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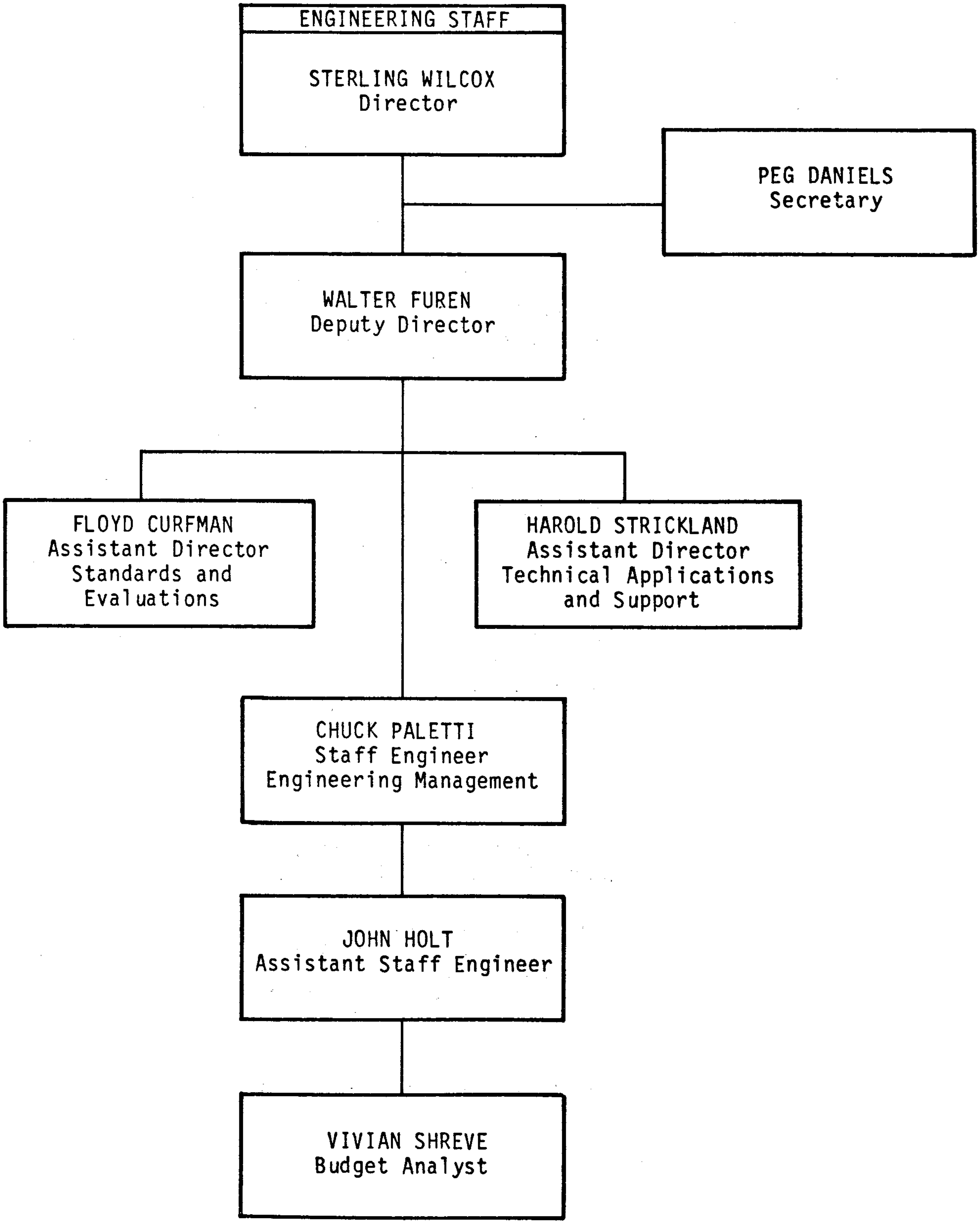
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Washington Office Engineering Staff Update

In response to recent field requests and because of the ongoing Washington Office Engineering Staff (WO-E) reorganization, we have prepared the following WO-E organizational directory.

We hope this directory will help improve communication and coordination between field units and the Washington Office.

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235-8098

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John Holt Assistant Staff Engineer 235-8042	Assists the Staff Engineer in providing leadership in the formulation, adoption, and inspection of Engineering standards, procedures, and practices for planning, formulating, controlling, executing, reporting, and evaluating the annual program of Engineering work.
Vivian Shreve Budget Analyst 235-8042	Reviews, analyzes, and develops budget data related to Regional programs of work and Appropriations Subcommittee questions related to annual budget requests. Coordinates requests to Regions for draft response to congressional inquiries.

STANDARDS & EVALUATIONS

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235-8087

Carol Funking
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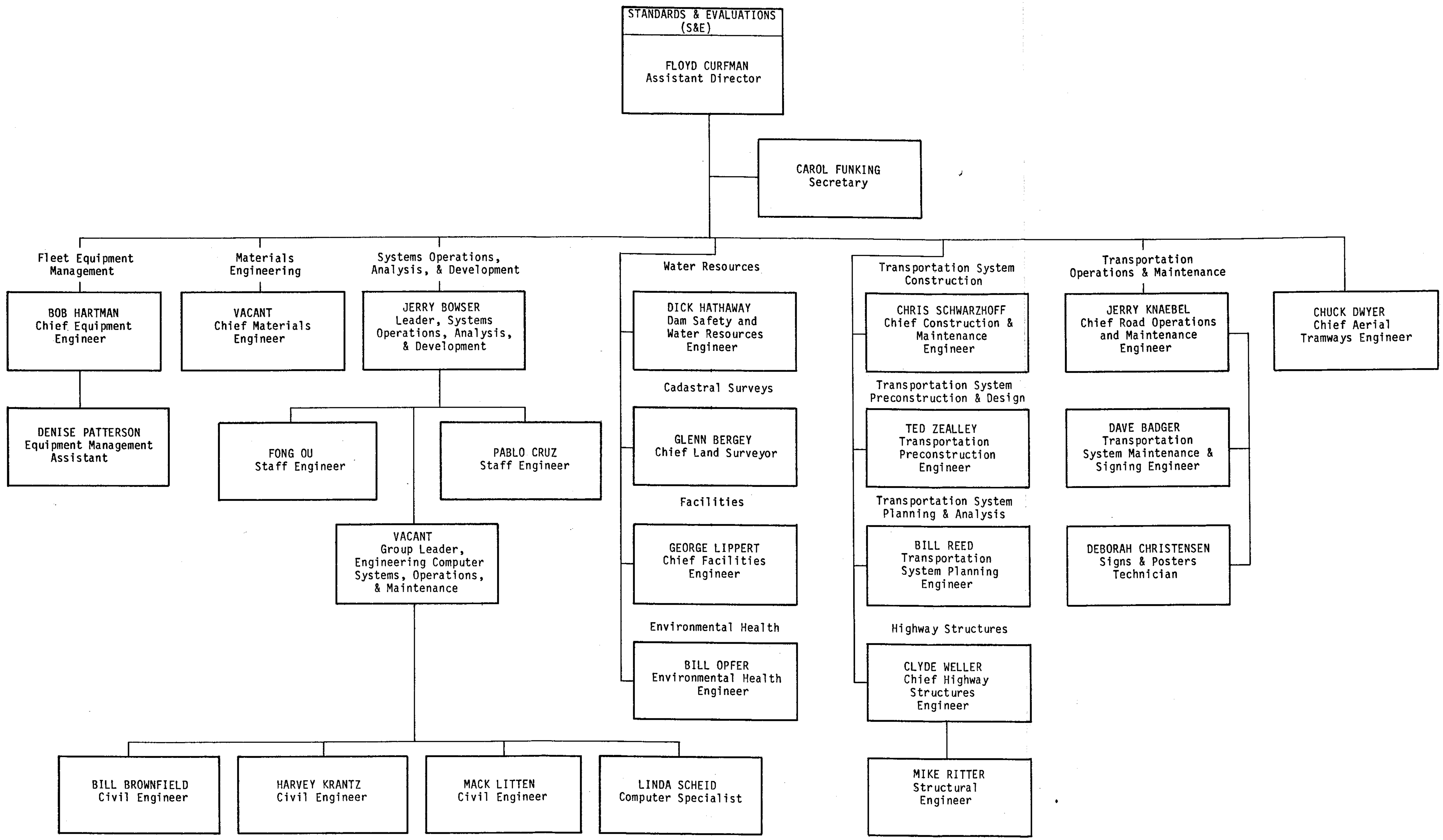
Bob Hartman Chief Equipment Engineer 235-8155	Provides leadership and technical expertise in all phases of fleet management to the field units. Coordinates this activity with other agencies in the Department of Agriculture, other Government Departments and Bureaus, and private industry.
Denise Patterson Equipment Management Assistant 235-8156	Works with representatives of the Fiscal and Accounting Management, Administrative Management, and Administrative Services Staffs in development of management and accounting systems applicable to the rental, acquisition, operation, management, maintenance, disposal, and replacement of equipment. Plans, directs, and makes studies to test and evaluate a wide variety of complex equipment and systems for equipment and accessories for use in Forest Service programs.
Vacant Chief Materials Engineer 235-8030	Provides leadership and direction concerning the application of Engineering technology to various construction materials such as soil, rock, asphalt, concrete, metal, and wood. Administers and coordinates geotechnical and materials Engineering studies.
Jerry Bowser Leader, Systems Operation, Analysis, and Development 235-1259	Provides leadership in the development and management of Service-wide Engineering systems. Coordinates hardware and software procurement, and system implementation. Searches out and transfers new technology.
Fong Ou Staff Engineer 235-3119	Develops and searches for new technology to improve systems efficiency. Coordinates new systems development. Provides technical assistance to solve specific problems.
Pablo Cruz Staff Engineer 235-1258	Performs system analysis, feasibility studies, program development, program testing certification, and evaluation of Engineering systems.

Vacant Group Leader, Engineering Computer Systems, Operations, and Maintenance 235-2621	Coordinates the operation, maintenance, and implementation of all Service-wide Engineering computer systems, except Geometronics.
Bill Brownfield Civil Engineer 235-2467	Supports and maintains national computer systems used for transportation analysis and RIDS. Provides support, training, consultations, and solutions to problems to Regional users of these systems.
Harvey Krantz Civil Engineer, FCCC Mack Litten Civil Engineer, FCCC 323-1720	Maintain and keep operational the computer road design programs such as the Road Design System (RDS), Rapid Survey and Design System (RSDS), Interactive Road Design System (IRDS), and the Surfacing Design and Management System (SDMS). Provide assistance to Regions whenever they have problems using any of these programs.
Linda Scheid Computer Specialist 235-2622	Responsible for the support and maintenance of national data base systems: the Dam Inventory System, the Energy Conservation System, and the Potable Water System Inventory. Provides consultations and solutions to problems encountered by field personnel responsible for updating and retrieving data from these systems. Assists in developing and editing user documentation.
Dick Hathaway Dam Safety and Water Resources Engineer 235-8018	Provides leadership and direction for the development, operation, and management of dams and water transmission facilities.
Glenn Bergey Chief Land Surveyor 235-3113	Provides leadership and technical direction concerning cadastral land surveys and other related boundary line management activities.
George Lippert Chief Facilities Engineer 235-8020	Provides leadership and direction concerning planning, development, and management of buildings and related facilities owned or occupied by Forest Service employees or permittees.
Bill Opfer Environmental Health Engineer 235-8019	Provides leadership, policy, standards, and evaluation of environmental health Engineering programs of the Forest Service. Coordinates public health and pollution control activities with other Federal agencies.

Chris Schwarzhoff Chief Construction and Maintenance Engineer 235-3121	Provides leadership in construction of Forest Service transportation system facilities.
Ted Zealley Transportation Preconstruction Engineer 235-8086	Provides technical leadership, coordination, and direction of the location, survey, and design of transportation facilities.
Bill Reed Transportation System Planning Engineer 235-9845	Provides leadership and consultation in the implementation of transportation planning direction and the integration with land and resource management planning.
Clyde Weller Chief Highway Structures Engineer 235-1477	Provides leadership in the field of structures for the Forest Service transportation system and liaison for ski lift and tram systems.
Mike Ritter Highway Structures Engineer, Forest Products Laboratory 364-5624	Provides leadership in the field of bridges structural computer applications. Is writing "Timber Bridge Design and Construction Manual." Involved in timber bridges technology transfer.
Jerry Knaebel Chief Road Operations and Maintenance Engineer 235-9846	Provides leadership and direction concerning the operation and maintenance of the Forest development transportation system. Principal staff contact for matters concerning Forest highways, administrative appeals, and litigation.
Dave Badger Transportation System Maintenance and Signing Engineer 235-3122	Staff assistant to the Chief Road Operation and Maintenance Engineer. Provides leadership, direction, and coordination for transportation system maintenance and signing activities.

Deborah Christensen Signs and Posters Assistant 235-8025	Provides leadership and direction for the small metal signs and posters program, and provides technical assistance in other areas of FS signing (including traffic control devices and guide signs) and road operations and maintenance.
Chuck Dwyer Chief Aerial Tramways Engineer, Denver, CO 234-3841	Provides leadership and guidance in the field of aerial passenger tramways, ski lifts, and tows.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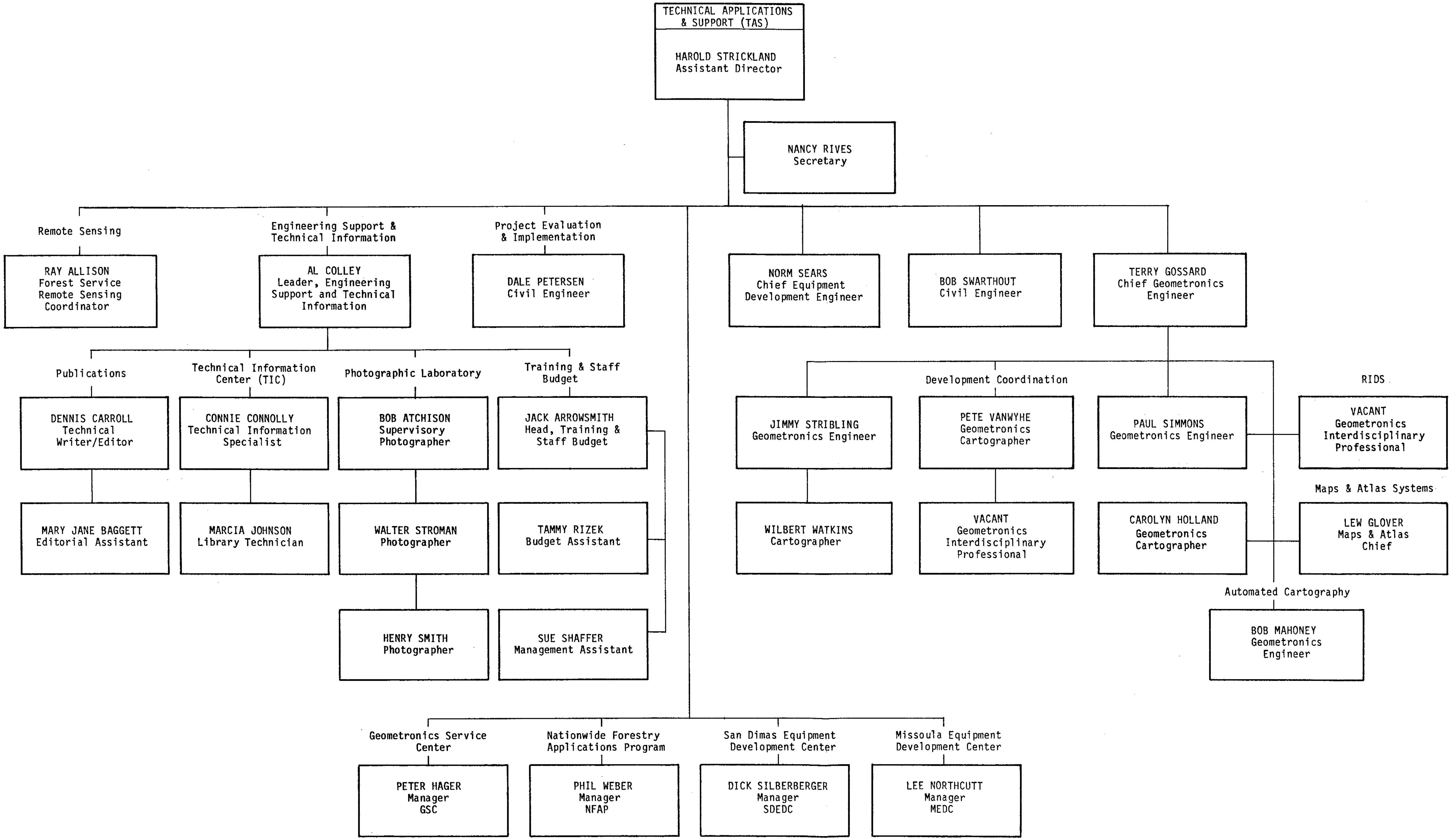
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235-8046

Nancy Rives
Secretary

Ray Allison Remote Sensing Coordinator 235-8184	Provides national leadership in the area of advanced remote sensing techniques and specializes in the applications of remote sensing technology to resource management problems.
Al Colley Leader, Engineering Support and Technical Information Group 235-1425	Supervises the following sections: Publications, Technical Information Center, Photo Lab, and Engineering Training and Staff Budget. Responsible for entire range of Engineering management support activities including Service-wide Engineering activity standards and evaluations, strategic planning, National Information Requirements, and cost analysis.
Dennis Carroll Technical Writer/Editor 235-8198	Provides leadership in the preparation, coordination, and production of publications (periodicals, reports, brochures, visual aids), directives, and forms.
Mary Jane Baggett Editorial Assistant 235-2346	Provides assistance in the preparation, coordination, and production of publications (periodicals, reports, brochures, visual aids), directives, and forms.
Connie Connolly Technical Information Specialist 235-3111	Provides publications, directives, informational, and technology transfer support to the WO Engineering Staff and field units.
Marcia Johnson Library Technician 235-1424	Assists in providing publications, directives, informational, and technology transfer support to the WO Engineering Staff and field units.

Bob Atchison Supervisory Photographer Walter Stroman Photographer Henry Smith Photographer 235-8129	Provide Washington Office-wide photographic support. The Photo Lab will close down by the end of FY 1986.
Jack Arrowsmith Head, Training and Staff Budget 235-8635	Provides leadership and coordination in the Engineering Construction Certification Program; Engineering A-76 Program; Engineering Staff budget and fiscal operations; personnel activities, including awards; and administrative services activities, including property and space. Provides Staff analysis on general projects and programs within Engineering.
Tammy Rizek Budget Assistant 235-8635	Provides assistance and direction in Engineering's annual operating budget and related financial matters. Oversees internal procurement actions.
Sue Shaffer Management Assistant 235-8635	Provides administrative coordination for the Engineering Construction Certification Program, the A-76 Program, and the tracking of personnel actions and training.
Dale Petersen Project Evaluation and Implementation Engineer 235-2378	Provides staff support for technology transfer, equipment development program, computer systems, and TA&S program budget.
Norm Sears Equipment Development Engineer 235-8114 Lee Northcutt Manager, MEDC 585-3910 Dick Silberberger Manager, SDEDC 793-8000	As a team, establish overall long- and short-term direction in accord with Forest Service goals. Oversee the work of the ten Project Leaders and two Staff Engineers located at the Centers to assure the Director of Engineering that ED&T work supports national and individual program goals; that work is performed for sponsors in an efficient and professional manner; and that sponsors are satisfied with the quality of the work. In addition, the two Center Managers are line officers responsible for all activities at their respective Centers.
Colburn D. Swarthout Civil Engineer 235-2376	Participates with the Regions to evaluate existing Engineering technology; discovers and transfers new or different technology in support of field needs. Coordinates Engineering research needs with Regions, Forest Service Research, other State and private groups, and academia.

Terry Gossard Chief Geometronics Engineer 235-8184	Provides national leadership in Geometronics activities. Is responsible for direction and coordination of plans and standards, formulation of policies and procedures, and investigation of new or improved methods and equipment for recording, handling, and displaying resource, terrain, and cultural data in support of Forest Service activities.
Paul Simmons Geometronics Engineer 235-8184	Project Leader in the area of Digital Terrain Modeling; provides technical development in the area of acquiring, handling, and displaying terrain and geographic data through photogrammetric/computer techniques. Projects: Systems Development and Training (multiple projects); and General Terrain Manipulation System (GTMS).
Jimmy Stribling Geometronics Engineer 235-8184	Head of Administrative Coordination Section; responsible for coordinating the formulation, implementation, direction, and evaluation of Geometronics policies, programs, and objectives. Project: Mapping and Geodetic Requirements.
Wilbert Watkins Cartographer 235-8184	Provides support to the Geometronics Engineer. Project: Aerial photography applications.
Pete VanWyhe Geometronics Cartographer 235-8184	Head of Development Coordination Section; responsible for the coordination of photogrammetric, cartographic, remote sensing, automated data processing, and contractual support to the Geometronics Development Program.
Vacant Geometronics Interdisciplinary Professional 235-8184	Trainee position to provide technical support for all Geometronics areas.
Carolyn Holland Geometronics Cartographer 235-8184	Project Leader in the area of Automated Cartography; provides technical development in computerized methods of acquiring, storing, retrieving, analyzing, and displaying planimetric and topographic map data. Projects: Archival Map Data, Interagency Data Exchange, and Systems Development and Training (multiple projects).
Vacant Geometronics Interdisciplinary Professional 235-8184	Project Leader to support development of standards for remote sensing, cartography and automated cartographic processes, products, and applications as they relate to Geographic Information Systems.

Lew Glover Maps and Atlas Chief 235-8071	Gives guidance on geographic names and mapping needs to the Geometronics Group.
Bob Mahoney Geometronics Engineer, Salt Lake City, UT 588-5668	Project Leader in the area of automated cartography; specializes in development of methods and equipment to compile, maintain, reproduce, and store maps and other spatial data. Projects: Editing and archival procedures for Digital Terrain Data and GSC conversion of FCCC software to minicomputers, and development support to Automated Cartography Unit.
Pete Hager Manager, GSC 588-4296	Provides leadership and technical direction in the compilation and production of the Forest Service Base Series, orthophotos, digital application, and special mapping programs.
Phil Weber Manager, NFAP 588-4580	Provides technical leadership and managerial oversight to a mission of improving the efficiency and cost-effectiveness of Forest Service operations through the introduction of new techniques and the improvement of employee skills in the photo-interpretation and remote sensing technical area as applied to agency responsibilities exemplified by the implementation and monitoring of Forest Land Management Plans.

Fence Failures at Dog Legs & What To Do About Them

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Fence failures or post pullout at dog legs (locations having a small change in fence alignment of up to about 60 degrees) are well known to anyone who installs or repairs fencing (see figure 1). Failures at dog legs in standard barbed-wire fencing are not as critical as failures in high-tensile, smooth-wire fencing, which requires proper tension to be maintained throughout to be effective.

WHY FENCES FAIL

Fence strainers (also called braces) generally fail for one of three reasons:

(1) Structural failure.

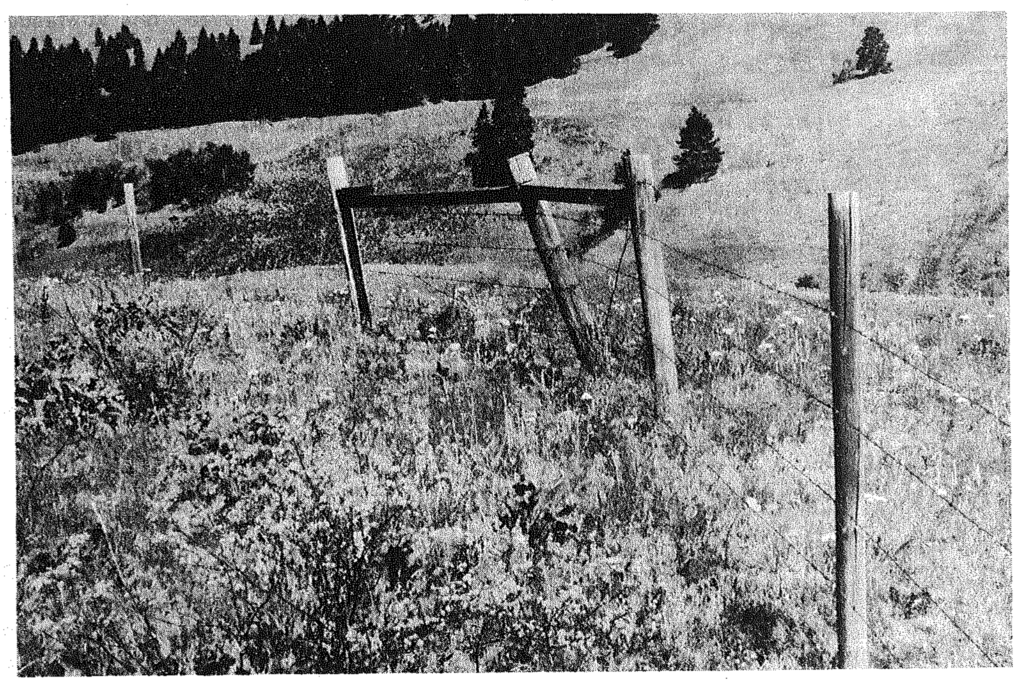

Figure 1.--Fence failure at dog leg.

(2) Soil movement or failure.

(3) Corner or end post pullout.

Structural failure of a fence end strainer usually results from improper design, poorly selected material, or overstressed members. Carefully designing fence strainers and properly proportioning and sizing the members should all but eliminate structural failures of fence strainers.

Soil failures of fence strainers occur when the soil is so weak that it cannot support the load placed on the soil by the fence strainer and the fence strainer moves through the soil. Improvements in the design of the fence strainers--such as using larger or longer posts, or applying plates that have larger areas to bear against the soil--usually can eliminate these soil failures.

Corner post pullout of fence strainers occurs when the corner post lifts out of the ground. Longer fence strainers or cleats placed on the post to increase the coefficient of friction between the post and the soil help prevent corner post pullout failures. Corner post pullout failure is related to the coefficient of friction between the fencepost and the ground. Post pullout will not occur when a corner or end fence strainer is longer than a critical length, which varies in each case. The fencepost bears against the ground, generating a vertical force resisting pullout, but the resisting force is limited to a maximum of the horizontal force bearing against the post by the ground times the coefficient of friction (approximately 0.1 to 0.5) between the fence corner post and ground. If the force trying to pull the post out of the ground is greater than the generated resisting force, the post will pull out. By doubling the length of the strainer, we can reduce the force pulling the post out of the ground by half. If the force pulling the post out of the ground is less than the maximum force generated to resist pullout, the strainer will not fail by pullout.

This critical length can vary depending on the moisture condition of the soil, which affects the coefficient of friction between the fencepost and the soil. Generally, as the soil moisture increases, the coefficient of friction decreases. When this happens, the decrease in the coefficient of friction may increase the critical length of the fence strainer beyond the actual length of the strainer--and the corner or end post pulls out. Pullout generally is the reason for fence failure at dog legs. Dog legs are small changes in the fence alignment, and small angle changes are the most difficult to hold and are where most pullouts occur.

In a dog leg, there is an equal pull on the corner post along each alignment, resulting in a combined resultant force bisecting the dog leg angle that is much smaller than the two equal forces (see figure 2). The effective strainer assembly length also is shorter than either strainer in alignment with the fence. If this effective strainer assembly length is less than the critical length, the fence will fail by pullout.

At a dog leg of 60 degrees, the resultant effective length of the strainer assembly is equal to the length of the strainers in alignment with the fence (see figure 3). If the strainers are longer than the critical length, pullout will not occur. At 90-degree corners, the resultant effective length of the strainer assembly is about 50-percent greater than the strainers in alignment with the fence (see figure 4). When a fence corner is less than 90 degrees, the resultant effective length of the strainer assembly becomes much greater than the strainers in alignment with the fence (see figure 5).

PREVENTING FENCE FAILURE

To prevent fence failures at dog legs, make the effective length of the strainer greater than the critical length of the strainer. Place a strainer in the bisect of the angle of the dog leg, which is

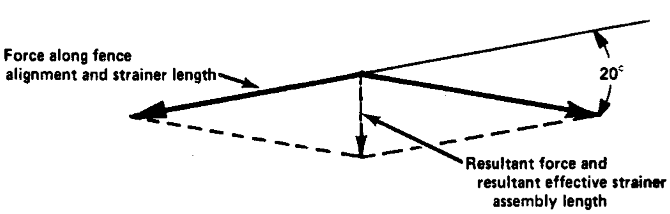

Figure 2.--Forces and resultant force at a 20-degree dog leg. The resultant force and the resultant strainer assembly length are much smaller than the forces and strainer assembly lengths in alignment with the fence.

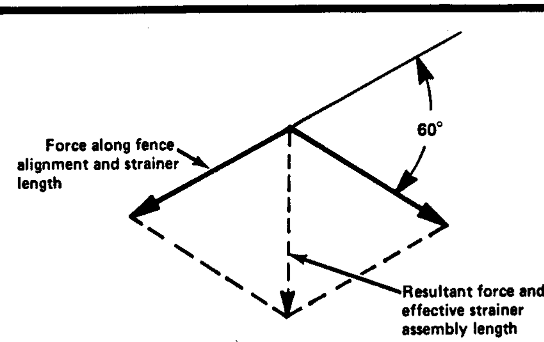

Figure 3.--At a 60-degree change in fence alignment, the resultant force and effective strainer assembly length is equal to the forces and strainers in the alignment of the fence.

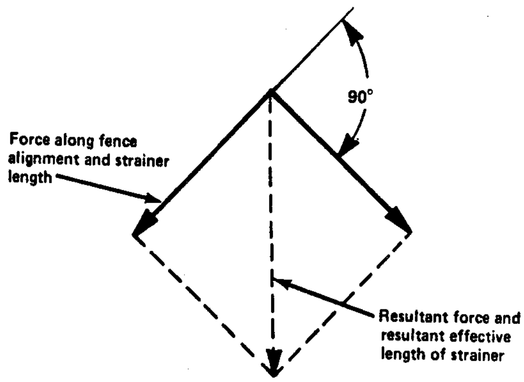

Figure 4.--At a 90-degree corner, the resultant force and the resultant effective length of the strainer is about 50 percent greater than the strainer assemblies in alignment with the fence.

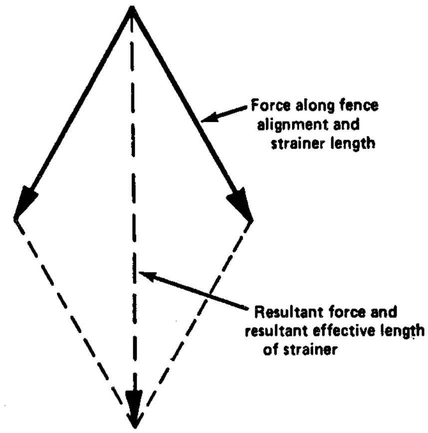

Figure 5.--When the fence corner is less than 90 degrees, the resultant force and resultant effective length of the strainer assembly become much greater than the strainers in alignment with the fence.

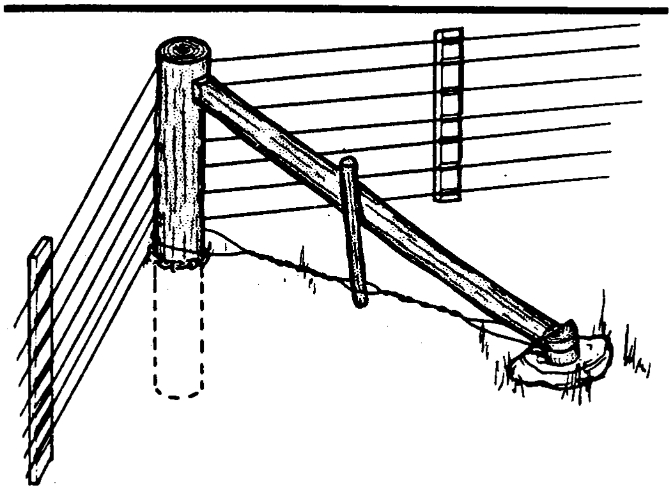

Figure 6.--One diagonal strainer used for a corner brace in a dog leg.

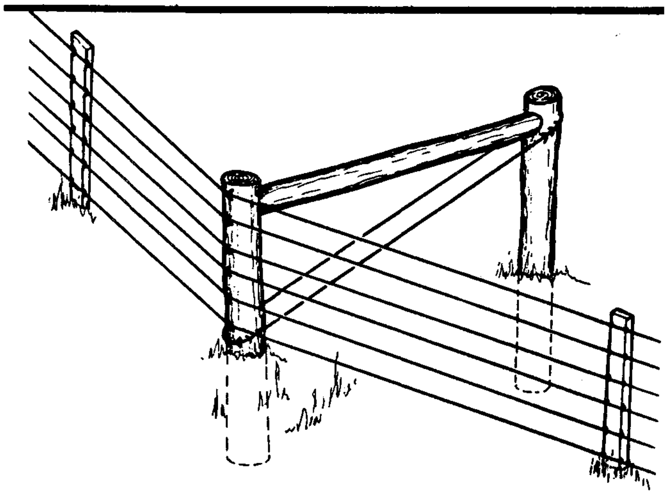

Figure 7.--Horizontal strainer bisecting the angle of a dog leg.

longer than the critical length of the strainer (see figure 6). A horizontal strainer also works (see figure 7), but the diagonal strainer is the easiest to install and costs less.

The diagonal strainer is equal in strength and holding force to a horizontal strainer. It is important to make a strainer as long as possible for best holding and to avoid blocking the end of a diagonal strainer on the ground by a stake or post. Be sure that the diagonal end on the ground is free to move in the direction the diagonal is pointing.

Several other methods have been used to make the effective length of the strainer greater than the critical length at a dog leg:

(1) Ending the fence with an end or gate strainer and starting in the new direction, also with an end or gate strainer (see figure 8).

(2) Installing four- or six-panel strainer assemblies to increase the effective length beyond the critical length (see figure 9).

(3) Installing a deadman anchor tieback (see figure 10).

These methods do work, but generally are more costly to install than a single diagonal strainer. A single diagonal strainer is easy to install and works very well in repairing or correcting an impending fencepost pullout problem at a dog leg.

SUMMARY

Fence failures at dog legs are caused when the resultant effective strainer length is less than the critical length (usually 6 to 8 feet, but sometimes as long as 10 feet for a 4-foot fence). Bisecting the dog leg angle with a diagonal strainer longer than the critical length can eliminate pullout problems at dog legs. If the dog leg angle is 60 degrees or less, use a single strainer bisecting the dog leg angle (see figure 11). If the fence change of direction angle is greater than 60 degrees, use either a single strainer or two strainers.

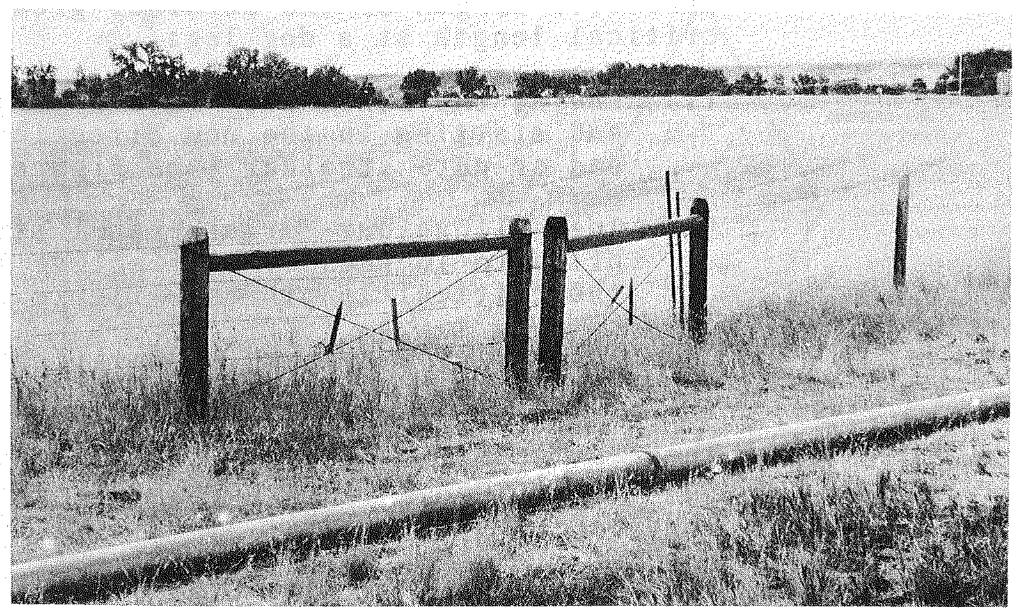

Figure 8.--Fence failures at dog legs can be eliminated by ending the fence with an end or gate strainer and starting in the new direction with an end or gate strainer. Either a horizontal or diagonal strainer can be used, for both are equal in strength and holding force.

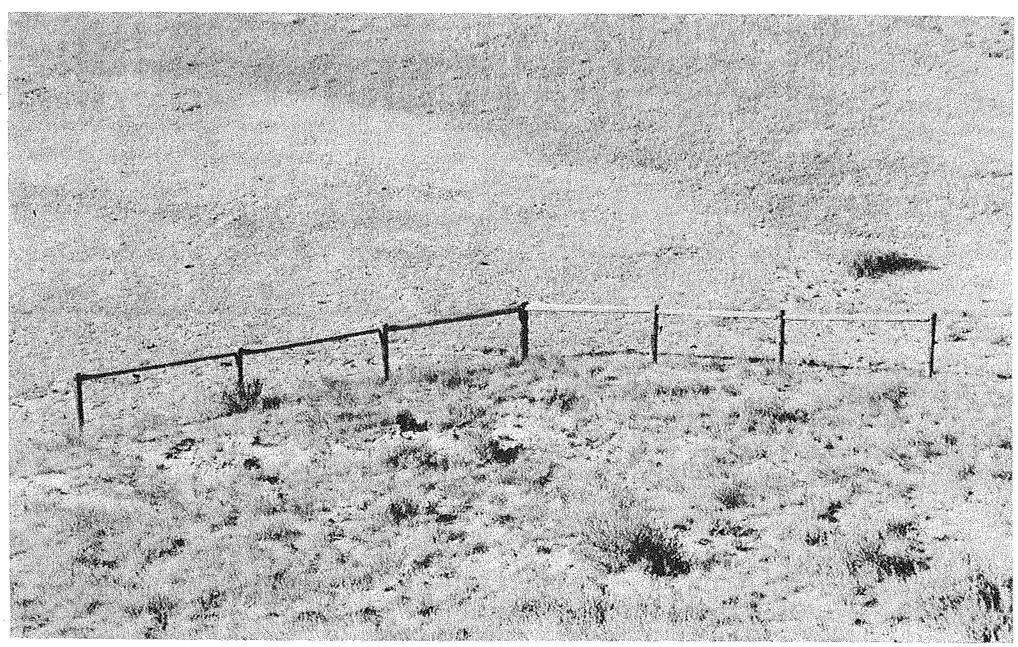

Figure 9.--A six-panel strainer assembly used to increase the effective length of a strainer beyond the critical length at a dog leg.

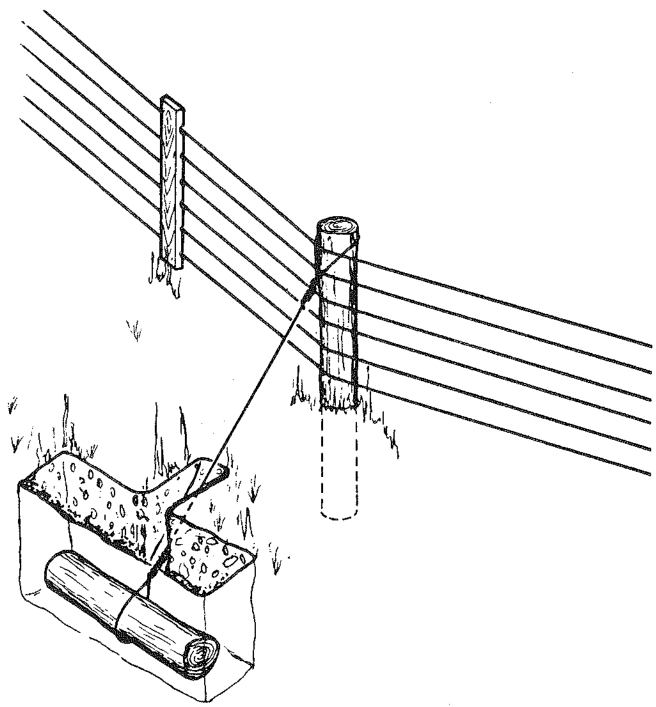

Figure 10.--Installation of a deadman anchor tieback to prevent fence failure at a dog leg by fencepost pullout.

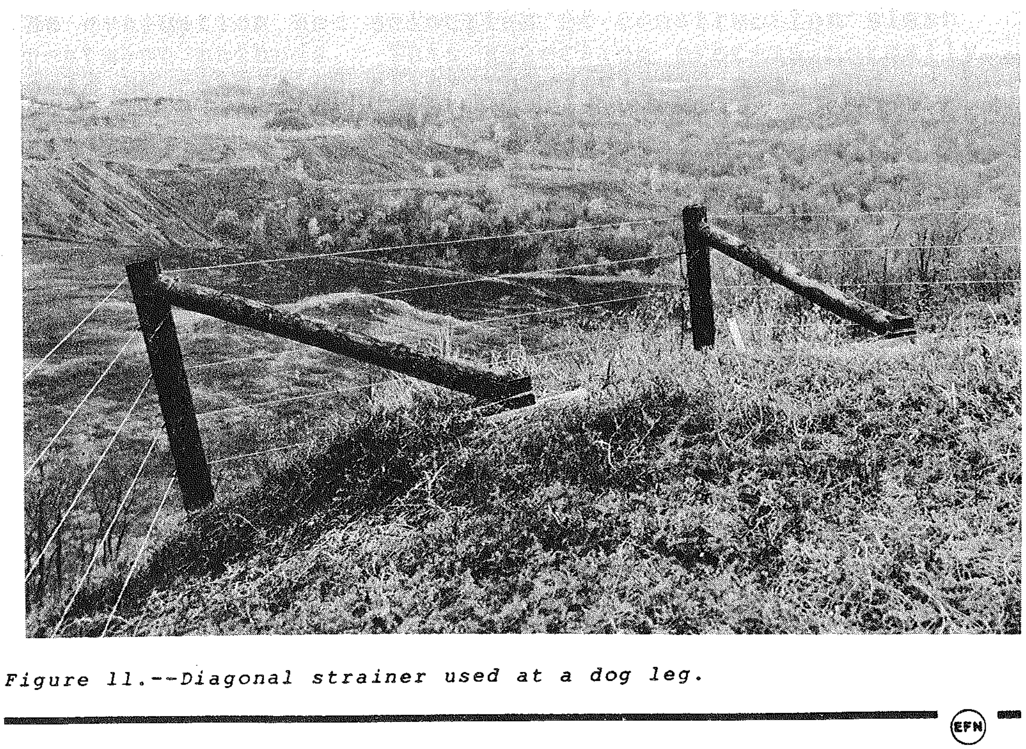

Figure 11.--Diagonal strainer used at a dog leg.

Selecting Construction Slash Treatment Methods

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INTRODUCTION

Road construction slash is vegetative material that does not meet utilization standards, such as logs, limbs, tops, brush, and grubbed stumps associated with the construction or reconstruction of a facility. The Forest Service publication Standard Specifications for Construction of Roads and Bridges (EM-7720-100LL, 1985) lists 12 methods for treating construction slash. The selection of one or a combination of treatment alternatives for an area, project, or road is a process that requires the evaluation of a variety of interacting factors. The difficulty in evaluating these factors and their interaction can result in the responsible line officer selecting alternatives based more on personal desires or traditional treatments than on objective analysis. The purpose of this article is to provide a structured process that will assist and document the evaluation and selection of construction slash treatment methods. This selection process normally would be completed after the environmental and planning documents have been completed. However, if construction slash disposal is critical to environmental considerations, it may be necessary to complete this evaluation during the NEPA process.

CONSTRUCTION SLASH TREATMENT METHODS

The following is a list of 12 specific methods for the treatment of construction slash. Regions also may develop Special Project Specifications to provide optional treatment methods for objectives and design criteria that are unique to individual roads.

(1) Windrowing Construction Slash. Unless specified otherwise in the Special Project Specifications, the contractor shall meet the following requirements. Areas used to windrow construction slash shall be cleared to accommodate the windrow. Construction slash shall be placed outside the roadway in neat, compacted windrows laid approximately parallel with and along the toeline of

embankment slopes. The top of windrows shall not extend above the subgrade. All material in the windrow shall be matted down with construction equipment to form a compact and uniform pile. Windrows shall have 16-foot minimum length breaks at least every 200 feet. Windrows shall not be placed against trees. A pioneer road may be constructed to provide an area for placing windrows, provided the excavated material is kept within the clearing limits and does not adversely affect the road construction.

(2) Windrowing Large Material. Construction slash 10 inches or more in diameter at the small end and 6 feet or more in length shall be windrowed as in (1) above. Smaller material shall be treated by one or more of the other included methods for slash treatment.

(3) Windrowing and Covering. Construction slash shall be placed and compacted as in (1) above and shall be covered with at least 6 inches of rock and soil to form a smooth and uniform windrow.

(4) Scattering. Unless specified otherwise in the Special Project Specifications, the contractor shall meet the following requirements. Construction slash shall be scattered outside the clearing limits without damaging trees. All logs shall be limbed. Logs and stumps shall be placed away from trees, positioned so they will not roll, and not placed on top of one another. Other construction slash shall be limbed and scattered to reduce slash concentrations.

(5) Burying. Construction slash shall be buried at the locations shown on the drawings and designated on the ground. Construction slash shall be matted down in layers and covered with at least 2 feet of rock and soil. The final surface shall be smoothed and sloped to drain.

(6) Chipping. Construction slash up to at least 4 inches in diameter and longer than 3 feet shall be processed through a chipping machine. Chips shall be deposited on embankment slopes or outside the roadway to a loose depth not exceeding 6 inches. Minor amounts of chips may be permitted within the roadway if they are thoroughly mixed with soil and do not form a layer.

(7) Piling and Burning. Construction slash shall be deposited in areas shown on the drawings and designated on the ground. Piles shall be constructed so that burning does not damage standing trees. If burning is incomplete, the slash remaining shall be piled and burned until pieces are reduced to less than 3 inches in diameter and 3 feet in length. These pieces shall then be scattered.

(8) Decking Unmerchantable Material. Logs not meeting utilization standards in subsection 201.03 of Standard Specifications for Construction of Roads and Bridges and other material that exceeds the diameter and length shown in the Special Project Specifications shall be decked in areas shown on the drawings. Other locations may be approved by the Engineer.

Material shall be cut into lengths not to exceed 32 feet and all limbs removed. Decks shall be stable and free of brush and soil. Other material shall be treated according to slash treatment methods shown on the drawings and in the schedule of items.

(9) Disposal in Cutting Units. Construction slash from within cutting units and 200 feet adjacent shall be disposed of with logging slash. Such construction slash shall be deposited at least 50 feet inside the cutting unit boundary in such a manner that it will not inhibit logging the unit and that it may be treated by the prescribed logging slash treatment method.

(10) Removal. Construction slash shall be removed or hauled to locations shown on the drawings and designated on the ground.

(11) Piling. Construction slash shall be piled in areas shown on the drawings and designated on the ground for later burning or disposal by others. Piles shall be placed and constructed so burning will not damage remaining trees. All stumps shall be reasonably free of dirt. Unmerchantable logs shall be cut into lengths less than 20 feet before placement in the pile.

(12) Placing Slash on Embankment Slopes. Construction slash shall be placed on completed embankment slopes to reduce soil erosion where shown on the drawings. Construction slash shall be

placed as flat as practicable on the completed slope. Slash shall be placed from the toe of the embankment to a point at least 2 feet below subgrade elevation. Priority for the use of available slash shall be given to through fills, inside of curves, and ditch relief outlets.

DESIGN CRITERIA

Disposal methods that best meet land management needs can be selected only by thoroughly considering design criteria established for a particular area or project. Design criteria, as defined in FSH 7709.56, Chapter 4, include requirements such as economics, resource management objectives, road management objectives, safety requirements, and traffic characteristics. The following is a list of the nine design criteria outlined in Chapter 4.

(1) Resource Management Objectives. These objectives provide information on the type and extent of activities the road will serve, give a general idea of location needed, identify project limits related to resources, and provide operation and maintenance objectives.

(2) Environmental Constraints. These may define limits relative to the location and traveled way, identify sensitive soils areas, identify wildlife and fisheries sensitivities, indicate that treatment is needed on exposed surfaces and roadsides, and identify visual quality concerns.

(3) Safety. Safety affects the selection of geometric elements and design speed, requires the examination of possible hazards and corrective actions needed, and identifies the needs for traffic service and control and maintenance activities.

(4) Physical Environmental Factors. These are factors (such as topography, climate, and soils) that affect the road location and normally affect the alignment, gradients, sight distance, road template, slope selection, drainage, and pavement structure.

(5) Traffic Requirements. Volume, composition, and distribution are elements of traffic criteria used in the design of turnouts, road widths, surfacing, safety features, and traffic control. Design vehicles and critical vehicles are design criteria selected from the composition of traffic.

(6) Traffic Service Levels. Traffic service levels describe the significant traffic characteristics and operating conditions for a road. These levels are identified as a result of transportation planning activities. Objectives are established for each road and may be expressed in terms of the areas and resources to be served, environmental concerns to be addressed, amount and types of traffic to be expected, life of the facility, and functional classification. Additional objectives concerning road management and maintenance also should be defined. These objectives must then be transformed into specific design criteria. An important element of this transformation is specifically defining the characteristics of the traffic that will use the facility. This consists of a description of the types and volumes of traffic and a general description of the road elements and the interaction between them.

FSH 7709.56, Chapter 4.1, Exhibit 1, contains descriptions of the four different levels of traffic service for Forest roads. These traffic service levels include the traffic characteristics that are significant in the selection of design criteria and describe the operating conditions for the road. The levels reflect a number of factors, such as speed, travel time, traffic interruptions, freedom to maneuver, safety, driver comfort, convenience, and operating cost. These factors, in turn, affect the following:

(a) Number of lanes.

(b) Turnout spacing.

(c) Lane widths.

(d) Type of driving surface.

(e) Sight distances.

(f) Design speed.

(g) Clearance.

(h) Horizontal and vertical alignment.

(i) Curve widening.

(j) Turnarounds.

The service levels, functional classification, and maintenance levels can be related, but are not totally dependent on each other and can have a wide variety of combinations.

(7) Vehicle Characteristics. Vehicle characteristics describe the physical characteristics of vehicles using the road.

(a) Design Vehicle. The vehicle frequently using the road that determines the minimum standard for a particular design element. No single vehicle controls the standards for all the design elements for a road. Determine the maximum and minimum standards from the type and configuration of the vehicles using the road. Analyze each design element to determine which vehicle governs the standard for that element.

(8) Road User. The selection of the design elements and standards should be based on a road user (design driver) who is considered a safe and prudent driver. This does not imply that all drivers are familiar with the type or environmental setting of the road.

(9) Economics. Economics is a basic factor in the determination and selection of alternative standards. Develop standards from traffic analysis data projected from the date of completion to the end of the planned use period. The analysis discount rates are established in FSM 1971.51. Study criteria for varying use periods, normally ranging from 5 to 25 years, with interest based on current indicators such as the consumer price index or projections from recognized sources.

Design Forest Development Roads to serve the projected traffic requirements at the lowest cost for transportation (lowest total for construction plus maintenance and user costs) consistent with environmental protection and safety considerations.

Design criteria often found in environmental and planning documents that relate to slash disposal are minimal cost, visual quality, wildlife habitat, stream and lake protection, soil protection (erosion and organic content), nonproductive land, fuel loading and wood residue utilization (fuelwood). Some criteria may not be in environmental and planning documents as they apply more to the physical characteristics of specific sites. Examples of these are ground slope, available disposal areas, tree density, tree damage, and other activities in disposal areas. They may limit disposal options only on specific roads or road segments.

The success of selecting slash treatment methods that best fit land management needs depends in part on how well the land manager has prescribed design criteria for evaluating the different treatment alternatives. Land managers must be aware of the importance of fully described design criteria in the appropriate documents. Design criteria should be as flexible as possible and consistent with management needs to allow evaluation of a range of alternative treatment methods.

Sources of design criteria frequently are Forest land and resource management plans, environmental impact statements and environmental assessments, and planning documents such as transportation plans and project plans. Before the evaluation, research all environmental and planning documents pertaining to the project and extract and document the applicable design criteria. Whatever the document design criteria format, record the criteria and the source of this criteria. If the person responsible for the road design does this task, that individual will have the opportunity to become fully familiar with the issues, concerns, and opportunities pertaining to the project. Figure 1 is an example of a form for recording this criteria. The responsible line officer should approve design criteria used in the evaluation.

EVALUATING SLASH TREATMENT ALTERNATIVES

An interdisciplinary (ID) team should evaluate slash treatment alternatives, except in cases where design criteria clearly make it unnecessary.

A variety of effective methods can be used to evaluate disposal alternatives using design criteria. Methods that numerically evaluate and rank alternatives, such as the Tradeoff Evaluation Process and the Kepner-Tregoe Process, are popular decisionmaking tools. They handle the information systematically and easily display the evaluation. Although this article presents one method of evaluating and ranking

ROAD DESIGN CRITERIA

ROAD(S) ____________________

1. Source Document: ____________________

   Criteria: ____________________

   ____

2. Source Document: ____________________

   Criteria: ____________________

   ____

3. Source Document: ____________________

   Criteria: ____________________

   ____

4. Source Document: ____________________

   Criteria: ____________________

   ____

5. Source Document: ____________________

   Criteria: ____________________

   ____

Documented: ____________________ Date ________ / ________

Approved: ____________________ Date ________ / ________
Line Officer

Figure 1.--Road Design Criteria form.

treatment methods, it is not intended to discourage the user from using other, more familiar evaluation techniques.

Figure 2 shows a form that can be used in evaluating and ranking slash treatment alternatives. The following are instructions for using this form:

(1) List the approved design criteria in the columns at the top of the form. If the ID team recommends design criteria in addition to those recorded from environmental and planning documents, add the criteria to the existing list.

(2) List all viable slash treatment methods in the left-hand column.

(3) Some environmental or physical constraints in specific areas of the project may preclude the use of some disposal options. Examples of these are requirements in an environmental assessment that slash material may not be disposed of within 100 feet of streams and that construction equipment shall not be operated outside clearing limits on slopes in excess of 40 percent. List these constraints in the right-hand column of the form to assist the ID team in selecting alternatives.

(4) Establish the relative importance of each criterion. Often, a numerical scale assigns the highest number to the criterion of most importance. Similar numerical weights may be assigned to different criteria. Display the criterion weight number on the Criteria Weight line.

(5) Rate the slash treatment methods against the criteria using a numerical rating. Again, use a numerical scale with the largest number indicating the method that best serves the criteria objectives. This numerical scale may be the same as that used to weigh the criteria. Ignore the numerical weight assigned to the criteria during this exercise. Develop evaluation criteria or other supporting information for each criterion to determine the rating for each treatment alternative. For example, fuel loading could be rated on a scale based on tons per acre, and nonproductive acres could be based

CONSTRUCTION SLASH TREATMENT ALTERNATIVE EVALUATION

ROAD(S) 107, 1047, 1048, 1137, 1183

CONSTRUCTION SLASH TREATMENT METHODS	APPROVED DESIGN CRITERIA: MINIMIZE COST	VISUAL QUALITY	SOIL EROSION	FUEL LOADING	NONPRODUCTIVE LAND	WILDLIFE HABITAT	FUELWOOD				TOTAL NUMERICAL VALUE	RANKING	TREATMENT NUMERICAL RATING (4) / CRITERION WEIGHT (6) / WEIGHTED NUMERICAL VALUE (24)
CRITERIA WEIGHT →	9	2	6	4	3	3	9						CONSTRAINTS
WINDROWING (1)	8/72	3/6	7/42	3/12	4/12	6/18	↓				162	1	
WINDROW & COVER (3)	5/45	6/12	6/36	7/28	5/15	3/9	↓				145	4	
SCATTERING (4)	7/63	3/6	4/24	4/16	6/18	5/15	↓				142	5	EQUIPMENT PROHIBITED ON SIDESLOPES OVER 40%
BURYING (5)	5/45	8/16	4/24	8/32	8/24	2/6	↓				147	3	"
CHIPPING (6)	3/27	7/14	7/42	6/24	7/21	2/6	↓				134	6	
PILING (11)	6/54	5/10	5/30	5/20	5/15	8/24	↓				153	2	"
PLACE ON EMB. (12)	3/27	3/6	8/48	4/16	6/18	5/15	↓				130	7	
DECK UNMERCH. (8)	USE	ON	ALL	OP	TIONS								
													NO SLASH WITHIN 100 FEET OF STREAMS

I.D. TEAM RECOMMENDED ALTERNATIVE: DECK UNMERCHANTABLE (8) FOR FUELWOOD, WINDROW REST OF SLASH (1) DATE 7 / 30 / 85

LINE OFFICER APPROVED ALTERNATIVE: ID TEAMS ALTERNATIVE

SIGNATURE: Allen Jones District Ranger DATE: 8 / 2 / 85

Figure 2.--Example Construction Slash Treatment Alternative Evaluation form.

on acres per mile. Table 1 is a rating chart that the Willamette National Forest in Region 6 uses to evaluate slash disposal methods. On the form, the treatment method numerical rating for each design criterion is displayed above the diagonal line for each treatment method.

(6) Multiply the numerical weight for each criterion by the rating of the particular treatment method to get the weighted numerical value of each alternative. This numerical value is displayed below the diagonal line for each treatment method.

(7) Obtain the total numerical value of each alternative by adding the weighted numerical values of all the design criteria for that alternative.

(8) Give the alternatives a relative ranking with the highest number for the apparent favorable alternative.

SELECTING SLASH TREATMENT ALTERNATIVES

The ID team should identify the slash treatment alternatives it recommends. If the recommended alternative differs from the ranking, the team should document reasons. If the recommendation is conditional, the team should provide those conditions and the reasons for them. The responsible line officer then selects an alternative. If this alternative is different from the ID team's recommendation, the line officer should document the reasons for selecting a different alternative.

CONCLUSION

This article presents one method of numerically evaluating and ranking construction slash disposal methods for a particular area, project, or road. Other methods also can be effective in this evaluation. Whatever method is used, it should provide a logical and sound approach to evaluating and ranking the alternatives against given criteria and an understandable format for documenting this evaluation and ranking. This article is only a tool that can assist in the decisionmaking process--it is not the final answer. The responsible line officer must make the final decision based on the results of this evaluation and good judgment.

Table 1.--Rating chart for evaluating slash disposal methods.

Decision Criteria		Project Rating
Visual		General Forest 0-4 Scenic II 5-8 Scenic I 9-10
Cost		B/C = MMBF (T.S.) x $250 + ADT x $5 / Road Cost B/C = 0-4; 7-10 B/C = 5-10; 3-6 B/C = 10; 1-2
Fire Fuel Loading		25 Ton/Ac 0-4 25-45 Ton/Ac 5-8 45 Ton/Ac 9-10
Land Out of Production		0-3 Ac/Mi; 0-3 Years 1-3 3-6 Ac/Mi; 3-6 Years 4-7 6 Ac/Mi; 6+ Years 8-10
Safety	Stem Size	18" d.b.h. Stump Size 24" 1-4 18"-30" d.b.h. Stump Size 24"-40" 5-8 30" d.b.h. Stump Size 40" 9-10
Smoke Management		
Proximity to developments	100	PAOT 8 miles away 8-10 9-20 miles away 7-5 20 miles away 4-0

The First Nationwide Forest Service Remote-Sensing Workshop: A Significant Step Into the Future

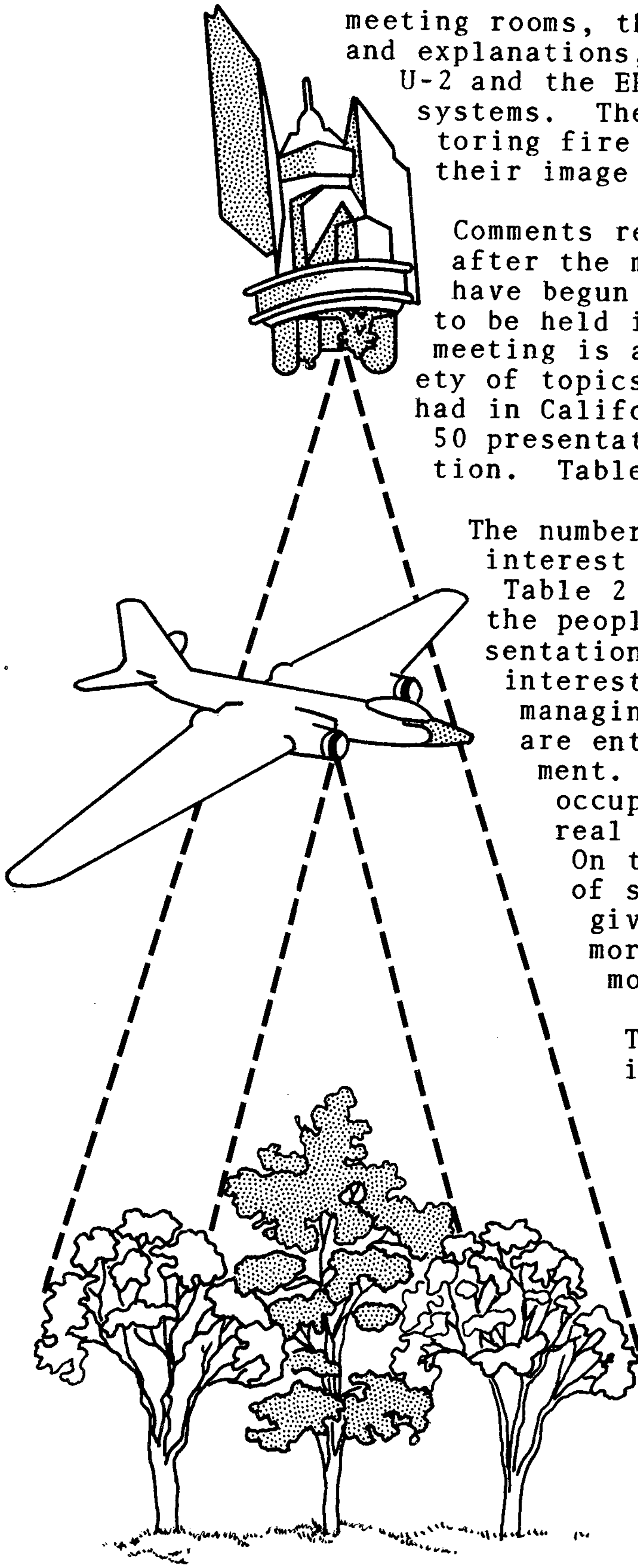
Jerry D. Greer
Workshop Chairman & Project Leader
Nationwide Forestry Applications Program

During the week of April 7, 90 people from across the Nation assembled near San Francisco to share ideas about remote sensing in resource management. This meeting grew out of a recognition that transferring remote-sensing technology is a critical issue. The meeting's objective was to provide a forum for sharing ideas, knowledge, and needs.

Attendees included representatives from Ranger Districts, Supervisors' Offices, Regional Offices, and the Washington Office. Two Forest Supervisors, Ed Schultz and Jim Berlin, and the Region 3 Regional Forester, Sotero Muniz, attended. They presented some challenges to the technical people and provided a valuable sense of direction to those of us who are charged with implementing new technology. During the session, those who made presentations explained some of the capabilities of remote sensing, reported on some ongoing projects, and showed how to use various remote-sensing products.

Three presentations made by the line officers who attended made this meeting different from other similar meetings. Technical people no longer have the freedom to pursue just anything of interest; now we must address only the problems of highest priority. Limited time, budgets, resources, and people dictate that we work to meet officially stated needs. The message from the line officers reinforced this and encouraged us to find out the real information needs of line officers and to reach out and give help where we see the need. We were told that we can improve the way we deliver our products and make remote sensing less mystic and more acceptable to managers who are not familiar with it.

The High Altitude Group hosted and cosponsored the meeting at the NASA Ames Research Center at Moffett Field, California. Besides providing logistics and



meeting rooms, they filled a day with presentations and explanations, including guided tours to see the U-2 and the ER-2 aircraft and associated sensor systems. They also explained their work in monitoring fire behavior, their GIS system, and their image archival and retrieval method.

Comments received from participants during and after the meeting were very encouraging. We have begun to plan a possible second meeting to be held in the spring of 1988. If the meeting is approved, we will hope for the variety of topics and broad representation that we had in California. The papers and talks from the 50 presentations will be published for distribution. Table 1 lists most of the topics covered.

The number of groups represented indicates the interest in this first nationwide meeting. Table 2 contains the affiliations of most of the people who attended. Such broad representation indicates that there is great interest and support for improved methods in managing Forest and range resources. We are entering a new era in resource management. Satellites and the permanently occupied space station now have a very real place in our vocabulary and plans. On the ground, computers and many kinds of sophisticated remote-sensing devices give daily aid to managers who must do more work with fewer people and less money.

Technical ability and professionalism have found a place together in the field and the office. The prospects for the future will depend upon the continued mixing of abilities between management and information gatherers. This meeting was a significant step into the future for a group of people who work hard to solve increasingly complex problems. EFN

Table 1.--Topics discussed at the workshop.

1. The State of the Art in Remote Sensing
2. The GSC Autocartography and Support Programs
3. National Coordination for the Forest Service Remote Sensing Program
4. NFAP Program Support
5. GIS: Making Remote Sensing Data Meaningful
6. The NASA Ames Research Center Operation
7. NFAP Support in Training
8. Remote Sensing in the National Park Service
9. Aerial Photography in Forest Inventory and Assessment
10. Using Aerial Photos To Determine Hardwood Crown Cover
11. How To Get Landsat Imagery
12. How Color Infrared Camera and Film Systems Work
13. How Reconnaissance Cameras Work
14. How Electronic Imaging Systems Work
15. Locating Buried Gravel Deposits With Thermal Sensors
16. Three Challenges to Technicians From Line Officers
17. Remote Sensing Used in the Intermountain Station Forest Inventory and Assessment
18. Applying Technology to Land Management Planning Problems
19. A New Way To Assess Imagery Scale Needs
20. The NASA Airborne Instrument Research Program
21. Using Archived Imagery To Monitor Historic Acid Disposition Trends
22. Monitoring Smoke Dispersal on Controlled Burns
23. Vegetative Typing Using Remote Sensing
24. The Effects of Leaf Area Index and Plant Biochemistry on Scanner Responses
25. The U-2 and ER-2 Aircraft and Sensor Systems
26. A Geographic Information System in Use at NASA Ames
27. How NASA Retrieves Specific Imagery from the Archive
28. Using Multispectral Scanner Data in Wildfire Analysis
29. Sensors and Data Systems for the Space Station
30. Spruce Decline, Southern Pine Beetles, and Mapping Mortality
31. Interpreting Color Infrared Imagery to Detect Pest Damage in Canada
32. Using Satellite Data in Timber Management in California
33. Using Photos and Digital Data to Map Wildlife Habitat on the San Juan National Forest
34. Using High-Altitude Color Infrared Photos To Map Riparian Areas
35. Detecting Change Using Aerial Photography
36. How To Integrate Data and Extract Resource Information
37. Using Landsat Data for Fire Management Planning and Dispatch
38. Making GIS Fit the Needs of the User
39. Evaluating Slope Stability With Computer Enhanced Images
40. The Utilization Guide for Aerial Photography
41. Remote Sensing in the Bureau of Land Management
42. The Alaska Four-Level Inventory

Table 2.--Groups and units represented at the meeting.

1. USDA FS WO (Engineering, Timber, Fire)
2. USDI Bureau of Land Management
3. USDI National Park Service
4. NASA Ames Research Center
5. Forest Inventory and Assessment, Southeastern Station
6. FS Research, Northeast Station
7. The EOSAT Corporation
8. FS R-3 (Regional Forester, Geometronics Ldr., Timber, Wildlife, I&DC)
9. FS R-9 (Geometronics Leader, Engineering)
10. FS R-2 (Geometronics Leader)
11. FS R-4 (Geometronics Leader)
12. FS R-1 (Geometronics Leader)
13. FS R-5 (Geometronics Leader, Timber, LMP, Engineering)
14. FS R-8 (Geometronics)
15. FS R-6 (Geometronics Leader)
16. FS R-10 (Geometronics Leader)
17. Nicolet National Forest (Forest Supervisor)
18. Forest Inventory and Assessment, Intermountain Station
19. Apache-Sitgreaves National Forest (LMP)
20. Lockheed Corp. (Environmental Protection Agency, Las Vegas)
21. FS Pacific Southwest Fire Laboratory
22. University of California, Santa Barbara
23. FA Methods Applications Group, Fort Collins, Colorado
24. FS Pacific Southwest Experiment Station
25. University of British Columbia, Canada
26. San Juan National Forest (Range and Wildlife Management)
27. USDA Soil Conservation Service
28. Bighorn National Forest (Forest Supervisor)
29. The General Electric Company
30. International Imaging Systems
31. Flathead National Forest (Geometronics-GIS)
32. The Spot Image Corporation (US Representatives for the French Corporation)
33. Okanogan National Forest (Fire Management)
34. Forestry Data Consultants
35. FR R-5 Geotechnical Engineering Center
36. Santa Fe National Forest (Fire/Soil & Water)
37. Forest Inventory and Assessment Pacific NW Experiment Station, Alaska
38. FS WO Geometronics Service Center (Manager)
39. FS WO Nationwide Forestry Applications Program
40. Sylvan Services
41. Ishikawa PI Contracting
42. FS WO Missoula Equipment Development Center
43. Klamath National Forest

Table 2. (cont.)--Groups and units represented at the meeting.

44. Los Padres National Forest
45. Angeles National Forest
46. Siuslaw National Forest
47. FS Research, NE Experiment Station, Syracuse University, New York
48. The State of California
49. Technicolor, Inc.
50. The country of Morocco
51. Terra-Mar Corporation
52. Dipex, Inc.
53. Imagineering Systems, Inc.

RTIP Bulletin Board—What's New?

Chris Schwarzhoff
Civil Engineer
Washington Office Engineering

By the time this article is published, we expect most users will be switched over to accessing RTIP by TELENET. Our TELENET address is 31107030060 and you can call the Bulletin Board by entering TC/P RTIPS from CLI when using the Data General. We will continue to maintain dial-up access, and now support 300, 1200, and 2400 baud (FTS 235-3573). Please call the RTIP Bulletin Board or Connie Connolly (235-3111) if you have any trouble.

There have been a number of new files added to the download section of RTIP since the last listing in Engineering Field Notes. To get a complete listing of all the files available or an update at any time, call RTIP and select the N (new) option once you are in the files section. RTIP will then display the last time you asked for a files listing and ask if you want to use this as a cutoff date for a new listing. At this point, you have the option of entering another date. If you would like a complete listing, just give it an older date (for example, January 1, 1984) and a listing of all files in the system since that date will be scrolled on the screen. We highly recommend that you capture the listing to a file for later review. If you are coming in on the DG using TTY, you can accomplish this easily by striking Function Key 14 or by striking CTRL-D followed by LOG FILENAME (FILENAME is any name you wish to use) when using TC.

The balance of this article is a listing of new files and updates.

DIRECTORY 1—PROGRAMMING AIDS

Help for BASICA Programmers

ADVBAS20.ARC. This is an OBJ file that adds many features to the MICROSOFT QUICKBASIC and IBM BASIC (version 2.0) compilers. It is hard to imagine why MICROSOFT did not include them in the compiler library.

QBX130.ARC. Cross-reference program for BASIC programs that do not use line numbers or labels for each line of code.

Help for PASCAL Programmers

BOOSTERS.ARC. A large collection of Turbo Pascal subroutines to make screenbuilding and menu-making easier.

TPTUTOR.ARC. A new tutorial for Turbo Pascal.

General Programming Aids

CHASM.ARC. Assembler--used by lots of folks. See article in February issue of PC Tech Journal.

DIRECTORY 2—DATA BASE MANAGEMENT

FE370-1.ARC and FE370-2.ARC. Updated and improved version of the powerful file management program FILE EXPRESS (version 3.70).

DIRECTORY 4—DISK MANAGEMENT

IBU.ARC. A file copier that makes the chore of copying files and rearranging disk directories easy.

FMT.ARC. Makes the process of FORMATTING disks at least five times faster.

FILER.ARC. Gives side-by-side comparison of file directories from different disks or subdirectories.

FCONSOLE.ARC. This is version 1.15F of the popular Console and Bias Driven FANCY CONSOLE.

G-WHIZ.ARC, DOSAMATC.ARC, and WFU.ARC. Three command shell programs that make it easy for beginners (and old hands, too) to execute programs from a hard disk. All are good, but for me WFU.ARC is best.

DIRECTORY 5—FINANCIAL, ECONOMIC, & STATISTICAL

FCALC103.ARC. Version 1.03 of the popular program Free Calculator to compute discount values and cash flow problems.

ECSTAT.ARC. This is a new, extremely easy-to-use statistics program.

ENGRECON.ARC. Very well-done engineering economics program. Patterned after approach used in the Engineering Economics textbook by Grant and Ireson. Should be useful for transportation planners in comparing alternatives and road operations engineers in evaluating economics of road disinvestment.

DIRECTORY 6— HIGHWAY ENGINEERING APPLICATIONS

NETANAL.ARC. Uses LOTUS 1-2-3 to find minimum path through a network.

FPMS.ARC. This is a micro version of the California Highway Department's Flexible Pavement Management System. Outstanding program for evaluating and prioritizing maintenance and reconstruction needs for flexible pavements. Could be a useful tool for Regional priority setting.

GANTT.WQS. Uses LOTUS 1-2-3 to prepare project management GANTT charts.

GANTT.ARC. The ultimate GANTT chart display--it expands and compresses the display.

PCSTABLE4. This is currently the very best public domain slope stability analysis for the IBM-PC. Can use sliding block, irregular, or circular sliding surfaces; and tie backs are allowed. Optional plot output to HP 7470A plotter.

PACE.ARC. Cost estimating using people/materials approach. Written by John Sessions. It is menu-driven and very easy to use.

SDMS.ARC. This is a micro version of the Surfacing Design and Management System currently running at Fort Collins.

SURVTRAV.ARC. Traverse reduction and plotting by Bob Echols on the Monongahela National Forest for HP 150.

HANS_ON.ARC. This is an updated version of the popular road design program by Marty Hanson (5/2/86).

ELSYM5.ARC. This is micro version of "tried-and-true" mainframe program ELSYM5. Analysis of 3-dimension idea elastic layer systems, with a much improved user interface as compared to mainframe version.

DIRECTORY 8— TELE-COMMUNICATIONS

QMODEM.ARC. This is version 2.0 of the popular QMODEM program which supports script files. (I still use PIBTERM.)

QFONE212.ARC. Utilities to edit, sort, and print the QMODEM (version 2.0) phone directory.

PCSIG433.ARC. All the files necessary to develop a DG to micro Kermit file transfer system (includes FORTRAN source for DG side).

MDM150.ARC. Updated (4/30/86) telecommunications program for HP-150. If you have nothing and want to get started, try sending a blank disk to Marty Hanson in Region 9.

DIRECTORY 9— UTILITY PROGRAMS

DP102A.ARC. This program works like the commercial program OPTIMIZER to eliminate fragmented files on 10-megabyte hard disks.

SCP35.ARC. Super-easy-to-set-up menus for accessing files on hard disk.

TSRSRC.ARC. Purge memory resident programs like Sidekick and Superkey without booting system.

UPDATE23.ARC. If you don't have the program FASTBACK, then you really should have a copy of UPDATE23. Makes updating and backup of hard disk simple, fast, and automatic. Takes a little work to set up the first time.

DIRECTORY 10— WORD PROCESSING

PCWRT26.ARC. Version 2.6 of the famous word processor PCWRITE.

PC-OUTLN.ARC. Outstanding program for report outlining. Use to record notes for later analysis or preparation of reports, letters, action plans, and so forth. If you are fortunate enough to have a computer available for recording notes during a meeting, this program would be fantastic.

Spell Checkers

TSPELL.ARC. Very easy-to-use spell checker for ASCII and WORDSTAR files.

Text Editors

QEDIT125.ARC. Updated version of text editor QEDIT (3/26/86).

DIRECTORY 11— GRAPHICS PROGRAMS

PC-PEN.ARC. Very nice drawing program in BASIC. Source code is provided so may be useful as subroutine for other programs. EFN

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Engineering Technical Information System

The Series:

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. Articles are usually less than six pages, and include material that is not appropriate for an Engineering Technical Report, or suitable for Engineering Management publications (FSM 1630 and 7113).

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R-8 Jim Gilpin
R-9 Fred Hintsala
R-10 Ron Hayden
WO Al Colley

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