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Engineering Field Notes

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1989 *Engineering Field Notes* Article Awards

It is that time of year again—time for our readers to vote on their choice for the best *Engineering Field Notes* articles published during 1989. We will give awards to the authors of the three articles receiving the most favorable response from the readers.

Engineering Field Notes strives to provide useful information to those in the field as well as those who manage or supervise projects from the office. Did you find any articles especially informative or useful this year? Did any articles help you develop more effective methods for doing your job? Did any articles help your office save money—or time?

If you have benefited from any of 1989's *Engineering Field Notes* articles, please complete the rating sheet on the following page. Select the three most interesting, beneficial, or informative articles, and rate them from 1 (highest) to 3 (lowest). If you believe an article helped the Forest Service save money, please indicate the amount that was saved or could be saved. Remember, *do not* rate more than three articles.

After you have voted, cut out the page (as indicated), fold and staple it closed, and mail it to the Washington Office. For your selection to be counted, your rating sheets must be delivered to the Washington Office by February 1, 1990.

Engineering Field Notes is intended to provide useful information to Engineering personnel in the field and to those who manage or supervise projects from the office. If you have a new way of accomplishing a job or a better idea for handling problems, why not share it? Write an article for *Engineering Field Notes*, and you may win a 1990 *Engineering Field Notes* Article Award!

1989 Engineering Field Notes Awards

Article	Author	Choice (1, 2, 3)	$ Saved
January/February			
Road Program Costs: Continuing Efforts Addressing the Issue	Tamera M. Rizek	______	______
Evaluation of the NAVCORS-1 Global Positioning System	Anthony E. Jasumback	______	______
Women in Engineering: Region 5	Alan H. Ambacher	______	______
Developing Road Logs & Inventories Using the HP-71B	Walt Keyes	______	______
March/April			
Roads Program Costs: Forest Service Stratigic Plan--NFS Road Program	John Holt	______	______
Workstations--Are They for Everybody?	Dale R. Petersen	______	______
California Park Road Reconstruction Project of the Routt NF	Rex Blackwell	______	______
Allowable Fill Height on Trees	Deborah J. Taylor	______	______
Geotechnical Field Methods	Douglas A. Williamson	______	______
May/June			
Road Program Costs: Continuing Efforts Addressing the Issue	Sam Morigeau	______	______
Information Sharing in Region 5 (Technology Transfer Revisited)	Rich Farrington	______	______
Geogrid Used in Steep Fill Slide Repair	Ron McNemar	______	______
GEOWEB Boat Ramps	Mary Miller	______	______
Liaison & Technical Support in the Nationwide Forestry Applications Program	Jerry Greer	______	______
"Super Good Cents" Makes Good Sense	Louis F. Janke	______	______
Resource Training for the Engineer	Brenda Styer	______	______
July/August			
Increasing Productivity by Preparing Road Plans with CADD	Tom Strassmaier and Jeff Orr	______	______
Timber Bridges Are Alive & Well	Larry Leland	______	______
Helicopters & Trail Bridges: The Treasure Falls Project	James R. White	______	______
Scheduling & Network Analysis Program	Kenneth D. Vaughan	______	______
The Management of Total Transportation Investments in Region 5	Jerry Wooten	______	______
A Facilities Information Center–Sharing Our Facilities Management Resources	George J. Lippert	______	______
Countering Vandalism to Forest Service Signs	Thomas Nettleton	______	______
Periodic Safety Message: Parents, Teach Your Children Well!	Jerry Greer	______	______
Road Program Costs: Continuing Efforts Addressing the Issue	Sam Morigeau	______	______
November/December			
Road Program Costs: Meeting for the Southern Rockies ROADS Group	John D. Fehr and James M. Kocer	______	______
Adopt-a-Road Maintenance Specifications for Four-Wheel-Drive Travel	Tonto National Forest	______	______
Forest Sign Plan Using CAD/DBMS	Chuck Ritter	______	______
Productivity = (Workstation + Information) Environment	Dale R. Petersen and Pablo Cruz	______	______

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COMMENTS: ____

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The LEGIS Program: A Personal Narrative

Jerry Bowser
Staff Engineer
Washington Office

Introduction

I was fortunate to be selected as one of the Forest Service participants in the Office of Personnel Management LEGIS Fellows Program in 1989. A number of field people have asked what this is all about.

The LEGIS Fellows Program is intended to give employees of the executive departments hands-on experience with the legislative branch. The sessions last 5 months, beginning in January, March, or July each year. Interested parties need to apply after the announcement in September. Chief and Staff select approximately ten attendees each calendar year, who, after 2 weeks of seminars, seek jobs with committee staff or personal staff of a Member of Congress. The Forest Service pays the salary.

What follows are my impressions of the program.

Final Report on LEGIS Fellows Office Assignment

I selected freshman Senator Conrad Burns (R—Montana) because I was told I would be assigned full legislative assistant duties for natural resource issues. I was impressed with the staff members during the interviews.

Staff members were in temporary quarters and unable to fill all staff positions until May because of space limitations. I received no special training and was immediately considered a full member of the staff, helping senatorial operations get under way. Training would have accomplished little because we all were fairly "green."

I was intrigued by this office because Burns had no legislative experience beyond county commissioner and was a newcomer also. There were no institutionalized positions other than those from the general campaign. As a result, I was somewhat influential in position and policy formulation, some of which have been, interestingly, counter to the Administration's position.

Responsibilities & Issues

As a legislative assistant in an office with limited people, I was expected to, and did, handle:

(1) Constituent responses (prepared in final form). It is hard to overstate the impacts of constituent mail. An overwhelming task, each and every letter is read and answered. I had to learn to withhold bad news, keep

it to one page, make limited commitments, and not invite further correspondence by asking questions.

(2) Constituent, proponent, lobbyist, and special interest group meetings concerned with natural resource issues. These meetings really picked up when we were getting close to markup in committee.

(3) Senator's support in committee. This means preparing briefing information, opening remarks, questions to ask witnesses, and strong points to make on the record. Support also includes running errands, reminding the Senator about appointments, and trying to make sure he does not do something that makes him look bad.

(4) Preparation of legislation and amendments. In writing a bill, the only constraints are political. The work usually requires quick action and precise timing. Fortunately, in the Senate, minority members have considerable power if they exercise it wisely. This is where backscratching can build a few chits.

(5) Keeping abreast of natural resource activities by other Members, including the House. This keeps the Senator informed and suggests initiatives or actions that will read well in Montana.

(6) Culturing of relationships with other personal staff and committee staff, as it will pay future dividends.

Issues with which I was actively involved include: wilderness designation in Montana (preparing legislation); roadless area access (major reason for controversy); public access across private lands (ranchers' rights); timber shortage and appeals issue (preparing legislation); grizzly and wolf issues (stockgrowers are mad); bison hunting and dying elk (animal rights); let-burn policy (private relief bill for private owners); outfitter guide (Gallatin); National Forest range fees (major rancher issue); noxious weeds (major Montana issue); log exports (cosponsor of Packwood bill); revision of the 1872 Mining Act (proposed bill); Tongass National Forest management issue (major bill); National Energy Policy Act (major national issue); Arctic National Wildlife Refuge oil and gas leasing; and appropriations (Interior). Responsibilities for these issues included briefing memos to the Senator to keep him up to date and substantial preparation for related hearings and lobbyist visits. I prepared standard responses for constituent mail. This required good contacts and frequent meetings with committee staff and other personal staff dealing with pending bills or potential legislation.

I traveled with the Senator to Montana for several days of meetings on natural resource issues. I also accompanied him for 2 days of hearings in southeast Alaska, to the Prince William Sound oil spill, and to Prudhoe Bay and the Arctic National Wildlife Refuge. This trip was one of the highlights of my Fellows assignment.

I was involved in political strategy sessions as well as legislative initiatives. One cannot forget the political consequences of any action the Senator takes—that is the driving force behind actions taken by legislators. How will it sell at home?

When the Senate was in session, the days were long, and there was never a dull moment. Staff seem to be on the run constantly, or hurriedly preparing for a hearing. Senator Burns is on three committees, and there were sometimes three different hearings competing for his time simultaneously.

The office staff was young in general, as in most legislators' offices. I had minimal difficulty working with so many young and brilliant people. I had a strong background in things they did not, so my contributions were helpful and satisfying.

I had open access to the administrative assistant, the Senator, and the legislative director. We were quite informal, with complete latitude and independence to handle projects and responsibility. It was a comfortable place to work.

Perks & Drawbacks

There are many perks one finds working as a legislative assistant. Among them are working with a lot of bright and exciting people, seeing what "real people" (constituents) say about real things, enjoying $4.50 haircuts, receiving free and convenient parking, gaining access to inner sanctums in the Capitol, hearings, and other Member offices, having immediate support and aid from the Congressional Research Service (CRS) and the General Accounting Office, access to committee staff expertise, receptions every night (if you wish to take advantage), and convenient office location to all the action.

There are, however, some drawbacks, such as long hours, limited sharing between and with offices of other Members, difficulty in finding true statesmanship (everyone is looking toward reelection), the specter of partisanship (my administrative assistant says this is a perk), low wages and lack of employee protective rights, typing of one's own work (one must be able to type well), work with the television on to monitor floor activity, and lack of time to perfect research of an issue because of deadlines.

Advice

I prepared some advice for agency people working with congressional staffers. One should realize that staffers address scores of issues each day, and they often need immediate responses. They are usually not too happy having to wait for a response or answer, because it may come too late. Staffers may spend only a few minutes on a given subject.

Staffers do not need, nor want, bureaucratic responses. They should be kept factual, simple, and short. Written responses are most helpful if they provide a quick and succinct response to the concern and can be forwarded to the constituent.

To staffers, agency people represent the status quo, with a tendency to support current policies. Often, the agency is contacted because a constituent is upset with an agency position or action.

Staffers frequently are not knowledgeable about a given subject, but they are young and bright and can grasp a subject very quickly. Conversely, there are some staff who are very knowledgeable on a subject and one should not try to buffalo them.

One should not underestimate the influence of a staffer with the Member. They are the eyes, ears, and experts on subjects and can have a major impact on the position the Member takes.

Most senators are down-to-earth, real people—not big names in the news.

Recommendations

The following are some recommendations for future Fellows:

(1) Most of the participants I talked with have gained much from the program. Those intending to learn, participate, and have fun were amply rewarded.

(2) It would probably be best to participate in mid-career, but that should not limit the opportunity for the older employees.

(3) One should be fully prepared to divorce agency activities, programs, and office politicking from a Capitol Hill job. I observed other Fellows spending most of their time working for agency deals and not for the Senator. This does not sit well with the rest of the staff members.

(4) A work schedule should be adjusted to that of the rest of the staff. We had several agency people on board who worked their former, earlier hours. As a result, they found themselves leaving the office during meetings or legislative activities.

(5) One should learn as much as possible about the little things in the Capitol Hill offices. There are many interesting practices not found elsewhere.

(6) Participation in CRS briefings when possible broadens one's perspective of the issues.

I also recommend Senator Burns as an assignment. He is laid back, very personable, and easy to talk to and work with. His whole staff is top notch, both in Washington, D.C., and in Montana.

I worked on many issues that affect the Forest Service. All the complaints heard were not indictments of a good agency. Members of Congress only hear from the disenchanted people, not those who are happy. One does not want to lose sight of that.

Region 6 Surface Recycling Project: Road 34 on the Fremont National Forest

Curt Allen
Zone Engineer
Fremont National Forest, Region 6

Project Description

Road 34 is a heavily used Challenge Cost Share Program road between the Fremont National Forest and the Weyerhaeuser Company. The contractor, Klamath Pacific Corporation, provided the recycling demonstration using a Caterpillar RR-250 recycling machine, grader, water truck, roller, and belly dump trucks. Road 34 is located a mile northeast of Bly, Oregon. The project length is 1.4 miles. This important arterial road connects to Oregon State Highway 140 by a short segment of county road.

Pre-Condition of Road

The road is 14 feet wide with 10-foot-wide turnouts. The surface structure consists of varying depths of cinder base with 4 to 6 inches of aggregate surfacing. In 1976, the road had a 3-inch cold mix treatment by blade mixing. After much off-highway haul by the cost share cooperator and continuous use from National Forest timber sales, the cold mix had broken up to where the road was being managed as an aggregate-surfaced roadway. Before 1976, and after the asphalt breakup, approximately 15 applications of various dust oil treatments had been applied to the road. The average application rate of dust oils was 0.5 gallon per square yard. The surfacing had become extremely potholed and, because of the varied asphalt contents in the surface aggregates, it was virtually impossible to blade the road. The Weyerhaeuser Company and the Forest Service agreed that something needed to be done to repair Road 34.

Recycling Demonstration

The Road 34 surface recycling project was jointly prepared by the Weyerhaeuser Company and the Forest Service. The primary objective was to mix existing surface structure materials together to restore a maintainable roadway. The cooperators worked with the contractor to set up demonstration sections on the road that would indicate the capabilities of this machine.

Surface Recycling

The 8-foot-wide recycling machine mixed the existing aggregate to a 5-inch depth (see figure 1). It did a thorough job of redistributing the large and fine mineral particles. The largest asphalt particles were about 2 inches in diameter. The speed of the machine was about 25 feet per minute or 1,500 feet per hour.

Bridge Cleaning

Bob Stewart of the Klamath Pacific Corporation demonstrated asphalt removal from two concrete bridge structures. Approximately 15 to 20 tons of

Figure 1.—Grinding and mixing a surface 5 inches deep and 8 feet wide, this machine can grind to a 16-inch depth.

asphalt were removed from each bridge, thus reducing their dead loads. Both bridges were completely free of asphalt and smooth (see figure 2).

Cementing Stabilized Base

Fremont National Forest Geotechnical Engineers had prepared a test section by placing dry cement in front of the recycling machine to approximate 6-percent cement by weight. The material mixed well (see figure 3). The final results are not known at this time; however, the test strip will be checked sometime in 1990.

Mixing New Aggregate With Existing Materials

Windrowing crushed aggregate ahead of the machine and mixing the new aggregate with the old exhibited the best gradation. Adding fine material to existing bony material or adding an open-graded material to an existing degraded fine material using this method had positive results.

Other Uses

The machine can mix asphalt, cement, lime, or other materials for recycling aggregate or asphalt pavements. The smooth surface lends itself to B.S.T. surface treatments after recycling.

Conclusion

The machine can accomplish approximately 2 miles per 8-hour day at an average cost of $1,800 per mile. Many of our roads could be rejuvenated by using surface recycling at a fraction of the cost of completely resurfacing with new aggregate.

The Fremont National Forest has a videotape of the project and is willing to share it with anyone. (Interested parties must provide a blank tape to Curt Allen, P.O. Box 303, Bly, OR 97622.)

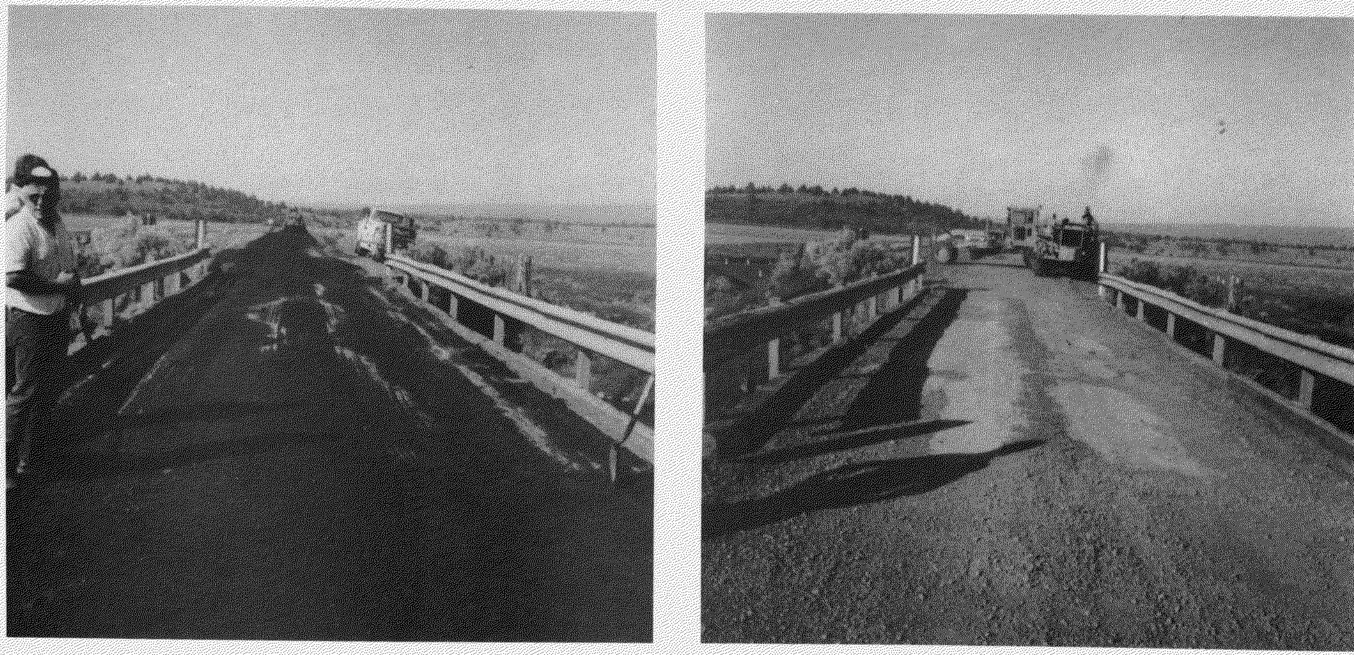


Figure 2.—Before and after photographs of the removal of over 4 inches of residual asphalt from bridge deck; approximately 20 tons of dead load was removed by grinding the asphalt off.

Figure 3.—Grinding and mixing cement to form cement stabilized base.

Saving the Fish Creek Bridge

Neil L. Siettmann
Facilities Engineer
Routt National Forest, Region 2

Background

In 1927, a trail bridge was constructed across Fish Creek, providing access for minerals and hunting on the Routt National Forest from Steamboat Springs, Colorado. It is located near the base of Fish Creek Falls.

The bridge was built from native timbers in a King-Post configuration, which allows for a two-span bridge without a center pier. The center support is provided by the structure above.

In the mid-1960's, extensive work was done on the bridge. The work consisted of replacing the exterior stringers and the King-Post structure with pressure-treated wood beams. The four interior stringers remained.

By the mid-1980's, these interior stringers had become almost completely decayed. The 1960's rehabilitation work materials also were showing signs of unsuitability because of checks and splits, decayed materials, and stressed hardware. Although a few good members remained, at least 80 percent of the structure needed replacement.

What Was Planned

The initial decision was to replace the bridge completely. This decision involved all resources and public notification. Therefore, a contract for $20,499 was let for replacement of the bridge with a 40-foot, prebuilt, weathered-steel arch structure (see figure 1). Under this contract, a helicopter was to deliver the bridge to the site.

Change of Plans

Although the public notification process was extensive, public outcry against removal of the bridge became very vocal. The local newspaper was filled with articles and letters against the project. Bumper stickers started appearing on vehicles around town that proclaimed "Save Fish Creek Bridge." This led to a reversal of the decision to allow the bridge replacement by the State Historic Preservation Officer.

Therefore, the contract was terminated. The new bridge structure, already fabricated, was delivered to the Forest Service yard for use on a future project.

Alternatives

A new bridge similar to the existing King-Post structure was estimated at over $40,000. Overall, this was considered the best way to go for a long-life structure. But, Forest Service funds were limited to approximately $20,000, and the bridge was near the end of its life. Fortunately, along came the Challenge Cost Share Program and a local contingent of people with skills, equipment, and an intense desire to "Save Fish Creek Bridge."

A local structural engineer offered to produce the design. His initial design efforts found that a completely new bridge design would take more time than he could offer and that it also would cost more in money and time than the Forest Service or local volunteer efforts could afford.

This led to a design that would build a bridge within a bridge. The four decayed interior stringers would be replaced by full-span, 35-foot steel I-beams. This would relieve all load on the center support "needle beam."

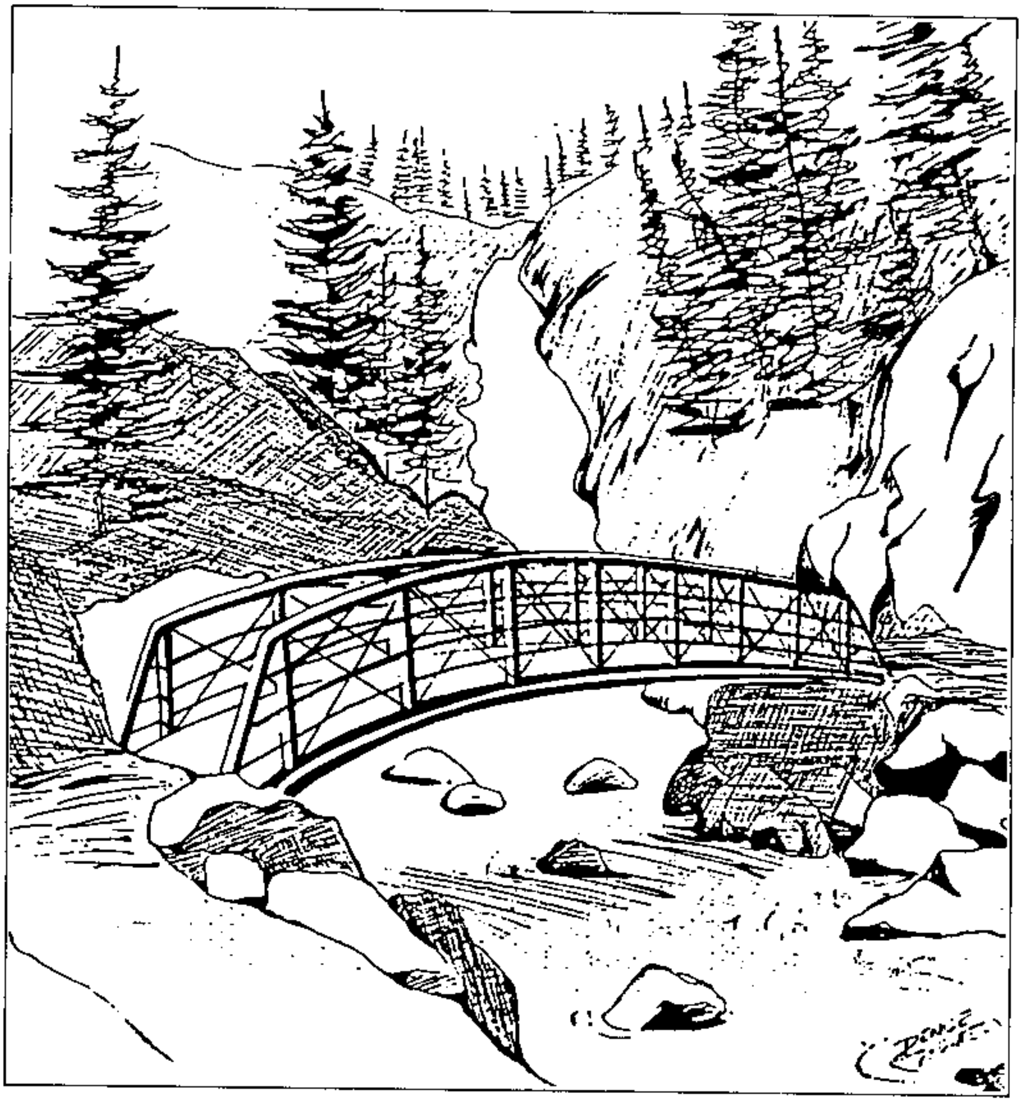


Figure 1.—Proposed bridge.

The exterior beams with their associated King-Post structure and center support needle beam would remain. These members would carry no bridge load, only dead load. Their only purpose would be to retain the bridge's "looks" (figure 2).

The cost of this alternate design was estimated at $34,000. Of this, the Forest Service would contribute $17,000 for materials and equipment. The local effort would contribute $17,000 for design and construction engineering and labor.

Organization

The Steamboat Springs Chamber of Commerce coordinated the entire project. They enlisted volunteer efforts from among their members and the community, including design, haul of materials, equipment, project foreman, and labor. They also coordinated food and drinks for the workers from several area restaurants. A total of 55 volunteers and 15 local business and service clubs were involved with the project.

Figure 2.—Before and after construction.

Construction

Construction work was centered around three weekends. The first weekend was for delivery of "sackreet" and concrete abutment work. The second weekend was for delivery of the new bridge materials and hauling out the old materials. The third weekend was for installation of the new bridge materials.

The first weekend's work was accomplished by hauling the 110 bags of "sackreet" 800 feet down the trail with pack horses and all-terrain vehicles. These services were donated by a local guest ranch. The abutment work involved removal of the rotten sill beams and replacement with reinforced concrete.

The second weekend's work originally was planned for extensively using a helicopter to haul materials in and out. However, because of extensive fire activity in the Region, the helicopter was not available. Again, a local volunteer came to the rescue. He had recently purchased a narrow track backhoe and accepted the challenge that others said could not be done. Four 35-foot long, 10-inch by 45-inch steel beams were snaked down one at a time with the trackhoe. Several persons with iron bars assisted with keeping the beams on the trail. The remaining materials were hand-carried in and out by volunteers.

The third and final weekend's work installed the materials and completed the bridge.

Conclusion

Upon completion, the most rewarding comment heard was, "It looks like it always did." Indeed, it did! Fish Creek Bridge was saved.

The Forest Service's willingness to reconsider a decision enhanced its image within the community. "Sometimes, the public, if it decides to become involved in a government activity, has a difficult time figuring out where it fits in," says Sherry Reed, Hahn's Peak District Ranger. "Sometimes, it's even difficult for us to figure out where they fit in. So a project such as this, where the roles become real clear and everyone feels as though they've contributed something, is very valuable."

Volunteer contractor Pat Gleason, also a city councilman and Steamboat Springs native, confesses that he had no special feelings about the old bridge—until after the reconstruction project was complete. That is when he saw a rendering of what the once-proposed new bridge would have looked like in front of the 283-foot-high falls. "In retrospect, seeing what would have been there instead made it all worthwhile," he says. "What's there has got some character. I can see now why people wanted to save it."

The lifeblood of a community is a concerned and cooperative citizenry. The Fish Creek Bridge project is one of numerous living tributes to the efforts of the people of Steamboat Springs, working together to sustain and enhance their already enviable quality of life.

Region 1 Promotes Preservation Program

Joy Bolton
Archeological Technician
Lolo National Forest, Region 1

Recording historic structures on a piecemeal basis is frustrating for Forest archeologists. They do not want to ignore or neglect structures simply because those structures are not immediately threatened by a timber sale or road construction. They are dismayed when funds or skills are not available to correct structural problems needing immediate attention. They face these realities and wonder how to rectify them with limited staff, time, and money. Attacking the situation in a systematic and holistic manner can assuage their frustrations.

Historic Preservation Program Components

Region 1 is taking an integrated approach to managing its historic structures. Inspired by the National Park Service's Williamsport Training Center and supported at the District and Forest levels, the Region is committed to historic preservation through training, conducting comprehensive inventories, developing management strategies, and applying knowledge and skills in specific projects. The components of a preservation program work together for the successful management of significant historic structures.

Training

Last spring, Williamsport preservation specialists taught two 1-week hands-on preservation skills classes for maintenance personnel at the Ninemile Wildlands Training Center at the Ninemile Ranger Station on the Lolo

Forest Service managers tour the Williamsport "Porch Class" at Ninemile Ranger Station in June 1989.

Cape-Cod style residence at Ninemile Ranger Station.

Forest Service managers observe the craft of constructing wooden porch columns at the "Sensitivity and Awareness Workshop for Managers," Ninemile Wildlands Training Center June 1989.

National Forest. (The Ranger Station is listed in the National Register of Historic Places. See the article in the Spring 1988 issue of *History Line* and the discussion later in this article.) Deteriorating concrete porches on several Cape Cod-style buildings were replaced with historically correct wooden ones. The master craftsmen and teachers shared important details that affect the quality and longevity of the porches—details such as choosing edge-grain lumber for flooring and priming and painting the floor as it is laid to provide a waterproofing seal. In a historic barn, other students learned the almost-forgotten, intricate skill of sharpening crosscut saws. During the session, the Center also hosted a 1-day workshop in historic preservation sensitivity and awareness for Engineers, District Rangers, and others responsible for managing historic facilities. Additional classes and training sessions are planned for the future.

Comprehensive Inventories & Management Strategies

On June 15, 1989, Forest Archeologists and Engineers came to the Ninemile Wildlands Training Center to hear the details of the Region 1 Building Survey. A comprehensive inventory of all historic Forest Service administrative buildings in Region 1 is under way and scheduled for completion by the fall of 1990. Early ranger stations, lookouts, tree nurseries of the Civilian Conservation Corps (CCC) era, and District powderhouses are being recorded and evaluated for National Register significance. This information will be key to correct and systematic management of the Region's significant historic buildings. A task force composed of Archeologists and Facilities Engineers was created to formulate Regional goals and objectives for historic preservation and has a management strategy for incoming information.

Kirby Matthews, Bitterroot National Forest, leveling the top surfaces of the new rafter ends of Horse Heaven Cabin in August 1988.

Removing rotting rafter ends from Horse Heaven Cabin.

Skills in Rehabilitation Projects

Cultural resource staff and District facilities personnel have many opportunities to apply their newly acquired skills and knowledge (for example, historic cabins need reroofing, lookouts need painting, early ranger stations need sill log replacements, and so on). After several training sessions with preservation specialists, Kirby Matthew of the Bitterroot National Forest, in close consultation with a historical architect and the Williamsport staff, assessed the needs of Horse Heaven Cabin. The log structure, nestled in a high-altitude meadow between the Selway-Bitterroot and River of No Return Wilderness Areas of northeast Idaho, was built by the CCC and once served as a backcountry fireman's cabin.

Matthew and the team of consultants prepared a scope of work for the project. With specifications in hand, Matthew, the Lolo National Forest cultural resource staff, and Stevensville District volunteers from the Bitterroot reroofed the cabin with cedar shingles, replaced rotting rafter ends, treated the exterior logs with a Forest Products Laboratory preservative, and graded around the cabin to improve drainage. Billowing columns of smoke to the west, made fiery orange by the sun, caused the group to wonder whether their efforts would soon be for naught. Rain squelched the flames when they came within 3 miles of the cabin, however, and the Bitterroot National Forest went on to win the Idaho State Orchid Award for Historic Preservation in 1988 for the Horse Heaven project.

The cabin is now being readied for the cabin rental program. When ready, the cabin will provide a unique opportunity for handicapped people and others to experience the remote scenic area. Other rehabilitation projects are under way on the Flathead, Kootenai, Lolo, and Gallatin National Forests in Region 1.

Summary of Components

Education and training at all levels of management raise consciousness, provide skills, and instill enthusiasm. *Comprehensive inventories* furnish the information needed to evaluate the condition and needs of structures, to set priorities, and to schedule work. Clear Regional goals and objectives help

Spring roundup at Ninemile Winter Range, circa 1930's (USDA Forest Service photo).

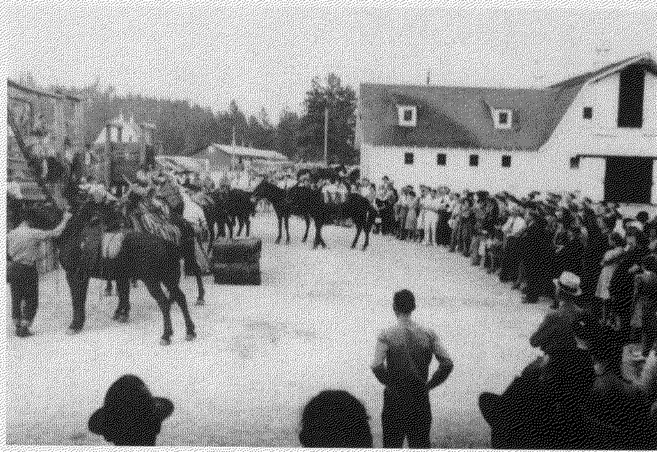
construct and implement *management strategies*. Forest archeologists need to consider programs instead of projects, maintenance instead of salvage, and proactive management instead of reactive management. The integrated approach is the key.

Focus on the Ninemile Wildlands Training Center

Ninemile Ranger District has a history of providing hands-on training. The District was established in 1930 as a "remount depot" to breed, pasture, and train horses and mules for backcountry jobs in the remote, rugged northern Rocky Mountains. The depot also served as a training center for packers and as a research center for the development of standardized packing equipment and techniques. When roads, mechanization, and, later, airplanes reduced the need for backcountry packing, the first Forest Service smokejumpers' base and training center was established nearby.

Today, the Ninemile Ranger Station is listed in the National Register of Historic Places. It also is a working station that manages a variety of resources, and the commitment to education and training continues. The original historic classroom building houses a newly designed interpretive center with classroom facilities. The Ninemile Wildlands Training Center based there offers courses designed to develop skills in wildland management, along with special courses in historic preservation. Forest Service employees and employees of other land management agencies at the State and Federal levels can participate in all courses.

Mules on trucks at Ninemile Remount Depot, circa 1930's (USDA Forest Service photo).



Ninemile "Packing Days," August 11, 1939 (USDA Forest Service photo).

Some of the courses to be offered in 1990 include:

Course	*Length*	*Date*
Historic Building Preservation and Sensitivity Awareness for Managers	1 day	May
Preservation and Maintenance of Historic Structures: Sawn Lumber Structures	5 days	May
Preservation and Maintenance of Historic Structures: Log Cabin	5 days	May
Use and Care of Primitive Tools	5 days	April-June
Horsemanship and Packing	2 days	April-June
Trail Bridge Construction	5 days	April

Anyone interested in registering for one of these courses or finding out about others should contact Bob Hoverson, NWTC Manager, Ninemile Ranger District, Box 616, Huson, MT 59846; (406) 626-5201 or DG at B.Hoverson: RO1F16DO4A.

Off-Tracking: Forest Service Formula, Vehicles, Roads, & Simulator

Carl H. Cain
Civil Engineer
Region 1

James R. Bassel, P.E.
Civil Engineer
San Dimas Technology & Development Center

To minimize resource damage, Forest Service Engineers design low-standard, narrow roads that conform to the natural terrain. These roads must accommodate large vehicles with long trailers that transport forest products. Such trailers off-track, and road planners must consider widening curves to allow for that off-tracking. The conflict is that planners aim to minimize road width, while vehicle operators desire to maximize their payload.

Off-Tracking Formula

In 1982, Forest Service Handbook FSH 7709.56 (section 4.24) presented a new formula and tables for off-tracking. The formula considers L_s, which is the *square root of the difference of the sum of the squares of all wheelbase lengths, minus the sum of the squares of all coupling distances*—or (when L_s is squared):

$$L_s^2 = \sum_{i=1}^{n} L_{wi}^2 - \sum_{i=1}^{n-1} L_{ci}^2.$$

where L_w equals the length of the wheelbase and L_c equals the length of the coupling distance.

For purposes of this article, the coupling distance is the length between an axle or axle group and the hitch point that is not an axle or axle group (for example, a fifth wheel, hitch, ball and socket joint, and so on). The coupling distance causes a vehicle train to off-track and is considered a minus quantity, as shown in the examples below.

The above formula does not consider the vehicle's total length or width, the number of axles or axle groups, nor the minimum turning radius. Therefore, one may conclude that if the difference of the sum of the squares of the wheelbase lengths, minus the sum of the squares of the coupling distances, of two vehicle trains is equal, their maximum off-tracking is the same. In other words, the off-tracking of a vehicle can be simulated by using any configuration whose L_s is equal to that of the vehicle being simulated.

This article is based on a previous ASAE paper (3).

When computing the L_s, there are the following two rules to remember:

(1) Measure the truck's wheelbase from the front axle to the rear axle or center of the axle group. Measure the length of the trailer from the hitch point to the center of the trailer's axle group.

(2) Subtract the sum of the squares of the coupling distances (because these are squared, it does not matter whether they are in front of or behind an axle).

Examples

A course with several different radii was laid out in a large parking lot at the Los Angeles County Fairgrounds in Pomona, California. The tractor-trailer combination traveled the course, and the off-tracking was measured. Then the vehicle simulator traveled the course in the different configurations shown in figure 1. The results of the runs are presented in tables 1 and 2.

To verify the statement "if the sum of the squares of the wheelbases (L_s) of two vehicles is equal, their off-tracking is the same," the fairgrounds study compared a lowboy truck-trailer combination to the field simulator (*1*). The simulator was configured in several ways, but all the configurations had the same L_s. The lowboy had the following component lengths: tractor equals 16.5 feet and trailer equals 33.25 feet. Then, the square root of the sum of the squares (L_s) is:

$$L_s = \sqrt{(16.5)^2 + (33.3)^2} = 37.1$$

The vehicle simulators were configured as follows:

(1) Hand steering (one simulator), where the length of the simulator equals 37.1 feet.

(2) Hand steering (two simulators), where L_1 equals 16.5 feet, L_2 equals 33.25 feet, and L_s equals 37.1 feet (see figure 2).

Figure 1.—Off-track measurements taken as simulator is pulled by pickup.

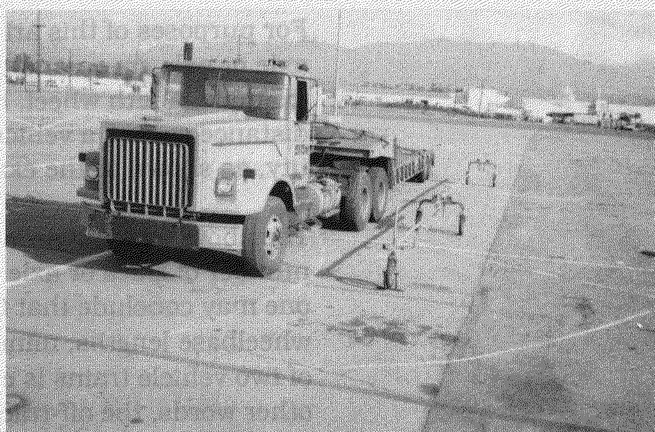
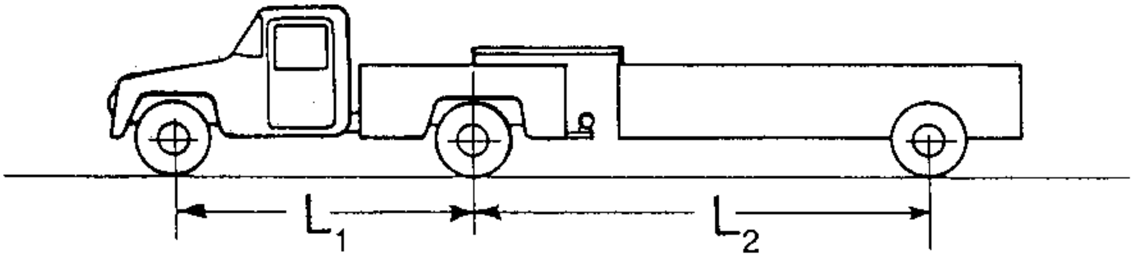
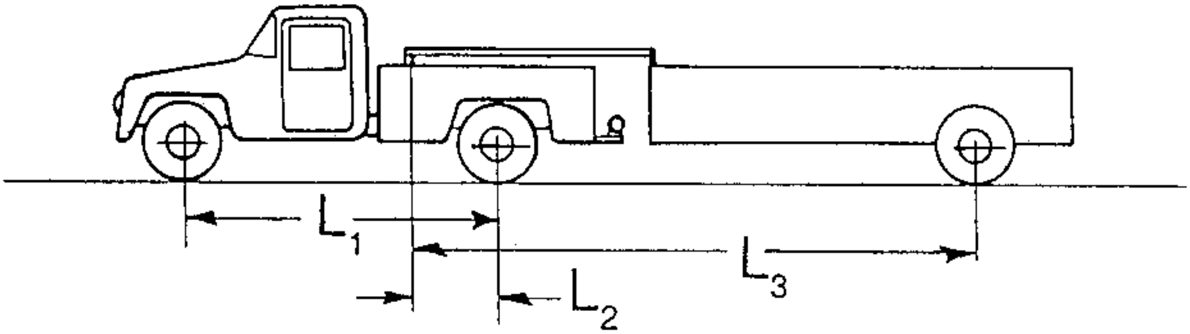


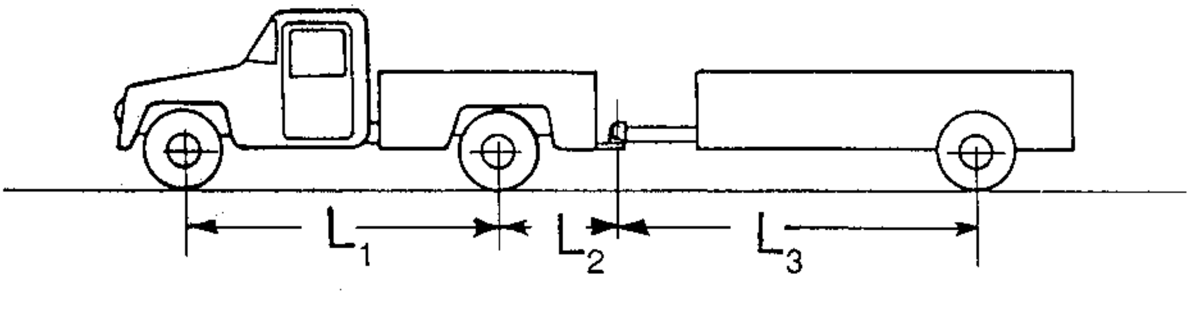
Figure 2.—Lowboy and field simulator at the Los Angeles County Fairgrounds, Ponoma, CA.



$$L_s = \sqrt{L_1^2 + L_2^2}$$



$$L_s = \sqrt{L_1^2 + L_2^2 - L_3^2}$$



$$L_s = \sqrt{L_1^2 + L_2^2 - L_3^2}$$

Table 1.—Off-tracking of log truck and simulator with pickup truck. L_s is the equivalent length of a single vehicle whose off-tracking is the same as that of a vehicle train.

Central Angle(Δ)	Central Angle Ahead of PC								Forest Service Formula
	PC	19°	30°	46°	64°	90°	116°	180°	
19°	1.8 1.4	2.1* 2.2**							2.0
30°	2.2 1.4	3.7 3.5	3.5* 3.5**						3.3
46°	2.2 1.5	4.6 4.2	5.0 4.6	3.7* 3.8**					4.5
64°	2.2 1.5	4.6 4.1	5.7 4.9	5.7 5.5	4.4* 4.2**				5.4
90°	2.2 1.5	4.6 4.2	5.7 4.7	5.8 5.6	6.3 6.0	4.8* 4.6**			6.0
116°	2.2 1.6	4.6 4.1	5.7 4.9	5.8 5.7	6.4 6.2	6.0 6.5	4.8* 4.9**		6.3
180°	2.2 1.6	4.6 4.2	5.7 4.8	5.8 5.6	6.4 6.2	6.0 6.6	6.8 6.5	4.7* 5.5**	6.5

	Tractor	Coupling Distance	Trailer	L_s
*Log truck	L_1=19.0'	L_2=9.0'	L_3=18.2'	24.7'
**Simul. w/pickup	L_1= 9.5'	L_2=3.75'	L_3=23.1'	24.7'

(3) Simulator towed behind a pickup truck, where the wheelbase of the pickup (L_1) equals 9.5 feet, the length between the axle and trailer hitch (L_2) equals 3.75 feet, and the length of the simulator (L_3) equals 36.1 feet.

Then, $L_s = \sqrt{L_1^2 - L_2^2 + L_3^2} = 37.1$ ft (see figure 3).

The results from the tests at the fairgrounds in Pomona confirm that the following principles of curve widening still apply:

(1) The width of the wheelbase does not affect vehicle off-tracking.

(2) Off-tracking is not symmetrical. A vehicle will off-track approximately one-third of the amount that it will achieve on the curve at the point of curvature and approximately two-thirds of the amount that it has achieved at the point of tangent.

Table 2.—Off-tracking lowboy and simulator. L_s is the equivalent length of a single vehicle whose off-tracking is the same as that of a vehicle train.

Central Angle(Δ)	Central Angle Ahead of PC: PC	19°	30°	46°	64°	90°	116°	180°	Forest Service Formula
50-ft radius									
19°	2.8	3.7*							2.6
30°	3.5	5.6	5.0*						5.3
46°	4.0	7.3	7.8	6.9*					8.4
64°	3.5	7.7	9.0	9.7	8.0*				10.9
90°	3.7	8.0	9.5	11.3	12.0	9.5*			13.2
116°	4.0	8.1	9.5	11.6	13.0	13.5	10.8*		14.5
180°	4.2	8.3	9.7	11.5	13.0	14.5	15.2	12.5*	16.0
	4.2	8.3	9.8	11.8	13.4	14.7	15.6	13.0**	
75-ft radius									
19°	1.9	3.0*							2.9
30°	2.2	5.0	4.3*						4.9
46°	2.0	5.8	6.7	5.4*					6.8
64°	2.1	5.8	7.1	7.8	6.2*				8.1
90°	2.0	5.8	7.0	8.0	8.8	6.6*			9.0
116°	2.0	5.8	7.0	8.0	8.8	9.2	6.9*		9.5
180°	1.8	5.5	7.0	8.0	8.9	9.2	9.6	7.4*	9.8
	2.3	6.1	7.3	8.3	9.2	9.8	10.2	7.3**	

	Tractor	Coupling Distance	Trailer	L_s
*Lowboy	L_1=16.5'	L_2=33.25'		37.1'
**Simul. w/pickup	L_1= 9.5'	L_2= 3.75'	L_3=36.08'	37.1'

Table 2. (cont.)—Off-tracking lowboy and simulator. L_s is the equivalent length of a single vehicle whose off-tracking is the same as that of a vehicle train.

Central Angle(Δ)	Central Angle Ahead of PC: PC	19°	30°	46°	64°	90°	116°	180°	Forest Service Formula
100-ft radius									
19°	1.5	2.7*							3.0
30°	1.2	4.3	3.6*						4.5
46°	1.5	4.9	5.7	4.2*					5.8
64°	1.5	4.7	5.7	6.4	4.8*				6.5
90°	1.4	4.8	5.7	6.2	6.6	5.0*			6.9
116°	1.5	4.8	5.8	6.4	6.6	7.0	4.9*		7.1
180°	1.4	4.7	5.7	6.3	6.8	7.3	7.1	5.0*	7.1
	1.3	4.7	5.7	6.6	6.9	7.0	7.5	5.5**	
	1.0	4.5	5.3	6.3	6.5	6.7	7.2	5.3***	
	0.7	4.4	5.1	6.2	6.5	6.5	6.9	4.7****	
125-ft radius									
50°	1.2	2.1*							3.0
30°	0.5	3.2	6.1*						4.1
46°	1.4	3.7	4.7	3.5*					5.0
64°	0.8	3.5	4.7	5.5	3.5*				5.4
90°	1.0	3.5	4.5	5.3	5.5	4.0*			5.6
116°	1.3	3.6	4.2	5.0	5.2	5.3	4.0*		5.6
180°	1.3	4.0	4.1	4.9	5.2	5.3	5.2	4.2*	5.6
	1.5	4.1	5.1	5.8	6.0	6.1	6.1	4.8**	

	Tractor	Coupling Distance	Trailer	L_s
*Lowboy	L_1=16.5'	L_2=33.25'		37.1'
**Simul. w/pickup	L_1= 9.5'	L_2= 3.75'	L_3=36.08'	37.1'
***One simulator	L_1=37.1'			37.1'
****Two simulators	L_1=16.5'	L_2=33.25'		37.1'

(3) A vehicle will start to off-track when the front axle is at the point of curvature of the curve.

(4) The maximum amount of off-tracking for various vehicle configurations that have the same L_s is the same. However, the tapering in and out to the point of maximum off-tracking and the place and/or area of maximum off-tracking are not the same. They seem to depend on the length of the components and their arrangement within the train. Much of the variation of off-tracking occurs as the configurations go into the curve and not when they leave the curve. This does not disprove the off-tracking formula, for it addresses the maximum amount of off-tracking for a specific curve and vehicle, and not the off-tracking at any specific period. For all practical purposes, variances can be disregarded. It is recommended that extra width be added to the road width to compensate for driver's error, vehicle slippage, simulator error, and so forth.

The study also pointed out the following helpful guidelines for simulator use:

(1) To simulate a vehicle, the L_s must be the same. (Measuring criteria to obtain the sum of the squares of the L_s were already discussed under the two rules to remember above.)

(2) When using the simulator with a pickup, a transport truck is usually 8 feet wide, while the pickup truck is 6 feet wide. To allow for this difference, the pickup needs to be driven as if the front tires are 1 foot (not 2 feet) further out on both sides. In other words, one must assume that each front tire is out an additional foot.

(3) One should not use a smaller turning radius than that available for the vehicle being simulated. A half-ton pickup will have a smaller turning radius than most tractors, even though they may have the same cramp angle. This is because of the differences in the lengths of the wheelbases of the vehicle train's steering component. The calculation is as

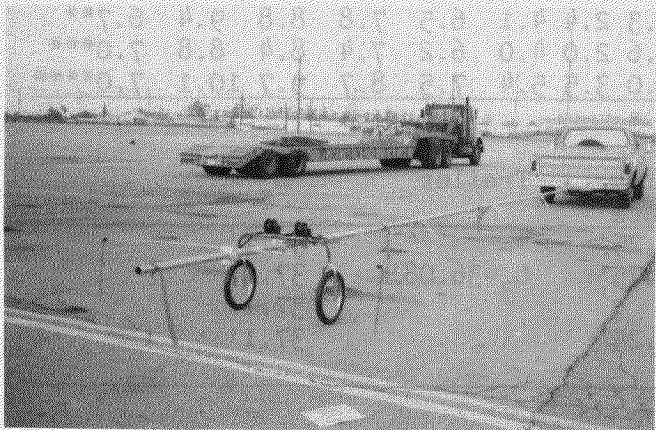


Figure 3.—Lowboy and field simulator setup behind the pickup.

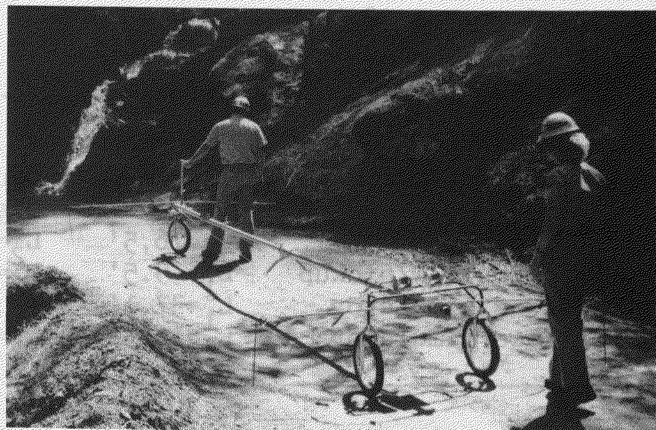


Figure 4.—Field use of vehicle simulator.

follows: the minimum turning radius equals the length of the wheelbase of the steering unit divided by the sine of its cramp angle.

(4) One must remember that *off-tracking is not symmetrical.* The simulator is pulled in each direction that the vehicle will travel. Log trucks can be an exception because, when empty, they are usually in the piggyback configuration, so the simulator should be used in the loaded direction. Both ways should be run for most other vehicles.

(5) When pulling the simulator with the pickup, maximum speed should be 10 miles per hour.

(6) When checking marginal areas of the road, it is best if a person is walking behind the simulator with a can of spray paint. This person can hold the rear of the simulator up while marking the additional width necessary on the ground. This in-the-field approach serves to designate these areas for the extra necessary width with little additional engineering.

Table 3.—Off-tracking lowboy and simulator, reverse curves. Off-tracking was measured toward the center of the curve. (On the reverse curve, the first nine measurements for each run were measured in one direction; the remainder were measured in the opposite direction.)

PC	19°	30°	46°	64°	90°	116°	150°	180°	20°	30°	45°	60°	90°	120°	180°
50-ft radius															
4.2	8.3	9.7	11.5	13.0	14.5	15.2	15.1	8.2	1.5	4.1	6.8	8.2	12.1	13.5	11.5*
4.3	8.4	10.0	10.2	13.5	14.8	15.5	15.8	9.5	0.5	3.6	6.9	8.6	12.4	13.4	11.4**
3.6	8.1	9.5	11.6	13.1	14.9	15.8	16.5	10.3	0.4	2.9	6.1	7.9	11.5	12.1	11.4***
3.8	8.0	9.5	11.3	12.8	14.1	14.8	14.8	8.0	2.0	5.0	8.0	9.7	13.2	13.9	11.8***
75-ft radius															
1.8	5.5	7.0	8.0	8.9	9.2	9.6	9.4	4.2	3.6	5.5	7.3	8.2	8.9	9.0	6.5*
2.5	6.1	7.3	8.4	9.1	9.7	10.0	10.1	5.3	2.4	4.1	6.5	7.8	8.8	9.4	6.7**
2.0	5.7	7.0	8.1	9.0	9.7	10.1	10.2	5.6	2.0	4.0	6.2	7.4	8.4	8.8	7.0***
2.0	5.5	6.7	8.0	8.5	8.9	9.1	9.0	4.0	3.5	5.4	7.5	8.7	9.7	10.1	7.0****

	Tractor	Coupling Distance	Trailer	L_s
*Lowboy	L_1=16.5'	L_2=33.25'		37.1'
**Simul. w/pickup	L_1= 9.5'	L_2= 3.75'	L_3=36.08'	37.1'
***One simulator	L_1=37.1'			37.1'
****Two simulators	L_1=16.5'	L_2=33.25'		37.1'

The advantages of using the field model is that existing roads can be checked to see whether they are adequate for any specific vehicle. The areas that are inadequate are quickly identified, allowing engineering activities to be concentrated on those portions of the road. Also, with the objective of designing narrow roads that lie "light on the land," land managers can be shown and can sense how much additional road width should be allowed as a margin of safety for driver error, vehicle slippage, and so forth—especially in mountainous terrain.

One road on the Deerlodge National Forest in Montana was checked with the field simulator after curve widening was placed in the design using the Forest Service formula (see figure 4). It was in a mountainous area where there were many compound and reverse curves. One would think that there may be an excessive amount of widening designed into the road because of the tapering of the vehicle off-tracking. This proved not to be true. Essentially, if one surveyed an existing road and put in curve widening by the formula or ran the simulator in both directions on the road, there will be little difference in the off-tracking design. (See table 3.)

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4. Cain, C., and J.A. Langdon. A Guide for Determining Minimum Road Width on Curves for Single-Lane Forest Roads. Engineering Field Notes 14 (April-June 1982):19–32.

Hells Canyon Boat Dock on the Snake River

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Wallowa-Whitman National Forest, Region 6

Introduction

"It will all pull loose and float down the river and break up at Wild Sheep Rapids next spring." "They haven't put a dock in here yet that stayed." These words were spoken by skeptical old-timers in the summer of 1985 as Forest Service personnel constructed the Hells Canyon boat dock on the Snake River. Four years later, the relatively maintenance-free dock is still in place. So far, the dock has not needed daily attention to adjust anchor cables for the tremendous variations in flow from the Hells Canyon Dam, which is 1 mile upstream.

The dock is in the heart of Hells Canyon National Recreation Area (HCNRA), on the Oregon side of the Snake River at the south end of the Hells Canyon Wild and Scenic River corridor. (See figures 1 and 2.) HCNRA encompasses 652,488 acres of high mountains, deep canyons, and wild rivers that straddle the Oregon-Idaho border, including the Snake River flowing through Hells Canyon. At approximately 7,900 feet deep, Hells Canyon is the deepest gorge in North America. Elevations range from 9,393 feet atop the Seven Devils Mountains to 800 feet where the Snake River flows out of HCNRA.

The rugged and diverse terrain of HCNRA provides a variety of recreational opportunities for visitors—boating on the Snake River being one of the most popular. Power boats and float boats (rafts) share Hells Canyon. The Hells Canyon boat dock was constructed to provide temporary mooring of power boats and float boats as their owners prepared for trips down the Snake River. Private power boat use in the canyon is not limited, but those unfamiliar with the canyon should be aware that the river is extremely hazardous. Private float boating in upper Hells Canyon is regulated each year between Memorial Day and September 15. Reservations and permits are required to launch float trips. (For river reservations and information, phone (208) 743-2297.)

Design

Designing a boat dock that would endure the extreme changes in river flows and weather elements presented many difficult challenges. The range of flow varies annually from 5,000 cubic feet per second (cfs) in late summer to 82,500 cfs in early spring during peak snow melt and heavy rains. (The velocity of the river flow was calculated by timing a floating object over a measured distance.) These extreme flows produce 21 feet of elevation change on the river surface.

Temperatures vary from below zero in January to 115 degrees in August. Winds, however, are relatively light at the bottom of a deep gorge. The dock was designed to withstand a steady wind of 35 miles per hour (mph) with peak gusts to 70 mph—velocities considerably higher than have been observed at this site in 17 years.

The dock was constructed approximately 200 feet downstream of the boat ramp and adjacent to a small inlet that causes an ebb flow next to the shoreline and relatively calm water to flow out into the main channel approximately 100 feet. Managers of HCNRA requested that the boat dock meet all or most of the following requirements:

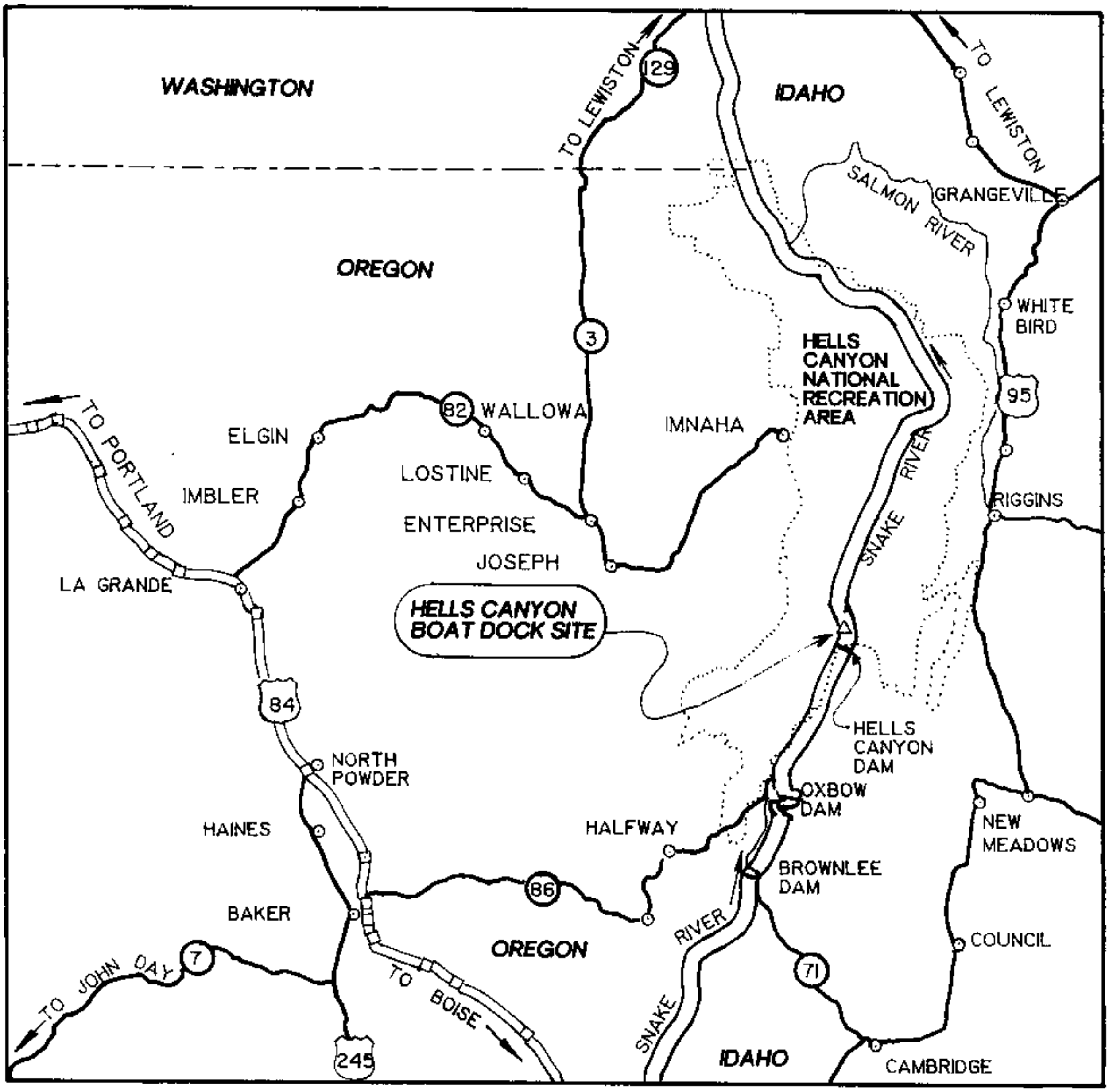

Figure 1.—Location of Hells Canyon National Recreation Area and boat dock site.

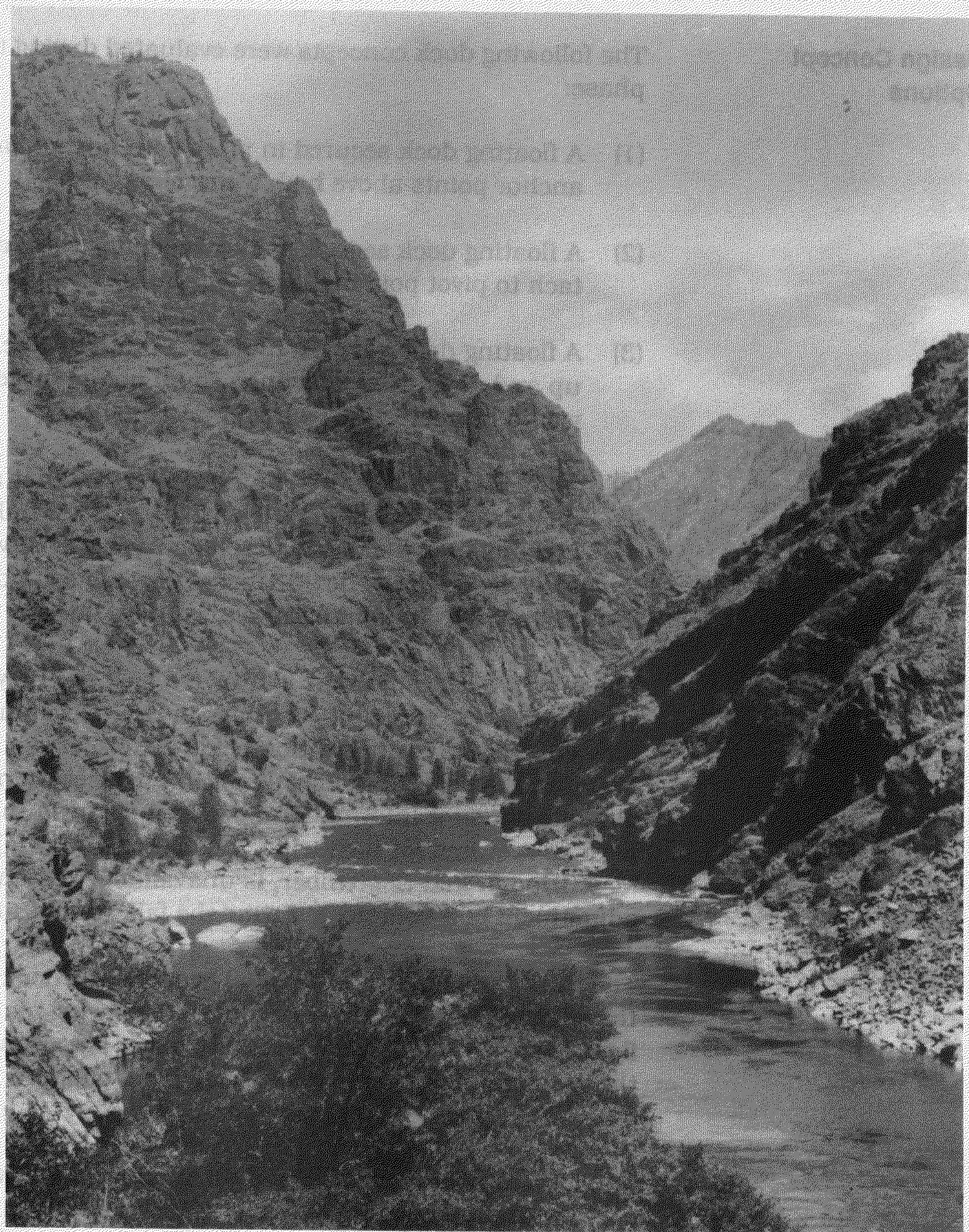

Figure 2.—Hells Canyon on the Snake River, looking downstream. Boat dock site is behind the trees in the foreground.

(1) The dock would be built on a preselected site—chosen through the HCNRA Comprehensive Management Plan.

(2) The dock would provide moorage for four jet boats, each up to 28 feet long. This would require the dock to be adjustable for minimum to maximum flows and remain in the water year-round.

(3) The dock would be available for public use and the use of two permittee outfitters all year.

(4) The dock would be accessible to the handicapped.

Design Concept Options

The following dock concepts were evaluated during the preliminary design phase:

(1) A floating dock secured in place with anchor cables and tether lines to anchor points above high water elevation.

(2) A floating dock secured with two long parallel arms or beams that attach to pivot points above high water elevation.

(3) A floating dock secured to piles set into bedrock. The dock would slide up and down vertically only, could not be moved horizontally, and would be accessible by a long gangplank.

(4) A floating dock secured to a trolley frame that rolls on rails set perpendicular to the shoreline. The trolley frame would be counterbalanced to eliminate any tendency to roll down the rails, which could, in turn, add more loads to the dock. The dock would self-adjust to changes in water elevation from minimum to maximum flows.

The first two concepts were eliminated because they would require daily attention and adjustment to changes in river elevation. Idaho Power Company may change the river elevation below Hells Canyon Dam up to 1 foot per hour, and the elevation may change by 10 feet overnight. The Forest Service stations a Visitor Information Specialist at the launch site to administer the permits required for float trips. This person, normally employed from mid-May through mid-September, is unavailable to monitor the maintenance and adjustment of a boat dock during the fall, winter, and early spring.

The third concept was eliminated because the dock would be positioned at the edge of the very turbulent and swift-flowing main stream during high flow rates, making it difficult to maneuver a boat into a dock slip. The end of the dock would be approximately 100 feet offshore, and access would require an impractical gangplank approximately 75 feet long.

The fourth concept met most of the requirements stated in the design prescription, except for access for the handicapped. The Uniform Building Code at the time of design required a ramp slope no steeper than 1 foot in 10 feet of horizontal distance, with a 5-foot landing for each 5 feet of elevation change. A ramp 210 feet long plus three level landings every 5 feet in length yields 225 feet total to meet the code for handicapped access. There seemed to be no practical way to provide ramp access to the boat dock within the limited space available. There was no electric power at the launch and dock site, so an elevator-chair mechanism was not considered.

A paraplegic gentleman from the Department of Health and Human Services in Seattle suggested that stairs 3 feet wide with 14-inch tread would enable wheelchair access with the assistance of others above and below the chair. The wide steps would provide a stopping point for rest at any time and would be easier to traverse (with help) than a steep ramp. Originally, this author proposed designing the stair stringers very wide and spaced so a wheelchair could roll on the stringers.

Final Design

The final design consisted of a pair of large galvanized steel I-beams with cross and diagonal bracing to keep the rails square and parallel. (See figures 3 and 4.) The rails were welded to columns set into concrete at the upper end, and trolley stops were welded to both ends of the rails to limit travel. (See figure 5.) The area below the rails and stairway was first graded to a uniform slope of 22.1 degrees (40.6 percent). (See figure 6.) The space between the rails was backfilled with pit-run rock to anchor the system in place. The trolley frame was fabricated from 5-inch-square structural steel tubing with heavy duty, roller-bearing wheels to receive loads both higher and lower than the rail surface, as well as lateral loads from wind, stream velocity, and boat docking. (See figures 7 and 8.) The stairs are attached to one rail with long tie rods 0.75 inch in diameter. The stairs also are anchored down to the streambank with steel stakes bolted to a stair stringer. A handrail was made using 2-inch-square steel tubing bolted to the

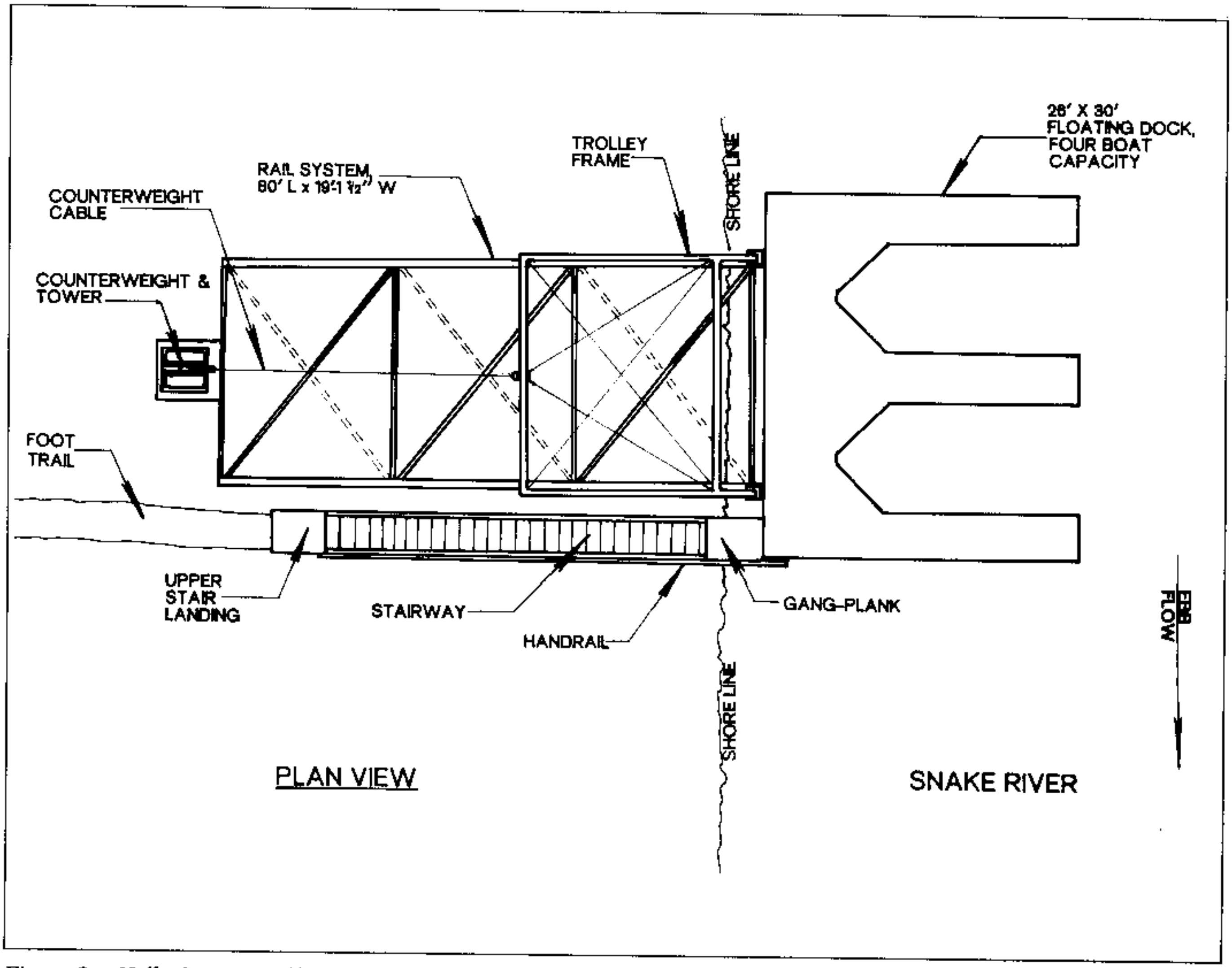

Figure 3.—Hells Canyon self-adjusting boat dock (plan view).

outboard stair stringer. A short (5.5-foot) wooden gangplank with roller bearing wheels, which roll on the top surface of the stair stringers, connects the stairway to the floating dock. (See figures 9 and 10.)

The dock was constructed using 3-inch by 9-inch glue-laminated Douglas-fir walers (framers), with all joints made with steel plates and angle braces. The deck consists of 2-inch by 6-inch Douglas-fir planks painted with an anti-skid (sand) urethane enamel. All timber members were pressure treated to inhibit decay. The rectangular floats were made with rotationally molded, cross-linked polyethylene and filled with closed-cell, expanded polystyrene. A sheet of 0.75-inch plywood covers the top of each float unit. All steel components were hot-dipped galvanized after fabrication, and all fasteners were galvanized.

The 3-foot-square by 20-foot-high counterweight tower was constructed using steel angle iron. (See figure 11.) Initially, the counterweight tower was planned to be approximately 35 feet high, projecting well above the adjacent

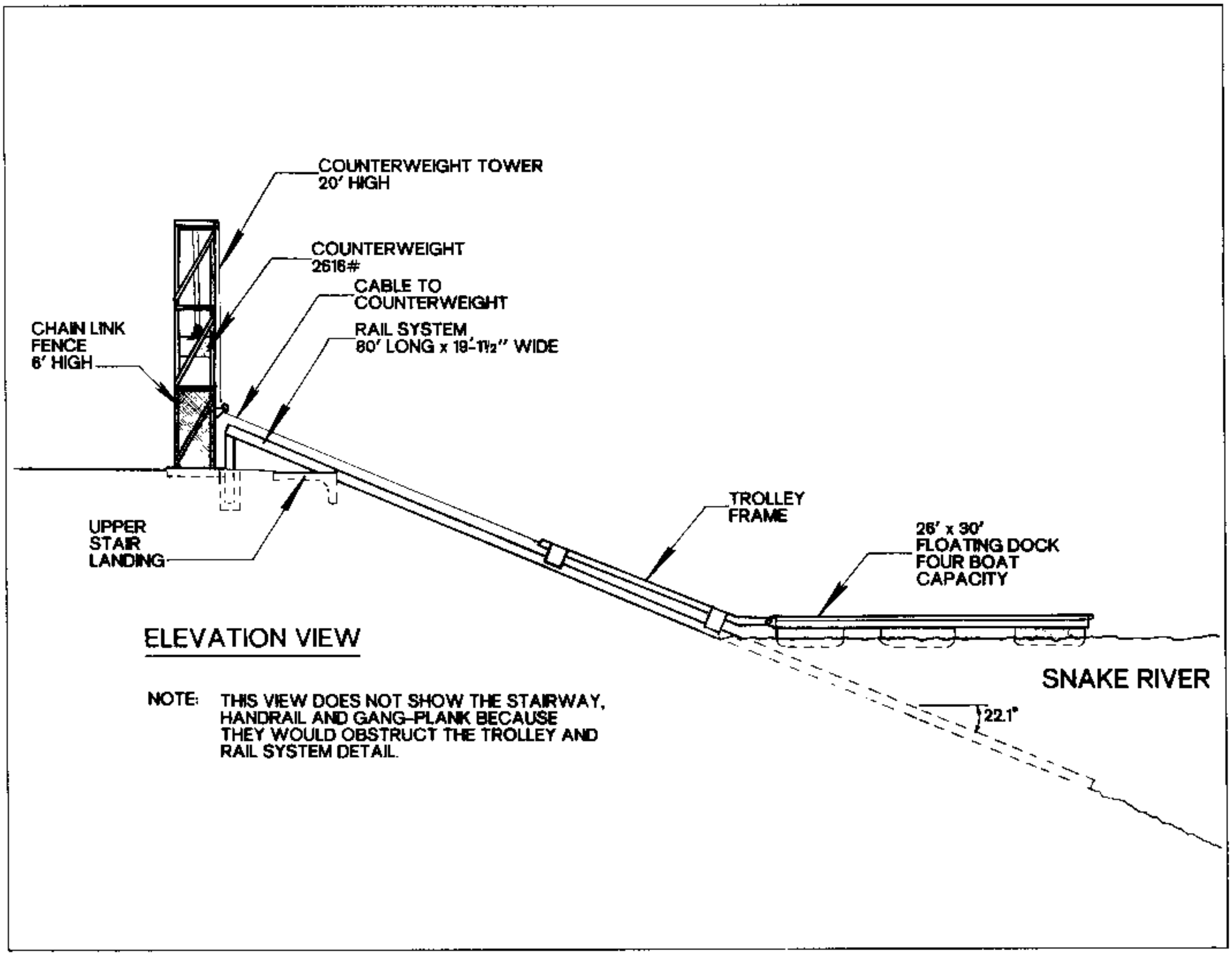

Figure 4.—Hells Canyon self-adjusting boat dock (elevation view).

Figure 5.—Field welding the upper and lower rails together.

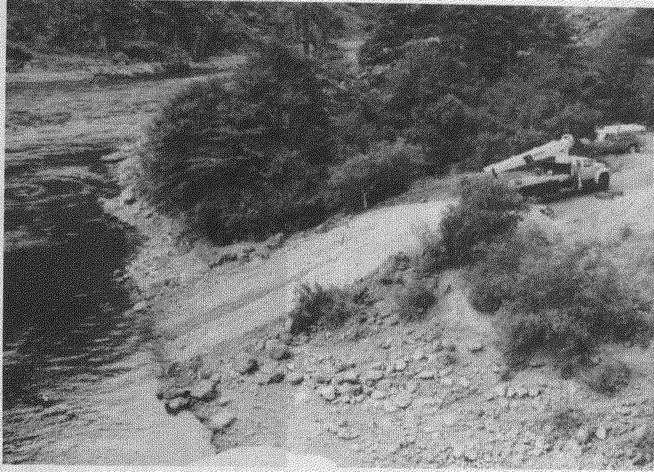

Figure 6.—Ramp earthwork completed and the sloped streambank is ready for placement of the rail system and stairway.

trees highly visible from the visitors' observation point above the dock. Incorporating a 4:1 ratio block-and-tackle mechanism above the counterweight shortened the overall height of the tower to 20 feet and allowed the trolley to traverse the full length of the 80-foot rail system with no manual adjustment to the cable system. Only the top 8 feet of the tower frame are visible from the observation point. (See figure 12.) This change required the reinforced-concrete counterweight to weigh four times the force generated by the trolley's tendency to roll down the rails. A 6-foot-high chain-link fence surrounds the counterweight tower to keep anyone from getting under the 2,616-pound concrete block. A 0.25-inch galvanized steel aircraft cable connects the trolley to the counterweight, and all sheaves are 6-inch-diameter forged steel to keep cable flexing minimal.

Figure 7.—Onsite assembly of the trolley rail system.

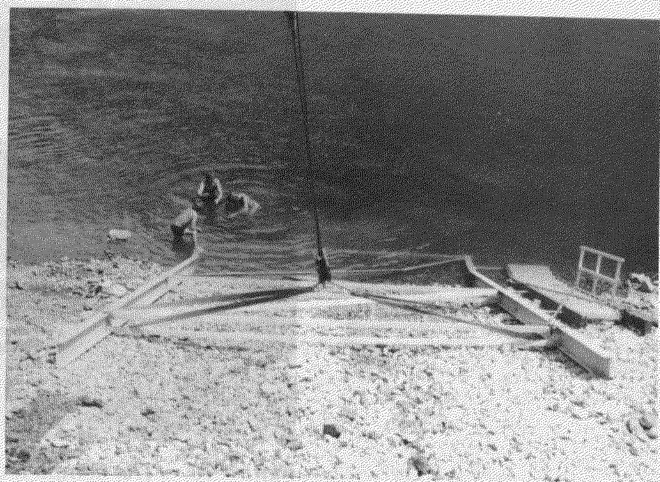

Figure 8.—Setting the lower half of the rail system to finished grade.

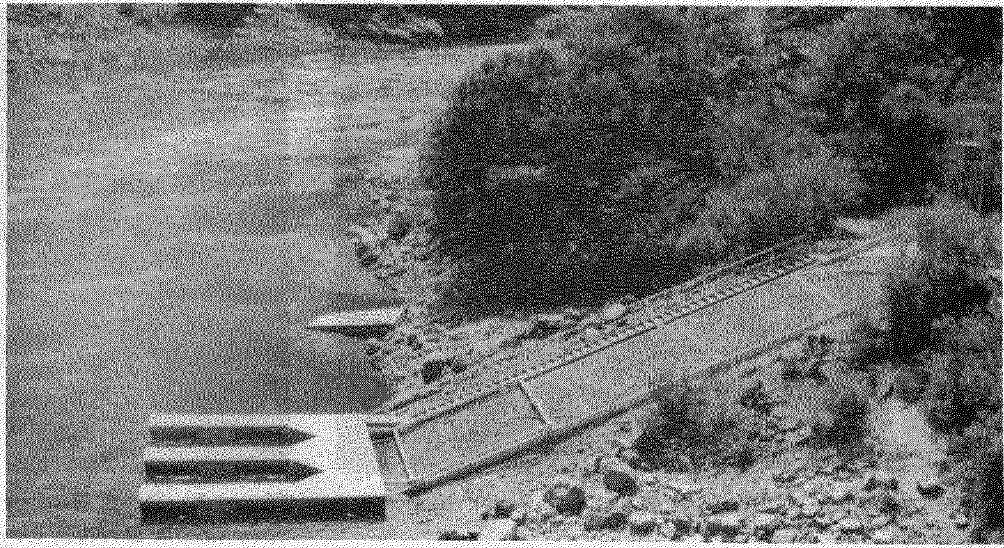

Figure 9.—The completed self-adjusting boat dock project.

It is important to contact the necessary authorities and apply for the required construction permits as soon as the final design is selected (in this case, the U.S. Army Corps of Engineers and the Oregon Division of State Lands). Because obtaining permits can be a time-consuming process, early application may prevent a delay in construction.

There are many other details that went into the design of this structure. Anyone interested in additional design information should contact the author.

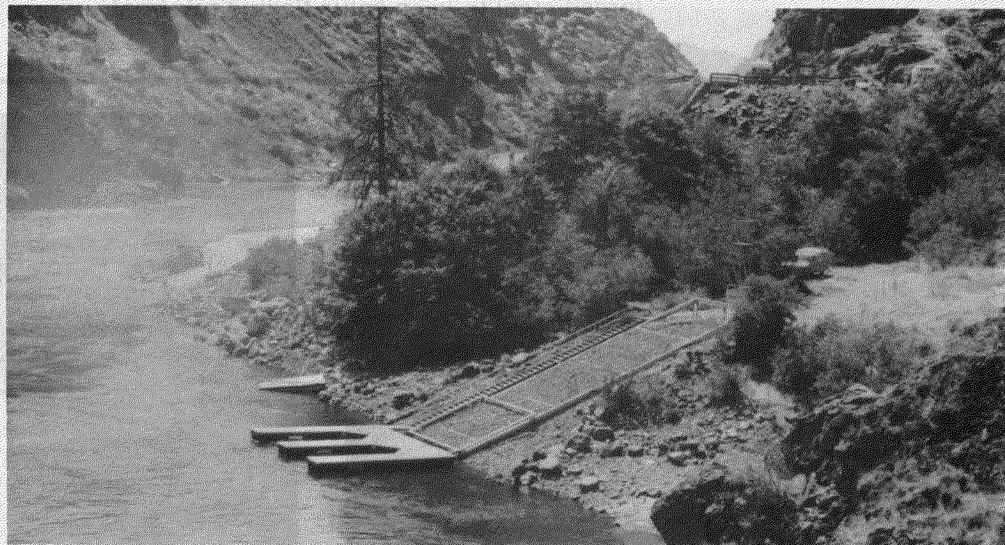

Figure 10.—The completed self-adjusting boat dock showing its location in relation to the boat ramp (above and to the left) and the visitor parking area (above and to the right).

Construction

A $57,130 contract was awarded to ADKY Construction Company of Vancouver, Washington, to fabricate (offsite) all necessary boat dock components and construct the dock as described above. The contractor used a small John Deere Model 450C bulldozer to grade the streambank. Onsite construction was performed in early August 1985, when river flows ranged from 8,000 to 11,000 cfs, requiring the rail system to be assembled out of the water and slid downslope approximately 6 feet into the water. The rails were built up from two 40-foot-long I-beams welded together onsite for an overall length of 80 feet.

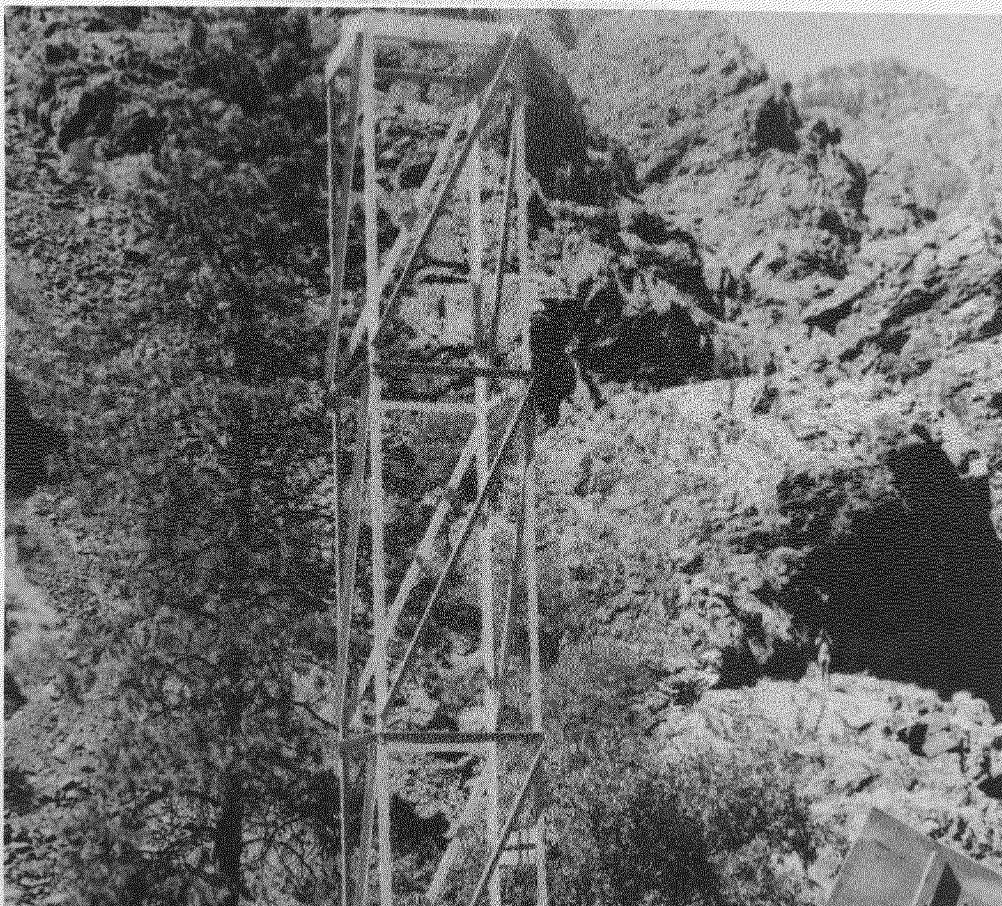

Figure 11.—Placing the counterweight tower over the counterweight and onto the concrete base.

The contractor constructed a temporary wooden deck and sidewalls on the trolley to ferry the pit-run rock fill to the lower end of the rail system. (See figure 13.) Because the 40-percent slope of the rails was not steep enough to make fill material slide off the deck when the gate opened, all the material had to be shoveled off the platform into the area between the rails. The concrete needed to anchor the rail columns and build the tower base, stairway landing, and counterweight was batched onsite in a portable mixer using commercially packaged sackcrete.

While constructing the deck, the contractor encountered only two problems worth mentioning. First, because the sawn timbers comprising the stair

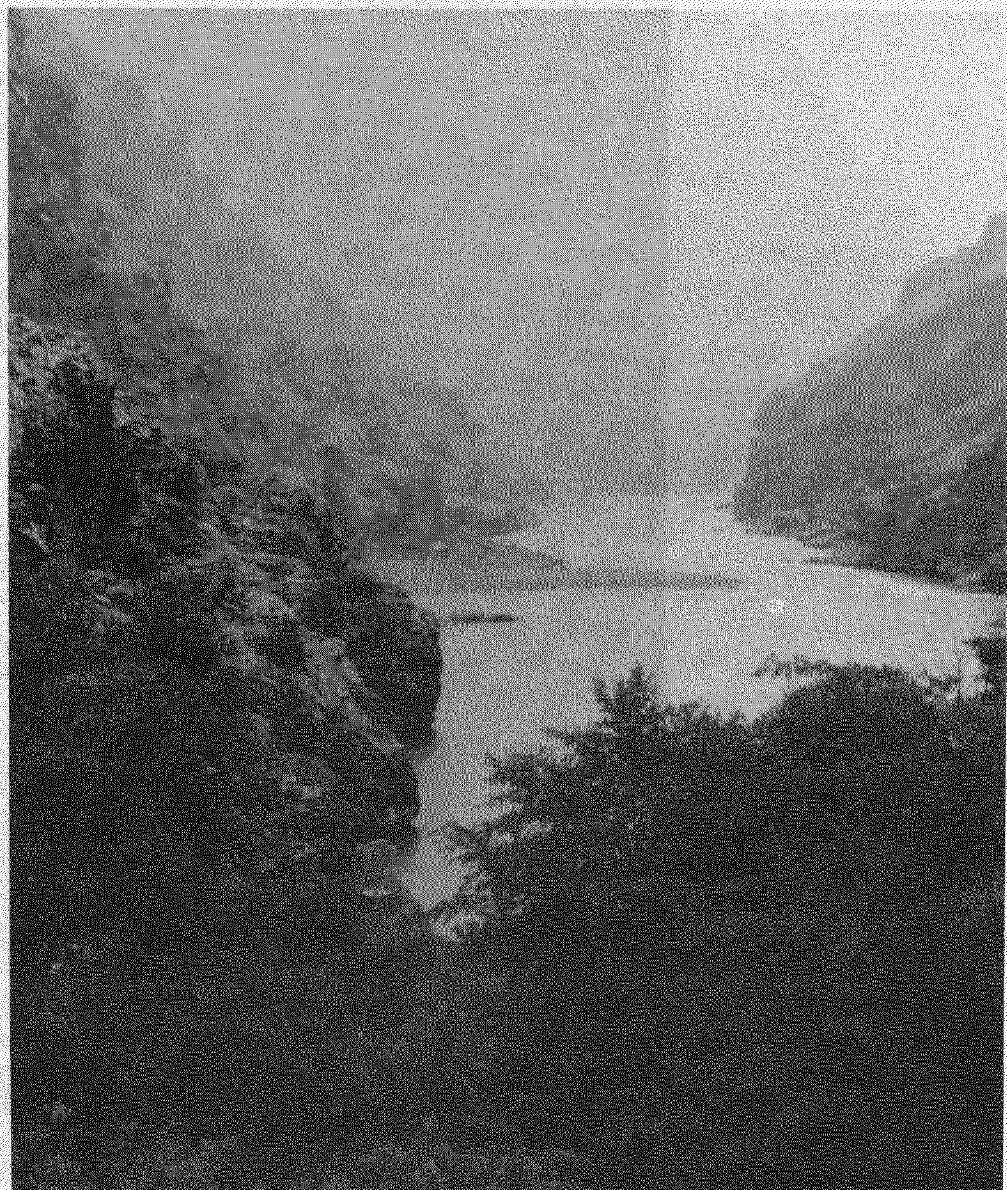

Figure 12.—View of the dock site from the visitor parking area. The only visible portion is the top half of the counterweight tower. It blends in so well with the rock background that it is difficult to spot between the trees.

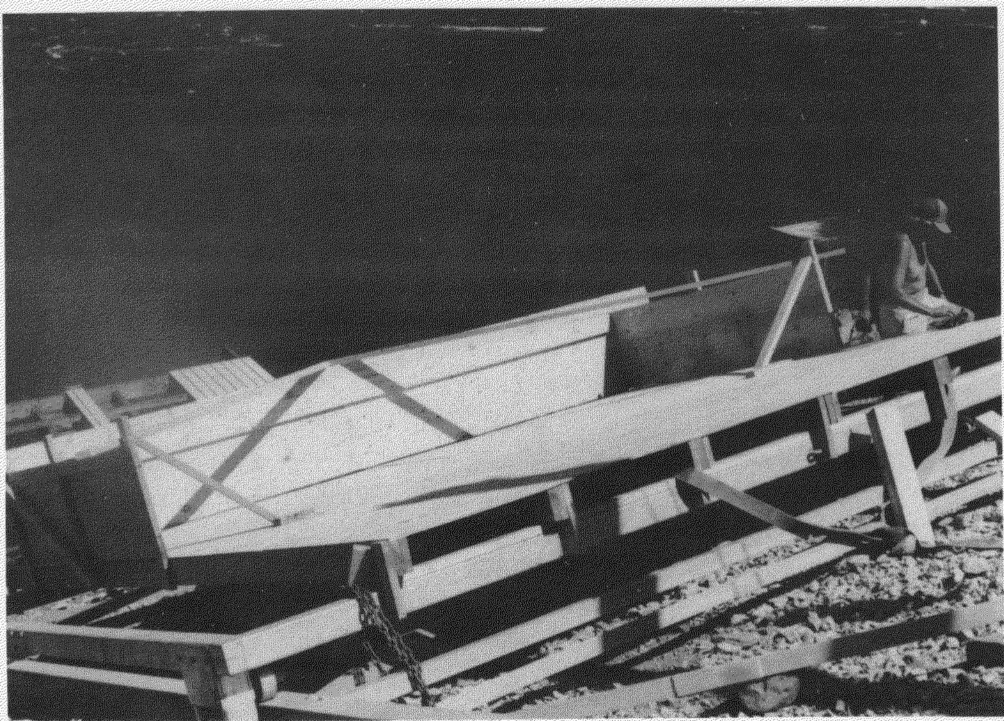

Figure 13.—Temporary platform constructed on top of the trolley frame. Fill material was placed on the platform; then the trolley was rolled down the rails with a crane and the pit run rock offloaded and placed between the rails to secure the entire rail system to the streambank.

stringers were fabricated 8 months before final construction, the timbers dried out and warped such that several of them resembled propellers. It was very time-consuming to untwist the timbers enough to make the required splices and install the galvanized steel stair treads. Glue-laminated stringers or an all-metal design should be specified when designing another stairway of this type. [*Editors note:* Similar problems with sawn wood have been experienced by Forest Service Bridge Engineers.] Second, the steel components were hot-dipped galvanized after all the holes were drilled and weldments completed. Considerable excess zinc had to be filed off by hand to insert bolts and assemble the components onto the trolley frame.

The construction superintendent was very conscientious in regard to quality, making contract administration a pleasure and ensuring a high-quality facility.

Maintenance

The only routine maintenance the dock requires is periodic greasing of the wheel bearings and sheaves and an occasional check for debris lodged in the rails. The river outfitter agreed to perform this maintenance for the Forest Service in exchange for free use of two slips to moor his jet boats.

There have been three problems with the dock, however. The first occurred approximately 1 year after construction. The original sheaves contained oil-lite (sintered bronze) bearings. The bronze bearing in the break over the

Road Program Costs: Continuing Efforts Addressing the Issue

Congress & the Forest Road Budget

Jerry Bowser
Staff Engineer
Washington Office

Some interesting signals have arisen from the legislative activities associated with the fiscal year 1990 Forest Road Budget. It is important that Engineers understand what seem to be the underlying causes and the implications of the actions.

Forest Service personnel are aware of the attention roads have received during the past decade. Congress has paid particular attention to a reduction in unit costs for road construction—something the Forest Service has handled very successfully. Therefore, it was quite a shock when Congress threatened large cuts in the road construction budget for 1990—cuts that would jeopardize completion of activities identified in the Forest Plans. Why did this happen when the Forest Service had reduced unit costs so well?

The road construction line item is an easy target; it is a large portion of the Forest Service total budget (17 percent in 1989). In many cases, road funds have become the "fall guy" or "surrogate" for those who disagree with planned management. The Forest Road Program is vulnerable to reductions because of desires to:

(1) Protect old growth timber allocated to timber harvest.

(2) Stop entry into roadless areas released from further wilderness consideration.

(3) Protect wildlife habitat from road intrusion.

(4) Stop a perceived subsidy to the timber industry when selling "below cost" timber sales.

(5) Halt the "huge" clearcuts occurring in the West or, in some organizations, stop all timber harvest on Federal lands.

(6) Cease "giving away" our quality old growth logs to the Pacific Rim countries.

In the past decade, environmental groups strengthened their efforts in shaping the actions of Congress. Their stories of public land and resources abuse strike the emotions of listeners. They show pictures of vast areas of clear-cuts, mine tailing wastes, and oil spills to convince the Members of Congress that more congressional protection is essential. Although most of the examples they cite or show pictures of are historic and not demonstrative of current practices, the message they are delivering has been effective in Congress.

The concept of public land management priorities among Members of Congress from eastern States differs from that of western Members. Eastern Members find it difficult to understanding the importance of Federal lands to the economies of States with small populations and where Federal lands exceed 35 percent of the States' land base. Similarly, it is just as difficult for western Members to be interested in or concerned about generally eastern issues, such as the plight of the inner cities.

These factors affect attitudes concerning how the public lands should be managed and, more specifically, how much of our limited national budget should be appropriated for building more roads.

Many misunderstandings remain about the road construction program, although the Forest Service has made a concentrated effort to explain what it does and why. There is no working understanding, outside the House and Senate Appropriations Committees, of the differences between the Forest Road Program and the timber purchaser credit program, or about the interdependencies between the roads and resource outputs carefully woven into the Forest Plans.

When Senator Fowler offered his amendment on the Senate floor to reduce by $65 million the road budget that the Senate Committee had previously passed, his argument included the following reasons:

(1) The Road Program is overfunded; there are already 340,000 miles.

(2) The Timber Program loses money, primarily because of the high cost of roads.

(3) Roads are built on fragile terrain and cause extreme environmental damage.

(4) More emphasis on fish and wildlife habitat is necessary.

(5) Funds saved by the cuts would go to cultural and historic program and to wetland and waterfowl programs.

(6) The Forest Service overachieved by 3,725 miles of road during 1983-88.

(7) This will restore balance to the management of our natural resources.

(8) Road construction funds are used only to build new roads.

The Forest Service knows internally that most of the allegations are incorrect, but it is important to know what they are in order to address them. However, it is important to understand that the Senator truly believed that he was taking the proper action when he said he was "restoring some fiscal and environmental responsibility to the Forest Service budget" by reducing what he considered to be "excessive funds for its roadbuilding program." There was considerable debate on the issue, and many of these allegations were countered by Senators McClure, Hatfield, and Stevens. Yet the amendment passed, indicating changing sentiment in the Senate.

In the House-Senate Conference, the road construction level was agreed to at House marks that were higher than the Senate marks. The Conference also agreed to increase road maintenance funds above the level requested in the President's budget. The conferees provided language to permit the use of excess receipts and salvage receipts for road design and construction. So, in essence, programs have been restored to planned or higher levels.

However, a challenge remains. The misunderstandings and questions about agency credibility must be faced directly. Road actions must be defensible in light of the many allegations that have been leveled. The confusion over the road construction line items will persist until the Forest Service clarifies why most of the money goes to improve existing roads. Some reconstruction activities may need to be accounted for as maintenance activities, because this terminology may be more acceptable to those who are confused about how road construction funds are actually used.

There may be a change in priorities for the management of public lands. Forest Plans must keep pace with changing public perceptions and desires. It is increasingly important that individual Representatives and Senators are kept abreast of forestry practices in their localities. Someone once said that "all politics are local."

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