

2006 ANNUAL REPORT FOR THE
MONTANA DEPARTMENT OF
TRANSPORTATION RESEARCH
PROGRAMS

FHWA/MT-06-017/8010

Annual Report

prepared for
THE STATE OF MONTANA
DEPARTMENT OF TRANSPORTATION

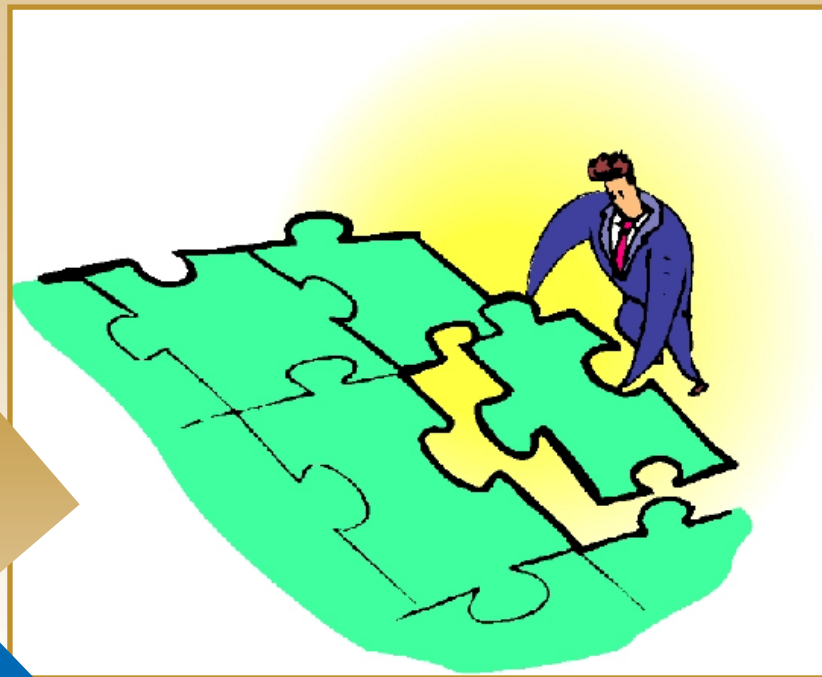
in cooperation with
THE U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

January 2007

prepared by

Susan C. Sillick
Craig Abernathy

Montana Department of Transportation



RESEARCH PROGRAMS



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**FFY 2006 ANNUAL REPORT
FOR THE MONTANA DEPARTMENT OF TRANSPORTATION
RESEARCH PROGRAMS**

**Prepared by
Susan C. Sillick
Craig Abernathy**

Montana Department of Transportation

January 2007

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16. Abstract <p>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 (FFY) 2006 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.</p> <p>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 2006 yielded results that when fully implemented will improve: efficiency and effectiveness of MDT operations and technology transfer, including improving ride on Montana's roads; economic vitality; sensitivity to the environment, including decreasing vehicle-wildlife collisions, improving design for safety, and improving revegetation of roadsides; safety, by decreasing roadside hazards, decreasing young driver accidents, and through training and technology transfer; and quality of what we do and how we do it, including bridge design and inspection, use of the most efficient materials and technology, and materials testing and acceptance.</p>		
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TABLE OF CONTENTS

TECHNICAL REPORT DOCUMENTATION PAGE.....	ii
ALTERNATIVE FORMAT STATEMENT.....	iii
TABLE OF CONTENTS.....	iv
LIST OF FIGURES.....	viii
1.0 INTRODUCTION.....	1
2.0 RESEARCH PROJECTS.....	2
2.1 OVERVIEW.....	2
2.2 ADMINISTRATIVE RESEARCH PROJECTS.....	5
2.2.1 Continuing Projects.....	5
2.2.1.1 Administration and Conduct of Research Programs.....	5
2.2.1.2 Evaluation of Experimental Projects.....	10
2.2.1.3 Transportation Research Board Support.....	11
2.2.1.4 Montana Local Technical Assistance Program (LTAP).....	12
2.2.1.5 Technology Transfer.....	14
2.2.2 Completed Projects.....	15
2.2.2.1 Research Peer Exchange.....	15
2.2.3 Contracted Projects.....	16
2.2.3.1 Industry Best Practices for Application Development Processes.....	16
2.2.3.2 OJT Program Evaluation.....	17
2.2.3.3 Evaluation of MDT’s Research Project Solicitation, Prioritization, and Selection Processes.....	18
2.2.3.4 Motor Fuel Tax Evasion in the State of Montana.....	19
2.2.3.5. Montana Air Service: Opportunities and Challenges.....	21
2.2.4 Pending Projects.....	23
2.2.4.1 Business Market Analysis.....	23
2.2.4.2 Disparity/ Availability Study.....	25
2.3 BRIDGE AND HYDRAULICS RESEARCH PROJECTS.....	28
2.3.1 Completed Projects.....	28
2.3.1.1 High Performance Concrete: Phase II Field Evaluation of the Performance of Three Concrete Bridge Decks on Montana Route 243.....	28
2.3.2 Contracted Projects.....	30
2.3.2.1 Evaluation Methods of Estimation of Bridge-Pier Scour for Streams with Coarse Bed Materials Based on Observed Scour in Montana.....	30
2.3.2.2 High Performance Concrete: Phase IV Specification Development and Implementation.....	32
2.4 ENVIRONMENTAL RESEARCH PROJECTS.....	34
2.4.1 Completed Projects.....	34
2.4.1.1 The Association Between Landscape Features and Transportation Corridors on Movements and Habitat - Use Patterns of Wolverines.....	34

2.4.1.2	Animal-Vehicle Collisions and Habitat Connectivity along Highway 83 in the Seeley-Swan Valley: Phase I.....	36
2.4.2	Contracted Projects	38
2.4.2.1	Evaluation of Wildlife Crossing Structures on US Highway 93 Evaro to Polson.....	38
2.4.2.2	Habitat Connectivity and Rural Context Sensitive Design: A Synthesis of Practice.....	40
2.4.2.3	Potential Effects of Highway Mortality and Habitat Fragmentation on a Population of Painted Turtles in Montana	42
2.4.2.4	Bozeman Pass Wildlife Linkage and Highway Safety Pilot Study	44
2.4.2.5	Evaluation of Organic Matter Compost Addition and Incorporation in Steep Cut Slopes: Phase II Test Plot Construction and Performance Monitoring	46
2.4.2.6	Fish Passage at Road Crossings in Montana Watersheds Providing Bull and Cutthroat Trout Habitat: Phase II Passage Goals	48
2.4.2.7	Warm Water Species Fish Passage in Eastern Montana Culverts	50
2.4.3	Pending Projects	52
2.4.3.1	Development of Wildlife Crossing Structures for Small and Large Species and Analysis of their Effectiveness	52
2.4.3.2	Compost Application for Optimized Vegetation Response	54
2.4.4	Canceled Projects	56
2.4.4.1	Evaluation of Fence Modifications to Exclude Deer and Elk from Highways	56
2.4.4.2	Montana Weeds to Web.....	56
2.5	GEOTECHNICAL, MATERIALS, AND PAVEMENTS RESEARCH PROJECTS..	57
2.5.1	Completed Projects	57
2.5.1.1	MDT Ride Specification Review	57
2.5.2	Contracted Projects	59
2.5.2.1	Preventative Maintenance Treatments: A Synthesis of Highway Practice	59
2.5.2.2	Comparative Analysis of Coarse Surfacing Aggregate using the Micro-Deval, L.A. Abrasion, and Sulfate Soundness Tests	61
2.5.2.3	Axial Capacity of Piles Supported on Intermediate Geomaterials.....	62
2.5.2.4	Pavement Performance Prediction Models.....	64
2.5.3	Pending Projects	65
2.5.3.1	Implementation of the Mechanistic Empirical.....	65
2.5.3.2	Determination of Unbound Base and Subgrade Resilient Moduli for use in the Mechanistic-Empirical Pavement Design Guide	65
2.5.3.3	I-15 North Corridor - Canadian Truck Load Bridge and Roadway Analysis	65
2.5.3.4	Evaluation of the Superpave Volumetric Specification.....	66
2.6	PLANNING AND SAFETY RESEARCH PROJECTS.....	67
2.6.1	Completed Projects	67

2.6.1.1	Effects of Defensive Vehicle Handling Training on Novice Driver Safety: A Case Study in Lewistown, Montana: Phase I Preparation for Advanced Driver Training.....	67
2.6.1.2	Effects of Defensive Vehicle Handling Training on Novice Driver Safety: A Case Study in Lewistown, Montana: Phase II Advanced Driver Training	69
2.6.2	Contracted Projects	70
2.6.2.1	A High Fidelity Driving Simulator as a Tool for Highway Design and Evaluation of Highway Infrastructure Upgrades	70
2.6.2.2	Effects of Defensive Vehicle Handling Training on Novice Driver Safety: A Case Study in Lewistown, Montana: Phase III Analysis of Safety Data	72
2.6.3	Pending Projects.....	74
2.6.3.1	Highway Project Cost Estimating Best Practices.....	74
2.6.3.2	Developing a One-Stop Shop for Public/Specialized Transportation Information in Montana.....	77
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.....	79
2.6.3.4	Computerized 3-Dimensional Highway Design and Modeling.....	81
2.7	TRAFFIC RESEARCH PROJECTS.....	82
2.7.1	Pending Projects.....	82
2.7.1.1	Design of a Vertical Shape Portable Concrete Barrier	82
2.7.2	Cancelled Projects	84
2.7.2.1	Field Evaluation of Passing Lane Operational Benefits on Two-Lane Rural Roads in Montana	84
3.0	EXPERIMENTAL PROJECTS.....	85
3.1	OVERVIEW.....	85
3.1.1	Work Plan.....	85
3.1.2	Construction Report	85
3.1.3	Progress and Final Reports.....	86
3.2	ACTIVE PROJECTS.....	87
3.2.1	100 mm Thin Composite Whitetopping	87
3.2.2	130 mm Thin Composite Whitetopping	88
3.2.3	Cold In-Place Recycled Asphalt.....	89
3.2.4	Cold In-Place Recycled Asphalt using Koch’s CIR-Engineered Emulsion.....	90
3.2.5	Effectiveness of Crack Sealing Milled Asphalt Pavement prior to Overlay.....	91
3.2.6	Statewide Installation and Testing of Detectable Warning Devices (DWD) for the Visually Impaired	92
3.2.7	Evaluation of Pavement Markers on MacDonald Pass	93
3.2.8	Evaluation of Radar Speed Display Trailer-Mounted Device for Speed Reduction for Use in Construction Work Zones	94
3.3	PENDING PROJECTS.....	95
3.3.1	Use of High-Density Polyethylene (HDPE) Culverts in Mainline Applications	95

3.3.2 Evaluation of Various Aggregate Base Preparations.....	96
3.3.3 Evaluation of Recycled Rubber and Plastic Mats as Weed Prevention and Erosion Control around Guardrail Posts.....	97
3.3.4 Evaluation of an Automated Fixed Anti-Icing Device for Use on Bridge Decks	98
3.3.5 Evaluation of Treated (CSS1) Base Preparations, (Emulsified Asphalt Treated Aggregate - EATA).....	99
4.0 POOLED-FUND STUDIES.....	100
5.0 SUMMARY.....	101
5.1 GENERAL.....	101
5.2 FISCAL.....	101

LIST OF FIGURES

Figure 1: Research Projects Process.	4
Figure 2: Research Program expenditures for FFY 2006 by project type.....	102
Figure 3: Research Program expenditures for FFY 2006 by subject.....	102
Figure 4: Administration expenditures for FFY 2006 by project type.....	103
Figure 5: Overhead expenditures for FFY 2006 as compared to all other expenditures.	103
Figure 6: Total funding for all projects active in FFY 2006 by funding source.	104

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 2006 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
- Conduct project and program evaluation.

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.



Janus, this Roman God symbolizes change and transition, such as the progression from past to future or of one vision to another.

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 spectrum 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 Programs 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), MDT/WTI Partnership, 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 steps below are followed:

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

Also, MDT meets periodically with the Western Transportation Institute (WTI) to discuss collaborative research in 9 topic areas: education, infrastructure design and materials, logistics and freight management, mobility and public transportation, road ecology, safety and operations, systems engineering development and integration, transportation planning and economics, and weather and winter maintenance. Research is funded 50% each by MDT and WTI. Once research ideas are identified and there is interest to move forward with the project, the following steps are followed:

- Technical panel is formed.
- Proposal is obtained.
- Technical panel recommends proposal for funding to RRC.
- RRC approves or denies funding request.

In addition, 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.

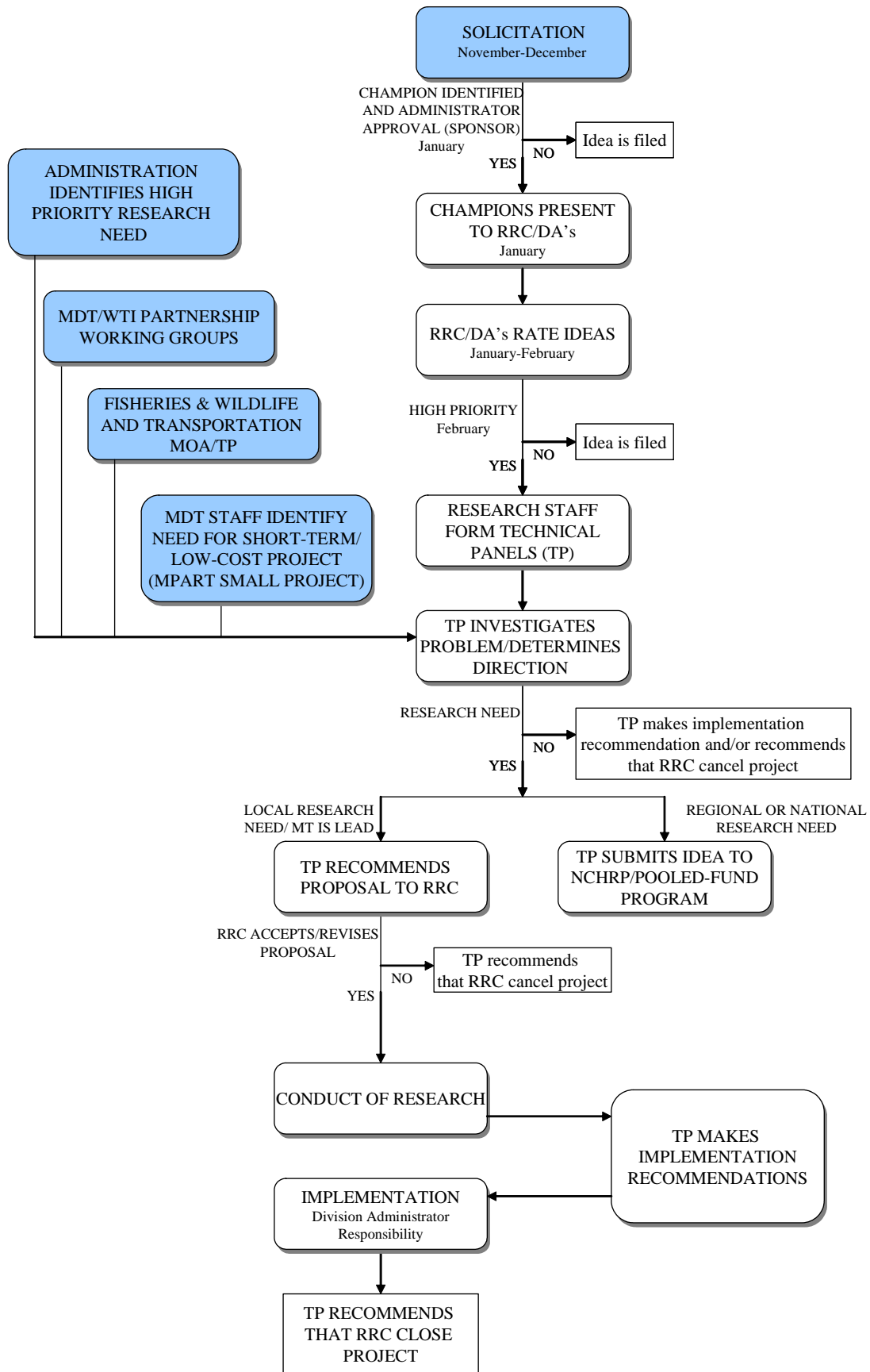


Figure 1: Research Projects Process.

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:	10/1/05	Start Date:	10/1/05
Completion Date:	9/30/06	Completion Date:	9/30/06
Total Cost:	\$167,619	Total Cost:	\$111,547
SPR Funds:	\$167,619	SPR Funds:	\$111,547
FFY 2006 Funds Expended:	\$167,619	FFY 2006 Funds Expended:	\$111,547
Status:	Continuing	Status:	Continuing

Objective:

The purpose of these two projects is threefold. The first purpose is to plan and administer the Research Programs and related research activities of MDT in finding solutions to existing highway and transportation challenges in Montana. The second purpose 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 attempting to solve existing highway construction, rehabilitation, or maintenance problems in Montana. The third purpose 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 2006, for the Research Projects Program, one solicitation cycle was completed, resulting in five new research projects:

- Computerized 3-Dimensional Highway Design and Modeling;
- Disparity/ Availability Study;
- Evaluation of Superpave Volumetric Specification;
- I-15 North Corridor - Canadian Truck Load and Bridge Roadway Analysis; and
- Montana Weeds to Web.

Four MPART projects were initiated in FFY 2006:

- Axial Capacity of Piles Supported on Intermediate Geomaterials;
- Experimental Assessment of Aggregate Surfacing Materials;

- Habitat Connectivity and Rural Context Sensitive Design within the Northern Rockies and Upper Great Plains: A Synthesis of Practice; and
- A High Fidelity Driving Simulator as a Tool for Design and Evaluation of Highway Infrastructure Upgrades.

Two projects were initiated as future phases of projects that were completed in FFY 2006:

- Effects of Defensive Vehicle Handling Training on Novice Driver Safety: A Case Study in Lewistown, Montana: Phase III Analysis of Safety Data and
- High Performance Concrete: Phase IV Specification Development and Implementation.

Fifteen projects are contracted and remain active:

- Bozeman Pass Wildlife Linkage and Channelization and Highway Safety Studies;
- Comparative Analysis of Coarse Surfacing Aggregate using the Micro-Deval, L.A. Abrasion, and Sulfate Soundness Tests;
- 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;
- Industry Best Practices for Applications Development Processes;
- 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, six projects are pending technical panel and Research Review Committee (RRC) review and approval:

- Business Market Analysis;
- Design of a Vertical Shape Portable Concrete Barrier;
- Developing a One-Stop Shop for Public/Specialized Transportation Information in Montana;
- Development of Wildlife Crossing Structures for Small and Large Species and Analysis of their Effectiveness;
- Highway Project Cost Estimating Best Practices; and

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

Three projects are pending completion of currently active projects:

- Compost Application for Optimized Vegetation Response;
- Determination of Unbound Base and Subgrade Resilient Moduli for Use in the Mechanistic-Empirical Pavement Design Guide; and
- Implementation of the Mechanistic-Empirical Pavement Design Guide for Designing Flexible Pavements in Montana.

Seven active research projects were completed:

- Animal-Vehicle Collisions and Habitat Connectivity Along Highway 83 in the Seeley-Swan Valley: Phase I;
- The Association Between Landscape Features and Transportation Corridors on Movements and Habitat - Use Patterns of Wolverines;
- 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;
- High Performance Concrete: Phase II Field Evaluation of the Performance of Three Concrete Bridge Decks on Montana Route 243;
- MDT Ride Specification Review; and
- Research Peer Exchange.

A research project close-out questionnaire was 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.

Finally, one project was cancelled:

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

During FFY 2006, the Experimental Projects Program had five new formal experimental projects constructed; construction reports were written. In addition, ten on-going field projects were visited, evaluated, and reports published. Finally, three new experimental projects have been nominated and are pending.

Reports/Training/Technology Transfer:

- One technology transfer project was funded.

- 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.
- Three newsletters were published (http://www.mdt.mt.gov/research/tech_trans/newsletters.shtml).
- MDT Research Programs Guidelines were revised in FFY 2006 (<http://www.mdt.mt.gov/research/docs/rmuguide.pdf>).
- The FFY 2005 Annual report was published in FFY 2006 (http://www.mdt.mt.gov/research/annual_report.shtml).
- Library services training was provided to approximately 40 MDT staff and others in five different sessions. In addition, new publications continue to be cataloged in MDT's library system (<http://www.mdt.mt.gov/research/unique/services.shtml>).
- Eleven Research Programs Overview presentations were given to MDT staff throughout the year.
- The Research Review Committee (RRC) met six times throughout the year to discuss research and pooled-fund projects.
- Eight of the nine MDT/WTI partnership working groups met in FFY 2006.
- A MDT peer exchange was held in October 2005.
- A TRB staff member was hosted for a day of meetings with MDT staff.
- A Research Programs audit was conducted.
- The Research Programs Manager and the Experimental Projects Program Manager attended the Transportation Research Board Annual Meeting. The Librarian attended the Transportation Library Connectivity Pooled Fund Meeting. In addition, the Research Programs Manager attended the National Research Advisory Committee Meeting; South Dakota, Alaska, and Hawaii Peer Exchanges; NCHRP Performance Measures for Research and Knowledge Management Panel Meetings; Transportation Library Connectivity Pooled Fund Meeting; Council of University Transportation Centers (CUTC) Conference; and the LTAP and WTI Governing Board meetings. The Research Manager gave four presentations at these meetings. Information from all meetings was disseminated to MDT staff as appropriate.

- The Region 4 (western region, includes 18 western states) Research Advisory Committee (RAC) meet via conference call five times throughout the year. Also, the Transportation Library Connectivity Pooled Fund Members met via conference call seven times in FFY 2006.
- Finally, performance appraisals were conducted for all Research Programs staff and performance plans were developed for the upcoming year.

MDT Project Manager:

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2.2.1.2 Evaluation of Experimental Projects

Project Number:	8021
Start Date:	10/1/05
Completion Date:	9/30/06
Total Cost:	\$4,089
SPR Funds:	\$4,089
FFY 2006 Funds Expended:	\$4,089
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 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=360&status=6>). The amount of funding is based on a triennium. For each year in the current triennium, MDT paid \$99,900 to support TRB core services. The National Cooperative Highway Research Program (NCHRP) is also supported through research funds (see <http://www.trb.org/CRP/NCHRP/NCHRP.asp>). The annual support amount is 5.5% of the total State Planning and Research (SPR) funds. For FFY 2006, support was provided in the amount of \$319,582.

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2.2.1.4 Montana Local Technical Assistance Program (LTAP)

Project Number:	2443
Start Date:	7/1/05
Completion Date:	6/30/06
Total Cost:	\$301,000
SPR Funds:	\$59,000
Federal Funds:	\$140,000
State Funds:	\$100,000
Contractor Cost Share:	\$2,000
FFY 2005* Funds Expended:	\$301,000
Status:	Continuing
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/ltap/ltap.shtml

* Note: The LTAP program is run on a state fiscal year. Hence, it is run nine months behind the federal fiscal year. FFY 2006 LTAP is currently active running from 7/1/06 to 6/30/07. Therefore, the FFY 2005 LTAP Program is presented here.

Objective:

The mission of the national Local Technical Assistance Program (LTAP) is to foster a safe, efficient, and 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 bridges 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 2005 included: 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, and program evaluation.

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 60 workshops/training sessions were given at various places throughout Montana (including: Community and Personal Preparedness; County Road Standards; Culvert Placement Trenching; Dump Truck Safety; Dust Control; Equipment Operator Training and Snow Rodeo; Forklift Operations; Gravel Roads Maintenance; Leadership; League of Cities and Towns Convention; MACRS Convention; Mowing Safety; Slips Trips, and Falls; Technical Leadership; Traffic Control Supervisor; Train-the-Trainer; Winter Maintenance; Winter Survival; Workforce Development: Equipment and Leadership; Work Zone Flagging; and Work Zone Traffic Control).

Reports:

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

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2.2.1.5 Technology Transfer

Project Number:	8117-999
Start Date:	10/1/05
Completion Date:	9/30/06
Total Cost:	\$336
SPR Funds:	\$336
FFY 2006 Funds Expended:	\$336
Unexpended Funds:	\$0
Status:	Continuing
Contractor:	Various

Objective:

During FFY 2006, a pot of research funding was set aside to fund various technology transfer efforts. This will continue as an annual project.

Progress:

One technology transfer effort was funded in FFY 2006. The Strategic Management Coordinator for the Wyoming Fish and Game Department was brought to Helena to present information on recent research titled *Pronghorn Movement and Distribution Patterns of Pronghorn in Relation to Roads and Fences in Wyoming*.

Reports:

N/A

MDT Project Manager:

Sue Sillick
406-444-7693
ssillick@mt.gov

Contractor Project Manager:

N/A

2.2.2 Completed Projects

2.2.2.1 Research Peer Exchange

Project Number: 6020
Start Date: 10/3/05
Completion Date: 10/7/05
Total Cost: \$10,000
SPR Funds: \$10,000
FFY 2006 Funds Expended: \$8,548
Unexpended funds: \$1,452
Status: Complete
URL: http://www.mdt.mt.gov/research/docs/peer/2005_report.pdf

Objective:

The objectives of the peer exchange were to: identify strengths, challenges, and opportunities for the information services component of MDT's Research Program; determine most pressing information needs of MDT staff; determine how best to meet these needs; explore potential areas of cooperation regionally and nationally to improve exchange and use of transportation information; discuss progress with the Midwest Transportation Knowledge Network, AASHTO sponsored Transportation Information Policy Study, Transportation Library Connectivity Pooled-Fund Study, and where to go from here; and identify useful ideas that each member of the peer exchange team can apply practically in his or her own organization.

Progress:

This project is complete. The final report was published.

Reports:

The final report was published and can be found at the above URL.

Implementation:

All recommendations have been implemented.

MDT Project Manager:

Sue Sillick
406-444-7693
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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: 5/1/05
Completion Date: 1/31/07
Total Cost: \$23,460
SPR Funds: \$0
State Funds: \$23,460
FFY 2006 Funds Expended: \$3,326
Unexpended Funds: \$5,854
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:

Due to principal investigator illness, this project has been delayed. All research has been completed. The final report is in review and should be finished early FFY 2007.

Reports:

No progress reports were received in FFY 2006 as the final report was being drafted. Project information can be found at the above URL.

MDT Project Manager:

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ssillick@mt.gov

Contractor Project Manager:

Ray Babcock
406-994-4870
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2.2.3.2 OJT Program Evaluation

Project Number: 8117-28
Start Date: 9/13/05
Completion Date: 4/30/07
Total Cost: \$18,315
SPR Funds: \$18,315
Contractor Cost Share: \$3,663
FFY 2006 Funds Expended: \$15,907
Unexpended Funds: \$2,408
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 on 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 proposes administering surveys of individuals involved with the OJT process to gather this information.

Progress:

This project has been extended at the request of the contractor to allow completion of analysis and the final report. An additional time extension was given because the contractor did not satisfactorily completed some required tasks. This project is active with a completion date of 4/30/07.

Reports:

Frequent communication occurred between MDT and the contractor. However, no formal progress reports were submitted despite numerous requests from MDT. MDT is holding funds pending satisfactory completion of work and acceptance of a final report.

MDT Project Manager:

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Contractor Project Manager:

John Baldrige
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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:	1/31/07
Total Cost:	\$23,351
SPR Funds:	\$23,351
Contractor Cost Share:	\$4,670
FFY 2006 Funds Expended:	\$18,647
Unexpended Funds:	\$4,704
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 process used by peer Departments of Transportation from around the United States. Obtaining this information is an important step in MDT's process of maintaining and improving the quality of its Research Projects Process. Bureau of Business and Economic Research (BBER) at The University of Montana-Missoula proposes reviewing the web sites and hard copy publications of MDT's peer research organizations, conducting a web-based survey with key research staff in MDT's peer organizations, conducting in-depth interviews with selected key informants from MDT's peer organizations, and conducting in-depth interviews with selected key informants from within MDT to gather this information.

Progress:

All work was completed with the exception of final analysis and drafting of the final report. This project is active with an anticipated completion date of 1/31/07.

Reports:

Frequent communication occurred between MDT and the contractor. However, no formal progress reports were submitted despite numerous requests from MDT. MDT is holding funds pending acceptance of the final report.

MDT Project Manager:

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Contractor Project Manager:

Daphne Herling
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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:	12/1/06
Total Cost:	\$215,907
SPR Funds:	\$215,907
FFY 2006 Funds Expended:	\$68,722
Unexpended Funds:	\$3,687
Status:	Contracted
Contractor:	Battelle
URL:	http://www.mdt.mt.gov/research/projects/admin/evasion.shtml

Objective:

The objective of this project 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 Highway 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 1/31/07 to allow for a thorough review of the final report. The research team concluded its examination of the region's motor fuel distribution and tax systems and found that the opportunities for motor fuel tax evasion within a state are affected by a number of factors including regional geography, fuel production, and fuel distribution. Moreover, relevant tax codes, fuel tax administrative procedures, and fuel tax enforcement efforts internal to a jurisdiction and of those in surrounding jurisdictions could potentially impact collections in a significant manner. Analysis of these factors is important in order to identify the potential compliance issues, and properly design and employ a methodology for estimating fuel tax evasion within a jurisdiction.

Several approaches have been utilized to analyze these factors for Montana. Visual representations and GIS maps were created using data characterizing regional fuel production, fuel distribution, geographic relationships, and motor fuel tax program features. Montana tax codes relating to motor fuel taxation were also examined and

compared with other jurisdictions. Further, characteristics of fuel tax administrative and enforcement procedures in Montana were identified and evaluated in relation to those identified in neighboring states.

Reports:

Monthly and quarterly progress reports are located at the above URL.

MDT Project Manager:

Craig Abernathy
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Contractor Project Manager:

Patrick Balducci
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balduccip@battelle.org



2.2.3.5. Montana Air Service: Opportunities and Challenges

Project Number:	8185
Start Date:	1/1/05
Completion Date:	12/1/06
Total Cost:	\$204,107
SPR Funds:	\$204,107
FFY 2006 Funds Expended:	\$88,909
Unexpended Funds:	\$9,094
Status:	Contracted
Contractor:	Wilbur Smith Associates (WSA)
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 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 monitor the performance of the strategy as changes occur in the future.

Progress:

Due to significant changes in air service within the State of Montana, MDT has requested the current report be updated to reflect those conditions. Significant progress has been made in updating the analysis and report, with a revised final report expected early FFY 2007. Montana passenger enplanements are now updated with totals for the first six months of 2006 compared against totals for the first six months of 2005. Other tables and related text are being reviewed and updated as necessary to reflect calendar year 2005 US DOT data. The most recent data available from the Air Transport Association is now incorporated in the graphs and tables where applicable. Socioeconomic data is now updated through 2005 per Woods & Poole.

Reports:

Quarterly progress reports are located 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 was included in a RFP. The project should be contracted early FFY 2007.

Purpose:

Initiate a study to determine what opportunities are available for a new or expanding business in Montana highway construction and consulting industries through MDT. The information provided by this study would help the disadvantaged business enterprise (DBE) Supportive Services program within the Department inform subcontractors and subconsultants of these identified opportunities, requirements, and challenges, individually or collectively at workshops.

It is for these reasons the Montana Department of Transportation is initiating a research project to report on the most efficient and effective methods to inform and educate new and existing businesses 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 practice, and available documentation, report on national and state level efforts to provide information to prospective contractors/subcontractors in working with MDT in providing contractual services. The report will include, but not be limited to:

- In addition to the literature review phase, the project will include surveys and interviews pertaining directly to the Department's needs with relevant information providers, contractors, MDT staff, and applicable experts to support the products of this effort. MDT staff will assist the consultant in providing supplemental information on those individuals required to participate. The Department will pre-approve all surveys and interview information.
- Determine what opportunities are available for companies and what challenges these companies have to enter and compete in that field of work.
- Collect data on work types for current contractors (subs) working on MDT projects. Determine the competitiveness of the market for the work types. Determine and explain the requirements of the contract work (equipment, bonding, insurance, expertise requirements, etc.).

- Identify and report on all barriers (real or perceived) to new companies wanting to work in this industry. Provide suggestions on possible strategies to address and resolve those barriers.
- Develop a checklist of items the contractors will need to compete successfully in this market and to assure they fulfill their requirements. Also, develop an internal checklist for MDT staff in assisting contractors to compete effectively.
- Identify and develop new tools to reach and educate potential DBE companies and new contractors.
- Develop a strategy to distribute this information to our stakeholder customers to include a tracking program tied to reasonable performance measures to assist the Department in monitoring the effectiveness to include all contractors in our highway program.
- Develop an implementation plan to support the above objectives.

MDT Project Manager:

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2.2.4.2 Disparity/Availability Study

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

Purpose:

The purpose of this RFP is to solicit proposals to establish a contract to conduct an in-depth study which will determine the extent to which barriers exist that impact small, disadvantaged businesses' ability to participate in federally assisted contracting opportunities in the transportation industry in Montana. This study must encompass highway, including metropolitan planning organizations (MPO's); public transit; and airport contracts and grants.

The primary purpose of this RFP is to identify and define, through an Availability and Disparity Study, the availability of ready, willing, and able minority and women owned businesses in the federal-aid transportation construction industry in Montana; to determine if discrimination exists in transportation construction industry in Montana; and, if so, to what extent it is present.

The federal-aid transportation construction program in Montana is funded by contracts using funds from State agencies. State modal administrations include the Federal Highway Administration (FHWA), the Federal Aviation Administration (FAA), and the Federal Transit Administration (FTA). The State contracts are administered by the recipients of FHWA, FAA, and FTA financial assistance.

The study must be the basis for legally defensible actions to be taken by the State in administering 49 Code of Federal Regulations Part 26 (49 CFR Part 26). The selected offeror shall have a proven ability to conduct an appropriate study within the legal framework established by the courts applicable to the implementation of affirmative action programs in public contracting. Proven ability means the offeror has proof of its experience and ability to conduct Availability and Disparity studies, as well as to defend its findings and conclusions in a US court of law.

Additionally, the offeror shall provide a complete review of the State Disadvantaged Business Enterprise Program to assist in administering the program and for the establishment of a statewide (or local recipient) overall DBE goal.

The offeror shall complete a two-part Study consisting of an Availability Analysis and a Disparity Analysis.

Objectives:

- To determine the extent to which Disadvantaged Businesses, defined as minority and women owned business, participate in the procurement of United States Department of

Transportation (USDOT)) federally funded highway/airports/ transit contracts within Montana in general construction services, professional services, supplies, and manufactured items;

- To determine if DBE participation is representative of the availability of minority and women owned businesses ready, willing, and able to participate in federally funded State contracts within Montana. By State modal administration, calculate the percentage of ready, willing, and able DBE firms by each of the presumed groups as defined in 49 CFR Part 26 to be presumed disadvantaged;
- To determine whether discrimination exists, and if found, identify by transportation modal group and individually all groups affected;
- To identify groups that are over or underutilized for federally funded State contracts based on their availability; and
- To quantify the magnitude of differences between DBE availability (based on capacity) and participation on federally funded State contracts.

Scope:

The scope of work shall include the following tasks for determining the availability of DBE firms able and willing to perform work, and for providing a statistical analysis which will determine if/or how much disparity results from discrimination.

Tasks:

AVAILABILITY ANALYSIS

- Determine DBE availability estimates for the three transportation areas: highways, public transit, and airports. To the extent allowable, vendor will use the State's existing electronic data base systems, and will incorporate information on prime Vendors and first-tier Subvendors, professional services consultants, and grantees.
- Determine geographic markets and product markets for construction contracts, professional agreements, and grantees. Geographic markets will be defined by county and by District. Product markets will be defined according to the most recent version of the North American Industrial Classification System (NAICS) code.
- Define the universe of firms potentially available to work in the identified industries. Determine the population numbers for DBE firms and non-DBE firms.
- Determine if, or how many DBE and non-DBE firms are misclassified in race, ethnicity, or gender of firms' ownership.
- Calculate availability estimates to be used by the State, public transit, airports, and MPO's for a) overall statewide goal-setting, and (b) contract/agreement/grant specific goal setting based on the detailed industries present in any given project.
- Provide an estimate of what the State DBE participation might look like in the absence of contract-based DBE goals. This will provide insights into how much of the overall goal for FHWA, FTA, and FAA projects could be met by strictly race or gender neutral means.

DISPARITY ANALYSIS

- Provide an analysis of discrimination and its effect separately for each of the groups presumed disadvantaged by 49 CFR Part 26, as amended.
- Provide an analysis of barriers in obtaining bonding and financing, disparities in business formation and earnings, studies and findings of governmental agencies and commissions, lawsuits and other legal actions, and other statistical evidence, as may be appropriate.
- Provide an analysis of factors other than discrimination that may account for statistical disparities between DBE availability and participation.
- Determine to what degree and extent the DBE program promotes or positively influences subcontracting opportunities for DBE and non-DBE firms on State assisted projects.
- The Disparity Analysis shall also provide an evaluation of the State's and selected DBE programs and recommend possible revisions to all aspects of these DBE programs to ensure effectiveness and compliance with 49 CFR Part 26. Particular emphasis will focus on the annual and project/contract goal setting processes for DBE goals.
- Provide an analysis of anecdotal information gathered through statewide hearings or other information gathering techniques.
- Provide an analysis of any differences between DBE availability and DBE participation in race-neutral and race-conscious contracts, agreements, and grants.
- Set forth the legal framework for the analysis, particularly noting any relevant Montana matters and court decisions.
- Provide assumptions made that impact the analysis, particularly discussing: any approaches utilized and support for the approach; the market area and regional breakdown utilized and reasoning behind the breakdown utilized; and any contracts or other information that were or were not included in the analysis, and the reasons for their inclusion or exclusion, as well as any limitations on the use of any data/proxies.
- Provide descriptions of the methodology used by Vendor in its data collection and evaluation, availability analysis, utilization analysis, and anecdotal evidence. In general, Vendor should address the complications of measuring potential discrimination when a DBE Program's own success may skew the numbers.
- The offeror shall track and show changes in availability and disparity of firms from 1999 through 2006.
- Provide recommendations as to how often an availability and/or disparity study should be conducted in order to maintain the validity and integrity of the program.

Project Manager:

Sue Sillick
406-444-7693
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2.3 BRIDGE AND HYDRAULICS RESEARCH PROJECTS

2.3.1 Completed Projects

2.3.1.1 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:	7/31/06
Total Cost:	\$301,400
SPR Funds:	\$253,400
Contractor Cost Share:	\$48,000
FFY 2006 Funds Expended:	\$38,814
Unexpended Funds:	\$0
Status:	Complete
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 was to investigate the performance of three different types of concrete bridge decks. A conventionally reinforced deck made with standard concrete, designed and constructed following standard practices of MDT's Bridge Bureau. 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. A conventionally reinforced deck made with high performance concrete (HPC) developed following FHWA guidelines.

Conclusion:

The analysis presented in the report generally serves as a baseline assessment of the relative condition of the decks. Based on all of the information obtained to-date, the HPC deck potentially will offer the most cost effective performance of the three deck configurations, followed closely by the Conventional deck, and more distantly by the Empirical deck. This conclusion is primarily based on the relative visual distresses observed in the decks and on the relative stability of their behavior over time, as inferred from the live load strain data. In making this statement, it is important to recognize that: a) the differences in performance between the decks were small; b) the various pieces of evidence related to their relative performance sometimes tell a conflicting story; and c) presently subtle differences in their performance could become

significant in the future. Thus, this conclusion must be considered as “preliminary” in nature, until it can be confirmed (or refuted) based on additional study of the decks’ performance over time.

Reports:

The final report can be found at the above URL.

MDT Project Manager:

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Contractor Project Manager:

Eli Cuelho
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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:	12/31/07
Total Cost:	\$321,790
SPR Funds:	\$160,895
Contractor Cost Share:	\$160,895
FFY 2006 Funds Expended:	\$12,995
Unexpended Funds:	\$40,775
Status:	Contracted
Contractor:	United States Geologic Survey
URL:	http://www.mdt.mt.gov/research/projects/hyd/bridge_scour.shtml

Objective:

The overall objective of this project is to improve pier-scour estimates at bridges in Montana. To this end, this 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 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 was extended to allow for additional monitoring. This project is active and on schedule with an anticipated completion date of 12/31/07.

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

Reports:

One semiannual progress report and one interim report have been received and can be viewed at the above URL.

MDT Project Manager:

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Contractor Project Manager:

Stephen Holnbeck
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2.3.2.2 High Performance Concrete: Phase IV Specification Development and Implementation

Project Number:	8156-003
Start Date:	7/1/06
Completion Date:	2/28/07
Total Cost:	\$30,000
SPR Funds:	\$20,000
Bridge Bureau Cost Share:	\$10,000
FFY 2006 Funds Expended:	\$5,769
Unexpended Funds:	\$14,231
Status:	Contracted
Contractor:	Wiss, Janney, Elstner Associates, Inc./HDR Inc.
URL:	http://www.mdt.mt.gov/research/projects/mat/high_concrete.shtml

Objective:

To maximize the efficiency of the construction process, a performance-based concrete special provision will be developed. This type of specification allows the contractor great flexibility to meet the job requirements in a manner that is least expensive for the state and targeted at producing the best final product. However, since short-term testing is not adequate to assess all aspects of long-term durability and to best implement the developmental work already completed, some guidelines for the mix designs will be specified.

This specification will cover each step in the process for submittals, approval, and implementing high performance mixtures that include supplementary cementitious materials (SCM's). The specification will include provisions covering raw material prequalification for cement, SCM's, and aggregates. A trial placement will be specified to allow the assessment of the batching, mixing, transporting, placing, and finishing of the HPC. The parameters of a trial batching and trial placement for contractors who have not used the proposed concrete mixture on a previous MDT job and for those that have successfully used the mixture on a previous MDT job will be outlined.

The individual performance components of the hardened concrete will include:

- Compressive strength,
- Abrasion resistance,
- Free drying shrinkage,
- Rapid chloride permeability,
- Chloride diffusion coefficient, and
- Parameters of the air void network.

Progress:

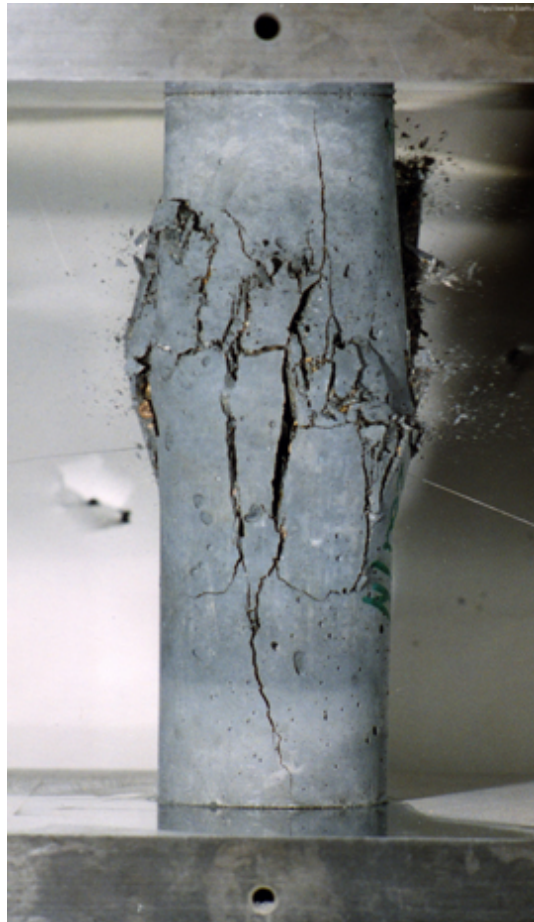
Initial draft HPC specification submittal is expected early FFY 2007.

MDT Project Manager:

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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 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:	6/30/06
Total Cost:	\$199,972
SPR Funds:	\$199,972
FFY 2006 Funds Expended:	\$27,106
Unexpended Funds:	\$53
Status:	Complete
Contractor:	The University of Montana
URL:	

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

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:

The project was extended to allow analysis of data and review of the draft final report. The final report was published.

Reports:

The final report was published and is available at the above URL.

MDT Project Manager:

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Contractor Project Manager:

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2.4.1.2 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 2006 Funds Expended: \$16,178
Unexpended Funds: \$0
Status: Complete
Contractor: Western Transportation Institute, Montana State University
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. 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 was printed and published. MDT has decided not to pursue Phases 2-4.

Reports:

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

MDT Project Manager:

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Contractor Project Manager:

Marcel Huijser
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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:	12/31/06
Total Cost:	\$597,700
SPR Funds:	\$147,700
Federal Funds:	\$450,000
FFY 2006 Funds Expended:	\$58,397
Unexpended Funds:	\$13,620
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/env/wildlife_crossing.shtml

Objective:

In December 2000, the Confederated Salish and Kootenai Tribes (CSKT), the Federal Highway Administration (FHWA), and the Montana Department of Transportation (MDT) agreed to reconstruct 90 km 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:

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

Reports:

One progress report was received and can be viewed at the above URL. Also, the final report was drafted and submitted for review.

MDT Project Manager:

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Contractor Project Manager:

Amanda Hardy
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2.4.2.2 Habitat Connectivity and Rural Context Sensitive Design: A Synthesis of Practice

Project Number:	8117-31
Start Date:	11/1/05
Completion Date:	1/31/07
Total Cost:	\$24,923
SPR Funds:	\$19,938
Contractor Cost Share:	\$4,985
FFY 2006 Funds Expended:	\$7,492
Unexpended Funds:	\$11,968
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/env/habitat.shtml

Objective:

There are a group of inter-related issues that are driving the need for increased knowledge about context sensitive solutions and context sensitive design (CSS/CSD) for rural transportation infrastructure including: 1) planning and management of land use (especially determining how transportation relates to other planning and management efforts), 2) preserving the rural nature through roadside design, and 3) preserving wildlife habitat connectivity and minimizing wildlife/vehicle collisions.

The objective of this project is to identify beneficial practices (including programs, design elements, or operations) used within comparable regions to Montana (intermountain west) that target at a minimum known strategic issues facing the department. These strategic issues include, but are not limited to: system-level planning requirements for habitat protection, traveler safety, improvements to habitat connectivity, and perpetuation of community character and links to local land-use decisions.

Although many transportation studies have been conducted to determine context sensitive solutions and help mitigate interactions between vehicles and wildlife, little work has been done to synthesize this information in a concise and meaningful way that is applicable to transportation in Montana. Therefore, the primary objective of this project is to synthesize the abundance of information related to transportation applicable to transportation planners at the Montana Department of Transportation. This synthesis will not include recommendations or guidelines, but identify case studies and practices of other states related to sustainable transportation in Montana.

Progress:

This project was extended to allow complete review of the final report. All work was completed with exception of drafting the final report. This project is active with an anticipated completion date of 1/31/07.

Reports:

Two progress reports were received in FFY 2006; these reports can be viewed at the above URL. Work was also conducted on drafting the final report.

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2.4.2.3 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: 10/31/06
Total Cost: \$178,624
SPR Funds: \$178,624
FFY 2006 Funds Expended: \$27,631
Unexpended Funds: \$5,399
Status: Contracted
Contractor: The University of Montana
URL: http://www.mdt.mt.gov/research/docs/research_proj/turtle/final_report.pdf

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 and 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:

This project was extended due to changes in scope and to allow complete analysis and review of the deliverables. All work is complete. The final report is in the final stages of review.

Reports:

The final report was published prior to this annual report and can be viewed at the above URL.

MDT Project Manager:

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Contractor Project Manager:

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2.4.2.4 Bozeman Pass Wildlife Linkage and Highway Safety Pilot Study

Project Number:	8173
Start Date:	2/28/03
Completion Date:	5/31/10
Total Cost:	\$82,498
SPR Funds:	\$82,498
FFY 2006 Funds Expended:	\$0
Unexpended Funds:	\$57,442
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/env/boz_wildlife.shtml

Objective:

Two different but related wildlife research projects on Interstate 90 at Bozeman Pass between Bozeman and Livingston, Montana are currently being conducted.

The first project, Bozeman Pass Wildlife Linkage and Highway Safety Pilot Study will evaluate the effectiveness of wildlife fencing that will be installed at the Montana Rail Link (MRL) overpass on I-90 near Bear Canyon. Data on wildlife crossings and animal-vehicle collisions will be collected before and after installation of the fencing in order to evaluate if the fencing reduces animal-vehicle collisions, as well as if animals maintain movements across the transportation corridor by traveling under I-90 through existing culverts and the MRL overpass.

The objective of the second project is to test the use of Intelligent Transportation Systems (ITS) in addressing wildlife-vehicle conflicts on Bozeman Pass (Intelligent Transportation System Deployment Program Project Identification Number VIL.H.24, entitled "Bozeman Pass Wildlife Channelization ITS Project"). ITS are advanced technologies (such as highway advisory radio or electronic message signs) that can be installed on roads to improve safety or address other transportation issues that affect drivers. This project will address whether wildlife advisories on automated roadside message signs may help reduce animal-vehicle collisions. This effort includes a speed study and driver survey to quantify potential effects that wildlife advisory messages may have on speed and driver behavior. In addition, a driver simulator study will test how drivers respond to wildlife advisory messages, as well as how their speed influences the occurrence of an animal-vehicle collision.

Together, these two projects will provide a better understanding of the effectiveness of highway construction options and traveler information methods in reducing wildlife-transportation conflicts on Bozeman Pass. This information can be used for long term

planning efforts to ensure that future highway construction promotes both wildlife protection and traveler safety.

The first study is contracted through the MDT Research Programs.

Progress:

The project was extended to allow the ITS wildlife channelization project to be completed and to allow additional monitoring. No work was conducted on the Bozeman Pass Wildlife Linkage and Highway Safety Pilot Study until the ITS wildlife channelization project was complete in June 2006.

Reports:

Monthly progress reports were received on the ITS wildlife channelization study. A final report was also published and is available at the above URL.

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Contractor Project Manager:

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2.4.2.5 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 2006 Funds Expended: \$31,040
Unexpended Funds: \$11,835
Status: Contracted
Contractor: Montana State University
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:

All work has been completed. The final report is currently being drafted.

Reports:

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

Note:

A Phase III project has been moved forward to the technical panel stage, pending completion of this project. The Technical Panel has not met yet (see Section 2.4.3.2).

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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 2006 Funds Expended:	\$57,778
Unexpended funds:	\$22,873
Status:	Contracted
Contractor:	Montana State University
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 that 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 that are being considered by state agencies in the Northwest. Some managers contend that all culverts should pass all fish at all times, whereas others suggest that 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:

Progress for FFY 2006 included equipment selection and fabrication, fish passage and hydraulic data collection, and data analysis. This project is on time, budget, and scope.

Reports:

Four progress reports were received in FFY 2006 and can be viewed at the above URL.

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Contractor Project Manager:

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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 2006 Funds Expended: \$62,310
Unexpended Funds: \$55,736
Status: Contracted
Contractor: Montana State University
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 that a culvert can have on a fishery. Recent basin-wide studies of various trout species that we conducted in western Montana indicate that the tools that 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 predictable from hydraulic analysis and to refine information about the physiologic abilities of these species to pass through culverts.

Progress:

Progress for FFY 2006 included experimental design, fish passage and hydraulic data collection, and data analysis. This project is on time, budget, and scope.

Reports:

Four progress reports were received in FFY 2006 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 numerous times in FFY 2006 to determine if a research need exists and, if so, to develop a scope of work.

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 structures. 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 back to 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 Compost Application for Optimized Vegetation Response

The following research problem statement was submitted. This project is pending completion of *Evaluation of Organic Matter Compost Addition and Incorporation in Steep Cut Slopes: Phase II Test Plot Construction and Performance Monitoring* (see section 2.4.2.5).

Problem Statement:

Revegetation of roadside disturbances has proven difficult when inhospitable growth media has been encountered. Recognizing that compost application may dramatically improve vegetation development, MDT contracted with Montana State University (MSU) Reclamation Research Unit to perform a research investigation evaluating compost application and incorporation on steep cut slopes. This research project was initiated during 2003. Several research plots were constructed near Happys Inn on U.S. 2 and near Miles City on U.S. 12. Summer 2004 was the first growing season for all the research plots. Vegetation response spanned a wide range from robust vegetation development on the compost treated plots at Happys Inn to incipient vegetation growth at the Miles City research site. The problems observed with compost application technologies are two-fold. First, the rate of application has not been optimized to minimize cost. Two application rates were applied during construction of research plots; a 1 inch and 2 inch layer. In the high moisture regime of northwest Montana, plants flourished in both treatments. It is probable that a lesser application rate can achieve acceptable vegetation results, and make the use of compost more attractive by virtue of reduced cost. A need exists to optimize application rates to reduce cost. Secondly, compost applied as a blanket at the Miles City research site was desiccated during the summer months reflecting drought conditions observed in eastern Montana. Concurrent wind removal of the compost prior to plant establishment diminished the potential treatment benefit. Substantial areas on the treated plots were negatively impacted by wind transport of applied compost. A need exists to develop techniques to stabilize compost and prevent wind effects.

In summary, development of compost amendment techniques show great promise for aiding in revegetation of difficult parent material along Montana transportation corridors. Preliminary results from existing test plots are very promising. Prior to adoption of compost-based revegetation prescriptions for large scale construction projects, optimization of the techniques employed and rates of application is required to address limitations observed. The compost application rate needs to be adjusted downward on sites with abundant rainfall to identify an optimal rate and techniques need to be developed to prevent compost blowing in wind-prone areas.

Research Proposed:

New research plots are proposed to optimize the compost application technology for Montana roadsides. The Four Corners-Madison River road corridor on Highway 84 is tentatively selected as a research site reflecting proximity to a compost supplier, proximity to Montana State University and sparsely vegetated roadcuts observed. Experimental plots will be constructed to evaluate compost application rates between 0 and 1 inch depths. The preliminary compost blanket thicknesses are 0, 0.25, 0.5, 0.75 and 1.0 inches. Vegetation response and erosional condition will be monitored. Similarly, experimental plots will be constructed evaluating several methods of stabilizing compost to prevent wind removal prior to vegetation establishment. The preliminary stabilization treatments include application of plastic netting, and use of liquid tacifiers. Compost retention and plant performance will be monitored for 3 years following implementation with emphasis placed on the critical first growing season.

MDT Project Manager:

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2.4.4 Canceled Projects

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

The technical panel chosen to oversee this project determined that at this time no formal research is needed.

MDT Project Manager:

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2.4.4.2 Montana Weeds to Web

The technical panel chosen to oversee this project met numerous times and determined that at this time no formal research is needed.

Currently, the Department has a weed management plan in place. This weed management plan includes inventory of weeds by site visits and treatment of weed infested areas by county-based weed coordinators or contract employees. Treatment and inventory occur together and is relatively easy due to easy access to right-of-way. This is a cost-efficient method of weed management, which must occur on the ground.

MDT Project Manager:

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2.5 GEOTECHNICAL, MATERIALS, AND PAVEMENTS RESEARCH PROJECTS

2.5.1 Completed Projects

2.5.1.1 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 2006 Funds Expended:	\$38,983
Unexpended funds:	\$7
Status:	Complete
Contractor	Sierra Transportation Engineers
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 were published.

Reports:

The final report and implementation documents were published and can be found at the above URL.

Implementation:

A number of implementation products were prepared as a result of this research, including: MT-422 Method of Test for Surface Smoothness and Profile, Profiler Operations Manual (POM) for MDT Profilers, Quality Control and Quality Assurance Plan (QC/QA) for MDT Profiling, and Ride Specification for Flexible Pavement. These products were implemented as of MDT's September 2006 letting.

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Contractor Project Manager:

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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:	10/31/06
Total Cost:	\$25,000
SPR Funds:	\$20,000
Contractor Cost Share:	\$5,000
FFY 2006 Funds Expended:	\$7,554
Unexpended Funds:	\$3,837
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/docs/research_proj/prevent_maint/final_report.pdf

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 was extended to increase survey participation and to allow for a complete analysis and review of the final report. This project is active with an anticipated completion date of 10/31/06. As of 9/30/06, all research was completed and the final report was in review.

Reports:

The final report was published prior to the completion of this annual report; it 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: 12/31/06
Total Cost: \$23,323
SPR Funds: \$18,082
Contractor Cost Share: \$5,242
FFY 2006 Funds Expended: \$15,868
Unexpended Funds: \$2,214
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 was extended at the contractor's request to allow the contractor time for complete analysis of the results. This project is active with an anticipated completion date of 12/31/06. All work was completed in FFY 2006, with the exception of final data analysis and drafting of the final report.

Reports:

Three progress reports were received in FFY 2006; they can be viewed at the above URL.

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2.5.2.3 Axial Capacity of Piles Supported on Intermediate Geomaterials

Project Number:	8117-32
Start Date:	3/1/06
Completion Date:	7/31/08
Total Cost:	\$40,041
SPR Funds:	\$23,896
Contractor Cost Share:	\$16,144
FFY 2006 Funds Expended:	\$595
Unexpended Funds:	\$23,301
Status:	Contracted
Contractor:	Montana State University
URL:	http://www.mdt.mt.gov/research/projects/mat/axial.shtml

Objective:

The axial capacity, driving resistance, and long-term resistance of piles driven into intermediate geomaterials are not well established. There is little to no published guidelines for addressing the properties of these materials in terms of pile axial capacity.

Intermediate geomaterials are encountered throughout Montana and it is anticipated that a significant number of future bridge foundations will be founded in these materials, especially in the eastern portion of the state. Because the expense of conducting pile loading tests is cost prohibitive for most bridge projects, MDT geotechnical engineers and geologists could greatly benefit from improved empirical procedures for performing axial pile analyses, for predicting driving resistances, for predicting axial resistance, and for estimating pile tip depth.

The primary objective of this study will be to develop empirically based guidelines for the analysis and design of piles driven into intermediate geomaterials. The guidelines will be developed by conducting back analyses using previously collected data from pile installation projects.

Results from this study will have the potential to improve the reliability and cost effectiveness of a significant number of future bridge foundations in the state of Montana.

Progress:

A project kickoff meeting was held in April 2006. At that time, it was determined quarterly reporting would alternate between written reports and reports given at panel

meetings. The first meeting report is due in October 2006. This project is active and on schedule, with an anticipated completion date of 7/31/08.

Reports:

No reports were due this FFY. Project information can be found at the above URL.

MDT Project Manager:

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Contractor Project Manager:

Bob Mokwa
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2.5.2.4 Pavement Performance Prediction Models

Project Number: 8158
Start Date: 6/12/01
Completion Date: 4/30/07
Total Cost: \$518,907
SPR Funds: \$518,907
FFY 2006 Funds Expended: \$0
Unexpended Funds: \$40,563
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 has been extended to allow a more thorough review of the final report. This project is active with an anticipated completion date of 4/30/07. All work is complete with the exception of drafting the final report.

Reports:

One progress report was received and can be viewed at the above URL. Work was also conducted on drafting the final report.

Note:

Two projects are pending completion of this project (see Sections 2.5.3.1 and 2.5.3.2).

MDT Project Manager:

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Contractor Project Manager:

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2.5.3 Pending Projects

2.5.3.1 Implementation of the Mechanistic Empirical Pavement Design Guide for Designing Flexible Pavements in Montana

This project is pending completion of *Pavement Performance Prediction Models* (see Section 2.5.2.4).

Project Manager:

Sue Sillick
406-444-7693
ssillick@mt.gov

2.5.3.2 Determination of Unbound Base and Subgrade Resilient Moduli for use in the Mechanistic-Empirical Pavement Design Guide

This project is pending completion of *Pavement Performance Prediction Models* (see Section 2.5.2.4).

Project Manager:

Sue Sillick
406-444-7693
ssillick@mt.gov

2.5.3.3 I-15 North Corridor - Canadian Truck Load Bridge and Roadway Analysis

The following research problem statement was submitted. The Technical Panel met numerous times in FFY 2006 to determine if a research need exists and, if so, to develop a scope of work.

Problem Statement:

Examine the feasibility of allowing Canadian "B" truck train traffic from Alberta, Canada into Great Falls, Montana. Allowing the heavier Canadian trucks would open up a North-South Corridor for increased commerce and economic gain to North Central Montana.

Research Proposed:

- Examine whether existing bridges are adequate for the heavier Canadian truck loads.

- Examine the impact the heavier loads would have on existing paving.
- Review of the earlier similar study by MSU Engineering Department of the Sweetgrass to Shelby corridor.

Project Manager:

Craig Abernathy
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2.5.3.4 Evaluation of the Superpave Volumetric Specification

The following research problem statement was submitted. The Technical Panel met numerous times in FFY 2006 to determine if a research need exists and, if so, to develop a scope of work.

Problem Statement:

Volumetric incentive system has been implemented for Superpave Grade S plant mix. The Department would like to determine how it has affected the quality and performance of the product, and the prices bid.

Research Proposed:

Research would consist mostly of evaluating the Department's plant mix construction and bid records, and the ride and pavement condition reports. A survey could be used to get opinions and recommendations from MDT and Contractor personnel. The proposed research should answer the following questions:

- Are we getting our money's worth?
- Are there any recommendations to change the specification to improve the product, for both the Department and the Contractors?

Project Manager:

Craig Abernathy
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2.6 PLANNING AND SAFETY RESEARCH PROJECTS

2.6.1 Completed Projects

2.6.1.1 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:	12/31/05
Total Cost:	\$94,756
SPR Funds:	\$94,756
FFY 2006 Funds Expended:	\$10,276
Unexpended Funds:	\$2,808
Status:	Complete
Contractor:	Western Transportation Institute, Montana State University
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 was published.

Reports:

The final report was completed and can be viewed at the above URL.

Implementation:

Implementation resulted in contracting Phase II of this project (see section 2.6.1.2).

MDT Project Manager:

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Contractor Project Manager:

Michael Kelly
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2.6.1.2 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 2006 Funds Expended: \$49,506
Unexpended Funds: \$7,338
Status: Complete
Contractor: Western Transportation Institute, Montana State University
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 II includes presentation to teens of the advanced driving training developed in Phase I.

Progress:

All research is complete. The final report was published.

Reports:

The final report was published and can be viewed at the above URL.

Implementation:

Implementation resulted in contracting Phase III of this study (see Section 2.6.2.2).

MDT Project Manager:

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Contractor Project Manager:

Michael Kelly
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2.6.2 Contracted Projects

2.6.2.1 A High Fidelity Driving Simulator as a Tool for Highway Design and Evaluation of Highway Infrastructure Upgrades

Project Number:	8117-33
Start Date:	4/1/06
Completion Date:	11/30/06
Total Cost:	\$48,000
SPR Funds:	\$26,202
Contractor Cost Share:	\$21,798
FFY 2006 Funds Expended:	\$15,692
Unexpended Funds:	\$10,510
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
URL:	http://www.mdt.mt.gov/research/projects/safety/high_fidelity.shtml

Objective:

High fidelity driving simulators provide an opportunity to simulate and test drivers' responses to improvements in infrastructure, information and warning messages, and other deployments. The planned deployments on U.S. 191 in the vicinity of Big Sky, Montana are an excellent opportunity for using a simulator for rapid prototyping. For many of the scheduled deployments of curve, ice, and excessive speed warnings, driving simulation would provide a tool to refine the plan for location, visibility, and message sets. WTI proposes to create and test a simulation capability, using our existing simulator, to quickly and inexpensively evaluate these proposed deployments.

Progress:

A project kickoff meeting was held in April 2006. Between April and September 2006, testing scenarios and tiles were developed. Data was collected as drivers were run through the simulation. Data is currently being analyzed and validated. This project is active and is approximately 3.5 months behind schedule.

Reports:

Two progress reports were submitted in FFY 2006; these can be viewed at the above URL.

MDT Project Manager:

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Contractor Project Manager:

Michael Kelly
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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 III Analysis of Safety Data

Project Number:	8183-003
Start Date:	5/1/06
Completion Date:	4/30/10
Total Cost:	\$170,000
SPR Funds:	\$85,000
Contractor Cost Share:	\$85,000
FFY 2006 Funds Expended:	\$24,879
Unexpended Funds:	\$60,121
Status:	Contracted
Contractor:	Western Transportation Institute, Montana State University
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. In the first two phases, accident records for young Montana drivers were analyzed and a defensive driving curriculum was designed to address the most common risks. WTI and the Montana Office of Public Instruction recruited approximately 400 young drivers in central Montana to take part in the study. Half received a one day intervention of advanced defensive driving during the summer of 2005. This third phase involves the longitudinal collection and analysis of accident and violation data.

Progress:

During the initial year of the study while training was being conducted, participants completed a written survey of their driving experience that was developed by the Montana Office of Public Instruction. Participants who did not participate in the training were mailed the survey during the same timeframe and reimbursed for their time in completing it. The survey covered their kinds and hours of driving and any violations, near accidents, or accidents they had encountered since completing high school driving training.

During this task in the 2006 effort, an identical survey covering the year ending in June 2006 was mailed to the study participants. They were reimbursed for their time in completing and returning the survey. Approximately 350 surveys were mailed with a goal of obtaining an 80% return rate. On the initial mailing, approximately 180 usable surveys were returned for a response rate of about 55%. An additional 12 surveys were returned by the post office as undeliverable. A second mailing was sent to the nonresponders with another copy of the survey form and a reminder letter. Followups were also sent to participants who had moved and had valid forwarding addresses. Another 50 responses were received to this mailing bringing the return rate for usable forms to approximately 68%, still below the goal of 80%. A third reminder will be mailed early FFY 2007.

During year 1, all survey data were obtained in written form on paper, but were not electronically archived. It was determined that an electronic data base allowing continual updates of contact information for participants and to record their information was needed. In order to support archiving and analyzing the data, an EXCEL based data base was developed to record all of the data obtained in 2005, in 2006, and in future years. Data provided by the participants during year 1 (2005) were transferred from their paper forms onto the EXCEL data sheet. The EXCEL data base contains names and updated mailing addresses of all participants and the driving experience data they report each year. It is suitable for preparing mailing labels for contacting participants as well as archiving/analyzing data. As written forms from the 2006 survey were received from participants, the data they submitted was entered for analysis. Participants who received the defensive driving training in year 1 are identified by a data field containing the date on which they were trained.

Preliminary analyses have been performed on the 2006 data. During this time, approximately one third of the young drivers reported having a single-vehicle or multiple vehicle accident. This includes 32% of the young drivers who received the defensive driving training and 36% of those who did not. A large proportion of these accidents were not reported to authorities because they involved no injuries and minimal damage. These included such reports as: "I backed into a light pole and got a small dent in my fender," or "I slid off of the road into a snow bank".

Reports:

Available information is located at the above URL.

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Contractor Project Manager:

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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 project cost estimating problems:

- 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 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.

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.

MDT Project Manager:

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

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

Purpose:

Transportation is an essential service, vital for keeping people connected with their community. Individuals need to get to jobs, medical facilities, and to access educational, social and other opportunities. Although there may be many different options for transportation within a community, 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 better access to transportation information and services.

It is for these reasons the Montana Department of Transportation is initiating a research project to report on the most efficient and effective means to make transportation information accessible to the public.

Tasks:

Through a review of literature, survey of the state of the practice, and available documentation (including interviews with relevant information providers and experts) report on national and state level efforts to provide public transportation information and their impact on transportation utilization and safety. The report will include, but not be limited to:

- A review the transportation information systems (software/hardware/data retrieval protocols) of Montana and other states.
- Identification of current technologies in Montana that could be utilized for transportation information dissemination.
- A description of what Montana transportation services information currently exists and what forms it exists in (fact sheets, websites, databases, etc.); review these information services and report on which service has been Bobby Approved or other types of ADA certifications.
- Determination of what transportation information the public needs. To include, but not be limited to:
 - Transportation information needs of persons who are transportation dependent, disabled, elderly, or economically disadvantaged.
 - Transportation information needs of the public during a disaster, emergency, or weather impediment.
 - Transportation information needs of persons using public transportation.

- Transportation information needs of persons planning trips, to include intrastate travel.
- Determine what additional transportation information needs to be gathered and how it should be gathered.
- Determine the most efficient and effective means for making transportation information accessible to the public, including references to:
 - The 2-1-1 system.
 - The 5-1-1 system.
 - Existing and potential website portals (MDT website, transit websites, etc.).
- Make recommendations regarding the modification, development, and/or purchasing of technologies to implement the process of improving the availability of transportation information in the state.
- Determine funding levels and resources necessary to support an effective one-stop-shop program, and the potential funding sources.
- Review related goals and actions of MDT's TranPlan 21, Montana's long-range transportation policy plan, with the initiatives of this project to ensure consistency where applicable.

Based on all tasks, make recommendations on how transportation information can best be made accessible to the public. Submit an implementation plan with reasonable performance measures to support the recommendations.

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

Purpose:

The recent reduction in Montana intermodal services presents a major barrier for Montana businesses as they attempt to compete in the U.S. and international marketplace. The absence of these services will affect Montana's economy by increasing transportation costs and keeping Montana businesses out of potential markets. Added value agricultural commodities are especially dependent upon intermodal transportation. Montana does not have a single location where containers can be loaded on rail cars at competitive rates on regularly scheduled intermodal trains.

For these reasons, the Montana Department of Transportation (MDT) has initiated a phased research project to explore ways to increase COFC/TOFC commerce in order to provide Union Pacific and BNSF Railways with the incentive to provide additional intermodal services to Montana shippers.

This will be a phased-approached project, beginning with Phase 1. Proposers are encouraged to describe potential additional phases in their proposal to demonstrate their understanding of the overall project. Depending on the results of Phase 1, MDT and the project's technical panel may terminate the project or ask the contractor to submit a proposal for additional phases.

Tasks:

Phase 1

It is important to identify the nature and volume of current and potential Montana products that could be shipped via COFC/TOFC shuttle trains or intermodal service. It is also important to determine the origin and destination of products currently shipped through Montana that could be transferred to COFC/TOFC shuttle trains intermodal service at Montana facilities for more efficient transport to their final destination. Phase 1 must therefore include, but not be limited to the following tasks:

- Through a literature review, surveys, and interviews with individuals and organizations at the local, national and international levels, with information that is available:
 - Identify the type and location of Montana businesses that could use and benefit from a COFC/TOFC shuttle train or intermodal service program.
 - Based on the businesses identified above:

- Estimate the volume density (annual) by commodity type.
 - Determine and note any seasonality factors of commodity.
 - Identify if commodity originated in Montana or if it was imported to the state.
 - Determine how and to what extent any of the three (volume, seasonality, and origin) may affect Intermodal performance.
 - Determine the current costs Montana shippers are incurring for truck transport from origin to destination.
 - Identify volumes, origins, and ownership of COFC/TOFC with Montana destinations and the amount of backhaul of empty containers. Include information on containers that are transferred from the flatcars to trucks for distribution within the state.
 - Of the determined volume, determine if there is sufficient economic balance to be an incentive for the railroad entities to consider an intermodal program within the state of Montana.
- Based on the results of Task 1, recommend strategies for a COFC/TOFC shuttle train or intermodal program for Montana.
 - Based on the results of Phase 1, the Technical Panel for this project will determine what if any additional research is needed. If additional research is required, MDT will ask the consultant to either submit a new proposal or revise the previous work plan based on the direction of the Technical Panel.

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2.6.3.4 Computerized 3-Dimensional Highway Design and Modeling

The following research problem statement was submitted. The Technical Panel met numerous times in FFY 2006 to determine if a research need exists and, if so, to develop a scope of work.

Problem Statement:

MDT construction contracts are being awarded to contractors who are either currently using machine control or are planning to use machine control in the future. Machine control is an emerging technology that allows a contractor to build a project using very little or no conventional construction staking. Machine control technology involves the use of GPS equipment connected to construction machinery that guides the operator during construction activities. The contractor uses the approved plans to create a 3-D model of the design either in-house or by using a consultant. The 3-D model is then loaded into computers on the machinery and combined with GPS, guides the equipment in the process of constructing the project. The problem is that once the 3-D model is generated, the approved plans, requiring a signature of the P.E. that's responsible and liable for the design, can be set aside and may have little influence on the construction. If there is no quality control or oversight of the 3-D modeling created and used by contractors, MDT could be exposed to considerable economic risk by any errors or omissions introduced to these 3-D models.

Research Proposed:

We have been creating 3-D models for years when we collect topographic data of the existing ground, input that data into GeoPak, and generate a digital terrain model (DTM) or 3-D model. A 3-D model of a project design is much more complicated to create and requires a high level of skill and ability. It may also require some specialized software in addition to MicroStation/GeoPak. The research proposed should focus on the use of and quality control of 3-D modeling done by the contractor and/or creation of 3-D models by MDT.

Project Manager:

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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 yet met 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.

MDT Project Manager:

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2.7.2 Cancelled Projects

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

The technical panel chosen to oversee this project determined that at this time no formal research is needed.

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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 Experimental Projects Manager (EPM) writes and submits a formal work plan to 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:

- FHWA will participate in the original construction and repair, if the project should fail prematurely, at 100% 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 ACTIVE PROJECTS

3.2.1 100 mm 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 to place a 100 mm (approximately 4 inches) Portland Cement Concrete Pavement (PCCP) overlay to create a composite pavement to extend the project's service life.

Progress:

The project has been in place for five years with good performance to date. Panel cracking not related to construction issues is at a minimum. Several small sections have been removed and replaced with full-depth repair. MDT Research will continue with formal analysis through the year 2006 and informal analysis annually for the life of the pavement.

Reports:

Construction and annual reports are located at the above URL.

MDT Project Manager:

Craig Abernathy
406-444-6269
cabernathy@mt.gov



3.2.2 130 mm 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: October 2010
Status: Active
Contractor: Riverside Contracting
URL: http://www.mdt.mt.gov/research/projects/kal_whitetopping.shtml

Objective:

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

Progress:

The project has been in place for six years with excellent performance to date. Approximately 17 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) don't show any load transfer problems. MDT Research will continue with formal analysis to the year 2010.

Reports:

Reports can be viewed at the above URL.

MDT Project Manager:

Craig Abernathy
406-444-6269
cabernathy@mt.gov



3.2.3 Cold In-Place Recycled Asphalt

Project Name: Fairfield North & South
Project Number: STPP 3-1(15)18
FHWA Number: Informal
Start 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 consists of cold milling approximately 75-90 mm of asphalt cement, and replacing it with cold in-place recycled plant mix surfacing (90 mm), and placing a seal & cover.

Progress:

The project is in its fifth year since construction and is rated as performing well. Rutting is at an average of five millimeters throughout the project, and transverse cracking has increased minimally since the 2005 evaluation. Pavement has good overall appearance. Research will continue to monitor the CIPR performance informally for the life of the project.

Reports:

Reports are located at the above URL.

MDT Project Manager:

Craig Abernathy
406-444-6269
cabernathy@mt.gov



3.2.4 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
Start Date: July 2001
Completion Date: September 2006
Status: Active
Contractor: Riverside Contracting
URL: <http://www.mdt.mt.gov/research/projects/redlodge.shtml>

Objective:

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

Progress:

The project is rated as performing well. All test sections to date have exhibited acceptable performance in regard to rutting and transverse cracking. Flushing is at a minimum. All mats have good visual appearance. Research will continue to report on the performance of the project informally for the life of the pavement.

Reports:

Reports are located at the above URL.

MDT Project Manager:

Craig Abernathy
406-444-6269
cabernathy@mt.gov



3.2.5 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
Start Date: June 2005
Completion Date: September 2010
Status: Active
Contractor: Schellinger Construction
URL: <http://www.mdt.mt.gov/research/projects/dutton.shtml>

Objective:

The objective of this project is to determine if crack sealing milled pavement prior to 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:

First year analysis reveals no evidence of cracking on either the test or control sections.

Reports:

Reports are available at the above URL.

MDT Project Manager:

Craig Abernathy
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3.2.6 Statewide Installation and Testing of Detectable Warning Devices (DWD) for the Visually Impaired

Project Name: DWD Truncated Domes
Project Number: STPU 5201(11)
FHWA Number: MT 00-05
Start 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 construction application, durability, and maintenance requirements of several truncated dome products as a preferred detectable warning device (DWD) at curb ramps for use by the visually and mobility impaired.

Progress:

Numerous products are being tested with varying degrees of effectiveness. Over half of the products tested have failed. Please refer to the annual project reports for current performance.

Additional installations were constructed in the Helena area in the spring of 2006. Evaluation reports will be available in spring 2007.

Reports:

Reports are located at the above URL.

MDT Project Manager:

Craig Abernathy
406-444-6269
cabernathy@mt.gov



3.2.7 Evaluation of Pavement Markers on MacDonald Pass

Project Name: MacDonald Pass – Lewis & Clark County
Project Number: Maintenance Project No. 307945
FHWA Number: MT 00-12
Start Date: August 2006
Completion Date: September 2011 (or life of products)
Status: Active
Contractor: Arrow Striping and Manufacturing, Inc.
URL: http://www.mdt.mt.gov/research/projects/macpass_markings.shtml

Objective:

The objective of this project is to compare current practice using epoxy type markings with various urethane modified type markings for long-term durability and retro-reflectivity. Various types of grinds will be employed to see if this variable will affect performance of the products.

Progress:

This project has been constructed. An installation and post-winter evaluation report will be available January 2007.

Reports:

Reports are posted at the above URL.

MDT Project Manager:

Craig Abernathy
406-444-6269
cabernathy@mt.gov



3.2.8 Evaluation of Radar Speed Display Trailer-Mounted Device for Speed Reduction for Use in Construction Work Zones

Project Name: Bear Canyon
Project Number: IM 90-6(90)304, UPN 3612
FHWA Number: MT 00-11
Start Date: May 2006
Completion Date: Estimated summer of 2007^a
Status: Active
Contractor: Not Applicable – Internal Study
URL: http://www.mdt.mt.gov/research/projects/bear_canyon.shtml

Objective:

This project is an experimental trial of trailer-mounted automated radar speed displays for use in potential speed reduction in construction work zones.

Progress:

Speed units are in place and an interim analysis report has been published on the initial effectiveness of the radar devices. Another speed analysis has been requested for March 2007 to supplement the initial evaluation.

Reports:

Reports are posted at the above URL.

MDT Project Manager:

Craig Abernathy
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^aThe Bear Canyon project is estimated to be completed in the summer of 2007. It is anticipated that the radar speed trailers will be used on other construction sites to further evaluate their effectiveness in reducing overall speed. These projects have yet to be determined.

3.3 PENDING PROJECTS

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

Project Name: Angela N&S
Project Number: STPP 18-1(9)18
FHWA Number: MT 00-09
Start Date: Spring 2007
Completion Date: September 2012
Status: Pending
Contractor: MK Weeding Construction Inc.
URL: http://www.mdt.mt.gov/research/projects/angela_north.shtml

Objective:

This project is an experimental trial of three HDPE culverts sizes (750 mm, 900 mm, and 1200 mm) on a primary mainline application.

Progress:

Weather has delayed the installation of the HDPE culverts; construction is tentatively scheduled for the spring of 2007.

Reports:

Available information is posted at the above URL.

MDT Project Manager:

Craig Abernathy
406-444-6269
cabernathy@mt.gov



3.3.2 Evaluation of Various Aggregate Base Preparations

Project Name: Angela N&S
Project Number: STPP 18-1(9)18
FHWA Number: MT 00-13
Start Date: Spring 2007
Completion Date: September 2012
Status: Pending
Contractor: MK Weeding Construction Inc.
URL: http://www.mdt.mt.gov/research/projects/angela_north.shtml

Objective:

Creating premium road base out of troublesome aggregates or soils is part of a successful formula in building superior performing pavements. In this effort, the Montana Department of Transportation is initiating an experimental trial of various aggregate base preparations in an effort to determine effectiveness of these treatments for potential use in future road construction projects.

Progress:

Construction began in the summer of 2006. Weather delay has pushed the installation of the test sections to spring of 2007.

Reports:

Available information is posted at the above URL.

MDT Project Manager:

Craig Abernathy
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3.3.3 Evaluation of Recycled Rubber and Plastic Mats as Weed Prevention and Erosion Control around Guardrail Posts

Project Name: Great Falls N & S
Project Number: IM-STPHS 90-8(152)433
FHWA Number: MT 00-10
Start Date: Spring of 2007
Completion Date: September 2012
Status: Pending
Contractor: Pending
URL: http://www.mdt.mt.gov/research/projects/gtf_rubber.shtml

Objective:

The Department currently paves areas around guardrail with asphalt cement (AC) for erosion and weed control. The objective of this project is to test two products made from recycled rubber and plastic mats to determine if this could be a cost effective alternative to paving with AC.

Progress:

Installation of the guardrail mats has been delayed until the spring of 2007.

Reports:

Available information is posted on the above URL.

MDT Project Manager

Craig Abernathy
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3.3.4 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 00-07
Start Date: Summer 2006/2007
Completion Date: September 2012
Status: Pending
Contractor: Boschung America LLC
URL: http://www.mdt.mt.gov/research/projects/blg_deicer.shtml

Objective:

This project is an experimental trial of an automated anti-icing device for use on a Billings district area bridge. The chosen device will be the Boschung 'Fixed Automated Spray Technology or 'FAST'.

Progress:

Installation of anti-icing bridge deck device is tentatively scheduled for FFY 2007.

Reports:

Available information posted on the above URL.

MDT Project Manager:

Craig Abernathy
406-444-6269
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3.3.5 Evaluation of Treated (CSS1) Base Preparations, (Emulsified Asphalt Treated Aggregate – EATA)

Project Name: Sportmans Campground – East
Project Number: STPP 46-5(2)51
FHWA Number: MT 00-14
Start Date: Summer 2006/2007
Completion Date: September 2012
Status: Pending
Contractor: Ascorp Inc.- DBA Debco Construction
URL: <http://www.mdt.mt.gov/research/projects/sportsman.shtml>

Objective:

This project is an experimental pug-milling trial using various depths of Cationic Slow Set Emulsion (CSS1) at varying residual asphalt contents (RAC) to determine the effectiveness as a wearing course through the winter months until construction can be completed in the spring. This procedure was originally suggested as a dust palliative, but it has been determined it may be effective in allowing winter traffic a more stable driving base than the use of straight gravel.

Progress:

Construction began in the summer of 2006. All sections should be complete early FFY 2007. An initial report will be published after documentation of progress early FFY 2007.

Reports:

Available information posted on the above URL.

MDT Project Manager:

Craig Abernathy
406-444-6269
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4.0 POOLED-FUND STUDIES

MDT contributed to the following pooled-fund studies in FFY 2006. Click on the project links to view project documents.

NUMBER	NAME	FUNDING LEVEL
TPF-5(035)	Pacific Northwest Snow Fighters http://www.pooledfund.org/projectdetails.asp?id=302&status=4	\$10,000
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(064)	Western Alliance for Quality Transportation Construction (WAQTC) http://www.pooledfund.org/projectdetails.asp?id=274&status=4	\$10,000
TPF-5(069)	Transportation Research Board Support of Core Services http://www.pooledfund.org/projectdetails.asp?id=300&status=6	\$99,900
TPF-5(099)	Evaluation of Low Cost Safety Improvements http://www.pooledfund.org/projectdetails.asp?id=332&status=4	\$30,000
TPF-5(105)	Transportation Library Connectivity http://www.pooledfund.org/projectdetails.asp?id=337&status=4	\$25,000
TPF-5(112)	Midwest States Pooled Fund Pavement Preservation Partnership http://www.pooledfund.org/projectdetails.asp?id=343&status=4	\$5,000
TPF-5(122)	Dynamic Passive Pressure on Abutments and Pile Caps http://www.pooledfund.org/projectdetails.asp?id=354&status=4	\$10,000
TPF-5(135)	Tire/Pavement Noise Research Consortium http://www.pooledfund.org/projectdetails.asp?id=364&status=4	\$10,000
	TOTAL	\$209,900

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 2006 yielded results that when fully implemented will improve:

- Efficiency and effectiveness of MDT operations and technology transfer, including improving ride on Montana roads;
- Economic vitality;
- Sensitivity to the environment, including decreasing vehicle-wildlife collisions, improving design for safety, and improving revegetation of roadsides;
- Safety, by decreasing roadside hazards, decreasing young driver accidents, and through training and technology transfer; and
- Quality of what we do and how we do it, including bridge design and inspection, use of the most efficient materials and technology, 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.

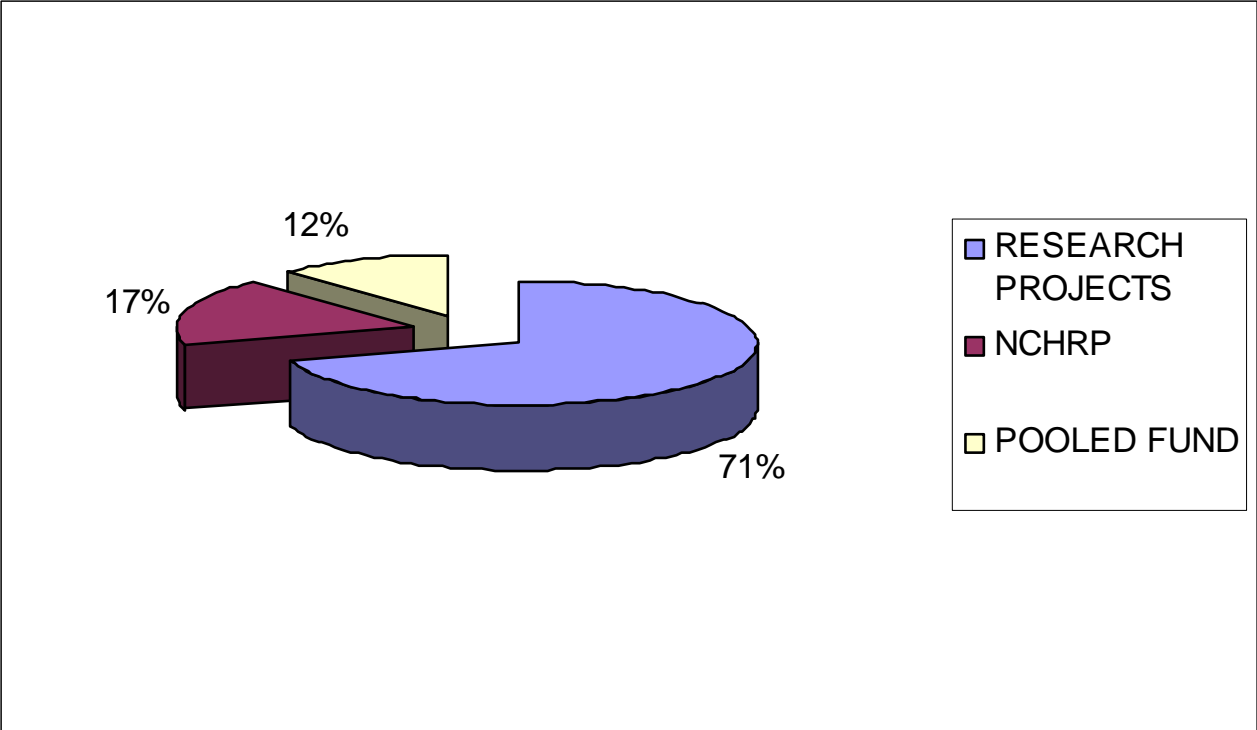


Figure 2: Research Program expenditures for FFY 2006 by project type.

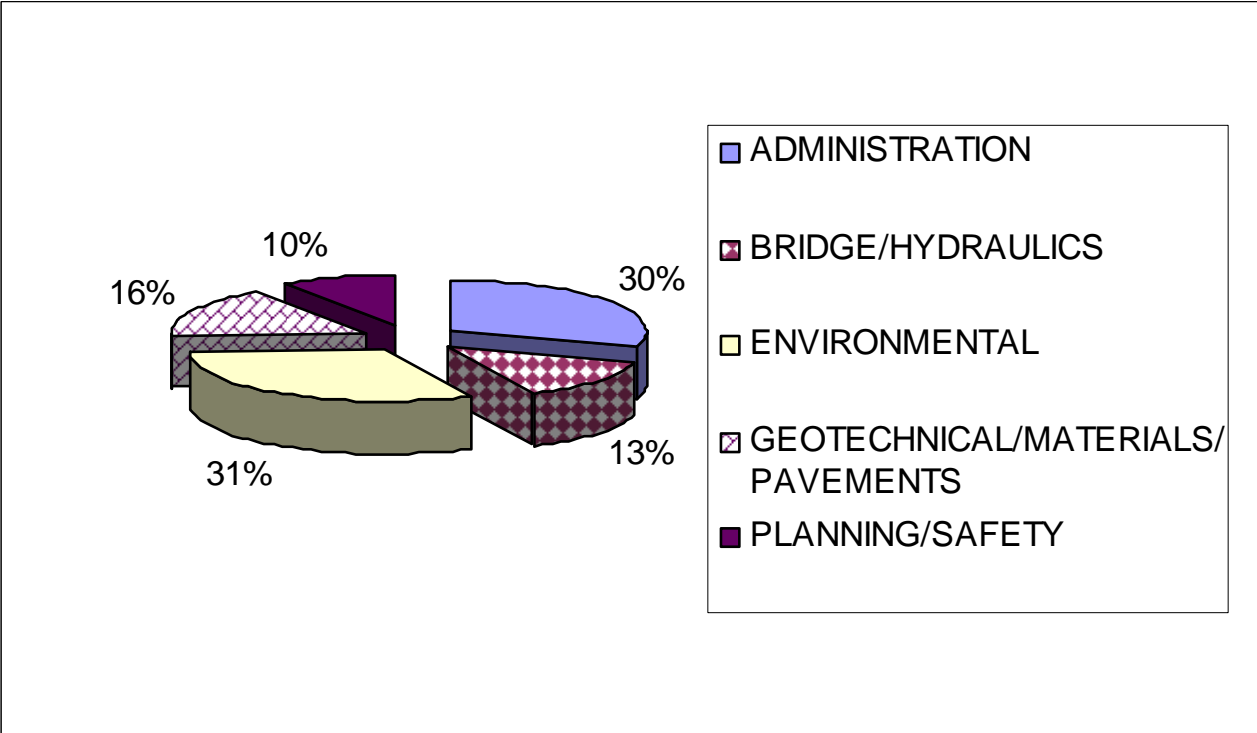


Figure 3: Research Program expenditures for FFY 2006 by subject.

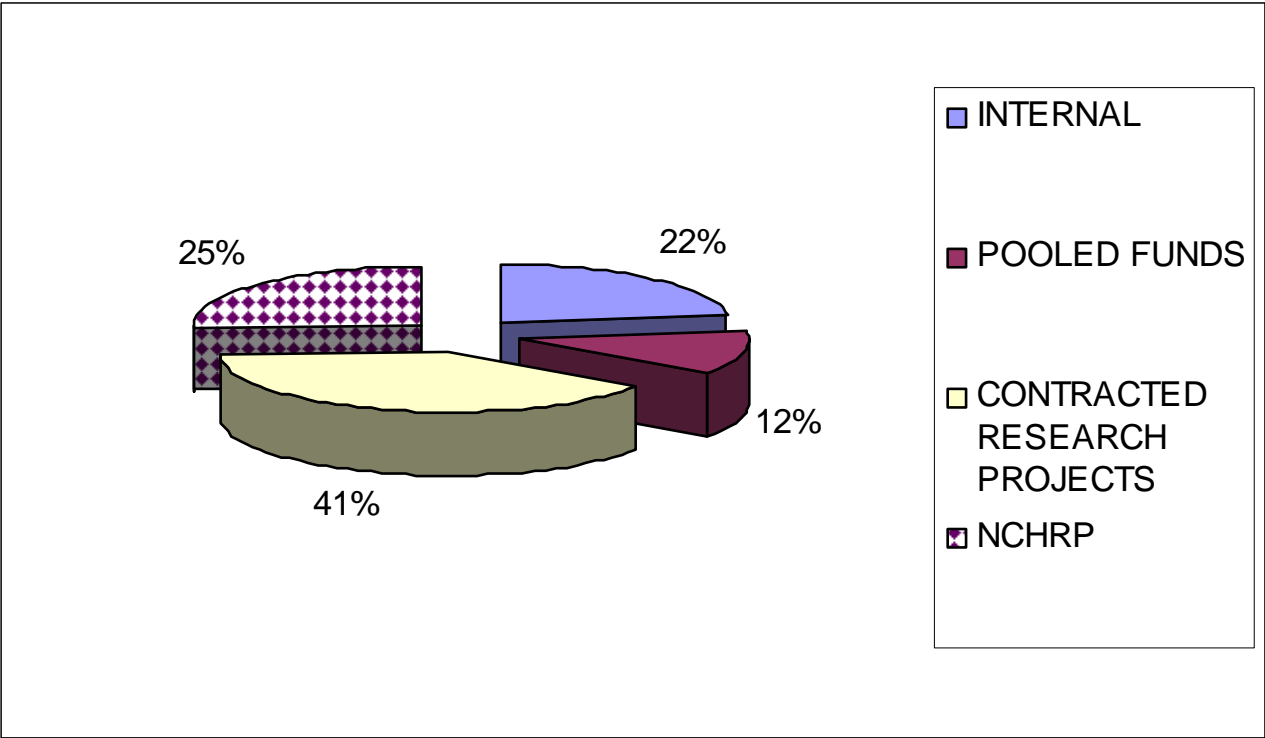


Figure 4: Administration expenditures for FFY 2006 by project type.

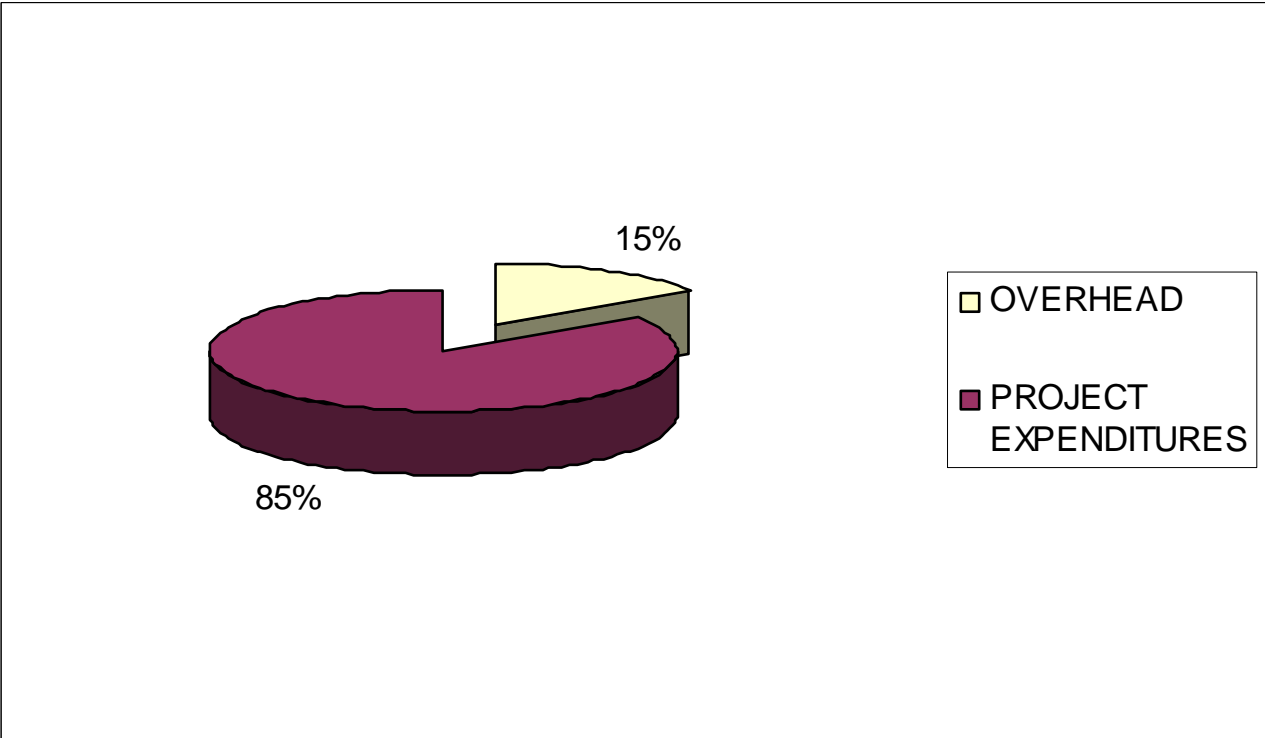


Figure 5: Overhead expenditures for FFY 2006 as compared to all other expenditures.

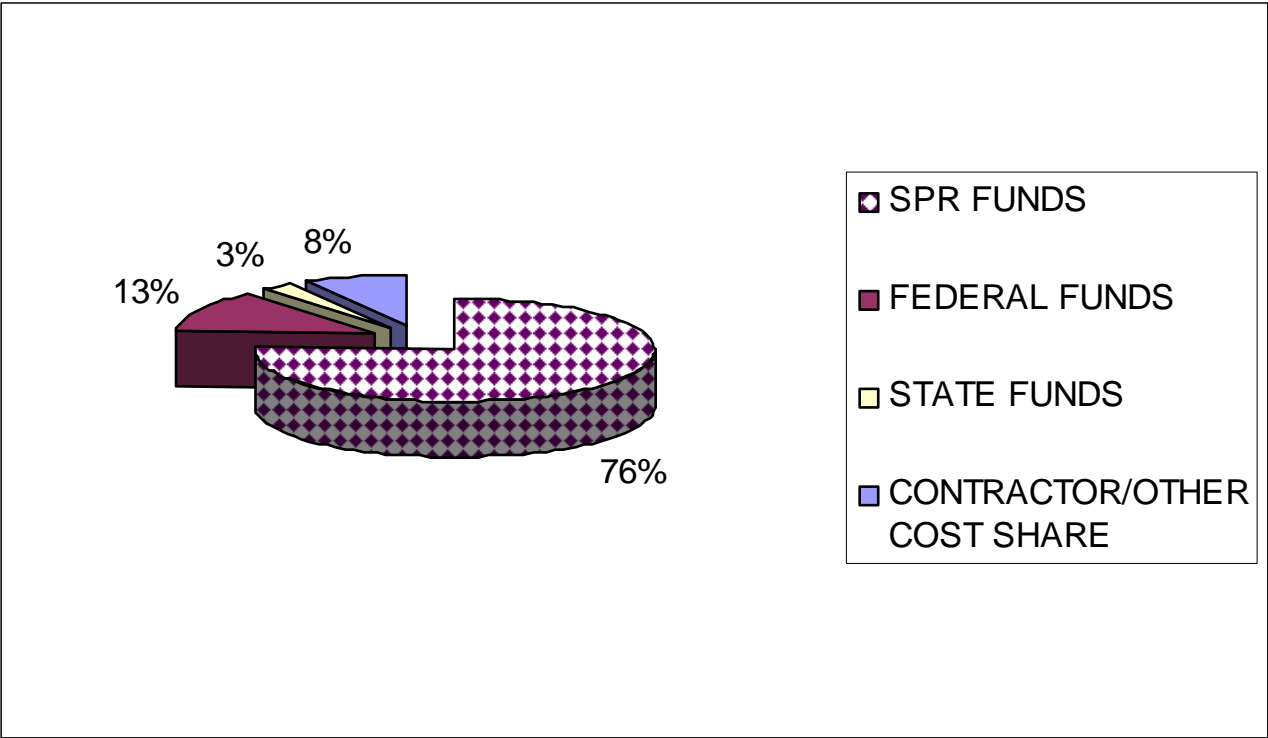


Figure 6: Total funding for all projects active in FFY 2006 by funding source.

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