Rec'd: 4/13/81

United States
Department of
Agriculture

Forest
Service

**Engineering
Staff**

Washington, D.C.

Engineering Field Notes

Engineering Technical Information System

Volume 13
Number 2
February 1981

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ENGINEERING IN
A FORESTRY ENVIRONMENT

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PROFESSIONAL DEVELOPMENT • DATA RETRIEVAL • MANAGEMENT • FIELD NOTES • TECHNICAL REPORTS

A LOW-COST X/Y STEREOCARRIER

Ray Allison
Natural Resource Specialist
Remote Sensing
Technological Improvements
Washington Office

During the next several years, small-scale photography (1:30,000-1:120,000) could become a major tool in land management planning, resource inventories, change detection, and many other fields. Small-scale photos could replace or supplement large-scale photos for many uses, due to: resolution improvements in all film types, increased capabilities of high-flying aircraft, and lower costs of obtaining large area coverage. As travel and budget restrictions reduce potential field time, more effective use of new techniques and materials will be required in the office.

One possible area of savings is the expanded use of a variety of aerial photographic sensors. The ongoing program of cyclical coverage of the contiguous United States with 1:80,000 B/W and 1:58,000 CIR should provide an extensive source of photographic data on which to practice these savings, as will the use of the large format (9 in. x 18 in.--228.6 mm x 457.2 mm) and panoramic optical bar photography.

The pocket stereoscopes now in common use will be of limited value in viewing this smaller scale imagery. Thus, a great deal of the information from these photographs might not be available. However, several currently available stereoscopes or systems will improve viewing potential. The better known instruments include: The Old Delft Scanning Stereoscope (about $4,500 plus $700 for 3X by 9X eyepieces); various mirror stereoscopes ($500 to $1,500 including 4X or 6X binocular eyepieces); and the Bausch and Lomb Zoom 95 stereoscope, which costs about $2,500 with a fixed stand. A more versatile light table unit (Richards GFL 940-MC or MIM-2) with an X/Y carrier and a Bausch and Lomb Zoom 95 costs about $4,500 to $7,500.

Of these instruments, the Bausch and Lomb stereoscope probably has the best optical quality and magnification range, but it needs an X/Y carrier for efficient utilization on continuous roll film. The Old Delft, with its scanning capability, overcomes part of that problem, but it also needs some sort of lateral film transport. Also, The Old Delft experiences some loss of resolution when compared to the Bausch and Lomb. Generally, the mirror stereoscopes are suitable only for use on cut film or prints; their binocular attachments provide only the minimum degree of magnification needed for small-scale photos.

Forest Service experience in using smaller scale aerial photography has shown the benefits of working with film transparencies. Transparencies retain original film quality and resolution better than paper prints. Ideally, however, the film should be in a continuous roll, both for ease of use and for protection of the film.

As noted, present scanning/viewing equipment with film transport systems is relatively expensive. The stereocarrier described below substantially reduces that cost. It was designed by Karl M. Hegg (RM Station) and Edward Dillion (WO Geometronics--retired). The first working model was produced by the San Dimas Equipment Development Center. The carrier is designed to be used in combination with the Bausch and Lomb Zoom stereoscope series on a standard light table or desk (figure 1).

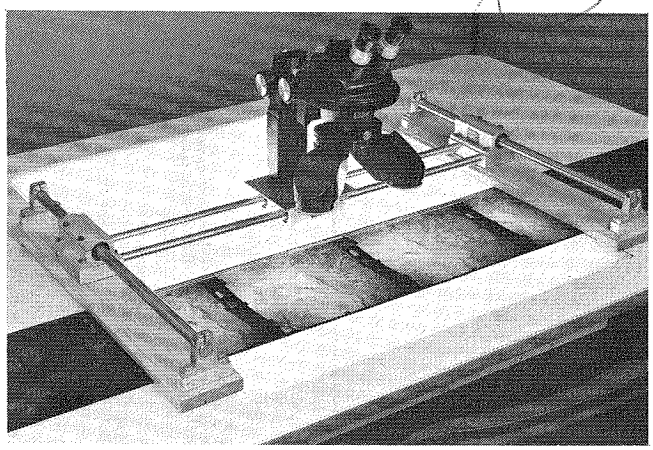

Figure 1. X/Y Stereocarrier on light table

Overall, the carrier is 37 inches (0.93 m) wide by 24 inches (0.61 m) deep. This unit is designed for simultaneous parallel viewing of two rolls of film. A smaller version, with less capability, measures 25 inches (0.64 m) by 18 inches (0.46 m). Either unit can be used on any adequate table or light table. Both, however, require a level surface because the stereo platform is not braked. It is self-aligning, so clamping is not needed. A small felt pad inserted between scope and stand will help ensure a parallel relationship with the viewing surface. The San Dimas Equipment Development Center can provide shop drawings, materials, and a source listing for off-the-shelf items (figure 2).

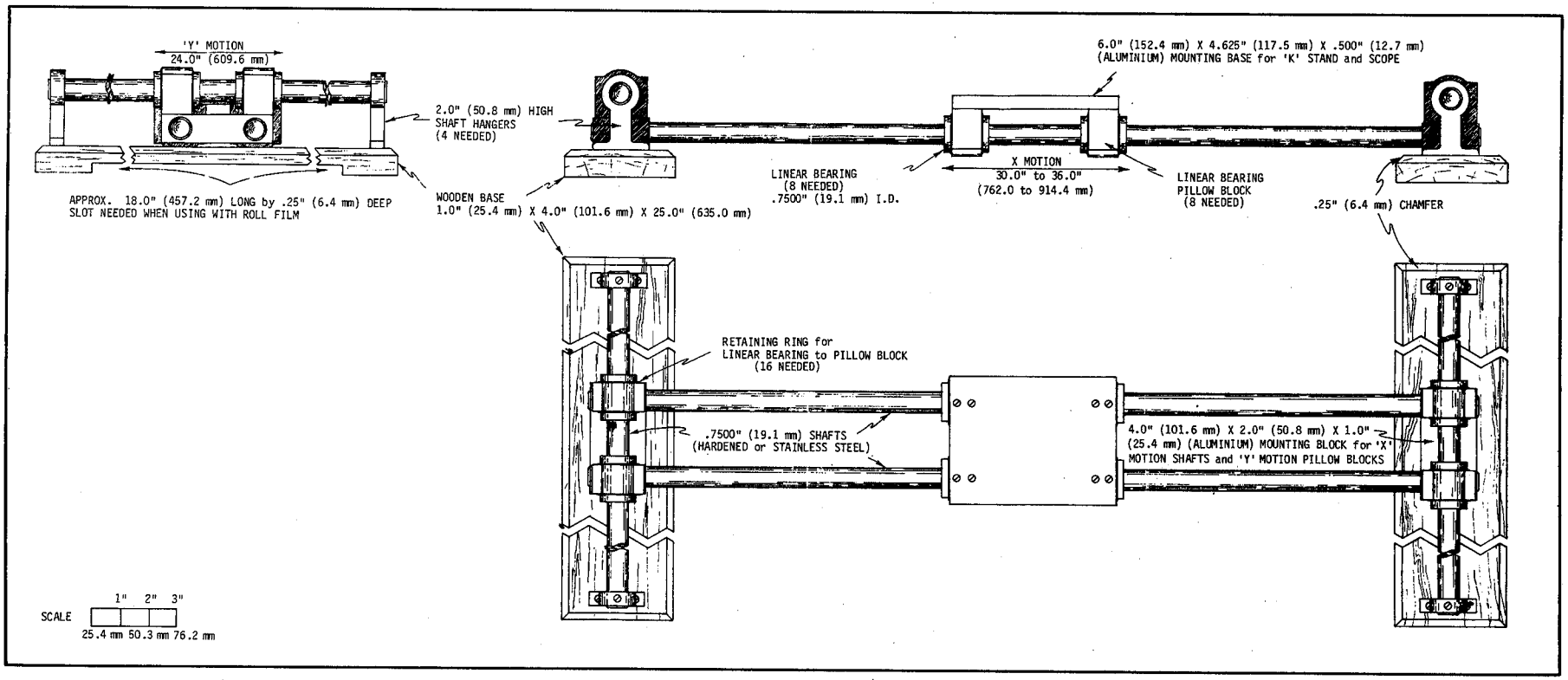

Figure 2. Universal X/Y motion device

In addition to the X-4 stereocarrier, seven items are needed to equip one work station for viewing roll film.

1 B/L Zoom Stereoscope
1 Stereomount--S Stand
1 Stereomount--ER Arm
1 X/Y Stereocarrier
1 Table or Light Table
1 Set of Rollers
1 Set of Reel Brackets

Literature, catalogs, and current prices for these components can be obtained from the sources listed below; some might be obtainable through GSA. Other sources might offer similar equipment.

Source	Item
Bausch and Lomb Special Products Division P.O. Box 543 Rochester, New York	Stereointerpretation System (Zoom 95 or 240) Stereomounts (S-Stand, ER-Arm)
Richards Corporation 1545 Springhill Road P.O. Box 340 McLean, Virginia 22101	Light table assembly (GFL 3040, Versatile) Reel bracket set Roller assembly
Alan Gordon Enterprises 5362 Cahuenga Boulevard North Hollywood, CA 91601	Portable light table Reel brackets Rebuilt Richards light tables
Staples Research Corporation 4110 Wheeler Avenue Alexandria, Virginia 22304	Reel brackets

FROM HAY MEADOW
TO INTERNATIONAL RESORT

Richard Kasel
PE
Region 2

Beaver Creek was just another mountain drainage in 1881 when a man named Talamage built the first log cabin at the site of the present town of Minturn, Colorado. Near the end of the Nineteenth Century the Beaver Creek area, west of Minturn, gained attention when settlers found that existing meadows could be enlarged and yield both timber and hay. For the next half century families labored in the drainage, at the business of mountain agriculture, with little realization that the location would develop into anything more than the "family homestead."

The Forest Service in 1969 gave Beaver Creek its first official recognition as a possible ski area, when a study was made of National Forest lands in Colorado for potential ski area sites. In that report Beaver Creek was given a "good" to "outstanding" rating as a potential winter sports area. With selection of Beaver Creek as the site for the Alpine Events of the 1976 Winter Olympic Games its destiny as a winter sports site seemed sealed. Even though the Colorado voters voted "no" to the 1976 Olympics in November 1972, Beaver Creek was already included in an Environmental Analysis being accomplished cooperatively by Vail Associates and the USDA-Forest Service. After 5 years of studies, numerous reviews and appeals, expenditure of several million dollars and consideration of input from Eagle County and the State of Colorado, the USDA-Forest Service approved the Beaver Creek Development Plan.

Many people feel it has to be all downhill from that point to a ski resort where each visitor is treated to his own "mountain fantasy." However, any designer or builder that has practiced his trade realizes the magnitude of any project where a new town is being created. Beaver Creek is planned as a destination year-round recreation facility. The development consists of 2800 acres (11,331,244 m^2) of National Forest land and 2200 acres (8,903,121 m^2) of privately-owned land, which covers an entire mountain valley. Think of your favorite mountain activity and it will be provided: downhill skiing, cross-country skiing and touring, hiking, bicycling, horseback riding, golf, tennis, fishing, and many others. In support of these recreational activities, 50 acres (202,344 m^2) are set aside for an alpine village of over 6000 beds in the form of lodges and apartments. Another 4500 beds will be provided in outlying development pods supplying a mix of single family townhouses, and employee apartment housing.

Working in our own speciality areas we can visualize the planning, design, and construction challenge of individual projects that must go together in the making of such a venture. Putting these together in 8 to 10 years almost seems impossible. Under the watchful eyes of Federal, state, and county agencies nearly 200 million dollars will be spent in the making of this mountain mecca in a place that once was hay meadows and timberland.

Starting at the top of the mountain let us first consider the skier, one of the prime reasons this mountain valley first attracted development attention. The development will offer a splendid mix of skiing for skiing abilities ranging from beginner to expert. Design capacity of the mountain will eventually be 7200 skiers with peak capacities of 9650. To transport these winter enthusiasts 14 uphill units, six in this first year, will be constructed by the Beaver Creek Association Mountain Company. These units, double and triple chairlifts, and one gondola are designed by the Doppelmayer Lifts Ltd. of Wolfurt, Austria, and are considered by many to be the Cadillac of the industry. These units will serve approximately 1300 acres (5,260,288 m^2) of ski slopes in an efficient and safe manner. The lifts are designed in Austria with most of the machinery shipped to this country and placed on steel structures fabricated by Denver steel fabricating firms.

The six lifts being constructed this summer will use over 11 miles (17.7 km) of haul and counterweight wire rope manufactured by Fatzer Ltd. of Romanshorn, Switzerland. The longest continuous length of rope to be shipped and installed will be 13,000 feet (3,962 m) of 1-1/2 inch (38 cm) diameter, 6 x 36 wire rope. The prime movers for these SCR controls. To comply with USDA-Forest Service and State of Colorado Regulations, each unit will have a companion diesel engine to pick up the workload if electric power is interrupted.

While all of the activity is progressing overseas and at home, the Beaver Creek Mountain Company had to clear hundreds of acres of trails and place 3000 cubic yards (2,294 m^3) of concrete at approximately 200 locations around the mountain. Each

installation is made with such accuracy that each piece of steel and machinery fits without modification. During this total construction project each drawing is being reviewed by the USDA-Forest Service for safety of operation and adaptability to the mountain environment. Inspectors representing the three Governmental agencies are constant companions during the construction stage. All of this activity is geared to the final day when each uphill unit will undergo a rigorous final inspection and load testing procedure under the watchful eyes of engineers of the Colorado Passenger Tramway Safety Board and the USDA-Forest Service. So now we have a ski area you say, not quite.

At this point we have skiing but not a ski area that the world has come to expect of Colorado ski country. We of course need a place to eat during our day in the mountains. This first year you will be spoiled with good food and a mountain panorama that is worth the trip alone to Mid-Willis Restaurant. This 18,000 square foot (1,672 m^2) structure took over a year to construct at a cost of over 3 million dollars. This structure is an architectural and engineering wonder on a location that God gave special attention to in His creative act. While you are enjoying your food and the view you probably will comment on the fact that there are few man-made facilities to hamper your visual enjoyment. This you should know is not by accident but by plan. Each utility that you make use of is placed underground so the only ill effects your eyes might be subject to is the sunlight and too much of the natural setting.

Probably the most important utility on the mountain is electricity, which keeps the lifts moving and the food cooking. To ensure your constant pleasure in this regard, the mountain power is looped to each station on the mountain. In case of line loss the show will go on as originally planned.

Before we dwell too much on the mountain, let's not forget that although the mountain is why most of the people will come to Beaver Creek, the hay meadow at the base is still 2 miles (3.2 km) from Avon, Colorado, where you enter this valley. As anyone who has seen a brown cloud knows, the one thing that can ruin a new town is too much traffic. Your skiing, golfing, and tennis will not be burdened with cars and traffic because two main parking accommodations will be provided out-of-site and out-of-mind. In the main village underground parking for some 800 vehicles will be provided for apartment and lodge guests. Near Avon, Colorado, parking will be provided for 1300 vehicles including oversized spaces for campers and those who like to rough it.

Realizing that 2 miles (3.2 km) is a long walk if you're not playing the new 18-hole golf course up the valley, a nonstop bus system is being provided for those who want to get to the action fast. This system will speed you from parking lot to the village day center in about 6 minutes with buses leaving each terminal at 3 to 10 minutes intervals, depending upon demand. If you are concerned about being bored on the ride, relax, in that 6 minutes you will be treated to a grand mixture of old and new construction that blends the structures of the valley's agricultural era with that of modern man. Whether you are being transported from the parking area or the new private airport at Avon, you will notice the old farm structures that have been preserved so that we may enjoy our progress, but not forget our past.

While you are enjoying the view from the bus window you needn't know that directly under your wheels fuel, utility, and communication systems are safely located in miles of conduits for ease of maintenance, and most importantly, nonvisibility. In addition to the normal services we take for granted, Beaver Creek offers a communications system that keeps everyone in touch regardless of where you are, on the mountain or in the valley below. The system considers emergency phones, company phones, public phones, lift information systems, fire protection, security systems, telemetric data collection, control circuits, and radio transmitter systems. Regardless of where you are on the 5000 acres (20,234,365 m^2) of Beaver Creek, be it mountain or valley, you are in touch with your little world or your real world.

If this story seems too simple for the magnitude of the project, that was also part of the original plan. In the beginning, planners and designers made use of field surface data compiled by Vail Associate surveys and a complete engineering geological study prepared by Woodward-Clyde Consultants. Based on these initial studies each structure, road, and utility was located to offer maximum stability, utility, and practibility. Each architect, engineer, and contractor was given the bounds of design and function of the individual project he would work on. This way each project can function individually but is coordinated by the Beaver Creek companies for maximum efficiency and minimum overlap.

Beaver Creek will have its official grand opening in the Fall of 1981 but will open for skiing in December of 1980. The valley will open this December with limited base facilities and the main corridor of the mountain in full operation. For those of us who enjoy winter sports and appreciate seeing progress in the making, this is the year to ski Beaver Creek. Construction,

in areas not open to the public, will continue throughout the winter. Add public transportation and ski activities to winter construction of a multi-million dollar village and you should be treated to a coordinating effort that should be as spectacular as the skiing or view. The continued effort of the three Beaver Creek entities and the three Governmental levels will provide Colorado with another landmark recreation area. The hay meadows are still there, the timbered mountain slopes are still there, now the public can be there to enjoy safe, comfortable recreation.

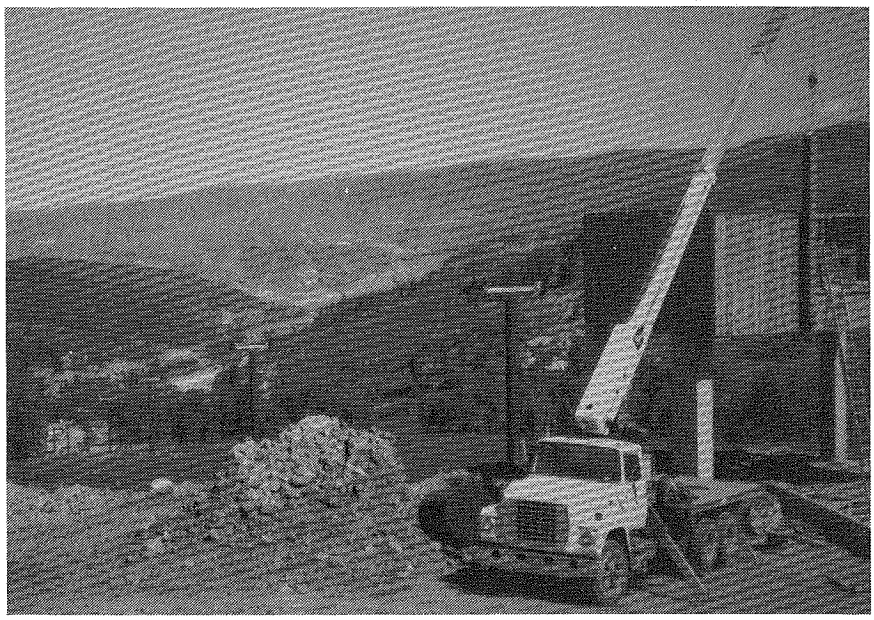

Figure 1. Hay meadow chair lift machinery receives its protective cover. Avon, Colorado is in center of photo.

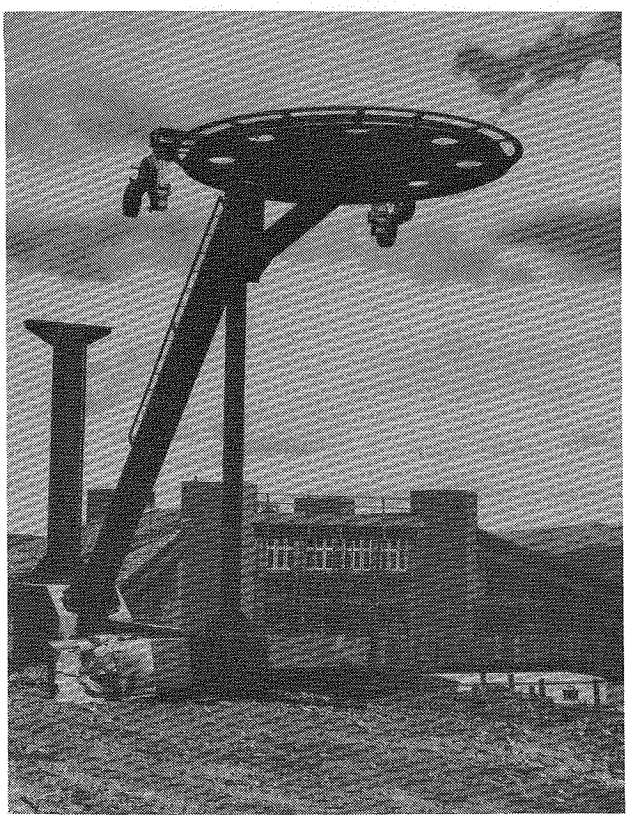

Figure 2. Lift No. 7 terminal waits for haul rope to be installed while main mountain restaurant rises up.

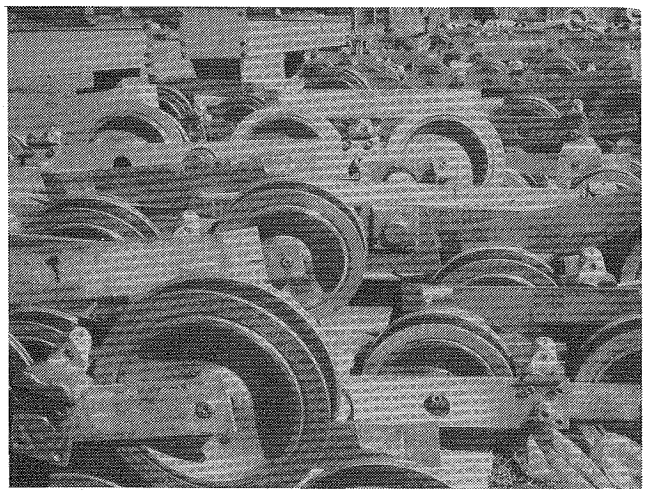

Figure 3. Tower machinery marshalled for transport to lift towers.

Figure 4. Beaver Creek development area, showing ski runs and hay meadow.

USE OF THE AGGREGATE TRANSPORT MODEL IN THE DEVELOPMENT OF AN AGGREGATE RESOURCE UTILIZATION PLAN

Hannes Richter
Geotechnical Engineer

Region 2

Michael Wofford
Civil Engineer

Norman Moore
Computer Specialist

INTRODUCTION

The Sierra National Forest has a continuing need for aggregate surfacing on many of its system roads. In the past, this need has been met by obtaining aggregate from both local on-Forest sources and distant Central Valley commercial sources. Unfortunately, a complete economic analysis cannot be performed for each procurement due to the complexity of the problem and the limited amount of time usually available. As a result, the most economical source might not be selected. Many alternatives, including variations in methods of soil stabilization, cannot be examined fully. Good management must perform a Forestwide assessment of needs and resources, and determine how to distribute the resources to meet the needs. The Aggregate Transport Model, developed by Malcolm Kirby, William Hager, and Peter Wong of the Management Sciences Staff at PSW, Berkeley, California, is an excellent means of performing this analysis.

MODEL DESCRIPTION

This relatively easy-to-use computer program is valuable because it enables the user to examine many complex options and alternatives conveniently. Important ramifications of potential management decisions can be explored. For instance, certain potential aggregate sites can--for visual, environmental, or other concerns--be deleted to determine the impact on the system. The land manager can assess the costs involved with not using these sites in order to make intelligent trade-offs. Extensive mitigation efforts might be warranted in some cases. Also, the manager can examine the effects of (1) using large centralized sites vs. local dispersed sites; and (2) using commercial sources vs. on-Forest sources. These studies will indicate areas that have high aggregate costs, so the manager can initiate investigations for additional materials sources. In addition, the model compares costs for alternative combinations of subgrade stabilization and protection:

1. Subgrade alteration with lime, cement, etc.
2. Borrowed higher strength soil for subbase
3. Aggregate base course
4. Asphalt concrete pavement

The program can be updated easily, enabling the user to refine the analysis and adapt to new and changing situations.

A significant amount of data gathering is necessary before implementation of the model. The major items of the Sierra National Forest's study are:

1. Predictions of the quantities of material required at 200 locations during the 10-year study period.
2. A basic inventory of identified and potential materials sources, including quantity available, quality, etc.
3. An estimate of the various transport costs associated with the different roads in the network. (The Timber Transport Model was used to generate these costs, but MINCOST can also be used.)
4. Cost estimates for the development and operation of the 20 materials sources.

RESULTS

The output from the model indicates which stabilization technique or materials sources to use at each road location. This can be depicted conveniently on maps that have plotted the "service areas" for each materials source, showing the roads and timber sales served by that source. A different map is prepared for each alternative, so impacts can be assessed readily. Figure 1 is a sample source map.

Some of the alternatives examined on the Sierra include: maximizing subgrade

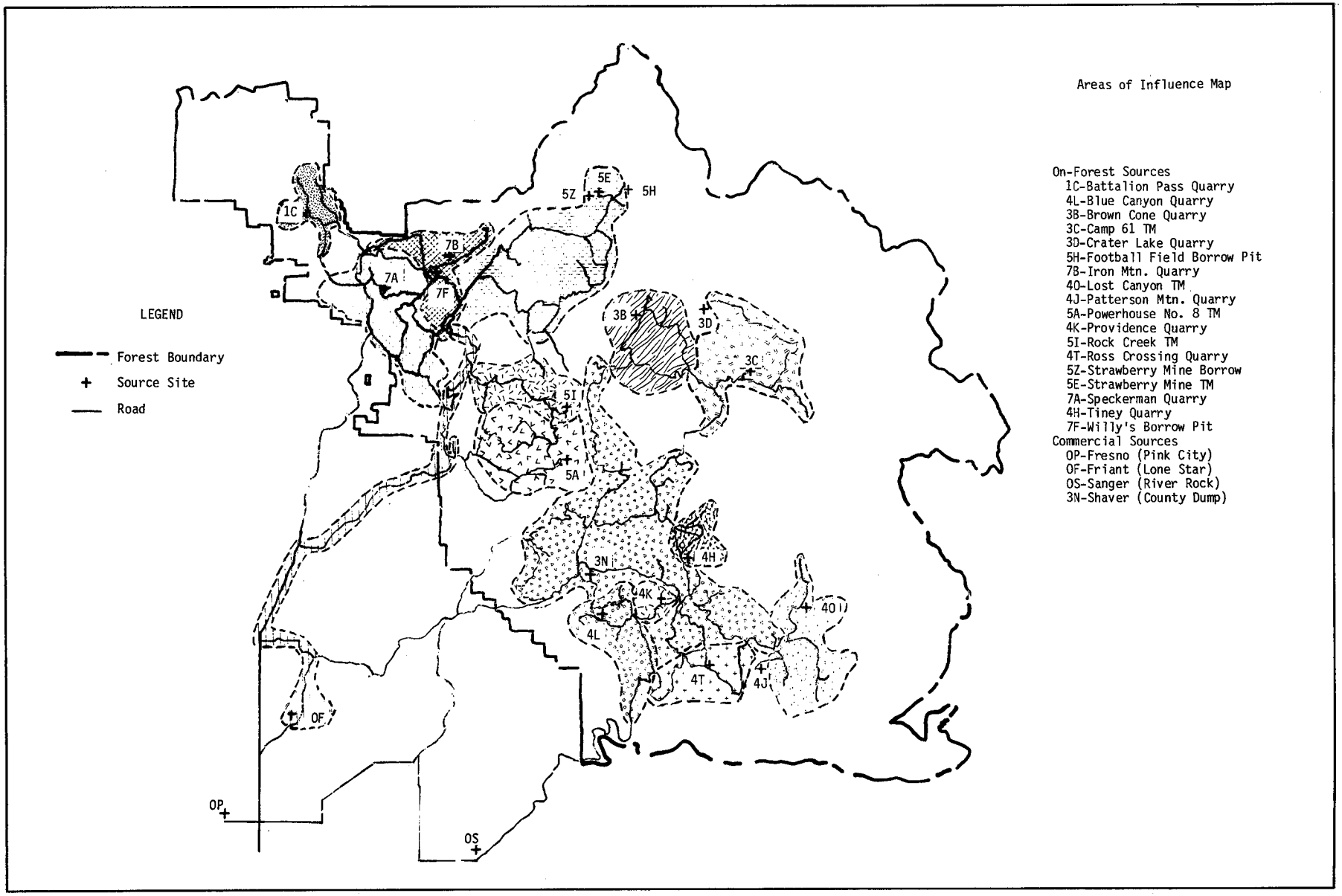

Figure 1. Sample source map

alteration, moderate subgrade alteration with a 3-inch (76.2 mm) aggregate surface course, no subgrade alteration, and many variations in materials sources. The following table lists the total 10-year costs for a sample selection of alternatives.

MAXIMUM SUBGRADE ALTERATION	MODERATE SUBGRADE ALTERATION		NO SUBGRADE ALTERATION	
Using all identified sources	Using all identified sources	Using limited on-Forest sources	Using all identified sources	Using limited on-Forest sources
$15,257,300	$19,335,900	$20,346,900	$23,538,000	$25,661,000

Due to high transport costs from commercial sources and high production costs from on-Forest sources, the model results indicate that maximum subgrade alteration should be used for maximum economy for the particular set of conditions existing on the Sierra. If this is not possible or feasible in all locations, the second choice is to use as much borrowed material as possible; the third choice is an on-Forest quarry; the last choice is a commercial source, selected when the on-Forest source is exhausted.

Cost savings realized as a result of this analysis are difficult to estimate. A reasonable figure might be 10-percent savings if the plan is implemented. This is about $2,000,000 over a 10-year period.

We feel that the Aggregate Transport Model is essential for planning the Forest materials resource; it provides information that enables the land manager and engineer to utilize both the most economical material and material source.

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Kirby, M. W., and W. Hager, "Resolving Conflicts in Transport of Rock Aggregates--A Cost Analysis," Journal of Forestry, V76, N5, May 1978.

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THE CONTINUING SAGA OF SIGNS VERSUS PORCUPINES

Dick Alexander
Traffic Engineer
Region 1

Region 1's transition from the "good old days" of long-lasting, homemade, rustic, routed, solid wood signs to short-lived, professionally manufactured, reflectorized traffic control devices has been painfully slow. Reasons for Regional noncompliance with National Highway Safety Program Standards are the usual: M.P.P. (money, people, priority), and concerns about "neon"-type signs in the Forest environment and sign life.

Direct quotes from Public Law, Federal Regulation, and USFS Directives generally were enough to overcome unique nonstandard signing proposals until a recent Idaho Panhandle National Forest sighting of a relatively large hystricomorph rodent devouring a metal-banded standard plywood guide sign, reflective sheeting and all. The rodent's physical features of stiff, sharp erectile bristles mingled with hair of the pelage immediately identified it as a Brush-Tailed Porcupine.

Facts drawn from the sighting could not be argued:

1. Porcupines do eat plywood.

2. Porcupines do not eat nonstandard solid wood routed signs.

These facts present a problem because plywood is the favored substrate material for reflectorized traffic control signs in Region 1. However, its advantages over other available materials--cost, weatherability, sheeting adhesion, ability to withstand many bullet holes without loss of sign message--are voided by one hungry porcupine.

Interest in a workable solution to the problem began in earnest after an Assistant Secretary of Agriculture visited the Idaho Panhandle National Forest during the winter of 1979-1980. Also, a Regional assessment indicated sign replacement needs as high as $30,000 annually due to damage caused by porcupines.

MEDC's December 1973 project report (ED&T 2166) determined that the phenolic resin glue normally used in ply bonding is a porcupine attractor. A January 1975 "Equip Tips" reported the trial-basis availability of porcupine-resistant (melamine/urea) adhesive plywood. Regions 4 and 6 tried the material in areas with histories of significant damage. They reported immediate and dramatic success. MEDC testing, plus the experiences of Regions 4 and 6, were determined to be sufficient justification for trying the special plywood.

Investigation into making the plywood available to the troubled Region 1 Forests offered many challenges and alternative pursuits.

1. Plywood manufacturers cringe at the mere suggestion of melamine-urea adhesive due to the needs for production line modification, shop equipment rearrangement, immediate spreader cleanup, and environmental waste disposal requirements.

2. The minimum order of the specially manufactured plywood is one truckload (800 panels) or 25,600 ft^2 (2,323 m^2) of sign substrate material, which equates into lots of signs (approximately $280,000 worth).

3. Understandably, our current SBA sign supply contractor, Ojo Caliente Craftsman, Inc., was hesitant to purchase and carry such a large inventory of special plywood without positive assurance that the pile would be used in a timely manner.

4. Budgeting by individual Forests within Region 1 for procurement and utilization of the minimum order was completely out of the question.

5. Presentation of the situation as a nationwide problem (as expressed by Regions 1, 4, 6, and 9) to be handled by the WO gained some understanding and considerable sympathy--but no plywood.

The only apparent alternative remaining was Regional procurement of the plywood, with delivery to Ojo Caliente for sign manufacture on demand of the Forests. The special plywood was delivered to Ojo Caliente in August 1980.

Although the A.P.A.-certified, porcupine-resistant plywood is relatively expensive ($1.96/$ft^2$), quality is outstanding and sign cost to the Forests is actually less than regular plywood signs due to 10 to 18 percent discounts associated with the Government-furnished material.

The special plywood might not be a total deterrent to porcupines. Region 4 realized 100 percent success, but Region 6 reported some teeth marks and sign edge chewing. The principal problem is that the "attrac-

tive" phenolic resin adhesive is a major ingredient of the very thin plywood veneer (high-density overlay).

Region 3 provided further assurance that we are headed in the right direction based on their reported experience of no signs pushed over by camels nor any camel sightings within the entire Region since using the special plywood.

Government purchase of the porcupine-resistant plywood is viewed by Region 1 as an excellent investment of FR&T dollars. Many signs have been purchased by Forests with no porcupine problems because they found the reduced sign cost attractive. Also, sign procurement was accelerated by the unplanned availability of porcupine-resistant plywood at end-of-year purchase time.

Regardless of the reasons, a couple of good things happened immediately after plywood delivery to the sign manufacturer:

1. Those Forests with sign damage occurrences have the opportunity to eliminate, or considerably reduce, the cost and frustration of frequent and continuous sign replacement. Plywood cost is quickly amortized in porcupine-damaged areas.

2. The availability of quality signs at a reduced cost to the Forest has renewed interest in signing and substantially boosted sign procurement within Region 1.

Procurement of the plywood would not have been possible within time constraints without the enthusiastic help and cooperation in technical advice of: American Plywood Association Manufacturing source contacts, and final inspection assistance of MEDC (Tom Nettleton), Region 3 (Paul Weaver), Ojo Caliente Craftsman, Inc., and the program support of Region 1's Engineering Management and Administrative Services.

Spotlight

Volume 13 Number 2
United States of America
Office of Personnel Management

Direct-Hire Authority for Engineers

The Office of Personnel Management has issued FPM Bulletin 337-56, dated December 23, 1980, authorizing a national direct hire authority for Engineers GS-5 through 11. This Bulletin authorizes all agencies to appoint any qualified engineer at GS-5 through 11 in any professional engineering occupation.

The direct hire authority is effective as of December 23, 1980 and will expire on September 30, 1981. Prior to the expiration date OPM will assess the need for continuation of this authority into fiscal year 1982. The authority is based on the continuing shortage in engineering occupations and is designed to enable agencies to make offers of employment in an expeditious manner. The FPM Bulletin provides further specific instructions. Copies should be available in your servicing personnel office.

ENHANCEMENTS TO THE ROAD DESIGN SYSTEM

John Richardson
Civil Engineer
Washington Office

The Road Design System (RDS) is an engineering computer program for developing alternative road designs through application and road templates of different feasible combinations of horizontal and vertical alignments. The designer uses the data to select the most economical alternative that satisfies a project's objectives and prescriptions.

Through its evolutions, a number of computer programmers have worked on modifications to RDS. As a result, the system became a complex maze with a small amount of documentation to guide the user.

During the last 4 years a cooperative agreement with Colorado State University has produced modifications and documentation to RDS to provide a workable base from which to begin a complex improvement of the system.

Three contracts were awarded in September 1980 to provide additional RDS enhancements:

1. "RDS--Graphics Enhancement" to the University of Texas in Austin.

2. "Editing and Data Corrections for the Road Design System" to Computer Sciences Corporation in Huntsville, Alabama.

3. "RDS-CRT Graphics," also to Computer Sciences Corporation in Huntsville.

RDS--GRAPHICS ENHANCEMENT

The objective of this contract is to provide the user the full graphics display capability presently listed in the Engineering Computer Applications Handbook (FSH 7109.16) and to incorporate changes requested by field personnel through their Regional RDS coordinators.

The enhancements, which will become part of the existing RDS software at the Fort Collins Computer Center, will range from minor improvements to complete new plot routines. Some graphic routines will enable the designer to interact with the program through on-line graphic display terminals. The graphics software will produce the following types of displays:

1. Printer plots (through remote terminals and printers)

2. Line plots (on flatbed and drum plotters)

3. Non-interactive cathode ray tube (CRT) displays (such as the Tektronix or Hewlett-Packard CRT). The addition of a "quick-look" feature using a graphic display terminal should reduce the time needed for a completed road design.

A few of the key enhancements to be provided as options to the graphic routines include:

1. Traverse Plot Routine (TRAV)
   - a. Is traverse-oriented, to allow the best fit for a continuous plot
   - b. Provides a variable plot scale
   - c. Plots cross-sections to the length actually stored in the data file
   - d. Provides variable annotation on the coordinate grid hash lines
   - e. Displays self-balanced tic marks on cross-sections
   - f. Combines road width and catchpoint plot (ROP) with TRAV
2. Horizontal Alignment Plot Routine (HAL)
   - a. Provides variable plot scale
   - b. Develops HAL Plot with contours independently of TRAV Plot
   - c. Provides HAL Plot oriented to allow the best fit (least paper utilized) for a continuous plot
   - d. Provides variable annotation on the coordinate grid hash lines
   - e. Combines road width and catchpoint plot (ROP) with HAL
3. Ground Profile Plot Program
   - a. Provides a variable plot scale
   - b. Combines catchpoint and profile grade plot (CAP) with ground profile plot program

4. Cross-Section

   a. Provides a variable plot scale

   b. Provides elevation at break points

   c. Shows limits of cross-sections

   d. Provides enhancements to design earthwork (DES)

5. Federal Aid

   a. Provides a variable plot scale plan and profile

   b. Plots data containing vertical or horizontal equations the same as data containing no equations

   c. Provides variable sheet sizes

   d. Provides catchpoint and profile grad plot (CAP) data on profile view

   e. Provides road width and catchpoint plot (ROP) data on plan view

   f. Provides contours on plan view

   g. Plots road width and catchpoint plot (ROP) program as a straight line diagram

6. Perspective Plot Program

   a. Eliminates need for observation station to match stations shown on design earthwork printout

   b. Provides capability for extending cross-section lines beyond the catchpoints

7. Mass Diagram

   a. Provides line plot and CRT display

   b. Enables unit mass to be displayed on mass diagram

   c. Provides mass diagram utilizing design quantities and/or construction quantities

8. Haul Diagram -- Provides diagram utilizing design or construction quantities

The non-interactive CRT graphic display will provide the designer the same graphics on a CRT screen that are available in a line plot.

EDITING AND DATA CORRECTION FOR THE RDS SYSTEM

The objective of this contract is to provide a free-format data input system that will perform error-checking routines for both batch and demand users. The demand version will provide an interactive graphics display and data correction capability.

Data error checks are necessary due to erroneous data from the original field survey or from data input (keypunch errors). The goal is to eliminate, as much as possible, the computer cost (CPU and input/output time) in checking topography, traverse, and Percent Abney Levels (PAL) data by performing this function outside the RDS software. Provisions will be made for a highly flexible free-field input facility to reduce the overall effort expended in entering the original survey data. Additional outputs will include error diagnostic messages and update facilities, both graphic and non-graphic.

The user will be able to display various aspects of the traverse, ground profile, and cross-sections, as requested. The program will prompt the user to input corrected data, if desired, via the terminal keyboard. The file to be utilized by RDS will reflect these user changes.

RDS-CRT GRAPHICS

The objective of this contract will be to provide a graphic display, with update capabilities, of the various functions of a road design. This custom software will reside outside RDS and interact with a design file in the RDS software.

The following graphic displays will be available on the CRT screen.

1. P-line traverse
2. P-line and L-line ground profile with L-line grade
3. P-line and L-line traverse with self-balance points
4. Mass diagram
5. Cross-section and template
6. Plan view (with road widths and cut and fill limits)

The user will be able to input the data via the terminal keyboard or a graphic cursor. The user will designate a section of road to be viewed on the CRT for design purposes. Each graphic display will be

scaled as prescribed by the user to fit the dimensions of the viewing screen. If the design section is too long, the system will rescale the desired section dynamically, so it will fit the screen.

The software will reside on the mainframe at Fort Collins Computer Center. The designer will access the program via remote graphic terminals at District, Forest, or Regional Headquarters. These remote graphic terminals will operate in the demand mode.

The designer will be able to complete all phases of the road design through the RDS-CRT software or through the main RDS program.

Pilot testing of the programs and the User Guides will not be completed until late summer of 1981. The contract time will expire in September 1981. We are striving for implementation of these enhancements to the Road Design System by late fall of 1981, just before the winter design season.

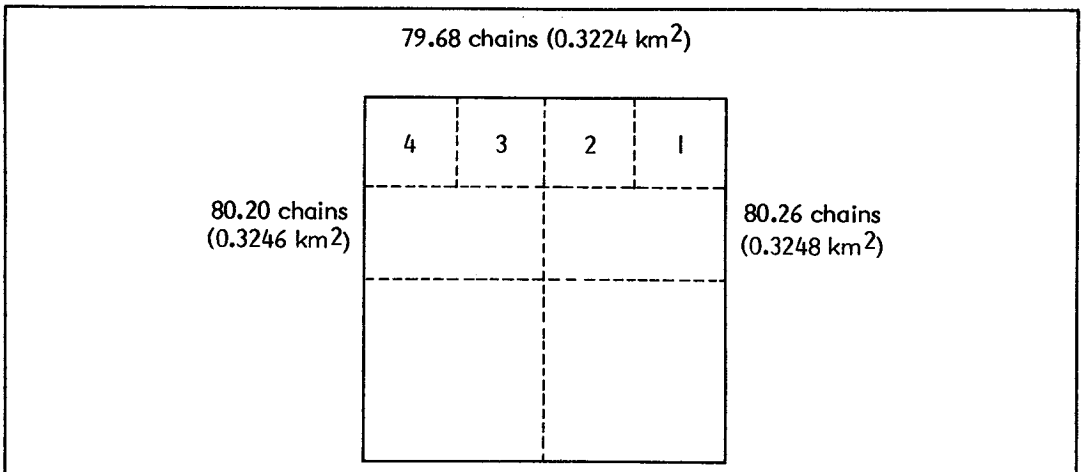
If you have any comments or questions concerning this subject please contact John Richardson in the Washington Office at (703)235-2613.

LOT SIZE IN PUBLIC LAND SURVEYS—CHANGES IN ARTWORK

Field Notes
Volume 12 Number 7
November—December 1980

In the article titled "Lot Size in Public Land Surveys" in the November--December 1980 Field Notes (Volume 12 Number 7), one piece of artwork was assigned incorrect nomenclature. Areas of measure in the diagram at the top of page 11 (Sample lot size calculations) should be expressed in "chains" rather than "acres." A corrected page 11 is provided below. Readers can cut out or reproduce the corrected copy from this issue and insert it in the November--December issue.

(cut on this line)



Manual Period	Area Lot 4 - Acres (km^2)	Method
1855-1881	$\frac{1}{10}\frac{(20.10 + 20.108)}{2}\frac{(19.91 + 19.92)}{2} = 40.04$ (0.1620 km^2)	Average dimensions, 1/16 cor@ mid-pt
1881-1893	$\frac{1}{10}\frac{(20.20 + 20.215)}{2}(19.915) = 40.24$ (0.1628 km^2)	Average dimensions 1/16 cor@ 20 ch (402.3 m)
1894-1929	$\frac{0.06}{4} = 0.01\frac{2}{4}$, d=0.01	
	2(20.20) + 0.01 = 40.41 (0.1635 km^2)	"d" quotient
1930-present	20.20 + 20.215 = 40.42 (0.1636 km^2)	Sum of meridional sides
Quadrilateral rule	(20.20 x 19.92 + 20.215 x 19.91) (0.05) = 40.24 (0.1628 km^2)	

Sample lot size calculations.

(cut on this line)

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Volume 13 Number 2

Engineering Field Notes