2005 ANNUAL REPORT FOR THE MONTANA DEPARTMENT OF TRANSPORTATION RESEARCH PROGRAMS

FHWA/MT-06-001/8010-3

Annual Report

prepared for
THE STATE OF MONTANA
DEPARTMENT OF TRANSPORTATION

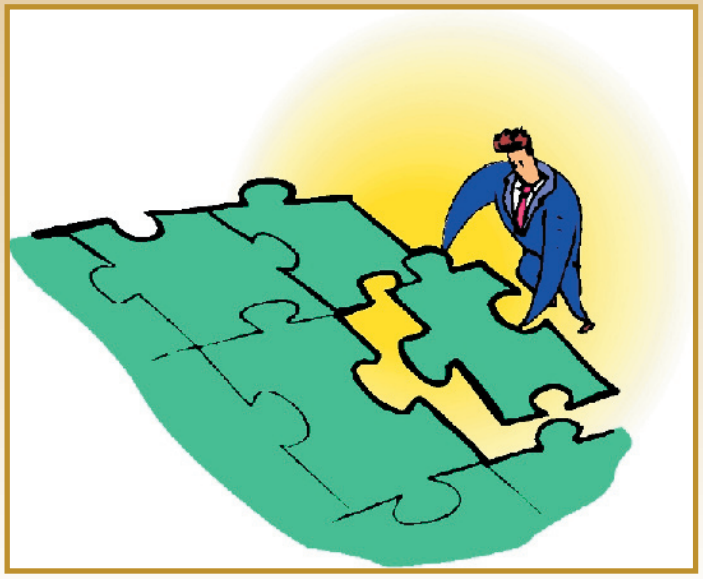
in cooperation with
THE U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

January 2006

prepared by

Susan C. Sillick
Craig Abernathy

Montana Department of Transportation



RESEARCH PROGRAMS

Montana Department of Transportation
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FFY 2005 ANNUAL REPORT
FOR THE MONTANA DEPARTMENT OF TRANSPORTATION
RESEARCH PROGRAMS

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15. Supplementary Notes Research performed in cooperation with the Montana Department of Transportation and the US Department of Transportation, Federal Highway Administration. This report can be found at http://www.mdt.mt.gov/research/docs/annual_report/2005.pdf.

16. Abstract

The Montana Department of Transportation (MDT) conducts research to discover, develop, or extend knowledge needed to operate, maintain, and improve the statewide multimodal transportation system. Specific goals include: evaluation and advancement of new technologies, materials and methods; development of design and analysis techniques; and study of current transportation challenges. The purpose of this report is to give an overall description of research, development, and technology transfer activities for federal fiscal year 2005 within the Research Programs of the Montana Department of Transportation (MDT). Through these activities the Research Programs enhances MDT's ability to deliver efficient and effective transportation services.

MDT's mission is to serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality and sensitivity to the environment. MDT'S Research Programs impacts each and every part of MDT's mission. Research projects completed in FFY 2005 yielded results that when fully implemented will improve: MDT efficiency and effectiveness, including cost-effectiveness, of MDT operations and technology transfer; increase sensitivity to the environment, including decreasing the release of pollutants to Montana's air and water from vehicle emissions, improving consideration of the health and survival of wildlife species during inspection and construction, and decreasing vehicle-wildlife collisions; improve safety by decreasing roadside hazards and through training and technology transfer; increase Montana's economic development and vitality through transportation projects and the encouragement of the development of Montana products; and improve the quality of what we do and how we do it, including bridge design and inspection, and materials testing and acceptance.

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ALTERNATIVE FORMAT STATEMENT

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1.0 INTRODUCTION

The purpose of this report is to give an overall description of research, development, and technology transfer activities for federal fiscal year 2005 within the Research Programs of the Montana Department of Transportation (MDT). Through these activities the Research Programs enhances MDT's ability to deliver efficient and effective transportation services.

Responsibilities of the MDT Research Programs include:

- Administer the Research portion of the State Planning and Research Program (SPR);
- Lead and participate in cooperative research efforts with other states, universities, industry, and other partners through pooled-fund and other cooperative research, development, and technology transfer efforts;
- Assist MDT staff in identifying and finding ways to meet research needs;
- Provide leadership for research, development, technology, and technology transfer initiatives within MDT;
- Conduct the Research and Experimental Projects Programs, and the Technology Transfer Program;
- Assist with the implementation of research results; and
- Project and program evaluation.

As with Janus, the Roman god who symbolizes change and transitions, such as the progression from past to future or of one vision to another, in taking a look back at where we have been, we are given a clearer view of where we are heading, continuously improving as we move forward.

2.0 RESEARCH PROJECTS

2.1 OVERVIEW

Once a year, the Research Programs Manager solicits research ideas from as wide a variety of individuals as possible. This open solicitation enhances the possibility of receiving a diverse sampling of research suggestions.

Before a problem statement can be prioritized, it must have a champion and a sponsor. A champion is internal to MDT, and is willing to support the problem statement to the Research Review Committee (RRC) and serve as the technical panel chairperson should the problem statement move forward to this stage. In doing this, the champion asserts there is a research need and this need is important to MDT. A sponsor is a District/Division Administrator or higher who agrees the research is important to MDT and is willing to ensure implementation occurs. Only problem statements with both a champion and sponsor move forward to the project prioritization stage.

The champions for each problem statement present their topic to the RRC and District Administrators for individual rating. Each member of these two groups rates every problem with respect to their overall worth (50%), timeliness (30%), and attainability (20%).

The RRC then reviews the ratings and comments, and selects the high priority topics for that solicitation cycle. These topics are chosen because they address actual concerns of the Department rather than topics of specific interest to individual researchers.

Following the selection of these high priority topics, Research Programs staff forms a technical panel for each topic. Technical panels are formed to follow research projects from inception through implementation. Technical panels are typically composed of three to ten people with knowledge or expertise, and interest in the specific area of research. Panel members are drawn from MDT's Division and District offices, as well as from outside the Department. The technical panel's responsibility begins with a review of the literature to determine the need for research, if any, and continues with the development of a viable research plan. This plan should include: what tasks need to be accomplished; how much time and money needs to be expended; who should perform the research; what are the barriers to implementation and how to reduce or eliminate these barriers; and what research products should be delivered to facilitate implementation. Final funding is approved by the RRC.

During and following the research, the Research representative on each technical panel serves as MDT’s project manager and liaison between the technical panel and the

consultant. The technical panel monitors research progress by reviewing quarterly, final, and any other reports produced by the principal investigator. Finally, the technical panel makes implementation recommendations to the appropriate MDT Administrator, through the RRC.

The research projects process as detailed above is shown in Figure 1. In addition to the solicitation process (as described above), there are a number of other methods to initiate research projects: Montana Partnership for the Advancement of Research in Transportation (MPART Small Projects), Wildlife and Fisheries Memorandum of Agreement (MOA), and Administration High Priority topics (Figure 1). MDT has contracts in place with both Montana State University and The University of Montana for small projects (<$25,000 and 1 year) under our MPART Small Projects agreement. If there is a need for a small project, such as a synthesis project, which includes a review of the literature and a survey of the state of the practice, similar to NCHRP synthesis projects, the below steps are followed:

- Champion notifies research of need;
- Technical panel is formed;
- Proposal is obtained;
- Technical panel recommends proposal for funding to RRC; and
- RRC approves or denies funding request.

Also, MDT has a MOA with both universities for the conduct of wildlife and fisheries research. A standing technical panel exists for these projects. As funding is available, the technical panel meets to determine needs and issues a RFP to both universities. The panel reviews proposals and recommends funding for the top proposals in each funding area. The RRC either approves or denies funding.

Finally, if MDT Administration identifies a research need that requires immediate attention, the Research Programs manager is informed, a technical panel is formed, and a proposal(s) is obtained and approved either by the RRC or Administration.

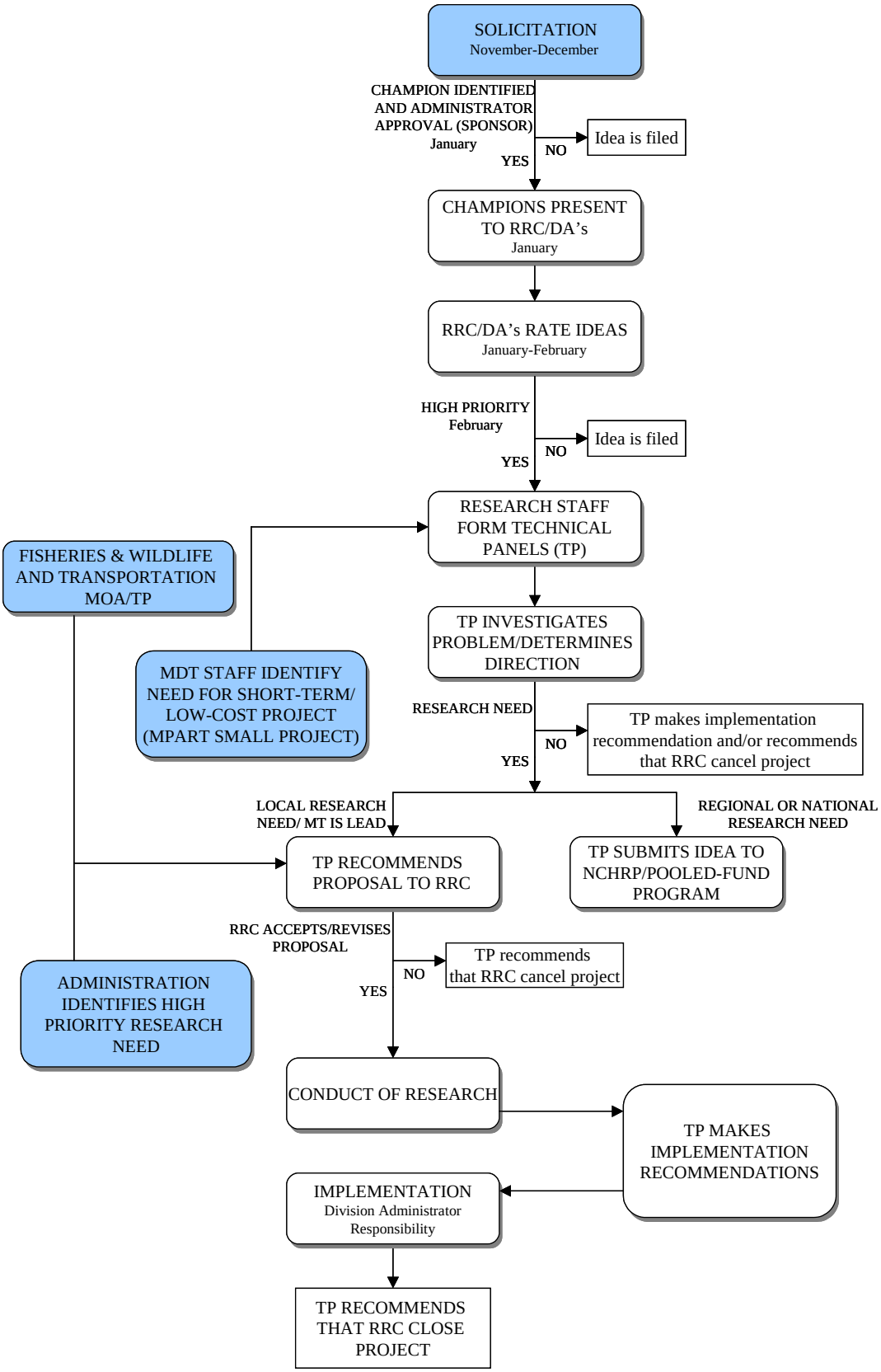

Figure 1: Research Projects Process.

2.2 ADMINISTRATIVE RESEARCH PROJECTS

2.2.1 Continuing Projects

2.2.1.1 Administration and Conduct of Research Programs

Project Number:	8010	Project Number:	8020
Start Date:	10/1/04	Start Date:	10/1/04
Completion Date:	9/30/05	Completion Date:	9/30/05
Total Cost:	$154,691	Total Cost:	$40,209
SPR Funds:	$154,691	SPR Funds:	$40,209
FFY 2005 Funds Expended:	$154,691	FFY 2005 Funds Expended:	$40,209
Status:	Continuing	Status:	Continuing

Objective:

The purpose of these two projects is threefold. The first part is to plan and administer the Research Programs and related research activities of the MDT in finding solutions to existing highway and transportation challenges in Montana. The second part is to manage, coordinate, and conduct a program to test and properly evaluate new highway materials, products, designs, methods, etc., for the ultimate purpose of improving highway performance; decreasing various highway costs; or of attempting to solve existing highway construction, rehabilitation, or maintenance problems in Montana. The third part is to plan and conduct a program of Technology transfer and to develop and maintain a knowledge and understanding of the latest highway research projects and programs.

Progress:

During FFY 2005, for the Research Projects Program, one solicitation cycle was completed, resulting in seven new research projects:

- Business Market Analysis;
- Compost Application for Optimized Vegetation Response;
- Design of a Vertical Shape Portable Concrete Barrier;
- Developing a One-Stop Shop for Public/Specialized Transportation Information in Montana;
- Evaluation of Fence Modifications to Exclude Deer and Elk from Highways;
- Field Evaluation of Passing-Lane Operational Benefits on Two-Lane Rural Roads in Montana; and
- Logistics and Marketing Research in Support of Container on Flatcar Shuttle Train on BNSF to Port of either Seattle or Tacoma.

Eight active research projects were completed:

- Bat Use of Bridges in South-Central Montana;
- Evaluation of Biodiesel Fuel: Phase II Field Test;
- Evaluation of the Engineering Characteristics of RAP/Aggregate Blends;
- Fish Passage at Road Crossings in a Montana Watershed: Phase I;
- High Performance Concrete: Phase III Development of Mix Designs;
- Montana Reconfiguration Study;
- Rockfall Hazard Classification and Mitigation System; and
- Soil Air Voids Method for Compaction Control.

Twenty projects are contracted and remain active:

- Animal-Vehicle Collisions and Habitat Connectivity along Highway 83 in the Seeley-Swan Valley: Phase I A Reconnaissance;
- The Association Between Landscape Features and Transportation Corridors on Movements and Habitat - Use Patterns of Wolverines;
- Comparative Analysis of Coarse Surfacing Aggregate using the Micro-Deval, L.A. Abrasion, and Sulfate Soundness Tests;
- Effects of Defensive Vehicle Handling Training on Novice Driver Safety: A Case Study in Lewistown, Montana Phase: I Preparation for Advanced Driver Training;
- Effects of Defensive Vehicle Handling Training on Novice Driver Safety: A Case Study in Lewistown, Montana: Phase II Advanced Driver Training;
- Evaluation of Organic Matter Compost Addition and Incorporation in Steep Cut Slopes: Phase II Test Plot Construction and Performance Monitoring;
- Evaluation Methods of Estimation of Bridge-Pier Scour for Streams with Coarse Bed Materials Based on Observed Scour in Montana;
- Evaluation of MDT's Research Project Solicitation, Prioritization, and Selection Processes;
- Evaluation of Wildlife Crossing Structures on US Highway 93 Evaro to Polson;
- Fish Passage at Road Crossings in a Montana Watershed: Phase II Passage Goals;
- High Performance Concrete: Phase II Field Evaluation of the Performance of Three Concrete Bridge Decks on Montana Route 243;
- Industry Best Practices for Applications Development Processes;
- MDT Ride Specification Review;
- Montana Air Service: Opportunities and Challenges;
- Motor Fuel Tax Evasion in the State of Montana;
- OJT Program Evaluation;
- Pavement Performance Prediction Models;
- Potential Effects of Highway Mortality and Habitat Fragmentation on a Population of Painted Turtles in Montana;
- Preventive Maintenance Treatments: a Synthesis of Highway Practice; and
- Warm Water Species Fish Passage in Eastern Montana Culverts.

In addition to the seven new research projects listed above, two projects are pending technical panel and Research Review Committee (RRC) review and approval:

- Development of Wildlife Crossing Structures for Small and Large Species and Analysis of their Effectiveness and
- Highway Project Cost Estimating Best Practices.

Finally, one project was cancelled:

- Evaluation of Mitigation Measures to Reduce Open-Range Livestock-Vehicle Collisions.

During FFY 2005, the Experimental Projects Program had two new formal experimental projects constructed. In addition, eight on-going field projects were visited, evaluated, and reports published. Finally, two new experimental projects have been nominated and are pending.

Reports/Training/Technology Transfer:

Research and experimental project progress and final reports were published on the Research Programs website (http://www.mdt.mt.gov/research/) and/or in hard copy.

Four quarterly newsletters were published (http://www.mdt.mt.gov/research/tech_trans/newsletters.shtml).

Guidelines were revised in FFY 2005 and published in early FFY 2006 (http://www.mdt.mt.gov/research/docs/rmuguide.pdf).

Library services training was provided to 60 MDT staff and others in seven different sessions. In addition, new publications continue to be cataloged in MDT's library system (http://www.mdt.mt.gov/research/unique/services.shtml).

Six Research Programs Overview presentations were given to MDT staff throughout the year.

A research project close-out questionnaire was developed and sent to all technical panel members at the completion of each research project. Results were compiled and disseminated with the ultimate goal of improving conduct and management of research projects.

The Research Programs Manager and the Experimental Projects Program Manager attended the Transportation Research Board Annual Meeting. In addition, the Research Programs Manager attended the National Research Advisory Committee Meeting, Oregon DOT Peer Exchange, NCHRP Performance Measures for Research Panel

Meeting, and the TRB State Representatives Meeting. The Research Manager gave a presentation on the Marketing of Research at the National Research Advisory Committee Meeting. Information from all meetings was disseminated to MDT staff as appropriate.

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2.2.1.2 Evaluation of Experimental Projects

Project Number:	8021
Start Date:	10/1/04
Completion Date:	9/30/05
Total Cost:	$16,764
SPR Funds:	$16,764
FFY 2005 Funds Expended:	$16,764
Status:	Continuing

Objective:

The purpose of this project is to provide a limited funding source for fieldwork involved in the inspection and evaluation of experimental projects and the conduct of research, where other funds are not appropriate or available.

Progress:

Field support for the evaluation of experimental projects was provided.

MDT Project Manager:

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2.2.1.3 Montana Local Technical Assistance Program (LTAP)

Project Number:	2443
Start Date:	7/1/04
Completion Date:	6/30/05
Total Cost:	$301,000
SPR Funds:	$59,000
Federal Funds:	$140,000
State Funds:	$100,000
Contractor Cost Share:	$2,000
FFY 2004* Funds Expended:	$301,000
Status:	Continuing
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/ltap/2005.shtml

* Note: The LTAP program is run on a state fiscal year. Hence, it is run nine months behind the federal fiscal year. FFY 2005 LTAP is currently active running from 7/1/05 to 6/30/06. Therefore, the FFY 2004 LTAP Program is presented here.

Objective:

The mission of the national Local Technical Assistance Program (LTAP) is to foster a safe, efficient, environmentally sound transportation system by improving skills and knowledge of local transportation providers through training, technical assistance, and technology transfer.

LTAP centers enable local counties, parishes, townships, cities and towns to improve their roads and bridge by supplying them with a variety of training programs, information clearinghouse, new and existing technology updates, personalized technical assistance, and newsletters.

Through these core services, LTAP centers provide access to training and information that may not have otherwise been accessible. Centers are able to provide local road departments with work force development services, resources to enhance safety and security, solutions to environmental, congestion, capacity and other issues, technical publications, and training videos and materials.

Montana has over 70,000 miles of roads in cities, counties, and highway districts. Montana LTAP has focused on assisting state and county road offices and city street departments in road and bridge maintenance and repair. By sharing technical information and improving the distribution of this information, the program promotes efficient use of local transportation agencies' scarce resources.

Specific LTAP tasks in FFY 2004 include: compile and maintain a mailing list, publish a quarterly newsletter, provide technology transfer materials, provide information and on-site technical assistance, conduct or arrange seminars/training sessions, program evaluation, and special projects (i.e., work zone safety guidelines and MUTCD primer).

Progress:

LTAP's mailing list continues to be updated. Four newsletters were issued. Technology transfer materials and technical assistance have been provided as requested. About 90 workshops/training sessions were given at various places throughout Montana (including: Work Zone Flagging Training and Certification, Gravel Road Maintenance, Forklift Operations and Certification, Loader Operations, School Bus Driver Training, PASER Training, Equipment Operator training, Snow Rodeo, MUTCD Training, Winter Maintenance, Winter Survival, Summer Survival, Full Depth Recycling, Spill Prevention, Technical Leadership, Risk Management and Loss Control, Emergency Management Signing, and Incident Management).

Reports:

Four quarterly progress reports were submitted and can be viewed at the above URL.

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2.2.1.4 Transportation Research Board Support

MDT Supports the Transportation Research Board (TRB) financially in two ways. Support of core services is provided through a pooled-fund study (see Section 4.0, http://trb.org/, and http://www.pooledfund.org/projectdetails.asp?id=300&status=6). The amount of funding is based on a triennium. For the current triennium, MDT paid $84,950 to support TRB core services. The National Cooperative Highway Research Program (NCHRP) is also supporting through research funds (see http://www4.nas.edu/trb/crp.nsf/reference%5Cappendices/NCHRP+Overview). The annual support amount is 5.5% of the total State Planning and Research (SPR) funds. For FFY 2005, support was provided in the amount of $338,172.

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2.2.2 Completed Projects

2.2.2.1 Evaluation of Biodiesel Fuel: Phase II Field Test

Project Number:	8117-22
Start Date:	12/1/03
Completion Date:	11/30/04
Total Cost:	$24,968
SPR Funds:	$20,178
Contractor Cost Share:	$4,994
FFY 2005 Funds Expended:	$4,475
Status:	Complete
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/env/biodiesel.shtml

Objective:

The purpose of the field test component of this research project was to provide a local example of biodiesel usage that could help in determining an appropriate course for biodiesel policy in the state. The field test consisted of a six-month test where a 20 percent blend biodiesel (B20) fuel was used in selected vehicles at two Montana Department of Transportation (MDT) maintenance facilities: Lolo South and Havre.

Progress:

All research was completed in FFY 2004. The final report was completed in FFY 2005.

Reports:

The final report can be found at the above URL.

Implementation:

The Montana Department of Transportation (MDT) was asked by the Transportation Committee of the Montana House of Representatives to initiate a research project focusing on the viability of using biodiesel as an alternative fuel in MDT's vehicle fleet. To undertake this study, MDT conducted this project in two phases: first, a review of relevant literature regarding the performance of biodiesel in motor vehicles; and second, a test application using a B20 blend (20 percent oilseed-based biodiesel, 80 percent conventional diesel) in select MDT vehicles housed in Missoula and three housed in Havre.

As a result of Phase II of this project, the 2005 Montana Legislature passed two bills encouraging the production and distribution of Montana produced biodiesel. Polices were developed using the research provided by the project, and the information gathered from the entire project was a major factor in the passage of these bills.

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2.2.3 Contracted Projects

2.2.3.1 Industry Best Practices for Application Development Processes

Project Number:	8117-25
Start Date:	5/5/05
Completion Date:	4/30/06
Total Cost:	$23,460
SPR Funds:	$0
State Funds:	$23,460
FFY 2005 Funds Expended:	$14,280
Status:	Contracted
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/projects/admin/app_dev.shtml

Objective:

The Industry Accepted Best Practices and Methodologies checklists, process metrics, and templates for each step of the software development life cycle (SDLC) are not readily available from one source, but could be cooperatively collected through numerous professional sources and Universities. This proposed research will involve the compilation and synthesis of this information as it pertains to the standard SDLC for MDT.

Progress:

This project is active with an anticipated completion date of 4/30/06. Progress is slightly behind schedule due to a change in the principal investigator. However, it is anticipated that this project will be completed on time.

Current MDT SDLC methodology has been studied and compared to industry practices. Details can be found in progress reports at the above URL.

Reports:

One progress report was received in FFY 2005. Reports can be found at the above URL.

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Contractor Project Manager:

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2.2.3.2 OJT Program Evaluation

Project Number:	8117-28
Start Date:	9/13/05
Completion Date:	4/30/06
Total Cost:	$18,315
SPR Funds:	$18,315
Contractor cost Share:	$3,663
FFY 2005 Funds Expended:	$0
Status:	Contracted
Contractor:	The University of Montana
URL:	http://www.mdt.mt.gov/research/projects/admin/ojt.shtml

Objective:

The Montana Department of Transportation needs information about the experiences of trainees from the MDT On-the-Job Training (OJT) Program. Obtaining this information is an important step in the MDT's process of monitoring the quality of the OJT program, and will enable MDT to report this information to the Federal Highway Administration and to the contracting community. Bureau of Business and Economic Research (BBER) at The University of Montana-Missoula will administer surveys of individuals involved with the OJT process to gather this information.

Progress:

This project is active and on schedule with an anticipated completion date of 4/30/06.

Progress reports were not due in FFY 2005.

Reports:

N/A

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Contractor Project Manager:

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2.2.3.3 Evaluation of MDT'S Research Project Solicitation, Prioritization, and Selection Processes

Project Number:	8117-29
Start Date:	9/13/05
Completion Date:	7/31/06
Total Cost:	$23,351
SPR Funds:	$23,351
Contractor Cost Share:	$4,670
FFY 2005 Funds Expended:	$0
Status:	Contracted
Contractor:	The University of Montana
URL:	http://www.mdt.mt.gov/research/projects/admin/research_eval.shtml

Objective:

The Montana Department of Transportation needs information about the research solicitation, prioritization, and selection processes used by peer Departments of Transportation from around the United States. Obtaining this information is an important step in the MDT's process of maintaining and improving the quality of its research processes. Bureau of Business and Economic Research (BBER) at The University of Montana-Missoula will review the web sites and hard copy publications of MDT's peer research organizations, conduct a web-based survey with key research staff in MDT's peer organizations, conduct in-depth interviews with selected key informants from MDT's peer organizations, and conduct in-depth interviews with selected key informants from within MDT to gather this information.

Progress:

This project is active and on schedule with an anticipated completion date of 7/31/06.

Progress reports were not due in FFY 2005.

Reports:

N/A

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2.2.3.4 Motor Fuel Tax Evasion in the State of Montana

Project Number:	8180
Start Date:	8/1/04
Completion Date:	3/1/06
Total Cost:	$193,204
SPR Funds:	$193,204
FFY 2005 Funds Expended:	$124,997
Status:	Contracted
Contractor:	Battelle
URL:	http://www.mdt.mt.gov/research/projects/admin/evasion.shtml

Objective:

The overall objective is to develop a comprehensive document to determine the origin, extent, and cost of fuel tax evasion in the state of Montana. Revenues from motor fuel are used primarily to support Montana's transportation system. Ensuring all motor fuel tax funds are collected, remitted, and credited to the Highway Special Revenue Account is a priority, but evasion of these taxes has proven to be a problem. Changes in legislation and increased enforcement and audit efforts have increased monies to the Special revenue account. However, the extent of the loss and the processes involving this loss of revenue from fuel tax evasion is not known in Montana. For the Montana Department of Transportation to efficiently direct its allocation of resources, it is imperative to determine the origin and extent of fuel tax evasion.

Progress:

The project is active and has been extended until 2/28/2006 for completion. The most significant issue is related to model development and data review. More specifically, the data required to perform the evasion analysis is currently being collected, reviewed, and quantified for inclusion into the tax evasion model. The project team has proposed a methodology for estimating evasion to the National Cooperative Highway Research Program (NCHRP) and is awaiting input on the proposal. Any model deployed in Montana would almost certainly benefit from the input we will receive from the NCHRP Panel and the Practitioner Review Team (PRT) that will be formed in order to review the proposal. Based on this input, refinements will be made to the final model, and this project would benefit from those refinements. The research team prepared a report explaining the suggested estimation methods and the data required from the Montana DOT to perform the analysis. The methodological approaches for estimating fuel tax evasion for the specific evasion techniques proposed for this analysis are: 1) the comparison of estimated consumption with taxed gallons, 2) audit and inspections analysis, 3) motor fuel tracking and 4) the supply and use approach. As part of the audit and inspections analysis, statistical sampling and tobit analysis are proposed.

Reports:

Four progress reports were received in FFY 2005 and can be viewed at the above URL.

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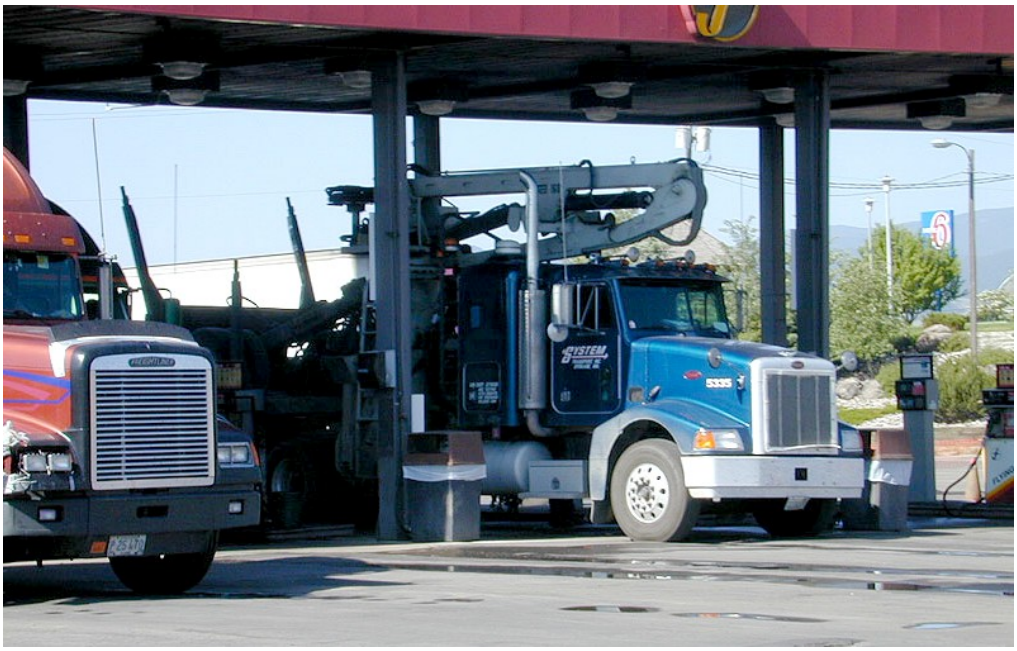

2.2.3.5. Montana Air Service: Opportunities and Challenges

Project Number:	8185
Start Date:	1/1/05
Completion Date:	3/31/06
Total Cost:	$199,567
SPR Funds:	$199,567
FFY 2005 Funds Expended:	$142,104
Status:	Contracted
Contractor:	Wilbur Smith Associates
URL:	http://www.mdt.mt.gov/research/projects/aer/air_challenges.shtml

Objective:

A historical framework and trend analysis will be followed by an assessment of the opportunities and challenges facing Montana in terms of growth and improvement in air service. Airport infrastructure needs, intermodal concerns, and long-range transportation policy issues will be identified as they relate to development of a strategy for air service enhancements. Finally, a statewide marketing strategy will be prepared that documents specific areas for improvements. The strategy will be clearly defined with responsibilities and potential costs assigned to implement the improvements in achieving a higher level of air service. The WSA Team plans to work closely with Montana Department of Transportation (MDT) to seek out and prioritize the top air service and air cargo opportunities in the State. Performance measures will be developed that can be used to monitored to monitor the performance of the strategy as changes occur in the future.

Progress:

To date the overview of Montana's air service including a presentation of the structure of current passenger airline service, review of activity, a report on air cargo on freight activity, and airport service trends for each of the 15 commercial service airports has been completed. Information such as enplanement trends, origin and destinations, fares, location, socioeconomic factors, current service, and historical trends are presented for each of the airports. The three specific federal initiatives and their impact on Montana's commercial air service: Essential Air Service (EAS), Federal Aviation Regulation (FAR) Part 139, and the Transportation Security Act (TSA) have also been summarized. A survey was developed, issued, and results compiled to garner information from the commercial service airports on their implementation of specific facets of Part 139 and TSA regulations. The survey also addresses components of the current health of the infrastructure at the State's commercial service airports, and provides information of the current intermodal activities and identifies potential opportunities for improved cargo operations.

Reports:

Progress reports can be viewed at the above URL.

MDT Project Manager:

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Contractor Project Manager:

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2.2.4 Pending Projects

2.2.4.1 Business Market Analysis

The below project scope of work is currently in draft format and is being reviewed by the technical panel before issuance of an RFP.

Purpose:

The purpose of this research is to initiate a study to determine what opportunities are available for a new or expanding business in Montana highway construction or consulting through the Montana Department of Transportation (MDT). The information provided by this research would help the DBE Supportive Services program within the Department inform subcontractors of these identified opportunities, individually or collectively at workshops.

It is for these reasons the Montana Departments of Transportation is initiating a research project to report on the most efficient and effective methods to inform and educate new and existing business's to compete and produce within the state of Montana through the procurement programs at MDT.

Tasks:

Through a review of literature, survey of the state's/province's practice, and available documentation (which may include interviews with relevant information providers and experts) report on national and state level efforts to provide information to prospective contractors/subcontractors working with the MDT to provide contractual services. The project will include, but not be limited to:

- Determine what opportunities are the friendliest for companies and what are the barriers to these companies to enter and compete in that field of work.

- Collect data on work types for current contractors (subs) working on MDT projects. Determine how many companies actively bid this work. Determine and explain the requirements of the contract work (equipment, bonding, insurance, expertise requirements, etc.).

- Determine DBE companies' areas of work that may be over concentrated and some of the problems they may have to face.

- Report on what barriers there are to new companies to encourage more participation.

- Review MDT's bid letting and construction program to ascertain any discrepancies in our contracting procedures regarding the inclusion of DBE companies.

- Develop a list of check items the DBE's, subs, and new contractors will need to compete with other contractors and to assure they fulfill their requirements.

- Devise a workable plan to educate subcontractors with better information to help them be successful when attempting to enter these Montana markets.

- Develop a statewide marketing strategy to improve the DBE contractor program in this state. Based on this strategy, develop a tracking program tied to reasonable performance measures to assist the Department in monitoring the effectiveness of the use of our DBE contractors. Devise a work plan and responsibility centers to support the implementation based on the output of said performance measures.

MDT Project Manager:

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2.3 BRIDGE AND HYDRAULICS RESEARCH PROJECTS

2.3.1 Completed Projects

2.3.1.1 High Performance Concrete: Phase III Development of Mix Designs

Project Number:	8156-003
Start Date:	1/1/05
Completion Date:	12/31/05
Total Cost:	$218,655
SPR Funds:	$218,655
FFY 2005 Funds Expended:	$6,869
Status:	Completed
Contractor:	Wiss, Janney, Elstner Associates, Inc.
URL:	http://www.mdt.mt.gov/research/projects/mat/high_concrete.shtml

Objective:

Concrete bridge decks in Montana are subjected to severe service conditions. Potential deterioration mechanisms include corrosion of the reinforcing steel and scaling of the concrete surface resulting from deicing salt applications, freezing and thawing distress, cracking due to thermal and humidity extremes during and after construction, and materials-related problems. To maximize the useful life of the structures, the concrete used in bridge decks constructed in Montana must be durable and impart durability to the bridge deck structure. This investigation was conducted to determine how best to achieve this objective, through the development of high performance concrete (HPC) mixtures based on materials available in Montana.

Design and implementation of an HPC for durability poses some specific challenges. Optimizing HPC for durability typically requires the use of supplementary cementitious materials (SCM's) that can both improve workability and beneficially modify the structure of the cementitious paste. Despite these benefits, the number of materials involved increases the complexity of batching, mixing, and placing the final concrete. In addition, since some of these supplementary materials are by-products of other industries, their properties can be inherently variable due to the limited production control involved in their manufacture. Therefore, generalizations about the best combination of SCM's cannot be made. Rather, the most effective solution must be uniquely determined based on locally available materials.

Progress:

The final report and project summary can be found at the above URL.

Implementation:

This research has established a solid base to begin implementing HPC deck mixtures in appropriate areas of the state where batching procedures and deck placement can be monitored for correct application and quality control. Since HPC is a relatively new practice in Montana, working with concrete producers and contractors in the use of these new mix designs will be imperative. The success of implementation will be realizing the same performance in the field as was seen in the laboratory results.

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2.3.2 Contracted Projects

2.3.2.1 Evaluation Methods of Estimation of Bridge-Pier Scour for Streams with Coarse Bed Materials Based on Observed Scour in Montana

Project Number:	8154
Start Date:	7/1/00
Completion Date:	12/31/06
Total Cost:	$295,800
SPR Funds:	$147,900
Contractor Cost Share:	$147,900
FFY 2005 Funds Expended:	$12,995
Status:	Contracted
Contractor:	United States Geologic Survey
URL:	http://www.mdt.mt.gov/research/projects/hyd/bridge_scour.shtml

Objective:

The overall objective of the proposed project is to improve pier-scour estimates at bridges in Montana. To this end, the proposed project has two major components. The first component is an analysis of existing bridge-scour data in Montana and adjacent mountain states similar to the comparison study done on a national basis. The second component of the proposed project is a long-term pier-scour data collection program for bridges over coarse-bed streams throughout Montana. The goal is to obtain on-site pier-scour measurements at selected sites per year over a 5-year period.

Progress:

This project is active and on schedule with an anticipated completion date of 12/31/06.

Scour measurements have been taken and data has been analyzed each year.

Reports:

One progress repost has been received and can be viewed at the above URL.

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Contractor Project Manager:

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2.3.2.2 High Performance Concrete: Phase II Field Evaluation of the Performance of Three Concrete Bridge Decks on Montana Route 243

Project Number:	8156-002
Start Date:	2/12/02
Completion Date:	2/28/06
Total Cost:	$301,400
SPR Funds:	$253,400
Contractor Cost Share:	$48,000
FFY 2005 Funds Expended:	$22,000
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/mat/high_concrete.shtml

Objective:

The objective of this project is to investigate the performance of three different types of concrete bridge decks. First, a conventionally reinforced deck made with standard concrete, designed and constructed following standard practices of MDT's Bridge Bureau. Second, a deck with reduced reinforcement made with normal concrete, designed following the empirical design approach presented in the AASHTO LRFD Specifications for Highway Bridges and constructed following standard practice. Lastly, a conventionally reinforced deck made with high performance concrete (HPC) developed following FHWA guidelines.

Progress:

Approximately 25 months of long-term data has been collected from selected sensors in each of the bridge decks. All the active long-term sensors continue to provide measurements once every hour. The long-term strain data is currently being analyzed to determine temperature related effects on the performance of each of the bridge decks. The second (and final) set of live load tests were conducted. Data collected during these tests is currently being analyzed and will be summarized in the final report. A comprehensive analysis of all data collected through the second live load test is underway. Data will be analyzed to identify differences in performance between the three deck types. Long term strain data and the second live load test data will be studied and summarized. This project has been extended with an anticipated completion date of 3/01/06.

Reports:

Four progress reports have been received and can be viewed at the above URL.

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Contractor Project Manager:

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2.4 ENVIRONMENTAL RESEARCH PROJECTS

2.4.1 Completed Projects

2.4.1.1 Bat Use of Highway Bridges in South-Central Montana

Project Number:	8159
Start Date:	3/28/02
Completion Date:	6/30/05
Total Cost:	$55,604
SPR Funds:	$55,604
FFY 2005 Funds Expended:	$9,837
Status:	Complete
Contractor:	Montana Natural Heritage Program

URL: http://www.mdt.mt.gov/research/docs/research_proj/bat/final_report.pdf

Objective:

The purpose of this research was to quantify the frequency of bridge use by bats in a relatively small portion of Montana, with the added goals of determining 1) bridge attributes that make structures more attractive to bats, 2) bridge attributes that contribute to their use as night roosts versus day roosts, and 3) features of the surrounding landscape (cover types) that might correspond to bridge use by bats. Additional benefits provided by this research are the identity of specific highway structures currently or recently used by bats and the provision to MDT biologists and engineers of field-tested techniques applied in Montana for determining bat use during routine inspections of bridges and culverts. This information will prove useful for future surveys of highway structures and contribute to the conservation of bat roosting habitat in the state.

Progress:

This project is complete.

Reports:

The final report can be viewed at the above URL.

Implementation:

Training will be provided on the results of the research to MDT staff at the Spring 2006 Highways and Engineering Conference.

MDT Project Manager:

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Contractor Project Manager:

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2.4.1.2 Fish Passage at Road Crossings in a Montana Watershed: Phase I

Project Number:	8160
Start Date:	10/3/01
Completion Date:	2/28/05
Total Cost:	$119,571
SPR Funds:	$119,571
FFY 2005 Funds Expended:	$13,958
Status:	Complete
Contractor:	Montana State University

Project URL: http://www.mdt.mt.gov/research/projects/env/fish_passage.shtml

Objective:

Providing adequate fish passage through culverts has been a topic of growing concern for fisheries biologists, engineers, and hydrologists over the last two decades. Previous studies of fish passage in culverts have focused primarily on the blocking or delaying of upstream spawning runs of large migratory adult salmonids. Movement of all species and life stages must be considered in developing and evaluating culvert passage design criteria.

A comprehensive assessment of culverts is necessary in order to prioritize sites for maximizing fish passage improvement. In this study, a tiered approach was used, combining assessments made using FishXing and a flowchart-based screening tool, species abundance, size structure, and presence above and below culverts, and direct assessment using marked individual fish to assess fish passage at culverts throughout a large drainage basin.

Progress:

This project is complete.

Reports:

The final report can be viewed at the above URL.

Implementation:

The results of this research have are being used on an operational basis by MDT's Hydraulics Section and Environmental Services Bureau.

MDT Project Manager:

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Contractor Project Manager:

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2.4.2 Contracted Projects

2.4.2.1 Evaluation of Wildlife Crossing Structures on US Highway 93 Evaro to Polson

Project Number:	1744
Start Date:	2/9/02
Completion Date:	6/30/06
Total Cost:	$597,700
SPR:	$147,700
Federal:	$450,000
FFY 2005 Funds Expended:	$53,073
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
Project URL:	http://www.mdt.mt.gov/research/projects/env/wildlife_crossing.shtml

Objective:

In December 2000, the Confederated Salish and Kootenai Tribes (CSKT), Federal Highway Administration (FHWA), and Montana Department of Transportation (MDT) agreed to reconstruct 90km of US Highway 93 on the Flathead Indian Reservation, Montana. The reconstruction discussions and plans focused on improving driver safety and preserving the natural and cultural heritage of the CSKT.

The plans include 41 wildlife crossing structures to provide safe animal passage under, and in one case over, the highway. In addition, there will be 15 km of wildlife exclusion fencing to reduce animals from accessing the roadway and to funnel movements to these crossings, at an estimated cost of $9 million for all of these installations. This effort is unprecedented in North America and provides an opportunity to study the effectiveness of wildlife crossing and fencing structures in a landscape that accommodates not only wildlife, but also agricultural, residential, business, recreational, and cultural activities.

The Western Transportation Institute (WTI) at Montana State University is evaluating the effectiveness of the US 93 wildlife crossing structures and developing best management practices that can be applied to future projects. The goal of the evaluation is to quantify the effect the mitigation efforts have on the following two parameters: 1) animal-vehicle collisions and 2) wildlife movements across US 93, with a focus on deer species and black bear. Effectiveness will be defined *a priori* and will ultimately be determined based on a comparative analysis of pre- and post-construction animal-vehicle collisions and animal crossings of the highway.

Progress:

Phase I, or pre-construction base-line data collection, began in 2002; the Phase I final report will be delivered to MDT by June 30, 2006. Descriptions of the ten Phase I tasks, and progress toward each task follow:

- TASK 1—Project Management, Coordination and Reporting: This task includes on-going oversight of administrative tasks, subcontracts, personnel, databases, and reporting and will continue until Phase I is completed.
- TASK 2—Animal-Vehicle Collision Database: WTI has been working with MDT to obtain Montana Highway Patrol animal-vehicle collision reports and MDT Maintenance carcass removal reports to add to the existing 10-year dataset of wildlife-vehicle mortalities in this area. This task is 95% complete (waiting on July-December 2005 data), and the pre-construction data will be summarized for the final pre-construction report.
- TASK 3—Tracking Bed Methods to Estimate Animal-Road Crossing Rates: WTI is quantifying preconstruction wildlife approaches and crossings of US 93 by monitoring sand tracking beds randomly placed along sections of road that will have the longest sections of wildlife fencing with the most concentrated placement of crossing structures. Preconstruction field data collection was completed in October 2005; results will be summarized in the final preconstruction report.
- TASK 4—Field Methods and Safety Protocol Handbook: The purpose of the handbook is to train personnel to safely work in the field and to ensure that standardized data collection and database management methods are applied throughout the duration of the project. WTI delivered a draft Handbook to MDT for review in April 2005, and will include the revised Handbook in the final preconstruction report.
- TASK 5—Summary of Literature and Existing Data: WTI has been collecting literature and existing data relevant to this evaluation project. A draft chapter of the literature review was delivered to MDT in October 2005 and the findings will be summarized in a chapter in the final preconstruction report.
- TASK 6—Define Measures of Effectiveness (MOEs): WTI will establish MOEs based on published literature, expert opinion, and transferability to other wildlife crossing structure and fencing mitigation projects. MOEs will be tied to the data collection techniques and analyses and will integrate biologically and statistically important factors to define how the results of the study will be interpreted in terms of changes in AVC and animal crossing rates. Draft MOEs will be delivered to MDT in the spring of 2006 and the final MOEs will be included in the final preconstruction report.
- TASK 7—Final Integrated (Pre- to Post-construction) Monitoring Plan: Because the pre-construction data collection protocols and MOEs set the course for post-construction monitoring, WTI will include a chapter in the final report specifying

how the pre- and post-construction methods are integrated, including an outline of the post-construction monitoring methods and required resources.

- TASK 8— Environmental Streamlining Design and Monitoring Case Study: WTI has been following the progress of the Technical Design Committee in order to document the lessons learned throughout the design discussions. A draft case study will be delivered to MDT in the spring of 2006 and the final will be included in the final preconstruction report.
- TASK 9—Pre-construction Black Bear Movement and Genetics Study: WTI subcontracted with a University of Montana graduate student, who conducted a master's thesis research project on black bear movements and genetic connectivity across US 93 in the focal study area. This thesis was completed in the spring of 2005; results will be summarized in a draft chapter that will be delivered to MDT in the spring of 2006; revisions will be incorporated into the final preconstruction report.
- TASK 10—Final Synthesis Report: This task involves integrating all of the above products into one report, including a final chapter synthesizing the preconstruction efforts, results, and recommended next steps for post-construction monitoring.

Reports:

Four quarterly progress reports have been received this federal fiscal year and can be viewed at the above URL.

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Contractor Project Manager:

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2.4.2.2 Potential Effects of Highway Mortality and Habitat Fragmentation on a Population of Painted Turtles in Montana

Project Number:	8169
Start Date:	4/15/02
Completion Date:	12/31/04
Total Cost:	$178,624
SPR Funds:	$178,624
FFY 2005 Funds Expended:	$30,791
Status:	Contracted
Contractor:	The University of Montana
Project URL:	http://www.mdt.mt.gov/research/projects/env/turtle.shtml

Objective:

Highways and other road systems can present problems to wildlife populations by decreasing habitat quality, increasing habitat fragmentation, altering animal behavior, and also through direct highway mortality. U.S. Highway 93, a major north-south highway that bisects a network of wetlands, will be reconstructed which may include some areas of expansion from 2 to 3 lanes. This reconstruction project has the potential to fragment wildlife populations. Semi-aquatic turtles are especially vulnerable to fragmentation because they have limited abilities to move effectively between isolated patches though they use terrestrial landscapes for nesting and seasonal movements.

Although the painted turtle (*Chrysemys picta*) is not listed as a threatened species wildlife managers, tribal biologists, and the general public have all expressed concern that highways create significant barriers to movement and sources of mortality for turtles, resulting in fragmented populations and lowered population viability. The issue of turtle road mortality has been raised at virtually every public meeting regarding the reconstruction project. Safety concerns were also raised due to automobiles braking and swerving as a result of turtles on the highway. Although freshwater turtles have presumably declined in abundance due to habitat loss and fragmentation, few quantitative studies of such a relationship have occurred. This research proposes to address the potential effects of fragmentation due to the highway on turtle populations and movements. This research also proposes to address management needs by providing information to decrease the perceived barrier of a highway via the design and placement of wildlife crossing structures.

Progress:

All research has been conducted. Project data will be analyzed and the final report written.

Reports:

Five progress reports have been received and can be viewed at the above URL.

MDT Project Manager:

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Contractor Project Manager:

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2.4.2.3 The Association Between Landscape Features and Transportation Corridors on Movements and Habitat - Use Patterns of Wolverines

Project Number:	8171
Start Date:	12/9/02
Completion Date:	3/31/06
Total Cost:	$199,972
SPR Funds:	$199,972
FFY 2005 Funds Expended:	$61,495
Status:	Contracted
Contractor:	The University of Montana

Project URL: http://www.mdt.mt.gov/research/projects/env/wolverines.shtml

Objective:

The indirect impacts associated with road improvements on wolverine are not understood, nor do we understand how roads and highways impact connectivity among populations. Until we gain a clearer understanding of how wolverine traverse landscapes, highway planners will be unable to design effective mitigation. Wolverine are capable of moving long distances. It is assumed, from the first principles of conservation biology that dispersal among wolverine populations is critically important for maintaining population connectivity and viability. Roads and highways may block or restrict the movements of forest carnivores, but actual data are lacking. The degree to which road improvements and travel corridors impact forest carnivores likely depends on road width and design, topography, and traffic patterns. For instance, road improvements in such areas as mountain passes may have large impacts on carnivore movements. This assumption, however, is based on untested assumptions concerning how carnivores navigate mountainous terrain. If wolverine follow the crest of mountain ranges and they are strongly funneled into specific areas by topographic constraints, then a specific road improvement project in the "wrong" place could negatively impact populations. However, if wolverine move randomly through the landscape, then site-specific mitigation (overpasses, underpasses, etc.) would be ineffective.

The goal of this research is to assess wolverine movements relative to vegetation type, topography, roads, and streams. Specific objectives are to: 1) Characterize wolverine movement paths and test the hypothesis that observed movement paths are non-random relative to vegetation type, topography, streams, roads, and putative linkage zones; 2) Evaluate movement patterns outside of home ranges and compare these to within-home range movement patterns; and 3) Provide observations concerning fine-scale response of wolverine to transportation corridors and putative linkage zones.

Progress:

All research has been conducted. Project data will be analyzed and the final report written.

Reports:

Five progress reports have been received and can be viewed at the above URL.

MDT Project Manager:

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2.4.2.4 Evaluation of Organic Matter Compost Addition and Incorporation in Steep Cut Slopes: Phase II Test Plot Construction and Performance Monitoring

Project Number:	8176
Start Date:	8/19/03
Completion Date:	12/31/06
Total Cost:	$118,007
SPR Funds:	$118,007
FFY 2005 Funds Expended:	$15,291
Status:	Contracted
Contractor:	Montana State University

Project URL: http://www.mdt.mt.gov/research/projects/env/organic_matter.shtml

Objective:

Fundamental to successful revegetation of highway corridors following disturbance is the creation of a growth environment conducive to the establishment and early survival of the seeded plants. Steep cut slopes present a unique problem. The steepness of cut slopes prevents practical replacement of salvaged topsoil with conventional equipment. The current remedy is simply to broadcast seed and hydromulch the bare slope. These techniques all too often result in marginal plant establishment since germination and initial seedling survival is limited by nutrient poor, rocky substrates characteristic of cut slopes. The resulting poor vegetation establishment leads to increased erosion and sedimentation, occasional slope failure, increased noxious weed growth, and low aesthetic quality. All of these factors except the latter can be expected to substantially increase maintenance costs in the affected areas.

Several types of geologic parent material have been identified in Montana that causes recurrent maintenance problems for MDT when encountered on steep cut slopes. Alluvial rock, glacial till, and marine shale are exposed in road cuts in many areas within the State. Glacial till and alluvial rock are common in western Montana while marine shale is common in eastern Montana. In all three cases limited vegetation has developed following seeding into nutrient poor parent material. Significant erosion has resulted, especially from the glacial till and marine shale deposits. Roadside ditches have become clogged with eroded sediment leading to increased maintenance costs and long-term concern for road base stability. Road base aggregate can become saturated as drainage ditches fail to operate properly leading to frost heaving of bituminous overlays. Amendment of steep cut slopes with organic matter may lead to improved vegetation condition, decreased erosion, and reduced maintenance cost.

The objectives of Phase II are to: 1) construct test plots on steep highway cut slopes with erosive and/or poorly vegetated parent material; 2) evaluate equipment and develop protocols for application and incorporation of compost on steep cut slopes; 3) monitor

and evaluate test plots on steep highway cut slopes; and 4) communicate, report and provide technology transfer of the research findings.

Progress:

Monitoring of field sites near Miles City and Happys Inn is on schedule. Strong vegetation growth was exhibited on all compost treatments. Limited vegetation development occurred on the control plots without compost. The Happys Inn research sites are dominated by the seeded species. The Miles City research sites exhibit a mixed vegetation community including both weedy and seeded species. The greater abundance of undesirable species at the Miles City site is potentially attributable to drought conditions observed during the first growing season (2004). Successful revegetation using compost has now been demonstrated on 4 different parent materials on all compost treated plots under two dissimilar climatic regimes. The degree to which the treatments differ from each other and from the control plot will be statistically demonstrated at the end of the research project when all data is summarized, however profound differences in vegetation response and erosion control between the compost treated plots and controls without added organic amendment are readily apparent.

Reports:

Four progress reports have been received and can be viewed at the above URL.

Notes:

A Phase III project has been moved forward to the technical panel stage as a pending project. The Technical Panel has not met yet.

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2.4.2.5 Animal-Vehicle Collisions and Habitat Connectivity along Highway 83 in the Seeley-Swan Valley: Phase I

Project Number:	8177
Start Date:	5/19/04
Completion Date:	3/31/06
Total Cost:	$65,580
SPR Funds:	$65,580
FFY 2005 Funds Expended:	$31,233
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
Project URL:	http://www.mdt.mt.gov/research/projects/env/seeley.shtml

Objective:

The Seeley-Swan Valley in northwestern Montana is part of the Northern Continental Divide Ecosystem (NCDE) and home to rare and endangered species such as grizzly bear (*Ursus arctos*), Canada lynx (Lynx canadensis) and bull trout (*Salvelinus confluentus*). The valley is bisected by US Highway 83, a road known for its great number of animal-vehicle collisions, especially with white-tailed deer (*Odocoileus virginianus*). For some species such as the grizzly bear, the road is also considered a barrier to their movements between the wilderness and multiple use forest areas on either side of the road. The Montana Department of Transportation (MDT) would like to take a proactive approach and reduce the number of animal vehicle collisions on Highway 83. At the same time, MDT would like to improve habitat connectivity and reduce the barrier effect of the road for selected species.

The purpose of the proposed project is to produce a concrete implementation plan for mitigation measures aimed at reducing animal vehicle collisions and improving habitat connectivity for selected specie along Highway 83. Input and feedback from natural resource management organizations and the local community characterize this proposal. It is aimed at producing an effective implementation plan that has broad support from natural resource management agencies as well as the local community.

The research is divided into 4 phases. Phase 1 (this project) is aimed at acquiring information and at identifying potential additional research and resource needs. With this information, mitigation strategies and options will be formulated in phase 2, and phase 3 is aimed at consensus building with natural resource management agencies and the local community. This should ultimately lead to a concrete and effective implementation plan that has broad support (Phase 4).

Progress:

All research is complete. The final report is in review.

Reports:

Two progress reports have been received and can be viewed at the above URL. The final report is in the final stages of review.

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2.4.2.6 Fish Passage at Road Crossings in Montana Watersheds Providing Bull and Cutthroat Trout Habitat: Phase II Passage Goals

Project Number:	8181
Start Date:	8/23/04
Completion Date:	6/30/07
Total Cost:	$149,166
SPR Funds:	$149,166
FFY 2005 Funds Expended:	$67,936
Status:	Contracted
Contractor:	Montana State University

Project URL: http://www.mdt.mt.gov/research/projects/env/fish_passage.shtml

Objective:

Culverts are a common and often cost effective means of providing transportation intersections with naturally occurring streams or rivers. Fish passage and fish habitat considerations are now typical components of the planning and design of waterway crossings. Many culverts in Montana span streams that support diverse fisheries. The health of these fisheries is an essential element of a recreational industry that draws hundreds of thousands of visitors to Montana annually. Transportation system planners, designers, and managers recognize that fish passage through Montana's culverts is a concern. However, there is much contention concerning the impact that a culvert can have on a fishery. Recent basin-wide studies in Montana (Phase I of this project - final report in November 2004 (see above URL)) indicate the tools that some planners and designers promote for forecasting fish passage concerns may be overly conservative. This is reflected in the diversity of fish passage goals being considered by state agencies in the Northwest. Some managers contend all culverts should pass all fish at all times, whereas others suggest this is an unrealistic criterion, particularly during high flow events. Which species, life stages, and how many individuals must have fish passage access for how long, are questions that are often brought forward during discussions on the design and retrofitting of culverts to accommodate fish passage concerns. The problem is that for fish species and settings in Montana, the timing and number of fish that must pass a culvert to maintain viable species diversity in the watershed is unknown. The primary objective of this study is to determine the rate and timing of fish passage in culverts that is desirable for species diversity maintenance.

Progress:

Equipment has been purchased and tested. Sites have been selected. Methodologies have been finalized. Finally, fish passage and hydraulic data have been collected.

Reports:

Four progress reports were received in FFY 2005 and can be viewed at the above URL.

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2.4.2.7 Warm Water Species Fish Passage in Eastern Montana Culverts

Project Number:	8182
Start Date:	8/23/04
Completion Date:	6/30/07
Total Cost:	$185,846
SPR Funds:	$185,846
FFY 2005 Funds Expended:	$67,780
Status:	Contracted
Contractor:	Montana State University
Project URL:	

http://www.mdt.mt.gov/research/projects/env/fish_passage_warm.shtml

Objective:

Culverts are a common and often the most cost effective means of providing transportation intersections with naturally occurring streams or rivers. Fish passage and fish habitat considerations are now typical components of the planning and design of waterway crossings. Many culverts in Montana span streams that support diverse fisheries. The health of these fisheries is an essential element of a recreational industry that draws hundreds of thousands of visitors to Montana annually. Additionally, there is growing recognition of the value of native Montana species, some of which are considered 'species of special concern' in the state. In recent years these concerns have become apparent for warm water species in low gradient, high sediment bearing, intermittently flowing streams that are typical of eastern Montana.

Transportation system planners, designers, and managers recognize that fish passage through Montana's culverts is a concern. However, there is much contention concerning the impact a culvert can have on a fishery. Recent basin-wide studies of various trout species we conducted in western Montana indicate the tools some planners and designers promote for forecasting fish passage concerns may be overly conservative. Which species, life stages, and how many individuals must have fish passage access for how long, are questions that are often brought forward during discussions on the design and retrofitting of culverts to accommodate fish passage concerns. The problem is that for warm water fish species and settings in eastern Montana, the timing and number of fish that must pass a culvert to maintain viable species diversity in the watershed is unknown, and the physiologic abilities of these species relative to such common fish passage questions are often unknown.

The primary objective of this study is to determine the rate and timing of fish passage in culverts that is desirable for warm water species diversity maintenance in eastern Montana.

Secondary goals are to discover fish passage issues for these species that may not be predicable from hydraulic analysis and to refine information about the physiologic abilities of these species to pass through culverts.

Progress:

Equipment has been purchased and tested. Sites have been selected. Methodologies have been finalized. Finally, fish passage and hydraulic data have been collected.

Reports:

Four progress reports were received in FFY 2005 and can be viewed at the above URL.

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2.4.3 Pending Projects

2.4.3.1 Development of Wildlife Crossing Structures for Small and Large Species and Analysis of their Effectiveness

The following research problem statement was submitted. The Technical Panel met once in FFY 2005, is determining if a research need exists, and, if so, will develop a research plan.

Problem Statement:

Highways may pose at least two significant problems for animal populations either by fragmenting dependent habitat and thus isolating groups of individuals (both physically and potentially genetically) or by causing increased mortality as individuals attempt to cross these barriers. Numerous studies have attempted to develop techniques to mitigate for these problems. Most efforts have been directed toward problems associated with larger species (e.g., deer) since these cause the greatest economic impacts (with ~1.2 million accidents/yr) and loss of human life. In Montana, particularly the western portion, a large number of species are abundant and may cause similar losses, thus it is important to consider the problems that highways create for all wildlife populations. MDT has taken a proactive approach by incorporating many, potentially useful wildlife-friendly structures in current highway construction plans. It is imperative now to demonstrate the effectiveness of these attempts through monitoring efforts and to use this data to further refine such ideas.

Research Proposed:

Experiment I: Comparison of the effectiveness of four types of crossing structure. Four types of crossing structures for large species will be used on Hwy. 93 (Florence /north of the Stevensville Wye). Bridges will span Sweeney, N. Bass, and S. Bass Creeks, each constructed with wildlife paths under the bridge. The second type of structure will be a 35 m-long concrete bridge near Bass Ck. that will allow large animal movement underneath. Two large, dry underpasses are proposed which will have a natural floor and 2 (possibly 3) large corrugated culverts will be used to accommodate fish movement in permanent streams. The latter structures may also allow for deer movement if siltation occurs. We also propose to modify similar culverts scheduled for inclusion in Phase 5 (see below). We will monitor use of each structure employing 35 mm cameras, standard video cameras, and preferably use of state-of-the-art, real time video systems linked to my laboratory at the university. Deer (n=20+) and other mid-sized mammals will be ear tagged for individual identification. To compare movement patterns adjacent to the highway, and to assess relative use of these structures, versus

random highway crossing activity, we will place GPS collars on 5 deer. Crossing locations can be determined to an accuracy of <5 m.

Experiment II: Additional verification of culvert shelf effectiveness. Our earlier research demonstrated the effectiveness of culvert shelves in allowing small mammals to circumvent the barrier posed by a 4-lane highway. Incorporated tubes also proved very effective in providing a corridor for species that behaviorally avoid open environments. To verify the true utility of these structures it is important to distinguish between repetitive use by one individual, versus more general use by a number of individuals. Passive integrative transponder (PIT tag) technology should allow us to answer this question. Mammals will be live-trapped on both sides of 3 of 5 culverts containing shelves. Fifty individuals on both sides will be PIT tagged. Scanners mounted on each shelf will identify animal movement. Since we will know the identity of each individual (species, sex, age), we will be able to distinguish between dispersing juveniles and movement by established adults. Such information will be useful in identifying the demography of the population moving and will help determine the effectiveness of these structures in allowing for potential genetic exchange between populations.

Experiment III: Modification of large corrugated culverts for use by deer. Our previous research on large, corrugated culverts demonstrated that deer will move through such structures though difficulty is encountered by hooves on the slick, corrugated steel surface. We propose to develop and test a rubberized mat that will smooth out the corrugations and provide a hard, but resilient surface. Such mats can also incorporate structure (e.g., simulated rocks) that would be appropriate for ripple/pool development within the culvert if so desired. Such modifications will be proposed for Phase 5 culverts so that these changes can be incorporated in to engineering plans at the appropriate time.

Experiment IV: Importance of vegetative cover adjacent to wildlife structures. Since we will be able to begin this research immediately, it will be possible to study the importance of post-construction vegetative cover to animal use of these structures. We will work closely with MDT to test appropriate vegetation types for each structure.

Experiment V: Comparison of results obtained along Highway 93 South and those obtained along Highway 93 North. Though it will be a few years before research is conducted along Highway 93 North, our data will be collected in such a manner that a comparison can be made between the effectiveness of the "independent" wildlife structures in our study and those tied together by many miles of fencing in the North.

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2.4.3.2 Evaluation of Fence Modifications to Exclude Deer and Elk from Highways

The following research problem statement was submitted. The Technical Panel met twice in FFY 2005, is determining if a research need exists, and, if so, will develop a research plan.

Problem Statement:

Increasing deer and elk populations in Montana continue to pose hazards to motorists. Numerous fencing techniques have been developed to exclude wildlife from highways but their cost and concerns related to impairment of wildlife movements has prevented large scale use of these designs. There is a need to develop effective, low-cost fencing designs that utilize techniques to modify existing right-of-way fences to prevent deer and elk from crossing highways. By developing low cost game fencing alternatives, a larger number of high-risk areas could be fenced. In some areas, fencing the crest of a hill or other low-visibility section of highway might reduce risk sufficiently to allow deer and elk to cross nearby sections where visibility is greater. Likewise, if some degree of permeability could be designed in to these fences, wildlife would not get trapped inside rights-of way of fenced areas.

Research Proposed:

This project proposes to test the feasibility of excluding deer and elk from highways using fence designs we have developed to exclude deer and elk from high value pastures.

Preliminary results indicate modifications to existing fences costing as little as $600 per mile will prevent entry by deer and elk. By extending posts and adding various wire combinations to the extensions, a game-proof barrier is created.

Phase one of this project will identify fence effectiveness in controlled experimental situations. To compare the effectiveness of 5 fence designs, standard 4 strand barbed wire fence will be used to construct exclosures at 8 test sites. Each exclosure will be 9.75 meters by 9.75 meters and will replicate a true existing fence. Corner and brace posts will be constructed, with a 5 meter gap between each, and wires and fence stays will be added. Four exclosures will then be randomly modified to one of the four selected types, with the fifth left as a control. Modification 1 will consist of adding a single strand of 12 gauge high tensile wire between each existing wire and between the bottom wire and the ground. Three strands of 12 gauge high tensile wire will be added above existing wire to bring the fence height to a total of 1.83 meters. The second modification will be exactly as the first; except for the bottom 4 strands of high tensile wire will be electrified. Modification three will have 1.19 meter woven wire placed at ground level over the barbed wire, with three strands of 12 gauge high tensile wire strung above

existing wire to bring the total height to 1.83 meters. The fourth modification will have .99 meter woven wire placed at ground level over the barbed wire, with .81 meter woven strung above to bring the total height to 1.80 meters.

Twelve bales (approximately 400 kilograms) of high quality alfalfa hay will then be placed inside each exclosure as bait. Exclosures will be monitored weekly to determine if deer or elk entered them. Necessary repairs will be made to fences on a weekly basis, and hay will be replenished as needed. Any breach will be counted as a failure for that period of one week, and no breaches will count as a success. Any deer or elk entering will count as a breach.

Phase two of this project will field test the fence designs that have been identified as having potential in phase 1. These designs would be placed along selected areas of highway and motion activated cameras would be used to observe wildlife behavior and fence effectiveness in field conditions. During snow cover, researchers will monitor wildlife response using tracks.

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2.4.4 Canceled Projects

2.4.4.1 Evaluation of Mitigation Measures to Reduce Open-Range Livestock-Vehicle Collisions

The technical panel chosen to oversee this project determined that at this time no formal research is needed. This initial problem was deemed a topic to be debated by the Departments Administrative staff for possible solutions prior to any more discussion for research needs.
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2.5 GEOTECHNICAL, MATERIALS, AND PAVEMENTS RESEARCH PROJECTS

2.5.1 Completed Projects

2.5.1.1 Soil Air Voids Method for Compaction Control

Project Number:	8117-23
Start Date:	6/1/04
Completion Date:	10/31/05
Total Cost:	$21,797
SPR Funds:	$17,438
Contractor Cost Share:	$4,359
FFY 2005 Funds Expended:	$4,880
Status:	Complete
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/projects/mat/airvoids.shtml

Objective:

The primary objective of this study was to evaluate the suitability of the soil air voids method as a means of evaluating the quality of a compacted layer of soil in terms of desired engineering properties.

Progress:

This project is complete.

Reports:

The final, project summary, and implementation reports can be found at the above URL.

Implementation:

The research indicates MDT is the only state using the soil air voids method for compaction control. It also showed there was little control over the moisture content and no maximum allowable water content. Instead the Department is relying on the fact an oversaturated soil will not support construction traffic and this fact will limit the amount of water contractors use for compaction. The report also points to the fact the correct specific gravities must be identified for each soil in order for the zero air voids method to be used properly.

The Department has not encountered widespread troubles with the use of the air voids method to date and some Districts are hesitant to discontinue the method's use. This report was distributed to the District Construction Engineers and District Materials Supervisors for their comments. Headquarters personnel also met with all of them at a joint meeting to discuss the content of the report and the Zero Air Voids test methods future use. Several of the District representatives voiced their concerns with eliminating the methods use and pointed to the fact it has been successfully used for quite some time now with no documented failures directly attributable to the use of the Zero Air Voids for compaction control. They also felt requiring the use of proctors for all projects could potentially increase staffing needs. The meeting also brought out the fact all Districts use the proctor method for compaction control to some degree so it would not require as extensive of training as if a new test method was being introduced.

It was determined that the Zero Air Voids method is a proven tool for controlling compaction in instances when a proctor is not available or multiple materials are being mixed. The Materials Bureau will use this report in conjunction with the results of an ongoing study looking at the Department's Quality Assurance (QA)/ Quality Control (QC) program. The current compaction control specifications will be rewritten to reflect the findings of the two studies. It is anticipated this rewrite will reduce the use of the Zero Air Voids method of compaction control to instances when a proctor is not available or when an accurate proctor cannot be selected because of the mixing of materials.

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2.5.1.2 Evaluation of the Engineering Characteristics of Rap/Aggregate Blends

Project Number:	8117-24
Start Date:	6/1/04
Completion Date:	10/31/05
Total Cost:	$24,914
SPR Funds:	$19,981
Contractor Cost Share:	$4,983
FFY 2005 Funds Expended:	$10,296
Status:	Complete
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/projects/mat/rap_aggregate.shtml

Objective:

The primary objective of this research was to evaluate changes that occur in the engineering properties of granular soils (natural soils or crushed and screened aggregates) after they have been blended with RAP. The laboratory-testing program was oriented towards examining changes in engineering properties rather than the absolute engineering characteristics of RAP blends. The suitability of the RAP blends was evaluated in terms of significant changes observed in relatively easily measured and quantifiable properties. The primary engineering properties considered included compaction, gradation, strength, stiffness, permeability, and resistance to degradation.

Progress:

This project is complete.

Reports:

The final, project summary, and implementation reports can be found at the above URL.

Implementation:

This study was undertaken based on the fact other states limit the amount of RAP they allow to be blended with virgin aggregates to as little as 10%. These states are limiting the RAP content based on concerns the RAP/aggregate blends are not as permeable or do not provide the structural support of virgin aggregates. In the past MDT has routinely specified RAP/aggregate blends utilizing 50% or more RAP.

The report findings indicate permeability actually increases with increased RAP content, while the findings regarding the strength were mixed. Some strength measures decrease with increased RAP content, while others stay the same or increase slightly. These findings are based solely on laboratory tests.

MDT's Pavement Analysis Section has compiled a list of projects dating back to 1988 where a RAP/aggregate blend was used for construction of the surfacing section. A review of how the projects over 5 years old are performing will provide a true measure of the performance of these mixtures.

Personnel from the Materials Bureau will work with District personnel familiar with the projects to evaluate the performance of these projects. This evaluation will be used to determine whether the reduced strength characteristics shown in the study are translating into problems on the roadway. Problems with overall performance of these roadways have not been documented to this point. Based on this fact it has been determined the use of the RAP/aggregate blends will continue, as before, until the evaluation can be completed. Once the evaluation has been completed, a determination will be made whether further modifications to MDT practices other than those listed below are necessary.

At the time this study was initiated there was no guidance to MDT designers on allowable RAP percentages. This lack of guidance led to at least one project designed to use approximately 90% RAP/ 10% virgin aggregate, which resulted in a claim. The revised Surfacing Design Guidelines Memorandum issued in April 2005 established a maximum percentage of RAP at 60%. Further clarification establishing 50% RAP or less as the desirable percentage will be provided to designers through memorandum. This memo will also be used to make the designers aware of the concerns associated with the use of higher percentages of RAP. This memo will be issued once the field evaluation has been completed.

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2.5.1.3 Rockfall Hazard Classification and Mitigation System

Project Number:	8174
Start Date:	2/6/03
Completion Date:	10/31/05
Total Cost:	$438,091
SPR Funds:	$438,091
FFY 2005 Funds Expended:	$68,079
Status:	Complete
Contractor:	Landslide Technology
URL:	http://www.mdt.mt.gov/research/projects/geotech/rockfall.shtml

Objective:

The goal of this research project was to define the extent of rockfall conditions and to gather data to allow MDT to strategically plan a statewide rockfall mitigation program. The objectives of the program would be to 1) reduce the overall rockfall hazard to the motoring public, 2) manage the cost of rockfall maintenance, and 3) limit MDT's exposure to potential rockfall litigation. The system selected for implementation, and then customized and made suitable for Montana conditions and MDT protocols was the Rockfall Hazard Rating System (RHRS). The RHRS had been used by many states and is a nationally recognized rock slope management tool.

Progress:

The final report can be found at the above URL.

Implementation:

With the completion of the Rockfall Classification and Mitigation Project, MDT is in the process of implementing the results of the study to plan a statewide rockfall mitigation program. The objective of the program is to optimize the use of available funding to reduce the overall rockfall hazard to the motoring public.

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2.5.2 Contracted Projects

2.5.2.1 Preventative Maintenance Treatments: A Synthesis of Highway Practice

Project Number:	8117-26
Start Date:	5/15/05
Completion Date:	2/28/06
Total Cost:	$25,000
SPR Funds:	$20,000
Contractor Cost Share:	$5,000
FFY 2005 Funds Expended:	$12,446
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/pave/prevent_maint.shtml

Objective:

Preserving and maintaining Montana's transportation infrastructure is a necessary, but costly endeavor. To ensure that preventive maintenance and rehabilitation of flexible pavements is cost effective, periodic evaluations of various preservation treatments are necessary. Although studies have been conducted to evaluate timely and cost effective treatments, it is not known how these treatments enhance or extend pavement performance under Montana's climate, traffic loads, and soil conditions. Therefore, the primary objective of this study is to identify existing and emerging technologies that could be used to enhance or even replace current approaches used by the Montana Department of Transportation. An extensive review and synthesis of past and ongoing research is proposed to determine the current state of practice in regards to pavement preservation treatments (including methods and materials).

Progress:

This project is active with an anticipated completion date of 2/28/06. This project is approximately one month behind schedule.

Most of the relevant literature has been collected; however, the literature review will proceed through the remainder of this project. Synthesis of this literature has begun. A draft survey instrument was crafted to query listserv affiliates regarding pavement maintenance practices in their respective states.

Reports:

Four progress reports were submitted in FFY 2005. Reports can be found at the above URL.

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2.5.2.2 Comparative Analysis of Coarse Surfacing Aggregate using the Micro-Deval, L.A. Abrasion, and Sulfate Soundness Tests

Project Number:	8117-27
Start Date:	9/1/05
Completion Date:	9/30/06
Total Cost:	$23,323
SPR Funds:	$18,082
Contractor Cost Share:	$5,242
FFY 2005 Funds Expended:	$0
Status:	Contracted
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/projects/mat/coarse_aggregate.shtml

Objective:

Ensuring that quality aggregates are used in the construction of pavement structures is important. Standard tests are available to determine pertinent strength parameters to ensure that aggregates are both strong and durable. Only limited work has been done to compare the results from other standard tests, such as the L.A. Abrasion and Sulfate Soundness tests. Therefore, the primary objective of this study is to determine whether the Micro-Deval test can be used to replace the Sulfate Soundness tests. If successful, the Micro-Deval test will provide a more cost effective and reliable means to characterize the toughness and durability of Montana aggregates.

Progress:

This project is active with an anticipated completion date of 9/30/06.

Progress reports were not due in FFY 2005.

Reports:

Progress reports were not due in FFY 2005.

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2.5.2.3 Pavement Performance Prediction Models

Project Number:	8158
Start Date:	6/12/01
Completion Date:	9/30/06
Total Cost:	$518,907
SPR Funds:	$518,907
FFY 2005 Funds Expended:	$39,416
Status:	Contracted
Contractor:	Fugro-BRE
URL:	http://www.mdt.mt.gov/research/projects/pave/pave_model.shtml

Objective:

The overall objective of this research is to develop a design process and performance/distress prediction models that will enable the Montana Department of Transportation (MDT) to use mechanistic-empirical principles for flexible pavement design. The project involves a comprehensive performance monitoring and laboratory-testing program and spans a period of five years.

Progress:

This project is active with an anticipated completion date of 9/30/06.

The calibration/validation database has been updated. All performance monitoring activities have been completed and the Consultant has made suggestions for future monitoring by MDT. A third Superpave site was added to the factorial. Test results for this site were provided. Local calibration of models is in process.

Reports:

Nine progress reports have been received and can be viewed at the above URL.

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2.5.2.4 MDT Ride Specification Review

Project Number:	8179
Start Date:	7/1/04
Completion Date:	4/30/06
Total Cost:	$171,979
SPR Funds:	$171,979
FFY 2005 Funds Expended:	$94,407
Status:	Contracted
Contractor	Sierra Transportation Engineers

Project URL: http://www.mdt.mt.gov/research/projects/const/ride_review.shtml

Objective:

The purpose of this project is to review the MDT asphalt ride specification, compare it with current literature and state of practice, and provide implementation documents (Profiler Operations Manual, QC/QA Plan, revised "Method of Sampling and Testing (MT-422)", and revised "MDT Ride Specification for Flexible Pavement").

Progress:

All research is complete. The final report and implementation documents are in preparation.

Reports:

Ten progress reports have been received in FFY 2005 and can be viewed at the above URL. The final report and implementation documents are in preparation.

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2.6 PLANNING AND SAFETY RESEARCH PROJECTS

2.6.1 Completed Projects

2.6.1.1 Montana Reconfiguration Study

Project Number:	8164
Start Date:	4/15/02
Completion Date:	5/31/05
Total Cost:	$816,427
SPR Funds:	$816,427
FFY 2005 Funds Expended:	$4,196
Status:	Complete
Contractor:	Cambridge Systematics
Project URL:	http://www.mdt.mt.gov/research/reconfigstdy/

Objective:

Montana's residents, employers, and a host of public and private-sector stakeholders regard transportation in general, and highways in particular, as a critical factor for the state's current and future economic vitality. The Montana Department of the Transportation (MDT) initiated the Reconfiguration Study in response to this widespread interest in the economic benefits of improving Montana's highways and to comply with a resolution of the 2001 Montana Legislature that directed MDT to incorporate economic factors into its planning processes. The focus of highway improvement was placed on adding capacity to Montana's two-lane state highways. In order to assure that the study addressed a wide diversity of interests beyond those most directly involved in maintaining and improving the state's highways, MDT convened a steering committee (RSSC) that drew heavily from economic development agencies, chambers of commerce, local elected officials, and private businesses, as well as state and federal agencies charged with the stewardship of the state's highway infrastructure.

The original goal of this study was to evaluate the impact of reconfiguring Montana's two-lane highway network to a four-lane network on Montana's economy. The RSSC developed the following three objectives to achieve this goal: 1. Identify which transportation investments will benefit specific Montana industries; 2. Provide MDT with an analytical toolbox to evaluate economic development impacts of transportation improvements; and 3. Apply the analytical toolbox to quantify the economic impacts of transportation improvement scenarios as part of MDT's planning process.

The toolbox developed to accomplish these objectives became known as the Highway Economic Analysis Tool (HEAT). HEAT also provides a much more detailed understanding of the relationship between specific changes in highway capacity and economic development, provides data and models to quantify that relationship, and estimates the likely economic impacts of a range of highway improvements within both a constrained and unconstrained fiscal environment. Finally, HEAT has more sophisticated methodology than used in existing benefit/cost tools. The existing software tools do not often quantify the effects of roadway improvements on business attraction. These benefits are often significant relative to the direct benefits to highway users in rural areas, where low existing and future traffic volumes produce modest aggregate benefits. HEAT includes a business attraction module and adds these benefits as inputs into the benefit-cost calculation. Ultimately, HEAT will provide MDT with an objective, efficient, and accurate way to quantify the potential economic benefits of roadway improvements.

Progress:

This project is complete.

Reports:

The final report can be viewed at the above URL.

Implementation:

HJR 30-2001 required that economic development criteria be included in MDT's funding apportionment process, and that the TranPlan 21 update include consideration of economic development issues. Now that HEAT has become another evaluation tool for MDT, policies are needed to incorporate economic development criteria into the planning, funding apportionment, and project selection processes on an ongoing basis. The recommended new process would use HEAT within the following processes: 1) Long-Range Policy Plan Updates. Use HEAT to conduct a series of corridor-level analyses, which rank corridors in importance from an economic development perspective, and identify which specific investments have benefits greater than their costs. 2) Investment Analysis. Within MDT's Performance Programming Process (P3), use HEAT to estimate economic benefits of various investment strategies. 3) District Nomination Process. Use HEAT to screen and rank projects that are suggested for selection based on relative economic development benefits. 4) Five-Year TCP Development. Use HEAT to examine the set of capacity projects not currently funded, and help prioritize which projects should be advanced in the program. Once the entire program is set, use HEAT to evaluate and then communicate the likely statewide economic benefits to be gained from the program. 5) Project Implementation. Use

HEAT as the standard tool for economic impact assessment for environmental evaluations.

With the completion of the Reconfiguration Study, MDT is in the process of implementing the above recommendations and is hiring a staff person to serve as MDT's HEAT modeler and economic expert to insure that the results of the study are institutionalized.

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2.6.2 Contracted Projects

2.6.2.1 Effects of Defensive Vehicle Handling Training on Novice Driver Safety: A Case Study in Lewistown, Montana Phase: I Preparation for Advanced Driver Training

Project Number:	8183-001
Start Date:	9/16/04
Completion Date:	12/31/06
Total Cost:	$94,756
SPR Funds:	$94,756
FFY 2005 Funds Expended:	$81,672
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
Project URL:	http://www.mdt.mt.gov/research/projects/safety/defensive.shtml

Objective:

New teenaged drivers have the highest accident rates of any group of drivers. Research shows that drivers under the age of 19 have a crash rate that is four times that of the general driving population and the youngest drivers have a higher accident rate yet. The highest accident rate is experienced within 2 years of receiving the driving license. Obviously, the crash rate decreases with driving experience. Research is needed to determine how to safely equip novice drivers with the important elements of experience before they encounter a need for it in an actual driving situation.

The purpose of this research program was to conduct such a study. This project has been divided into three phases. Phase 1 included (A) identification of potential participants, (B) development of recruiting materials, (C) recruitment and scheduling of participants, (D) preparation of training plans and instructional materials, and (E) coordination with the Montana Office of Public Instruction for use of their facilities and instructors for the training workshops.

Progress:

All research is complete. The final report is in the final stages of review.

Reports:

The final report was completed in the first quarter of FFY 2006 and can be viewed at the above URL.

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2.6.2.2 Effects of Defensive Vehicle Handling Training on Novice Driver Safety: A Case Study in Lewistown, Montana: Phase II Advanced Driver Training

Project Number:	8183-002
Start Date:	5/15/05
Completion Date:	12/31/05
Total Cost:	$146,899
SPR Funds:	$146,899
FFY 2005 Funds Expended:	$90,055
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
Project URL:	http://www.mdt.mt.gov/research/projects/safety/defensive.shtml

Objective:

New teenaged drivers have the highest accident rates of any group of drivers. Research shows that drivers under the age of 19 have a crash rate that is four times that of the general driving population and the youngest drivers have a higher accident rate yet. The highest accident rate is experienced within 2 years of receiving the driving license. Obviously, the crash rate decreases with driving experience. Research is needed to determine how to safely equip novice drivers with the important elements of experience before they encounter a need for it in an actual driving situation.

The purpose of this research program was to conduct such a study. This project has been divided into three phases. Phase 2 includes presentation of the advanced driving training developed in Phase 1 to teens.

Progress:

All research is complete. The final report is in the final stages of review.

Reports:

One progress report was received in FFY 2005 and can be viewed at the above URL. The final report is in the final stages of review.

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2.6.3 Pending Projects

2.6.3.1 Highway Project Cost Estimating Best Practices

The Technical Panel developed the following scope of work for this project. A Request for Proposal (RFP) has been issued.

Purpose:

Over the time span between when a project enters the future construction program and the completion of construction, many factors influence a project's final cost. This time span is normally several years in duration, but for more complex projects, project duration can easily exceed 10 years. Because project nominations are linked to estimates of future funding and the analysis of system needs, initial, inaccurate cost estimates lead to overloading the program with projects that are not fundable in the future, misallocating design resources, and creating false expectations with the public and stakeholders.

Inaccurate cost estimates also impact MDT's financial planning and financial management business processes. Significant project cost increases make it very difficult for MDT's financial managers to accurately plan for needed legislative budget authority, manage the Department's cash flow, and efficiently manage the federal fund obligations. Significant changes in project cost estimates require staff resources to resolve, and may ultimately force delays to single or multiple projects.

The following list includes some areas that may potentially contribute to initial project

- Cost estimate issues;
- Insufficient knowledge of right-of-way costs;
- Changes in project scope and location;
- Ultimate environmental mitigation requirements;
- Delay in project delivery from initiation to contract letting,;
- Unforeseen engineering complexities and constructability issues;
- Changes in economic and market conditions, such increases in steel or asphalt;
- Increased local government, community, and stakeholder expectations;
- Understating incidental cost issues;
- Changes in traffic control needs to design or traffic growth; and
- Unexpected utility involvement and costs.

While some of these issues are unforeseen, many of these could be addressed with either improvements to the systematic approach to the estimating process, or the explicit inclusion of risk in the estimate as it matures. The impact of all these issues is compounded if there is a lack of understanding of the estimating process, appropriate

training in cost estimation or an institutional lack of cost estimation management process.

The focus of this effort is on improving early cost estimation to reduce the variance between estimates when projects are initially programmed and the final construction costs. While the research is centered on project initiation and completion, it must include a thorough understanding of the changes in cost that occur during the phases of project development.

It is for these reasons the Montana Department of Transportation is initiating a research project to establish a highway cost estimating and management procedures to aid the Department in more efficient cost estimating.

Objective:

The overall objective is to develop a comprehensive document to determine the best practice of efficient highway cost estimating for the Montana Department of Transportation.

Tasks:

Through a review of literature, state of the practice survey, and available documentation, report on federal initiatives, states or provinces cost estimating practices regarding success and failure scenarios that relate to this effort. This endeavor should provide a critical review of cost estimating and management practices. It should also identify potential strategies, methods and tools. Work in progress from NCHRP 8-49 regarding cost estimation will be made available to the prospective consultant. A review of the financial plan for FHWA's Mega-Project monitoring program may offer some insight into this effort. This is not a software develop project. However, through the literature review the consultant may report on available products, the costs, and their effectiveness.

It will be necessary to understand how the Department currently conducts business regarding cost estimation. The consultant will report on all aspects of highway cost estimation procedures within the Department. The development of this report will include participation by all affected parties through surveys and personal MDT staff interviews. Development of the report may also require interviews with members of the private sector that may affect cost estimation within the Department, to be determined jointly by MDT staff and the consultant. This effort should delineate the strengths and weaknesses of MDT's current cost estimating process. There should be an emphasis on the following points:

- Initial cost estimates at time of nomination;
- Regional differences of project specific costs;
- Tracking of project cost estimates throughout the phases of the project development process;
- The review of the Department's existing procedures on uniform cost estimating methods highlighting the consistency or inconsistency of the system; and
- Documentation of historic cost estimates vs. actual completed costs by project types (will be updated by MDT once developed and used as a tool to track performance improvement in estimating).

Investigate and frame recommendations regarding use of inflation rates, Monte Carlo and other risk assessments including contingency factors for inclusion in cost estimating procedures.

Based on all tasks, develop a detailed strategic procedure the Department can realistically implement to effectively manage and track the cost estimation process. The products from this effort may include training programs or new business processes in the:

- District Offices;
- Planning Division;
- Highway and Engineering Division; and
- Administration Division.

A detailed implementation plan and appropriate timelines must support all objectives along with responsibility centers clearly defined. Realistic performance measures tied to a work plan must also be developed to track performance of the cost-estimating program.

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2.6.3.2 Developing a One-Stop Shop for Public/Specialized Transportation Information in Montana

The following research problem statement was submitted. The Technical Panel met twice in FFY 2005 and is developing a scope of work.

Problem Statement:

Problem: Lack of information on transportation options impedes use of available services.

Transportation is an essential service. Transportation is vital for keeping people connected with their community. Individuals need to get to jobs and to medical facilities. They also need transportation to access educational, social and other opportunities. Although there may be many different options for transportation within a community, currently information on these services is scattered and difficult to access. Integrating transportation information into a one-stop shop, and other information portals such as the Internet, 2-1-1 and/or 5-1-1 system will allow everyone in MT to have better access to transportation information and services.

Research Proposed:

This research project would determine how to integrate transportation information into information portals, such the Internet, 2-1-1, and 5-1-1 systems.

Research objectives would be to:

- Review the transportation information systems (software/hardware/data retrieval protocols) of Montana and other states;
- Identify current technologies in Montana that could be utilized for this process;
- Determine what existing MT transportation services data exists and what forms it exists in (fact sheets, websites, databases …) ,
- Determine what additional transportation data needs to be gathered and how it should be gathered;
- Determine the most efficient means for integrating transportation data into the information portals (creating a separate transportation database with links to the portals, putting transportation data directly into the portals, other methods …);
- Determine protocols for updating transportation information in the database(s) and information portals; and
- Recommend modification, development, and/or purchasing of technologies to implement the process of improving the availability of transportation information in the state.

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2.6.3.3 Logistics and Marketing Research in Support of Container on Flatcar Shuttle Train on BNSF Mainline to Port of either Seattle or Tacoma

The following research problem statement was submitted. The Technical Panel met once in FFY 2005, is determining if a research need exists, and , if so, will develop a research plan.

Problem Statement:

The recent closing of the intermodal hub at Shelby, Montana by the Burlington Northern Santa Fe has left the State of Montana without an intermodal hub on the main line of this Class I railroad. The severity of the problem was cited in a guest editorial in the Great Falls Tribune on Sunday May 9, 2004 which stated: " …the announcement last week that the Burlington Northern Santa Fe Railroad will discontinue intermodal service to Shelby dealt a major economic blow to northern and central Montana". The Montana Rail Link intermodal facilities in Missoula have closed. The Burlington Northern Santa Fe Railway facility in Billings is also threatened with closure and the Union Pacific Railway served intermodal facilities located at the Port of Montana at Silver Bow have been dramatically de-emphasized by that railroad. Intermodal shipping capabilities are vital to the Montana economy. This dramatic loss of Montana intermodal facilities statewide presents a huge hurdle for Montana manufacturers as they attempt to serve the U.S. and international market place. This loss will impact the current and future Montana economy by creating increased transportation costs and the related loss of potential markets. Added value agricultural concepts are extremely dependent upon intermodal transportation. Currently Montana does not have a single location where containers can be loaded on rail cars at competitive rates on regularly scheduled intermodal trains.

Research Proposed:

The proposed work is multi-faceted. The research will be conducted in three areas. All areas are to support the concept of increasing Intermodal service within Montana, and identifying and addressing issues related to developing a dedicated Montana container on flatcar shuttle service on the BNSF mainline between central Montana and the Port of either Seattle or Tacoma.

Research the logistics related to dedicated container on flatcar shuttle service. This may include scans of U.S. and Canadian non-grain shuttle trains. Special attention should be paid to understanding logistical issues relative to aggregated shuttles containing multiple products. (i.e. identification of concerns with transport delay, identification of issues surrounding multiple end destinations, etc.). Research should include suggested solutions including risk analysis.

Research candidate characteristics of Montana value added exports that could use container on flatcar shuttle trains.

- Identify value added products with export potential through ports of either Seattle or Tacoma;
- Identify value added products and potential logistical issues relative to re-routing trailers to U.S. destinations once they have reached either Seattle or Tacoma; and
- Identify potential back-haul products and dispersion issues for container on flatcar shuttle from the coast to Montana.

This component should exploit all current research and tools including the Montana Rail Competition Study, and the Highway Economic Analysis Tool (developed to support the Montana Highway Reconfiguration Study), and other commodity flow information. Additional surveys may be needed to determine the potential for value added exports, or to determine target markets and logistics of backhauls.

Review existing studies and analysis regarding Montana's position relative to container on flatcar service and suggest additional strategies that may expand this service within Montana.

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2.7 TRAFFIC RESEARCH PROJECTS

2.7.1 Pending Projects

2.7.1.1 Design of a Vertical Shape Portable Concrete Barrier

The following research problem statement was submitted. The Technical Panel has not met in FFY 2005, and needs to determine if a research need exists, and, if so, develop a research plan.

Problem Statement:

Currently, all of the non-proprietary temporary concrete barrier systems in use on the national highway system are comprised of safety shape barrier segments made up of one or more sloped faces. These segments are connected by simple connections that allow the barriers to be easily installed or moved in work zones and other temporary barrier applications. Research has shown that the sloped face of safety shape barriers causes increased vehicle instability and rollover, especially with regard to small cars. These studies have shown that 8.5 percent of safety shape barrier accidents result in rollover, and that safety shape median barriers pose over twice the rollover rate of other median barriers. The increased rollover potential with these barrier shapes becomes critical because rollover accidents double the risk of incapacitating and fatal injuries.

Vertical shape concrete barriers have been shown to provide the largest reduction in vehicle rollover when compared with safety shape barriers through both computer simulation and full-scale crash testing. However, the use of vertical shapes has not been implemented due to concerns that vertical shapes might increase the lateral loads on impacting vehicles. Review of crash test data has demonstrated that this concern is not valid. Comparison of data from safety shape and vertical shape barrier testing found that vertical shape barriers only increase lateral vehicle accelerations by 5 percent. Vertical shape barriers would be easier to transport and store, thus increasing the functionality of the barrier. In addition, the use of a vertical shape could potentially decrease both the overall height and width of the barrier. Barrier reinforcement could be made simpler and more consistent throughout the barrier section due to its rectangular shape. Pre-cast vertical barrier segments may also be easier to form than the current sloped shapes. Because the new vertical shape barrier would start from a clean sheet of paper, the length of barrier sections and the design of the connection between barriers could be optimized to improve both the functionality and safety performance of the barrier system. Design of the new barrier would also include consideration for tie-down options to constrain barrier motion in critical areas such as barriers placed on a bridge deck edge. Therefore, it is believed that a new vertical shape temporary concrete barrier should be developed that would reduce the potential for vehicle

rollover while improving upon many of the shortcomings in current safety shape barrier designs.

Research Proposed:

The development process of the new vertical shape temporary barrier would include computer simulation modeling of barrier geometries, joint designs, and tie-down options, component testing of the various barrier design elements, and full-scale testing of the free-standing and tie-down barrier designs as well as transitioning methods according to Test Level 3 (TL-3) of NCHRP Report No. 350.

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2.7.1.2 Field Evaluation of Passing Lane Operational Benefits on Two-Lane Rural Roads in Montana

The following research problem statement was submitted. The Technical Panel met twice in FFY 2005, is determining if a research need exists, and , if so, will develop a research plan.

Problem Statement:

Two-lane rural roads constitute the vast majority of highway facilities particularly in states where most vehicular travel takes place in rural areas (including the state of Montana). Those roads are known for higher level of interaction between vehicles moving in the same as well as in opposing directions. Specifically, passing maneuvers are restricted on those highways and are typically performed using the opposing lane when sight distance and gaps in the opposing traffic stream permit. This has serious implications on traffic performance and safety. From traffic performance perspective, the limited passing opportunities would result in higher impact of slow-moving vehicles (mainly trucks and agricultural equipment) on mobility and performance. This impact generally increases with the increase in traffic level (in both directions of travel), the proportion of slow-moving vehicles in the traffic stream, and the average speed differential between the mainstream and slower vehicles.

The use of passing lanes is known to alleviate this unique operational situation on two-lane highways. Passing lanes allow vehicles traveling at faster speeds to overtake slow-moving vehicles, thus breaking up platoons and reducing delays due to inadequate passing opportunities. Therefore, it is well known that using passing lanes generally improves operations and results in better level of service on two-lane highways.

Estimating the operational benefits of passing lanes with reasonable accuracy is critical for the planning, design, and operation of two-lane highway facilities. Currently, the Highway Capacity Manual (HCM) includes analytical procedures to estimate the level of service on two-lane highways while TWOPAS is the main software package that is being used to simulate traffic operations on those facilities (model was also used in the development of the recent HCM procedures). Evaluation of the predictive ability of those models (as related to passing lane operations) and the subsequent calibration and validation is essential for those models to yield reasonably accurate estimates.

Research Proposed:

The proposed research involves the following components: (1) field evaluation of the effect of passing lanes on the performance of two-lane rural roads in the state of Montana, (2) validation of the analytical modeling tools that are being used by the

Montana Department of Transportation (MDT), and (3) calibration of the models to best reflect the conditions on Montana's two-lane highways.

The proposed research will utilize field data from candidate passing lane sites on US 93 between Evaro and Polson and on US 287 (N-8) between Helena and Three Forks where measures of performance of interest will be collected using appropriate technologies according to study design. Average travel speed and percent-time-spent-following are two main performance measures that are to be investigated by this study. Besides conventional speed and travel time measurement techniques, the use of surveillance cameras mounted on mobile trailers or use of a mobile lab are envisioned as possible means to collect data pertaining to platooning.

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3.0 EXPERIMENTAL PROJECTS

3.1 OVERVIEW

The incorporation of experimental features into construction and maintenance projects allows for a vital field evaluation of new materials and methods. This evaluation, if performed well and scientifically based, allows MDT to determine the implementation value of these new materials and methods.

3.1.1 Work Plan

Prior to construction of an experimental feature, the EPM writes and submits a formal work plan to the FHWA for their approval. This work plan should include the following information:

- Location of project;
- Construction project number;
- Title (type) of project;
- Principal investigator;
- Statement of objectives;
- Experimental design;
- Estimated quantities and costs;
- Evaluation schedule; and
- Reporting requirements.

This work plan is important as it formalizes the project with FHWA, which yields two additional benefits:

- If the project should fail prematurely, FHWA will participate in the repair at the same percent as is the original construction and
- Proprietary features may be specified.

3.1.2 Construction Report

Following the construction of an experimental feature, the EPM is required to submit a construction report for statewide distribution through the Research Programs. This report should be written within thirty days of completed construction of the project and should include:

- Location of project;
- Construction project number;
- Title (type) of project;
- Principal investigator;
- Statement of objectives;

- Date construction of experimental feature was completed;
- Summary of materials and methods;
- Quantity and cost of experimental feature;
- Construction Details; and
- Construction problems and a statement of how these problems might have been alleviated.

3.1.3 Progress and Final Reports

Progress and final reports are required by the FHWA throughout the formal evaluation period as stated in the work plan and should be completed within 30 days of the performance evaluation. Reports consist of a performance summary of the experimental feature to date. The final performance summary should contain information on the experimental feature as specified in the work plan, including implementation recommendations. Implementation recommendations should also be presented to MDT management. This report is due by the end of the final evaluation year.

3.2 COMPLETED PROJECTS

3.2.1 90mm Ultra-Thin Composite Whitetopping

Project Name:	Great Falls Whitetopping
Project Number:	Maintenance No. 305626
FHWA Number:	Not Applicable
Start Date:	October 1998
Completion Date:	September 2005
Status:	Completed
Contractor:	United Materials
URL:	http://www.mdt.mt.gov/research/projects/gtf_whitetopping.shtml

Objective:

The objective of the project was to experiment with a pavement preservation method in milling the existing asphalt pavement to place a 90mm (approximately 3.5 inches) Portland Cement Concrete Pavement (PCCP) overlay to create a composite pavement to extend the projects service life.

Progress:

The project was rated as performing well and is still in place to date. Several areas of the pavement have been repaired due to poor subgrade and deteriorating asphalt cement not associated with the whitetopping composite application. Research will continue to informally report on this project during its service life.

Reports:

Reports are located at the above URL.

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3.2.2 Use of Fiber-Reinforced Polymer (FRP) for Snow Fence Applications

Project Name:	Livingston
Project Number:	IM90-7(63)331
FHWA Number:	MT 00-01
Construction Date:	November 1999
Completion Date:	September 2005
Status:	Completed
Contractor:	Western Montana Sunrooms
URL:	http://www.mdt.mt.gov/research/projects/livingston_snowfence.shtml

Objective:

The purpose of this study was to evaluate the feasibility of using a fiber-reinforced polymer (FRP) material in the construction of snow fences. FRP is a process where continuous glass-fiber strands are pulled through a thermosetting polyester resin to form a composite. The key intention of testing the FRP product is to determine its structural integrity based on MDT's current snow fence specifications, especially with the harsh climate these structures are subjected to in the state of Montana.

Progress:

The project was rated as failed. Severe vibration from wind turbulence was determined the main cause of failure in 2005. The project has been dismantled and removed.

Reports:

Reports are located at the above URL.

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3.3 ACTIVE PROJECTS

3.3.1 100mm Thin Composite Whitetopping

Project Name:	Glendive Whitetopping
Project Number:	STPP 20-1(8)0 P-20, Highway 16
FHWA Number:	MT 00-02
Start Date:	May 2001
Completion Date:	September 2006
Status:	Active
Contractor:	Century Contracting
URL:	http://www.mdt.mt.gov/research/projects/gld_whitetopping.shtml

Objective:

The objective of the project is to experiment with a pavement preservation method by milling the existing asphalt pavement and placing a 100mm (approximately 4 inches) Portland Cement Concrete Pavement (PCCP) overlay to create a composite pavement and extend the project's service life.

Progress:

This project has been in place for four years with good performance to date. Panel cracking not related to construction issues is at a minimum.

Reports:

Reports are located at the above URL.

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3.3.2 130mm Thin Composite Whitetopping

Project Name:	Kalispell Whitetopping
Project Number:	STPP 1-2(93)121
FHWA Number:	MT 00-02
Start Date:	August 2000
Completion Date:	September 2010
Status:	Active
Contractor:	Riverside Contracting
URL:	http://www.mdt.mt.gov/research/projects/kal_whitetopping.shtml

Objective:

The objective of this project is to experiment with a pavement preservation method by milling the existing asphalt pavement and placing a 130mm (approximately 5 inches) Portland Cement Concrete Pavement (PCCP) overlay to create a composite pavement and extend the projects service life.

Progress:

The project has been in place for five years with excellent performance to date. Approximately 12 panels have cracked out of an estimated 4500 sawn panels. All cracks are hairline in nature with no evidence of debonding of the composite layers. Transition areas (whitetopping section to asphalt pavement sections) have depicted no load transfer problems. MDT Research will continue with formal analysis to the year 2010.

Reports:

Reports can be viewed at the above URL.

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3.3.3 Cold In-Place Recycled Asphalt

Project Name:	Fairfield North & South
Project Number:	STPP 3-1(15)18
FHWA Number:	Informal
Construction Date	September 2001
Completion Date:	September 2006
Status:	Active
Contractor:	Riverside Contracting
URL:	http://www.mdt.mt.gov/research/projects/fairfield.shtml

Objective:

This experimental rehabilitation project consisting of cold milling approximately 75-90mm of asphalt cement, replacing it with cold in-place recycled plant mix surfacing (90mm), and placing a seal & cover.

Progress:

The project is rated as performing well. Rutting and transverse cracking is at a minimum. Pavement has good overall appearance.

Reports:

Reports are located at the above URL.

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3.3.4 Cold In-Place Recycled Asphalt using Koch's CIR-Engineered Emulsion

Project Name:	Red Lodge North
Project Number:	STPP 28-2(22)70
FHWA Number:	MT 00-03
Construction Date:	July 2001
Completion Date:	September 2006
Status:	Active
Contractor:	Riverside Contracting
URL:	http://www.mdt.mt.gov/research/projects/redlodge.shtml

Objective:

This experimental rehabilitation project consisting of cold milling approximately 75mm of asphalt cement, replacing it with cold in-place recycled plant mix surfacing using Koch's CIR-EE (Cold In-Place Engineered Emulsion), and placing a seal & cover.

Progress:

The project is rated as performing well. All test sections to date have exhibited acceptable performance in regard to rut and transverse cracking. Flushing is at a minimum. All mats have good visual appearance.

Reports:

Reports are located at the above URL.

MDT Project Manager:

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3.3.5 Effectiveness of Crack Sealing Milled Asphalt Pavement prior to Overlay

Project Name:	Dutton N & S
Project Number:	IM 15-6(35)309
FHWA Number:	MT 00-08
Construction Date:	June 2005
Completion Date:	September 2010
Status:	Active
Contractor:	Scellinger Construction
URL:	Pending

Objective:

The objective of this project is to determine if crack sealing milled pavement prior to an overlay will deter the migration of transverse cracking, or have an effect on pavement performance, when compared to an adjacent milled pavement that receives no crack sealing.

Progress:

Project is complete and the first annual performance report due in summer of 2006.

Reports:

To be posted.

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3.3.6 Statewide Installation and Testing of Detectable Warning Devices (DWD) for the Visually Impaired

Project Name:	Truncated Domes
Project Number:	STPU 5201(11)
FHWA Number:	MT 00-05
Construction Date:	August 2003
Completion Date:	October 2008
Status:	Active
Contractor:	Various
URL:	http://www.mdt.mt.gov/research/projects/6th_street.shtml

Objective:

The objective of this project is to test the ability of several manufactures designs in the use of truncated domes as a preferred detectable warning devise (DWD) at curb ramps for use by the visually and mobility impaired, and to report on the construction application of each treatment, durability, and maintenance requirements of such products.

Progress:

Numerous products are being tested with varying degrees of effectiveness. Please refer to the annual project reports (see above URL) for current performance.

Reports:

Reports are located at the above URL.

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3.3.7 Use of Koch's Emulsified Asphalt Prime (E-Prime) for Prime Coat Application

Project Name:	Dickie Bridge-Wise River
Project Number:	STPP 49-6(3)58
FHWA Number:	Informal
Construction Date:	August 2004
Completion Date:	September 2009
Status:	Active
Contractor:	A. M. Wells, Inc.
URL:	Pending

Objective:

The objective of this project is to determine if emulsified asphalt in crushed aggregate course can be used for a prime coat application.

Progress:

First year analysis rates project as performing well. Rutting is at a minimum with no transverse cracking to date.

Reports:

To be posted.

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3.4 Pending Projects

3.4.1 Evaluation of an Automated, Fixed Anti-Icing Device for use on Bridge Decks

Project Name:	West Laurel Interchange
Project Number:	IM-STPHS 90-8(152)433
FHWA Number:	MT 00-08
Construction Date:	Tentative summer of 2006
Completion Date:	Pending
Status:	Pending
Contractor:	Boschung Incorporated
URL:	Pending

Objective:

The objective is to test the effectiveness of an automated anti-icing device for use on Billing's District area bridge. The chosen device will be the Boschung 'Fixed Automated Spray Technology or 'FAST'

Progress:

Installation of anti-icing bridge deck device tentatively scheduled for the summer of 2006.

Reports:

To be posted.

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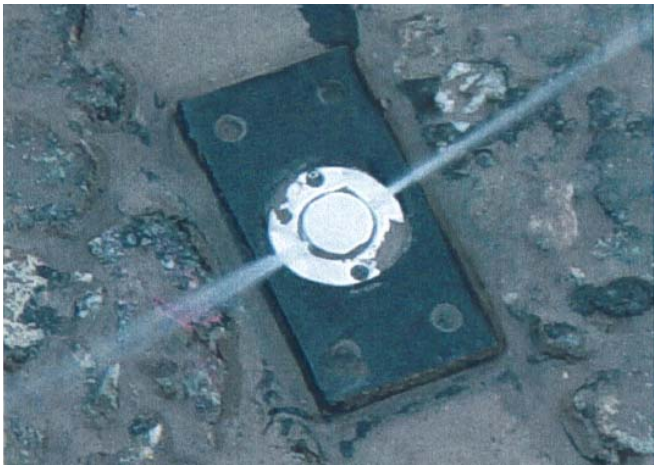

3.4.2 Use of High-Density Polyethylene (HDPE) Culverts in Mainline Applications

Project Name:	HDPE Culverts
Project Number:	STPP 18-1(9)18
FHWA Number:	Pending
Construction Date:	Pending
Completion Date:	Pending
Status:	Pending
Contractor:	Pending
URL:	Pending

Objective:

The objective of this project is to test three HDPE culverts sizes 750mm, 900mm, and 1200mm on a mainline application.

Progress:

Installation of HDPE culverts tentatively scheduled for the summer of 2006.

Reports:

To be posted.

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4.0 POOLED-FUND STUDIES

MDT contributed to the following pooled-fund studies in FFY 2005. Click on the project links to view project documents.

NUMBER	NAME	FUNDING LEVEL
TPF-5(051)	Construction of Crack-Free Concrete Bridge Decks http://www.pooledfund.org/projectdetails.asp?id=295&status=6	$15,000
TPF-5(076)	Development of a Geotechnical Procedures/Operations Manual http://www.pooledfund.org/projectdetails.asp?id=312&status=4	$5,000
TPF-5(099)	Evaluation of Low Cost Safety Improvements http://www.pooledfund.org/projectdetails.asp?id=332&status=4	$30,000
TPF-5(075)	Extending the Season for Concrete Construction and Repair – Phase II Defining Engineering Parameters http://www.pooledfund.org/projectdetails.asp?id=313&status=6	$15,000
TPF-5(112)	Midwest States Pooled Fund Pavement Preservation Partnership http://www.pooledfund.org/projectdetails.asp?id=343&status=4	$5,000
TPF-5(046)	Transportation Curriculum Coordination Council Training Management and Development http://www.pooledfund.org/projectdetails.asp?id=299&status=4	$20,000
TPF-5(105)	Transportation Library Connectivity http://www.pooledfund.org/projectdetails.asp?id=337&status=4	$20,000
TPF-5(069)	Transportation Research Board Support of Core Services http://www.pooledfund.org/projectdetails.asp?id=300&status=6	$84,950
TPF-5(064)	Western Alliance for Quality Transportation Construction (WAQTC) http://www.pooledfund.org/projectdetails.asp?id=274&status=4	$10,000
	TOTAL	**$204,950.00**

5.0 SUMMARY

5.1 GENERAL

MDT's mission is to serve the public by providing a transportation system and services that emphasize quality, safety, cost effectiveness, economic vitality and sensitivity to the environment. MDT's Research Programs impacts each and every part of MDT's mission.

Research projects completed in FFY 2005 yielded results that when fully implemented will improve:

- MDT efficiency and effectiveness, including cost-effectiveness, of MDT operations and technology transfer;
- Increase sensitivity to the environment, including decreasing the release of pollutants to Montana's air and water from vehicle emissions, improving consideration of the health and survival of wildlife species during inspection and construction, and decreasing vehicle-wildlife collisions;
- Improve safety by decreasing roadside hazards and through training and technology transfer;
- Increase Montana's economic development and vitality through transportation projects and the encouragement of the development of Montana products; and
- Improve the quality of what we do and how we do it, including bridge design and inspection, and materials testing and acceptance.

5.2 FISCAL

Research Programs expenditures occurred through research projects, pooled-fund studies, and NCHRP support (see Figure 2). Figure 3 shows these expenditures categorized by subject. The expenditures for the administration subject area are further classified by internal administration (overhead), NCHRP support, pooled-fund studies, and contracted research projects (Figure 4). Figure 5 shows internal administrative expenditures as compared to all other expenditures. Finally, figure 6 shows total funding for all active research projects by funding source.

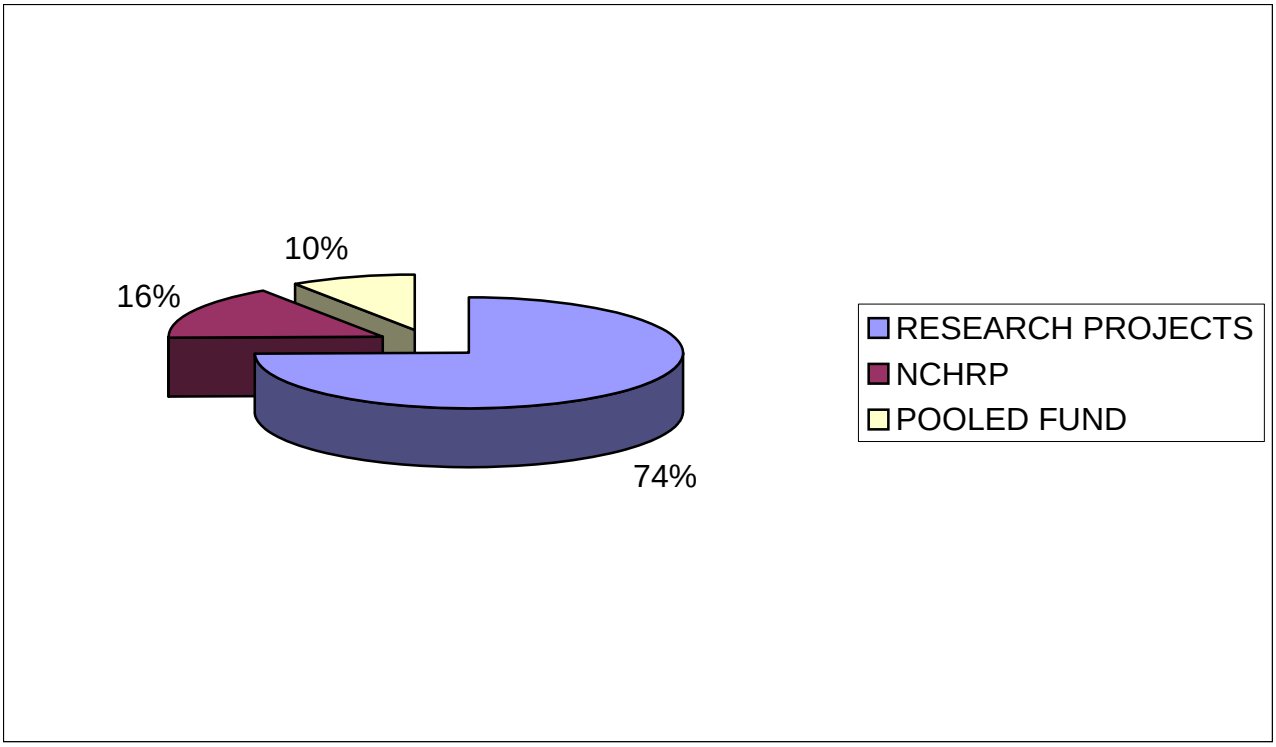

Figure 2: Research Program expenditures for FFY 2005 by project type.

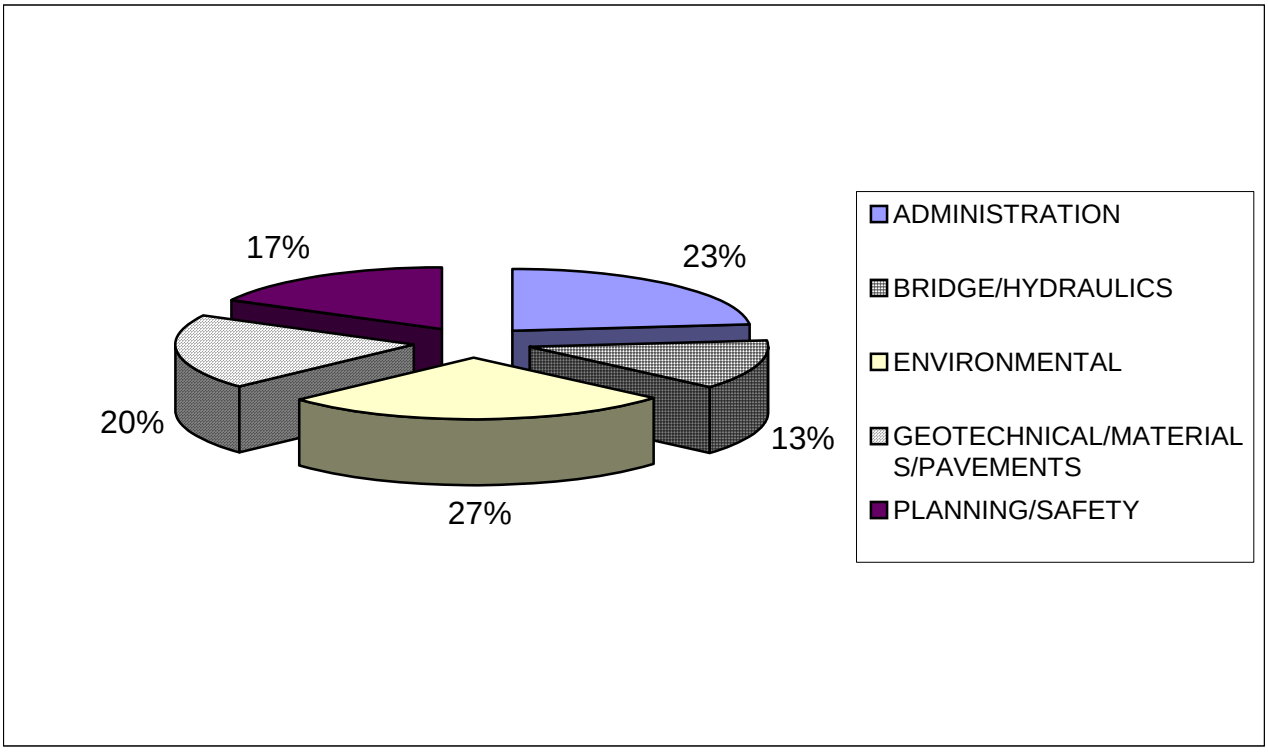

Figure 3: Research Program expenditures for FFY 2005 by subject.

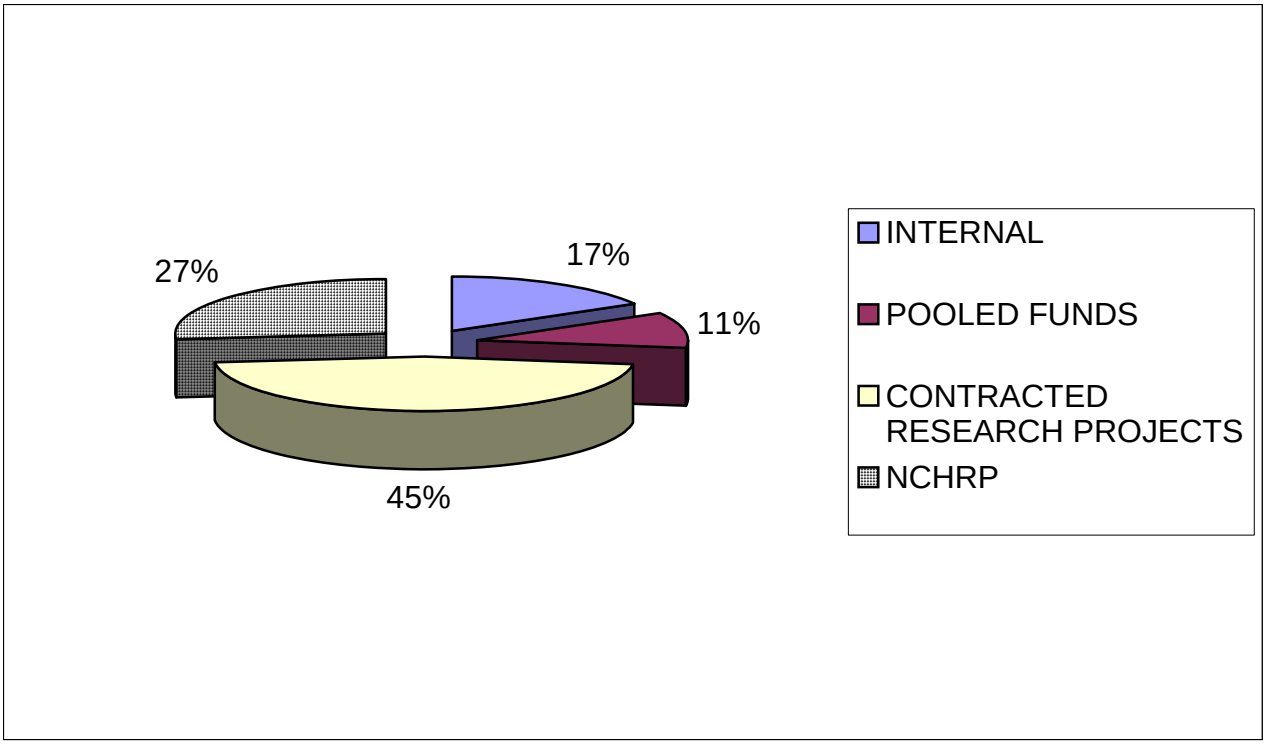

Figure 4: Administration expenditures for FFY 2005 by project type.

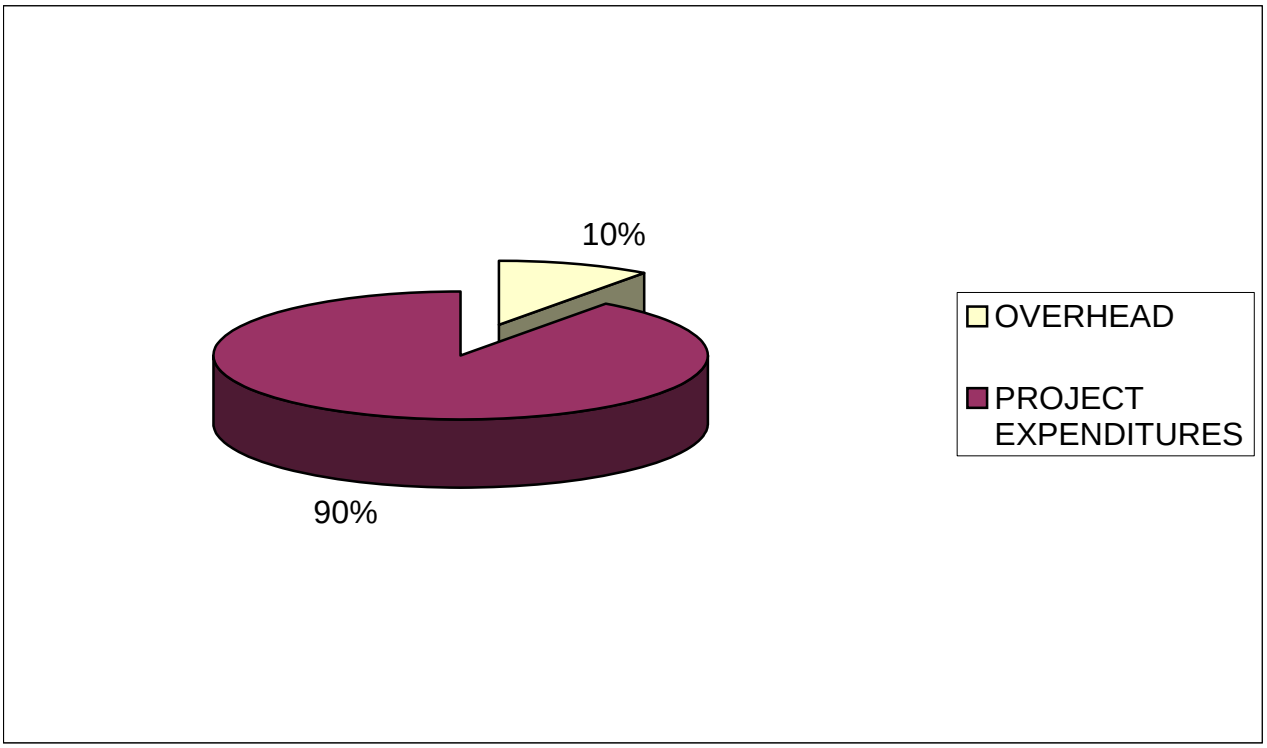

Figure 5: Overhead expenditures for FFY 2005 as compared to all other expenditures.

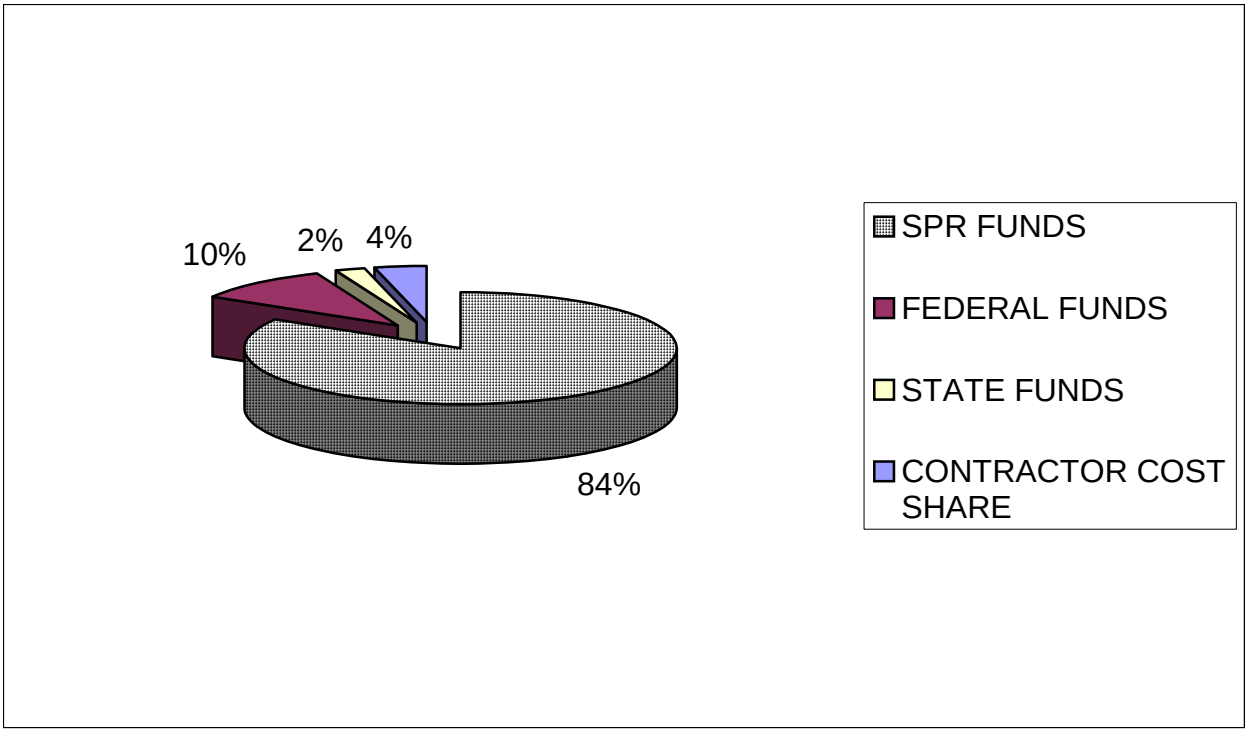

Figure 6: Total funding for all projects active in FFY 2005 by funding source.

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