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Engineering Technical Information System

1993 *Engineering Field Notes* Article Award Winners

Congratulations, *Engineering Field Notes* authors! The votes have been tallied and we are proud to announce our 1993 article award winners.

Article	Author
Canyon Creek Bluffs Rock Slope Stabilization; Sweet Home, Oregon	John W. Arambarri and Michael T. Long, Region 6 Willamette National Forest
Ground-Coupled Heat Pump Installations in Region 8	Randy L. Warbington Region 8 Regional Office
"Watts" Happening in Energy Conservation: Tips for Saving Energy in Facilities	George Kulick, Region 3 Santa Fe National Forest (formerly Washington Office)

We appreciate everyone who took the time and effort to contribute an article. We would also like to thank everyone who took the time to fill out and return a rating sheet. According to the comments received, *Engineering Field Notes* articles are saving the Forest Service time and resources.

In order for *Engineering Field Notes* to remain a valuable resource to personnel in the field, it is important that we continue to receive such relevant articles. Can you think of a project you worked on, a workshop attended, or other information that may be of value Service-wide? If so, send in an article and maybe next year it will be selected as one of the top *Engineering Field Notes* articles of the year.

Road Closure and Obliteration Project Project Submissions to Date

Jeffry E. Moll, P.E., Project Leader, Roads Program
San Dimas Technology and Development Center

Field response to the Road Closure and Obliteration Project being undertaken by the San Dimas Technology and Development Center (SDTDC) has been very positive. Many excellent submissions and suggestions have been made in response to an article describing the project in January–April 1994 issue of *Engineering Field Notes*. Primary project goals include assembling a broad knowledge base on closure devices, obliteration treatments, machinery, cost estimating, and contracting. Use of emerging technologies, innovations, and the products of research are also of interest.

This summary is meant to update the field on work being done and provide an idea on the content of future reports and articles on the subject. Submissions here are arranged according to category and include attributes and source.

If you made a submission and it's not here, don't panic! I have a large pile still to process. Thanks to all who have taken the time to share information. Additional submissions may be made by DG to J.Moll:W07A, or mailed to SDTDC:

Jeff Moll
444 E. Bonita Ave.
San Dimas, CA 91773

Definitions and Glossary of Terms

1. Project submission: Definitions.
   Attributes: Definitions of common terms in road obliteration, from FSM 7700, Region 6 supplement 7700-92-2. 1 pp
   Forest or source: Willamette National Forest, Region 6

2. Project submission: Division C.1.4 definitions.
   Attributes: Definitions specific to subsoiling. 1 pp
   Forest or source: Plumas National Forest, Region 5

3. Project submission: Glossary of terms.
   Attributes: Description of common terms in road obliteration, from FEMAT. 1 pp
   Forest or source: Willamette National Forest, Region 6

Example Road Obliteration Projects

1. Project submission: Article on a road obliteration project (21 miles) in a drainage area.
   Attributes: Priorities for rehabilitation activities; ID team function and planning; description of work; costs. 6 pp
   Forest or source: Gifford Pinchot National Forest, Region 6

2. Project submission: Road obliteration, water quality, and soil stabilization project descriptions.
   Attributes: Priorities for rehabilitation activities; ID team function and planning; description of work; costs; equipment rental. 50 pp
   Forest or source: White River National Forest, three districts, Region 2

3. Project submission: Road obliteration, erosion control, and soil stabilization project description.
   Attributes: Specs for maintenance and obliteration; equipment specs for rental agreement; details and drawings. 5 pp
   Forest or source: Arapaho-Roosevelt National Forest, Region 2

4. Project submission: Watershed improvement projects involving roads.
   Attributes: Includes accomplishments report and description of projects, history, planning, implementation, equipment, and suggestions. 20 pp
   Forest or source: Idaho Panhandle National Forest, Region 1

5. Project submission: Obliteration methods.
   Attributes: Homemade rippers and Tilth self-drafting winged subsoiler use; closures using log blocks with metal strips to deter chain sawing, earth covered logs, split rail fences, and signing for public education and acceptance. 1 pp
   Forest or source: Stanislaus National Forest, Region 5

6. Project submission: Article on road obliteration supporting watershed rehabilitation.
   Attributes: Description of situation, road condition survey, and decommissioning techniques and costs. 5 pp
   Forest or source: Mt. Baker-Snoqualmie National Forest, Region 6

7. Project submission: Functional Assistance Trip (FAT) Report and related information.
   Attributes: Road obliteration project in which insufficient work was done in removing fill from drainages, stabilization of drainage slopes, and providing adequate erosion control, prompting emergency measures. Reasons include lack of NEPA process, lack of resource management standards, and non-specific contract specifications. 18 pp
   Forest or source: Klamath National Forest, Region 5

Inventories

1. Project submission: Road inventory system.
   Attributes: Inventory format detailing site information, fluvial erosion, mass movement, and excavation and erosion volumes. Road assessment field form with culvert information checklist, slope failure probability rating system. Includes instructions. 3 pp
   Forest or source: Siuslaw National Forest, Region 6

2. Project submission: Road Condition Survey Guidelines (general).
   Attributes: Includes sections on general, vegetation, subgrade and slope stability, base and surfacing, drainage, traffic control devices, structures, features, and driveability. Includes instructions. 6 pp
   Forest or source: Gifford Pinchot National Forest, Region 6

3. Project submission: Watershed Improvement Needs (WIN) Casual Inventory Form.
   Attributes: Detailed checklists for site characteristics, affected habitat, road prism, drainage structures, upland erosion, stream channels, and riparian function. 3 pp
   Forest or source: Umpqua National Forest, Region 6

4. Project submission: Aquatic ecosystem restoration techniques on the IPNF.
   Attributes: Guidelines for planning and implementation of watershed restoration and rehabilitation projects based on conditions within the tributaries of the Coeur d'Alene River, applicable to other similar areas. Includes an inventory system for roads, channels/road fills, erosion/mass wasting, road rehabilitation, drainage/area rehabilitation brief, watershed accomplishment report, riparian restoration plan, structure layout, and in-stream structure implementation/monitoring. Includes detailed documentation, drawings, and sketches. 100+ pp
   Forest or source: Idaho Panhandle National Forest, Region 1

5. Project submission: Culvert inventories.
   Attributes: Suggestions for assessment of culvert installations on forest roads. 13 pp
   Forest or source: Six Rivers National Forest, Region 5

6. Project submission: Tracking of funds.
   Attributes: Accountability tracking items for "CNWR" restoration funds, with footnotes. 2 pp
   Forest or source: Willamette National Forest, Region 6

Planning

1. Project submission: Restoration and rehabilitation plan for the South Fork Salmon River Road.
   Attributes: Obliteration plan in four sections: (1) stabilization of road surfaces, channels, and riparian areas; (2) categorically organized site-specific treatments for cut slopes and (3) fillslopes; and (4) scheduling obliteration activities. Includes treatments developed such as a log grid system for slopes, use of slabwood on slopes, straw and silt fences, biotechnical treatments, native plant programs for seed collection and contract growing, and a porta-tank irrigation system. 27 pp
   Forest or source: Payette National Forest, Region 4

2. Project submission: Aquatic ecosystem restoration techniques on the IPNF.
   Attributes: Guidelines for planning and implementation of watershed restoration and rehabilitation projects based on conditions within the tributaries of the Coeur d' Alene River, applicable to other similar areas. Includes an inventory system for roads, channels/ road fills, erosion/mass wasting, road rehabilitation, drainage/ area rehabilitation brief, watershed accomplishment report, riparian restoration plan, structure layout, and in-stream structure implementation/monitoring. Includes detailed documentation, drawings, and sketches. 100+ pp
   Forest or source: Idaho Panhandle National Forest, Region 1

3. Project submission: Identification of equipment and techniques for site preparation on slopes steeper than 35 percent.
   Attributes: Includes site preparation considerations, equipment identified, non-mechanical site preparation methods, and an appendix on commercial sources and equipment brochures. 91 pp
   Forest or source: Missoula Technology and Development Center, 2400-Timber, February 1993, 9324-2804-MTDC.

Survey and Design

1. Project submission: Field survey of roads and design of obliteration, fill removal, and recontouring.
   Attributes: The laser survey instrument and LASERSOFT survey platform provide topographical information for a Design CAD treatment of earthwork and recontouring, with construction staking information a product of the design.
   Forest or source: Six Rivers National Forest, Region 5

Cost Estimating

1. Project submission: Example worksheets.
   Attributes: Earthwork quantities determination worksheets; computation sheets. 12 pp
   Forest or source: Mt. Baker-Snoqualmie National Forest, Region 6

2. Project submission: Cost estimating guides.
   Attributes: Road construction cost guides.
   Forest or source: Region 1, Region 5, Oregon State University Forest Research Lab.

3. Project submission: Bid tabulation summary.
   Attributes: Results of recent bid opening for road obliteration and watershed restoration contract.
   Forest or source: Idaho Panhandle National Forest, Region 1

Equipment

1. Project submission: Drawing.
   Attributes: Tool bar mounted winged implement for subsoiling. Designed to optimally fracture compacted soils and surfacing for revegetation and to re-establish infiltration and percolation. 1 pp
   Forest or source: Plumas National Forest, Region 5

Specifications

1. Project submission: Special project specifications for obliteration of abandoned roadways.
   Attributes: Sections 210C, D, and E correspond to closure level prescriptions "C," "D," and "E," which are described. Includes typicals for scarification, plowing, ripping, typical before and after obliteration, and typical fill removal drawings. 11 pp
   Forest or source: Idaho Panhandle National Forest, Region 1

2. Project submission: Forest Service specifications for maintenance of roads.
   Attributes: Section 836, Road Obliteration; closing roads, returning roadway to resource production, removing drainage structures, seeding fertilization, scarification, ripping, outsloping, barricades, slashing, and camouflaging road junctions. 6 pp
   Forest or source: Region 5

3. Project submission: Federal Acquisition Regulations (FAR).
   Attributes: Sections E, F, G, H, J. 12 pp
   Forest or source: Wallowa-Whitman National Forest, Region 6

4. Project submission: Special project specifications.
   Attributes: 836F Road Obliteration; T-841-02F and 841-1 Vegetation Establishment, including intent and use guides. 13 pp
   Forest or source: Wallowa-Whitman National Forest, Region 6

5. Project submission: Section C—Description/Specification/Work Statement.
   Attributes: Specific to subsoiling roads, skid trails, and landings. 8 pp
   Forest or source: Plumas National Forest, Region 5

Contracts

1. Project submission: Example contract format.
   Attributes: Contract documents, including schedule of items, project description, specifications list, special project specifications, and tolerances. Contract drawings, including maps, summary of estimated quantities, work descriptions, and typicals. Drawings on Auto CAD disks. 70 pp
   Forest or source: Mt. Baker-Snoqualmie National Forest, Region 6

2. Project submission: Schedule of items.
   Attributes: Three examples of 15 work items associated with obliteration, including costs. 2 pp
   Forest or source: Wallowa-Whitman National Forest, Region 6

Research

1. Project submission: Article on principles of high elevation ecosystem restoration and revegetation.
   Attributes: Ecosystem restoration and revegetation in classical subalpine and alpine regions, applicable practically at all elevations and in virtually all ecosystems in the Intermountain and Northern Rocky Mountain Regions. Discussion of factors limiting revegetation, and principles of restoration and revegetation. 15 pp
   Forest or source: Intermountain Research Station

2. Project submission: Effects of road ripping on hydraulic conductivity.
   Attributes: Planned study of ripping effects on hydraulic conductivity using rainfall simulation on two soil types, designed to distinguish between cases in which surface sealing can and cannot occur.
   Forest or source: Intermountain Research Station

3. Project submission: Hydrologic integration of forest roads with stream networks in two basins, Western Cascades, Oregon
   Attributes: Research on increased drainage networking in watersheds due to roads and road construction methods.
   Forest or source: Pacific Northwest Research Station; Masters Thesis by Beverly Wemple

4. Project submission: Re-establishment of subsurface flow in road recontouring.
   Attributes: Use of composite geosynthetics in a collection, transmission, and distribution system to re-establish subsurface flow. A road segment being recontoured that intercepted subsurface flow as a result of the road prism and subsequently converted it to surface or overland flow will be chosen to test the ability of the composite system in the re-establishment of subsurface flow.
   Forest or source: SDTDC

Flower Pot Wall

John Mohney, Regional Geotechnical Engineer, Region 6
Bill Powell, Group Leader, Dams and Geotechnical Services, Region 6

Introduction

On 23 June 1994, John Mohney and Bill Powell built a small wall on an existing trail to determine the feasibility of using cellular containment material. There are numerous narrow spots in trails where added width is needed for a safe trail. The test wall was constructed on the Skokomish River Trail, which is located on the Hood Canal Ranger District, Olympic National Forest. The location was on a steep sideslope, approximately 80 percent, and the trail switched back to continue below the wall location. The existing trail was built with sidecast material that was undercut as a result of a small dogwood tree that overturned. The trail was used heavily by horses, and there was a concern for safety. The District personnel had discounted moving further into the hill because the cut would have to be made about 10 feet above the trail, and the existing cut was well-vegetated. Their preferred alternative was to fell a cedar tree and drag the logs about 1/2 mile to the site. Bill Powell suggested using cellular containment materials after attending a seminar on geosynthetic materials.

Material and Equipment Needs

The necessary materials and equipment include:

1. Cellular confinement system. The material is available in 4-, 6-, and 8-inch thicknesses. We used 6-inch, which I would recommend for trail use. It comes in 10-foot by 20-foot sizes for about $200. There was enough material for four walls of the size we built (18 inches wide x 2 feet deep x 10 feet long) on the Olympic National Forest. The material can be purchased from any geotextile material supplier.
2. Razor knife to cut material.
3. Clinometer and tape to measure section. Tape can be used to measure cellular material and size of the excavation.
4. Shovel for excavating foundation and filling and compacting cell fill.
5. Pick may be needed for more compact or rocky material excavation.
6. Twelve #4 or #5 rebar in 16-inch lengths. Single jack to pound in rebar.
7. Pulaski for cutting roots and small trees.

Building Procedure

The procedure for building the wall is as follows:

1. Measure the field section showing the trail and other pertinent features. Use shovel and probe rod to determine the depth and density of the soil. See figure 1 for a plot section of the Olympic wall.

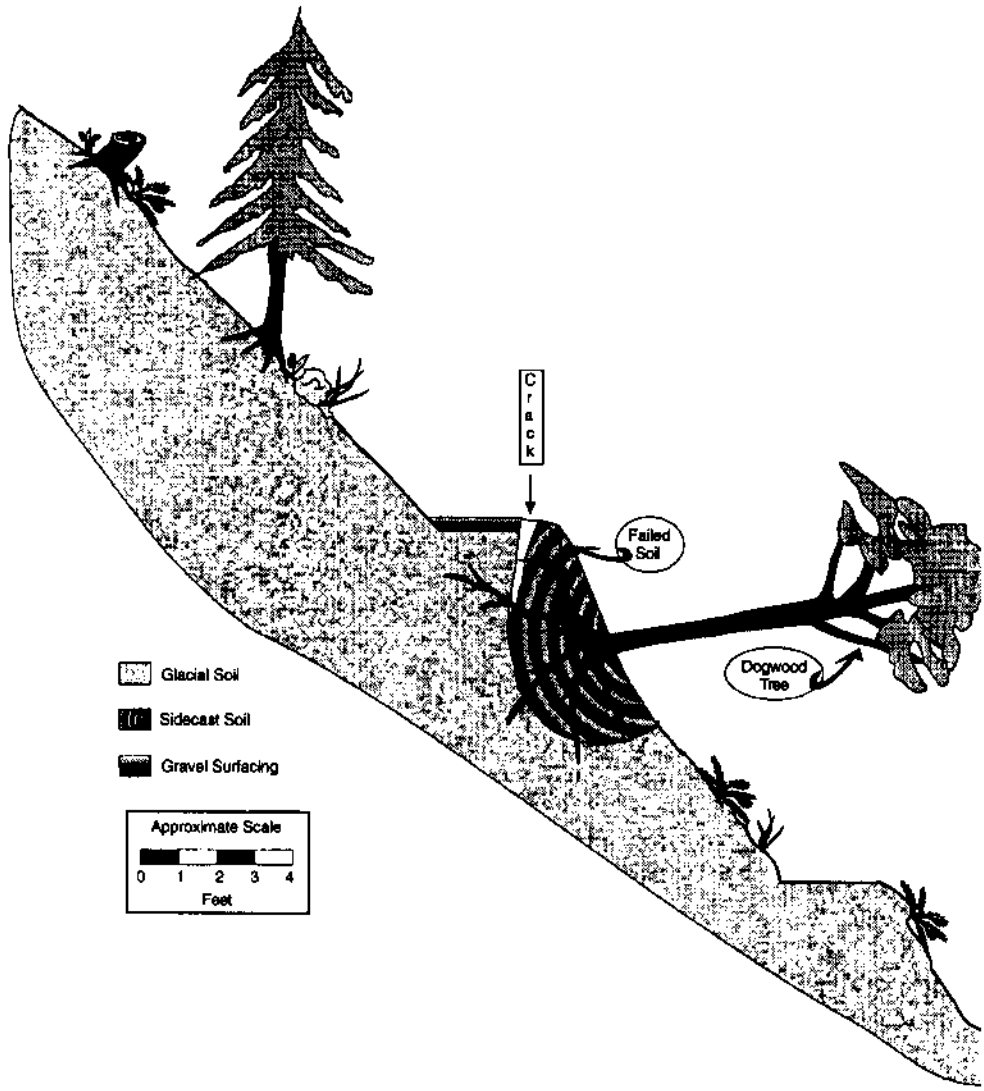


Figure 1.—Plot section of Olympic wall.

Figure 2 shows a section of the completed wall. If there appears to be any potential for weak or unstable soils within the wall foundation, you might consult a geotechnical specialist. Geotechnical specialists should be consulted on any walls over 4 feet high.

2. Try to project where the wall foundation might be using a depth/height ratio of 1 for walls less than 3 feet high. A depth-height ratio of 0.7 can be used for higher walls.

3. For the Olympic wall, the base was estimated to be 1-1/2 to 2 feet deep. The excavation was located on the section and measured on the ground to start digging for the foundation. The foundation appeared to be relatively firm on natural ground at 1-1/2 feet, so the

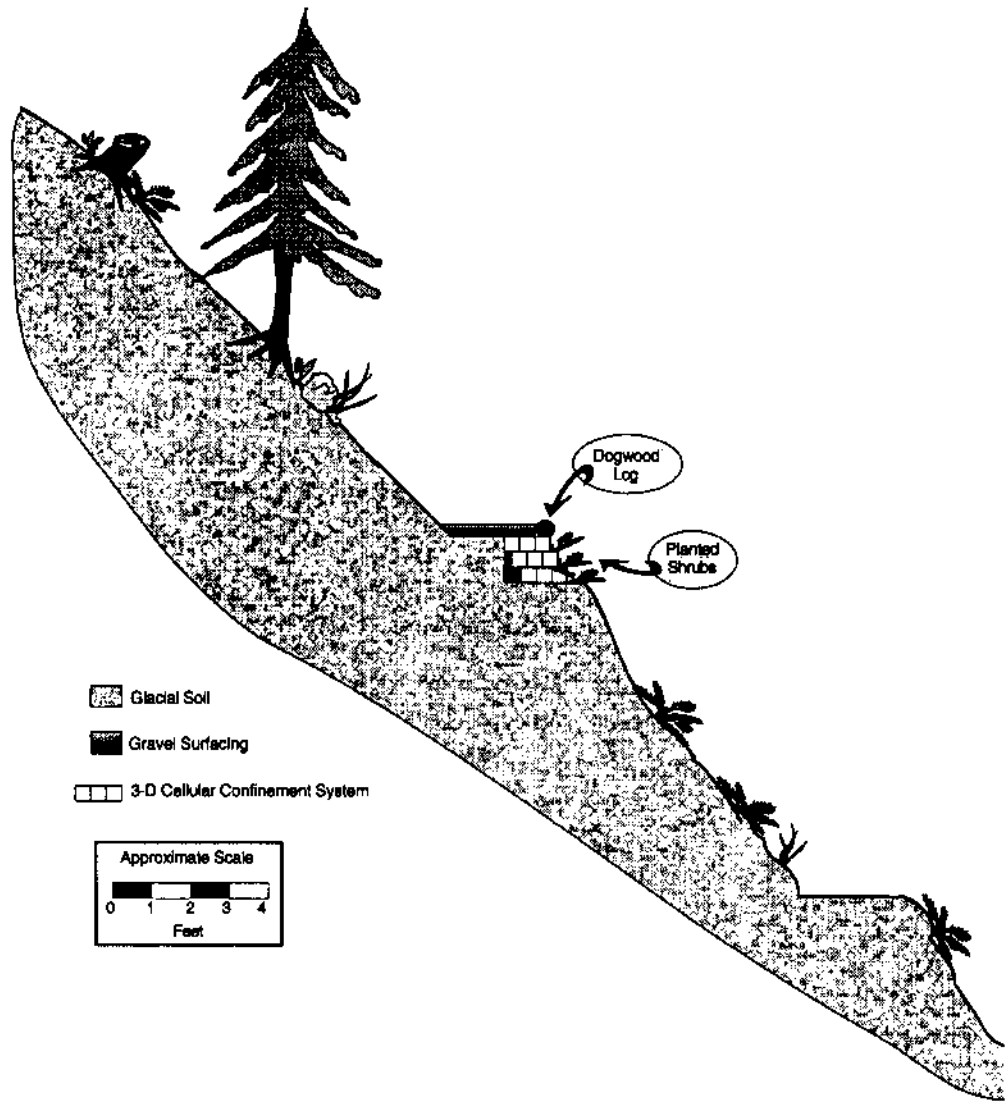
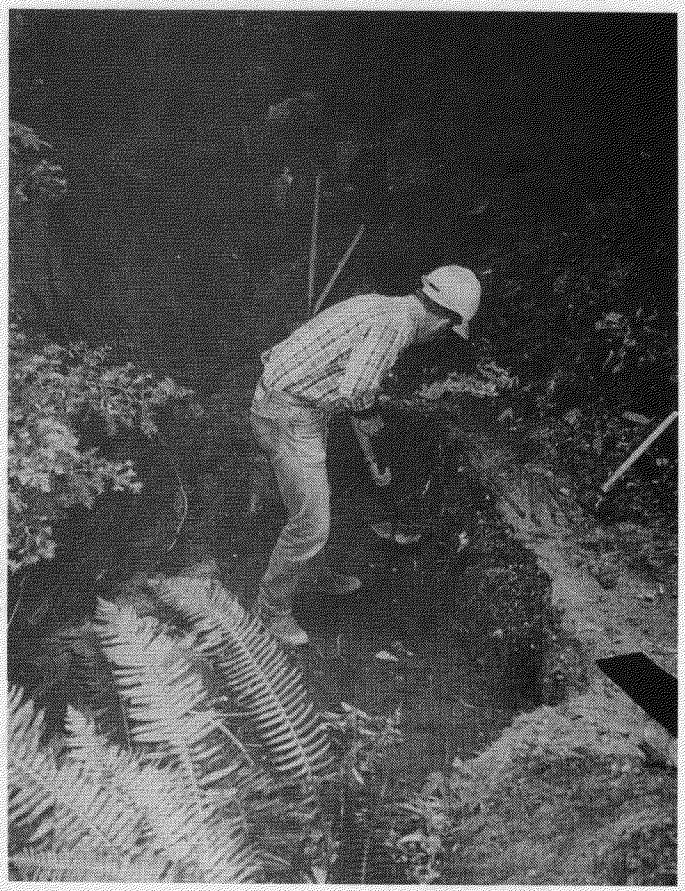


Figure 2.—Olympic wall.

base elevation was set. The excavation was over-excavated 3 inches to allow placement of a gravel fill above the cellular confinement material. See photo 1.

4. After the base of the excavation was reasonably level, there were final measurements to determine the necessary size for the cellular material. When measuring the material, make sure the cells are expanded open because the width changes when they are. It is very difficult and time-consuming to attempt splitting the welds between the cells. It is much faster to cut the web between cells and sacrifice one cell width for each layer cut. A razor knife works well for this.



5. Placing the material in the excavation is not difficult and it can be contracted or expanded to match irregularities. It is best to cut the material slightly oversize, then adjust it before filling. Sixteen-inch lengths of rebar were used to hold the cells somewhat in place before filling. It is important to start at one end and fill the cells to the desired wall face. The excavated material is used to fill the cells. It is easy to make minor adjustments before compacting the material. See photo 2.

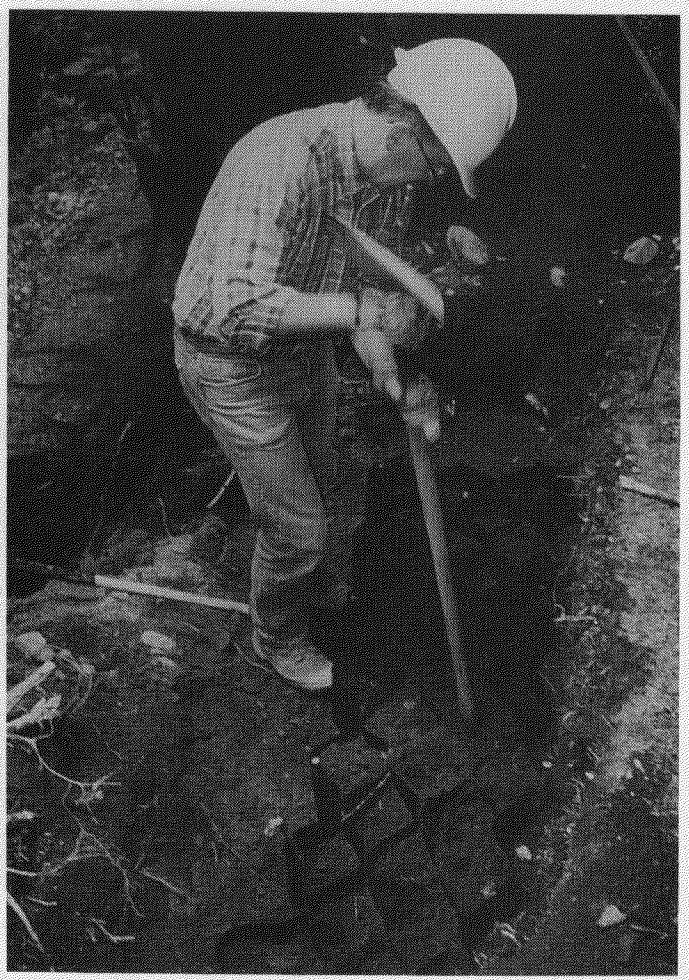
6. Compaction is obtained by applying force with the rounded end of the shovel handle. See photo 3. Two 3-inch layers will work well with final leveling required to fill and compact to the top of the cell. The rebar can be removed by prying upward with the shovel point. Final compaction can be obtained by stomping with your boot heel. Then the next layer can be placed.

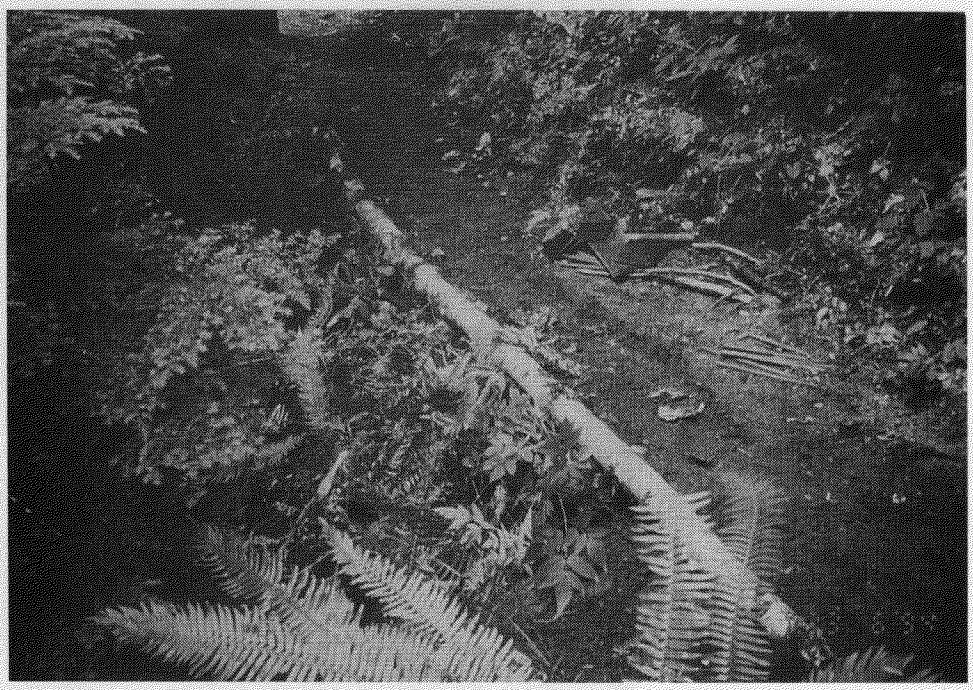
7. Continue placing layers until the final grade is reached (see photo 4). Each layer should be offset approximately 2–3 inches, both longitudinally and transversally, to leave an open cell at the face for planting.

8. We placed a 6-inch diameter log on the top outer edge of the wall to retain the gravel tread surface. See the attached final section and photo 5. Native plants were planted in the vicinity of the wall. Mostly a variety of ferns, with some Oregon Grape and Salmon Berry, was used (see photo 6). We expect that some replanting will be needed during a wetter time of year.

Summary

Two people could easily build the wall in 1 day. The total material cost was about $50. All the materials and equipment can easily be packed in one trip to the site, about 1/2 mile. The wall appears to be a long-term solution and is visually pleasing. It is easy to construct, and we expect that building another wall would be very easy after learning what is needed. For information, contact Bill Powell at (503) 326-2413, DG B.Powell:R06C, or John Mohney at (503) 326-2738, DG J.Mohney:R06C.





Partnering: "The Future Ain't What It Used To Be"

Jerry Coleman, Preconstruction/Construction Engineer
Pacific Northwest Region

Introduction

Partnering is not a new concept in the contracting process. It has been around for a long time, probably since the first contract was consummated by a handshake. A relationship of trust and respect between the contracting parties was a natural part of the construction contracting process. Owners and contractors worked together to produce quality projects on schedule and within budget. However, at some point in the past this relationship between the owners and contractors began to change into an adversarial one. Quality of projects decreased; disputes, claims, and litigation increased; and a large amount of energy from both parties was devoted to activities that added nothing to the value of the project. This change appeared to reach a peak in the 1980's. Both owners and contractors became increasingly frustrated—owners because projects were not being completed on time; disputes, claims, and litigation increased dramatically; administrative costs had increased; and the quality of projects had decreased—contractors because projects were not being completed on time, driving up overhead costs; disputes, claims, and litigation increased; and profits had decreased. Owners and contractors became acutely aware that an enormous amount of resources were being spent on activities that had no direct benefit to either party's interests. As early as 1981, owners and contractors began to realize that there had to be a better way to meet both parties' goals. In the Transportation Research Record #792 (TRR #792) an article titled, "Contractual Relationships—An Essential Ingredient of the Quality-Assurance System," by Edward A. Abdun-Nur stated, "Contractual relationships that are a subsystem of the overall system have been traditionally an adversary relationship between the owner and the contractor and thus have slowed the work and raised the cost. Frequently they have resulted in claims that were fought in courts. Defusion of such adversary relationships by equitable and fair specifications and contract documents and by engendering a team effort does away with all these negatives and, therefore, is advantageous to everyone concerned." In another article in TRR #792, titled "Summary of Contractual Relations: An Essential Ingredient of the Quality-Assurance System," Richard L. Davis wrote, "Adversarial relations are disruptive and costly in the construction field. It is in the interest of all parties to try to reduce the waste from this friction through improved communication and understanding. It is very helpful to the completion of the job if each party is competent and cooperative." In the

public contracting sector it was not until the late 1980's that the formalized concept of partnering actually made its way into the contracting process. In 1988, the Portland District, U.S. Army Corps of Engineers was probably the first public contracting agency to use a formalized process on the Bonneville dam projects. Since then, they have partnered about 200 contracts. Currently 85 percent of the Nation's state transportation departments and the Federal Highway Administration are using a formalized partnering process in their construction contracting process.

Definition

The Partnering Task Force of the Construction Industry Institute (CII) offers the following definition of partnering:

"Partnering is a long-term commitment between two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant's resources. This requires changing traditional relationships to a shared culture without regard to organizational boundaries. The relationship is based upon trust, dedication to common goals, and an understanding of each other's individual expectations and values. Expected benefits include improved efficiency and cost-effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services."

Goal

The ultimate goal of partnering is to produce a quality project safely, on time, and within budget.

Why Partner?

There has been a dramatic increase in disputes, construction claims, and litigation, which is expensive and counterproductive to everyone's effort to produce quality projects on time and within budget.

Disputes, claims, and litigation destroy working relationships.

Adversarial relationships between owners and contractors are the root cause of claims.

Partnering maximizes the effectiveness of each participant's resources.

There is a move on National, State, and local levels that places an increased emphasis on quality products and services.

What Is It?

Partnering is a term that describes an umbrella of activities that enhance the cooperative climate of public contracting and the contractual relationship. This approach focuses on the relationship of the parties and commitments to mutual goals to achieve mutual success.

Partnering puts a new emphasis on the working relationship. Through partnering, we seek to improve our efficiency in achieving the goals described in a written contract by increasing the effectiveness of our working relationships.

There are two parts to every contract. The written part establishes the legal relationships and partnering attempts to establish the working relationships.

Partnering is a team building process that strives to create mutual trust and respect for each other's roles in the construction process.

Partnering is a long-term commitment, not a contract, between two or more organizations for the purpose of achieving specific objectives by maximizing the effectiveness of each participant's resources.

Partnering changes mindsets from an adversarial relationship to one of cooperation and goodwill among all members of the building team.

Partnering focuses on the solutions rather than on the problems.

Partnering is going back to the way people used to conduct business, when a person's word was their bond.

What It Is Not

Partnering is not a substitute for the terms of the written contract. It is an informal agreement describing the relationship of the parties.

Partnering is not an unethical way of doing business. All activities are conducted within the terms of the written contract and within the law.

Partnering is not a contract, it is a commitment.

Partnering is not a quick fix to traditional adversarial relationships. Changes in attitudes and culture take years.

Partnering is not a guarantee of profit.

Partnering is not a substitute for good plans, processes, or well-trained employees.

Partnering is not a project-level workshop only. It involves the commitment of the entire group. Cultural change takes place only when it is fully supported by management. Partnering will not survive in one unit of a company if partnering isn't ingrained by company philosophy.

How It Works

It is a voluntary program that is identified in the solicitation and offered to the successful bidder at the time of contract award.

The foundation for the partnering process begins with a third-party facilitated workshop (1–2 days) held prior to the preconstruction meeting. The cost for such a workshop can run from $1,250 to $2,900 per day, depending on the number of participants. The workshop includes owners, contractors, subcontractors, and all other key stakeholders. Outcomes of the workshop are:

1. Creation of a partnering charter signed by all participants.
2. Development of an issue resolution process.
3. Development of a joint evaluation process.

Key Elements

Commitment. The commitment to partnering must come from top management and extend to all levels of the company.

Fairness. All stakeholders' interests must be considered.

Trust. Personal relationships must be established among the parties. This fosters better understanding and its by-product—trust.

Development of mutual goals and objectives. These may include such things as setting goals for value engineered savings, limiting cost growth, limiting review periods, no litigation, and other objectives.

Issue resolution process. Stakeholders must jointly develop strategies for problem solving.

Continuous evaluation. Periodic joint evaluation of progress toward mutually established goals must take place over the life of the project.

Timely responsiveness. The faster issues can be resolved, the better. Ideally, a problem is solved at the level at which it occurs, rather than escalating into a dispute.

Intangible Benefits

The result is a better quality product because energies are focused on the goal rather than on adversarial concerns.

There is a reduction in paperwork.

Morale is enhanced and work becomes more meaningful and fun.

There is a heightened awareness of the value of fair-dealing that can be used internally, externally, and in all aspects of business and life.

An awareness develops that all parties have legitimate needs that can be accommodated without jeopardizing each other's interests.

Tangible Benefits

There is reduced exposure to disputes, claims, and litigation.

- The Washington Department of Transportation (WSDOT) to date has partnered 72 contracts with one $3,000 claim paid.
- The Arizona Department of Transportation (ADOT) has partnered 96 contracts worth $300 million since 1991 and has had no claims against them, saving $5 million dollars.
  - In fiscal year 1994, ADOT's budget for legal counsel was reduced by $134,000, with an additional reduction of $80,000 anticipated in fiscal year 1995.
- The U.S. Army Corps of Engineers has partnered 200 contracts since it began partnering in 1988 and has had no claims go to litigation.

There is potential to expedite projects through efficient implementation of the contract.

- Prior to partnering, 27 percent of ADOT's projects failed to be completed in original contract time. Currently, construction time on completed projects has been reduced 20 percent.
- All of WSDOT's partnered projects have been completed on or ahead of contract time.

Prompt resolution of contract changes reduces the cost and minimizes the effects the change has on other work. Information suggests that cost of changes may be reduced between 25 and 40 percent.

There are lower administrative costs.

- ADOT has realized a 24 percent reduction in construction administration costs.

There is an increased opportunity for innovation, especially through value engineering changes and constructability improvements.

- ADOT has saved approximately $1,0Q0,000 since they started partnering 2 years ago.

There is an increased opportunity for financial success stemming from a win/win atmosphere.

- ADOT has reduced their contingency funds for partnered projects from 5 to 3 percent due to reduced total project costs (contractor's bid +/– changes – value engineering + project claims).

Disadvantages

Partnering has these disadvantages:

- Up front money is required for the facilitated workshop.
- It requires commitment from folks to attend a 1–2 day partnering workshop.
- It makes all parties feel more vulnerable.
- It requires that we change the way we have been doing business.

Present and Future Use in Region 6

Partnering has been completed on one contract in the Region, the remodel of the Tiller R.S. office on the Umpqua National Forest ($120,000).

Partnering was included and accepted on the Indian Crossing Road project on the Wallow-Whitman National Forest ($700,000). The partnering workshop has not yet been conducted.

Partnering has been included in the contract for the Toketee office contract ($1,200,000—bid open mid-August 1994) and the Diamond Lake West Side Road reconstruction project ($400,000—tentative FY 95 award).

Partnering has been included in the Johnston Ridge project on the Mt. St. Helens National Volcanic Monument ($7-8,000,000—bid open August 1994).

Partnering was offered on the Main Eagle Bridge project ($500,000—awarded spring 1994) on the Wallowa-Whitman. The contractor opted not to partner on this project.

Partnering is being used successfully by Federal, State, and local agencies but we will continue to evaluate these projects to see if adjustments are needed to better fit our needs.

Evaluate future applications of partnering to other types of public works projects and also timber sale contracts.

Propose including partnering in select projects that exceed $100,000.

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Tarricone, Paul. "Howdy, Partner." *Civil Engineering.* March 1992. p. 72–74.

The Associated General Contractors of America. "Partnering a Concept for Success." September 1991.

Warne, R. Thomas. "Partnering for Success." American Society of Civil Engineers, New York, NY. 1994.

"85% of DOT's Use Partnering on Projects." *Better Roads.* February 1994. p. 29.

SAMPLE PROVISION TO BE INCLUDED IN CONTRACT SOLICITATION

PARTNERING

The Partnering Task Force of the Construction Industry Institute offers the following definition of partnering:

> "Partnering is a long-term commitment between two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant's resources. This requires changing traditional relationships to a shared culture without regard to organizational boundaries. The relationship is based upon trust, dedication to common goals, and an understanding of each other's individual expectations and values. Expected benefits include improved efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services."

The Forest Service intends to encourage the foundation of a cohesive partnership with the contractor and its subcontractors. This partnership will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objectives are effective and efficient contract performance, intended to achieve completion within budget, on schedule, and in accordance with plans and specifications.

This partnership will be bilateral in makeup. Participation will be totally voluntary and will not be an evaluation factor for award. In the event that the contractor elects to participate in a partnering agreement, the key personnel of the contractor (including subcontractor personnel) and key Forest Service personnel involved in the project will attend and participate in a 1-day partnering orientation workshop arranged by the Forest Service at a mutually agreed upon time and place. A third-party facilitator for the initial partnering orientation workshop will be selected and compensated by the Forest Service. All other costs associated with effectuating this partnership (salaries, transportation, etc.) will be born by the respective parties to the contract with no change in contract price. Participants in the orientation workshop will not be available for other duties while the workshop is being conducted. It is intended that the orientation workshop be held prior to issuance of the notice to proceed. Some minimal delay in the issuance of the notice to proceed may occur to facilitate completion of the orientation workshop. Follow-up workshops may be held periodically throughout the duration of the contract as agreed to by the contractor and the Forest Service.

The contractor may exercise the election to partner by signing and returning a form provided with the notice of award. The form must be completed and returned within 5 calendar days of receipt of the notice of award. Either partner may withdraw from the partnership arrangement upon written notice to the other. However, no claim or dispute settled or change approved during the existence of the partnership shall be revived.

PARTNERING AGREEMENT

❑ I DO ❑ I DO NOT

Elect to enter into a partnering agreement with the USDA Forest Service, Region 6, for the following project:

CONTRACT NUMBER:
PROJECT NAME:
FOREST:

RETURN FORM WITHIN 5 CALENDAR DAYS AFTER RECEIPT

_____ _____

SIGNATURE DATE

_____

COMPANY

_____

POSITION

Burgess Junction Visitor Center

Lexie Benson, Civil Engineer
Bighorn National Forest Region 2

The newly-constructed Burgess Junction Visitor Center sits in North Central Wyoming just 2 miles east of Burgess Junction, at the intersection of two scenic byways in the northern Big Horn Mountains. Visitors can look out of its large two-story bay window towards the stunning Twin Buttes to the North, a Dolomite outcropping that typifies the geology of the Big Horns. The facility is located 30 miles from the nearest town of Dayton, population 500 people.

Why a Remote Site for this Visitor Center?

The Burgess Junction Visitor Center concept was developed as a unique single solution to two separate needs. First, the State of Wyoming was considering constructing a year-round rest stop to accommodate those people travelling across the Big Horns. A large and growing number of vacationers traverse this corridor en route to and from Yellowstone and Grand Teton National Parks, Devil's Tower, and the Black Hills area. Secondly, a consortium of National Forest and Grasslands representatives from the Nebraska National Forest to the Bridger-Teton National Forest were collaborating on methods to provide a unified interpretive theme for the multitudes making this East-West migration. It could also serve as a place to share information with the travellers about what they might encounter "down the road."

This collaborative effort by the Forests led to a contract, awarded in 1989, for the development of the interpretive theme as well as for exhibit design for two visitor centers. The result was a travel corridor entitled "Passage to Adventure" that links the Forests together. A couple of preliminary designs for a visitor center building and site as well as exhibits were also developed.

Burgess Junction was identified as a key link in the "Passage to Adventure," situated in the middle of the travel corridor (see figure 1). At this point, a cooperative agreement was entered into between the Big Horn National Forest and the Wyoming Transportation Commission for the joint construction of the Burgess Junction Visitor Information Center and Rest Area Facility.

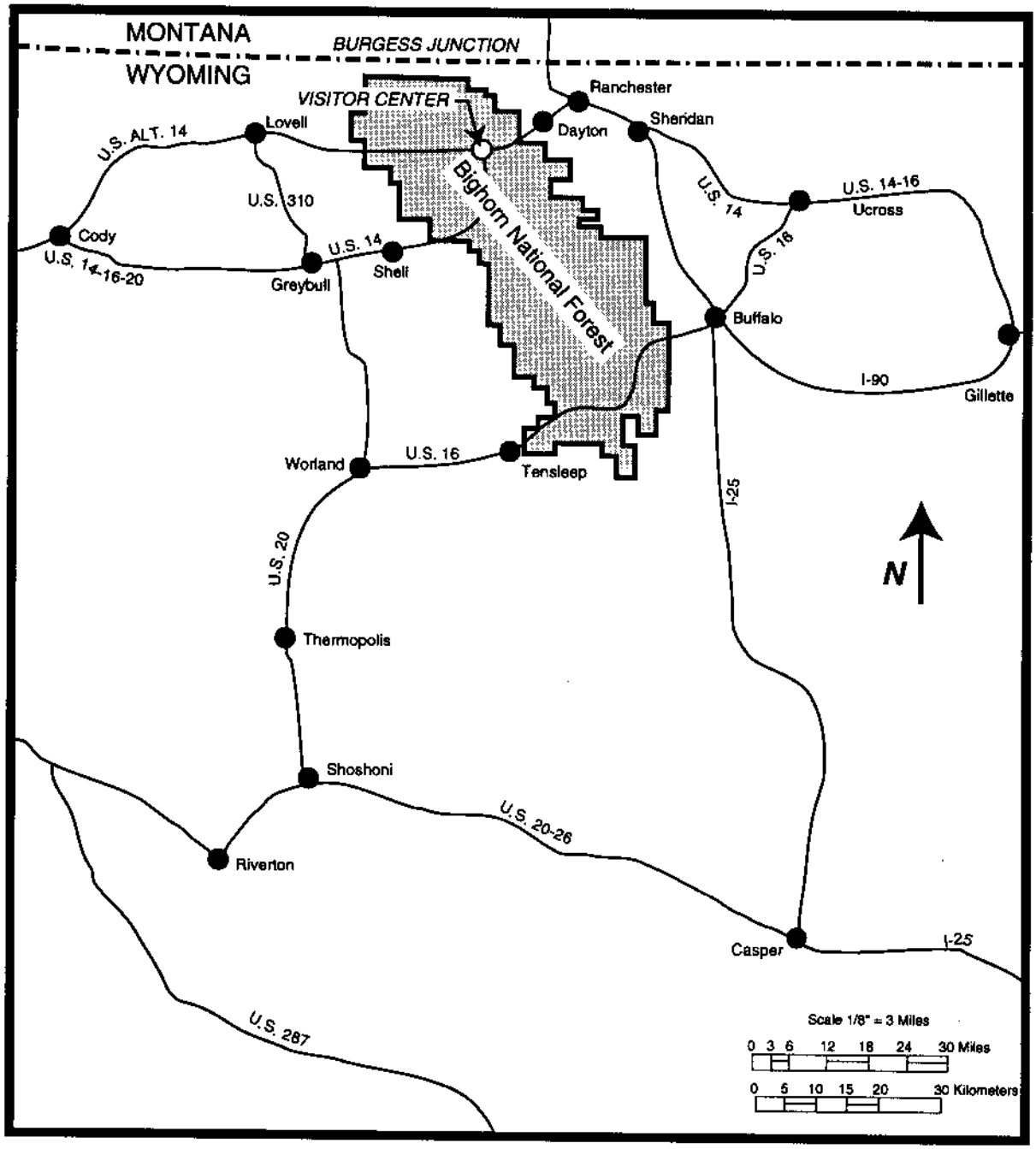


Figure 1.—Vicinity of Big Horn National Forest.

Construction Contracts

Building Contract—$1.3 Million

The building contract was awarded in September 1992 to N.A. Nelson Construction of Sheridan for $1.3 million. The contract was for of the building, site water and sewer systems, entry plaza, three drop-off areas, landscaping and irrigation, and an interpretive trail.

The facility has an interior area of approximately 5,000 square feet. It is comprised of a large exhibit hall, sales area, and storage room; a theater; a lobby, reception area, and office; and a restroom area that is separated from the rest of the building by a vestibule entryway. This allows the exhibit and visitor portions to be closed off during the winter months, while the restroom portion can remain open.

The site receives a tremendous amount of snow and wind. Designers used a snow load of 120 psf and an average wind speed of 100 mph. This, added to the desire for a timber building that would blend with the terrain and other buildings in the surrounding area, required some very large structural timber members.

To support the structure on the site's expansive clay, the foundation was designed as a grid of 43 concrete piers, 1 foot in diameter, at an approximate depth of 20 feet. A system of concrete grade beams 1 foot wide by 4 feet high sits atop the piers. Three different flooring systems were utilized. The exhibit hall area is supported by steel beams and premanufactured wood truss joists. The storage room and main vestibule have open web steel joists with a pan floor system. The restroom area encompasses a concrete slab-on-grade with 6 inches of corrugated cardboard "SureVoid" underneath.

The roof system, with an R-value of 30, is comprised of 3- by 6-inch tongue and groove decking, 1-1/2-inch rigid board insulation, 4 inches of insulated construction panel, 1/2-inch plywood, rubber sheeting, and fiber/cement shakes alternated with felt.

The lower half of the exterior will be covered in "manufactured" rock called "cultured stone," while the upper portion will be covered with vertical cedar siding.

Parking Lot Contract—$400,000

The construction of the parking lot and entrance road will be handled by WDOT in conjunction with 5 miles of highway reconstruction work. They will also perform all pavement maintenance and snow removal at the visitor center site.

Exhibit Contract—$300,000

The contract for the visitor center's exhibits went out to bid in the summer of 1993. It was awarded to Interpretive Exhibits, Inc. of Salem, Oregon. The exhibits are currently under construction in Oregon. They will be installed in the visitor center between April and June of 1995. The contract consists of the following:

1. Fabrication and installation of 15 distinct exhibits to be housed in the exhibit hall. Topics include "Four Seasons of Fun," "Nature-See for Yourself," and "Ranching Heritage." The types of exhibits to be used are also varied. There will be life-size replicas, audio displays, photo essays, artifacts, photo-murals, and "touch-feel" exhibits.
2. Fabrication and installation of interpretive signs along the foot trail to interpret scenery and geology of the Big Horn Forest and Mountains (Twin Buttes, Black Mountain, etc.)
3. Fabrication and installation of exhibits for the outdoor kiosk.
4. Installation of multimedia presentation equipment such as stackable seating and a laser disc with a 5–7 minute show about exhibits that visitors will see in the hall.
5. Provide a sales area for an interpretive association to sell books, souvenirs, etc. A children's area also may be included.

Recycled Timbers Used as Structural Members

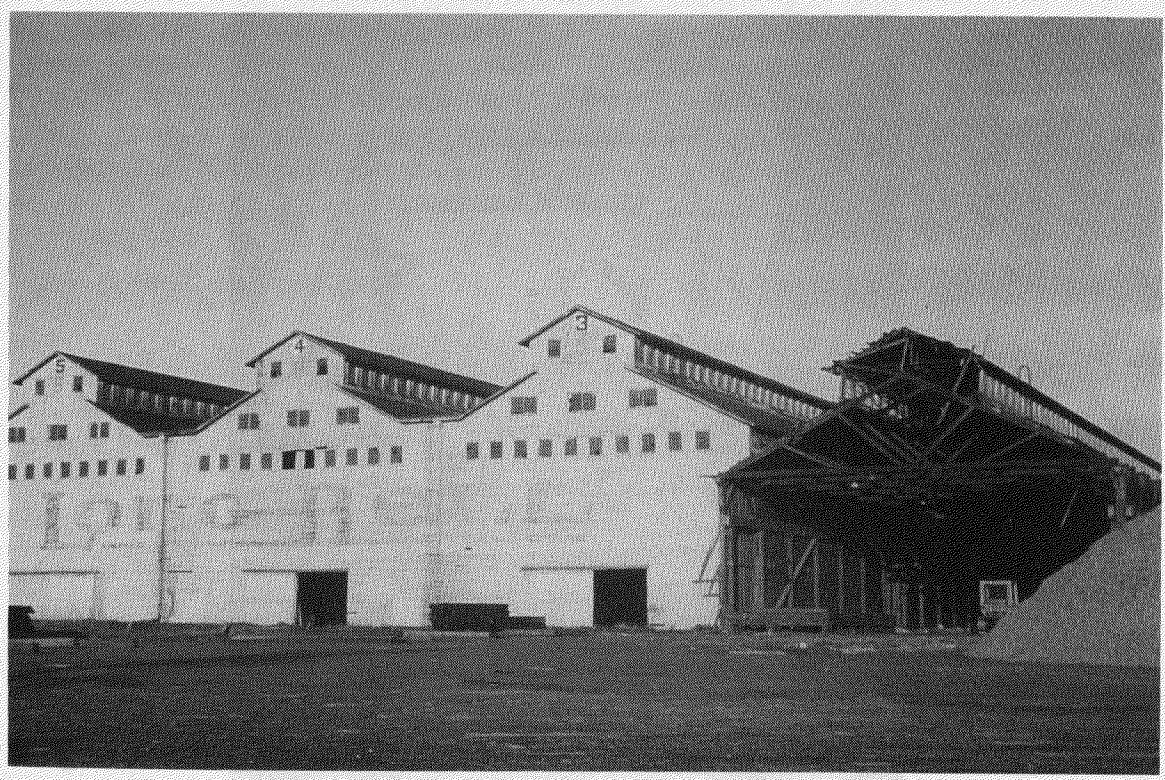
During the preconstruction meeting, N.A. Nelson's vice president voiced concern about the feasibility of using the specified material for the structural heavy timbers. The structural members had been designed to be of new, kiln-dried lumber with a moisture content at the time of installation of no more than 19 percent. All members were to be solid; no glue-laminated members were to be allowed. The superintendent's concerns were:

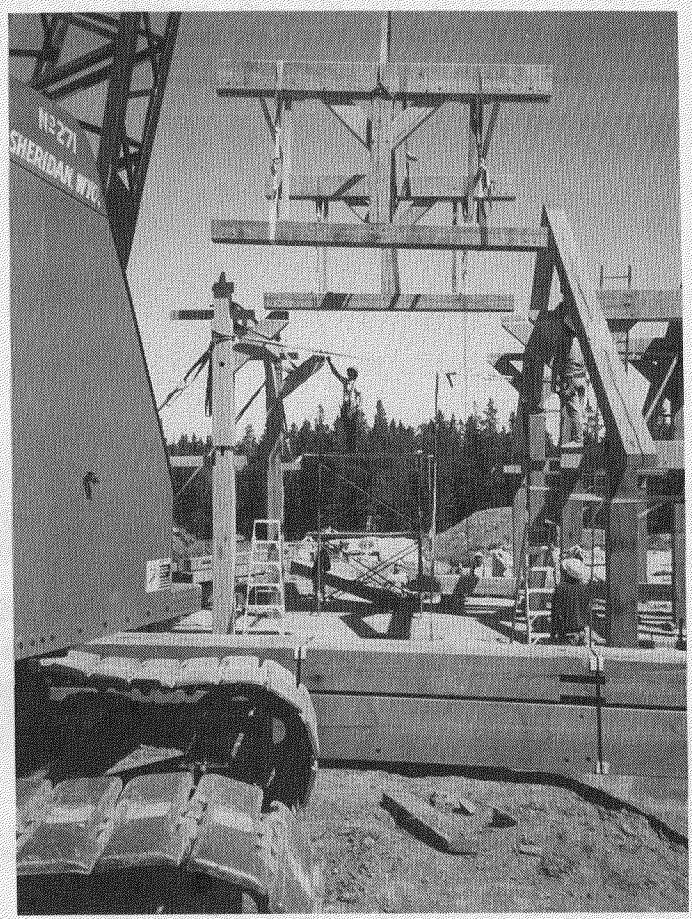
1. Since the time that the specs were written, the price of lumber had skyrocketed because of the hurricane in Florida.
2. A moisture content of 19 percent is very difficult to achieve and maintain in new lumber. The wood undergoes many cycles of expansion and contraction for an infinite number of years.
3. Solid members of the dimensions that had been designed (as large as 11 by 17 inches in cross-section) are extremely expensive because trees of that size are hard to find nowadays.
4. The original design included 32 tons of steel connectors; therefore, there was a definite need to decrease the dead load.

N.A. Nelson Construction proposed to use "recycled timbers" instead; these are members that are taken out of an old building that is torn down because of age or lack of future need. The proposal was accepted and became what we know as a Value Engineering Cost Proposal (VECP). (The VECP states that if a contractor can come up with a less expensive way of doing something that is acceptable to the Forest Service, the savings will be split, with 55 percent going to the contractor and 45 percent going to the Forest Service.) In this case, the Forest Service enjoyed a $7,000 savings, while the contractor kept $9,000.

These recycled timbers were supplied by Big Timberworks, Inc. (BTWI), a subcontractor out of Bozeman, Montana. They deal primarily in salvage and utilization of large, old growth solid sawn lumber. The source, otherwise known as the "industrial forest," for the Burgess Junction Visitor Center was a Georgia Pacific lumber mill in Longview, Washington. This facility was built in the early 1900's out of old growth Douglas Fir and was comprised of four enormous warehouses, each 100 feet wide by 400 feet long (see photo 1). After being removed, the timbers were sent to the BTWI warehouse, where first they were pressure-washed to remove old paint and dirt. Next, all metal fasteners were located with a metal detector and removed by hand so as not to jeopardize the integrity of the wood. Each face was then individually re-sawed to straighten the timber and to size the member to the dimensions as specified by BTWI's structural engineer and verified by the architect. The proper cuts for the mortise and tenon joinery were then made (see photo 2). No bolts or nails were used in the installation—oak dowels were the only connectors (see figure 2).

The 255 members were assembled by BTWI craftsmen in approximately 2 weeks, using ancient heavy timber techniques and a lot of teamwork. In many instances, several timbers were put together first on the floor into what is called a "bent," or section of the structure from one crossbeam to the next. The bent was then hoisted by a crane to its destination with thick nylon straps (see photo 3). Chisels, files, and a huge mallet were used to fit the timbers into their final connecting positions (see photo 4).





The finished product was truly a masterpiece (see photo 5). Many of the exterior heavy timbers have since been covered up, at least partially, with conventional wall framing. But the interior members have evolved to become part of the main exhibit hall. In fact, a special exhibit is being developed to interpret the use of the recycled heavy timbers as the building's structural system. The old timbers give visitors a link between the past and the present, along with the realization that much can be learned from past successes. We here on the Big Horn feel that the Burgess Junction Visitor Center, in its conservative use of new timber, one of our most treasured resources, portrays the Forest Service as an agency committed preserving our natural resources.

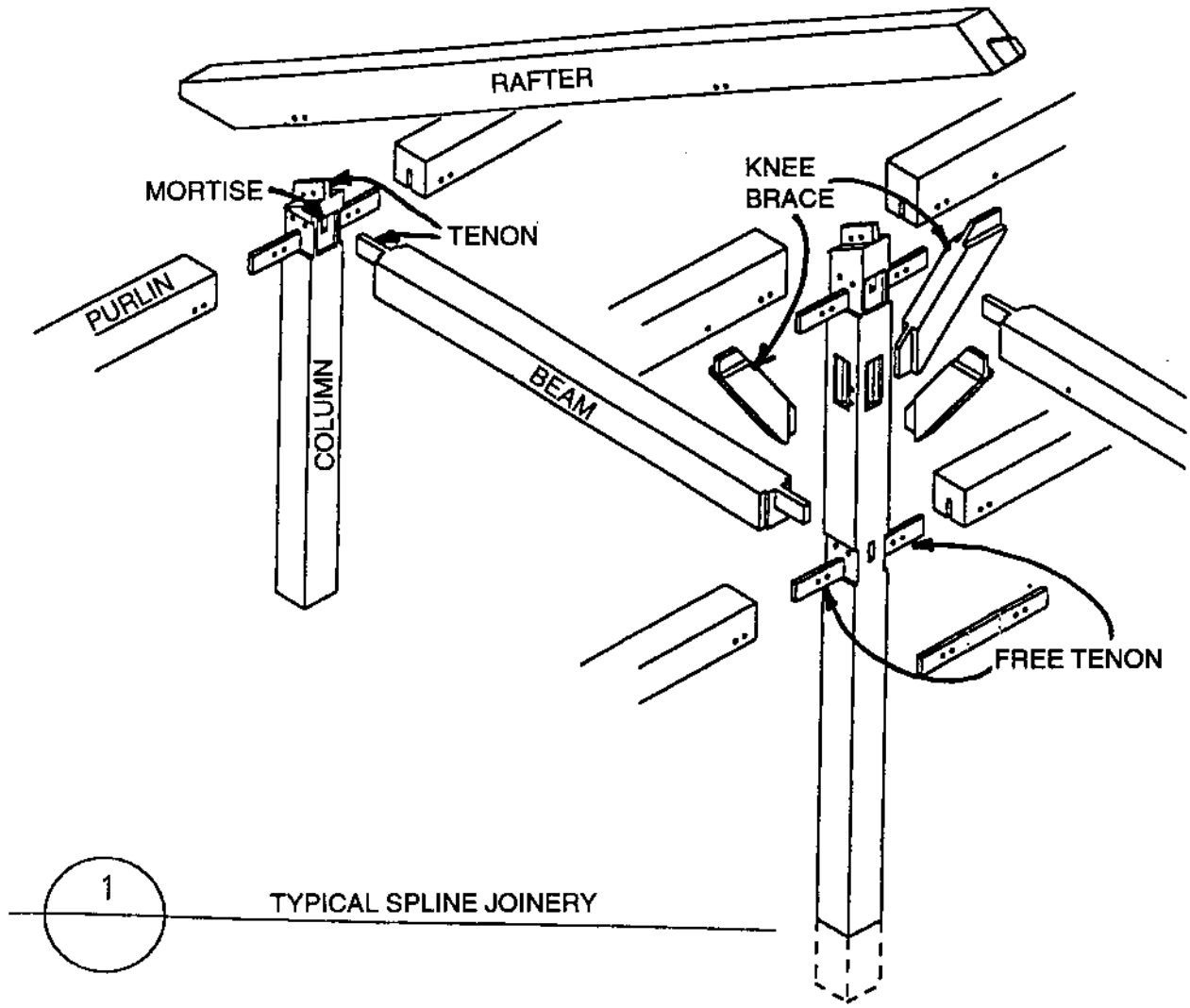


Figure 2.—Spline Joinery.

Forest Service Design/ Construction Personnel

Head Architect: Lee Deeds, Regional Office Service Center
Structural Engineer: Scott Mitchell, Regional Office
Electrical Engineer: Terry Armbruster, Regional Office
Landscape Architect: Dan Lovato, Regional Office
Hydraulic Engineer: Max Carpenter, Big Horn National Forest

Contracting Officer: Laurene Hothem, Regional Office
Contracting Officer's Representative: Gary Blyth, Big Horn National Forest
Inspector: Lexie Benson, Big Horn National Forest

Contracting Personnel— Building Construction

Prime Contractor: N.A. Nelson, Sheridan, WY
Superintendent: Brad Nelson
Heavy Timbers Sub: Big Timberworks, Inc., Bozeman, MT
Electrical Sub: Demchok Electric, Sheridan, WY
Mechanical/Plumbing Sub: Green/Orr Heating & Plumbing, Sheridan, WY
Sheet Metal Sub: Prill Bros., Sheridan, WY
Roofing Sub: Irvin Roofing Co., Columbus, OH
Drywall Sub: Double R Drywall, Sheridan, WY
Painting Sub: Clymore Painting, Inc., Sheridan, WY
Masonry Sub: Thompson Master-Masons, Sheridan, WY
Excavation Sub: Buckley Construction, Sheridan, WY
Pier Drilling Sub: Elco Drilling, Casper, WY
Welding Sub: Al's Welding & Fabrication, Sheridan, WY
Surveying Sub: Presfeldt Surveying, Sheridan, WY

Bibliography of Washington Office Engineering and Technology & Development Publications

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

This issue lists material published since our last bibliography (*Engineering Field Notes*, Volume 25, November-December 1993). Copies of *Engineering Field Notes, Technology & Development News*, Engineering Management Series, and other publications listed herein are available to Forest Service personnel through the Engineering Staff Technical Information Center (TIC). Copies of "Project Reports," "Tech Tips," and "Special & Other Reports" are available from the Technology & Development Center that is listed as the source.

Forest Service—USDA
Engineering Staff, TIC
201 14th St., SW
Washington, DC 20250

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

Forest Service—USDA
Missoula Technology & Development Center
Fort Missoula, Bldg. 1
Missoula, Montana 59801

Engineering Field Notes

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

EFN by Title

EFN by Author

Griswold, Gordon W. EFN 26 (May–August 1994): 7–15	Field Application and Review of Hand-Held Laser Survey Instrument Grand Mesa, Uncompahgre, and Gunnison National Forests, Gunnison Engineering Zone
Guerin, Tracey. EFN 26 (January–April 1994): 21–26	Erosion Control/Trout Habitat Structures
Mohney, John and Powell, Bill. EFN 26 (September–December 1994): 9–16	Flower Pot Wall
Karksy, Dick. EFN 26 (May–August 1994): 17–20	Excavators for Site Preparation
Moll, Jeffry E. EFN 26 (January–April 1994): 31–33	Road Closure and Obliteration Project
Moll, Jeffry E. EFN 26 (September–December 1994): 3–8	Road Closure and Obliteration Project, Project Submissions to Date
Moll, Jeffry E. EFN 26 (January–April 1994): 37–44	The Lasersoft Revolution
Zirkle, John L. EFN 26 (January–April 1994): 15–21	Licensing Requirements for Federal Engineers

Engineering Management Series and Other Publications

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

Application Guide for Launched Soil Nails, Volume I July 1994.	EM 7170-12A
Application User's Guide: AMS Drinking Water Module for Drinking Water Systems Inventory Version 01.00. November 1993.	EM 7400-1
Basic Mathematics Self-Study Training Course—Engineering Construction Certification Program. Revised April 1994.	EM 7110-1
Buildings Self-Study Training Course—Construction Certification Program. Revised June 1994.	EM 7115-512-100
Forest Service Guide to CERCLA. January 1994.	EM-2160-1
Lowell Surfacing Thickness Test Road Final Report. June 1994	EM 7170-15
Project Report for Launched Soil Nails—1992 Demonstration Project. July 1994.	EM 7170-12B
Public Works Administration for Construction Inspectors and Contracting Officer's Representatives Self-Study Training Course—Construction Certification Program. January 1994.	EM 7115-503-100
Retaining Wall Design Guide. September 1994.	EM 7170-14
Slope Stability Reference Guide for National Forests in the United States, Volumes I, II, and III. August 1994.	EM 7170-13
Standards for Forest Service Signs and Posters. Revised August 1994.	EM-7100-15

Timber Sale Contract Administration for Construction Inspectors and Engineering Representatives Self-Study Training Course—Construction Certification Program. April 1994.	EM 7115-502-100
Trails Self-Study Training Course--Engineering Construction Certification Program. Revised January 1994.	EM 7115-506-100

Technology & Development News

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

Title	***Issue***
Accident Site Investigation Guide	January–February 1994
Accident Site Investigation Guide	March–April 1994
Aircraft GPS Navigation Equipment Demonstration/Evaluation	September–October 1994
Aviation Crews and Noise Exposure	January–February 1994
Central Tire Inflation (CTI) Update	January–February 1994
Central Tire Inflation (CTI) Update	November–December 1994
Change in Distribution Techniques for *Technology & Development News*	January–February 1994
Do You Have an Idea for a Recreation T&D Project?	March–April 1994
Explosive Technology Field Assistance	September–October 1994
GPS Receiver Test	January–February 1994
Helicopter Pilots and Fire Suppression—The Video	January–February 1994
Indonesian GPS Training	November–December 1994
Laser Survey	November–December 1994
Laser Surveying Update	March–April 1994
Leadline Hook Latches and Safety	January–February 1994
Machine Vision	March–April 1994
Mechanical Engineering (ME) Support Program	January–February 1994

Microtaggant Field Trials	May–June 1994
National Pesticide Use Management Course	May–June 1994
New Explosives Product	March–April 1994
New Field Crew Training Video	July–August 1994
New Fireline Explosive Qualified	September–October 1994
New Recreation Publications	January–February 1994
New Recreation Publications	November–December 1994
New Recreation *Tech Tips* Issued	May–June 1994
New Smokejumper Parachute Canopy—"Concept-7"	July–August 1994
NWCG Publications	September–October 1994
Preliminary Evaluation of Military PLGR	November–December 1994
Recreation Experiences and Noise Exposure	January–February 1994
Region 6 Truck-Mounted Crew Carriers	July–August 1994
Region 6 Fire Engine Overheating	July–August 1994
Road Technology Projects Change with the Times	January–February 1994
Smallwood Project Completed	November–December 1994
Stump Applicator Design	November–December 1994
T&D Project Reassignments	July–August 1994
T&D Recreation Steering Committee Convenes	September–October 1994
Three New Publications Available	March–April 1994
Timber Sale Portable Crossings	September–October 1994
"The Road and the Environment" Video	September–October 1994
Tree Marking Paint	January–February 1994
Tree Marking Paint News	March–April 1994

Trimble Centurion P(Y) Code Receiver Evaluation	May–June 1994
Two New Sound Measurement Reports	September–October 1994
Type I Helicopters in Fire Suppression	March–April 1994
Vehicles Retrofitted for Central Tire Inflation	May–June 1994
Venezuela	July–August 1994
	November–December 1994

Tech Tips

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

Title	***Source***	***Number***	***Date***
55-Gallon Drinking Water Bag	MTDC	9451-2306	12/93
55-Gallon Suppression Water Bag	MTDC	9451-2307	12/93
Accessible Lock-Bar Toilet Paper Dispenser	SDTDC	9423-1301	3/94
Aerial Lifts for Working in Tree Tops	MTDC	9424-2314	1/94
ATV Operator Training	MTDC	9467-2804	11/93
Battery Evaluation	MTDC	9423-2331	4/94
Carbohydrate/Electrolyte Replacement Beverages	MTDC	9451-2343	6/94
Dip Tanks for Type 1 Helicopter Operations	SDTDC	9457-1307	7/94
Excavators for Site Preparation	MTDC	9424-2310	12/93
Face/Neck Shrouds	MTDC	9451-2342	6/94
Fusee Launcher	MTDC	9451-2350	6/94
GPS Use in Wildland Fire Management	MTDC	9451-2337	4/94
Ground Ignition Systems Guide: An Equipment Guide for Prescribed and Wildfires	MTDC	9451-2313	1/94
Handling Bio-Hazard Material	MTDC	9451-2353	6/94
Hazard Tree Blasting	MTDC	9471-2344	6/94
Helicopter Operations and External Accessories	SDTDC	9457-1302	8/94
Lessons Learned: The Use of Personal Protective Equipment on Wildland Fire Entrapments in 1993	MTDC	9451-2335	4/94

Machine Vision—A Computerized Sorting and Grading System for Seedlings	MTDC	9424-2319	2/94
Monocable Zigzag Yarding System	SDTDC	9424-1305	5/94
New Explosives for Trail Construction	MTDC	9423-2315	2/94
New Water Storage Tank Coating Regulations	SDTDC	9471-1304	5/94
Reducing Tire Pressure Reduces Sediment	SDTDC	9477-1306	7/94
Remote Hook Suppliers	SDTDC	9457-1303	5/94
Spotters Video	MTDC	9451-2334	4/94
Tree Marking Paint Improvements	MTDC	9424-2325	4/94
Water Bags for Wildland Firefighting	MTDC	9451-2305	12/93

Project Reports

Project Reports are detailed engineering reports that generally include procedures, techniques, systems of measurement, results, analyses, special circumstances, conclusions, and recommendations rationale.

Title	*Source*	*Number*	*Date*
Alaska Helicopter Tours Sound Measurements: Juneau, Alaska	SDTDC	9457-1204	6/94
Fish Cleaning and Disposal of Fish Viscera	SDTDC	9423-1203	10/94
Investigation of Leadlines Separating From Helicopter Hooks	SDTDC	9357-1206	11/93
Road Use Estimator	SDTDC	9451-1205	9/94
Rock Creek Enduro Sound Tests—Eldorado National Forest May 1993	SDTDC	9423-1202	5/94
Steep Slope Slash Treatment	SDTDC	9451-1206	9/94
Use of Tags for Identification and Improved Log Accountability—A Limited Trial	SDTDC	9424-1201	7/94

Special and Other Reports

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

Title	***Source***	***Number***	***Date***
1993 MTDC Publications Brochure	MTDC	9471-2801	10/93
Aerial Lifts for Working in Tree Tops	MTDC	9424-2829	3/94
Aerial Spray Drift Modeling	MTDC	9434-2839	5/94
Aerial Spray Drift Modeling	MTDC	9434-2847	9/94
Atmospheric Tracer Concentrations from an Elevated Source in an Urban Core	MTDC	9434-2803	11/93
Central Tire Inflation: USDA Forest Service Development Program	SDTDC/ ASAE	937510 PAPER	12/93
Computing Total Accountancy of Aerially Released Materials	MTDC	9434-2839	11/93
Cut-to-Length Logging—A New Tool for Land Managers	SDTDC	9324-1402 Video	1993
Employee Wellness in the Forest Service: New Programs for a New Century	MTDC	9467-2816	5/94
Field Comments—Spray Block Marking	MTDC	9434-2855	9/94
Foam Applications for Wildland and Urban Fire Management	SDTDC/ NWCG	Vol. 6, No. 1	8/94
Foam VS Fire—Class A Foam for Wildland Fires	SDTDC/ NIFC	NFES 2246	10/93
FS T&D Program—History & Mission	SDTDC	9371-1501	12/93
GPS Training in Indonesia Trip Report	MTDC	9471-2808	11/93
GPS Use Survey Results	MTDC	9424-2824	3/94
Health Hazards of Smoke	MTDC	9451-2802	10/93

Health Hazards of Smoke	MTDC	9452-2841	5/94
Loblolly Tree Seed Collection System	MTDC	9424-2811	6/94
MTDC Pruning Equipment Survey Results	MTDC	9424-2818	3/94
Nursery Drawings Available from MTDC	MTDC	9424-2828	3/94
Observed Downwash Concentrations Compared to ISCST Predictions in an Urban Core	MTDC	9434-2812	1/94
Operations and Programming Manual PT-100V and RP-30lV USDA Forest Service Version	MTDC	9453-2820	4/94
Penetration of Aerially Released Spray Material into Forest Canopies—A Review of Early Work	MTDC	9434-2848	6/94
Power Platform Termination Report	MTDC	9124-2830	4/94
Recreation Equipment and Supply Guide	SDTDC	9423-1507	9/94
Rocky Soils Supplement to an Earth Anchor System: Installation and Design Guide	SDTDC	9424-1801	5/94
Smallwood Equipment Catalog—Japanese Additions	SDTDC	94-1	1/94
Smart Tool Bar Progress Report	MTDC	9424-2821	4/94
Spark Arrester Guide—General Purpose and Locomotive (GP/Loco) Volume 1	SDTDC/ NIFC	NFES 1363	5/94
Trail Maintenance Equipment Questionnaire Analysis and Recommendations	MTDC	9423-2826	4/94
Trail Traffic Counters for Forest Service Trail Monitoring	MTDC	9423-2823	3/94
Trails Management Handbook Wet Areas	MTDC	9423-2846	9/94
Tree Shelter Survey Results	MTDC	9424-2822	3/94

Unique Blasting Applications in the U.S. Forest Service	MTDC	9472-2836	1/94
Water Handling Equipment Guide	SDTDC/ NIFC	NFES 1275	3/94
Wildland Fire Engine Component Guide	SDTDC/ NIFC	NFES 1871	3/94
The Wind Flow Field Through a Forest Edge: A Comparison of Foliated and Unfoliated Canopies	MTDC	9434-2846	5/94
Visual Prioritization Process—User's Guide	SDTDC/ USDOT	FHWA-FLP-93-007	7/94

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

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Engineering Field Notes

Administrative Distribution

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THE ENGINEERING FIELD NOTES is published periodically as a means of exchanging engineering-related ideas and information on activities, problems encountered and solutions developed, or other data that may be of value to Engineers Service-wide.

Submittals

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		R-8	Bob Bowers		

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

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