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# Your Good Work Brings Good Results

***Vaughn Stokes***
***Director of Engineering***
***Washington Office***

Another exciting summer has come and gone. It started with a focus on Forest Service Road and Roadless policy, but it is ending with the largest fire season of our careers. It has been exciting, tiring, invigorating . . . . There are many words that could describe it—dull is not one of them.

I am proud of all of the folks who have worked so hard in the development of the new road management policy. This policy is necessary to ensure that the National Forest System (NFS) roads meet future land and resource management objectives and public use of NFS lands, provides for safe public access and travel, allows for economical and efficient management, and begins to reverse adverse ecological impacts. Be sure to read Glenda Wilson's article in this edition of *Engineering Field Notes* on why we have this new road management policy.

Even in these times of tight budgets, many of the engineering programs such as road maintenance continue to receive budget increases. These increases are coming from bipartisan congressional support. As we continue to demonstrate that good road maintenance supports local economies, improves user safety, and provides enhanced environmental protection, we will continue to get more support for this program.

The excellent work that was done at the field level on the 10 Percent Road and Trail Projects gave us plenty of examples across the country on how important maintenance is, and it was a great tool to demonstrate our ability to be accountable. We need to continue to take every opportunity to demonstrate how proper management and maintenance of the roads we have on National Forest System lands serve and enhance forest resources and environments.

Our effort to be a public road agency is going very well. We will be presenting our report to the congressional committee staff for transportation here in the next few weeks. There has been great staff work on this effort. As you work with the States and counties, keep in mind the benefits that this initiative would have for the National Forest users—the value of seamless transportation to support rural economies, tourism, resource work, and environmental protection. The business is big and Congress will decide where the money comes from to sustain it. We want to enhance the Forest Highway Program as a sure way of being a good partner with counties and States on transportation to and through the National Forests. We also want our own category of Public Forest Service Roads (PFSR), so we can focus on attaining sustainable funding for our high-use needs. I think if we just keep doing what we've been doing this past year, we will get the dollars we need to get the job done.

The Federal Highway Administration (FHWA) has been a great partner, and pilot projects at Greys River Road in Wyoming and Sandy Beach in Alaska will be great examples of what PFSR's are all about and of how the program enhances forests and adjacent areas. We will double our demonstration projects for 2001, and that project selection process will be completed in November . . . so stay tuned.

At the September National Leadership Team (NLT) Meeting in Missoula, MT, we presented our Facilities Initiative. The NLT adopted three major parts of the Initiative as listed below:

1. Require that Master Facility plans be done as prescribed in our report.

2. Move forward with legislative language to sell unneeded administrative sites and use those funds for new construction.

3. Adopt a Working Capital Fund (WCF) concept with maintenance and replacement components.

I'd really like to thank the facilities folks who have worked on this effort—great staff work on preparing the report. Now the real work begins—implementation.

Last, but not least, is our Real Property Inventory (INFRA) work. As I write this, we are beginning the reporting. My thanks goes out to each of you for your work. The audits from the first two regions were very positive. If we continue down this path, we will see a qualified opinion, or maybe even a better outcome this year.

Thanks again, and keep up the good work!

# 1999 Engineering Field Notes Article Award Winners

Vote for the candidate of your choice, but vote! A special thanks goes to the dedicated readers who sent us their favorite *Engineering Field Notes* articles published during 1999. We appreciate your feedback on EFN articles and your efforts to let our authors know their articles are read and valued.

Despite drastic program changes, budget constraints and tracking, and personal commitment to reducing the overwhelming fire threat, substantive articles have come in from a variety of sources. We appreciate our authors' willingness to submit articles. As always, we rely on people who are willing to spend their precious time sharing knowledge, experiences, successes, and failures. As demands on our field personnel continue to escalate, your articles continue to save the Forest Service time and resources.

And now, here are the winners of the cash awards for the winning *Engineering Field Notes* articles for 1999!

- Tom Pettigrew for "Road Analysis"
- Josiah Kim for "The National Forest Service Facility Infrastructure"
- Charles G. Showers for "Economic Fish Passage: An Innovative Alternative"

Congratulations to our winners and to the authors who make this publication possible. This year's challenges that you have faced and met should provide topics for some worthwhile articles for 2001. *Engineering Field Notes* provides a forum to express your ideas and gives you an opportunity to be one of our award-winning authors.

# A Perspective on Travel Management on National Forest System Lands

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***Rocky Mountain Region***
***Member, Roads Policy Revision Team***

## Why?

Since being named to the Roads Policy Revision Team, I have been asked the same question many times. Why do we need a new road policy? We currently have the tools needed, so why invent something new? To best explain why, it is necessary to revisit some of our history.

## History

The Forest Service (FS) has been challenged with the issues of managing travel on National Forest System (NFS) lands since before the signing of a 1972 Executive Order dealing with the regulation of off-highway vehicles. Implementation of the land management planning process further raised the importance and complexity of managing roads to provide access to NFS lands.

Efforts like the 1986 National ORV/Travel Management Activity Review, 1988 Keystone Center Policy dialogue on "Access to Federal Lands," and the 1989 "Getting There and Back" initiative raised the awareness that travel on NFS lands was a national issue. Agency interest developed into a FS-sponsored National Access and Travel Management Conference held in Denver, August 1991. Prior to the conference, the Chief named a National Access and Travel Management Strategy Team who participated in the conference. In addition to the conference record, the team reviewed and evaluated existing regulations, directives, and reports from other sources. This information and much team discussion led to the identification of six goals for managing travel on NFS lands. These goals, although developed almost 9 years ago, are still very applicable today:

1. Provide a national leadership framework for travel management.

2. Provide uniformity and consistency in travel management for public use of NFS lands.

3. Make travel management an integral part of the land management planning process.

4. Minimize conflict in travel management on NFS lands.

5. Strengthen travel management coordination within the Forest Service and with local and rural communities, private interests, tribal governments, and other agencies.

6. Provide public access to NFS lands.

The report and implementation plan "Travel Management—Bringing People and Places Together" was prepared for the Chief and presented at the Winter RF&D Meeting in 1992. One of the basic components for implementation of the Travel Management Report was the designation of an Associate Deputy Chief with responsibility for national travel management coordination, including the establishment of a national coordinating council. This basic component for successful implementation did not happen. The WO, regions, and Forest Engineering Staff continued with efforts to implement access and travel management. What individual regions and forests accomplished through localized efforts did not provide a uniform and consistent integrated approach across all NFS lands. If the FS put the energy into the implementation of access and travel management, we would not be in the same position now with the NFS's road management.

## What have we learned?

In taking a step back and looking at the less than fully successful implementation of Access and Travel Management (ATM) agency wide, we learned that the effort:

1. Was predominantly an engineering staff led effort.
2. Used a project-by-project approach—limited use of the landscape approach.
3. Focused on single resource issue analysis rather than an integrated approach, such as wildlife closures.
4. Failed to establish accountability for results and accomplishments.
5. Locked a high enough work priority.
6. Lacked public involvement.

The movement of people to and across NFS lands needs to be managed. The impact of human interaction with forest resources needs to be balanced with the capabilities of the land. If the movement of people is not managed, then we do not know the cumulative impacts of their activities until the impacts are visible on the land.

## Facts and Figures

By failing to achive agency-wide implementation of ATM in the early 1990's, we are now faced with a road infrastructure that we are unable to manage and maintain. The following are some key facts and figures that clearly reflect the situation the FS faces.

- Over 380,000 miles of classified roads. Current funding (only about 20 percent is available) is inadequate to maintain all existing roads to intended safety, service, and environmental standards to permit efficient and safe use, while mitigating adverse environmental impacts. The estimated maintenance backlog on National Forest System roads is $8.4 billion.
- The agency estimates that over 60,000 miles of unauthorized, unplanned, and temporary roads exist on NFS lands.

- Most of the existing system of classified roads was built for timber harvest; 22 percent serve passenger car use, 55 percent are maintained for high-clearance vehicles, and 23 percent are closed to highway use by the public.

- Logging traffic has declined with reduced timber harvest levels.

- Driving for pleasure is the single largest recreational use of NFS lands, over 35 percent of all 1996 use was recreational. Recreational driving during the summer accounts for 13.6 million vehicle-miles per day. The recreational outlook is for an additional 64 percent increase by the year 2045.

## So What's Next?

The management of travel is a critical link to all programs essential to the stewardship of NFS lands. Travel management is the movement of people and products to and through our National Forests and Grasslands. It connects many different varieties of users and multiple uses on NFS lands. Travel is fundamental to what the FS does, whether it is associated with recreation, wildlife, timber, range, water, fire, minerals, or any other program.

It is essential that the management of travel, both planning and implementation, be integrated with other programs and activities. The two major components on travel management are: gaining access across other lands and providing appropriate selection of roads on public lands. The difference in how the management of travel has been approached by the agency raised the awareness of the NFS roads to a national issue.

The environmental concerns associated with the construction and reconstruction of roads on NFS lands has steadily increased. Congressional interest in management of NFS roads peaked during the FY 98 budget hearings when the FS was one vote away from losing most of the road budget. Congressional interest has remained high since those hearings. The FS Chief, in the release of the Agency's Natural Resource Agenda, responded to this increased public concern by identifying roads as one of the Agenda's four emphasis areas. Within the framework of the Natural Resource Agenda, a new Forest Road Agenda was set forth:

1. Determine the best way to provide all Americans with access to the National Forests.

2. Accelerate the pace of decommissioning unneeded substandard roads that damage the environment.

3. Selectively upgrade forest roads.

4. Seek additional funding, such as for Public Forest Service Roads.

On January 28, 1998, in an Advance Notice of Proposed Rulemaking, the Forest Service announced its intent to revise regulations concerning management of the National Forest transportation system. Simultaneously, the FS published a proposed interim rule to temporarily suspend permanent and temporary road construction and reconstruction in certain areas

of NFS lands. The final rule, issued on February 12, 1999, temporarily suspended permanent and temporary road construction and reconstruction in certain areas of NFS lands. The temporary suspension was to be in effect until development of a revised FS road management policy and the analytical tools to provide a more ecological approach to existing and future road needs was completed or 18 months from the effective date, whichever was sooner.

The Agency has identified three primary actions to help find an appropriate balance between safe and efficient access for all forest road users and protection of healthy ecosystems:

1. Develop new analytical tools to decide when and if both new and existing roads are needed to meet resource management objectives. ("New Science-Based Road Analysis Process" was discussed in Volume 31 of *Engineering Field Notes.)*

2. Aggressively decommission nonbeneficial or unauthorized roads that are determined through forest planning and NEPA and other analysis to be damaging to the environment or to be no longer necessary for achieving resource management objectives.

3. Outline a plan to proactively accomplish what is needed for the future and the risk and priority of accomplishments needed, identifying appropriate timing and the tools and funding available.

FS researchers and resource specialists have developed an integrated, science-based road analysis process that allows objective evaluation of the environmental, social, and economic impacts of proposed road construction, reconstruction, maintenance, and decommissioning. The road analysis neither makes decisions nor allocates lands for specific purposes. Rather, the new science-based road analysis identifies and addresses a set of possible issues and applicable analysis questions that, when answered, produce information for responsible FS officials to consider about road construction, reconstruction, and decommissioning needs and opportunities. The road analysis process examines issues at various scales, is flexible, and is driven by road issues important to the public and managers. When access opportunities are identified through the use of the science-based road analysis process, responsible Forest Service officials will use the NEPA process for making final decisions.

Implementing the road management strategy will improve service to users, protect environmental values, enhance public safety, mitigate environmental impacts, promote viable local communities, and boost credibility of our natural resource management.

## Challenges

As an agency, we are still faced with many challenges for managing road travel on NFS lands. Some of the challenges we face include:

1. Reconciling social values and science as we work from the development of a process to its implementation.

2. Showing credible resource accomplishments in reducing road system liabilities.

3. Listening to and establishing more relationships with public and key partners.

4. Learning to speak about NFS roads in common terms, definitions, and phrases that are easily understood by the public.

5. Continuing to develop partnerships with other government agencies—local, State, Federal, and tribal—to provide a broader landscape approach to travel management across multiple ownerships.

6. Understanding that, to the public user, if it looks like a road, then it is a road.

7. Raising the awareness of the impacts of road use on resources as our users become more and more urbanized.

We must work effectively and efficiently to address these challenges to successfully manage and maintain NFS roads. We have the tools—the Road Analysis Process, INFRA, and RMO's. We need to find ways to better use our resources.

# Jones Wreckum Road Low-Water Crossing Revisited

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I originally reported this low-water crossing in a 1974 *Engineering Field Notes* article. The structure is located on the Eldorado National Forest, Pacific Ranger District, approximately 1 mile upstream from the Union Valley reservoir.

The Jones Wreckum Road is a primary access road needed for multiple uses, particularly for timber sale access. However, any previously considered crossing on the Jones Fork was prohibitively expensive. The existing route has a wetted perimeter of about 150 feet. I offered, and the alternative was selected, to construct a 180-foot low-water crossing, using concrete piers with spread footers on 16-foot centers and custom-built cattleguards with 16-foot spans. The structure was completed in 1971 at a total construction cost of $53,000.

Because the cattleguards generally were only 2 feet above summer flows, there was a strong likelihood of periodic debris jams under the cattleguards. The structure was designed to allow easy removal of cattleguards to clear jams with only the use of a backhoe and a wrench to remove a few bolts.

***Figure 1.*** *Jones Wreckum Crossing looking upstream from east side.*

## Life History

Through observations from annual maintenance inspections, it became apparent that debris jams were likely to be a persistent problem. As time went on, engineers recognized that collecting the debris at this crossing was of great benefit to the Union Valley Reservoir's management. The Jones Fork, a major tributary to the reservoir, was a significant source of lake debris causing safety hazards to boating. Installation of the Jones Wreckum low-water crossing reduced the debris level.

Surprisingly, local 20-plus-year employees on the ranger district do not remember having to remove any of the cattleguards to dislodge jammed debris. Instead, debris was removed periodically so that it would not go over or under the structure and end up in the reservoir one mile downstream.

As can be seen from the photographs, the structure is performing remarkably well after being in place for nearly 30 years. The downside is that I don't think it could be build today for $53,000!

***Figure 2.*** *Jones Wreckum Crossing looking downstream from the east.*

***Figure 3.*** *Jones Wreckum Crossing looking west.*

# Barns and Barracks, Offices and Outhouses: The Humboldt-Toiyabe National Forest's Approach to Managing Historic Facilities

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The Humboldt-Toiyabe National Forest (H-T) is addressing the issue of its historic facilities in a proactive manner. What started as an initiative to demolish old buildings has evolved into a plan to manage them in compliance with the National Historic Preservation Act (NHPA).

## The National Historic Preservation Act

The Forest Service established a National Facilities Team in 1998 to improve management of the 40,000 Forest Service-owned buildings.[1] Thirty-one percent of these buildings are 50 years or older and fall under the protection of the NHPA.[2] The Act has several sections that affect engineers and facilities managers:

- **Section 106.** Most people are familiar with Section 106, which states that any Federal undertaking affecting a resource that is listed on the National Register of Historic Places (or that is *eligible* for such listing) must undergo a review. The agency may not carry out the undertaking until it has taken into account the effects on the resource and has provided the State Historic Preservation Office (SHPO) or Tribal Historic Preservation Office (THPO), consulting parties, interested publics, and the Advisory Council on Historic Preservation an opportunity to comment. In other words, we must determine which of our facilities are eligible for the National Register before taking action on them. While we can carry out routine maintenance, we cannot demolish or alter them without going through a "Section 106 Review" and getting comments from various people, groups, and agencies.

- **Section 110.** While Section 106 may be described as reactive, Section 110 tends to be proactive by encouraging Federal agencies to develop management plans. It requires every Federal agency to use historic properties, to the maximum extent possible, before acquiring, constructing, or leasing buildings to carry out agency responsibilities. It also requires agencies to develop preservation programs for the identification, evaluation, National Register nomination, and protection of historic properties. A lack of resources often makes it difficult to comply with this section of the NHPA.

**Selected Section of the National Historic Preservation Act**

**Section 106**
Federal undertakings that affect resources eligible for the National Register of Historic Places are subject to review and comment from various people, groups, and agencies.

**Section 110**
Federal agencies must use historic properties before acquiring, constructing or leasing buildings. Agencies should develop a preservation program to identify, evaluate, list and protect historic properties.

**Section 111**
Federal agencies must establish and implement alternatives for historic properties that are no longer needed for agency purposes.

- **Section 111.** This section emphasizes a Federal agency's responsibilities to establish and implement alternatives for historic properties that are not needed for current or projected agency purposes. The Advisory Council considers this provision when reviewing alternatives for the treatment of excess property. This will require some creative problem solving when it comes to disposing of historic buildings we no longer need. Some solutions include adaptive use, relocation, special use permits, and exchanges.

## The H-T Approach

Recognizing the requirements of the NHPA, engineers from the H-T met with the Nevada SHPO to discuss the forest's historic facilities. The SHPO advised the H-T to hire an architectural historian to write a historic context statement and to identify and evaluate the historic facilities. With this information, a programmatic agreement and management plan could be developed.

As the H-T architectural historian, I am following standard practices as outlined by the Secretary of the Interior and upheld by the SHPO. These include:

- **Writing a Historic Context Statement.** The significant people, events, and patterns in each forest's history must be understood to determine which buildings and sites are eligible for the National Register. This requires a significant amount of archival research and some oral history interviews. The historic context statement serves as the foundation for decisions about identification, evaluation, and treatment.

- **Identifying and Surveying Historic Facilities.** There is a standard method for conducting a survey (sometimes called an inventory) of

historic buildings. Historic information (e.g., construction dates, builder, architect) is gathered through archival research, while field surveys provide data on the building's architecture and integrity. The person conducting the field survey takes photographs, draws a site plan, and completes a standard form (approved or provided by the SHPO) with information such as the building's materials, condition, integrity, features, and architectural style. The H-T is entering this information into a database from which it can be easily manipulated, transported, and converted as required by INFRA and other heritage databases.

- **Evaluating Facilities for NRHP Eligibility.** Upon completion of the historic context statement and survey, each building and site will be evaluated for eligibility for the National Register. Evaluation takes place *after* the survey and context statement have been completed, since it is influenced by comparative studies. In other words, it would be difficult to determine which building may be "the only," "the best," or "the first" without having the complete picture.

There are two dimensions of eligibility: significance and integrity. Significance is determined by using four criteria established by the Secretary of the Interior (see sidebar). Integrity is the "authenticity of a property's historic identity" and is the composite of seven qualities: location, design, setting, materials, workmanship, feeling, and association. For example, if a historic building has been remodeled so that the character-defining features are no longer apparent, it has low integrity and may not be eligible for the National Register. These features may include the building's form, windows, materials, and decorations. Integrity should not be confused with condition. For example, a building may be in poor condition but have high integrity. Another may be in excellent condition, but due to remodeling that does not meet the Secretary of the Interior's Standards[3] (also known as "remuddling"), it may have lost its integrity.

**Criteria for Determining Significance**

Historic significance is the importance of a property to the history, architecture, archeology, engineering or culture of a community, State or the nation. It is achieved in several ways:

Criterion A: Association with events, activities, or patterns

Criterion B: Association with important persons

Criterion C: Distinctive physical characteristics of design, construction, or form

Criterion D: Potential to yield important information (usually archeological sites)

- **Developing a Programmatic Agreement.** The purpose of a programmatic agreement (PA) is to streamline consultation procedures. For example, it may outline activities (e.g., repair, replacement, installation) that we can carry out without going through the full Section 106 process. It may also outline such issues as mitigation measures, qualifications of cultural resource professionals, and acceptable treatments. The PA is signed by the SHPO and the agency, as well as any invited parties.

- **Developing a Treatment Plan.** "Treatment" usually refers to the rehabilitation, restoration, or preservation of a building. Technically, these three treatments are distinct and have separate guidelines as defined by the Secretary of the Interior. In the context of a management plan, treatment may include other activities such as maintenance, demolition, removal, rental, and transferal. The challenge is to develop a comprehensive treatment or management plan that complies with the NHPA while taking into consideration budgets and goals.

## Work to Date

In September 1999, I completed surveys of 189 historic buildings.[4] Several of my colleagues, most of whom work in urban areas, were intrigued by the idea of working on a national forest and volunteered their services. They, along with several forest archeologists and district staff, assisted me with locating and accessing sites, surveying buildings, identifying archeological features, and finding archival records.

The historic context statement, titled "Privies, Pastures and Portables: Administrative Buildings on the Humboldt-Toiyabe National Forest, 1891-1950," is nearly complete. Volume I is divided into separate sections that deal with the general forest history and administration, histories of each district, and early architectural development. Appendices include a list of all historic administrative sites, a timeline, a list of district personnel, and short biographies of significant individuals. Volume II addresses the survey and evaluation of the buildings and includes survey forms, photographs, and location maps for each building.

It has taken approximately 18 months to complete the historic context, survey, and evaluation at a cost of about $450 per building. This cost, which includes salary, travel, vehicle use, and supplies, is high when one considers several factors:

- Nothing on this scale had been done in Region 4 and it took a significant amount of time to research and write the historic context statement. In the future, much of this document can be used and built upon to evaluate the remaining buildings in Region 4.

- Three-quarters of the survey time was taken up by travel. This is attributed to the size of the Humboldt-Toiyabe (6.3 million acres), as well as the considerable distances between districts, which are not contiguous. This also resulted in higher travel costs for hotels, airfare, vehicle use, and per diem.

- Since I was new to the FS, it took some time to become oriented with matters such as the FS organization, general history, locations of archival records, and filing systems.

Naturally, costs will vary from forest to forest, but one may estimate a range of $300 to $500 per building.[5]

The next major tasks are the development of a programmatic agreement and a historic facilities management plan. These will require a great deal of input from the SHPO, as well as from district and forest staff. In addition, the new Section 106 regulations require increased public and tribal comment. This will be a time-consuming effort, but will pave the way for more efficient management of our historic facilities.

## Lessons Learned and Friendly Advice

The following points may be helpful to others planning similar work on the National Forests:

- Meet with your SHPO to discuss the intended work, procedures, and qualifications of the person carrying out the work. The professional criteria vary between Architectural Historians, Archeologists, Historic Architects, and Historians. Most SHPOs use the criteria established by the Secretary of the Interior, which identify the necessary type and amount of education and experience.

- Be aware that research may need to be carried out on other forests, since many of today's forests have been formed from earlier forests that may or may not still exist. For example, the H-T includes areas that were originally part of the Dixie, Stanislaus, Mono, and Tahoe forests.

- Check to see if your SHPO has a standard survey form for historic buildings. If not, get approval of the form you propose to use.

- Plan to survey on the most comprehensive level possible. The survey and evaluation of all administrative facilities on the entire H-T is beneficial as it allows us to approach facilities management holistically.

- Consider travel time when planning surveys. The number of historic facilities on the H-T is not particularly large, but the travel distances are great. This was a significant factor in planning survey work. Allow for slower travel in wilderness areas.

- Some historic facilities may no longer be on your facilities lists, either by error or because of abandonment.

- Talk with as many district staff individuals as possible. They may know of administrative buildings not on current facilities lists, locations of pertinent records and maps, and local people who can provide assistance.

- Construction dates in your facilities records may not be accurate. Sometimes these dates reflect the year a building was moved or significantly remodeled.

- Buildings that do not "look old" may still be historically significant.

- Do not confuse condition with integrity. Buildings that are in poor condition may have a high degree of integrity, just as those in good condition may have low integrity.

- Be ready for surprises. Most people know that the Civilian Conservation Corps built many FS structures in the 1930's and that many of these buildings are eligible for the National Register. I was surprised to learn that the CCC was followed by Conscientious Objectors (COs), who worked from Civilian Public Service camps during World War II. The COs were responsible for extensive development on the H-T. Since they represent a significant national trend, any building associated with them may be historically significant.

## Finally . . .

The H-T's approach to managing its historic facilities garners many benefits. It meets the Agency's obligation to comply with all parts of the National Historic Preservation Act, rather than just Section 106. This proactive, rather than reactive, approach encourages the development of positive relationships with the SHPO, the community, and personnel. It also replaces piecemeal efforts with a comprehensive planning process, thus paving the way for a successful program of work.

## Notes

1. *The National Facilities Team's Facilities Management Strategy*, DRAFT, 7 February 1999, p. 2.

2. Ibid., 5.

3. The Secretary of the Interior's Standards for the Treatment of Historic Properties can be found at *http://www2.cr.nps.gov/tps/secstan1.htm*.

4. It was later determined that some of the buildings were not administrative facilities, but ranch buildings acquired in land exchanges. These ranch buildings will be evaluated using a separate historic context.

5. In a letter dated June 7, 1999, Chief Operating Officer Phil Janik offered an example of $1,000 per site (not per building) and $500 per archeological site. The $1,000 estimate per site was reiterated in the FY2000 Revised Infra Protocols.

***Figure 1.*** *In the early years, the rangers were responsible for building cabins, barns, and other structures such as this building at the Currant Creek Ranger Station, photographed in 1910.*

***Figure 2.*** *In addition to buildings, ranger station sites included other features such as yard fences, flagpoles, gardens, corrals, and pastures. Lamance Ranger Station, 1914.*

***Figure 3.*** *The Civilian Conservation Corps, Works Progress Administration, and other work relief crews built bundreds of new buildings for the Forest Service in the 1930's including these at the Lamoille Ranger Station, photographed in 1938.*

***Figure 4.*** *During the 1930's, each region developed standard building plans to reflect local building traditions and materials. This led to distinct architectural identities for each region. This building is of Region 4 Plan 7A for a guard station. Berry Creek Ranger Station, 1936.*

***Figure 5.*** *During the 1940's, Conscientious Objectors from Civilian Public Service Camp 37 in Coleville, CA, constructed and occupied the Dog Valley Guard Station.*

***Figure 6.*** *The Forest Service has a long history of moving buildings. The 1911 Martin Creek Ranger Dwelling was moved to a new site and remodeled in 1958.*

***Figure 7.*** *The Coon Creek Snow Survey Cabin, constructed in 1936, is one of several cabins built to accommodate snow surveyors from the Forest Service and other agencies.*

# Blended Tree–Marking Paint for Facilities

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## Introduction

This article is intended to answer questions you may have about the use of mixed oil-based Tree Marking Paint (TMP) for painting or staining Forest Service Facilities.

## Background

For decades, as part of the timber sale preparation process, the FS has been designating trees for timber harvest by marking them with oil-based paint. Oil-based paint was used for its durability and ability to be applied in a wide range of weather conditions. To differentiate FS tree marking paint (TMP) from other paints, our suppliers are required to add a unique tracer to the paint. TMP is considered accountable property and inventories are tightly controlled.

Some timber markers using the oil-based TMP complained of various health problems that could be associated with exposure to solvents. Aware of these complaints, and attempting to be proactive to expected trends in air quality regulations, the National TMP Committee began working with our paint suppliers in 1994 to develop a low Volatile Organic Compounds (VOC) TMP that would also meet FS performance needs. Parallel to this effort, the FS in 1993 requested the National Institute of Occupational Safety and Health (NIOSH) to investigate employee concerns. Results of the NIOSH work were published in 1998 recommending that the FS select and field test high solids, low solvents, or water-based marking paints; and that old supplies of paint be collected and disposed of properly. Pre-1990 paints were collected and disposed of nationally.

In order to provide the safest working conditions possible for FS employees the Chief directed that only waterborne TMP would be used for marking timber beginning with the 1999 field season.

As of September 1999, the FS had 120,700 gallons of bulk oil-based TMP and 15,500 gallons (217,000 cans) of oil-based aerosol TMP distributed across nearly every District in the Nation. Washington Office staff groups including Law Enforcement and Investigations, Acquisitions Management, Safety and Health, Forest Management, and Engineering, met to select a disposal method which would: 1. Consider the ***safety of FS employees*** as a top priority. 2. Protect the ***security of the tracer***. 3. Meet ***Executive Order 12856*** requirements for an 80 percent reduction of our hazardous waste stream and a fiscal commitment to find alternative and appropriate uses for all products before selecting disposal. 4. M***inimize cost*** impacts.

The group's preferred alternative was discussed with the National Federation of Federal Employees, National Institutes of Occupational Safety and

Health, Engineering-Facilities, and the Chief Landscape Architect, and then approved by the Deputy Chief, National Forest System. The alternative selected is to blend various TMP colors into new colors that can be readily used for facilities maintenance by the FS and other agencies. Paint exceeding these needs will be collected on a National basis, professionally mixed, and made available to all FS units. Blended paint that exceeds FS needs will be handled as excess personal property and made available to other Federal agencies. If the paint is not needed by other Federal agencies, the paint becomes surplus and will be donated or sold.

This alternative utilizes the TMP as an in-kind replacement with a comparable safety profile of paint and stain products normally procured and currently used by FS employees. The alternative maintains complete control of the tracer within the FS, creates relatively no hazardous waste, maximizes the utilization of the unneeded TMP within the government as a useful product and at a minimum cost to the agency. Depending on the proportion of paint used on Federal facilities, the cost is estimated to be between 25 and 50 percent of the cost of standard hazardous material disposal on a service-wide basis.

## Safety of FS Employees

An obvious question that has been asked is "Why is it safe for FS employees to paint buildings and other facilities but not mark trees?"

Many timber markers work with TMP 5 days a week in a production mode, often for the entire field season. Marking timber is often done under adverse environmental conditions. Timber markers may be doing their jobs while carrying paint and equipment up steep slopes. Heavy respiration increases exposure to airborne solvents created from spraying.

Exposure to VOCs can be reduced by modification of working conditions. Most of these are more practical to adopt when working on facilities, compared to the conditions under which tree marking takes place.

When using the paint, methods to reduce exposure to solvents which should be considered are: limiting the number of days in a week using solvent-borne paints, choosing days which are cooler, have a stronger breeze, etc., and wearing gloves, coveralls, and other personal protective equipment (PPE). Also, except for those employees approved to wear a respirator, the use of the blended TMP should only be with a brush or roller, again reducing the amount of solvent exposure.

In December 1999 NIOSH did a field evaluation of the potential health hazards of using blended TMP on facilities in the National Forest System. NIOSH determined that "There was not a health hazard from the VOCs or metals present in the TMP." The report of this study and other information relating to the use of TMP can be found on the San Dimas Technology Development Center (SDTDC) website: *http://fsweb.sdtdc.wo.fs.fed.us/programs/fm/paint/reuse/index.html* or call Bob Monk or Bob Simonson at SDTDC (909) 599-1267.

## Security of Tracer

There are seven distinct colors used for tree marking. When the TMP is blended into a color that is distinctively different from any currently in use for tree marking, it is no longer considered accountable property. The blended paint may be used on FS facilities, "excessed" to other Federal agencies and, if necessary, donated or sold.

## Executive Order 12856

It has been suggested that it may be easier (and possibly less expensive) to dispose of the paint as hazardous waste.

Executive Order 12856 requires reduction of the hazardous waste stream by 80 percent and a fiscal commitment to find alternative and appropriate uses for all products before selecting disposal. There is an estimated 135,000 gallons of TMP across the Nation. If this paint were dealt with as hazardous waste it would *increase* the hazardous waste generated rather than lead to a reduction. The uses identified for blended TMP (see website identified above) are "appropriate uses" for the product, thus complying with EO 12856.

## Minimize Cost

The cost of handling the paint at the collection centers in Mississippi and Oregon is estimated to average $10 per gallon (not including shipping costs to the sites). Aerosol cans are considerably more expensive to handle than bulk paint and all aerosol paint is to be shipped to the collection centers. Until final inventories are reported, it is uncertain how much paint will be handled at each site.

It has been suggested that disposing of the paint as hazardous waste may be less costly than handling it at the collection centers. In some cases or locations this may be true. However, such actions would not meet EO 12856 and security of the tracer (if the paint is not blended) could not be easily assured.

## Use of TMP

TMP was designed and tested to meet specifications of a long-lasting exterior wood coating with excellent hiding characteristics. The TMP can be utilized as a stain or as paint. TMP can be used for architectural coatings and appurtenances such as signs, curbs, tables, etc. There are some limitations with regard to TMP and its performance with other coatings and different surfaces. Detailed information about paint uses, performance, and compatibility are addressed on the SDTDC website.

# West Fork Energy Audit Synopsis

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## Introduction

Energy audits evaluate the energy efficiency of a building. This article presents a short summary of an audit done on a typical Forest Service (FS) ranger station compound. In it you will find information about common measures to save energy for new and old equipment and buildings, the factors to use when deciding to increase efficiency, and some examples of the use of alternative energy. This article also lists additional sources of information about energy conservation and energy audits. Only FS and Bureau of Land Management employees have access to the MTDC web site, which is on an internal computer network rather than on the Internet.

## Background

The Energy Policy Act of 1992 and Executive Order 13123 of 1999 mandate Federal agencies to:

- Reduce their facilities' energy consumption by 30 percent from 1985 levels by 2005 and by 35 percent by 2010.
- Reduce greenhouse gas emissions from facilities by 30 percent from 1990 levels by 2010.
- Increase the use of renewable energy sources.
- Reduce the use of petroleum in facilities.
- Reduce water consumption.

The West Fork Ranger Station compound (figure 1) on the Bitterroot National Forest in southwestern Montana was chosen as a case study in evaluating energy use and energy savings opportunities. It includes a wide range of types and ages of buildings, making it especially suitable as a test case.

***Figure 1.*** *The West Fork Ranger Station's compound.*

Audits are a useful tool for discovering and evaluating potential energy-saving measures. Conducting an audit includes reviewing historic energy use and checking current energy systems for potential energy savings. A basic audit will also reveal whether investing in a more expensive detailed analysis is warranted.

Examples of commercial audits are few and far between for FS buildings. Most "free" information is directed toward residential applications and large office or retail operations. The results of the West Fork audit are presented here to provide an example of a typical energy audit and to identify the kinds of energy savings you may be able to find at your own district or supervisor's office.

## Decision Factors

Several factors determine the feasibility of energy savings improvements. These factors include energy usage patterns, energy costs, type of energy sources, and building and equipment age and condition.

### Usage Patterns

The level of building or equipment use is perhaps the biggest factor in deciding whether to exchange existing machinery or supplies with more efficient replacements. Energy costs are directly associated with the use of equipment; the more you use it, the more it will cost to operate. Likewise, the more you use it, the more money (and energy) you will save by replacing it with a similar but more efficient model.

### Cost of Energy and Energy Source

The cost of energy plays an important role in determining whether to upgrade to more efficient equipment. Higher energy rates enable a manager to purchase more costly and efficient equipment because the lifetime energy savings balance out the higher initial cost of the more efficient equipment. Lower energy costs, such as the West Fork's electrical rate of $0.036 per kWh, push a decision toward keeping an older piece of equipment. Furthermore, having an inexpensive and readily available source of heat, such as wood, also adds to the inclination to keep older equipment.

### Codes, Conditions, and Age

Older buildings and equipment usually do not use energy as efficiently as newer facilities, and sometimes do not comply with new regulations. Aged machinery also may have a tendency to break down and wear out. Significant efficiency improvements have been made in new motors, insulation, lighting, and controls. Replacing defective machinery with more energy-efficient equipment makes sense.

### West Fork Ranger Station

The West Fork Ranger Station is about 30 miles south of Darby, MT. The compound includes the Ranger Station office building, several historic log cabins, a bunkhouse, a warehouse, and a vehicle shop. About 20 full-time employees work in the main building year-round, along with about 35 seasonal employees during the summer. The Ravalli County Electric Cooperative serves the station. Natural gas is not available. West Fork was chosen for an audit because it contains a variety of different types and ages of buildings and energy uses. The results of the audit should apply to a wide range of other FS facilities.

Table 1 shows all buildings included in the audit, along with some basic characteristics of the buildings. Brief summaries of the recommendations are also included. The recommendations are discussed in more detail in the next section.

**Table 1—Characteristics of buildings included in the West Fork Energy Audit.**

| Building | Floors (Square Feet) | Number of Staff | Year Built | Recommendations | Notes |
|---|---|---|---|---|---|
| Ranger Station Office | First-3000<br>Second-2650 | 15-20 year-round<br>Additional 36, seasonally | 1997 | 1.Remove lamps until light levels are reduced to 50 to 60 foot-candles.<br>2.Light only areas that are occupied.<br>3.Install timer on electric hot water heater. | Ground source heat pump. Very efficient! |
| Warehouse | Main-2016<br>Second-2016 | One or two, varies seasonally | 1968 | 1.Replace broken ballasts with electronic ballasts and T8 lamps.<br>2.Replace overhead door with insulated when needed.<br>3.Enclose weight room with insulated wall if use warrants it. | |
| Shop and Garage | Shop-1500<br>Garage-1800 | One or two, varies seasonally | 1968 | 1.Repair themostat on unit heater in carpentry shop.<br>Unheated garage area<br>Electrical heated shop | |
| Bunkhouse | Main-1360<br>Basement-1360<br>(four total units) | Summer-four units occupied<br>Winter-one or two units occupied | 1968 | 1.During the winter reduce the temperature of the upper units and occupying only the lower units.<br>2.Install timer on water heaters.<br>3.Disconnect or lower temperature of water heaters when units are not used. | |
| Laundry | Main-300 | All seasons except winter | 1968 | 1.Install setback thermostat to operate below 60 degrees during occupied times. | |
| Tree Cache | Main-1040 | Occasional during all seasons | 1968 | 1.Shut off heat to the small toilet room during the heating season.<br>2.If the toilet room cannot be shut down for the winter (hot water tank drained), turn down or disconnect water heating elements in the 20-gallon electrical-resistance hot water tank. | |

**Table 1—*Continued*. Characteristics of buildings included in the West Fork Energy Audit.**

| Building | Floors (Square Feet) | Number of Staff | Year Built | Recommendations |
|---|---|---|---|---|
| Residence No. 1 | Main-1100<br>Second-1100 | Three occupants-all seasons | 1970 | 1.Consider insulating the walls with blown-in fiberglass insulation (lower level built into slope).<br>2.Insulate exposed water pipes in basement (electric furnace, wood heat.)<br>3.Insulate attic space with blown-in fiberglass insulation. |
| Residence No. 2 | Main-810<br>Basement-810<br>Second-400 | One occupant-all seasons | 1935 | 1.Insulate exposed water pipes in basement (basement built into slope, oil furnace, wood heat, 2nd-floor bedroom). |
| Residence No. 3 | Main-1344<br>Basement-1344 | Two occupants-all seasons | 1960 | 1.Insulate the basement walls (electric-resistance basebaord heat).<br>2.Keep the door to the basement closed, conserving heat from the oil furnace and wood heat upstairs. |

## Energy Audit Recommendations That Might Apply to Your Facility

The audit of the West Fork Ranger Station compound shows that money and energy-saving possibilities are likely to exist at any installation, even yours. Cost-effective opportunities to reduce energy use are limited at the station because the facilities are generally used only during three seasons. The office building was constructed in 1997. The recent construction and the frequent use of the facility enabled the building to benefit from many energy-saving measures. The following selected recommendations and findings include those we felt would apply to other FS facilities, along with some that are innovative.

### Ranger Station Office

The building's designers chose to use efficient fluorescent lighting in its construction. The fixtures include T8 (1-inch diameter) lamps and electronic ballasts. This technology is a big improvement over the old T12 ($1^{1/2}$-inch diameter) lamps and magnetic ballasts that gave fluorescent lighting a bad name. The T8 lamps are more efficient and provide much better color rendition. The electronic ballasts are quiet, start instantly, last longer than magnetic ballasts, and are more energy efficient.

The lighting levels in the offices were found to be excessively high, almost 100 foot-candles. This is not only inefficient, but can also decrease employee comfort and productivity. Lighting levels should be about 60 foot-

***Table 2. Common lighting recommendations.***

| **Lighting** | **Lighting intensity (foot candles)** |
|---|---|
| Average reading and writing | 50 |
| Offices with computer screens | |
| Task lighting | 50 |
| Ambient lighting | 25 |
| Hallways | 10 |
| Stockroom storage | 30 |
| Loading and unloading | 20 |
| Drafting rooms | 100 |

Source: *Energy Star Building Manual & West Fork Energy Audit*

candles. Table 2 contains recommendations for common lighting applications. Refer to the Illuminating Engineering Society of North America's (IESNA) Lighting Handbook for additional guidance.

It's common but wasteful to have the lights on at all times during operating hours. Turn off the lights manually when they are not in use or install sensors so that lights are operating only in occupied areas.

Install a timer on the electric hot water heater to prevent the heating element from operating when the building is unoccupied. Remember to set the timer to start heating water a couple of hours before the early birds arrive in the morning.

The main office has two geothermal heat pumps, one for each floor. The heat pumps transfer heat from the building to the earth in the summer, and move heat from the ground into the office during the winter. A geothermal heat pump can also heat water, eliminating the need for (or reducing the size of) a separate water heater. Heat pumps do all this while using about half the energy of a propane furnace and a third the energy of an electric furnace. If you cool your building with a geothermal heat pump in the summer, you will reduce your energy use by one-fourth from that required by a typical air conditioner. Ground source heat pumps cost more to install and may not be cost effective if you have a cheap supply of energy. For more information on geothermal heat pumps, check out the Department of Energy's web site at *http://www.eren.doe.gov/geothermal.*

## Warehouse

The warehouse (figure 2) is used enough to justify replacing the old fluorescent lights and magnetic ballasts with electronic ballasts and T8 lamps as the older models fail. Whether or not you need to upgrade depends on your lighting use and energy costs. An audit can help you determine whether an upgrade is justified.

If the overhead door needs to be replaced, install an insulated door. This is a perfect example of saving money while spending it. Simply replacing a usable large loading door doesn't make sense, unless you are in a cold climate, the facility is heated, and it is in constant use. However, if the door needs to be replaced anyway, buy a new door with a better insulation rating. The energy savings will pay for the higher initial cost. The time needed to make up the doors' higher initial cost depends on your use and the climate.

The fitness room attached to the warehouse is used heavily during the summer season, but not as much during the winter. It is not insulated, but space heating is provided. The audit did not recommend insulating the weight room unless its use increases to more than 4 hours per day in the winter.

## Shop and Garage

The thermostat on the heater in the carpentry shop (figure 3) should be repaired. Maintenance (such as checking thermostats) is critical to maintaining an energy-efficient building. MTDC has produced an evaluation of computerized maintenance scheduling programs, *Choosing Computerized Maintenance Management Systems for Facility Management*, 0071-2322-MTDC.

***Figure 2.*** *The West Fork Ranger Station's garage.*

## Bunkhouse

The bunkhouse (figure 4) has an upper and lower level. During the winter, when occupancy is reduced, lower the temperature of the upper level, and use just the lower level units. The upper level will act as an additional buffer to heat loss.

If your bunkhouse is occupied only at certain times, like the bunkhouse at the West Fork, consider installing a timer on water heaters to eliminate operation when the building isn't occupied. You may also want to consider disconnecting or lowering the setting on the water heaters when the buildings are not in use. Be sure the temperature stays high enough so the water does not freeze during the cold season.

***Figure 3.*** *The West Fork Ranger Station's carpentry shop.*

***Figure 4.*** *The West Fork Ranger Station's bunkhouse.*

## Laundry and Tree Cache

These two outbuildings (figures 5 and 6) had the same problem. The temperature was set too high on the heating equipment, especially when the buildings weren't being used. If you have a building that is not used during certain parts of the day, turn down the heat, or install a setback thermostat. These thermostats can be set to provide different cooling or heating levels during different parts of the day. Their cost depends on the features you want. Basic thermostats cost less than $20. Their cost can reach up to around $250, or even more if you include additional sensors for advanced thermostats.

The Tree Cache is used very little during the winter and contains a small toilet. Energy is used to heat the building during the winter. Consider not heating the building or turning the heat down if the water pipes can be drained during the winter. The West Fork audit did not estimate the savings for this measure. However, a recent audit of the Missoula Aerial Fire Depot showed draining the pipes and shutting off the heat in a 418-square-foot trailer over the winter would save an estimated $138.

***Figure 5.*** *The West Fork Ranger Station's laundry.*

***Figure 6.*** *The West Fork Ranger Station's tree cache.*

## Residences Numbers 1 and 2

No insulation was found in the 2-by-4 wood frame of Residence Number 1, and no insulation was on the concrete basement walls in Residences 1 or 2 (figures 7 and 8). In addition, the attic insulation had a rating of just R-19 when R-38 would be much more efficient in this northern climate. You naturally assume that these buildings need additional insulation. However, wood, provided at very low cost from the forest, is the primary heating source. The audit concluded that as long as wood is available, it would not be cost effective to insulate these buildings.

The water pipes running through the basement are not insulated, resulting in energy loss. Insulating exposed water pipes will save energy and improve occupant comfort.

***Figure 7.*** *Residence Number 1 at the West Fork Ranger Station.*

***Figure 8.*** *Residence Number 2 at the West Fork Ranger Station.*

## Residence Number 3

Residence Number 3 has basically the same heating system as the other residences, a furnace, electric baseboards, and a wood stove. While the other residences have insulation between the basement and the living floor, Residence Number 3 does not. Insulating the basement's concrete walls will save energy and improve occupant comfort. Keeping the door to the basement closed in the winter will help keep the upper floor warm. Naturally, opening the door in the summer and having a fan pull the cool air out of the basement will help cool the living area. Check out the Department of Energy's web site *http://www.eren.doe.gov/buildings/home/heatcool.html* for tips on efficiently heating and cooling residences and buildings of about the same size.

## Conclusions

The West Fork Ranger Station offers a perfect example of identifying energy-saving measures in a wide range of different types and ages of buildings. Taking the time to perform an energy audit, even a basic audit, can help you identify energy saving measures and determine their practicality.

## Additional Information

You can find more energy audits and related material by checking out these sources:

MTDC's Tech Tip, *Energy Conservation Measures for Buildings*, 9971-2333-MTDC

Funding Energy Conservation Projects: An Overview, *Engineering Field Notes*, 1998 May-August *[http://fsweb.wo.fs.fed.us/eng/pubs/efn/1998-2.pdf]*

The Department of Energy's Energy Efficiency and Renewable Energy Network *[http://www.eren.doe.gov]*

The Department of Energy's Federal Energy Management Program *[http://www.eren.doe.gov.femp]*

The Department of Energy's Building Technology web site *[http://www.eren.doe.gov/buildings]*

Your State's energy official *[http://www.naseo.org/Members/statewebs.htm]*

Executive Order Number 13123 *[http://www.eren.doe.gov/femp/aboutfemp/exec13123.html]*

Geothermal Information *[http//www.eren.doe.gov/geothermal]*

General Energy Efficiency Information *[http://www.pge.com/customer_services/residential/saving_energy]*

# Bibliography of Washington Office Engineering and Detached Units' Publications

This bibliography contains information on publications produced by the Washington Office Engineering staff and its detached units. Arranged by series, the list includes the title, author or source, document number, and date of publication.

This issue lists material published since our last bibliography (*Engineering Field Notes*, Volume 31, July-December 1999). Copies of *Engineering Field Notes* and most Engineering Management Series documents can be obtained from the Washington Office Engineering staff. Copies of project reports, *Tech Tips*, and special and other reports can be obtained from the technology and development center listed as the source.

Forest Service—USDA
Engineering Staff
201 14th Street, SW
Washington, DC 20024
(202) 205-0922

Forest Service—USDA
San Dimas Technology and Development Center
444 E. Bonita Avenue
San Dimas, CA 91773
(909) 599-1267

Forest Service—USDA
Missoula Technology and Development Center
Fort Missoula, MT 59801
(406) 329-3978

## *Engineering Field Notes* (EFN) – Volume 32

This publication, which is published every six months, provides a forum for the exchange of information among Forest Service personnel. It contains the latest technical and administrative engineering information and ideas related to forestry.

## EFN by Title


| | |
|---|---|
| 1999 *Engineering Field Notes* Article Award Nominations | Editor (January-June 2000): 27-30 |
| 1999 *Engineering Field Notes* Article Award Winners | Editor (July-December 2000): 3-4 |
| 2000 Forest Service Engineers of the Year (for service in 1999) | Editor (January-June 2000): 15-25 |
| Arch of Middle Fork: A Trail Bridge of Distinction (The) | Renison, Bill. (January-June 2000): 7-13 |
| Barns and Barracks, Offices and Outhouses: The Humboldt-Toiyabe National Forest's Approach to Managing Historic Facilities | Wilson, Richa. (July-December 2000): 13-21 |
| Bibliography of Washington Office Engineering and Detached Units' Publications | Editor (July-December 2000): 37-43 |
| Blended Tree-Marking Paint for Facilities | Monk, Robert. (July-December 2000): 23-26 |
| Introduction to the Water/Road Interactive Field Guide | Moll, Jeffry. (January-June 2000): 3-6 |
| It's A Good Time | Stokes, Vaughn. (January-June 2000): 1 |
| Jones Wreckum Road Low-Water Crossing Revisited | Brink, Steven A. (July-December 2000: 11-12 |
| Perspective on Travel Management on National Forest System Lands, A | Wilson, Glenda. (July-December 2000): 5-9 |
| West Fork Energy Audit Synopsis | Neese, Jasen. (July-December 2000): 27-36 |
| Your Good Work Brings Good Results | Stokes, Vaughn. (July-December 2000): 1-2 |


## *EFN* by Author


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|---|---|
| Brink, Steven A. (July-December 2000): 11-12 | Jones Wreckum Road Low-Water Crossing Revisited |
| Editor. (July-December 2000): 37-43 | Bibliography of Washington Office Engineering and Detached Units' Publications |
| Editor. (January-June 2000): 27-30 | 1999 *Engineering Field Notes* Article Award Nominations |

| | |
|---|---|
| Editor.<br>(July-December 2000): 27-30 | 1999 *Engineering Field Notes* Article Award Winners |
| Editor.<br>(January-June 2000): 15-25 | 2000 Forest Service Engineers of the Year (for service in 1999) |
| Moll, Jeffry.<br>(January-June 2000): 3-6 | Introduction to the Water/Road Interactive Field Guide |
| Monk, Robert.<br>(July-December 2000): 23-26 | Blended Tree-Marking Paint for Facilities |
| Neese, Jasen.<br>(July-December 2000): 27-36 | West Fork Energy Audit Synopsis |
| Renison, Bill.<br>(January-June 2000): 7-13 | Arch of Middle Fork: A Trail Bridge of Distinction (The) |
| Stokes, Vaughn.<br>(January-June 2000): 1 | It's A Good Time |
| Stokes, Vaughn.<br>(July-December 2000): 1-2 | Your Good Work Brings Good Results |
| Wilson, Glenda.<br>(July-December 2000): 5-9 | Perspective on Travel Management on National Forest System Lands, A |
| Wilson, Richa.<br>(July-December 2000): 13-21 | Barns and Barracks, Offices and Outhouses: The Humboldt-Toiyabe National Forest's Approach to Managing Historic Facilities |

## Reports

### Project Reports

| Title | Number | Source | Date |
|---|---|---|---|
| 1999 MTDC Documents | 0071-2846 | MTDC | 09/00 |
| Accessible Loading Platform for Boaters | 0023-2837 | MTDC | 07/00 |
| Biomechanical Analysis of Grubbing Technique in the Use of Fire Hand Tools | 0051-1201 | SDTDC | 05/00 |
| Compact Compressed Air Foam Systems | 9951-1208 | SDTDC | 11/99 |
| Field Evaluation of Electronic Fee Collection Machines for Forest Service Recreation Sites | 0023-2844 | MTDC | 09/00 |
| Geosynthetics for Trails in Wet Areas: 2000 Edition | 0057-2838 | MTDC | 08/00 |

| Title | Number | Source | Date |
|---|---|---|---|
| Ground Pattern Performance of the Ayres Turbo Thrush | 0057-2836 | MTDC | 04/00 |
| Ground Pattern Performance of the Griffith Big Dipper Model 100 Helibucket | 0051-2829 | MTDC | 04/00 |
| Ground Pattern Performance of the Marsh Turbo Thrush | 0057-2835 | MTDC | 04/00 |
| Ground Pattern Performance of the SEI Industries Bambi 324-gallon Helibucket | 0057-2802 | MTDC | 05/00 |
| Ground Pattern Performance of the Sims Rainmaker 2000-Gallon Helibucket Model SF 2000 | 0057-2816 | MTDC | 03/00 |
| Ground Pattern Performance of the Western Pilot Services Dromader | 0057-2834 | MTDC | 04/00 |
| Guide for Using, Storing, and Transporting Explosives and Blasting Materials: 2000 | 0067-2803 | MTDC | 08/00 |
| How to Prevent Woodpeckers from Damaging Buildings | 0071-2847 | MTDC | 07/00 |
| Improving Firefighter Safety in Wildland-Urban Intermix | 0051-2811 | MTDC | 02/00 |
| MTDC Forest Health Protection Program Fiscal Year 1999 Achievements | 0034-2806 | MTDC | 05/00 |
| Miniature Data Loggers Record Temperature Inexpensively and Reliably | 0025-2805 | MTDC | 03/00 |
| Operation and Maintenance Manual for Hand Pumps—2nd Edition | 9923-1209 | SDTDC | 11/99 |
| Soil Stabilizers on Universally Accessible Trails | 0023-1202 | SDTDC | 09/00 |
| T&D News: January-February 2000 | 0071-2818 | MTDC | 01/00 |
| T&D News: July/August 2000 | 0071-2862 | MTDC | 07/00 |

| Title | Number | Source | Date |
|---|---|---|---|
| T&D News: March-April 2000 | 0071-2824 | MTDC | 03/00 |
| T&D News: May-June 2000 | 0071-2845 | MTDC | 05/00 |
| Trail Construction and Maintenance Notebook: 2000 Edition | 0023-2839 | MTDC | 09/00 |
| Understory Biomass Reduction Methods and Equipment | 0051-2828 | MTDC | 04/00 |
| Understory Biomass Reduction Methods and Equipment Catalog | 0051-2826 | MTDC | 04/00 |
| User's Guide to the Lease, Purchase, or Construction Spreadsheet Program<br>Intranet only:<br>*http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm9971-2819* | 9971-2819 | MTDC | 01/99 |
| Using Recharge Control To Reduce Mine Adit Discharges: a Preliminary Investigation | 0071-2804 | MTDC | 07/00 |
| Violence Awareness Training for Field Employees | 0067-2820 | MTDC | 06/00 |
| West Fork Energy Audit Synopsis<br>*http://fsweb.mtdc.wo.fs.fed.us/pubs/htmlpubs/htm99712846* | 9971-2846 | MTDC | 09/99 |
| Wildland Fire Engine Guide | 0051-1203 | SDTDC | 09/00 |
| Wildland Firefighter Health and Safety: Recommendations of the April 1999 Conference | 9951-2841 | MTDC | 04/99 |
| Wildland Firefighter Health and Safety | 0051-2825 | MTDC | 05/00 |
| **Report No. 1 Tech Tips** | | | |
| Choosing Computerized Maintenance Management Systems for Facility Management | 0071-2322 | MTDC | 06/00 |
| Evaluating Digital Meters for Fire Weather Observations | 0051-2315 | MTDC | 06/00 |
| Evaluation of the PLGR GPS Receiver—Using WAGE Data | 0071-2340 | MTDC | 09/00 |
| Focus on the Mission: Transporting Wildland Firefighters | 0067-2357 | MTDC | 09/00 |

| Title | Number | Source | Date |
|---|---|---|---|
| Handheld Infrared Viewers for Wildland Fire Applications | 0051-2312 | MTDC | 05/00 |
| Introduction to Mechanized Trail Equipment (Video) | 0023-1401 | SDTDC | 09/00 |
| Keeping Warm on Fires | 0051-2307 | MTDC | 05/00 |
| Liquid Tank Baffles | 0051-1302 | SDTDC | 03/00 |
| Modified Romtec Trailside Composter | 0023-1305 | SDTDC | 09/00 |
| Nonmetallic Lead Lines—The Good, the Bad, and the Ugly | 0057-1303 | SDTDC | 09/00 |
| Overview of Roofing Materials for Forest Service Facilities | 0071-2314 | MTDC | 03/00 |
| Overview of Siding Materials for Forest Service Facilities | 0071-2308 | MTDC | 02/00 |
| Ripper Retrofit for the SWECO 480 Trail Dozer | 0023-2310 | MTDC | 02/00 |
| Safe Drop Height for fixed-Wing Airtankers | 0057-2317 | MTDC | 03/00 |
| Small Forestry Equipment: Island Park Demonstration | 0024-2309 | MTDC | 02/00 |
| Sustainable Building: What Are Green Building Products and Where Do I Find Them? | 9971-2307 | MTDC | 04/99 |
| Trail Buster: Portable Powered Fireline Builder | 0051-2319 | MTDC | 04/00 |
| Trails Resources Available from MTDC | 0023-2343 | MTDC | 06/00 |
| Vault Toilet Vent Gas Odor Control | 0023-1304 | SDTDC | 09/00 |
| Water Conservation Plumbing Fixtures: Metered Showers | 0023-1301 | SDTDC | 06/00 |
| Weather-Resistant Message Holders for Bulletin Boards | 0023-2359 | MTDC | 09/00 |
| Working Safely in Areas with Africanized Honey Bees | 0067-2313 | MTDC | 05/00 |

Special Reports

| Title | Number | Source | Date |
|---|---|---|---|
| Field Evaluation of the Long-Term Performance of Geocomposite Sheet Drains | 0077-1804 | SDTDC | 10/00 |
| Math for Firefighters—A Self-Study Course | 0051-1802 | SDTDC | 09/00 |
| Soil Bioengineering: An Alternative for Roadside Management | 0077-1801 | SDTDC | 09/00 |
| Soil Bioengineering Guide for Streambank And Lakeshore Stabilization | 0023-1806 | SDTDC | 10/00 |
| Using Time Domain Reflectometry (TDR) and Radio Frequency (RF) Devices to Monitor Seasonal Moisture Variation in Forest Road Subgrade and Base Materials | 0077-1805 | SDTDC | 10/00 |
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# Engineering Field Notes

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