

AN OVERVIEW OF THE LVR PROBLEMS, NEEDS, AND IMPACTS FOR THE NATIONAL FORESTS OF THE UNITED STATES

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USDA FOREST SERVICE ROAD TECHNOLOGY AND DEVELOPMENT PROJECTS

USDA Forest Service field notes presented here are intended to provide a nontechnical overview of the road 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.

The following projects are planned or underway, and the project summaries are categorized to aid in presentation and identification of trends. It is interesting to note that nearly half of the projects are in the Environmental and User categories.

Annually, about \$1.5 million is invested in roads technology and development by the Forest Service. Typically, \$100,000 to \$200,000 of Coordinated Technology Implementation Program (CTIP) funds from the Federal Highway Administration are added to the program. The majority of these projects are managed by the Forest Service Technology and Development Centers at San Dimas, California and Missoula, Montana.

Road Surface

Central Tire Inflation (CTI)

This major project:

- Evaluates the effect on roads of lowered tire pressures,
- Evaluates the central tire inflation technology, and
- Implements appropriate technologies.

Major benefits have been identified through formal studies and field demonstration projects. The Forest Service is currently working with involved industries to implement the technology and has 51 Forest Service trucks operating with CTI systems. Private industry has developed commercial systems and cooperators are beginning to purchase these systems. Significant reductions in traffic-generated sediment from non-paved roads have been quantified by using CTI tire pressures.

Non-Traditional Stabilizers

This Central Tire Inflation 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 U.S. Stabilizer types included three pozzolans, four bioenzymes, two sulphinated oils, an ammonium chloride, two mineral pitches, and two clay fillers. The project final report, "Non-Standard Stabilizers" July, 1992, FHWA-FLP-92-011 is available from the National Technical Information Service, Springfield, VA 22161. A follow-up report on the long term effect of the stabilizers is planned for publication in the fall of 1995.

Aggregate Surfacing Design Method Verification

Field trials verify the aggregate surfacing thickness design method in the Surfacing Thickness Program (STP). Variations in soil type, climate, aspect, and other factors may require modifications for local conditions. Result of this work will be either general modifications or procedures for making adjustments for local conditions. The project final report, "Lowell Surfacing Thickness Design Test Road, Final Report" September, 1994, FHWA-FLP-094-15 and FS EM-7170-15 is available from the National Technical Information Service.

Chunkwood Surfacing

Chunkwood is made by processing whole trees through a machine called a chunker. The resulting wood chunks range from 1 to 4 inches (25 to 100 millimeters) in size, resembling "pit run rock" used in road construction. The chunker was developed for producing wood chunks for biomass power generation and for flakeboard source material. Field trials indicated the material is a suitable substitute for aggregate for low-volume roads in aggregate-short areas. The design method developed for using chunkwood as a replacement for aggregate will be included in the "Earth and Aggregate Surfacing Design

Guide for Low Volume Roads" under development by the USDA Forest Service. The design guide is scheduled to be published in the summer of 1995.

Seasonal Adjustment Factors

This study involves the establishment of reliable seasonal factors/adjustments for the design of asphalt and aggregate surfaced roads using deflection testing. There are three volumes planned. Volume 1 and 2 will review international studies done in this area and analyze the data. Volume 3 will be a user's guide giving pointers on how to use these factors in field situations. All volumes are anticipated to be available in 1995.

Winter Haul Effect on Pavements

A literature study and analysis by the U.S. Army's Cold Regions Research and Experiment Laboratory (CRREL) will form the bulk of this study's look at the effect of heavy loads on pavements in freeze-thaw and continuous freeze situations. CRREL will be using their FROST program to develop several operating scenarios for comparison. Final report anticipated November 1995.

Environmental

Fish Culverts/Fish Passage

A fisheries biologist and a civil 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 minute accompanying video developed to aid in training and meetings to increase awareness and understanding is available from the USDA Forest Service Technology and Development Center, 444 E. Bonita Avenue, San Dimas, CA 91773.

Engineering/Environmental Considerations in Road Design

A video titled *The Road and the Environment* has been produced. This video is intended to be shown at public meetings to set the stage for constructive discussions. It is an introduction to the practical considerations of road-building in an environmentally-sensitive area and is designed to encourage cooperation between all parties.

The video has a facilitator's guide included that discusses the purpose and key points. The video is available from the USDA Forest Service Technology and Development Center.

Visual Prioritization Process

This final report is designed to describe and teach the Visual Prioritization Process (VPP). The VPP allows one to inventory and analyze the visual resources of a corridor and to assign priorities to the various segments of that corridor. The VPP can be used for project planning through design, and is intended to be used by all design disciplines including engineers, landscape architects, and planners. The "Visual Prioritization Process User's Manual" July 1994, FHWA-FLP-93-007, is available from the National Technical Information Center.

Surface Drainage/Inslope - Outslope

This project will provide guidance on the various types of roadway drainage devices that are available for low volume roads. Intent is not to be all encompassing, as much of this material exists elsewhere, but rather to act as a checklist for road designers to be certain they are aware of all the available technology. An additional component of this study is to make an assessment of where or when insloping or outsloping of the road surface is the better surface drainage approach. Culvert lining materials for old, deteriorated culverts will also be addressed. Anticipate report being available December 1995.

WEPP (Water Erosion Prediction Project)

This major Department of Agriculture project's goal is to replace the Universal Soil Loss Equation that was developed for agricultural soils and used in forested areas. The WEPP project includes specific field tests and equations for roads in mountainous areas. Some preliminary algorithms, developed at the Forestry Sciences Laboratory, Moscow, ID, are available for testing within the Forest Service.

Environmental Road Initiative

This project will solicit input from field sources on all the good ideas that have been employed to enable

transportation facilities to mesh well with the environment. Examples include sediment reduction methods, aesthetic retaining walls and energy dissipators. Intent is to produce a binder that will be periodically updated with material that comes to the attention of the project engineer. Binder to be produced in January 1995.

Users

Getting There and Back

"Access and Travel Management" is a major effort. "Access" refers to the physical facilities or land base used for travel, and "travel management" refers to the control of the users of the National Forests. Decisions in Forest Plans translate into needs for roads into, and through, the forests. Increasingly, recreation users are putting pressure on existing access points, and fostering demand for additional routes.

Road User Information

Demographics on the use of the forest transportation system is the objective of this project.

Vehicle Operating Cost Model

The Forest Service has been using a curves and equations developed in the 1950s to predict haul times of commercial log trucks. These equations form the basis for many of the agency's automated models and this update is being performed to determine what work may be necessary to alter the currently accepted methods. Results are showing that the Byrnes, Nelson and Googins (BNG) analysis performed in the 1950s is still sound. Two current computer truck simulation models are being evaluated against the BNG analysis for comparison related to alignment. Report scheduled for completion 1995.

Engineering/Other

Global Positioning System

This project is a continuing study on application of global positioning (GPS) hardware and methods to surveys, mapping, and locating positions.

Laser Survey Instrument

Work continues on making this portable, hand held laser surveying unit compatible with personal computer road design software. Electronic data recording units have been identified and software has been developed to download directly from the laser surveying instrument to PC design programs. This removes the need for notes taken in the field and dramatically increases the effectiveness of a survey team. Field trials continue across the nation with positive feedback being reported.

Structures

Low Speed Bridge Rail Test

This project involves crash testing of bridge railings on low speed, low-volume roads in order to ascertain whether 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. Testing should be complete in the summer of 1995.

Demonstration of Wood Bridge Construction

This demonstration project involves the evaluation and testing of improved techniques for building economical wood bridges in conjunction with cities, counties, and states. About 100 wood bridges have been constructed under this program since 1989. As a result of this work, AASHTO has accepted as a design guide the stress laminated wood bridge design criteria which are available from the National Timber Bridge Information Center, Morgantown, WV.

High Performance Level Bridge Rail Tests for Wood Bridges

FHWA and the Forest Service are funding crash tests for bridge railing attached to wood bridges for performance levels I and II (low to medium roads.)

Traffic

Traffic Surveillance and Analysis

A final report will soon be issued that evaluates currently available technology for low volume road

traffic surveillance and counting. Report should be available November 1995.

Sign Expert System

This CTIP sponsored project will result in a personal computer (PC) based program using artificial intelligence (AI) 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. The software chosen for the project did not prove robust enough to perform all of the required tasks. Therefore, the final product is much more limited in scope and usefulness than was originally expected.

Low-Volume Road Signing

A final report for CTIP study H-13 "Evaluation of Traffic Control Devices for Low Volume Roads" was submitted to FHWA in December 1990. The report recommended changes to the MUTCD including the addition of a new class of highway, Special Purpose Roads, as defined by AASHTO. An ITE project also addressed the unique signing needs of low volume roads. The MUTCD is currently being reformatted and a new edition is expected to be published in late 1996. The NCUTCD committee is currently coordinating a separate chapter addressing Low-Volume Roads for inclusion in the 1996 edition of the MUTCD.

Road Traffic Accident Site Investigation Guide

This guide leads Forest Service employees through the accident investigation process by discussing when and where to investigate accidents, including preserving evidence, dispatching the proper investigation team in a timely fashion, interviewing those involved in the accident and witnesses, photographing and videotaping the accidents in the appropriate manner, cooperating with local law enforcement authorities, communicating accident details and causal factors through the Forest Service chain-of-command, preparing for litigation, and facilitating a team approach to road traffic accident site investigation. It presents hypothetical accident scenarios to illustrate potential problems facing investigators.

Monitoring Evolving Technology for Low-Volume Roads

Screen new ideas and use various communication 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 slope stability analysis and stabilization guide for forested areas. The three volume guide is coordinated with research and slope stability software programs developed by the Intermountain Station researchers for three levels of analysis for forested areas. The analysis levels are planning, project, and site specific. The guide, "Slope Stability Reference Guide for National Forests in the United States" EM-7170-13, August 1994, is an internal Forest Service Publication with limited distribution.

Geocomposite Drains

This CTIP funded project includes the installation and long term monitoring of geocomposite geotextile drains in the field. The drains will be installed in 1994 and 1995 and their performance monitored for a 5 year period.

Upgrading Retaining Wall Design

The objective is to develop a design guide for low height retaining walls for use on low-volume roads, including geo-textile reinforced walls. The guide will include design procedures, standard details, specifications, and costs. The guide will include designs that can be used directly by non-specialist designer on projects where low retaining walls are required in non-critical conditions. The guide, "Retaining Wall Design Guide" September 1994, FHWA-FLP-94-006 and FS EM-7170-114, will be available from the National Technical Information Center in 1995.

Demonstration of the Soil Nail Launcher

In July and August of 1992 the USDA Forest Service, with financial assistance from the Federal Highway

Administration, facilitated a demonstration in the western United States of launched soil nails for stabilizing failing road shoulders and cutslopes. The project included soil nailing of road shoulders, retaining walls, a cut bank, and a sand bank. The soil nail launcher is capable of rapidly inserting 18 foot long by 1.5 inch diameter steel nails into the ground for reinforcement using high pressure air gun. An "Application Guide for Launched Soil Nails" (FHWA-FPL-93-003 and FS EM 7170-12A, July 1994), and the "Project Report for Launched Soil Nails — 1992 Demonstration Project" (FHWA-FPL-93-004 and FS EM-78170-12B, July 1994) are available from the National Technical Information Service, Springfield, VA 22161. A limited number of the reports and the project video are available from the Forest Service. A second, longer term demonstration of the technology is being planned for 1995 and 1996 in conjunction with the Forest Service and the U.S. Army Corps of Engineers.

Operation and Maintenance

Maintenance Management Systems

This project report evaluates several different computer maintenance programs for low volume roads. Included are the National Park Service and Bureau of Land Management systems as well as several local variations from the Forest Service. A comparison chart enables managers to select the items that best fit their needs.

Commensurate Share Damage

This project involved the construction of a four section test track in the dry climate of Nevada. Intent is to determine the ratio of roadway deterioration attributable to heavy hauling vehicles, light vehicles and traffic with reduced tire pressures. Results point out that grade and alignment have considerable influence on relative road surface deterioration between heavy and light vehicles. The final report due in December 1994.

In-Place Road Reconditioning

This project will evaluate existing technology for the processing of aggregate materials on the surface of a roadway. One of the more promising pieces of equipment was located in New Brunswick, Canada and is mounted on a front-end loader. Geotechnical testing results and production rates will be included in the final report which is scheduled for completion in November 1995.

Road Closure and Obliteration

Throughout the Forest Service there has been a need to close and obliterate redundant and unneeded roadways. This project will examine the various techniques being employed by the agency and review their successes and failures. Included is an examination of the various treatments from simple closure and seeding to full recontouring of the roadway prism. Guidelines for estimating costs will also be included. Report anticipated in December 1995.

Projects Requested, Not Funded

- 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 wood bridges;
- Field performance of geocomposite drains;
- Logging road C&M video;
- Produce national user guide/expert systems:
 - Geotextile use with pavement,
 - Retaining Walls,
 - Drainage structures, and
 - Dust treatments;
- User cost estimator for roads;
- Effects of winter haul on pavement; and
- Stabilizing "boney" road surfaces.