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Engineering Technical Information System

It's A Good Time

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Now is a good time to be working in engineering, geospatial, remote sensing, and technology development. As both a statement of fact and a view of the future, I hope it is a point of view you can identify with and share.

We have a long list of successes this year—restoration projects, road condition surveys, financial reports, road decommissioning projects, expanded use of Geographical Information Systems (GIS), and growth in the use of remote sensing. You have done and continue to do some remarkable work. I have seen your work on graveling operations on the Dixie National Forest and in the high-quality, very detailed maps produced for the Roadless Team by teamwork between the forests and the Geospatial Service and Technology Center (GSTC). The use of GIS in production of the maps was an excellent example of applied GIS. If I had to voice a complaint, it would be that some of you are reluctant to exercise well-earned and much deserved "bragging rights" to your accomplishments over the past months.

Water/Roads Interaction is a topic in this issue of *Engineering Field Notes* that represents one of the positive changes coming from our technology development efforts. Working in partnerships, working on teams, and working with others is a common work style for many of you, and it is a trend that is likely to continue.

Two other continuing trends are the increased participation in Forest Service activities by regulatory agencies and higher standards of process and performance for our operations and maintenance. Plans for developing and executing maintenance, construction, and repairs will need to reflect these evolving standards and greater precision in performance. The bar is always moving up, and our ability can and must move with it.

Growth areas include environmental audits, Occupational Safety and Health Administration (OSHA) compliance, new U.S. Army Corps of Engineers nationwide permit requirements, new U.S. Environmental Protection Agency (EPA) storm water requirements, Federal Highway Administration (FHWA) environmental streamlining, effectiveness monitoring of best management practices (BMP's), and public Forest Service roads. We will continue to be challenged to do more. We have good prospects to gain more future funding to address critical maintenance needs and deal with mainline roads through a public Forest Service road program. People are discovering the usefulness of GIS, and they are starting to mine our data for valuable information.

It is a good time to be working in engineering, geospatial, remote sensing, and technology development. Join me in continuing to make it a good time as we work toward our future.

Introduction of the Water/Road Interactive Field Guide

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A hard copy of the Water/Road Interaction Field Guide will be distributed to Forest Service field units in FY 00. The purpose of the guide is to:

- Provide an illustrated field-going guide of observable water/road interaction problems damaging to roads, watershed conditions, water quality, aquatic life, or public safety.
- Increase awareness of how road location, design, maintenance, and management affect interactions with rainfall, runoff, and ground water.
- Facilitate communication on water/road interaction problems among professionals and technicians in a variety of physical and biological science disciplines and fields of engineering.
- Improve recognition of basic road drainage problems and the ability to identify and verify likely causes.
- Increase awareness of possible alternative treatments to mitigate existing problems.
- Develop the knowledge and experience required to conceptualize road segment characteristics that provide desired safe access with minimal affect to watershed, water resources, and aquatic life.
- Help line officers to make informed decisions.

Many drainage problems on low-volume roads begin with surface water concentration and flow. Other problems involve road and stream crossings. The following are some contrasts illustrated by the guide between desirable conditions and those in which damage is occurring to the road and/or the watershed:

- Desired: Roadway surfaces are sufficiently drained so that water flows do not concentrate volume or erosive energy levels that may cause access, safety, maintenance, or environmental problems.
- Damaging: Roadway surfaces exhibit water concentration and erosion, with rills or gullys present over substantial areas. Wheel ruts are present in the traveled way channel flow. The road prism is entrenched into the landscape.

- Desired: Roadway surfaces are sufficiently treated so that concentrated flows do not leave the prism with volume or energy sufficient enough to create gullys to adjacent areas or other mass erosion.

- Damaging: Adjacent areas exhibit gullys that are not associated with the unroaded landscape condition. Sediment has been deposited in drainage ways and streams downslope of the road.

- Desired: Road and stream crossings are designed to adequately duplicate naturally occuring conditions for passage of water, debris, bedload, and aquatic organisms and do not exhibit diversion potential.

- Damaging: Passage of one or more of the required entities is constricted, and a diversion potential exists.

An electronic version of the draft Water/Road Interaction Field Guide is available on the San Dimas Technology and Development Center's Intranet webpage. Navigate to Engineering, then access Water/Road. The Field Guide link refers to a "work in progress."

The Water/Road Interaction Field Guide is based on observable water/road interactions in 10 major problem areas. These problem areas are:

- Surface water concentration problems on the traveled way.

- Surface water concentration problems on the back slope.

- Surface water concentration problems on the fill slope.

- Ditch or leadout ditch problems.

- Subsurface flow interception by the prism.

- Surface cross-drain failure.

- Ditch relief-culvert failure.

- Channel impacts and increased drainage density.

- Channel encroachments from road alignment in the channel and flood plain.

- Road and stream crossing problems.

These 10 problem areas contain multiple observations that are illustrated by photographs. Each observation also provides:

- Important site and road conditions.

- Some possible treatments.

- A reference and definition aid.

- A list of disciplines available to help recognize and analyze the problem.

The photographs are captioned and show two scenarios: example observations of a water/road interaction problem on the ground; and situations in which the problem could occur, but does not, due to either nature or design. This is referred to in the guide as "proper drainage provision."

Important road and site conditions are included with each observation as an aid to information gathering and to highlight critical conditions. The observer should consult with a specialist in the listed field for more information on critical conditions. The following descriptions are important road and site conditions:

- Geology—includes parent material characteristics, soil properties, and slope stability.
- Climate—takes into consideration precipitation amounts, types, durations, intensities, and ambient temperatures.
- Topography—includes landform type, shape, and relief.
- Vegetation—involves types, characteristics, and ease of establishment.
- Biology—includes plant and animal considerations affected by road drainage.
- Template—refers to back and fill slope ratios and heights; traveled way surface shape, width, and surfacing materials; presence or absence of ditches and berms; and construction methods.
- Grade—refers to road grade.
- Access—includes considerations of road location, road standard requirements, road maintenance, and vehicle requirements.
- Policy—refers to any external constraints imposed on transportation system development and activities other than those described above.

The list is included to help the observer gather and organize information on road and site conditions needed to recognize and analyze the problem. This list is not exhaustive; other conditions may apply, and required information varies considerably.

Possible treatments listed are basic configurations. Many other options and specialized treatments exist to aid in solving water/road interaction problems, but they are beyond the scope of this guide. For more information on possible treatments, the observer should consult with the appropriate discipline specialist. References are mainly related to documents in the Water/Road Interaction Technology Series binder. Basic definitions and a listing of disciplines for consultation are also provided. Disciplines include the hydrologist, biologist, geologist, forester, engineer, geotechnical engineer, and maintenance foreman, and the interdisciplinary team in general.

Table 1 gives a brief idea as to what this guide can provide and what it cannot provide.

Table 1. The Water/Road Interaction Field Guide

The Guide Is	The Guide Is Not
A mentoring, training, and general design aid for professionals and technicians in physical and biological science and engineering disciplines.	For specific design use by experienced professionals and technicians.
Designed to facilitate use of the Water/Road Interaction Technology Series.	A stand-alone document that is comprehensive in and of itself.
As simple and concise as is reasonably possible.	An expert system.
A problem recognition and analysis tool.	A problem correction tool.
For leading from observations to most likely causes or basic problems.	For jumping from observation to treatment action.
For considering alternative treatments that could feasibly correct observed road drainage problems.	For prescribing a selected treatment.
For facilitating communication and conceptual understanding among personnel.	For selecting a specific course of action.
A field-going guide on low-volume road drainage problems.	An office-bound reference.
For use within the scope of typical authority of entry level professionals.	Designed to encourage actions beyond typical authority or to bypass the decision making process.

The Arch of Middle Fork: A Trail Bridge of Distinction

Bill Renison
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Mt. Baker-Snoqualmie National Forest
(Prepared from stories by volunteers and employees)

Introduction

Several years ago a citizen of Seattle, Jack Wheeler, contacted the North Bend Ranger District with a bold proposal: using a volunteer effort to coordinate the design and construction of a trail bridge over the Middle Fork Snoqualmie River. The bridge would be approximately 150 ft in length.

Although constructing road and trail bridges of this length is not uncommon on the Mt. Baker-Snoqualmie National Forest, working with volunteers to build one would be a unique challenge. After a considerable number of meetings and subsequent negotiations, District Ranger Rudy Edwards accepted Wheeler's offer and the journey began.

Volunteer Proposal

From the early 1980's, the North Bend Ranger District had been planning and developing a trail system for the Middle Fork Snoqualmie River and two of its principal upper tributaries: the Pratt and Taylor Rivers. Planners determined that access to the Pratt Valley and the southwest portion of the Alpine Lakes Wilderness would be significantly improved with a bridge over the Middle Fork, just below its confluence with Taylor River.

The volunteers' proposal for this bridge was actually part of the district's long-term strategy. It was consistent with ongoing trail reconstruction and the construction of expanded trailhead facilities. The proposed bridge was a good candidate for the region's Challenge Cost Share Program.

Several outdoor organizations in the Puget Sound area entered into a volunteer agreement with the district for this project. Through this partnership agreement, members of these outdoor organizations provided assistance with the survey, design, foundation construction, and bridge assembly. The Weyerhaeuser Company furnished the main structural timber components for the bridge. They also provided space at one of their yards for the main span's assembly.

Jack Wheeler, a member of The Mountaineers and the Middle Fork Outdoor Recreation Coalition, became the project coordinator. He assumed the role of liaison between the volunteer groups and Mt. Baker-Snoqualmie National Forest personnel.

Jack Christiansen, a prominent Seattle engineer, designed the bridge. Excellent structural design review, geotechnical investigation, and hydrologic analysis were completed by engineers Robert Harn, Roger Lowe, and Craig Campbell, respectively.

Figure 1. *View of the bridge from upstream.*

The results of untold hours of volunteer time by a team of individuals can best be acknowledged and appreciated when viewing the completed bridge (figure 1).

In addition to extensive coordination by North Bend district employees, the Mt. Baker-Snoqualmie Forest shared in the project by:

- Completing National Environmental Policy Act (NEPA) requirements.
- Obtaining agency permits and reviewing designs.
- Preparing shop drawings.
- Providing site and control surveys.
- Drilling the core.
- Inspecting the construction.
- Giving technical support to volunteer crews.
- Furnishing connectors, cables, concrete, and miscellaneous supplies.
- Contracting for helicopter service to transport assembled bridge components.

Design

The volunteer designers developed three alternatives that were evaluated by Forest Service personnel and the volunteer groups. Design criteria included typical live loading for hiker and horse use, snow load of 100 lb per

Figure 2. *View of the arch showing the taper from the wide base to the narrow center spline.*

ft^2 (low elevation site), wind loading at 80 mi per h (exposure C), durable materials, visual consideration within the forest setting, and feasibility for construction by volunteer craftsmen. The selected alternative was a glue-lam timber arch with a clear span of 154 ft. The arch frame, somewhat atypical, tapered from a wide base to a narrow center spline section (figure 2). The arch was designed to carry the full load of a suspended timber deck and railing.

The designer, Jack Christiansen, used standard design methods for individual components as well as three-dimensional analysis for the complex arch configuration. Design reviewer Robert Harn used plane-frame analysis to review member sizes and a dynamic analysis for vibration potential. Both Harn and the Regional Office Structures Group offered valuable comments regarding connections, railing design, wood preservation, and foundation considerations.

Some of the concerns reconciled during the design review process were:

- Improving resistance to delamination of the exposed glue-lam timber arch by additional wood preservation.

- Installing a curb rail and modify the railing system to improve user safety.

- Using a heavier gauge wire rope for the suspension cables (or using rods instead, if vibrations for users are unacceptable).

- Including adjustment capability for suspension components (figure 3).

- Reviewing and addressing foundation settlement consequences.

Volunteer Craig Campbell conducted a basin and site hydrologic analysis to determine the design bridge elevation. He used three methods to determine a flood discharge estimate of Q100 = 26,200 ft^3 per s: proportional area, the Washington State Department of Transportation regression analysis, and Bodhaine and Thomas. He used the Civil Tools computer program to calculate flood stage based on site conditions. An additional 5 ft were allowed for debris flow.

Christiansen did the foundation design using the geotechnical investigation provided by Roger Lowe. Each of the four reinforced concrete pedestals (abutments) was required to resist a three-dimensional thrust load due to the flare of the arch. The south abutment was set on a rock foundation with grouted anchor bolts. The north side foundation of cobbles and sand required a spread-footing for the pedestal supports. The accurate location of each pedestal (and its anchored hinge connection) (figure 4) was critical because the assembled arch had minimal adjustment for error as you will realize in the following explanation on construction.

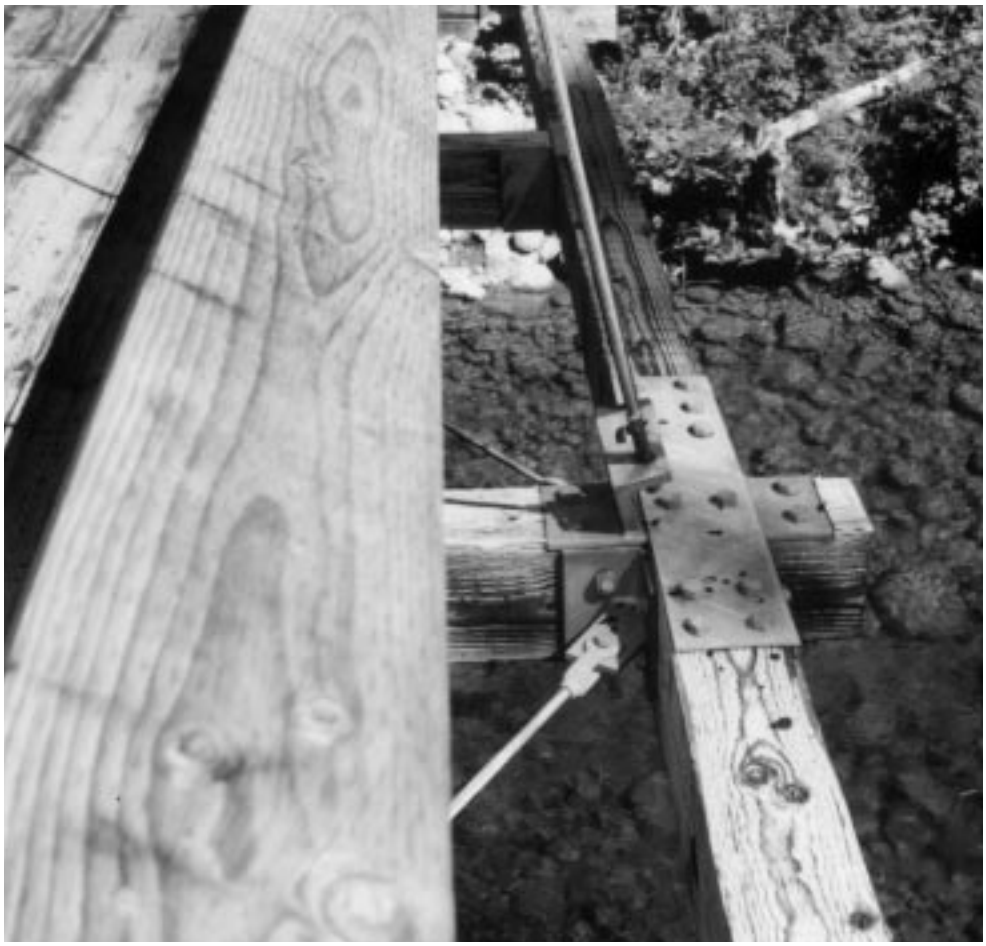

Figure 3. *Typical connection of the deck system and suspension cables.*

Construction

Several alternatives for assembling the bridge were considered. The first option considered was a skyline concept whereby one end of the fully assembled bridge would be supported by a cable. A vehicle supporting the other end would move it across the river until it aligned with the pedestals on the far side. Another option using a skyline was to build each component individually. Because of safety reasons and access, the selected alternative was to use a helicopter to install a partially assembled bridge.

The Weyerhaeuser Company had the timber arch components delivered to their yard in North Bend. The bridge has three primary timber components: two identical end sections weighing 7,000 lb each, and the center spline section weighing 16,200 lb. Because of its length and curvature, the center section had been cut in half to allow for wood preservative treatment and for overland transport. A truck transported the sections to a staging area near the Taylor River, about a mile from the bridge site. At this location the volunteers completed the assembly of the sections and the attachment of the cables.

Scaffolding was installed at the bridge site for the temporary support of the end sections. The heavy-duty shoring frames were designed for a 10,000 lb capacity per leg. Lateral stability was ensured with 5/16-in guy wires. The scaffolding was provided by a company hired by the Mt. Baker-Snoqualmie Forest.

All three assembled sections were flown to the site by a Sikorsky S64E helicopter procured by the Forest under an existing contract with the Boise Interagency Fire Center. The end sections were placed first. Each was secured to its respective hinge connection on the abutment pedestal, with the free end placed on scaffolding. Once these sections were secure, the helicopter placed the center section on the scaffolding, attempting to align the connections. However, because of extreme rotor wash from the helicopter, the work-

Figure 4. *Footing pedestal and anchored hinge connection.*

ing conditions were very difficult. Considerable finesse was required by the helicopter crew during this placement—these were tense moments, as was expressed by everyone present.

As it turned out, the helicopter crew was not able to place the center section directly into the connections on the end sections. Instead, the center section was set on the scaffolding. The volunteers completed the final assembly by using jacks and winches.

For safety reasons, all personnel working under the helicopter were contract crews trained for this type of work. Volunteer workers and Mt. Baker-Snoqualmie personnel remained clear of the area while the aircraft was working overhead. The Mt. Baker-Snoqualmie Forest partially offset the cost for the helicopter mobilization because the Forest was airlifting replacement stringers for a bridge located in a remote area of a neighboring district.

Completing the Project

Some volunteer work continued beyond this phase, but the district was becoming more concerned with the complexity of the remaining work and project safety. By all standards, the bridge construction was a major effort for a volunteer project. Over time fewer individuals assumed much of the work load, which placed an extreme burden on those remaining.

The amount of hours needed for construction was underestimated by everyone involved in the project. With a desire to complete the project before winter, the district arranged for the remaining work on the deck and railing to be done by a Forest Service trail contractor (figure 5).

Today, the bridge is enjoyed annually by thousands of visitors. Some call it the Gateway Bridge for what it means to them. Perhaps, for those who donated so much of their free time, it has a very special meaning.

Figure 5. *A view of the deck frame from below, showing cross bracing with rods.*

The Mt. Baker-Snoqualmie Forest appreciates the support of the following organizations: The Mountaineers, Middle Fork Outdoor Recreation Coalition (MidFORK), Northwest Wilderness Programs, Pratt River Coalition, Alpine Lakes Protection Society, Issaquah Trails Club, Rivers Council of Washington, Sierra Club, Washington Trails Association, Boeing Club, and Sellen Corporation.

Sincere thanks is extended to those volunteers who contributed so much of their personal time and expense: Jack Wheeler, Jack Christiansen, Robert Harn, Mark Boyar, Roger Lowe, Craig Campbell, Allen Kenney, Vern Southward, Bob Jacoby, Paul Rood, and Red.

2000 Forest Service Engineers of the Year

From the list of excellent candidates, three winners of the 2000 Engineer of the Year awards were selected. Congratulations to the following winners:

- Managerial—Jack Callahan from the Cherokee National Forest in Region 8.
- Technical—Charles F. (Fred) Cammack from the San Dimas Technology and Development Center.
- Engineering Technician—Diane Cunes from the Six Rivers National Forest in Region 5.

In recognition of their achievements, Forest Service Chief Mike Dombeck and Associate Director of Engineering Mike Ash presented each with a special plaque and cash award at a ceremony in Washington, D.C., on April 6, 2000. Members of the executive leadership team and the winners' families were among those who attended the ceremony. The following pages contain a summary of the winners' accomplishments.

We would also like to extend our congratulations to those who were selected to represent their region as candidates for the 2000 Forest Service Engineers of the Year. The finalists in all of the categories include:

Managerial	Technical	Engineering Technician
Harvey Hergett	Jonathan Kempff	John McGrath
Mike Clinton	Veronica Mitchell	Steve Coupal
Lou Leibbrand	Tom Torres	Bill Townsend
Don Marchant	Craig Greene	B. Jerry Jacobs
Ed James	Ed Rose	Ken May
David Summy	Marc Anderson	Martin Bryan
	John Doiron	Richard Paccagnella

Jack Callahan, Managerial Engineer of the Year

As a Forest Engineer and a member of the forest leadership team on the Cherokee National Forest, Jack Callahan has played a vital role in managing both the Engineering and the Recreation/Telecommunications programs. Jack's work is recognized locally, regionally, and nationally.

Jack has provided innovative leadership in developing national Forest Service specifications. He initiated and led the development of Forest Service specification 299, Composite Road Construction. This specification allowed for the construction of low-standard roads to be paid for by the mile, which greatly reduced the cost of engineering and constructing such roads nationally.

While serving in the Atlanta Regional Office, he was instrumental in developing language for the Forest Service Sign Handbook pertaining to the warning signs on gates regarding the road standard and approach speed. As a result, reflective material could often be placed directly on gate bars, which generated substantial savings in cost and maintenance. He served as a member on a three-person Forest Service team that coordinated with all federal land management agencies and the Federal Highway Administration (FHWA) to develop the "Low Volume Road" section of the *Manual for Uniform Traffic Control Devices* (MUTCD), the national standard for road signs in the United States used by all public road authorities.

Jack's visionary approach was evident as he pursued improvements to water quality and aquatic habitat through road improvements long before the creation of the 10 Percent Road and Trail Funds or the Chief's National Agenda on Roads, Recreation, Ecosystem Management, and Sustainability. A partnership with Trout Unlimited for streambank stabilization and paving of roadway sections along the North River, a prime trout stream on the Cherokee Forest, started an ongoing effort to improve both the Paint Creek and Conasaga River drainage.

As Recreation Staff Officer, Jack embraced the Fee Demonstration Authority; with the forest supervisor's and ranger's concurrence, he oversaw the designation of the Cherokee National Forest as a fee demonstration site. He coordinated quarterly forest meetings of all recreation personnel to ensure their cooperation and adherence to program requirements, creating opportunities for prioritizing forest improvements and reducing the backlog of maintenance projects.

Jack also conceptualized and developed the Recreation Opportunity map for eastern Tennessee and western North Carolina, which was designed to showcase the variety of recreational opportunities available to visitors of the national forests of the Smoky Mountains. He oversaw the data collection and basic map design; and with the assistance of the North Carolina recreation staff and geometronics group leader, he obtained funding for the summer 1999 printing and Forest Service and National Park Service distribution.

Jack handled oversight responsibilities on large projects, such as major flooding in excess of $5.2 million, coordinating work with the Eastern Direct Federal Division of the FHWA, the Regional Office and resource staff and specialists on the Cherokee Forest, the Fish and Wildlife Service, and State agencies. All work was completed on schedule while ensuring practical, well-designed repairs and accommodating environmental requirements.

The Bureau of Land Management (BLM) asked Jack to represent the Forest Service on a national interagency group: a reinventing government phase II project for moving from force accounting to contracting in the field of road maintenance. His exceptional ability and work on this project was recognized by Secretary of Agriculture Dan Glickman, Secretary of the Interior Bruce Babbit, former Acting Director of the BLM Mike Dombeck, and former Forest Service Chief Jack Ward Thomas.

While Jack was involved in the reinvention project, he was also active in a group designated to coordinate internal and external efforts to complete the Ocoee Olympic Project. This was a time-intensive effort that included the completion of a cable-stayed bridge and waste and sanitary facilities. He was again recognized individually by the Forest Service Chief and Regional Forester and as a group member by the Secretary of Agriculture.

Jack's designation as team leader for the Cherokee's workforce assessment effort in August 1997 was only the beginning of his dedication to the Forest reorganization effort. From his team's initial recommendation of eliminating 20 positions with a potential savings of $1 million in salaries, he continued to make recommendations that resulted in reducing the Forest's fixed costs from almost 90 percent to less than 74 percent by the end of FY 1999 by consolidating six districts into four, rewriting and reclassifying all district position descriptions, and eliminating a leased office.

To enhance the capabilities of members of the reduced workforce, Jack aggressively pursued regional, Washington Office, BLM, and Natural Resources Conservation Service details for his unit and expanded employees into more zone responsibilities. For example:

- The forest bridge inspector's responsibility for all bridge inspection work on three adjacent forests.

- The forest facilities technician's national role in Infra and Meaningful Measures.

- The North Zone radio technician's regular assistance to the George Washington and Jefferson National Forests.

Acquiring grants and special funding from FHWA and other sources to support work on the Cherokee Forest has been another notable success for Jack and his group. They have achieved all targeted goals despite shouldering extra tasks both on and off the Forest.

Jack has continued his efforts to use the Forest's personnel resources wisely by forming ecosystem and implementation teams to address Forest Service priorities. In addition, he continues to devise strategies to reduce fixed costs so that the Cherokee Forest is capable of adjusting to both fluctuating and declining budgets. Currently, he is involved in drafting proposed legislation for the sale of all surplus administrative properties on the Forest, with the proceeds to be used to acquire a newly constructed leased office. This effort will reduce costs of maintenance and leasing by almost $175,000 annually.

Not surprisingly, Jack's commitment to achieving quality work with the wise use of personnel resources is solidified by his firm belief in professional development. He and the county engineer have alternately hosted American Society of Civil Engineers (ASCE) meetings in Cleveland to encourage local engineers to attend. He has given numerous presentations at different chapter meetings in east Tennessee, at the annual state ASCE meeting, and at college student chapter meetings. He has used these opportunities to differentiate between the Forest Service and other land management agencies and to answer questions about Forest Service programs. He has strongly encouraged professional registration and has made this a requirement in several engineering positions at the Cherokee Forest. Besides himself, Jack has six registered professional engineers and one registered landscape architect on his staff. He is registered in two states and has been a member of ASCE since his graduation from Auburn University in 1970.

Jack has been very active in the local community, serving on the Cleveland High School beautification committee to improve its facilities, both inside and outside. Recently, he helped raise funds to support the school's Booster Club. His professional expertise in building construction helped in plans to enlarge the playing area for the school's athletic field and in providing needed irrigation. To ensure that the playing surface was in top condition, he personally repaired, maintained, and moved the sprinkler system seven days a week, two or three times a day, for almost 2 months.

Jack has consistently demonstrated leadership skill, innovative thinking, managerial ability, and professional excellence as an engineer in his long career with the Forest Service.

Charles F. (Fred) Cammack, Technical Engineer of the Year

Charles F. (Fred) Cammack provides technical expertise as a staff engineer at the San Dimas Technology and Development Center (SDTDC). He has been recognized for outstanding performance and leadership in the fire chemicals program, fire and aviation management program, and mechanical engineering support programs within the Center and in coordinating services offered to the regions.

During the last decade, Fred has been commended for:

- Evaluating, selecting, and procuring computer-aided drafting and engineering (CAD/CAE) software and hardware for SDTDC and implementing a training program.

- Successfully rehabilitating the Spark Arrester Test Facility for the Forest Service fire prevention program and managing the mechanical engineering support services for SDTDC that resulted in streamlining the fire engine design, providing drafting services to regional equipment managers, and defining problems and issues concerning fleet management and maintenance.

- Providing technical and consulting assistance to the administrative staff and all program areas to significantly improve the operational efficiency of the Center.

- Assisting in rehabilitating and modernizing equipment in the SDTDC Fire Chemicals Test Laboratory and managing the editing and publication of the *Air Tanker Base Planning Guide*.

- Providing outstanding performance and leadership at the Center within the fire and aviation management and technology and development programs, including defining 615 system needs and managing system implementation.

- Managing the SDTDC Federal Recreation Symbols Project to a timely completion and coordinating the Forest Service National Signing Team.

Fred has been active in addressing technology challenges through cooperative research, testing, innovative design, and effective management of people and resources by:

- Producing a manual on installing, servicing, and maintaining hand pumps to ensure that drinking water at recreation sites throughout the Forest Service is safe.

- Assessing alternative approaches for recycling obsolete tree marking paint and recommending environmentally safe alternatives. Fred developed a slide presentation that defined seven feasible alternatives in terms of implementation, agency issues, and estimated cost and helped to identify more than 20 potential source firms that could handle the work effectively.

- Coordinating the development of a new commercially viable nonproprietary mixing system for fire retardants at air tanker bases with the capability to mix all known commercially manufactured and anticipated new products. Fred researched requirements of the National Wildfire Suppression Technology (NWST) program and the chemical manufacturers before preparing procurement specifications and a prototype system test plan. After successful preliminary testing, a test system was installed at West Yellowstone, where it has performed without problems for two fire seasons. Fred authored a 1999 SDTDC Forest Service project report on the system.

- Defining methods for the proper handling and disposal of wastes produced from air tanker base operations through participating in planning and upgrading base facilities in Forest Service regions and preparing and presenting training materials at regional meetings. Fred served as managing editor and primary author for portions of the *1995 Interagency Air Tanker Base Planning Guide* and wrote a 1996 project record on the same topic, both of which are used throughout the Forest Service by facilities engineers and contractors to define and evaluate tanker base waste treatment needs.

- Organizing, leading, and coordinating a national committee of Forest Service signing specialists to develop a 1999 Forest Service Sign Standard. Fred wrote an *Engineering Field Notes* article on the new symbols. He also led the development of software for sign manufacturers for producing recreation symbol placards, which assists in reducing layout time and cost while improving quality, consistency, and standardization. In the year 2000, the Federal Highway Administration (FHWA) will not only include the new symbols in their *Manual for Uniform Traffic Control Devices* (MUTCD), but will also recommend them for use by all Federal agencies.

- Researching, designing, and testing improved storage tank recirculation systems to maintain quality fire retardant during base storage,

especially complicated by trying to apply commercially available fluid handling and mixing hardware with air tanker base chemical storage and handling equipment. Fred documented his extensive field testing of conceptual designs conducted in Region 6 and recommended improved, commercially available tank recirculation hardware in a 1996 publication. His recommendations are now slated to be installed at new bases and to be considered for rehabilitating existing bases.

- Evaluating the potential for Forest Service Fire, Wildlife, Engineering, and Recreation applications of the ORB-COMM satellite data communication system. Fred's recommendations included defining the technology necessary and the cost of applying it to each application.

- Participating in operational field testing of new products for Forest Service fire chemicals qualification specifications to design improved test equipment and methods for the SDTDC Fire Retardant Test Laboratory, reducing the time to perform required tests while increasing the reliability and accuracy of test results.

- Preparing a white paper on the current status of the spark arrester and multi-position engine test program at the Center with recommendations (now implemented) for relocating the engine test program to an independent laboratory and for the modernization of the Spark Arrester Laboratory at SDTDC.

- Redesigning and managing the construction of an improved SDTDC Spark Arrester Test Laboratory, which required extensive engineering analysis of existing testing procedures and equipment and incorporating state-of-the-art electronic measuring equipment with the potential for test automation. In addition, Fred coordinated extensive testing on potential test carbons to replace the dwindling supply at the Center and prepared a paper discussing the test results with recommendations for a replacement carbon supplier. The new test laboratory has reduced the time to test a spark arrester from a week or more in the old laboratory to 3 days.

- Managing design, testing, and implementation of mechanical slash and brush treatment and disposal equipment and writing five technical papers on improved methods for mechanical treatment. Fred redesigned the SDTDC Slash Laboratory and tested various cutter heads for brush disposal operations. He designed, supervised the construction of, and tested the final prototype of the Hydro-Ax System (forest lands residues reduction machine) for the Center.

Fred has been an active leader in his community as well as in the work environment. For 6 years, he served as Benefits Coordinator for the Employees Association of the Metropolitan Water District of Southern California. From 1970 to 1975, while serving as treasurer of Saint Mark's Episcopal Church in Upland, CA, he tutored disadvantaged children in English, reading, and mathematics in San Bernardino County and in housing projects near Upland and Rancho Cuccamonga, CA. He was Cub Scout Master for 1 year and President of the National Federation of Federal Employees (NFFE) Local 1979 from 1979 to 1981 at SDTDC.

In 1997, Fred became a board member of ABATE Local 27 Riverside, a motorcycle safety and rights organization. He continues to work through ABATE to support fundraising efforts for the local Salvation Army and the Mountain View Home for Disabled Children. He has helped organize and participate in three food drives and several gift collections for homeless shelters in Riverside County. Fred's willingness to volunteer in his community also extends to working during primary and general elections to encourage voter registration and participation.

Fred has demonstrated an outstanding ability to analyze complex technical engineering problems and respond with thorough, well-documented, economical, and innovative solutions. His long-term dedication to excel-

lence has resulted in significant contributions to the Forest Service Engineering program locally, regionally, and nationally.

Diane Kunes,

Engineering Technician of the Year

Diane Kunes is an outstanding engineering technician on the Six Rivers National Forest in Region 5. Consistently recognized for her performance and leadership ability, she has made significant contributions in developing and applying technical innovations.

Before joining the Forest Engineering Staff in 1990, Diane was demonstrating her ability to successfully accomplish project after project. She received commendations for:

- Completing the Older Plantation Inventory project on the Orleans and Lower Trinity Ranger Districts (1985).
- Exhibiting leadership on the Continuous Forest Inventor project for the Department of the Interior's Bureau of Indian Affairs (1986).
- Supervising a Youth Conservation Corps crew (1987).
- Working during the 1987 fire season (1988).
- Supplying data to the Lower Trinity Ranger District's Stand Record System (1989).

The Forest Service has recognized Diane's superior performance throughout the 1990's for her leadership in the Forest Facilities Program and completion of the Forest Facilities Master Plan. In addition, she was commended for her support of the Forest Timber Sale Program in 1991; for serving as Special Emphasis Program Manager (SEPM) for the Federal Women's Program in 1995; and for leading and completing the deferred maintenance surveys, Infra, and Forest Accessibility Action Plan for the Six Rivers Forest.

Evidence of Diane's flair for providing technical engineering leadership surfaced when she worked with the forest hydrologist, fisheries biologist, and botanist to develop criteria for assessing and prioritizing watershed restoration projects. She helped to develop a risk assessment system to analyze the risk of fill failure, potential sedimentation loss, resource effects, and long-term effectiveness of the prescribed treatment.

Diane developed design standards for road decommissioning that included the restoration of the natural hill slope and channel bank configuration, special project specifications, and typical drawings that described

restoration treatments, including culvert removal, finished channel bank slope, channel width, drainage control features, scarification, degree of road outsloping, location of waste material, and erosion control measures. Based on her site surveys (which used the Criterion 400 laser survey instrument and data collector), Diane designed and calculated fill volume, limits of excavation, and site-specific drawings. Working with the forest botanist, Diane initiated the use of rice straw for slope stabilization—an innovative technique that holds newly disturbed soils in place while remaining almost completely free of weeds. Diane administered many of the restoration contracts that she had surveyed and designed.

To enhance her engineering skills, Diane has pursued and achieved certification through the Construction Certification Program for Roads, Public Works Inspector and Contracting Officer's Representative (COR), Aggregate Base and Surfacing, Concrete, Asphalt, Bridges, Buildings, and Water and Sanitation. As the lead inspector and eventually the COR on the Grouse Creek Bridge—a technically innovative and challenging project—Diane worked with the bridge designers from the Region 5 and 6 structures section to complete the first prestressed, post-tensioned concrete girder bridge built in either of those regions. She is consistently assigned to the most technically difficult and complicated contracts.

Diane's varied field experience in silviculture, timber, fire, recreation, and range has forged a thorough understanding of forest practices, principles, and multiple-use land management. She has earned the trust and respect of professionals in other disciplines and is often sought out for her technical support in developing new concepts. Diane has designed road diversion channels and a variety of drivable rolling dips, including a new one for removing water from roadways to prevent surface erosion.

In 1997 and 1998, storms caused widespread road damage in Klamath Province. As part of the province assistance agreement, Diane shouldered responsibility for the design and contract preparation of three Emergency Relief for Federally Owned (ERFO) projects for the Klamath National Forest. This was in addition to her normal work, which included ERFO flood repair projects for the Six Rivers Forest. She also prepared a road-resurfacing contract for the Shasta Trinity National Forest as part of the Jobs in the Woods Program.

Diane has repeatedly accepted and excelled at meeting challenges. When the forest accessibility coordinator was unable to complete the Forest Accessibility Action Plan, she led the project team to its completion. She has also been a leader in promoting the Forest Safety Program and helping the Six Rivers Forest achieve the best safety record in the region.

In her role as SEPM for the Federal Women's Program from 1993 to 1995, Diane cooperated with other managers and civil rights officers to plan, organize, and promote forest cultural awareness events. She was the primary organizer and promoter of Women's History Month, putting together displays and presentations. She trained both Forest Service employees and Federal Highway Administration employees on how to handle sexual

harassment and hostile work environments. As a member of the Forest Employee Advisory Committee, she helped to develop and promote the Forest Affirmative Employment Program Plan.

Due to her consistent record of outstanding leadership and achievement, Diane landed a seat on the Six Rivers Partnership Council. In 1999, she revised the forest housing and barracks policy for occupants of Government quarters. The new housing policy was reviewed and approved by the Six Rivers Partnership Council and is now a supplement to Forest Service Manual 6400—Property Management.

Workplace safety is another area that Diane has championed. She participated in Occupational Safety and Health Administration safety inspections of forest facilities with the Regional Safety Program Manager to identify hazards or potential for personal injury in the workplace. Her suggestion to appoint a forest-wide safety committee to the Forest Partnership Council has been implemented, along with the selection of a new Forest Safety Officer and the development of a new Forest Safety Plan.

While putting together timber sale road packages, Diane realized that cost recovery figures in use were inaccurate. The Government was not collecting its proportional share of deferred maintenance and surface replacement costs attributable to commercial hauling. Diane initiated a complete review of the Six Rivers Forest's actual cost recovery to revise the formulas and procedures used. She then updated the cost recovery collection rates to those used by the Six Rivers Forest today.

Diane's leadership abilities are not confined to her workplace. In June of 1999, she coordinated and organized an annual softball tournament and picnic fundraiser for the Six Rivers Employee Association. The organization is comprised of Forest Service, Redwood Sciences Laboratory, Bureau of Land Management, and Fish and Wildlife Service employees. Diane has been a member of the association for 10 consecutive years.

In the wider community, she helps raise funds for the Pacific Union Elementary School Youth Orchestra by donating and selling items for bake sales and rummage sales and by washing cars. She is active in the "Bowl for Kids Sake" event to fund the local North Coast Chapter of Big Brothers and Big Sisters. She volunteered with the Humboldt Youth Soccer League teams for young girls by assisting the coach with workouts. She chaperones a third grade class on bimonthly trips to the Arcata Marsh. During these trips, she helps identify any birds spotted and discusses the individual characteristics of these species with the students.

Diane's communication skills, attention to detail, initiative, problem-solving abilities, and willingness to learn and face new challenges—in conjunction with her dedication to enhancing her engineering skills through education and experience—make her an exceptional and highly valued employee of the Forest Service engineering community.

1999 Engineering Field Notes Article Award Nominations

A special thanks goes to each of our authors and readers for making 1999's *Engineering Field Notes* (EFN) a valuable resource. Articles ranged from Forest Service engineering facilities and geospatial programs to the future of the Forest Service road system. Authors offered practical suggestions for reducing aggregate surfacing maintenance, operating solar-powered water systems, and using the Water/Road Interaction Field Guide as well as reviews of new software for road survey and design and for analysis of fish passage through culverts. Through EFN, authors continue to share their knowledge, experiences, and insight as Forest Service engineers at all levels and from all regions.

Now, we would like you to tell us which 1999 articles you feel were the most informative, beneficial, and interesting; which articles helped your unit save money; and which articles helped you develop more effective ways of getting your work accomplished.

After selecting your three favorite articles, please complete the rating sheet on the following page. Rate the articles from 1 (best) to 3 (third best). If you believe an article has or will help the Forest Service save money or other resources, please let us know. Remember, this is a one-person, one-vote system. Your vote counts!

When you have voted, cut the rating sheet along the dotted line, fold and tape or staple it closed, and mail it back to us. In order to be counted, your rating sheet must be received by September 30.

If you have never submitted an article, you may want to write about a project you have worked on and the experiences you have had. Next year you could be one of our winners!

1999 *Engineering Field Notes* Article Awards Nomination Form

Article	Author	Choice (1,2,3)	$ Saved ( )
January-June			
The National Forest Service Facility Infrastructure	Josiah Kim	_____	_____
Engineering Geospatial Program	Mark Flood	_____	_____
Engineering Is Supporting Watershed Restoration	John Fehr	_____	_____
The National Forest Road System: An Engineering Emphasis Item for The 21st Century	John Bell	_____	_____
Reducing Aggregate Surfacing Maintenance	Steve Monlux	_____	_____
RoadEng™—Road Survey and Design Software	Sam Carlson	_____	_____
Solar-Powered Water System Operation	John Janson	_____	_____
FixhXing: New Software Under Development To Assist in the Analysis of Fish Passage Through Culverts	Mike Furniss, Tom Moore, Mike Love, Thomas Dunklin, Bob Gubernick, Susan Firor, Margaret Lang, Terry Roelofs, and Bill Trush	_____	_____
July-December			
Road Analysis	Tom Pettigrew	_____	_____
Water/Road Interaction Training Project	Jeffry Moll	_____	_____
Economic Fish Passage: An Innovative Alternative	Charles G. Showers	_____	_____

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Comments: _____

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