUM	8"	25 MPH
6	5	15	5.70	1-4"X 4"	W1-B	8"X 12"	2	6	BROWN	R	150.00	4	P.S.	WOOD	6"	25 MPH
6	5	15	5.70	1-4"X 4"	W1-7	17"X 10"	2	6	BROWN	R	75.00	3	P.S.	WOOD	6"	25 MPH
6	5	15	6.20	1-4"X 4"	W3-1	24"X 24"	2	6	YELLOW	R	755.00	4	P.S.	ALUMINUM	8"	25 MPH
6	5	15	6.40	1-4"X 4"	W3-2	24"X 24"	2	6	YELLOW	R	175.00	4	P.S.	ALUMINUM	8"	25 MPH
6	5	15	6.50	1-4"X 4"	W1-7	12"X 10"	2	7	BROWN	R	75.00	0	P.S.	WOOD	8"	25 MPH
6	5	15	7.20	1-4"X 4"	W1-7	12"X 10"	1	7	BROWN	R	75.00	4	P.S.	WOOD	6"	25 MPH
6	5	15	7.50	1-4"X 4"	W1-7	12"X 10"	2	8	BROWN	R	75.00	0	P.S.	WOOD	6"	25 MPH
6	5	15	7.54	1-4"X 4"	W1-7	12"X 10"	2	8	BROWN	R	75.00	0	P.S.	WOOD	6"	25 MPH
6	5	15	7.60	1-4"X 4"	W1-7	12"X 10"	1	8	BROWN	R	75.00	1	P.S.	WOOD	6"	25 MPH
6	5	15	7.80	1-4"X 4"	W1-7	12"X 10"	2	8	BROWN	R	75.00	0	P.S.	WOOD	6"	25 MPH
6	5	15	8.30	1-4"X 4"	W1-7	12"X 10"	2	8	BROWN	R	75.00	0	P.S.	WOOD	8"	25 MPH
6	5	15	8.31	1-4"X 4"	W1-7	12"X 10"	2	8	BROWN	R	75.00	0	P.S.	WOOD	6"	25 MPH
6	5	242	1.20	2-4"X 4"	IMP01	12"X 52"	1	1	BROWN	R	185.00	2	STATE	WOOD	2"	55 MPH
6	5	242	1.28	2-4"X 4"	IMP01S	24"X 52"	1	1	BROWN	R	185.00	3	STATE	WOOD	2"	55 MPH
6	5	242	1.50	2-4"X 4"	IMP01	12"X 52"	1	2	GREEN	R	75.00	0	STATE	WOOD	2"	55 MPH
6	5	242	4.20	1-4"X 4"	W1-7	12"X 10"	2	4	BROWN	R	75.00	0	P.S.	WOOD	6"	55 MPH
6	5	242	5.20	2-4"X 4"	IMP02	12"X 52"	1	5	GREEN	R	78.00	0	STATE	WOOD	2"	55 MPH
6	5	1018	1.20	2-4"X 4"	IMP01	12"X 52"	1	1	BROWN	R	75.00	0	P.S.	WOOD	2"	25 MPH
6	5	1018	1.40	2-4"X 4"	IMP01	15"X 32"	1	1	BROWN	R	78.00	0	P.S.	WOOD	2"	25 MPH
6	5	1018	1.42	1-4"X 4"	W3-1	24"X 24"	1	1	YELLOW	R	175.00	1	P.S.	ALUMINUM	8"	25 MPH
6	5	1018	1.60	2-4"X 4"	IMP01	10"X 52"	1	2	BROWN	R	79.00	0	P.S.	WOOD	2"	25 MPH
6	5	1018	4.30	1-4"X 4"	W3-1	24"X 24"	2	4	YELLOW	R	165.00	2	P.S.	ALUMINUM	6"	25 MPH
6	5	1018	5.20	1-4"X 4"	W3-1	24"X 24"	2	5	YELLOW	R	165.00	0	P.S.	ALUMINUM	6"	25 MPH
6	5	1018	5.34	1-4"X 4"	W3-3	24"X 24"	2	5	YELLOW	R	164.00	2	P.S.	ALUMINUM	8"	25 MPH
6	5	1018	5.40	1-4"X 4"	W2-1	24"X 24"	1	5	YELLOW	R	35.00	0	P.S.	ALUMINUM	6"	25 MPH
6	5	1018	5.70	1-4"X 4"	W2-2	24"X 24"	2	6	YELLOW	R	165.00	1	P.S.	ALUMINUM	6"	25 MPH
6	5	1018	5.80	1-4"X 4"	W2-2	24"X 24"	2	6	YELLOW	R	165.00	3	P.S.	ALUMINUM	6"	25 MPH
6	5	1030	2.40	1-4"X 4"	W1-5R	24"X 24"	1	2	YELLOW	R	40.00	0	P.S.	ALUMINUM	25 MPH	
6	5	1030	3.20	1-4"X 4"	W2-2	24"X 24"	1	3	YELLOW	R	35.00	0	P.S.	ALUMINUM	25 MPH	
6	5	1030	3.25	1-4"X 4"	W1-5R	24"X 24"	1	3	YELLOW	R	40.00	0	P.S.	ALUMINUM	25 MPH	
6	5	1030	3.30	1-4"X 4"	W1-5-B	8"X 39"	1	3	BROWN	R	50.00	0	P.S.	WOOD	3"	25 MPH
6	5	1030	3.30	1-4"X 4"	R1-27	36"X 36"X 36"	1	3	RED	R	35.00	0	P.S.	ALUMINUM	2 1/2"	25 MPH
6	5	1030	3.40	1-6"X 6"	W2-2	24"X 24"	1	3	YELLOW	R	30.00	0	P.S.	ALUMINUM	25 MPH	
6	5	1030	4.00	1-4"X 4"	W2-2	24"X 24"	1	5	YELLOW	R	35.00	0	P.S.	ALUMINUM	25 MPH	
6	5	1030	4.70	1-4"X 4"	R1-27	24"	1	5	RED	R	35.00	0	P.S.	ALUMINUM	2 1/2"	25 MPH
6	5	1030	4.70	1-6"X 6"	W2-3-B	33"X 8"	1	5	BROWN	P	50.00	0	P.S.	WOOD	3"	25 MPH
6	5	1030	4.80	1-4"X 4"	W2-2	24"X 24"	1	5	YELLOW	R	35.00	0	P.S.	ALUMINUM	25 MPH	
6	5	1030	5.50	1-4"X 4"	W3-1	24"X 24"	1	6	YELLOW	R	35.00	0	P.S.	ALUMINUM	5"	25 MPH
6	5	1030	5.60	1-6"X 6"	W1-5-B	40"X 16"	1	6	BROWN	P	50.00	0	P.S.	WOOD	3"	25 MPH
6	5	1141	5.20	1-4"X 4"	W2-3	24"X 24"	1	5	YELLOW	R	55.00	0	P.S.	ALUMINUM	2"	25 MPH

Figure 3.—Example of a standard report—an inventory of all signs.

Productivity = (Workstation + Information) Environment

Dale R. Petersen and Pablo Cruz
Engineering Systems
Washington Office Engineering

Introduction

This article represents an unofficial summary of recent information on workstations and information management as seen through the eyes of the authors. Mr. Cruz has been involved in evaluating workstations and in developing information systems during the past 2 years. During this same period, Mr. Petersen has supported information management efforts and served on a workstation environment task group. He presented this article as a paper prepared for the Area I Highway Engineering Exchange Program (HEEP) on June 7, 1989. That paper was essentially as presented here, with some modifications for the benefit of *Engineering Field Notes* readers. The purpose of the article is to provide a summary of how the workstation and information environment is likely to affect them. At the same time, it is an invitation to be involved in the process to more fully define the future of computer use in the Forest Service. This article provides some history and shows how it is important to think broadly about workstations and information. We are sharing our vision and how it should improve productivity.

History

Forest Service Engineers were some of the first to use computers in the agency and to this day continue to be extensive users. Mainframes served the Engineers almost exclusively for road design in those early years. In 1983, the Forest Service began an 8-year procurement of a distributed processing network. As a result, there now are approximately 800 offices connected with Data General (DG) minicomputers mainly for office automation functions including X.400 worldwide mailing. Because Engineers' needs were not given priority in this procurement, in 1985, an Engineering report defined the computer power needed in the next 5 years. The result was a nonbinding agreement whereby Engineers in the Regions would implement their needs either on the DG or on MS-DOS microcomputers. Each Region chose to implement its plan quite differently. One Region chose a nearly 100-percent DG implementation through a supplemental DG DS/7540 workstation contract. Another Region chose a nearly 100-percent microcomputer solution. The other Regions use some combination of DG and the micros. As of this date, most Engineers have the computing power needed.

In 1987, the Forest Service adopted SQL and relational data base technology as a standard. Recently, the Forest Service purchased *Oracle* for an SQL data base, which is now being implemented at all sites. This will allow

applications to be operated on existing hardware platforms and provide distributive data base technology.

The Forest Service is currently working on a major geographic information system (GIS) procurement. In 1988, a request for information (RFI) for a GIS resulted in considerable interest and dialogue with the industry to help define the desired GIS system. A second RFI, released July 17, 1989, was designed to more fully define GIS needs before a request for procurement (RFP) planned later this year, which will lead to the first delivery of GIS to begin in 1991.

Engineering Computer Usage

Typical engineering computer usage is as follows:

- (1) CAD—primarily *AutoCad* with several other packages in use.
- (2) Calculations—primarily *Lotus 1-2-3* and a variety of specialized packages.
- (3) Data base—variety now; will be *Oracle* (including spreadsheet).
- (4) Design/Analysis—variety depending on need.
- (5) Emulation—primarily *CEO Connection* to communicate with DG.
- (6) Expert Systems—micro-based signs advisory under development on *IBIS*.
- (7) Graphics—DG and mostly *Harvard Graphics* on micros.
- (8) Road Design—several micro/workstation variations of *RDS*.
- (9) Text processing—DG and mostly *WordPerfect* when micros are used.
- (10) Workstations—only the DS/7540's are true workstations with windows.

Workstation Environment

The existing computing environment described above is fragmented in a sense. On the one hand, there is a highly integrated DG system for office automation, which is the corporate system. On the other hand, there are widely scattered micros of various configurations for Engineering work. Many micros are connected with DG through emulation and asynchronous communications with *CEO Connection* software. This provides online mini-computer functions on a micro. The ability to transfer files between DG and micros is directly related to the supported file format on DG. Micro and DG text-processing files are compatible unless there are extensive graphics or sophisticated desktop publishing operations. Data base files will be fully compatible on both systems and even with the few Macintoshes. The *Oracle* data base will be compatible with *Lotus 1-2-3* files. Engineering files are located either on a micro or a mini. For example, *AutoCad* files stored on DG can be mailed to other sites and downloaded for use on a micro due to DG's

storage and networking. Engineers have the best of both worlds—individual and distributive processing.

This description is *not* our definition of a workstation environment because each system is not transparently connected, nor is there a same “feel and look.” That is a goal.

The Forest Service created a Workstation Environment Task Group, whose report was completed in September 1988. Another workstation report, completed in July 1988, provided more information based on an actual evaluation of DG's DS/7500 workstation. The following are items from the reports and other sources that attempt to define a workstation environment during this period of evolution:

- (1) A workstation environment is created by combining **User Needs** with **Opportunities** (that is, *Technology Trends* and *Standards*) into a **Plan** (consisting of a *Vision*, *Issues* to be resolved, and *Strategies/Actions*) to result in a bias for action. As figure 1 indicates, the process should be recycled continually until a goal is reached—getting from where you are to where you want to be.
- (2) A workstation concept can be defined by two segments, as figure 2 indicates. Segment 1 is the ideal, having those characteristics that users want and technology can provide. Segment 2 is composed of corporate applications, or those that require widespread understanding and

Workstation Environment Planning Process Model

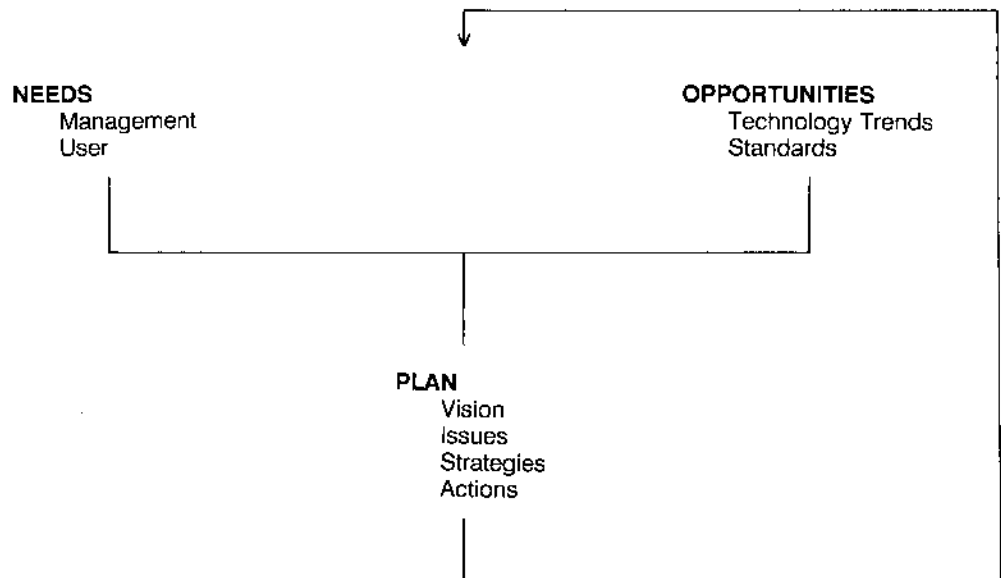


Figure 1.—A workstation environment in “blueprint” form.

Workstation Concept

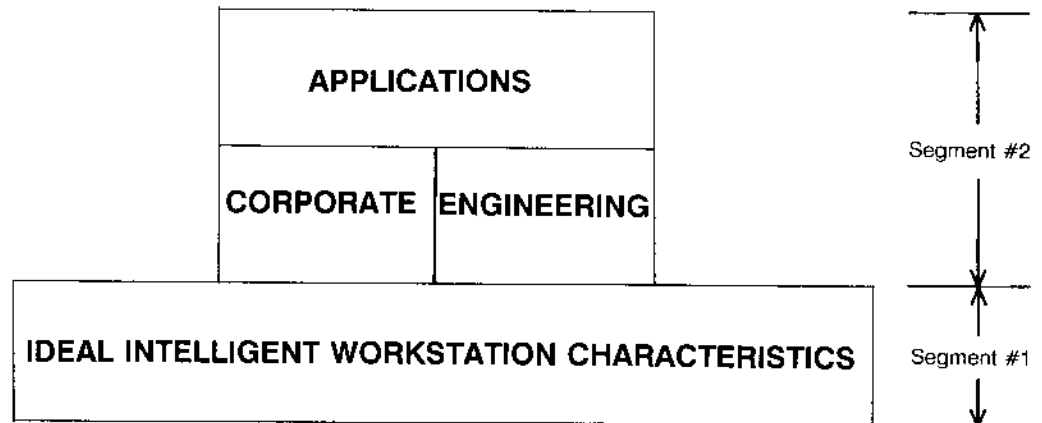


Figure 2.—The workstation concept as defined by Engineering is composed of two major segments.

sharing, and the more specialized engineering applications. Off-the-shelf software is included.

- (3) Most computing was on mainframes in the 1970's and on minis in the 1980's; however, most will be migrating to new platforms in the 1990's.
- (4) Systems will be more open and compliant with Federal Information Processing Standards (FIPS).
- (5) Trends indicate more millions of instructions per second (MIPS) on the desktop with more speed, graphics, color, and a common windows interface, which will allow the user to access a variety of computers in a transparent fashion without regard to where the computing is taking place.
- (6) A well-focused **Vision** offers a target for an organization to move toward. The Forest Service's vision is a technology platform that fits a variety of user needs and integrates them in a "seamless fashion" through a common user interface.
- (7) Information management must be institutionalized with GIS setting the pace. This means moving toward standard data languages.
- (8) Management should encourage increased participation, communication, innovation, and coordination to broaden the base of technology planning to include users throughout the organization.

Figure 3 illustrates the kind of client-server network family of workstations that may occur at each office in the Forest Service.

Future Network Concepts

SERVERS

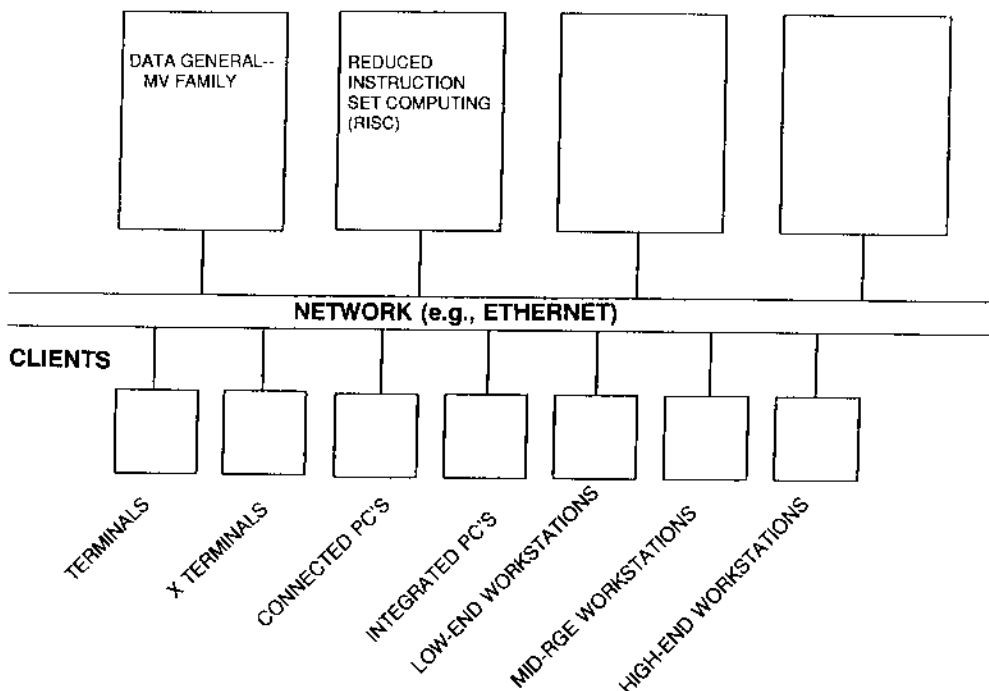


Figure 3.—A client-server network.

Information Environment

Forest Service personnel are learning to think beyond the technologies. As large as our integrated minisystem, scattered micros, and forthcoming GIS already are, these are only part of the answer—only tools within an information environment, which can be defined as:

The combination of data, technology, processes, organization, and roles that delivers quality management information to every employee and public we serve to enable us to more effectively accomplish our mission.

Figure 4 illustrates an information environment. At the center is a data processing infrastructure surrounded by an operating system. Next is an information structure that is the manner in which personnel organize information and includes data base activities. Two major applications shown are GIS and office automation (OA). There will be numerous other applications. Next is the user interface, followed by access management (a security system), and, finally, the users themselves.

Figure 5 shows how source documents should translate into GIS/SQL data base capabilities. Within an information environment, the keys are common language (definitions), structure, and sharing. Information is a resource; it should have local ownership by those responsible for updating it, and it must support national reporting requirements and should provide for effective public presentations.

An Information Environment

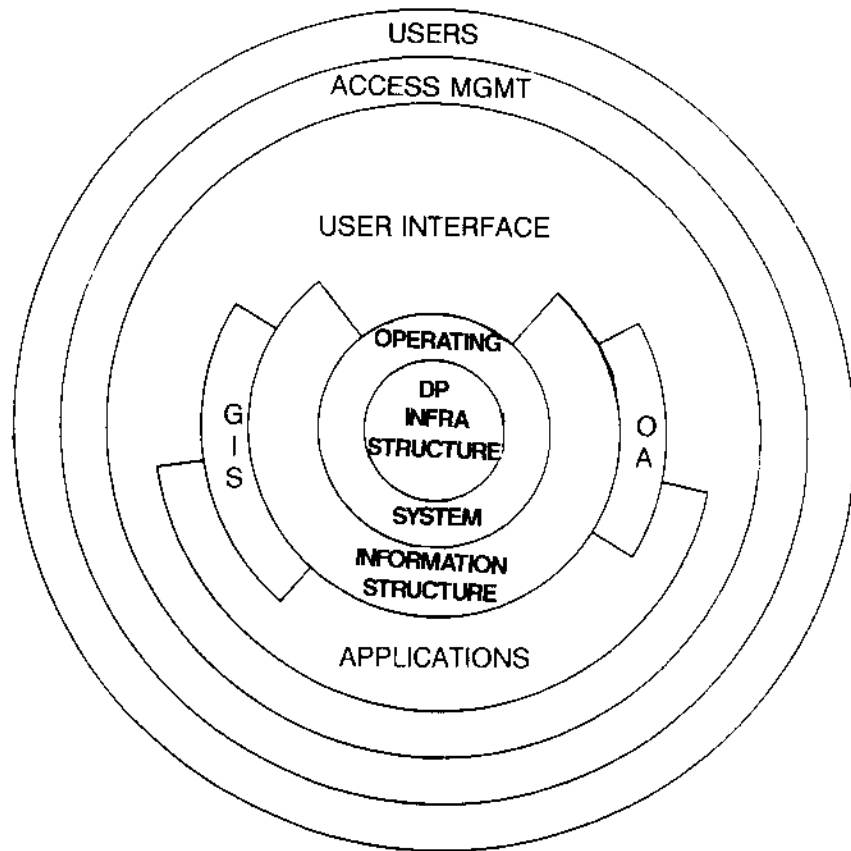


Figure 4.—An information environment conceptualized.

Figure 6 illustrates progress in information management. In the past, there were unconnected islands of information. Today, these islands are connected, but in rather crude ways, with many independent information systems. A goal is to have a cohesive future system.

Figure 7 illustrates the Forest Service's independent engineering information systems at present and their interrelationships. Many information systems are duplications of many fields in other systems. This can, and does, result in duplicate data entry and reports from more than one source producing different answers! Functional ownership is acceptable when operating alone but is a problem when corporate sharing is necessary. We know we must change from a functional paradigm, or an individual scope, to a corporate paradigm, or a global scope, of information. This is illustrated in figure 8 by the oil well example of changing from managing individual oil wells to managing an oil field.

GIS/SQL Data Base Capabilities

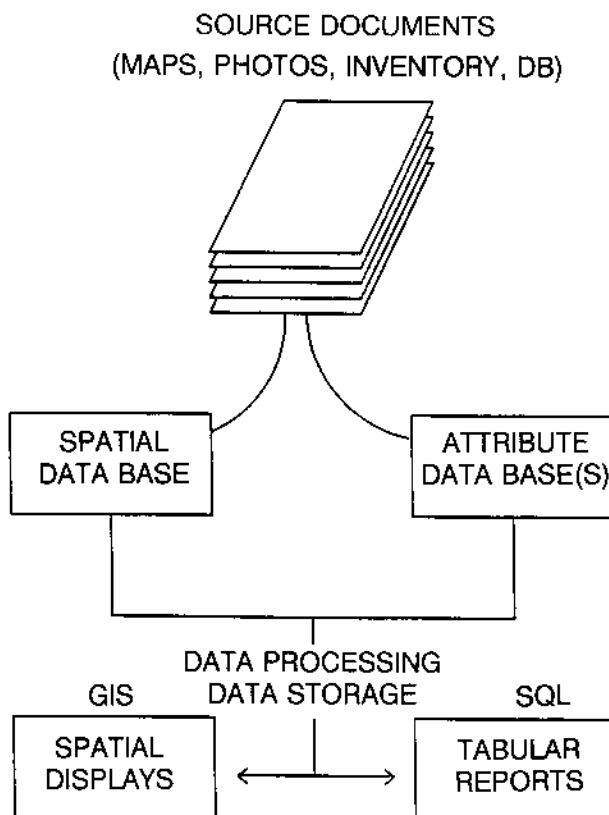


Figure 5.—The translation of source documents into GIS/SQL data base capabilities.

Figure 9 shows how a corporate information system must relate. At the national level, relatively little information is required by law or for budget and accomplishment reporting purposes. This information is accumulated at every level of the organization and, as such, is "common" from top to bottom. In the case of the Forest Service, this includes the Washington Office, 9 Regional Offices, 156 National Forests, and approximately 750 Ranger Districts, National Grasslands, and Research units. At each level closer to the ground, additional information is necessary to provide required information to a higher level and to manage that unit. Only the required (minimum) information is corporate or common. The remainder is noncorporate, project, or facilitating information.

Putting It All Together

The whole process described above is evolving. It represents a historical track and a vision being pursued. Figure 10 is a busy chart but illustrates how one Region is integrating the information. At the top are NEEDS that must exist in order to have the information. The chart shows the dynamic process by which information is managed using administrative and computer processes. Ultimately, analysis tools and queries provide the information for users. The days of the information broker or controller soon will be gone. This open process provides for getting corporate data approved.

Information Management Situation

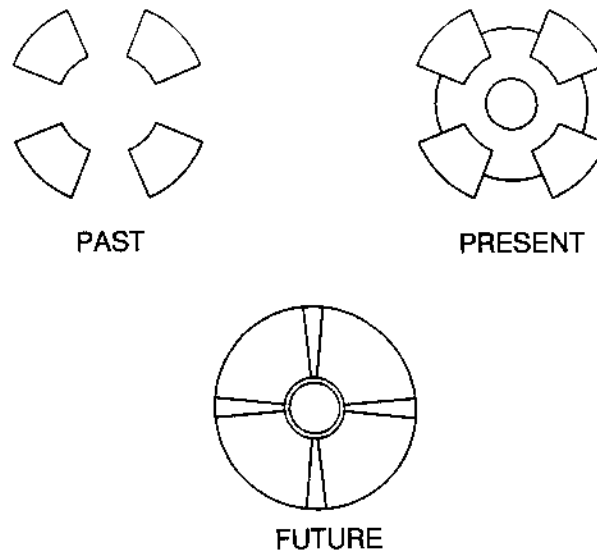


Figure 6.—Development and projected growth of information management.

Figure 11 is another view of how tools will be used to manage information. Office automation, data base, or GIS are the major applications that can be accessed. DG CEO is the present office automation. Oracle is the data base tool to be used over the next several years. GIS, currently limited to evaluation sites and special needs, will become a major and universal tool in 1991-95, like the other two platforms, and they will all work together. A 1989 GIS plan more fully defines how information will be organized, including facilities managed by Engineers. As time and technology change, the brands and tools will change. The migration should always be progressive toward a vision of what information management should be. We expect to see newer technologies included in the above as appropriate. For example, expert systems may be a part of data base frontends and analysis models. Optical systems, like CD-ROM, may play a role in data storage. There may be other innovations included.

Summary

This article should help personnel understand the future of workstations and information management. The important lesson here is that Engineers no longer should be just road designers. Neither should they alone be experts on workstations, expert systems, or other technologies. They should not be zealots nor brokers of information. They should be advocates and team players to implement an information environment. Just as we learned very early that $2+2=4$, we can learn now that a workstation environment + information environment = productivity.

Present Independent Engineering Information Systems

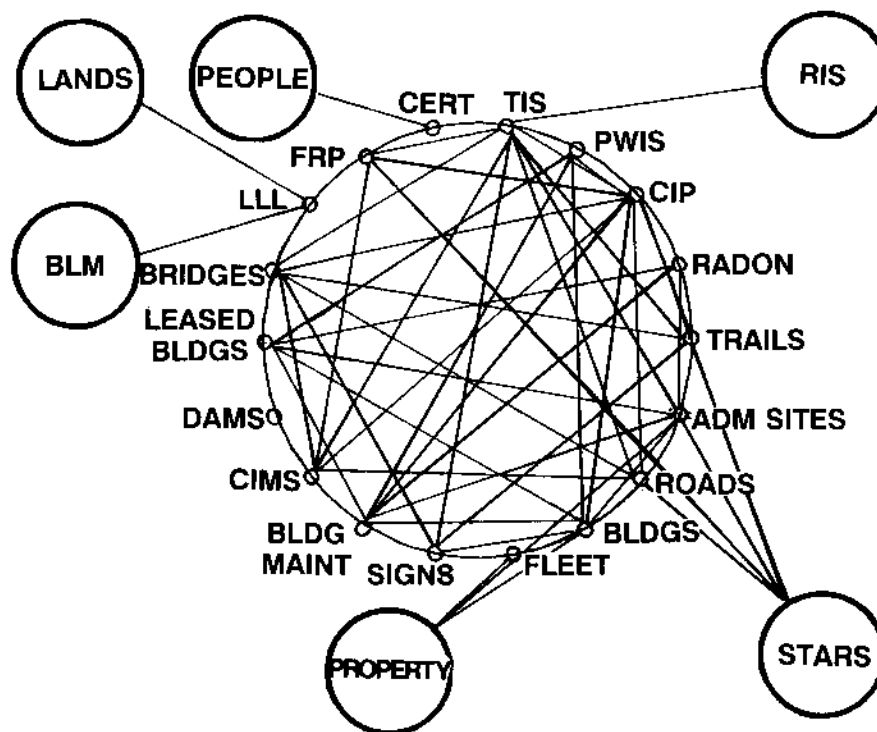


Figure 7.—Service-wide systems are evolving toward the ideal of a cohesive whole.

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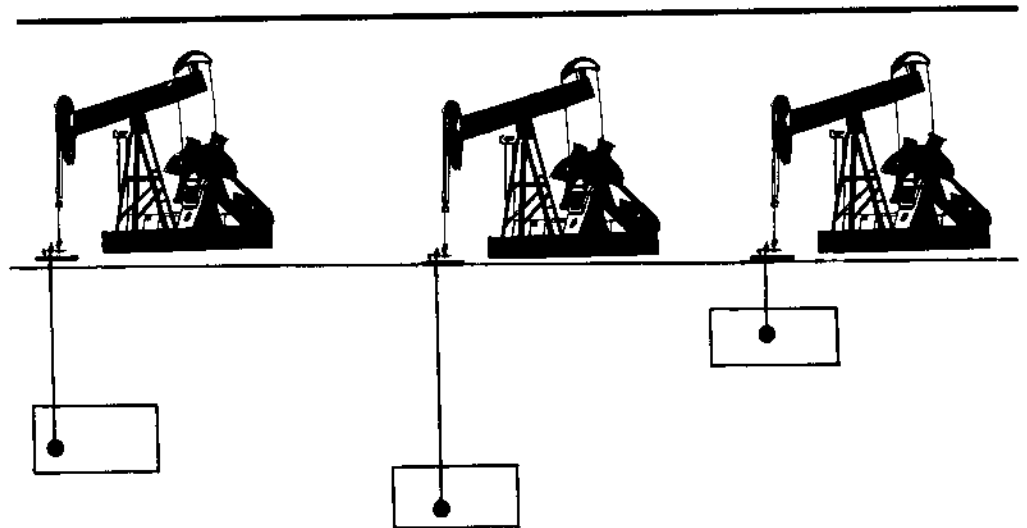
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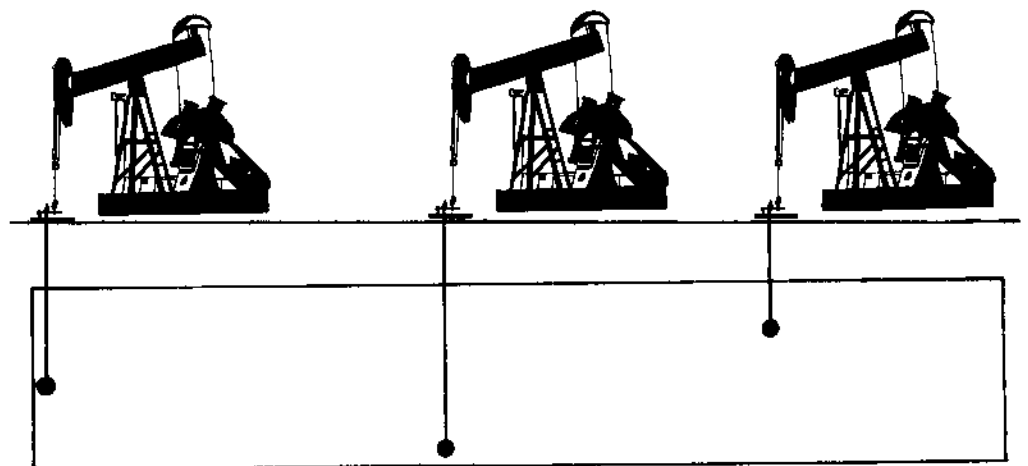
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Individual oil well paradigm.



Corporate oil well paradigm.

Figure 8.—Information management must blend individual and corporate needs.

Relationships of Corporate Information

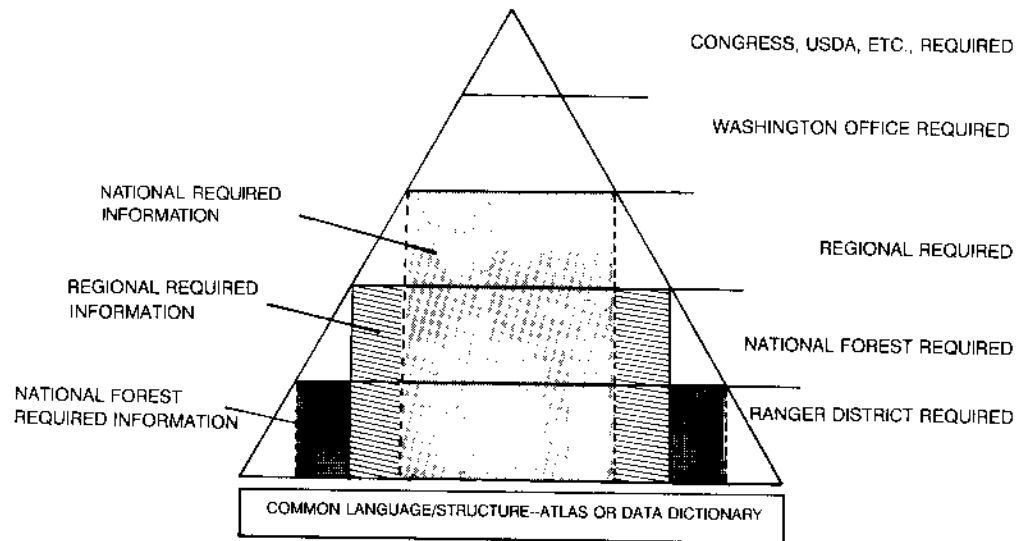


Figure 9.—Relationships of corporate information.

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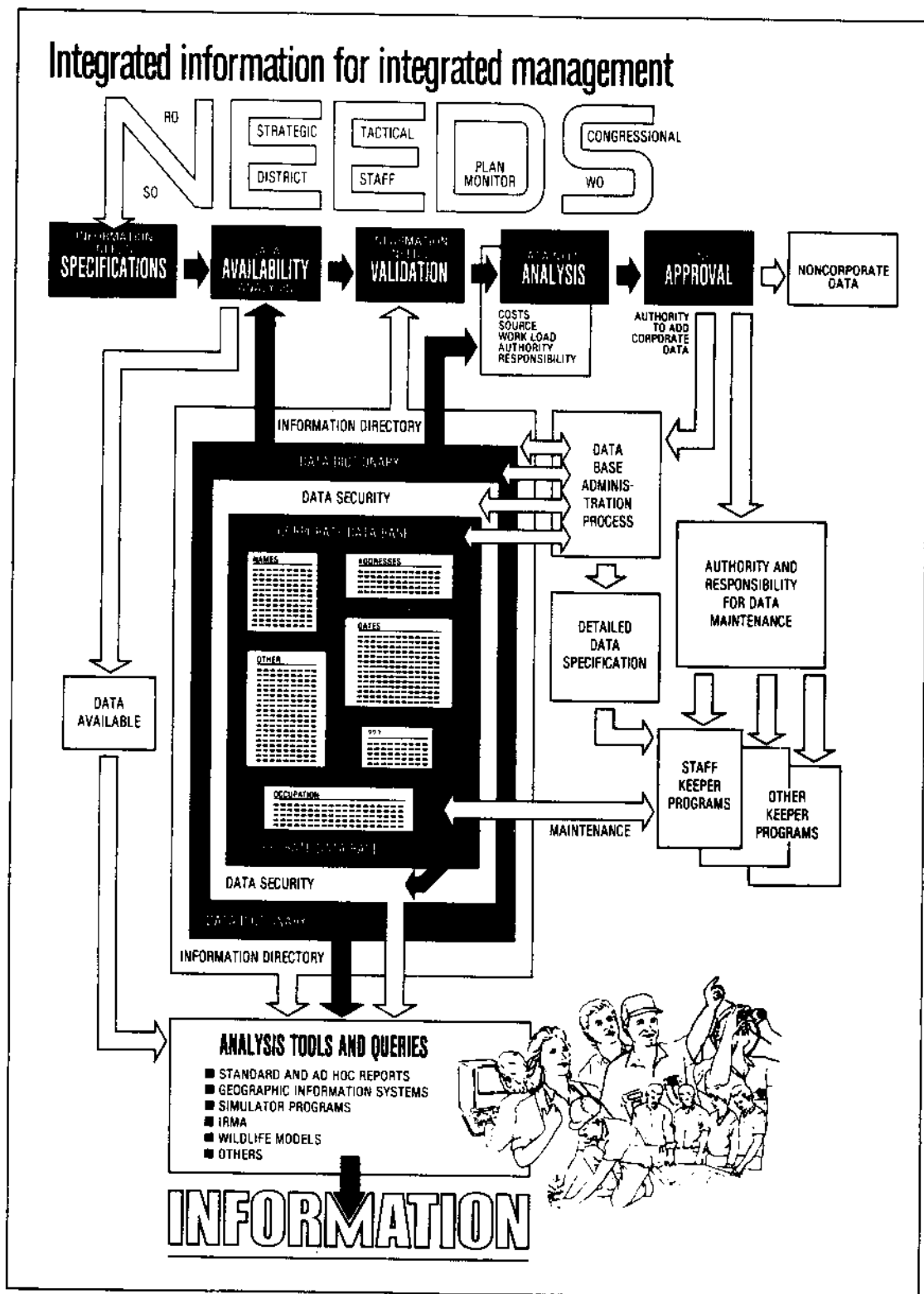


Figure 10.—How one Region integrates and manages information.

The Forest Service Information Environment

APPLICATIONS

Office Automation	Data Base	GIS
CEO	ORACLE	??????-1991-1995
All FS Sites	All FS Sites	Districts/SO's
PC's (CEO Conn.)	NFC	Workstations
	PC's	

NOTE: Oracle is the data base upon which the Forest Service will standardize data base-related information activities over the next few years.

Figure 11.—The information management system contains three major applications.

Employee Suggestion Bulletin

Here are some more Engineering-related employee suggestions that have been approved for Service-wide use.

7160—Signs and Posters

Jeffrey C. Oulton 5445 (R2-10-89)

Adopted: Optional Service-wide use.
Location: Grand Mesa, Uncompahgre, and Gunnison National Forests
Taylor River Ranger District

Change the wording to "Please leave gate as you found it" on Forest Boundary and Grazing allotment gate closure signs.

John M. Shackleford
Earl J. Snyder
Jasper M. Sams 6440 (R6-1223)

Adopted: Optional Service-wide use.
Location: Colville National Forest
Supervisor's Office

Use plastic signs purchased locally instead of metal signs from the General Services Administration.

Bibliography of Washington Office Engineering and 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 publication 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 20, November-December 1988). 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.

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Engineering Staff, TIC
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Washington, DC 20090-6090

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San Dimas Technology &
Development Center
444 E. Bonita Avenue
San Dimas, CA 91773

Forest Service—USDA
Missoula Technology &
Development Center
Fort Missoula, Bldg. 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

1988 <i>Engineering Field Notes</i> Article Awards	Carroll, Dennis. EFN 21 (January-February 1989): 1-4.
Adopt-a-Road Maintenance Specifications for Four-Wheel-Drive Travel	Tonto National Forest. EFN 21 (November-December 1989): 5-18.
Allowable Fill Height on Trees	Taylor, Deborah J. EFN 21 (March-April 1989): 23-30.
Awards for the 1988 <i>Engineering Field Notes</i> Articles	Editor. EFN 21 (May-June 1989): 1.
California Park Road Reconstruc- tion Project of the Routt National Forest	Blackwell, Rex. EFN 21 (March-April 1989): 19-22.
Countering Vandalism to Forest Service Signs	Nettleton, Thomas. EFN 21 (July-August 1989): 37-41.
Developing Road Logs & Inventories Using the HP-71B	Keyes, Walt. EFN 21 (January-February 1989): 31-40.
Dire Straits	Baggett, Mary Jane. EFN 21 (July-August 1989): 1.
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(A) Facilities Information Center— Sharing Our Facilities Management Resources	Lippert, George J. EFN 21 (July-August 1989): 31-36.
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Forest Sign Plan Using CAD/DBMS	Renison, Bill. EFN 21 (November-December 1989): 19-23.
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