DRAFT WYOMING DEPARTMENT OF TRANSPORTATION: RESEARCH WORK PROGRAM
# INTRODUCTION

2014 Budget Summary

National Cooperative Highway Research Program (NCHRP)

Transportation Research Board Correlation Service (TRB)

STRATEGIC HIGHWAY RESEARCH PROGRAM (SHRP II)

Local Technical Assistance Program (LTAP) at University of Wyoming

Technology Transfer Center (T2) at University of Wyoming

Administration of Research

8 - Pooled Fund Projects Funding Summary

8.1 – TPF-5(002) – FHWA 13/02F

8.2 – TPF-5(005)

Study Erection Issues and Composite System Behavior of the Full Scale Curved Girder Bridge Currently Under Test at the Turner-Fairbank Research Center

8.3 – TPF-5(054)

Development of Maintenance Decision Support System

8.4 – TPF-5(145)

Western Maintenance Partnership

8.5 – TPF-5(177)

Improving Resilient Modulus Test Procedures for Unbound Materials

8.6 – TPF-5(178)

Implementation of the Asphalt Mixture Simple Performance Tester (AMPT) for Superpave Validation

8.7 – TPF-5(189)

Enhancement of Welded Steel Bridge Girders Susceptible to Distortion-Induced Fatigue

8.8 – TPF-5(192)

Loop and Length Based Classification Pooled Fund

8.9 – TPF-5(193)

Midwest States Regional Pooled Fund Project
8.10 – TPF-5(218) ................................................................................................................. 26
Clear Roads Winter Highway Operations Pooled Fund (continued from TPF-5(092)).....26
8.11 – TPF-5(251) .................................................................................................................. 27
Relative Operational Performance of Geosynthetics Used as Subgrade Stabilization.....27
9 - State Research Projects Funding Summary (Obligated) ............................................ 29
9.1 – RS09(206) – FHWA 13/04F......................................................................................... 31
Evaluating the Risk of Alkali-Silica Reaction in Wyoming Through an Inter-Laboratory
Investigation of Multiple ASR Evaluation Methods................................................................. 31
9.2 – RS03(209) ....................................................................................................................... 32
Implementation of the Mechanistic-Empirical Pavement Design Guide in the Wyoming
Department of Transportation............................................................................................... 32
9.3 – RS03(210) – FHWA 13/08F.......................................................................................... 33
Understanding Mule Deer Movement and Habitat Use Patterns in Relation to Roadways
in Northwest Wyoming.......................................................................................................... 33
9.4 – RS04(210) – FHWA 13/03F.......................................................................................... 34
Rural Variable Speed Limit Systems: Phase II...................................................................... 34
9.5 – RS06(210) - FHwy 13/05F............................................................................................ 35
Statewide Mesoscopic Traffic Simulation for Wyoming........................................................ 35
9.6 – RS04(211) ..................................................................................................................... 36
Investigation of Silica Fume Concrete Bridge Deck Overlay Failures................................. 36
9.7 – RS05(211) ..................................................................................................................... 37
Instrumentation and Analysis of Frost Heave Mitigation on WY-70, Encampment, WY...37
9.8 – RS06(211) ..................................................................................................................... 38
A Comprehensive Technology Assessment for Avalanche Hazard Management:
Developing and applying an avalanche hazard technology optimization process to a case
study on US Route 189-191 in Hoback Canyon, Wyoming .................................................... 38
9.9 – RS07(211) ..................................................................................................................... 39
Rural Travel Times ............................................................................................................... 39
9.10 – RS08(211) ................................................................................................................... 40
Evaluating Base Widening Methods...................................................................................... 40
9.11 – RS09(211) ................................................................................................................... 41
Developing a Roadway Safety Improvement Program for Indian Reservations .............41
9.12 – RS10(211) – FHWA 13/01F .................................................................42
Criteria for a WYDOT Culvert Selection Policy ........................................42
9.13 – RS11(211) .........................................................................................43
Trapper’s Point Wildlife Crossing Study ......................................................43
9.14 – RS02(212) .........................................................................................44
Managing Risks in the Project Pipeline – Minimizing the Impacts of Highway Funding
Uncertainties .................................................................................................44
9.15 – RS03(212) .........................................................................................45
Structural Health Monitoring of Highway Bridges Subjected to Overweight Trucks, Phase
I – Instrumentation and Validation ...............................................................45
9.16 – RS04(212) .........................................................................................46
Evaluation of a Mitigation Site: Amphibian Population .............................46
9.17 – RS05(212) .........................................................................................47
Evaluating the Effects of Deer Delineators on Wildlife-Vehicle Collisions in Northwest
Wyoming .........................................................................................................47
9.18 – RS06(212) .........................................................................................48
Evaluating the Risk of Alkali-Silica Reaction in Wyoming: Continued Evaluation of Field
Specimens, Proposed Mitigation Strategies and Improving Existing ASTM Standards.....48
9.19 – RS07(212) .........................................................................................49
Jackson South Snow Supporting Structures Proposed Performance and Health
Monitoring of WYDOT Project No. N104085, Teton County, Jackson, Wyoming........49
9.20 – RS08(212) .........................................................................................50
Multi-Measure Performance Assessment and Benchmarking of the Divisions of the
Wyoming Highway Patrol ..............................................................................50
9.23 – RS04(213) .........................................................................................52
Characterization of Material Properties for Mechanistic-Empirical Pavement Design in
Wyoming ........................................................................................................52
9.22 – RS05(213) .........................................................................................53
A Literature Review of Approach Slab and Its Settlement for Roads and Bridges in
Wyoming ........................................................................................................53
9.24 – RS06(213) .........................................................................................54
Wyoming Low Volume Roads Traffic Volume Estimation ..............................................54
9.25 – RS02(214) ........................................................................................................55
Developing an Effective Shoulder and Centerline Rumble Strip Policies to Accommodate
all Roadway Users.................................................................................................55

10 - Completed/Closed Research Projects ...............................................................57

COMPLETED RESEARCH PROJECTS ......................................................................58
RS04(206) Evaluation of Treatment Options for ASR-Affected Concrete Completion:
January 2010 ...........................................................................................................58
RS05(207) Variable Speed Limit System for I-80 Elk Mountain Corridor .................58
Completion: October 2010 .........................................................................................58
RS06(207) ITS System to Reduce High Wind Truck Crashes on I-25 near Bordeaux, WY:
Completion: October 2010 .........................................................................................58
RS02(208) Use of Truck-Mounted Changeable Message Signs (CMSs) During Mobile
Operations Completion: July 2010 .........................................................................58
RS06(209) Gravel Roads Management: Developing a Methodology Completion: October
2010 ..........................................................................................................................58
RS05(210) Wyoming County Road Fund Manual – Update Research Funding Proposal –
Phase 1: Completion: June 2010 ..............................................................................58
RS07(210) Utilizing Road Profiler Measurements in Determining the Fore Slopes of
Shoulders Completion: January 2011 ..................................................................58
RS09(210) Wyoming County Road Fund Manual – Update Research Funding Proposal –
Phase 2 Completion: June 2011 ..............................................................................58
RS08(210) Comparing Crash Trends and Severity in the Northern Rocky Mountain Region
..................................................................................................................................58
RS07(207) Effectiveness of Using Recycled Asphalt Materials (RAP) and other Dust
Suppressants in Gravel Roads .................................................................................58
RS04(209) Bridge Deck Evaluation using Non-destructive Test Methods ..................58
RS01(211) Wyoming LTAP Center 2011 ..................................................................58
RS03(211) Evaluation of the WYDOT Research Center and Research Program (Phase II).58
TPF-5(116) Investigation of the Fatigue Life of Steel Base Plate to Pole Connections for
Traffic Structures Completion: August 2011 .........................................................59
TPF-5(051) Construction of Crack Free Concrete Bridge Decks Completion: March 2010 .59
INTRODUCTION

With the 2005 passage of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)¹, which represents the largest surface transportation investment in our Nation’s history, federal funding levels earmarked for research and technology transfer purposes have increased over previous years. The Moving Ahead for Progress in the 21st Century (MAP-21) Act², and the Planning and Research Program Administration Federal Rules³ require that two (2) percent of “the sums apportioned to a State for fiscal year 1998 and each fiscal year thereafter … shall be available for expenditures by the State …” for various surveys, investigations projects, planning, development, implementation, studies, research, technology transfer activities, and training. MAP-21 further requires “not less than 25 percent of [the 2 percent]… be expended by the State for research, development, and technology transfer activities…”⁴ and that the Federal share for state planning and research (SP&R) shall be 80 percent.⁵

Title 23 of the Code of Federal Regulations, Sec. 420.209(a) sets out that state DOTs must:

1. Implement a RD&T work program;
2. Use all Federal Highway Administration (FHWA) planning and research funds to the maximum extent possible;
3. Implement a procedure for tracking program activities, schedules, accomplishments, and fiscal commitments;
4. Support, use and report to the transportation research information system (TRIS) database;
5. Implement procedures to determine effectiveness of the state’s DOT RD&T outputs, and facilitate peer exchanges;
6. Produce final reports which include data collection, analyses performed, conclusions and recommendations; and
7. Participate in peer exchange programs.

Subpart (c), of Title 23 of the Code of Federal Regulations, Section 420.209, requires research programs certify that their programs conform to management processes. (See Certificate attached hereto.)

WYDOT’s Mission Statement is to provide a safe, high quality and efficient transportation system.

The Goals of the Wyoming Department of Transportation (WYDOT) state as follows:

1. Improve safety on the state transportation system.
2. Serve our customers.

³ 23 C.F.R. 420.103(a)(1)
⁴ Id
⁵ Id
3. Take care of all physical aspects of the state transportation system.
4. Improve agency efficiency and effectiveness.
5. Develop and care for our people.
6. Exercise good stewardship of our resources.

To accomplish WYDOT’s mission and goals, and to remain complaint with the federal rules and regulations, the WYDOT Research Center (Center) strongly emphasizes applied research designed to solve practical problems, and assist stakeholders by taking full advantage of new technologies. The Center’s staff continues to provide direction in the national research community through our participation in the Transportation Research Board, the AASHTO Research Advisory Committee and other technical organizations.

This report details the diversity of our research involvement including:

Research and Development Studies
- Transportation Pooled Fund Studies - Studies which are generally 100 percent Federally funded and provided with technical input by WYDOT.
- WYDOT Studies - studies funded, directed, and sometimes performed by WYDOT personnel.
- SP&R Research – studies performed by outside entities and the funding for these projects are at an 80% federal, 20% state mix.

Technology Transfer Activities
- Research Information Services - The Research Center acts as WYDOT’s central location for facilitating, acquisition and distribution of technical information (publications, videos, technical expertise, etc.), through its library, electronic database and sharing capabilities with state and federal repositories.
- Local Technology Assistance Program - Providing technical training and information resources for local governments and organizations through the Wyoming Technology Transfer (T2) Center at the University of Wyoming.
## 2014 Budget Summary

<table>
<thead>
<tr>
<th>Line Number</th>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SP&amp;R Funds</td>
<td>$4,892,606</td>
</tr>
<tr>
<td>2</td>
<td>SP&amp;R RES Funds</td>
<td>$1,198,152</td>
</tr>
<tr>
<td>3</td>
<td>LTAP Special Allocation (Fund 438)</td>
<td>$140,000</td>
</tr>
<tr>
<td>4</td>
<td>Previous FY unobligated funds</td>
<td>$150,063.85</td>
</tr>
<tr>
<td>5</td>
<td>RES2212 Carryover</td>
<td>$62,895</td>
</tr>
<tr>
<td>6</td>
<td>Total Revenues</td>
<td>$1,551,110</td>
</tr>
<tr>
<td>7</td>
<td>NCHRP</td>
<td>$258,329</td>
</tr>
<tr>
<td>8</td>
<td>TRB Correlation Service (est.)</td>
<td>$85,000</td>
</tr>
<tr>
<td>9</td>
<td>SHRP II</td>
<td>$97,852.12</td>
</tr>
<tr>
<td>10</td>
<td>Technology Transfer to U.W. Fund 438</td>
<td>$125,000</td>
</tr>
<tr>
<td>11</td>
<td>LTAP Funds (RS01(214))</td>
<td>$22,500</td>
</tr>
<tr>
<td>12</td>
<td>Administrative Costs (est.)</td>
<td>$138,837</td>
</tr>
<tr>
<td>13</td>
<td>Pooled Fund</td>
<td>$25,000</td>
</tr>
<tr>
<td>14</td>
<td>State Research Projects (80% federal)</td>
<td>$487,072.74</td>
</tr>
<tr>
<td>15</td>
<td>ICAP funds (80% federal) (est.)</td>
<td>$49,962.09</td>
</tr>
<tr>
<td>16</td>
<td>Total Expenses</td>
<td>$1,289,553.55</td>
</tr>
</tbody>
</table>

**TOTAL FY14 FEDERAL FUNDS AVAILABLE** $261,556.45

**LINE NUMBER EXPLANATIONS:**
1. Total estimated 2014 SP&R funds.
2. Under MAP21, at least 25 percent of the SP&R funds must be used for research, development, and technology transfer activities. WYDOT presently obligates the minimum amount which is made up of 100% Federal funds, i.e., 25% of line 1. (See Page ____).
3. Federal program requiring 100% State funding match. See Local Technical Assistance Program (LTAP) (See Page ____)& Technology Transfer (T²) Center summary (See Page ____ for a complete financial breakdown.
4. Un-obligated Federal funds from previous fiscal year apportionments.
5. RES2212 Carryover from fiscal year 2012.
6. Summation of lines 2 through 5.

**EXPENSES**
7. Under Section 124 of the 1987 Surface Transportation and Uniform Relocation Assistance Act (STURAA), 5.5 percent of SP&R funds can be contributed to NCHRP. WYDOT presently contributes the full 5.5 percent which is made up of 100 percent Federal funds. TPF-5(414).
8. The TRB Correlation Service is a pooled fund and obligated annually using 100% Federal funds.
9. SHRP II funds are authorized under SAFETEA-LU, Sec. 5210. The planning department pays half of the amount (est. $98,000) and the research department is responsible for the other half (est. $98,000).

10. The T² Center, at University of Wyoming, is contracted and obligated annually. See Local Technical Assistance Program (LTAP) & Technology Transfer (T²) Center summary for financial breakdown. (See Page ____).

11. LTAP, at University of Wyoming, is contracted and obligated annually. See Local Technical Assistance Program (LTAP) & Technology Transfer (T²) Center summary for financial breakdown. (See Page ____).

12. See Administrative Cost summary for financial breakdown. (See Page ____).

13. See Transportation Pooled Fund Projects summary for financial breakdown. (See Page ____).

14. Federal funds only (80% of the contracted amount). See State Research Projects summary for financial breakdown Page ____.

15. Indirect Cost Allocation Plan (ICAP) funds (an additional 8.23% added on to each contract (80/20 split)

16. Summation of lines 6 through 11.

TOTAL

17. Total amount available for new research (revenue, less expenses.)
National Cooperative Highway Research Program (NCHRP)

Identification: TPF-5(414)

Contacts: WYDOT Representative:
Tim McDowell, P.E.
307-777-4177
WYDOT Programming

Funding: $258,329.60

Scope: Administered by the Transportation Research Board (TRB) and sponsored by the member departments (i.e., individual state departments of transportation) of the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration (FHWA), the National Cooperative Highway Research Program (NCHRP) was created in 1962 as a means to conduct research in acute problem areas that affect highway planning, design, construction, operation, and maintenance nationwide.

The state departments of transportation are the sole sponsors of the NCHRP. Support is voluntary and funds are drawn from the states' Federal-Aid Highway apportionment of State Planning and Research (SP&R) funds. Furthermore, the funds can be spent only for the administration of problems approved on ballot by at least two-thirds of the states. Each state's allocation amounts to 5.5 percent of its SP&R apportionment and is set forth in supplementary tables issued with each year's Federal-Aid Highway apportionments.

The National Cooperative Highway Research Program is 100% federally funded, requiring no State match.
Transportation Research Board Correlation Service (TRB)
aka: (Core Program Services for a Highway Research, Development, and Technology Program, 2014)

Identification: TPF-5(277)

Contacts: WYDOT Representative:
Tim McDowell, P.E.
307-777-4177
WYDOT Programming

Funding: $85,000 (est.)

Scope: The Research Correlation Service of the Transportation Research Board (TRB) of the National Academy of Sciences is subscribed to annually by the Wyoming Department of Transportation. Membership allows receipt of all major publications and input to various national research programs including NCHRP. In 2002 the FHWA authorized yearly payment of the TRB Correlation Service using the FHWA-administered pooled fund mechanism. Starting in FY’95, the FHWA allowed the TRB correlation service charge to be paid at 100% federal funding, requiring no State match.
STRATEGIC HIGHWAY RESEARCH PROGRAM (SHRP II)

Identification: SHR-2(013)

Contacts: WYDOT Representative:
Tim McDowell, P.E.
307-777-4177
WYDOT Programming

Funding: $97,852.12

Scope: The second Strategic Highway Research Program (SHRP 2) was authorized by Congress to address some of the most pressing needs related to the nation’s highway system: the high toll taken by highway deaths and injuries; aging infrastructure that must be rehabilitated with minimum disruption to users; and congestion stemming both from inadequate physical capacity and from events that reduce the effective capacity of a highway facility. These needs define the four research focus areas in SHRP 2:

- The Safety area is conducting the largest ever naturalistic driving study to better understand the interaction among various factors involved in highway crashes—driver, vehicle, and infrastructure—so that better safety countermeasures can be developed and applied to save lives.
- The Renewal area is developing technologies and institutional solutions to support systematic rehabilitation of highway infrastructure in a way that is rapid, presents minimal disruption to users, and results in long-lasting facilities.
- The Reliability area is developing basic analytical techniques, design procedures, and institutional approaches to address the events—such as crashes, work zones, special events, and inclement weather—that result in the unpredictable congestion that makes travel times unreliable.
- The Capacity area is developing a web-based tool to provide more accurate data and collaborative decision-making in the development of new highway capacity in order to expedite the provision of that capacity while simultaneously addressing economic, community, and environmental objectives associated with new construction.

SHRP 2 is administered by the Transportation Research Board of the National Academies under a Memorandum of Understanding with the Federal Highway Administration and the America Association of State Highway and Transportation Officials.
Local Technical Assistance Program (LTAP) at University of Wyoming

Identification: LTAP(014)
LTAP(013)
FUND 438

Contacts:  
Principal Investigator: Khaled Ksaibati, P.E., Ph.D
307-766-6230
University of Wyoming

WYDOT Representative: Tim McDowell, P.E.
307-777-4177

Funding Summary:

<table>
<thead>
<tr>
<th>Code</th>
<th>Funds</th>
<th>State Portion</th>
<th>Federal Portion</th>
<th>Budgeted 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTAP (0438)</td>
<td>Local Tech. Assist.</td>
<td>125,000</td>
<td></td>
<td>$125,000</td>
</tr>
<tr>
<td>HPRF</td>
<td>(WYDOT) SP&amp;R RES</td>
<td>31,250</td>
<td>31,250</td>
<td></td>
</tr>
<tr>
<td>SCFM</td>
<td>SC Fund (4 cent)</td>
<td>31,250</td>
<td>31,250</td>
<td></td>
</tr>
<tr>
<td>CCOF</td>
<td>Municipal &amp; County</td>
<td>31,250</td>
<td>31,250</td>
<td></td>
</tr>
<tr>
<td>CCOF</td>
<td>University of Wyoming</td>
<td>31,250</td>
<td>31,250</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>125,000</strong></td>
<td><strong>125,000</strong></td>
<td><strong>$250,000</strong></td>
</tr>
</tbody>
</table>

Scope: The Local Technical Assistance Program (LTAP) is part of the Federal Highway Administration's Technology Transfer Program. LTAP creates a process using Technology Transfer (T²) Centers to transfer research findings and new technology to the local-level end-user. T² Centers have been established in each state to provide information, advice, and training to local agencies, with Wyoming's T² Center being established in 1985 at the University of Wyoming.

Wyoming Statute 21-17-115 states that:

The University of Wyoming may operate a technology transfer center and provide training to Wyoming county and municipality employees regarding current trends in transportation technology.

The state portion of the funding comes from equal contributions from WYDOT; counties (Wyo. Stat. 24-2-110); cities and towns (Wyo. Stat. 39-17-111(d)(iii)(A)); and the University of Wyoming in an annual amount no less than $25,000 and a maximum of $31,250. The federal government or other non-state contribution must equal that of the total state portion.
Technology Transfer Center (T2) at University of Wyoming

Identification: RS01(214)

Contacts:  Principal Investigator:  Khaled Ksaibati, P.E., Ph.D 307-766-6230  University of Wyoming  
WYDOT Representative:  Tim McDowell, P.E. 307-777-4177  
WYDOT Planning

Funding Summary:

<table>
<thead>
<tr>
<th>Code</th>
<th>Funds</th>
<th>State Portion</th>
<th>Federal Portion</th>
<th>Budgeted 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS01(214)</td>
<td>Federal State Match</td>
<td>$7,500</td>
<td>$30,000</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>$7,500</td>
<td>$30,000</td>
<td>$37,500</td>
<td></td>
</tr>
</tbody>
</table>

Scope: The Technology Transfer Center is part of the Federal Highway Administration's Technology Transfer Program. The Technology Transfer (T²) Center transfers research findings and new technology to the local-level end-user. T² Centers have been established in each state to provide information, advice, and training to local agencies, with Wyoming's T² Center being established in 1985 at the University of Wyoming.
Administration of Research

Identification: RES2214

Contacts:  WYDOT Representative:
           Enid White,
           Research Manager
           307-777-4182
           WYDOT Research Center

Funding Summary: (Project RES2214, Activity RES0)

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>State Portion</th>
<th>Federal Portion</th>
<th>Budgeted 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>Research Proposal Development</td>
<td>1,000</td>
<td>4,000</td>
<td>5,000</td>
</tr>
<tr>
<td>101</td>
<td>Research Printing</td>
<td>100</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>101</td>
<td>Computer Monitor</td>
<td>30</td>
<td>120</td>
<td>150</td>
</tr>
<tr>
<td>101</td>
<td>Research Office Supplies</td>
<td>100</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>102</td>
<td>Vehicle Usage</td>
<td>150</td>
<td>600</td>
<td>750</td>
</tr>
<tr>
<td>104</td>
<td>Research Library Materials</td>
<td>200</td>
<td>800</td>
<td>1,000</td>
</tr>
<tr>
<td>105</td>
<td>RAC Administration</td>
<td>100</td>
<td>400</td>
<td>500</td>
</tr>
<tr>
<td>106</td>
<td>Research Presentation</td>
<td>10,000</td>
<td>40,000</td>
<td>50,000</td>
</tr>
<tr>
<td></td>
<td>Travel</td>
<td>854</td>
<td>3,416</td>
<td>4,270</td>
</tr>
<tr>
<td></td>
<td>Nat’l RAC Meeting</td>
<td>70</td>
<td>280</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>Employee Time Charges and Leave</td>
<td>14,106.80</td>
<td>56,427.19</td>
<td>70,533.99</td>
</tr>
<tr>
<td></td>
<td>Contract Management and Misc</td>
<td>800</td>
<td>3,200</td>
<td>4,000</td>
</tr>
<tr>
<td></td>
<td>Professional Fees</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td><strong>27,510.80</strong></td>
<td><strong>110,043.19</strong></td>
<td><strong>137,553.99</strong></td>
</tr>
</tbody>
</table>
## 8 - Pooled Fund Projects Funding Summary

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TPF-5(005) Study Erection Issues and Composite System Behavior of the Full Scale Curved Girder Bridge Currently Under Test at the Turner Fairbank Research Center</td>
<td>60,000</td>
<td></td>
<td></td>
<td>15,000</td>
<td></td>
<td></td>
<td>60,000</td>
</tr>
<tr>
<td>TPF-5(054) Development of Maintenance Decision Support System</td>
<td>200,000</td>
<td>25,000</td>
<td>25,000</td>
<td></td>
<td></td>
<td></td>
<td>250,000</td>
</tr>
<tr>
<td>TPF-5(145) Western Maintenance Partnership</td>
<td>10,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>10,000</td>
</tr>
<tr>
<td>TPF-5(177) Improving Resilient Modulus Test Procedures for Unbound Materials</td>
<td>40,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>40,000</td>
</tr>
<tr>
<td>TPF-5(178) Implementation of the Simple Performance Tester (SPT) for Superpave validation</td>
<td>105,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>105,000</td>
</tr>
<tr>
<td>TPF-5(189) Enhancement of Welded Steel Bridge Girders Susceptible to Distortion-Induced Fatigue</td>
<td>75,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75,000</td>
</tr>
<tr>
<td>TPF-5 (192) Loop and Length Based Classification Pooled Fund</td>
<td>30,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30,000</td>
</tr>
<tr>
<td>TPF-5(193) Midwest States Regional Pooled Fund Project</td>
<td>295,000</td>
<td>65,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>360,000</td>
</tr>
<tr>
<td>TPF-5(218) Clear Roads Winter Highway Operations Pooled Fund (continued from TPF-5(092))</td>
<td>25,000</td>
<td>75,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>100,000</td>
</tr>
<tr>
<td>TPF-5(251) Relative Operational Performance of Geosynthetics Used as Stabilization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60,000</td>
</tr>
<tr>
<td>TPF-5(253) Member-level Redundancy in Built-up Steel Members</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75,000</td>
</tr>
<tr>
<td>Solicitation 1265 Testing Unmanned Aircraft for Roadside Avalanche Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75,000</td>
</tr>
<tr>
<td>Total</td>
<td>840,000</td>
<td>275,000</td>
<td>25,000</td>
<td>15,000</td>
<td>25,000</td>
<td></td>
<td>1,165,000</td>
</tr>
</tbody>
</table>

Notes: Pooled Fund research projects are generally 100% federal funds.
8.1 – TPF-5(002) – FHWA 13/02F
Updating “A Guide to Standardized Highway Lighting Pole Hardware”

Contacts: Lead Agency Contact: Malcolm H. Ray, P.E., Ph.D.
186 Staples Hill Road
Canton, ME 04221
508-831-5340

WYDOT Representative: Keith Fulton, P.E.
WYDOT Bridge
5300 Bishop Blvd.
Cheyenne WY  82002
307- 777- 4427

Period of Study: Proposal Approved: November 2000
Estimated Completion: 2013

Scope: Prepare in printed and electronic formats, an update to the “Guide” and to recommend an ongoing process for updating the publication electronically.

Status: The report for this project has been published and the closing documents have been forwarded to the federal Pooled Fund site.

Abstract: This report describes the development of an updated Online Guide to Luminaire Supports. The Guide is a web-based content management system for luminaire support systems that allows full viewing, submission, management, and reporting services to its users (e.g., State DOT personnel, construction contractors, etc.). The Online Guide to Luminaire Supports is one of six online guides maintained by the AASHTO-AGC-ARTBA Joint Committee on New Highway Materials Task Force 13 (TF13). The homepage for the Online Guides can be found online at http://guides.roadsafellc.com/.

The luminaire support systems included in the Online Guide to Luminaire Supports have been successfully crash tested according to NCHRP Report 350 or the Manual for Assessing Safety Hardware (MASH) and comply with the AASHTO Standard Specification for Structural Supports for Highway Signs, Luminaires and Traffic Signals. A link to the appropriate FHWA Eligibility letter is included in the index listing for each system.
8.2 – TPF-5(005)

Study Erection Issues and Composite System Behavior of the Full Scale Curved Girder Bridge Currently Under Test at the Turner-Fairbank Research Center

Contacts:  Lead Agency Contact:  WYDOT Representative:
William Wright  Keith Fulton, P.E.
202-493-3053  WYDOT Bridge
FHWA, Washington, DC  5300 Bishop Blvd.
  Cheyenne WY  82002

Period of Study:  Proposal Approved: January 2001
      Estimated Completion: May of 2013

Scope:  The development and calibration of predictor equations for the design and construction of horizontally curved structures.  Anticipated study duration was three years

Status:  The close out Memorandum was finalized on May 8, 2013.
8.3 – TPF-5(054)

Development of Maintenance Decision Support System

Contacts: Lead Agency Contacts: WYDOT Representative:
Dave Huft Jeff Frazier, P.E.
South Dakota DOT Field Operations, WYDOT
605-773-3358 5300 Bishop Blvd.

Investigator:
Leono@meridan-enviro.com

Period of Study: Proposal Approved: July 2005
Estimated Completion: September 2013

Scope: The purpose of this study was to develop a system capable of integrating accurate
weather forecasts, road condition reports, and maintenance resource information so proactive
maintenance decisions can be made before and during adverse weather events, resulting in a
higher level of service, reduced operational costs, and safer highway conditions.

Status: Each district in Wyoming has several roads with MDSS sites and is using the
information gathered as a tool in determining snow removal procedures. The software being
developed for commercial use has many variables allowing each user state to input equipment
and chemical parameters available for each road condition and the software will generate snow
removal recommendations for that condition. Unfortunately due to lack of funding only a few
roads in Wyoming are currently benefitting from this study. Additional funding of $25,000 was
approved for 2012 but was never obligated. These funds will come from the 2014 fund.
8.4 – TPF-5(145)

Western Maintenance Partnership

Contacts: Lead Agency Contacts:
Michael Fazio
Utah DOT
Mfazio@utah.gov
801-957-8595

Daniel Hsiao
dhsiao@utah.gov
801-386-4929

WYDOT Representative:
Jeff Frazier, P.E.
Field Operations, WYDOT
5300 Bishop Blvd.
Cheyenne WY 82002
307-777-4052

Period of Study: Proposal Approved: 2006
Estimated Unknown

Scope: In the 1980’s the Rocky Mountain Maintenance Tour established a highly effective forum for the exchange of information, techniques, policies and strategies for the maintenance of the Highway System. Since that time the role of Maintenance as a critical element in the overall management of the State Highway infrastructure has increased. Most Maintenance managers have been completely replaced since the discontinuance of the Rocky Mountain Maintenance Tour. The primary focus has also shifted from new construction and major rehabilitation to more attention to infrastructure preservation and asset management via cost effective maintenance. Reactive maintenance alone is not adequate to overcome the challenges of rapid deterioration of roads, considering aging of the infrastructure and growing economic constraints.

The Western Maintenance Partnership (WMP) will pool the efforts of the participating agencies to provide a focused look at Maintenance, and will partner with WAASHTO states to share experiences, innovations, expertise and solutions to the complex management of highway assets. Maintenance issues include policies, practices, specifications, field investigations, applied research, materials, and training. It is expected that a roundtable and sharing of field experience via hands on demonstration of features will be key elements of the annual meetings.

Status: WYDOT is no longer funding or part of this pooled fund.
8.5 – TPF-5(177)

Improving Resilient Modulus Test Procedures for Unbound Materials

Contacts: Lead Agency Contacts: WYDOT Representative:
Mike Moravec Greg Milburn, P.E.
FHWA Materials Lab, WYDOT
Office of Pavement Technology 5300 Bishop Blvd.
202-366-3982 Cheyenne WY 82002
Mike.Moravec@FHWA.dot.gov 307-777-4070

WYO TAC Member:
Louis Maillet
Materials Lab, WYDOT
5300 Bishop Blvd.
Cheyenne WY 82002

Period of Study: Proposal Approved: January 2007
Estimated Completion: Unknown

Scope: To reduce the variability currently associated with resilient modulus testing of unbound materials: to conduct a precision and bias study of the test procedure; and, provided assistance to states to properly equip and setup a laboratory for successful MR testing.

This pooled fund study has three primary goals:
1. To reduce the variability currently associated with resilient modulus testing of unbound materials.
2. To conduct a precision and bias study of the test procedure.
3. Provide assistance to states to properly equip and setup a laboratory for successful MR testing.

Status: No updates have been posted. The E-Portal for this project can be found at www.resilientmodulus.com.
8.6 – TPF-5(178)

Implementation of the Asphalt Mixture Simple Performance Tester (AMPT) for Superpave Validation

Contacts: Lead Agency Contact: WYDOT Representative:
Jeff Withee Greg Milburn, P.E.
FHWA Materials Lab, WYDOT
202-366-6429 5300 Bishop Blvd.
Jeff.Withee@dot.gov Cheyenne WY 82002
307-777-4070

Period of Study: Proposal Approved: April 2008
Estimated Completion: December 2014

Scope: The objectives of this pooled fund study are to (1) nationally procure the SPT for highway agencies interested in obtaining and using the SPT to characterize asphalt mixtures designed using Superpave technology; (2) provide support in training technicians to use the SPT to perform the proposed standard practices for measuring dynamic modulus, flow number and flow time of asphalt mixtures compacted using the Superpave Gyratory Compactor (SGC); and (3) evaluate the nation-wide implementation and use of the SPT for assessing performance of asphalt mixtures over a wide range of climatic conditions, materials, and structures.

Status: Two additional AMPT equipment orders (VA and WV) were placed; work on implementation phase activities continued through a cooperative agreement between FHWA and the National Center for Asphalt Technology; NCAT analyzed the submitted results and have been developing the draft report; the AMPT Western Workshop was on September 24-25 in Carson City, Nevada; a study plan for an evaluation of the potential for spray silicone to improve the consistency and reduce the effort in fabrication of greased latex friction reducers was developed; work on implementation phase activities began through a cooperative agreement between FHWA and the Asphalt Institute; a draft study plan has been developed to evaluate multiple factors in the specimen fabrication process from lab mix heating to test specimen air voids. The potential impact of these factors on AMPT test results will be determined through this study; a study plan is under development to evaluate AMPT fatigue testing alongside other fatigue cracking tests; AMPT implementation status and flow number test protocol standardization efforts were presented and discussed at the FHWA Asphalt Mixture ETG in Fall River, MA in September 2013.
8.7 – TPF-5(189)
Enhancement of Welded Steel Bridge Girders Susceptible to Distortion-Induced Fatigue

**Contacts:**

Lead Agency Contact: Rodney Montney  
Kansas Department of Transportation  
rodney@ksdot.org  
785-291-3844

WYDOT Representative: Keith Fulton, P.E.  
5300 Bishop Blvd.  
Cheyenne WY  82002  
307-777-4427

Investigator:  
crb@ku.edu

**Period of Study:**  
Proposal Approved: April 2008  
Estimated Completion: August 2013

**Scope:**  
A large number of steel bridges within the national inventory are affected by distortion-induced fatigue cracks. Repairs for this type of failure can be very costly, both in terms of direct construction costs and indirect costs due to disruption of traffic. Furthermore, physical constraints inherent to connection repairs conducted in the field sometimes limit the type of technique that may be employed. The goal of the proposed research is to investigate the relative merit of novel repair techniques for distortion-induced fatigue cracks.

**Status:**  
Weekly research group meetings have continued to take place. The contract is in-force, and operating on an end date of August 31, 2013. The angles with backing plate retrofit are performing well under demanding fatigue loading in the 30-ft bridge setup. Some crack propagation has been noted while the retrofit is in place, however, it should be noted that the retrofit thus far has been applied over cracks that either had no crack-arrest holes, or very small crack-arrest holes (1/4-in. dia.). Testing taking place this quarter will include slightly larger crack-arrest holes (1/2-in. dia.) for the cracks that did reinitiate through the 1/4-in. dia. crack arrest holes. Additionally, a crack was found to have formed in a cross-frame tab plate, indicating that the angles with backing plate retrofit was capable of protecting the web gap to the extent that a significant crack was forced to a less sensitive region.
8.8 – TPF-5(192)

Loop and Length Based Classification Pooled Fund

Contacts:  Lead Agency Contact:  WYDOT Representative:  Debra Fick  Mark Wingate, P.E. deb.fick@dot.state.mn.us Planning, WYDOT Phone: 651-366-3759 5300 Bishop Blvd. Cheyenne WY 82002 307-777-4180

Period of Study:  Proposal Approved: April 2008  Estimated Completion: Unknown

Scope:  Field test installation methods for loops to determine the most cost effective and best performing procedures and materials. Determine the number of bins and the length spacing for each of those bins for uniform collection of length based classification data. Establish calibration standards for vehicle length based measurements.

Status:  Completed Task 6, Determine Feasibility of Common LBVC Bins. Findings for that task are documented in the draft final report. The draft final report was submitted to the TAC for comment. A project team meeting was held during the 2012 NATMEC conference in Dallas to discuss project findings with the TAC.

<table>
<thead>
<tr>
<th>Task</th>
<th>Percent Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task 1 Literature Review</td>
<td>100% (on schedule)</td>
</tr>
<tr>
<td>Task 2 Experimental Design</td>
<td>100% (on schedule)</td>
</tr>
<tr>
<td>Task 3 Determine Error in Loop LBVC</td>
<td>97% (on schedule)</td>
</tr>
<tr>
<td>Task 4 Determine Error in non-Loop LBVC</td>
<td>95% (on schedule)</td>
</tr>
<tr>
<td>Task 5 Establish LBVC Accuracy Standards</td>
<td>100% (on schedule)</td>
</tr>
<tr>
<td>Task 6 Feasibility of Common LBVC Bins</td>
<td>90% (on schedule)</td>
</tr>
<tr>
<td>Task 7 Multi State Results</td>
<td>40% (on schedule)</td>
</tr>
<tr>
<td>Task 8 Final Report</td>
<td>80% (on schedule)</td>
</tr>
</tbody>
</table>
8.9 – TPF-5(193)
Midwest States Regional Pooled Fund Project

Contacts: Lead Agency Contact: WYDOT Representatives:
Jodi Gibson Keith Fulton, P.E.,
Nebraska Department of Roads WYDOT Bridge
402-479-3687 307-777-4427
Bill Wilson, P.E.
WYDOT Engineering Services 307-777-4216
5300 Bishop Blvd.
Cheyenne WY 82001

Period of Study: Start Date: October 17, 2006
Estimated Completion: October 31, 2014

Scope: To crash test highway roadside appurtenances to assure that they meet criteria established nationally.

Status: Information gained from the various projects within this pooled fund has proven beneficial to WYDOT. All quarterly reports for this project can be found on the Pooled Fund Webpage.
8.10 – TPF-5(218)

Clear Roads Winter Highway Operations Pooled Fund (continued from TPF-5(092))

Contacts:  Lead Agency Contact:  WYDOT Representative:
Debra Fick  Cliff Spoonemore, P.E.
Minnesota Department of WYDOT Maintenance
Transportation  5300 Bishop Blvd.
deb.fick@dot.state.mn.us  Cheyenne WY  82001
Phone: 651-366-3759  307-777-6377

Period of Study:  Proposal Approved: October 2006
Estimated Completion: September 2014

Scope:  The Clear Roads pooled fund project began in 2004 with four members and a focus on real world testing of winter maintenance materials, methods and equipment. During its five years of funding and overseeing research projects, the pooled fund grew to include fourteen member states funding two or three research projects annually. As the group grew, however, there was much interest in expanding the project scope to include more technology transfer and direct support for staff in the field. The group proposes to close the original pooled fund project--TPF-5-092) and request funding and support for a new Clear Roads project with this solicitation. See the Clear Roads Web site at www.clearroads.org for both the history and latest information on this project.

This new Clear Roads pooled fund project will maintain its focus on advancing winter highway operations nationally but will include a more pronounced emphasis on state agency needs, technology transfer and implementation. State departments of transportation are aggressively pursuing new technologies, practices, tools and programs to improve winter highway operations and safety while maintaining fiscal responsibility. This pooled fund is needed to evaluate these new tools and practices in both lab and field settings, to develop industry standards and performance measures, to provide technology transfer and cost benefit analysis and to support winter highway safety. This project responds to research and technology transfer needs not currently met by other pooled fund projects. Existing partners make every effort to coordinate with other agencies to avoid duplication of efforts and to encourage implementation of results.

Status:  The WYDOT RAC voted not to continuing participating in this project.
8.11 – TPF-5(251)

Relative Operational Performance of Geosynthetics Used as Subgrade Stabilization

Contacts:  
Lead Agency: Montana DOT  
Susan Sillick  
sillick@mt.gov  
Phone: 406-444-7693  

WYDOT Representative: Jim Coffin, P.E.  
WYDOT Geology  
5300 Bishop Blvd  
Cheyenne WY  82002  
307-777-4180

Period of Study:  
Proposal Approved: July 2010  
Estimated Completion: February 2014

Scope:  
State departments of transportation (DOTs) routinely use geosynthetics for subgrade stabilization. This construction practice involves placing an appropriately specified geosynthetic on a weak subgrade prior to placement of roadway subbase. The geosynthetic provides stabilization of the subgrade by increasing the load-carrying capacity of the system and maintaining separation between the soft subgrade and subbase materials. Subgrade stabilization allows for a firm construction platform to be built with less aggregate and less construction time as compared to construction without the stabilization geosynthetic. There is a general consensus concerning the effectiveness of geosynthetics in this application; however, there is a lack of understanding and agreement on the material’s properties needed for performance. Those properties should be specified in order to ensure its beneficial use and to allow a broad range of products to be considered. In order to provide for the most economical geosynthetic selection while minimizing conflicts and promoting competitiveness, MDT and other states are conducting a study to examine the performance of various geosynthetics for subgrade stabilization. The aim of the study is to relate this performance to material properties that can be incorporated into standard specifications to allow for broad and economical use of geosynthetic products for a specific application.

Status:  
The synthesize results from all material has been tested; the monitoring equipment has been set up; planning and construction has been completed; installation of the instrumentation is completed; and traffic and data collection has been completed. Tasks which still need to be completed: conduct forensic investigation; collection of subgrade samples to assess moisture content; collection of base course samples to assess subgrade migration; conduct DCP and LWD tests on subgrade; removal of geosynthetic samples for damage assessment; and conduct full damage assessment of geosynthetics.
8.12 – TPF-5(253)
Member-Level Redundancy in Built-up Steel Members

Contacts: Lead Agency Contact: WYDOT Representative:
Indiana DOT Keith Fulton, P.E.
Division of Research WYDOT Bridge
Tommy Nantung 5300 Bishop Blvd
tnantung@indot.in.gov Cheyenne WY 82002
Phone: 765-463-1521 ext 248 307-777-4427

Period of Study: Proposal Approved: January 2011
Estimated Completion: Unknown

Scope: The objective of this research project is to quantify the redundancy possessed by
built-up members. For example, a riveted built-up member will not typically “fail” if one of the
components fractures. However, there is very little experimental data which is available to
quantify the remaining fatigue life or strength of a member in which one of the components has
failed. Furthermore, if built-up members are located in bridges classified as fracture critical,
when significant member redundancy can be shown the bridge may not need to be classified as
FC. However, doing so would release these members from the more rigorous arms-length
inspection currently required. As a result, should a component fail, it may go undetected for an
extended interval. Thus, a portion of the project is devoted to setting rational inspection intervals
for these members. Lastly, the advantages of using built-up members fabricated with HPS
components fastened using HS bolts in new construction will also be explored.

Status: Received repaired actuator; assembled second test setup - actuators mounted, and
calibrated; received first set of bolted built-up specimens; material tests completed for specimen
component material; completed fatigue testing of the following specimens; ordered and received
additional flange angle and cover plate material for 46” specimen; assembled specimen 46-3
using new cover plate and flange angle in conjunction with welded top flange and web from
specimen 46-1; prepared for interim progress meeting in October; and continued work on FE
analysis. FE Models using built-up riveted plates have been created and are being compared with
experimental data.
### 9 - State Research Projects Funding Summary (Obligated)

<table>
<thead>
<tr>
<th>Project Number</th>
<th>Title</th>
<th>Contract Amount</th>
<th>Obligated 1995-2012 80% Fed/ 20% State</th>
<th>Obligated 2013 80% Fed/ 20% State</th>
<th>Obligated 2014-2015 80% Fed/ 20% State</th>
<th>ICAP Funds (8.23% total contract) 80% Fed/ 20% State</th>
<th>Obligated to Date 80% Fed/ 20% State</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS09(206)</td>
<td>Evaluating the Risk of Alkali-Silica Reaction in Wyoming Through an Inter-Laboratory Investigation of Multiple ASR Evaluation Methods</td>
<td>228,125</td>
<td>182,500/ 45,652</td>
<td>0.00</td>
<td></td>
<td>182,500/ 45,652</td>
<td>*26,568</td>
</tr>
<tr>
<td>RS03(209)</td>
<td>Implementation of the Mechanistic-Empirical Pavement Design Guide in the Wyoming Department of Transportation</td>
<td>404,972</td>
<td>223,200/ 80,994</td>
<td>100,778</td>
<td></td>
<td>350,641.36/ 87,659.84</td>
<td></td>
</tr>
<tr>
<td>RS03(210)</td>
<td>Understanding Mule Deer Movement and Habitat Use Patterns in relation to Roadways in Northwest Wyoming</td>
<td>310,864</td>
<td>269,158/ 67,290</td>
<td></td>
<td></td>
<td>289,625.28/ 72,406.82</td>
<td></td>
</tr>
<tr>
<td>RS04(210)</td>
<td>Rural Variable Speed Limit Systems: Phase II</td>
<td>182,403</td>
<td>157,932/ 39,483</td>
<td></td>
<td></td>
<td>169,994.23/ 42,485.54</td>
<td></td>
</tr>
<tr>
<td>RS06(210)</td>
<td>Statewide Mesoscopic Traffic Simulation for Wyoming</td>
<td>127,538</td>
<td>110,428/ 27,607</td>
<td></td>
<td></td>
<td>118,825.10/ 29,706.28</td>
<td></td>
</tr>
<tr>
<td>RS04(211)</td>
<td>Investigation of Silica Fume Concrete Bridge Deck Overlay Failures</td>
<td>129,500</td>
<td>110,151/ 27,538</td>
<td></td>
<td></td>
<td>118,677.28/ 29,669.57</td>
<td></td>
</tr>
<tr>
<td>RS05(211)</td>
<td>Instrumentation and Analysis of Frost Heave Mitigation on WY-70, Encampment, WY</td>
<td>127,856</td>
<td>110,703/ 27,676</td>
<td></td>
<td></td>
<td>119,120.60/ 29,780.51</td>
<td></td>
</tr>
<tr>
<td>RS06(211)</td>
<td>Comprehensive Technology Assessment for Avalanche Hazard Management: Developing and applying an avalanche hazard technology optimization process to a case study on U.S. Route 189-191 in Hoback Canyon, Wyoming</td>
<td>344,428</td>
<td>254,928/ 63,732</td>
<td>25,768</td>
<td></td>
<td>303,373.14/ 59,401.28</td>
<td></td>
</tr>
<tr>
<td>RS07(211)</td>
<td>Rural Travel Times</td>
<td>130,730</td>
<td>113,192/ 28,298</td>
<td></td>
<td></td>
<td>121,799.26/ 30,449.82</td>
<td></td>
</tr>
<tr>
<td>RS08(211)</td>
<td>Evaluating Base Widening Methods</td>
<td>178,434</td>
<td>151,908/ 37,977</td>
<td></td>
<td></td>
<td>163,654.10/ 40914.02</td>
<td></td>
</tr>
<tr>
<td>RS09(211)</td>
<td>Developing a Roadway Safety Improvement Program for Indian Reservations</td>
<td>76,492</td>
<td>67,478/ 16,870</td>
<td></td>
<td></td>
<td>72,514.23/ 18,129.06</td>
<td></td>
</tr>
<tr>
<td>RS11(211)</td>
<td>Trapper’s Point Wildlife Crossing Study</td>
<td>139,887</td>
<td>156,396/ 30,279</td>
<td></td>
<td></td>
<td>165,605.96/ 32,581.49</td>
<td></td>
</tr>
<tr>
<td>Project Code</td>
<td>Project Description</td>
<td>Budget Details</td>
<td>Notes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------------------------------------------------------------------</td>
<td>----------------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS02(212)</td>
<td>Managing Risks in the Project Pipeline – Minimizing the Impacts of Highway Funding Uncertainties</td>
<td>$197,600/140,786/30,300/13,009.98/3,252.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS03(212)</td>
<td>Structural Health Monitoring of Highway Bridges Subjected to Overweight Trucks, Phase I – Instrumentation and Validation</td>
<td>$151,923/62,544/28,691/10,064.50/2,516.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS04(212)</td>
<td>Evaluation of a Mitigation Site: Amphibian Population</td>
<td>$99,500/79,600/19,900/6,551.08/1,637.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS05(212)</td>
<td>Evaluating the Effects of Deer Delineators on Wildlife-Vehicle Collisions in Northwest Wyoming</td>
<td>$234,303/73,164/114,278/15,426.51/3,856.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS06(212)</td>
<td>Evaluating the Risk of Alkali-Silica Reaction in Wyoming: Continued Evaluation of Field Specimens, Proposed Mitigation Strategies and Improving Existing ASTM Standards</td>
<td>$103,283/111,783/22,357/6,800.15/1,700.40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS07(212)</td>
<td>Jackson South Snow Supporting Structures Proposed Performance and Health Monitoring of WYDOT Project No. N104085, Teton County, Jackson, Wyoming</td>
<td>$104,566/90,538/22,634/6,884.62/1,721.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS08(212)</td>
<td>Multi-Measure Performance Assessment and Benchmarking of the Divisions of the Wyoming Highway Patrol</td>
<td>$173,452/57,331/34,690.40/81,450.60/11,420.08/2,855.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS01(213)</td>
<td>Developing a Database and Web Viewing Tool for Ungulate Migration in Wyoming</td>
<td>$152,677/132,194/33,048/10,052.26/2,513.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS05(213)</td>
<td>A Literature Review of Approach Slab and Its Settlement for Roads and Bridges in Wyoming</td>
<td>$69,466/42,007/13,893.20/4,573.64/1,143.41</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS02(214)</td>
<td>Developing an Effective Shoulder and Centerline Rumble Strips/Stripes Policy to Accommodate All Roadway Users**</td>
<td>$89,672/76,166/19,410/5,904/1,476</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS03(214)</td>
<td>Assessment and Evaluations of I-80 Truck Loads and Their Load Effects</td>
<td>$206,931/179,169.14/44,792.28/13,624.34/3,406.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** **Funds which will come from the Planning division and not the research funds.
9.1 – RS09(206) – FHWA 13/04F
Evaluating the Risk of Alkali-Silica Reaction in Wyoming Through an Inter-Laboratory Investigation of Multiple ASR Evaluation Methods

Contacts:
Principal Investigator: Jennifer Tanner, Ph.D.
University of Wyoming
Laramie, WY 82071
307-766-2073

WYDOT Representative:
Bob Rothwell, P.E.,
WYDOT Materials Lab
5300 Bishop Blvd
Cheyenne WY 82002
307-777-4071

Period of Study:
Proposal Approved: August 2006
Estimated Completion: August 2012
Revised Completion: September 2013

Funding Summary:

<table>
<thead>
<tr>
<th>Contract and Amendment/Revision</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>228,125.00</td>
<td>2006</td>
<td>182,500</td>
<td>45,625</td>
<td>0.00</td>
<td>26,568</td>
</tr>
</tbody>
</table>

Scope: Evaluate the effects of ASR on Wyoming Aggregates using the most common test methods, ASTM C 1260, a modified C 1260 using a curve fitting approach, ASTM C 1293, the Chinese Accelerated Mortar Bar Test (CAMBT), and field performance.

Status: A classification system has been devised to evaluate concrete field conditions related to ASR and has been used to rate the extent of damage on selected concrete roads in Riverton, WY. The primary task at present will be to cast the Labarge field specimens, take initial measurements, and move them to the exposure site. In addition, preparations have been made to allow for the testing of the recycled concrete aggregate specimens using ASTM C 1260. ASTM C 1293 specimens and field specimens will continue to be measured.

The final report has been published.
9.2 – RS03(209)

Implementation of the Mechanistic-Empirical Pavement Design Guide in the Wyoming Department of Transportation


Period of Study:
Proposal Approved: January 2009
Estimated Completion: March 2013
Revised Completion Date: August 2014
Second Revised Completion Date: September 2014

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>404,972</td>
<td>2009-2012</td>
<td>223,200</td>
<td>80,994.40</td>
<td>33,329.20</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>100,778</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scope: Implement the Interim AASHTO Mechanistic-Empirical Pavement Design Guide and prepare a design manual of recommended procedures for WYDOT.

Status: A project meeting was held to exchange information between the project team and the Wyoming DOT to review the principles of the Mechanistic-Empirical Pavement Design Guide, its input requirements and model calibration data needs, and the resources required to implementing and using it on a day-to-day basis in Wyoming. A no cost time extension was approved until November 2011. A time extension was granted until September 30, 2014. This contract has been revised twice since the original contract expired.
9.3 – RS03(210) – FHWA 13/08F
Understanding Mule Deer Movement and Habitat Use Patterns in Relation to Roadways in Northwest Wyoming

Contacts:  
Principal Investigator: Corinna Riginos
WYDOT Representative: Robert Hammond, P.E.
Morgan Graham  Resident Engineer
Conservation Research Center of  WYDOT District 3
The Teton Science Schools  Jackson, Wyoming 83001
700 Coyote Canyon Road  307-733-3665
Jackson, Wyoming 83001

Period of Study:  
Proposal Approved: May 2010
Estimated Completion: December 2012
First Amendment Extension: June 2013
Second Amendment Extension: September 2013
Third Amendment Extension: October 2013

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>310,864</td>
<td>2010</td>
<td>248,691.20</td>
<td>62,172.80</td>
<td>25,584.11</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope:  Identify short-distance mule deer migration corridors in Teton County using store-on-board GPS collars and document ungulate road crossings.

Status:  The final report has been published.
9.4 – RS04(210) – FHWA 13/03F
Rural Variable Speed Limit Systems: Phase II

Contacts: Principal Investigator: Rhonda Young, Ph.D., P.E.
Department of Civil & Architectural Engineering
1000 E. University Ave.
Dept. 3295
Laramie, WY 82071

WYDOT Representative: R. Vince Garcia, P.E., WYDOT GIS/ITS
Qwest Building
Cheyenne WY 82002
307-777-4177

Period of Study: Proposal Approved: May 2010
Estimated Completion: December 2012
First Amendment Extension: May 2013

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>182,403</td>
<td>2010</td>
<td>145,922.40</td>
<td>36,480.60</td>
<td>15,011.77</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope: Study baseline conditions for weather and speeds for each of the proposed VSL corridors in order to develop a decision support system for each corridor.

Status: The final report for this project was published in 2013.
9.5 – RS06(210) - FHWY 13/05F
Statewide Mesoscopic Traffic Simulation for Wyoming

Contacts: Principal Investigator: Stephen Boyles, Ph.D.
In conjunction with both The University of Wyoming
Laramie, Wyoming
and The University of Texas at Austin
Austin, Texas

WYDOT Representative: Lee Roadifer, P.E.
WYDOT Traffic
307-777-4190
Sherm Wiseman, P.E.
WYDOT Planning
5300 Bishop Blvd
Cheyenne WY 82002
307-777-3906

Period of Study: Proposal Approved: May 2010
Estimated Completion: December 2012
Revised Contract Estimation: July 2013

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>127,538</td>
<td>2010</td>
<td>102,030.40</td>
<td>25,507.60</td>
<td>10,496.38</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope: Develop statewide mesoscopic traffic simulation software for WYDOT.

Status: This project has been completed and the final report should be published in early 2014.
9.6 – RS04(211)
Investigation of Silica Fume Concrete Bridge Deck Overlay Failures

Contacts: Principal Investigator: Kim Basham, Ph.D., P.E.
KB Engineering
1716 Capital Avenue
Cheyenne, WY 82001

WYDOT Representative: Robert Rothwell, P.E.,
WYDOT Materials
5300 Bishop Blvd
Cheyenne WY 82001
307-777-4071

Period of Study: Proposal Approved: April 2011
Estimated Completion: August 2012
Revised Contract: April 2014

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>127,856</td>
<td>2011</td>
<td>102,284.80</td>
<td>25,571.20</td>
<td>10,522.55</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope: Identify the failure mechanisms and root causes of Silica Fume Concrete (SFC) overlay distress and failures. Make design, materials, and construction recommendations to improve SFC overlay designs.

Status: The lab testing portion was behind schedule due to delays in construction and debugging of the specialized testing equipment. The equipment has been debugged and lab testing of concrete bridge deck overlay mixture has begun. Due to the delay, the contract was extended to April 31, 2014.
9.7 – RS05(211)
Instrumentation and Analysis of Frost Heave Mitigation on WY-70, Encampment, WY

Contacts:  
Principal Investigator: Thomas Edgar, Ph.D., P.E.
University of Wyoming
Laramie, WY 82071
307-766-6220

WYDOT Representative: Tim McGary, P.E.,
District 1, DME
Laramie, WY
307-745-2100

Period of Study:  Proposal Approved: May 2011
Estimated Completion: May 2013
Informal Extension: October 2013

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>127,856</td>
<td>2011</td>
<td>102,284.80</td>
<td>25,571.20</td>
<td>10,522.55</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope:  Determine whether or not the controlled injection of Urethane in the subgrade soil will stabilize the frost heave occurring at Milepost 51.8 on WY-70.

Status:  This report is being reviewed and should be published in December.
9.8 – RS06(211)
A Comprehensive Technology Assessment for Avalanche Hazard Management: Developing and applying an avalanche hazard technology optimization process to a case study on US Route 189-191 in Hoback Canyon, Wyoming


Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>344,428</td>
<td>2013</td>
<td>254,928.00</td>
<td>68,885.60</td>
<td>8,346.42</td>
<td>344,428</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>20,614.40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scope: Develop a generic, broadly proudly applicable, structured process to optimize the choice of avalanche hazard management methods and technology for a given roadway application, including an assessment of the state-of-the-art TAS O’BELLX portable, remotely operable gas blaster for active avalanche control.

Status: A Buy America waiver was approved Federal funds to be used to purchase the TAS O’Bell gas blaster. The waiver delayed the project by one year. The TAS OBELLX has been installed and test fired.
9.9 – RS07(211)

Rural Travel Times

Contacts:  Principal Investigator:  Rhonda Young, Ph.D., P.E.
           University of Wyoming
           Laramie, WY 82071
           307-766-2184
           
           WYDOT Representative:  R. Vince Garcia, P.E.,
           WYDOT GIS/ITS
           Qwest Building
           Cheyenne WY 82002
           307-777-4231

Period of Study:  Proposal Approved: August 2011
                 Estimated Completion: July 2014

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>130,730</td>
<td>2011</td>
<td>104,584</td>
<td>26,146</td>
<td>10,759.08</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope: Investigate the applicability of traveler information on travel time and travel time reliability measures to a rural interstate corridor for use in making travel decisions by passenger car and heavy vehicle travelers.

Status: The software has been coded for TMC calculation of travel time and travel indices; developed laptop version of software for use in travel is survey; and working on chapter 1-5 of report.
9.10 – RS08(211)
Evaluating Base Widening Methods


Period of Study: Proposal Approved: August 2011 Estimated Completion: December 2013

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>178,434</td>
<td>2011</td>
<td>142,747.20</td>
<td>35,686.80</td>
<td>14,685.12</td>
<td>63,700</td>
</tr>
</tbody>
</table>

Scope: Evaluate road widening projects to determine if there is a preferred joint construction method that would prevent premature deterioration.

Status: Completed testing on new projects; sent surveys to Wyoming Contractor’s Association Paving Committee; completed testing of new base widening projects; performed analysis of DCP and FWD data for new projects; completed survey analysis; and prepared draft chapter of all statistical analysis.
9.11 – RS09(211)
Developing a Roadway Safety Improvement Program for Indian Reservations

Contacts: Principal Investigator: Khaled Ksaibati, Ph.D., P.E.
Wyoming T2/LTAP Center
University of Wyoming
Laramie, WY 82071
307-766-6230

WYDOT Representative: Matt Carlson, P.E.,
WYDOT Highway Safety
5300 Bishop Blvd
Cheyenne WY 82002
307-777-4450

Period of Study: Proposal Approved: August 2011
Estimated Completion: September 2013

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>77,934</td>
<td>2011</td>
<td>63,347.20</td>
<td>15,586.80</td>
<td>6,413.97</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope: Develop a methodology for identifying high risk locations on Indian reservation roads; also identify gaps in crash data and make recommendations to bridge these gaps.

Status: The project has been completed and the report has been published.
Criteria for a WYDOT Culvert Selection Policy

Contacts:  
Principal Investigator: John Turner, Ph.D., P.E.  
Ryan Kobbe, P.E.  
University of Wyoming  
Laramie, WY 82071  
307-766-4265  

WYDOT Representative: William B. Wilson, P.E., WYDOT Engineering Services  
5300 Bishop Blvd  
Cheyenne WY 82002  
307-777-4216

Period of Study:  
Proposal Approved: August 2011  
Estimated Completion: July 2013

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>76,492</td>
<td>2011</td>
<td>61,193.60</td>
<td>15,298.40</td>
<td>6,295.29</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope: Comply with a Federal mandate for State DOTs to develop culvert selection policies that consider all available pipe products judged to be of satisfactory quality and equally acceptable on the basis of engineering and economic analysis, while also meeting the need of WYDOT.

Status: This project is complete and the report has been finalized.
9.13 – RS11(211)
Trapper’s Point Wildlife Crossing Study

Contacts:  Principal Investigator:  WYDOT Representative:
            Hall Sawyer  John Eddins, P.E., DE,
            Chad LeBeau  District 3;
            Western Ecosystems Tech, Inc  Rock Springs
            200 South 2nd St., Suite B  307-352-3031
            Laramie, WY 82070  Thomas Hart

Period of Study:  Proposal Approved: August 2011
                 Estimated Completion: September 2015

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>139,883</td>
<td>2011</td>
<td>111,906</td>
<td>27,976.60</td>
<td>11,512.37</td>
<td>5,000</td>
</tr>
</tbody>
</table>

Scope:  Determine: 1) how mule deer and pronghorn respond to newly-constructed underpasses and overpasses, and 2) how many animals use each type of structure.

Status:  The cameras are operational and data is being collected; all photos have been entered into the Access Database; and the winter and migration databases have been merged.
Managing Risks in the Project Pipeline – Minimizing the Impacts of Highway Funding Uncertainties

Contacts: Principal Investigator: Larry Redd, P.E. Larry Redd, LLC 5302 Golden Willow Drive Fort Collins, CO 80528 WYDOT Representative: Timothy McDowell, P.E. State Programming Engineer 5300 Bishop Blvd Cheyenne WY 82002


Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23%</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>197,600</td>
<td>2012</td>
<td>158,080</td>
<td>39,520</td>
<td>16,262.48</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>30,304</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scope: If WYDOT can maintain a suitable number of projects in the project pipeline with an optimum mix of project types in an attempt to provide flexibility in the face of uncertain funding, scope creep, inflation, materials market volatility, legal issues, etc., then the savings to WDYOT could be in the millions of dollars per year.

Status: The report has been reviewed and the report has been published.
9.15 – RS03(212)
Structural Health Monitoring of Highway Bridges Subjected to Overweight Trucks, Phase I – Instrumentation and Validation

Contacts:  
Principal Investigator: Richard J. Schmidt, Ph.D.  
University of Wyoming  
Laramie, WY 82071  

WYDOT Representative: Keith Fulton, P.E.  
WYDOT Bridge  
5300 Bishop Blvd  
Cheyenne WY 82002  
307-777-4427

Period of Study:  
Proposal Approved: June 2012  
Estimated Completion: July 2014  
Revised Contract: December 2015

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>152,863</td>
<td>2012</td>
<td>54,074</td>
<td>30,572.60</td>
<td>12,580.62</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>2012</td>
<td>68,216.40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scope:  
Develop, install, and operate a field instrumentation package for structural health monitoring (SHM) of bridges subjected to overweight trucks and to correlate field performance data to the behavior of the bridges predicted by analysis and rating software.

Status:  
Developed packaging, protection and repair mechanism; developed instrumentation package; working on data collection, processing, and transmission capabilities; and studied the behavior of the FBG sensor.
9.16 – RS04(212)
Evaluation of a Mitigation Site: Amphibian Population

Contacts:  Principal Investigator:  Erin Murths
           U.S. Geological Survey
           2150 Centre Ave. Bldg C
           Fort Collins, CO  80526
           970-226-9474

           WYDOT Representative:  Bob Bonds
           Environmental Coordinator
           5300 Bishop Blvd
           Cheyenne WY  82002
           307-777-4364

Period of Study:  Proposal Approved:  May 2012
           Estimated Completion:  May 2014

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>86,562</td>
<td>2012</td>
<td>69,249.60</td>
<td>17,312.40</td>
<td>7,124.05</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope:  Quantify the success of a successful mitigation site for amphibian species and compare the results between other wetland mitigation sites. The results will provide information for future mitigation efforts in this and similar types of habitat and provide evidence of successful wetland mitigation efforts.

Status:  Field crews were deployed in April to catch early spring breeding activity. Photo points were established at 10 identified sites; automated recording units were placed at 4 focal sites; and auditory records were made throughout the season of frog and bat calls. Capture and recapture data was taken.
9.17 – RS05(212)
Evaluating the Effects of Deer Delineators on Wildlife-Vehicle Collisions in Northwest Wyoming

Contacts:  Principal Investigator: Conservation Research Center of Teton Science Schools
WYDOT Representative: Shelby Carlson, P.E.
700 Coyote Canyon Road Jackson, WY  83001
307-734-3740

WYDOT Dist. #5 Basin WY 307-568-3425

Period of Study:  Proposal Approved: August 2012
Estimated Completion: June 2015

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>234,303</td>
<td>2013</td>
<td>73,164</td>
<td>46,806.60</td>
<td>19,283.14</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>14,278.40</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scope:  This study will provide much needed data on deer delineator efficacy as a Wildlife-Vehicle Crash mitigation tool.

Status:  Identified mule deer migration corridors and seasonal ranges; analyzed deer behavior in relation to roadways; identified mule deer road crossing hotspots and environmental variables associated with high likelihood of crossing; and analyzed mule deer habitat use in relation to roadways and other environmental variables.
9.18 – RS06(212)
Evaluating the Risk of Alkali-Silica Reaction in Wyoming: Continued Evaluation of Field Specimens, Proposed Mitigation Strategies and Improving Existing ASTM Standards

Contacts:  
Principal Investigator:  
Jennifer Tanner, Ph.D.  
Associate Prof.  
University of Wyoming  
Laramie, WY  82071  
307-766-2073

WYDOT Representative:  
Bob Rothwell, P.E.  
WYDOT Materials Lab  
Cheyenne WY  82002  
307-777-4071

Period of Study:  
Proposal Approved:  September 2012  
Estimated Completion:  August 2014

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>103,283</td>
<td>2012</td>
<td>82,626.40</td>
<td>20,656.60</td>
<td>8,500.19</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope:  This study builds on a comprehensive test program of a suite of eight aggregate types from pits around Wyoming, with primary focus in the Big Horn Basin. A second phase of the research evaluates the effectiveness of using fly ash as a mitigation tool in new construction. A third phase of this research repeats the C1293 testing for one inconclusive aggregate as well as considering a more rapid testing method.

Status:  Project is in the early stages and a progress report has not been received.
9.19 – RS07(212)

Jackson South Snow Supporting Structures Proposed Performance and Health Monitoring of WYDOT Project No. N104085, Teton County, Jackson, Wyoming

Contacts:  Principal Investigator: Joshua Hewes, Ph.D.
InterAlpine, Associates, LLC
83 El Camino Tesoros
Sedona, AZ 86336

WYDOT Representative: John Eddins, P.E.
District 3 District Engineer
307-352-3031

Period of Study: Proposal Approved: September 2012
Estimated Completion: September 2015

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>104,566.60</td>
<td>2013</td>
<td>83,652.80</td>
<td>20,913.20</td>
<td>8,605.78</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope: Evaluate the performance of the milepost 151 snow supporting structure installation, and provide an initial basis for development of design guidelines for future constructed snow defense measures at other locations within the western United States. The project will also design parameters and establish domestic guidance documents.

Status: After a delay due to foundation issues, the instrumentation has been placed and the project is moving forward.
Multi-Measure Performance Assessment and Benchmarking of the Divisions of the Wyoming Highway Patrol

Contacts:  
Principal Investigator: Mehmet Egemen Ozbek, Ph.D.  
Assistant Professor  
Graduate Program Coordinator  
Colorado State University  
Fort Collins, CO 80523-1584  
970-491-4101  

WYDOT Representative:  
Captain Derik Mickelson  
Safety, Training and Records  
Wyoming Highway Patrol  
5300 Bishop Blvd  
Cheyenne WY 82002  
307-777-4310

Period of Study: Proposal Approved: August 2012  
Estimated Completion: February 2015

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>173,452</td>
<td>2012</td>
<td>57,311</td>
<td>34,690.40</td>
<td>14,275.10</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>2013</td>
<td>81,450</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scope: The research objective is to develop a Data Envelopment Analysis (DEA) based multi-measure performance assessment system that will result in the identification of the best-performing (i.e., most efficient) divisions of the Wyoming Highway Patrol. These best performing divisions can, then, be used as peers/benchmarks for the divisions that do not perform as good so as to help those divisions improve their performances. This should then leads to greater cost savings, greater safety benefits, and better public performance.

Status: Worked with Joe McCarthy, Captain Derek Mickelson, Captain Shawn Dickerson, and Lieutenant Tom Prichard to get answers related to data; completed the preparation of the data to be used in the first set of models; presented research at the 2013 INFORMS Annual Meeting; and continued with literature review.
9.21 – RS01(213)
Developing a Database and Web Viewing Tool for Ungulate Migration in Wyoming

Contacts: Principal Investigator: Bill Rudd, Project Director
Wyoming Migration Initiative
Wyoming Cooperative Fish and Wildlife Research Unit
University of Wyoming
Laramie Wyoming 82071
307-369-2776

WYDOT Representative: John Eddins
WYDOT
Rock Springs Wyoming
307-352-3031

Period of Study: Proposal Approved: November 2012
Estimated Completion: December 2015

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>152,617</td>
<td>2013</td>
<td>122,141.60</td>
<td>30,335.40</td>
<td>12,565.32</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope: Develop an ungulate movement database that will contain the combined research results of animal ungulate movements and develop a framework for the long term partnership and maintenance of the database for use as a decision support tool.

Status: Project personnel held numerous internal meetings and phone conversations to plan and administer project and to discuss progress; met with Game and Fish and made presentation to regional supervisors in Cody; traveled to Jackson and Laramie to gather input; meetings have been held with partners to design and develop a conceptual approach to the user interface; and presented project as an update to the RAC.
9.23 – RS04(213)
Characterization of Material Properties for Mechanistic-Empirical Pavement Design in Wyoming

Contacts:  Principal Investigator:  Dr. Kam Ng, Ass’t Professor  
Dr. Khaled Ksaibati, Professor  
University of Wyoming  
Laramie Wyoming 82071  
307-766-4333  
307-766-6220  

WYDOT Representative:  
Bob Rothwell  
WYDOT Materials Program  
5300 Bishop Blvd  
Cheyenne WY  82009

Period of Study:  Proposal Approved: March 2013  
Estimated Completion: December 2016

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>317,759</td>
<td>2013</td>
<td>119,905</td>
<td>63,551.80</td>
<td>26,151.57</td>
<td>50,010</td>
</tr>
<tr>
<td></td>
<td>2014</td>
<td>80,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2015</td>
<td>54,302</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scope: The project is set up to characterize representative, local material properties for unbound base and subgrade layers for the mechanistic-empirical pavement design in Wyoming

Status: This project is in the early stages and no reports have been received. There were some major issues with the funding and this project is being reviewed by the Materials Lab.
9.22 – RS05(213)
A Literature Review of Approach Slab and Its Settlement for Roads and Bridges in Wyoming

Contacts: Principal Investigator: Dr. Kam Ng, Ass’t Professor Dr. Thomas Edgar, Assoc. Prof.
University of Wyoming Laramie Wyoming 82071
307-766-4333 307-766-6220
WYDOT Representative: Michael E. Menghini, P.E.
Assistant Bridge Engineer-Design
WYDOT Bridge Program 5300 Bishop Blvd.
Cheyenne WY 82009 307-777-4427

Period of Study: Proposal Approved: March 2013
Estimated Completion: December 2014

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>69,446</td>
<td>2013</td>
<td>42,007</td>
<td>13,893.20</td>
<td>5,717.05</td>
<td>0.00</td>
</tr>
</tbody>
</table>
<pre><code> | 2014       | 13,565.80 |             |                        |                                  |
</code></pre>

Scope: Perform a literature review of the approach slab and the associated settlement problems at bridge approaches.

Status: The literature review is 36% completed; the national survey has not begun; and the draft report has been started.
9.24 – RS06(213)
Wyoming Low Volume Roads Traffic Volume Estimation

Contacts: Principal Investigator: Dr. Khaled Ksaibati, P.E.  WYDOT Representative: Martin Kidner
George Huntington, P.E.  State Planning Engineer
University of Wyoming  Mark Wingate
Laramie Wyoming 82071  Systems Planning Engineer
307-766-6230  5300 Bishop Blvd.
307-766-6783  Cheyenne WY 82009

Period of Study: Proposal Approved: June 2013
Estimated Completion: December 2015

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>148,945</td>
<td>2013</td>
<td>43,324</td>
<td>29,789</td>
<td>12,285.17</td>
<td>0.00</td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td>75,832</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Scope: This project will develop models for estimating traffic volumes on Wyoming’s rural low-volume roads.

Status: This project is in the early stages and no reports have been received.
9.25 – RS02(214)
Developing an Effective Shoulder and Centerline Rumble Strip Policies to Accommodate all Roadway Users.

Contacts:  Principal Investigator:  WYDOT Representative:
Dr. Mohamed M. Ahmed Matt Carlson
Dr. Khaled Ksaibati, P.E. State Highway Safety Engineer
University of Wyoming Wyoming Safety Management System
Laramie Wyoming 82072 Committee
307-766-6230 5300 Bishop Blvd.

Period of Study: Proposal Approved: October 2013
Estimated Completion: December 2015

Funding Summary:

<table>
<thead>
<tr>
<th>Contract Amendment Revisions</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>89,672</td>
<td>2014</td>
<td>70,262</td>
<td>19,410</td>
<td>7,380</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope:  This project will develop recommendations, guidelines and policies for the implementation of rumble strips/stripes that ensure that there is a significant reduction of negative impact to all roadway users.

Status:  The funds have been obligated through the Planning Office. The contract is being circulated for signature. The funds for this project will come from the planning funds and not the research funds.
9.26 – RS03(214)
Assessment and Evaluations of I-80 Truck Loads and Their Load Effects

Contacts:  Principal Investigator:  Dr. Jay Puckett, P.E.
           WYDOT Representative:  Keith Fulton, P.E.
           Brian Goodrich, P.E.
           302 S. 2nd Street, St. 201
           Laramie WY  82070
           307-721-5070

           WYDOT Bridge
           5300 Bishop Blvd
           Cheyenne WY  82002

           307-777-4427

Period of Study:  Proposal Approved:  October 2013
                  Estimated Completion:  December 2015

Funding Summary:

<table>
<thead>
<tr>
<th>Contract</th>
<th>Fiscal Year</th>
<th>Federal</th>
<th>State Match</th>
<th>ICAP 8.23% 80/20 split</th>
<th>Other Match Funds or Internal Funds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amendment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revisions</td>
<td>2014</td>
<td>179,169.14</td>
<td>41,386.20</td>
<td>17,030.42</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Scope:  Determine whether a) the FHWA requirements outlined in the September 29, 2011 memorandum are being met; b) the current legal loads compare to Wyoming weigh-in-motion (WIM) data and vehicles allowed by state statute; c) the WIM and current legal loads compare to the AASHTO LRFR Legal/Raging Loads; and d) the accumulative damage effects of large loads on I-80 begin to be qualified.

Status:  The contract is being circulated for signature.
10 - Completed/Closed Research Projects

Listings on the following pages are

Research Projects and Pooled Fund Projects

Completed within the last three years
COMPLETED RESEARCH PROJECTS

RS04(206) Evaluation of Treatment Options for ASR-Affected Concrete Completion: January 2010

RS05(207) Variable Speed Limit System for I-80 Elk Mountain Corridor Completion: October 2010

RS06(207) ITS System to Reduce High Wind Truck Crashes on I-25 near Bordeaux, WY: Completion: October 2010

RS02(208) Use of Truck-Mounted Changeable Message Signs (CMSs) During Mobile Operations Completion: July 2010

RS06(209) Gravel Roads Management: Developing a Methodology Completion: October 2010

RS05(210) Wyoming County Road Fund Manual – Update Research Funding Proposal – Phase 1: Completion: June 2010

RS07(210) Utilizing Road Profiler Measurements in Determining the Fore Slopes of Shoulders Completion: January 2011


RS08(210) Comparing Crash Trends and Severity in the Northern Rocky Mountain Region

RS07(207) Effectiveness of Using Recycled Asphalt Materials (RAP) and other Dust Suppressants in Gravel Roads

RS04(209) Bridge Deck Evaluation using Non-destructive Test Methods

RS01(211) Wyoming LTAP Center 2011

RS03(211) Evaluation of the WYDOT Research Center and Research Program (Phase II)
RS08(200) Control and Prevention of Alkali-Silica Reaction in Recycled Portland Cement Concrete Pavement Using Lithium Nitrate

RS01(209) Evaluating the Effectiveness of Mule Deer Crossing Structures in Nugget Canyon

RS05(209) (DARWin-ME) Development of Software for the Design and Analysis of New and Rehabilitated Pavements Using Mechanistic-Empirical Methods

RS02(211) Preparation of Samples for the Asphalt Mixture Performance Tester (AMPT)

RS10(211) Criteria for a WYDOT Culvert Selection Policy

COMPLETED POOLED FUND PROJECTS

TPF-5(116) Investigation of the Fatigue Life of Steel Base Plate to Pole Connections for Traffic Structures Completion: August 2011

TPF-5(051) Construction of Crack Free Concrete Bridge Decks Completion: March 2010

SPR-3(072) Strength and Deformation of Mechanically Stabilized Earth (MSE) Walls

TPF-5(001) Soil Mixing Methods for Highway Applications

TPF-5(002) Updating "A Guide to Standardized Highway Lighting Pole Hardware"

TPF-5(016) Micropile Systems for Highway Bridges

TPF-5(068) Long-Term Maintenance of Load and Resistance Factor Design

TPF-5(116) Investigation of the Fatigue Life of Steel Base Plate to Pole Connections for Traffic Structures

TPF-5(151) Subsurface Drainage for Landslide and Slope Stabilization