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A Summary of Roads Technology and Development Projects

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Introduction

This summary of projects was presented at the Low Volume Roads (LVR) Session at the 71st Annual Meeting of the Transportation Research Board (TRB) in Washington, DC, on February 13, 1992. The presentation was titled *An Overview of the LVR Problems, Needs, and Impacts for the National Forests of the United States.*

The LVR Session at TRB was a series of invited presentations from throughout the world to discuss the problems, needs, and impacts in low-volume roads technology development and research. Forest Service attendees at the workshop felt that *Engineering Field Notes* readers would be interested in this summary of road-related technology and development projects. The notes presented here are intended to provide a nontechnical overview of the roads development projects underway or planned. Since the intent of the summary is to demonstrate the range and extent of roads development projects undertaken by the Forest Service, not all projects are included.

Projects Planned or Underway

The project summaries are categorized to aid in presentation and identification of trends. Nearly half of the projects are in the Environmental and User categories.

The Forest Service invests about $1.5 million a year in roads technology and development. Typically, $100,000 to $200,000 of Coordinated Technology Implementation Program (CTIP) funds from the Federal Highway Administration (FHWA) are added to the program. Most of these projects are managed by the Technology and Development Centers at San Dimas and Missoula.

Road Surface

Central Tire Inflation (CTI): A Major Project

This project involves evaluation of : (1) the effect on roads of lowered tire pressures; (2) evaluation of CTI technology; and (3) implementation of appropriate technologies. Major benefits have been identified through formal studies and field demonstration projects. We are currently working with involved industries to implement the technology. We have four or five Forest Service trucks operating with CTI systems, and we are funding installation of 39 CTI systems on cooperators' trucks. Private industry has developed commercial systems, and cooperators are beginning to purchase them.

Non-traditional Stabilizers
This CTIP project involves the field evaluation of a variety of non-traditional, in-place treatment materials for stabilizing road-surfacing materials. The study has provided over 160 miles of test and demonstration sections on more than 60 projects across the United States. Stabilizer types included three pozzolans, four bioenzymes, two sulfinated oils, an ammoniumchloride, two mineral pitches, and two clay fillers. A draft final report is being reviewed.

Aggregate Surfacing Design Method Verification
Field verify the aggregate surfacing thickness design method in the Surfacing Thickness Program (STP). Variations in soil types, climate, aspect, and other factors may require modifications for local conditions. Results of this work will be either general modifications or procedures for making adjustments for local conditions.

Chunkwood Surfacing
Chunkwood is made by processing whole trees through a machine called a chunker. The resulting wood chunks are in the range of 1 to 4 inches in size (24 to 100mm), resembling the "pit run rock" used in road construction. The chunking machine was developed for producing wood chunks for biomass power generation and for flakeboard source material. Field trials indicated that the material was a suitable substitute for aggregate for low-volume roads in aggregate-short areas. Field and laboratory trials are being summarized into a design and construction guide.

Seasonal Adjustment Factors
Establishment of reliable seasonal factors/adjustments for design of asphalt- and aggregate-surfaced roads using deflection testing. Includes a literature and records search of deflection-testing reports and records for different seasons and conditions with limited field.

Environmental

Fish Culverts: Fish Passage
A fisheries biologist and Forest Engineer wrote a report summarizing existing information on fish passage through culverts. The report contains common-sense guidelines on what is needed to design, construct, and maintain an acceptable structure that is capable of fish passage. A 15 to 20 minute live-action video is being developed to aid in training and meetings to increase awareness and understanding.

Engineering/Environmental Considerations in Road Design
This study identifies the major technical and environmental issues and concerns associated with highway design in rural and wildland areas. Products resulting from this project will include a video, a pamphlet, and a short facilitator's manual covering methods for decision makers and the public to weigh the issues and resolve conflicts in the most beneficial manner. The methods presented in the manual will give due consideration to technical, environmental, and economic concerns.

Visual Prioritization Process
This CTIP project involves working with the Southwest Region's visual prioritization process and improving upon it for national use. The process identifies and prioritizes the visual resources at specific locations along a roadway. The road project is then designed and constructed to preserve the highest priority visual resources.

Surface Drainage/Inslope-Outslope
An assessment of which is the best surface drainage approach for conditions: insloping or outsloping. The project will develop information on appropriate circumstances and environmental effects.

Sediment Delivery
Develop current information on sediment delivery from new travelways and roads into streams and drainage systems.

Water Erosion Prediction Project (WEPP): A Major Project
A Department of Agriculture-wide project to replace the Universal Soil Loss Equation that was developed for agricultural soils and used in forested areas. WEPP includes specific field tests and equations for roads in mountainous areas. Some preliminary algorithms may be available for testing within the Forest Service in late 1992.

Construction Sediment Removal
An assessment of methods and their effectiveness for preventing sediment for new construction from being delivered into streams and drainage systems. This project is associated with the Sediment Delivery Project.

Environmental/Road Initiative
This project will catalog (1) the best tools and methods to reduce or minimize the adverse environmental effects of roads, and (2) the best opportunities for further reducing the adverse environmental effects of roads.

Users

Getting There and Back: A Major Effort
Access and Travel Management:
— Access = the physical facilities or land base used for travel.
— Travel Management = control of users of the National Forests.
Decisions in Forest Plans translate into needs for roads into and through the Forests. The increase in recreation users is putting pressure on existing access points and fostering demand for additional routes.

Road User Information
Study the various maps, signs, and posters to ensure that the Forest Service is conveying goodwill and an attitude of customer service.

Scenic Byways
Summarize and communicate guidelines for managers to use in planning for and managing roads designated as "Scenic Byways."

Road Use Estimates
Update information on traffic using Forest roads.

Vehicle Operating Cost Model: A Major Study
Develop new operating, maintenance, users, repair, delay, construction, and reconstruction cost data for Forest Service Road Users. Information currently available is based on data from the 1950's that was updated in 1976 for new powered trucks. Because of new technology for trucks and lowered tire pressure, the data needs to be upgraded.

Engineering/Other

Global Positioning System (GPS)
Continuing study and application of GPS hardware and methods to ongoing processes, i.e., surveying, mapping, and locating positions in general.

Laser Survey Instrument
A laser tree-measurement instrument has been developed to cruise standing timber. This technology may have applications in low-volume road surveys.

Structures

Low-Speed Bridge Rail Test
Crash testing of bridge railings for bridges on low-speed, low-volume roads. The feeling is that railing performance standards for bridges on high-speed roads are too high for low-volume, low-speed roads. These tests will determine the performance of low-cost rails attached to timber bridges.

Demonstration of Wooden Bridge Construction: A Major Project
This project involves evaluating and testing improved techniques for building economical wooden bridges. Involves demonstration and experimental projects with cities, counties, and states. About 100 wooden bridges have been constructed under this program since 1989. As a result of this work, AASHTO has accepted the stress-laminated wooden bridge design criteria as a design guide.

High-Performance-Level Bridge Rail: Tests for Wooden Bridges
The FHWA and the Forest Service are funding crash tests for bridge railing attached to wooden bridges for performance levels I and II (low-to-medium speed roads).

Traffic

Traffic Surveillance and Analysis
The purpose of this project is to develop improved methods for traffic surveillance and analysis.

Sign Expert System
This CTIP-sponsored project will result in a personal computer-based program using artificial intelligence software to help make better decisions for road signs. The system queries the user about the site and traffic conditions and rapidly provides written and visual guidance for proper sign installation, maintenance, and management based on published standards.

Low Volume Road Signing
A CTIP project that developed a sign guide book for low-volume roads. The guide is now being reviewed.

Accident Surveillance and Inventory
Development of an Accident Investigation Guide.

Tracking Sign Performance
Combined with another project and renamed: "Monitoring Evolving Technology for Low Volume Roads." This project will screen new ideas and use various communications media to convey project results and other technology-related news, ideas, and tips to field personnel.

Geotechnical

Develop Slope Stability Analysis Guides
Intermountain Research Station and National Forest System personnel are combining efforts to write a comprehensive guide for a slope stability analysis and stabilization guide for forested areas. The guide is coordinated with research and slope stability software programs developed by Intermountain Research Station researchers for three levels of analysis for forested areas, i.e., planning, project, and site-specific.

Geocomposite Drains
Continue laboratory and field evaluations.

Upgrading Retaining Wall Design Guide
Develop a design guide for low-height retaining walls for use on low-volume roads, including geotextile-reinforced walls. The guide will include design procedures, standard details, specifications, and costs. It will include designs that can be used directly by non-specialist designers on projects where low retaining walls are required in non-critical conditions.

Operation and Maintenance

Maintenance Management Systems (MMS's)
This project will result in an evaluation process (or processes) that will allow managers to evaluate the effectiveness of their MMS's. This is not an effort to create a national MMS.

Commensurate Share Damage: A Major Project
This new project will determine Equivalent Unit (EU) ratios for heavy vehicles (high- and low-pressure tires) and light vehicles through structured field tests. EUs are used to determine the allocation of maintenance costs (commensurate shares) between road users.

Front Runner Rock Rake
This project evaluated a device mounted on the front of a light service vehicle (typically a pickup truck) for removing loose rocks from the road surface.

Projects Requested but Not Funded

These projects are listed to provide an idea of the kinds of projects being requested. Each of these projects will be considered by the Road Projects Steering Committee.

- Road Standards for Low-Volume Roads
- Field Demonstration of Soil Nail Launcher
- Optimal Maintenance Investments
- Mobile Rock Crusher Evaluation
- Support FHWA Geotextile Durability Study
- Bentonite Dispenser for Road Maintenance
- Collection of Economic Data on Wooden Bridges
- Field Performance of Geocomposite Drains
- Logging Road Construction and Maintenance Video

- Produce National User Guides/Expert Systems
  - — Geotextile Use with Pavement
  - — Retaining Walls
  - — Drainage Structures
  - — Dust Treatments

- User Cost Estimator for Roads

- Effects of Winter Haul on Pavement

- Stabilizing "Boney" Road Surfaces

Summary

The Roads Technology and Development Program in the Forest Service is significant and changing. The process is driven by proposals from the field. Proposals are reviewed in the spring of every year by the Road Technology and Development Steering Committee. This committee, made up of representatives of most Regions, makes project recommendations to the Regional Engineers, who help to establish the annual program.

Additional information on any of the projects listed above can be obtained from the Washington Office or the Technology and Development Centers. Proposals and suggestions for future projects are always welcome.

The Changing Role of Engineering in Region 4: A View

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The adoption of Total Quality Management (TQM) by the Intermountain Region a few years ago ushered in a new and exciting era for all employees that offers much and promises nothing. Individually and collectively, we determine how successful the process will be. The analogy of walking through a fog graphically depicts the problems and challenges we face. We need to remember that TQM is an unending organizational "trip," not a destination. We must change our underlying culture to ensure success.

I am convinced that, at all levels of the organization, Engineering has much to gain by embracing author Karl Albrecht's concepts of service management and customer focus. Albrecht consolidated many of his ideas in his recent book, *Service Within.* I view Engineering's position in Region 4 differently than I did a few months ago, primarily because of this book. *Service Within* describes a model for service management that can open the door to a better tomorrow for all who provide service to the customer.

Albrecht's service management model contains key ideas and implications not incorporated into the TQM model. First, service management is a total organizational approach making quality of service, as perceived by the customer, the primary driving force for the operations of the service provider. The process must involve everyone directly, because the resulting outcomes affect everyone. Service management causes cultural change in the organization by creating a philosophy of work, a way of doing business, and a system for rewarding the individual. Second "quality of service" is the key component of the model and its measure of success. The customer's perception is the only standard by which the quality of service can be evaluated. The service provider recognizes that the customer's perception of quality service must be the number one priority and motivator for everyone in the organization. Consequently, it influences everyone's job. Finally, a key ingredient in the service management process is a focus on customer interface as the starting point for all management actions.

In its purest form, Engineering's primary role in the Forest Service is to provide service to its "customers." Few of us, I fear, understand this basic concept. Instead we measure our contributions by the jobs we perform. Our "job" is not to build and maintain roads, erect structures, or conduct safety or other engineering surveys; our "job" is to serve our customers. Our engineering activities can, but do not necessarily, satisfy our customer's needs. In a worst case scenario, our engineering activities may simply be unwanted, unnecessary, or dictatorial.

The erosion of support for Engineering via grade reductions, staff consolidations, or organizational modifications may be a direct measure of customer discontent. In the business world, discontented customers vote with their feet; they go elsewhere for service. In the Forest Service, discontented customers vote by withdrawing their support and, with it, program funding. In these times of limited budgets, the financial impacts of such actions can be devastating. We cannot sit back complacently and expect to reap the unearned reward of assured financing and support. Times have changed! Each of us is affected in varying degrees. Fortunately, the worst case possibility is the exception, not the rule. We must act immediately to implement the necessary changes to ensure that budget cutbacks and limited staffing remain the exception.

What, then, should Engineering do to prepare for its future role in the Forest Service? I recommend immediate implementation of the service management model described by Karl Albrecht in *Service Within*. Let me expand on why I feel we need to adopt this model and what steps are necessary to accomplish these ends. Karl Albrecht's message is clear and direct: *"If you're not serving the customer, your job is to serve someone who is."* Who are our customers? Why should we be concerned about serving their needs? If you don't know the answer and are interested in finding it, then *Service Within* should be on your list of books to read.

We have just embarked on our journey to implement service excellence in Engineering on the Caribou, so I'm unable to share a complete list of my customers with you. My customers and their needs, motivations, and expectations are unique; I cannot create a generic list for you to use. I do know, however, that the Forest Management Team—the Forest Supervisor, Staff, and District Rangers—forms the nucleus of "key" customers that many of my efforts will be focused on. I'm sure our service analysis will identify many more customers as we proceed through the process.

So what is Karl Albrecht's prescription, or "recipe," as he calls it, for successful leadership? His program consists of five steps.

1. Get next to your customers and stay there.
2. Define your service missions.
3. Orient your people on service.
4. Focus your systems on service.
5. Focus your rewards on service.

Most of *Service Within* serves as a primer to flesh out these five principles. By following them, an organization can effectively implement service excellence.

There may be nagging questions for many of you, like "What's in it for me?" or "Why should I go to all of this trouble?" I know, because I had them too. Doubts and concerns still remain, but I feel there are at least four good reasons why the *Service Within* process should be implemented:

1. **Desire for an organizational future.** None of us should be complacent about the future of Engineering in the Forest Service. Most of what we do could be contracted out, thereby eliminating most of the work force and leaving only a skeleton cadre for administration. If Engineering fails

to demonstrate the added value we bring to the customer in our individual projects and resource programs, the erosion of support for Engineering services will continue. Should it be any surprise to see Engineering positions downgraded or eliminated by organizational consolidations when we fail to meet customer needs? The consequences of disregarding customer needs will likely result in funding reductions. I'm convinced that implementation of Albrecht's service excellence process will do much to forestall this downward spiral.

2. **Desire to provide the service the customer needs.** Engineering must consistently guard against performing self-serving work that fails to serve customer needs. Additionally, we need to actively communicate engineering standards, guidelines, and requirements to the customer so that discretionary decision making remains visible and available. Policing activities tend to be viewed as self-serving unless restrictions and project constraints surface long before the decision is made. When we deliver service to a customer without first determining what the customer needs, it is not service; it is a prescription for failure. We fail to communicate, and worst of all, we often fail to provide the appropriate service. When we perform work on a low- or no-priority basis, the activity has little, if any, tangible worth to the customer. Implementing the principles of service excellence will help an organization to eliminate or minimize redundant, unnecessary, and unwanted activities and projects.

3. **Desire to effectively and efficiently do the job.** Success in implementing the service excellence process is assured when customers validate that their needs and expectations are consistently being met. This forms the basis for assessing how well we have conceived our strategy for service based on customers' priorities. Close interaction with and recurring feedback from the customers will lessen the chances of misunderstanding, false starts, and wasted effort.

4. **Have a strong desire to know what to do.** Initiating the service management process in Engineering will expand and formalize ongoing methods of identifying, prioritizing, and scheduling activities that support customers' needs. Effective exchange of information will reduce the possibility that key customer service items will be overlooked. Serving the customer mandates that we provide information to educate the customer regarding unknown needs.

By providing a brief overview of the service management model described by Karl Albrecht in *Service Within*, I hope you will agree that we have little choice but to intensify our efforts to provide quality customer service. I'm sure there are other models around that could help us. The important thing is to move forward to strengthen the tenuous bonds that connect Engineering to the broad range of resource uses and activities managed by the Forest Service. The synergy of these associations is too valuable to jeopardize. The standards of excellence and commitment by the majority of Engineering personnel to the Forest Service land ethic cannot be replicated. If we fail to communicate the importance of the added value that Engineering provides, then we can blame no one but ourselves. We have the tools and the blueprint; the only other ingredients we need are the will and the commitment to provide quality customer service every day, everywhere, every time.

Impact Tests on Road Delineator Posts—The Bradystake and Three Carsonite Marker Designs

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Introduction

The Pacific Southwest Region (R-5) requested that the San Dimas Technology and Development Center (SDTDC) compare the Bradystake post with three types of Carsonite markers—common road delineators in R-5. W.H. Brady Co., Milwaukee, Wisconsin, manufactures the marking post called the Bradystake, which is on the Federal Supply Schedule (FSS). Since it was on the FSS, Region 5 wished to determine if this post was suitable as a road delineator, even though the W.H. Brady Co. does not recommend the Bradystake for such use.

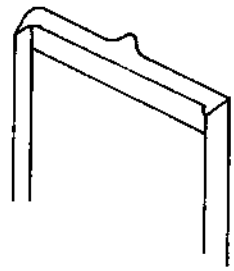
A series of impact tests was performed to determine how traffic impacts typical of Forest Service applications would affect the durability of Bradystakes as road delineators. These tests were conducted at the California Highway Patrol Academy test site near Sacramento, California, on October 16, 1991. The tests utilized SDTDC's 1990 four-wheel drive, 3/4-ton, American-made pickup and the California Department of Transportation's (CalTrans) impact vehicle—a 1985 Mustang. The pickup truck had a special bumper attachment that allowed a 2-inch diameter pipe to be extended 4 inches in front of the truck and 6 inches above the travelway. The Mustang bumper was about 6 inches above the ground.

Bradystakes are made from vertical glass-fiber-reinforced polymer. They are 66 inches long and 3-3/4 inches wide. Carsonite markers are manufactured by Carsonite International, Carson City, Nevada, and have a vertical fiberglass core wrapped with a horizontal reinforced polymer fiber. These markers are also 66 inches long and 3-3/4 inches wide. Representations of the three Carsonite markers and the Bradystake are presented in figure 1.

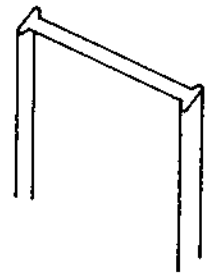
Test Procedures

A Pionjar with a spade attachment was used to drive a pilot hole for each post. A post driver designed for these posts was used for post installation. As recommended by the manufacturers, each post was driven 18 inches into the very dry and hard ground. After the posts were installed, the ground around them was tamped. All posts were driven vertically and then turned at a 30° angle to the road.

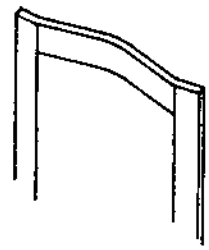
Two sets of posts were used for the test. The posts were placed 20 feet apart in the following sequence: Bradystake and the Carsonite Roadmarker, Dual-Sided, Curv-Flex. This was repeated again in the same order, for a total of



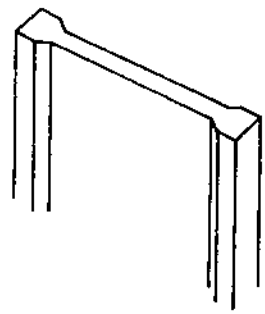
Carsonite Recreational Marker/Roadmarker—Flat face with ribbed edges, and a center rib running the length of the post.



Carsonite Dual-Sided Trail Marker—Flat on both sides, with ribbed edges similar to an "I" beam.



Carsonite Curv-Flex Marker—Slightly concave face/convex back, with straight edges.



Bradystake—Flat on both sides with ribbed edges, similar to the Carsonite Dual-Sided Marker.

Figure 1.—The four tested road delineators.

eight in each set. The SDTDC truck hit one set at 5 and 35 mph; the CalTrans vehicle hit the other set at 55 mph. The pickup truck hit the posts at the center of the 2-inch diameter bar. The truck made 10 passes at 5 mph and 10 additional passes at 35 mph (figure 2), hitting one set of posts. The CalTrans test vehicle made 10 impact passes at 55 mph on the second set of posts.

Figure 2.—Pickup truck hitting post at 35 mph.

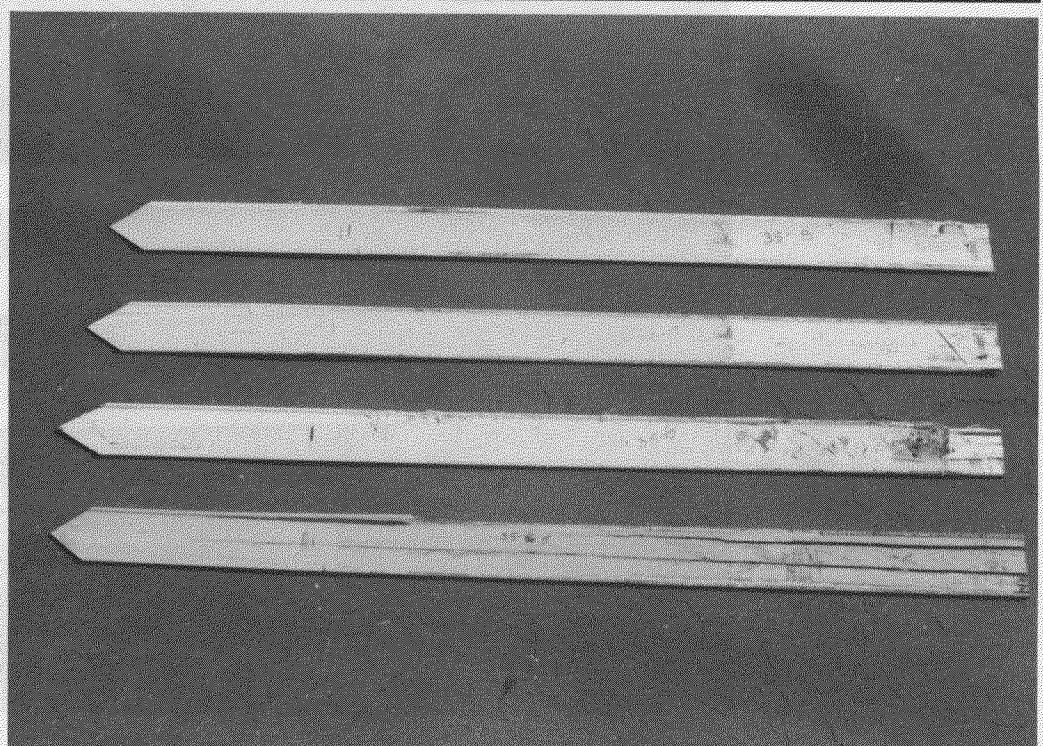


Figure 3.—Posts after 35-mph passes. (Top to bottom: Carsonite Curv-Flex, Dual-Sided, and Roadmarker; the Bradystake)

Test Results

After the first 10 passes (5-mph impact), all posts had scratches, but all were still intact and standing upright. After the second 10 passes (35-mph impact), the posts (figure 3) had the following damage:

- Bradystake—Top 4 inches were frayed, and major longitudinal splits were present from top to bottom.
- Carsonite Roadmarker—Top 4 inches were frayed; the post, including the back rib, was cracked 6 inches from the ground.
- Carsonite Dual-Sided—Top 2 inches were frayed; no other apparent damage.
- Carsonite Curv-Flex—Top 2 inches were frayed; cracks (but no breaks) were on the back surface from ground level to 4 inches above ground level.

The following damage (figure 4) was noted after the CalTrans test vehicle made its 10 passes at 55 mph:

- First Bradystake—Pulled out of the ground on fifth pass.
- First Carsonite Roadmarker—Pulled out on tenth pass.
- First Carsonite Dual-Sided—Pulled out on fifth pass.

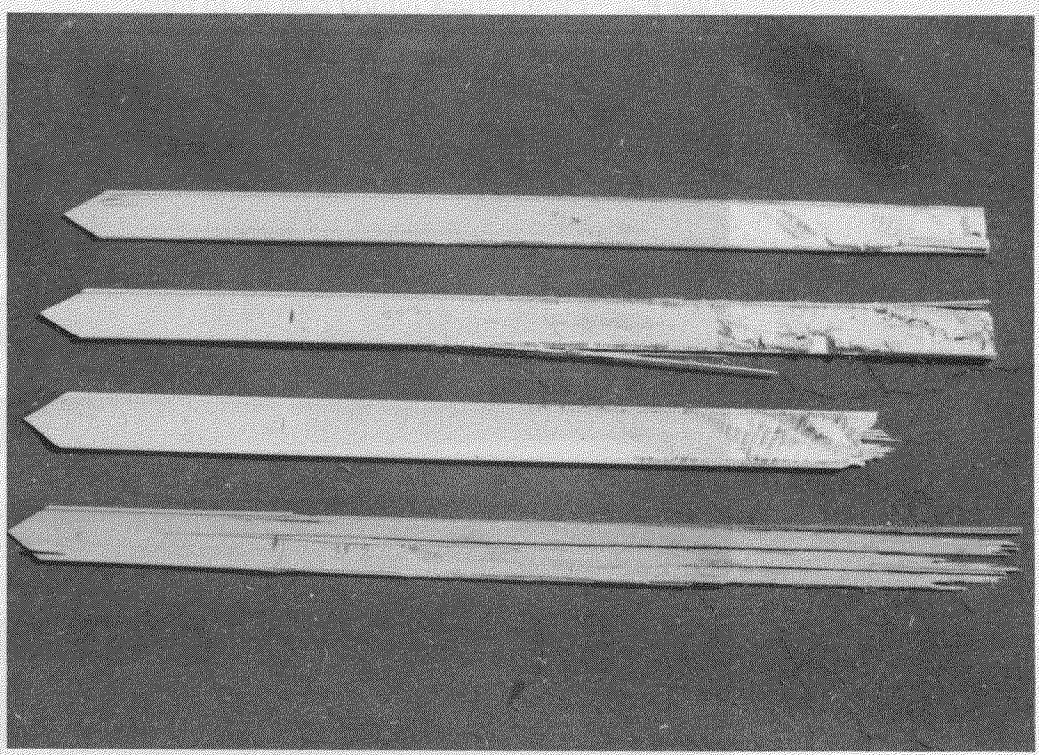


Figure 4.—Posts after 55-mph passes. (Top to bottom: Carsonite Curv-Flex, Dual-Sided, and Roadmarker; the Bradystake)

- First Carsonite Curv-Flex—Top 4 inches frayed; no other apparent damage.
- Second Bradystake—Split from top to bottom; nothing left of post but vertical strands.
- Second Carsonite Roadmarker—Top 24 inches frayed; wrapping broken.
- Second Carsonite Dual-Sided—Top 24 inches frayed.
- Second Carsonite Curv-Flex—Top 4 inches torn off.

Since SDTDC had the opportunity to use the CalTrans impact vehicle, we were able to impact the posts at 55 mph. While these 55-mph impacts represent a standard test by CalTrans, they are not as applicable to Forest Service needs as the pickup truck's impacts. Thus, this phase of testing was for information only, and the results were not considered in the overall evaluation.

Direct-Wheel Impact Testing

On October 8, 1991, just prior to the tests described above, SDTDC performed a direct-wheel impact test (figure 5) on the four different posts at San Dimas, California. The posts were installed in the same manner as described. The pickup truck drove over each post, making sure that the front wheel hit the post. Ten passes were made at approximately 5 mph. Except for the Carsonite Curv-Flex, which showed no cracking, all other posts showed cracking at ground level, but were able to return to an upright position.

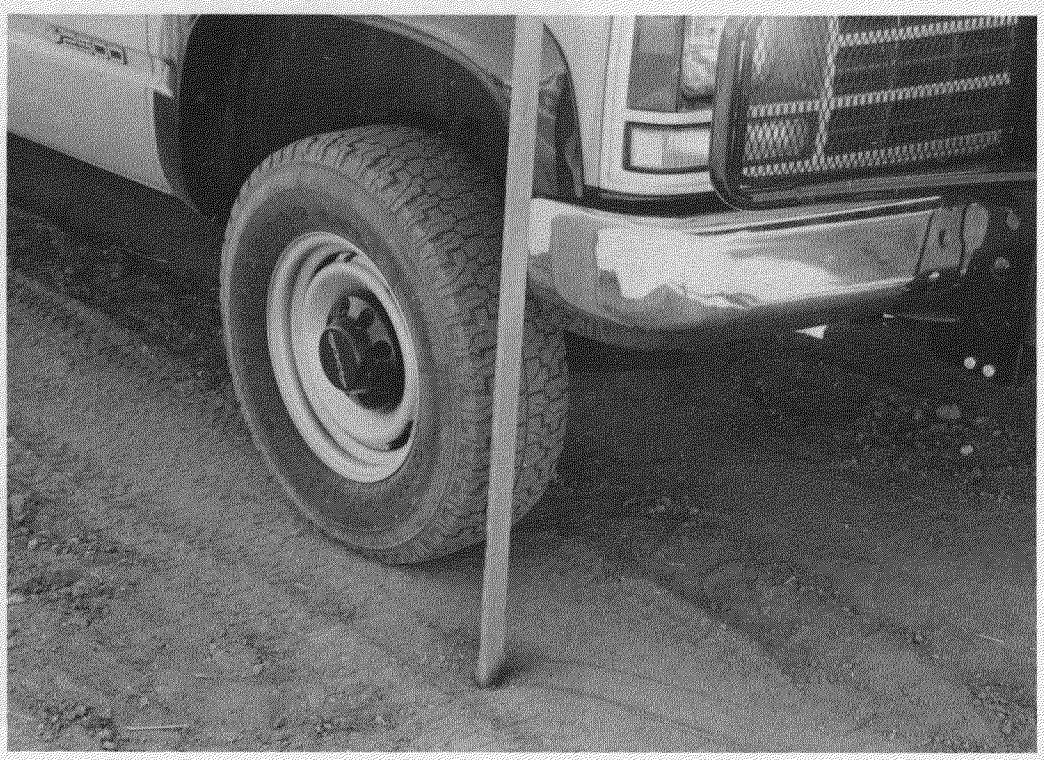


Figure 5.—Pickup truck performing the direct-wheel impact.

Conclusions and Recommendations

Whenever the vehicle or truck hit a post, the post would bend and go under the vehicle. Even though the initial impact was at the center of the vehicle, the 30° angle of installation caused the post to bend away from the travelway. This resulted in the vehicle's wheel running over the upper portion of the post. That accounts for the frayed tops on the different posts.

Road delineators need to be driven firmly into the ground. For these tests the ground was very hard and dry. The ground compaction around the post was minimal, and this could account for losing three of the eight posts while performing the 55-mph impact test.

Strictly considering impacts, the Carsonite Curv-Flex appeared to be the best post for use as a road delineator. It had no structural damage and returned to an upright position after impact and direct-wheel impact testing.

The Carsonite Dual-Sided and Roadmarker remained upright through the tests even though their ribs were broken after impact testing.

Figure 6.—The Bradystake after the 35-mph impact test.

The Bradystake had no horizontal reinforcement wrapping around the post, and it split longitudinally. The more vehicle impacts, the more splinters. After the 35-mph impact testing, the splinters were brushlike, and the post no longer looked like a post (figure 6). SDTDC shares W.H. Brady's opinion that the Bradystake should not be used as a road delineator. The test program in no way indicated that the Bradystake is an unacceptable post for other applications.

NFAP Light Aircraft Airborne Video System with Real-Time Differential GPS

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In 1991, the Nationwide Forestry Applications Program (NFAP) staff configured an airborne SVHS video system that uses real-time differential GPS (D-GPS) to obtain accurate geographic coordinate information which is displayed on the video imagery. Acquisition of the coordinate information utilizes the Navstar Global Positioning System (GPS) and real-time differential processing of the collected satellite data (D-GPS). A Hasselblad 70mm camera was mounted alongside the video camera for the purpose of acquiring vertical photographs as a supplement to the SVHS video imagery. The entire system was designed for installation in a single-engine Cessna 182 aircraft. The NFAP airborne SVHS video system with the D-GPS and Hasselblad camera can acquire simultaneous, coincident, high-quality video and photographic imagery at relatively low cost. The geographic coordinate information that is recorded on the video image makes it possible to easily and quickly obtain an accurate geographic position of the strips or individual frames of the video imagery.

Imaging System Components

The imaging system installed in the Cessna uses (1) a Panasonic SVHS 300 CLE video camera with a Canon 9.5mm–143mm zoom lens, and (2) a Hasselblad 70mm camera with an 80mm lens. The video components are the same as those used in the airborne video system developed by the Methods Application Group for forest pest-management applications. Other imaging system components in addition to the cameras include:

- Panasonic SVHS AG-7400 video recorder equipped with a hand mike for voice recording
- Panasonic BT-S100N color video monitor
- Canon TCR-201F remote controller
- Hasselblad shutter release cord

The above cameras and their associated components are all standard, commercially available, industry equipment.

Real-Time Differential GPS Components

The D-GPS equipment installed aboard the aircraft includes the following items:

- ASHTECH 12-channel GPS receiver.
- ESE caption generator—Places D-GPS coordinate information on the video image.
- Bendix-King programmable VHF radio equipped with an RF packet modem—Serves as a data link between the remote GPS receiver in the aircraft and the base station GPS receiver at a known location.
- GPS aircraft antenna mounted externally above the aircraft cabin.
- VHF aircraft antenna mounted externally on the aircraft and dedicated to the VHF radio that serves as the D-GPS data link.

The GPS coordinate information is displayed on the video image and recorded on the video tape (see figure 7). The coordinates can be obtained with the GPS either in the autonomous mode using only the on-board GPS receiver, or in the differential mode, using the on-board GPS receiver and a base station GPS receiver that is positioned over a known survey reference point. In the D-GPS mode, the on-board GPS receiver and the base-station GPS receiver communicate with each other using VHF radios equipped with RF-packet modems.

Figure 7.—D-GPS geographic information displayed on SVHS video.

Power Requirements

All system components requiring electrical power use 12-volt DC power. Electrical power is supplied by two rechargeable 12-volt gel cell batteries that are connected in parallel. The two batteries provide sufficient power for a minimum of four hours of continuous data collection. Other power items include:

- Six DC power cables
- Power junction box with six XLR, 4-pin output connector terminals

Aircraft Configuration

The cameras are carried in the baggage compartment of the Cessna Aircraft. The baggage compartment door is removed from the aircraft and the cameras are placed far enough outboard of the door opening to permit the unobstructed acquisition of vertical imagery (see figure 8). The cameras are firmly attached to an aluminum plate assembly that serves as a camera mount. The aluminum plate is bolted to an oak plywood box that is strapped securely to the aircraft floor using four cargo anchors in the floor of the baggage compartment. A padded plate is placed between the plywood box and the aircraft floor, dampening vibration to the cameras.

Figure 8.—Installation of videography equipment in rear baggage compartment.

An aerodynamically shaped fiberglass pod houses the cameras and shields them from the windstream and weather elements (see figure 9). The cameras are placed so that their lenses point vertically downward and they are positioned slightly outboard of the floor edge on the port side of the aircraft. The fiberglass pod completely covers the baggage door opening except at the bottom where the pod has been cut away to provide the camera lenses with an unobstructed vertical view. The pod is securely bolted to the baggage door rib frame using six AN3-6A bolts, AN970-3 washers, and A10K-80 rivnuts.

To comply with Federal Aviation Administration (FAA) regulations, an FAA Form 337 had to be completed and approved. This form describes the work accomplished in removing the baggage compartment door, installing the fiberglass pod, and installing the cameras. It also confirms that the required placards have been placed in the aircraft and that the installation of the airborne video system complies with FAA design and safety standards.

Airborne Video Applications

The NFAP airborne video system with D-GPS was used extensively during 1991. Imagery was successfully acquired over portions of the Daniel Boone National Forest in Region 8, the Tahoe and Cleveland National Forests in Region 5, and the Santa Fe National Forest in Region 3.

Figure 9.—Fiberglass camera pod installed in Cessna 182 aircraft.

Evaluation and analysis of the acquired imagery indicates that the airborne video will prove useful for many resource applications. Some of the possible applications include surveys for recreation sites, critical riparian areas, wildlife habitat, range conditions, road updates, snag counts, archaeological sites, forest pest damage, and catastrophic damage (fires, floods, slumps). Other applications include reconnaissance and documentation of illegal activities such as timber theft, arson, and illegal dumping.

Summary

The NFAP airborne video system with D-GPS has proven to be a very versatile and cost-effective system for acquiring high-quality airborne video imagery. Several practical considerations influenced the design and development of this system to make it so: (1) the video system can be mounted on the type of aircraft that is commonly available at relatively low cost; (2) major modifications to the aircraft are not required; and (3) the selected aircraft can be flown safely at the slow airspeeds that are desired when acquiring airborne video and aerial photography.

All components of the NFAP airborne video system and D-GPS are standard items that are commonly available, with the exception of the following:

- ESE caption generator
- Plywood box with aluminum mounting plate
- Fiberglass pod
- DC power cables
- Power junction box with six SLR, 4-pin output connector terminals

The ESE caption generator, plywood box with aluminum mounting plate, and the fiberglass pod were all special-order items designed to meet system specifications. The DC power cables and power junction box were made in-house.

Partnerships—A Philosophy

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The following article consists of excerpts from a presentation made by Clyde Lay at a Forest Service Recreation University training session, January 27–31, Salt Lake City, Utah.

Success in partnerships is based to a large degree on your philosophy of dealing with people in your everyday work place. I would like to present what I think are some successful philosophies.

Forming partnerships is actually a way of doing business, even a way of life.

For many of us, it is probably a very different way of doing business than we have been doing, and, most definitely, it is not the traditional way held up as an example for generations.

When dealing with partnerships, do you have a goal of getting something done by going out and finding someone who is willing to provide materials, labor, equipment, or funding to help ***you*** get ***your*** project done?

Sometimes this works and sometimes it doesn't. But when it works it is usually a one-shot deal, leaving the partners feeling that they've been used, or that they've done you a favor.

A basic guideline for a successful partnership is that there must be something in it for all participating parties.

If you look back at your past experiences that were truly successful and resulted in continuing efforts by partners, you will always find some payoff to the partners.

Something that they wanted was accomplished. If they were happy partners, a payoff was involved.

If you want to build a successful partnership, approach it as if you are building a long-term relationship and friendship.

Start by looking to your neighbors and users to determine if there is something ***they*** want that ***you*** might help them accomplish. Consider it an added benefit if it is also something you want to accomplish.

The key is to look to the needs of others first, then try to fit their needs into your program.

You will find that making these contacts and developing these kinds of relationships will take a lot of time. You may be frustrated in the beginning because things are moving slowly and you are not always working on things you consider to be of the highest priority.

In time, things will start to happen. These things may not be your highest priority, but your priority items will eventually be accomplished more easily as a result of the relationships you are building.

Remember throughout this effort that you are building relationships and making friendships that previously didn't exist. You are also strengthening existing relationships because you are making a conscientious effort to work on things other people are interested in.

We need to convert our "contacts" into friends and partners. Instead of going to meetings to inform our contacts of our planned actions, we need to go to meetings to plan joint ventures in which they become active partners.

Every time you make a friend or an ally, their friends, to some degree, become your friends.

You might be tempted to think of this as a pyramid scheme, with yourself at the top, and all the benefits flowing to you. If this is your view, you can expect your pyramid to collapse.

Instead, think of what you are trying to construct as a wagon wheel with yourself as the hub. You are the contact person people come to because you are helping them to do the things they want to do.

You will find yourself coordinating groups or individuals and trying to get them to work together on projects all of you would like to complete. In the beginning, you are the key to building this network of contacts and friends. You are holding it together. You are the catalyst causing communication to begin.

As your partnerships develop, be prepared to let go.

In the beginning, you are the key; however, as communication channels open around the rim of the wheel and your partners begin to communicate and work with others on the rim, you will find that you are not always the key to keeping the process moving.

If your partnerships are strong, others will move to the hub at different times, and you will move to the rim. Be prepared to let go of leadership and ownership and share this responsibility. As you let go and share the role, you will find that the opportunities and payoffs begin to increase dramatically.

In the Forest Service, we have a tendency to think we must retain control for something to be successful. We have to learn to let go and understand that the end product will generally be better if we share leadership and develop common solutions to problems.

Success comes when others are taking leadership to accomplish a variety of mutually desirable projects, and you are able to move to the role of a key player or facilitator.

At this point you will find many things being accomplished with limited time commitment by you. You will find yourself getting more done than you ever thought possible.

Before, you expended effort fighting and confronting people. Now, the same people are your partners and friends. Now your efforts have a positive effect, and good, constructive communication takes place.

Notice throughout this discussion that I freely interchange the use of the words "friend" and "partner." To be really successful at this effort, the words need to become synonymous in your mind.

With others taking leadership in areas that they are interested in, several things will happen.

1. Others enthusiastically help you make significant progress on a variety of projects that are mutually desirable.

2. Time that you might have spent getting something accomplished is saved because much of the work is being done by others.

3. Things that might never have been accomplished are getting done.

4. With the involvement of others, new ideas and concepts are developed that you would not have thought of alone.

5. Opposition disappears because people are communicating and are much more knowledgeable. You have friends who understand you better, and they are communicating with their friends.

6. The work being accomplished is not viewed as your work any longer. It is the product of every part of the wheel. Each person involved has ownership and actively supports the efforts of their peers.

7. Negative effort is reduced. Time explaining your actions to others is reduced because, in many instances, your former opponents are now your partners. Your partners are spreading the word about the project more effectively than you ever could have.

8. Your pool of available resources and opportunities continually expands.

9. Your job becomes a pleasant experience because your interpersonal relationships are friendly and constructive.

10. Occasionally, when you have to tackle projects that may not be accepted, you will have people in the community who are willing to listen to you. You will have established your credibility as a positive person who is willing to work with them, and they will be receptive to reason.

For many years it has appeared to me that the Forest Service was managing the National Forest System lands as independent islands. Very little coordination was taking place with adjacent landowners and very little consideration was demonstrated for the needs of the users.

As an agency we survived with this type of approach simply because the public was used to it and because they generally thought we knew best.

Times have changed, and the knowledge and awareness of the public have increased at a tremendous rate. Instead of dealing with a local public that had grown to accept things the way they were, we began to deal with statewide and national interest groups. And many of them were disagreeing with our basic concepts and principles of Forest Management.

The public began to raise questions, and as technology and knowledge changed, many employees also began to question our time-honored ways and methods.

I think it is a credit to our society that we have the opportunity to question the actions of government agencies. It is also definitely to the credit of the agency that employees can look at what they are doing and have the opportunity to change themselves and cause changes to happen.

One of the most significant changes taking place is that the Forest Service recognizes that it is not an island.

In recognizing this, it became more and more evident that we really were not doing a good job of involving the public in our decision-making and land-management processes. If we are going to do an adequate job, we must involve our neighbors in what we are doing and they must involve us. We must develop free-flowing, two-way communication.

To me the development of partnerships and the need for more involvement by others are one and the same thing.

If we are really doing an adequate job of public involvement, we are developing partners.

I think many people have the perception that a partnership is always something described in a formal document that spells out in detail the commitments and obligations of each party involved.

There is place for this kind of partnership, and, in many cases, a written agreement is necessary. However, let's not overlook the day-to-day opportunities to build small partnerships that may someday lead to formal agreements.

Begin by looking for the small things and build the trust that leads to the ability to work out the larger things.

To summarize what I view as the key points in developing partnerships:

1. Actively seek and listen to what your users and neighbors want.
   a. Work to accommodate your users and neighbors. Become known as a helpful person and a problem solver.

2. Be willing to adjust your priorities to accommodate others.
   a. How many times have you thought: I don't have time, or this is not free?

   b. Assess your priorities and find the time.

3. Involve others.
   a. Be involved with others. Can we expect others to be involved with and interested in our efforts if we are not interested in theirs?

   b. Look for ways to involve others in your processes that go beyond the traditional ways of keeping them informed.

   c. As you involve others, develop open communication and trust.

4. Don't be an island; look beyond your boundaries.
   a. Find the good things happening on other lands; try to become a part of it; then try to make it happen in your area.

5. Look for activities that overlap with your neighbors' activities.
   a. Take the time to coordinate with your neighbors so that work on contiguous lands has continuity.

   b. As you examine your total area of influence, listen to your public; pay particular attention to those things that are feasible only through cooperation with your neighbors.

6. Develop a "want-to-do" attitude when working with others.
   a. We have always heard that we need a "can-do" person. This falls short of the mark. What we really need is a "can-do" person with a "want-to-do" attitude.

7. Don't forget to develop your internal partners.
   a. Develop partnerships between Ranger Districts, other Staff Groups, and yourself. Realize the need for better relationships and actively work with each as a partner.

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