# ENGINEERING TECHNICAL INFORMATION SYSTEM

FIELD NOTES • TECHNICAL REPORTS
DATA RETRIEVAL • MANAGEMENT
PROFESSIONAL DEVELOPMENT

VOLUME 9 NUMBER 10

# Field Notes

Benefits of Computer Models for Transportation System Analysis

Native Log Stringer Bridge Research in Region 10

Washington Office News

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U.S. DEPARTMENT OF AGRICULTURE

# ENGINEERING FIELD NOTES

Volume 9 Number 10



**FOREST SERVICE**
**U.S. DEPARTMENT OF AGRICULTURE**
**Washington, D.C. 20013**

## READER'S QUESTION BOX

*July 1977 Volume 9 Number 7: "Tinker Toy" Bridge*

*QUESTIONS FROM THE JEFFERSON NATIONAL FOREST*

*Q.* What would be the linear cost per span foot?

*A.* The average bridge cost per linear foot is ± $700. Actual cost depends on abutment heights and span length required. Low abutments with long spans are the least expensive, and high abutments with short spans are the most expensive. The price range should be from $600 to $800 per linear foot.

*Q.* What are the span sizes for which the bridge could be ordered.

*A.* Spans range in flat slab design from 14 feet (4.27 m) to ± 44 feet (13.41 m). R-5 plans to restrict range use to 30 to 40 feet (9.14 to 12.19 m); however, ⊓ or ⊤⊤ sections may be used.

*Q.* Can these bridges be ordered from any company in the eastern U.S.?

*A.* Any yards that produce precast/prestress materials should be able to manufacute the bridge. The current bridge design was custom-made for the Eltapom Creek site. If enough interest develops, R-5 may produce a standard design for various span lengths, abutment heights, and allowable foundation loadings.

# BENEFITS OF COMPUTER MODELS FOR TRANSPORTATION SYSTEM ANALYSIS

*Victor M. Dekalb*
*Chief Transportation Engineer*
*WO*

In recent years, the use of computer models for analysis of Forest Service Transportation Systems has increased. Records at the Fort Collins Computer Center show that at least 24 field units currently have a project under analysis. Seven of those projects have been reviewed by the Washington Office: a variety of problems were evaluated, and major benefits were identified.

We developed three categories of advantages that will be of interest to field practitioners: two were financial (actual and probable savings), and the third was related to intangibles--improvements in procedures or activities.

1. Actual: Savings resulting from a decision based on the use of the computer model in analysis of the project.

   For instance, if the analysis indicated that a road should be closed, the resulting savings in maintenance costs were identifiable. Or, if the analysis caused a change in the previous decision on a proposed project, the reduced expenditures resulting from that change were identifiable as actual financial benefits.

2. Probable: Savings resulting from analysis in a "multiple alternative situation."

   For instance, if a given alternative had been chosen without the model analysis, the financial differences between the initially-attractive alternative and that selected by means of the model analysis could have been expressed as probable financial benefits.

3. Intangible: Advantages derived from facilitating procedures (automating route analysis factors--mileage, dollars, time), and improving understanding of issues.

   For instance, rapid analysis of alternatives, precise evaluation of data, improved documentation of the basis for decisions are benefits. These benefits could not be expressed in dollars; but the advantages to the engineering effort (and, ultimately, the public) are as important as the identifiable dollar savings. These benefits possibly resulted in greater long-range savings than the immediate dollar savings attributed to the individual projects, since improvements in both formalized procedures and work habits continued to "pay off" indefinitely, as does well-developed communication between the Forest Service and the public.

The review of the seven projects provided an estimate of financial benefits totalling over $14 million (one-third in actual savings); these figures were derived as shown in the table below.

The summary of each project provides a basic description of the various factors considered.

| Project | | Estimated Benefits | |
|---|---|---|---|
| | | Actual | Probable |
| 1 | Prince of Wales Island | not determined | $2,000,000 |
| 2 | Deception--Comet Creek | $ 101,500 | 2,000,000 |
| 3 | Elk Summit | 606,550 | not determined |
| 4 | Willamette | not determined | 2,000,000 |
| 5 | Bear--Dixie | 106,000 | not determined |
| 6 | Camp Creek | 1,220,000 | not determined |
| 7 | Oroville--Quincy | 3,000,000 | 2,000,000 |
| Total | | $5,033,050 | $8,000,000 |

*PROJECT 1--PRINCE OF WALES ISLAND*
*SOUTH TONGASS NATIONAL FOREST--1972*

Kind of Work

On a 150,000-acre (60705 ha) area, construction and operation costs of roading and shipping alternatives were evaluated for timber harvesting.

Forty different options which included hundreds of miles of road, scores of timber sales, and several water routes were analyzed.

Cost of Work

1. Not determined; estimated as less than required for manual analysis.

Financial Benefits

1. Actual--Not determined.

2. Probable--$2 million in projected road construction costs over a 20-year period ($100,000 annually).

Intangible Benefits

1. Minimized the number of log dumps.

2. Facilitated decisionmaking by using Factor Profile for comparing alternatives.

3. Clarified the basic issues and relevant tradeoffs.

4. Provided documentation of the analysis of key variables needed for public involvement.

5. Helped the public and special interest groups to evaluate more rationally by quantifying variables.

6. Allowed 40 to 50 alternatives to be studied by computer analysis versus only two alternatives by manual analysis.

7. Allowed quick analysis of other alternatives later supplied by various interested public sectors.

*PROJECT 2--DECEPTION-COMET CREEK*
*CLEARWATER NATIONAL FOREST--1974*

Kind of Work

Existing logging road systems were evaluated to determine which road projects should be improved. The analysis included 52 timber entry points, six sales, and a 20-year time horizon.

Cost of Work

1. $3,000: Includes 20 man-days.

2. $670: Computer costs.

Financial Benefits

1. Actual--$50,000 per year saved in maintenance cost over a 10-year period by closing a road.

   --$50,000: Reconstruction costs saved.

   --$1,500: 10 man-days of analyst's time saved by using the computer.

2. Probable--$2 million saved by generating the most economical road improvement alternatives and by eliminating unnecessary road construction.

Intangible Benefits

1. Allowed evaluation of maintenance needs over a 20-year period by using a chart showing time distribution of timber flow.

2. Provided optimal solutions and more alternatives by using the model method instead of the hand method.

3. Provided background material for environmental assessment and engineering reports for individual roads.

4. Reduced erosion by closing a road, thereby improving environmental benefits.

*PROJECT 3--ELK SUMMIT*
*CLEARWATER NATIONAL FOREST--1975*

Kind of Work

Timber harvest schedules and resulting log haul were evaluated to determine if road widening was necessary. The analysis considered nine alternatives that included recreation and timber traffic predictions.

Cost of Work

1. $3,000: 20 man-days.

2. $50: Computer costs.

Financial Benefits

1. Actual--$600,000 saved by changing timber sale schedule instead of widening a road.

--$4,800: 32 man-days of analyst's time saved over an 18-month period by using the Timber Transport Model on five other studies.

--$750: 5 man-days of analyst's time saved by using the Model.

2. Probable--Not determined.

Intangible Benefit

1. Developed predicted "average daily traffic" charts showing little additional widening needed.

*PROJECT 4--FOREST LAND MANAGEMENT PLAN*
*WILLAMETTE NATIONAL FOREST--1974*

Kind of Work

A 3,800-mile (6080 km) Forest road system for logging and recreation traffic was evaluated in order to develop a Forest land management plan. The analysis predicated the roading needed for each of several land management alternatives.

Cost of Work

1. $9,000: Field work.

2. $4,500: 30 man-days for data assembly.

3. $4,000: Computer costs and data work.

Financial Benefits

1. Actual--Not determined.

2. Probable--$2 million in future road reconstruction.

--Several thousand dollars in collecting new data each year.

--Millions of dollars by deciding not to construct roads on portions of land base where this was not economically feasible.

Intangible Benefits

1. Developed a method to use the Timber Transport Model to assign recreation traffic.

2. Provided a method to add road mileage and costs for each additional acre of timber added to the timber harvest base.

3. Helped in presenting plans to the public.

*PROJECT 5--BEAR-DIXIE SALE*
*MALHEUR NATIONAL FOREST--1974*

Kind of Work

An evaluation of a 3,000-acre (1214 ha) timber sale to determine whether the sale conflicted with the wildlife habitat. Analyzed eight possible log haul strategies and considered elk habitat and other wildlife problems.

Cost of Study

1. $1,800: 11 man-days.

2. $1,200: Computer costs.

Financial Benefits

1. Actual--$106,000 saved over the previously-planned action (prior to analysis).

2. Probable--Not determined.

Intangible Benefits

1. Allowed rapid analysis of various major and secondary routes which would have been time-consuming, if hand analysis had been used.

2. Facilitated decisionmaking by providing exhibits and displays for Rangers to examine. Rangers felt that the displays enhanced the decisionmaking process.

3. Provided consideration and protection of wildlife habitat.

*PROJECT 6--CAMP CREEK DRAINAGE*
*MALHEUR NATIONAL FOREST--1975*

Kind of Work

A 30,000-acre (12141 ha) area was evaluated to determine whether there were too many roads, which roads to abandon, and the road standards for a Forest arterial. The analysis included nine alternatives, and each included 60 miles (96 km) of road and nine timber sales.

Cost of Work

1. $5,625: 37.5 man-days.

2. $400: Computer costs.

Financial Benefits

1. Actual--$20,000 per year in maintenance cost by abandoning 20 miles (32 km) of the road system.

   --$1 million in construction costs by eliminating 10 miles (16 km) of road ($100,000 per mile), since a two-lane road was not necessary for the arterial.

   --$200,000 by using the Timber Transport Model on 12 timber sales and by abandoning planned expensive actions.

2. Probable--Not determined.

Intangible Benefit

1. Made network files available to allow computer analysis of changes in future years.

*PROJECT 7--OROVILLE-QUINCY CORRIDOR*
*PLUMAS NATIONAL FOREST--1975*

Kind of Work

A 150,000-acre (60705 ha) area was evaluated to determine if a county road should be upgraded for haul of National Forest timber, and which Forest Service roads should be eliminated, upgraded, or kept in the same condition. This analysis included 30 alternatives which considered 75 timber sales.

Cost of Work

1. $1,500: 10 man-days.

2. $1,000: Computer costs.

3. Data collection work was minimal; therefore, it was not determined.

Financial Benefits

1. Actual--$2 million over a 20-year period by using construction funds on the projects delineated by the analysis.

--$200,000 by eliminating plans to construct two bridges.

--$800,000 by eliminating construction of 20 miles (32 km) of collector roads.

--$20,000 annual maintenance.

2. Probable--$200,000 by cooperatively rebuilding a single road to meet separate County and Forest Service systems needs.

Intangible Benefits

1. Issues concerning road and haul impacts on the environment were clarified. By decreasing timber output (haul) through the area, impact on the road was reduced.

2. Eliminated preconceived need for crossing a fishing stream.

3. Eliminated the building of a road through a potential reservoir site.

4. Exposed the need for a complete study of land use and transportation in a 50,000-acre (20235 ha) basin.

# NATIVE LOG STRINGER BRIDGE RESEARCH IN REGION 10

*Frank W. Muchmore, P.E.*
*Regional Structural Engineer*
*Region 10*

*Roger L. Tuomi, P.E.*
*Research General Engineer*
*Forest Products Laboratory*

*and*

*Ronald Wolfe*
*Technologist*
*Forest Products Laboratory*

Within the last 20 years, several hundred bridges have been built of native logs in Southeast Alaska (fig. 1). This effort is part of the development of the National Forest Transportation System on the islands of the Alexander Archipelago in the Southeast Alaska Panhandle.

Bridges were needed to span streams, and high-quality Sitka spruce logs, up to 5 feet (1.52 m) in diameter, were locally available in abundance. Therefore, it proved economically advantageous to build the bridges from this native material. With trees cut in the proximity of the bridge site, the cost of construction was only about $70 per linear foot ($5 per square foot).

Typically, logs are not sawn into timbers and planks, but are placed butt-to-tip on log crib abutments and tied together with cables (fig. 2). Blast rock is then placed on the logs and bladed to provide a running surface. Brow logs are placed at the sides of the bridge to serve as curbs and bridge rails.

Although this method may appear primitive, the several hundred bridges of this type that are currently in use function quite adequately for 10 years or more. Some of the bridges are quite impressive, with clear spans approaching 100 feet (30.5 m), and carry off-highway logging trucks with gross vehicle weights exceeding 100 tons (90.7 Mg).

*BRIDGE SAFETY*

Public access to previously-isolated areas requires a safer road system--including bridges--for the public traffic as well as for logging and Forest Service administrative traffic.

As a consequence of the "Silver Bridge" disaster in 1967, Congress passed the Federal-Aid Highway Act of 1968, which required the Secretary of Transportation to establish National Bridge Inspection Standards. These standards apply specifically to the Federal-Aid Highway Systems, but they

*Figure 1 (M 143 751-14). Native log stringer bridge on Prince of Wales Island in Southeast Alaska. This bridge has a clear span of 92 feet (28 m) and is designed to carry 80-ton (72.6 Mg) logging trucks.*

*Figure 2 (M 143 536). Log crib abutments and bottomside of log stringer superstructure. Many of these logs have diameters up to 5 feet (1.5 m).*

were adopted by other Federal agencies, including the Forest Service. The inspection standards require that all bridges on Federal and Federal-aid roads be inspected at intervals not to exceed 2 years, and that they be load-rated using recognized procedures. Those bridges not meeting the load-rating criteria must be appropriately posted for allowable loads.

Unfortunately, the current knowledge for analysis and design of log stringer bridges is extremely limited. Little is known about the binding strength or the expected life of large-diameter logs; the recommended allowable design stresses were based on procedures developed for poles and piles. In addition, the manner in which wheel loads are distributed between log stringers is not well understood; wheel loads are distributed both by cables that tie the logs together, and by the rock fill wearing surface, which can be 0.5 to 3 feet (0.15 to 0.9 m) or more in depth.

Inspecting and load-rating existing bridges by current procedures indicated that many log stringer bridges were being seriously overloaded. In a number of instances, the calculated allowable load was much less than the weight of some logging trucks, which had been regularly using these bridges for several years. It was apparent that new and reliable design information was needed to properly analyze log stringer bridges.

## *COOPERATIVE RESEARCH PROGRAM*

To obtain the needed information on the performance of log stringer bridges, the USDA-Forest Service, Alaska Region (Region 10), and the U.S. Forest Products Laboratory (FPL) conducted the wheel-loaded distribution tests on existing bridges, and made strength evaluations on both used and green Sitka spruce and green western hemlock logs.

Bob Willis, Forest Service Enngineer at Ketchikan (now Assistant Forest Engineer on the Bitterroot NF, R-1); Fred Zeigler, Forest Service Resource Management Assistant at Thorne Bay; and Lloyd Jones, Manager of Ketchikan Pulp Company operations at Thorne Bay, were assigned to work in this program.

Log testing took place at Thorne Bay, on Prince of Wales Island. This is in the Ketchikan area of the Tongass National Forest, about 60 air miles (97 km) northwest of Ketchikan. The wheel-load distribution work was conducted on four existing log stringer bridges accessible by road from Thorne Bay.

Two major pulp companies in Alaska--Alaska Lumber and Pulp Company (AL&P) of Sitka, and Ketchikan Pulp Company (KPC) of Ketchikan--cooperated with the Forest Service by furnishing the stringer logs from their logging operations. The testing program can benefit both industry and Government by providing a common base of engineering criteria for the analysis and rating of the loading capacity of log stringer bridges used for harvesting National Forest timber.

## *WHEEL-LOAD DISTRIBUTION*

Four bridges with clear spans ranging from 38 to 92 feet (11.6 to 28 m) were selected for the wheel-load distribution work. They were loaded with a large, off-highway gravel truck (fig. 3) with a gross vehicle weight of 87,000 pounds (39500 kg). Figures 4, 5, and 6 show a test truck that broke through one of the test bridges and narrowly missed one of the researchers. Luckily, there were no injuries, and the truck was not damaged. It was later learned that the two stringers which broke had seen several years of use as spar trees *prior* to being used as bridge stringers.

Centerline deflections of each stringer and each brow log were recorded for nine different truck positions. The amount of deflection was considerably less than anticipated: the maximum recorded deflection on the 92-foot-span (28 m) bridge was only 0.11 feet (33 mm). Interestingly, there was significant deflection in the brow logs, indicating that they were contributing structurally to the performance of the bridges.

The test data are currently being analyzed under a cooperative research project at Iowa State University by Professor Wally Sanders, Jr., and graduate student J. Woodworth. They will determine the portion of the total applied load resisted by each stringer, based on the stiffness and deflection of the individual stringers. This project will also include testing of scale-model bridges of this type.

## *FIELD TEST OF LOG STRINGERS*

Twenty-five green Sitka spruce logs, 15 green western hemlock logs, and 28 used Sitka spruce logs were tested to destruction in a field test facility. These are the common species for log stringer bridges, with Sitka spruce being predominately used.

In order for the results to be of maximum usefulness, the sampling of logs for the individual stringer tests had to be representative of the 16-million-acre Tongass National Forest. From a practical standpoint, the logs had to be obtained from existing logging operations. These operations were widely separated with no land transportation links connecting them.

In addition to the logs obtained on Prince of Wales Island, samples were taken from Zarembo Island, between Ketchikan and Juneau, and from Chichagof Island, midway between Sitka and Juneau.

The 61-foot (18.6 m) Forest Service workboat, *Sitka Ranger,* towed these logs to Thorne Bay. The log quality met requirements of Region 10's *Design Guide for Native Log Stringer Bridges;* lengths ranged from 47 to 86 feet (14.3 to 26.2 m) with diameters of up to 4 feet 10 inches (1.47 m) at the butt end.

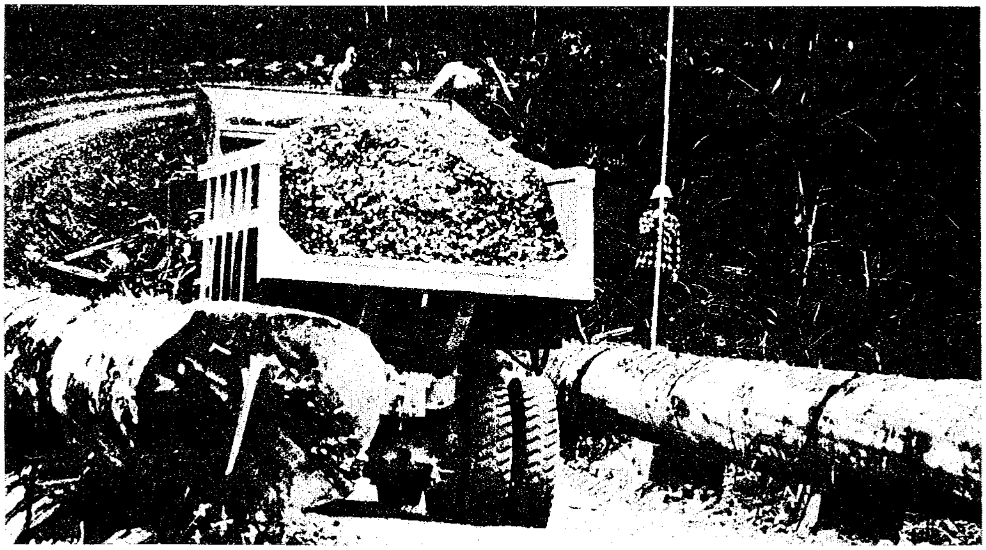

*Figure 3 (M 143 751-4). Load-deflection data were obtained by positioning an 87,000-pound (39500 kg) test truck at different locations on existing bridges. Deflection readings were taken on all stringers below the bridge and on the brow logs on the topside.*

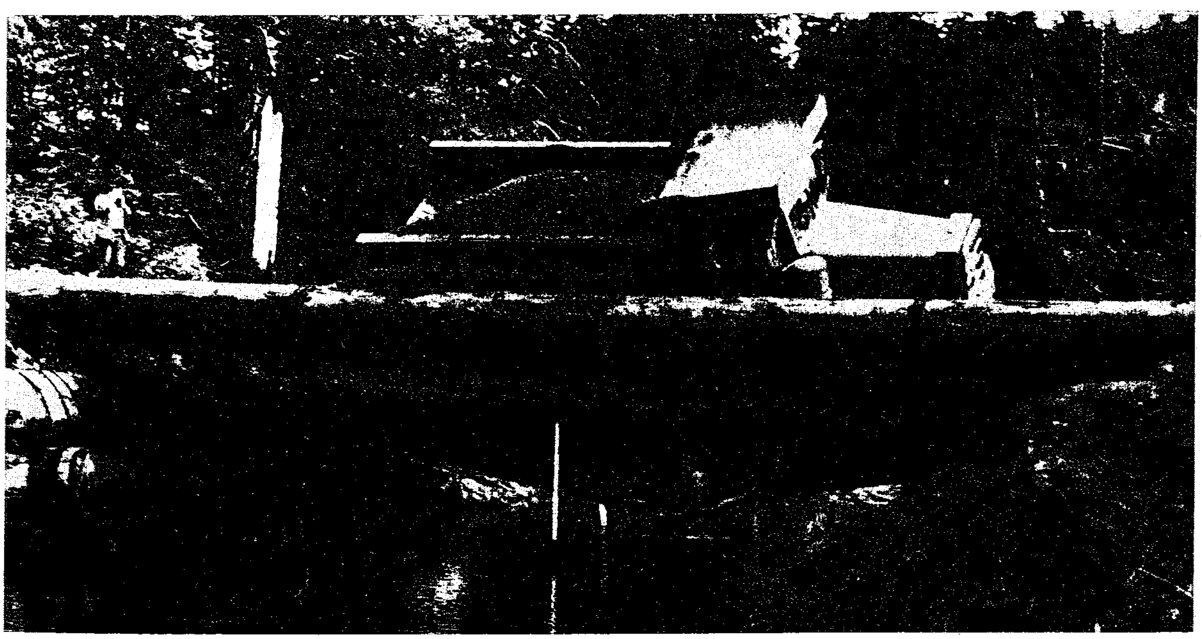

*Figure 4 (R-10). Test truck broke two stringers in the 51-foot (15.54 m) test bridge.*

*Figure 5 (R-10). Test truck resting against brow log, which prevented complete collapse.*

*Figure 6 (R-10). Broken stringer log had previously seen service as a spar tree.*

The field test facility was located in an abandoned rock quarry and consisted of a holddown anchor, support cribs, and a loading system. Bill Vischer, Soils and Materials Engineer for Region 10, designed and supervised the installation of the holddown anchor. For the holddown anchor, 16 rock anchors were installed to secure a tiedown bolt capable of resisting an uplift force of 200,000 pounds (90700 kg).

Two support cribs were built by cross-stacking large logs to a height of about 16 feet (4.9 m) above the ground. Rocker supports were used at the top of each crib so that the ends of the test logs could rotate freely when the logs were being loaded. The cribs could be moved along the base rails to adjust the span according to the length of the test log. Logs were placed on the supports with a giant log stacker. Each log had to be raised 20 feet (6.1 m) to clear the support saddles.

Loads were applied by cable through a double-drum yarding hoist (fig. 7). Two quadruple sheave blocks were used to increase the cable force by a mechanical advantage of about 8 to 1. A flexible girth strap was put around the log and fastened to the upper sheave block, and a 150,000-pound (68040 kg) capacity load cell was installed between the lower sheave block and the ground anchor to measure the downward force on the log.

Load and deflection measurements were taken simultaneously at a safe distance from the loaded log. Deflection readings were taken optically relative to a constant tension reference wire installed at the horizontal centerline of the logs. Load forces were monitored electronically with a digital strain indicator.

## *LOG STRENGTH*

The strongest green log held up a load in excess of 120,000 pounds (54430 kg) before it broke. The green western hemlock logs frequently broke explosively, scattering some of the loading apparatus about the site (fig. 8). Fortunately, the equipment was rugged enough to sustain the punishment. Green Sitka spruce logs, on the other hand, failed gradually but stayed up on the supports (fig. 9). However, a few of the old, used spruce logs shattered upon failure.

The average bending strengths of the two species (green) were reasonably close: 4,340 psi (29.9 MPa) and 4,120 psi (28.4 MPa) for western hemlock and Sitka spruce, respectively. These are not allowable design stresses, because adjustments must be made to account for variability, duration of load, and appropriate safety factors.

The results of these field data, on wheel-load distribution, basic strength properties, and deterioration with age, are currently being evaluated. The findings of this study will be made available by the Forest Products Laboratory, and will be the subject of a future article.

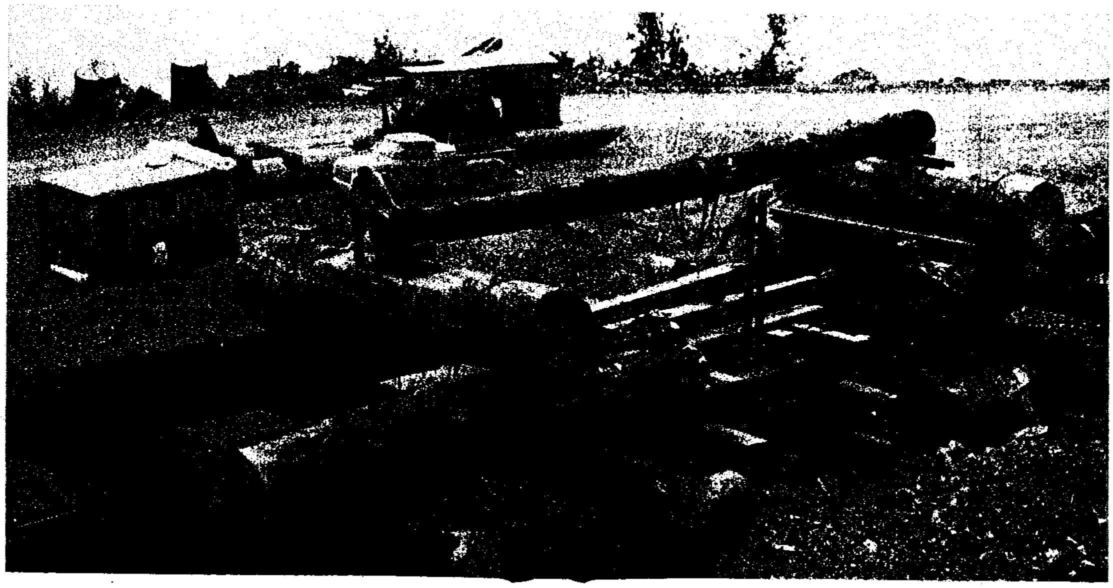

*Figure 7 (M 143 750-7). Test log in position for bending tests. Loads were applied through a cable system from the hoist in the background (on skids). The strongest log broke at a load of more than 120,000 pounds (54430 kg).*

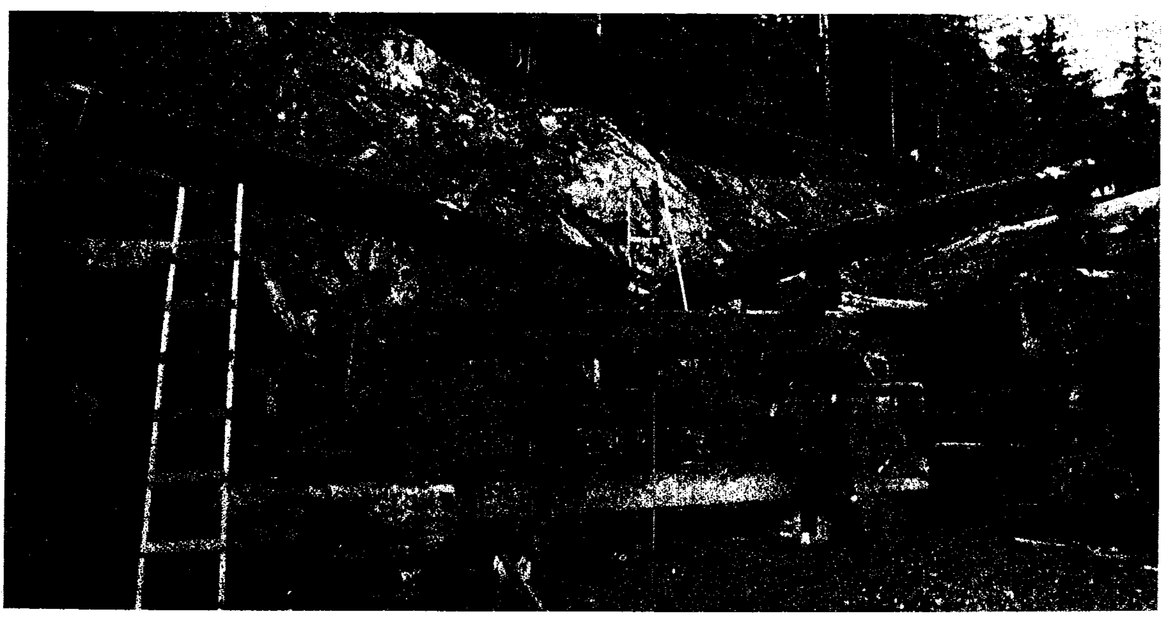

*Figure 8 (M 143 750-5). Western hemlock logs, although equally as strong as Sitka spruce, failed abruptly, scattering load equipment about the site.*

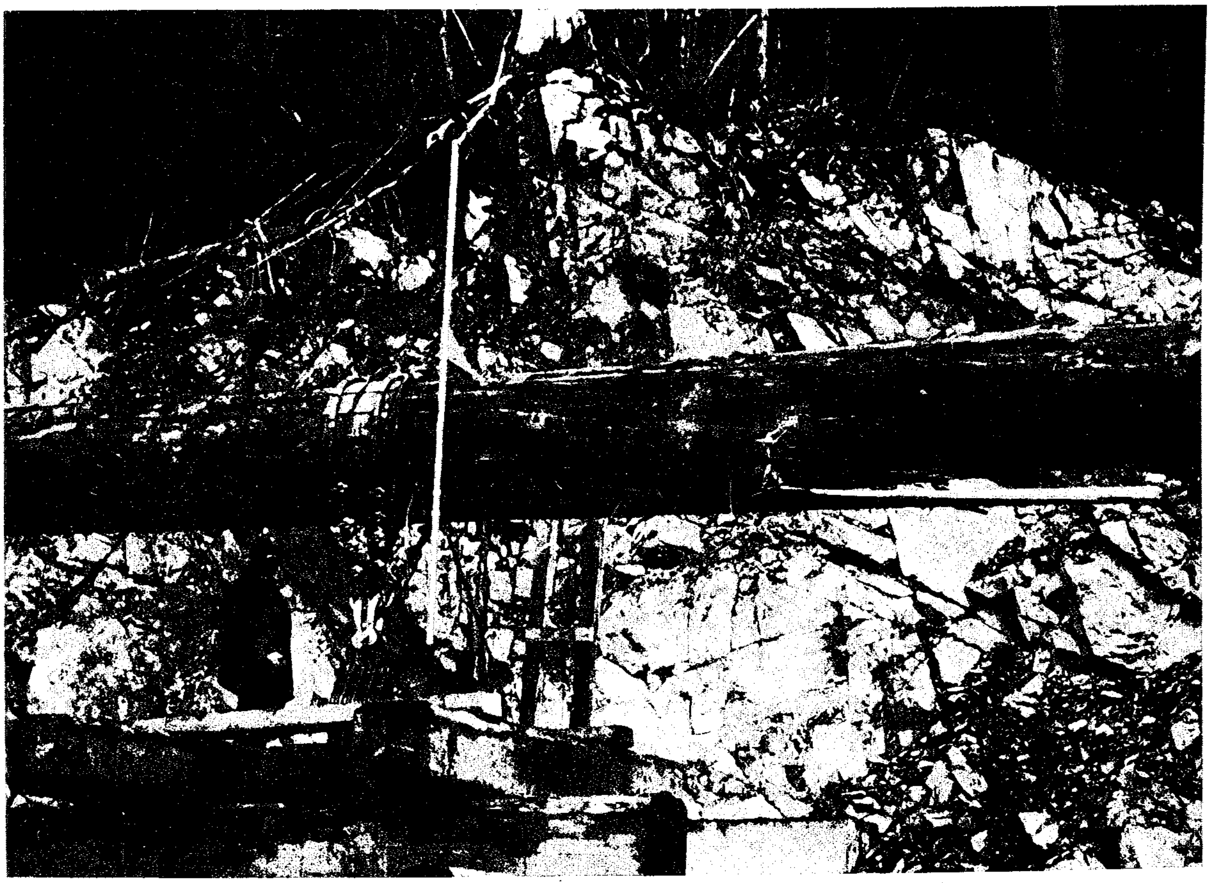

*Figure 9 (M 143 750-10). Sitka spruce logs broke gradually and stayed up on the supports.*

## WASHINGTON OFFICE NEWS

### TECHNOLOGICAL IMPROVEMENTS

*Heyward T. Taylor*
*Assistant Director*

*ROAD DESIGN SYSTEM (RDS)*

This past year, the Forest Service initiated a cooperative agreement with Colorado State University (CSU) to document the *Road Design System (RDS)*.

The reasons for cooperating with CSU in this venture are manyfold. The Forest Service and the State of Colorado have a mutual interest in advancement of the *RDS*, and they have joint responsibilities in maintaining, operating, constructing, and/or reconstructing 15,000 miles (24000 km) of forest development roads in Colorado. Some 11,000 miles (17600 km) of these roads are under FS jurisdiction, and the balance are under the State of Colorado. CSU--Colorado's State Land Grant University--specializes in computer applications for the design of Colorado highways, including forest development roads in the National Forest of Colorado. CSU is particularly interested in providing the State of Colorado and the county engineers responsible for design of farm, forestry, and rural roads a road design such as *RDS* that is responsive to their needs, reliable, maintainable, transportable between computers, and compatible with Federal road design systems.

*RDS* is a Service-wide Computer Program that is one of the largest systems within the functional area of Engineering, and is a major production system. *RDS* is an integrated system of computer programs, originally written for numerous computer hardware models. These programs were first put together to serve Regions 2, 3, 8, and 9, and then rapidly expanded to include all nine Regions. With this rapid expansion of use, documentation to make the entire *RDS* system fully integrated and easily transferable to other hardware was delayed, postponed, or rescheduled for a number of years; thus, the documentation was never completed.

Now, through a cooperative effort with engineers and computer specialists at CSU, we are completing the entire *RDS* documentation package. Because of this interest, CSU is funding 20 percent of the cooperative effort, and the FS is funding 80 percent. To date, we have completed the documentation of 60 percent of the computation programs. The remaining computation programs and all the graphic programs are scheduled for completion by September 1978. Such completion is an achievement we all look forward to, in order that the *RDS* will be more maintainable and readily transportable.

## CONSULTATION & STANDARDS

*Walter Furen*
*Assistant Director*

### *HIGHWAY SAFETY TRAFFIC CONTROL*

Activity in the Sign and Highway Safety fields has increased during the past 2 months. One reason for the increase is that the Federal Highway Administration has rekindled its interest in Federal agencies and their highway safety programs. As a result, on October 10, the Forest Service, together with the Federal Highway Administration, began developing a comprehensive safety program plan. This plan, when completed and approved by both agencies, will be the Forest Service's guide in complying with the Highway Safety Act.

Other activities deal with signs. It should be of interest to many of you that the negotiations are underway with Federal Prison Industries, Inc., to develop an agreement that will lead to the manufacture of better quality signs and faster delivery on sign orders. Our goal is to provide better service to field units.

Region 8 held a Sign Coordinator's Workshop during the week of October 4-6, Willard Clementson gave a presentation relating to the role of the Washington Office Sign Coordinator. He also reviewed with the Coordinators the Memoranda of Understandings between Forest Service, FHWA, and the National Highway Traffic Safety Administration (NHTSA).

# OPERATIONS

*Harold L. Strickland*
*Assistant Director*

## *THE GEOMETRONICS SERVICE CENTER*

September marks the end of the first year of production activities for the Geometronics Service Center (GSC). Even though staffing of the GSC has been only 42.5 percent of the total cumulative personnel months projected, significant production accomplishments have occurred.

The following lists the accomplishments:

| Activities | Accomplishments |
|---|---|
| 1. Primary Base | 888 quads |
| 2. Secondary Base | 21 maps |
| 3. Orthophotos | 568 models |
| 4. Digitizing* | 56 quads |
| 5. Aerial Triangulation | 339 models |
| 6. Special Timber Sale Maps | 55.6 square miles |

*Byproduct of Orthophoto

Our staffing at the end of the fiscal year is as follows:

| Unit | Personnel |
|---|---|
| Primary Base | 42 |
| Secondary Base | 14 |
| Orthophoto | 6 |
| Project Mapping | 5 |
| Aerial Triangulation | 4 |
| Carto Creation | 6 |
| ARST | 2 |
| Project Control | 2 |
| Staff Support | 11 |
| Administrative | 4 |
| Automated Cartography | 11 |
| Computer Systems | 3 |
| Total | 110 |

Our personnel have come from all corners of the U.S. The following breakdown indicates the breadth of their experience.

Personnel Source

| Region | No. Personnel |
|---|---|
| 1 | 3 |
| 2 | 3 |
| 3 | 4 |
| 4 | 19 |
| 5 | 8 |
| 6 | 5 |
| 8 | 3 |
| 9 | 4 |
| 10 | 2 |
| WO | 9 |
| | 60 |
| **Other** | |
| USGS | 3 |
| BLM | 2 |
| Other Government | 16 |
| Outside Private | 29 |
| Total | 110 |

Our personnel have had a variety of backgrounds, and their training needs have been high in order to meet Civil Service requirements for supervisors and short-range personnel goals. Total training has required over 2,800 hours.

Minority employment is 10.4 percent, which is well within the GSC equal opportunity goals.

Starting the new fiscal year with 110 personnel on board, compared with 20 at the start of FY 1977, will give GSC a running start on work commitments.

## INVITATION TO READERS OF
## *FIELD NOTES*

Every reader is a potential author of an article for *Field Notes*. If you have a news item or short article you would like to share with Service engineers, we invite you to send it for publication in *Field Notes*.

Material submitted to the Washington Office for publication should be reviewed by the respective Regional Office to see that the information is current, timely, technically accurate, informative, and of interest to engineers Service-wide (FSM 7113). The length of material submitted may vary from several short sentences to several typewritten pages; however, short articles or news items are preferred. All material submitted to the Washington Office should be typed double-spaced; all illustrations should be original drawings or glossy black and white photos.

*Field Notes* is distributed from the Washington Office directly to all Regional, Station, and Area Headquarters, Forests, and Forest Service retirees. If you are not currently on the mailing list ask your Office Manager or the Regional Information Coordinator to increase the number of copies sent to your office. Copies of back issues are also available from the Washington Office.

Each Region has an Information Coordinator to whom field personnel should submit both questions and material for publication. The Coordinators are:

| | | | | | |
|---|---|---|---|---|---|
| R-1 | Melvin Dittmer | R-4 | Ted Wood | R-9 | Norbert Smith |
| R-2 | Royal M. Ryser | R-5 | Jim McCoy | R-10 | Frank Muchmore |
| R-3 | Bill Strohschein | R-6 | Kjell Bakke | WO | Al Colley |
| | | R-8 | Bob Bowers | | |

Coordinators should direct questions concerning format, editing, publishing dates, and other problems to:

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Attn: Gordon L. Rome or Rita E. Wright
P.O. Box 2417
Washington, D.C. 20013

Telephone: Area Code 703-235-8198

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