

**WYOMING DEPARTMENT OF  
TRANSPORTATION 2016 WORK  
PROGRAM**

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## INTRODUCTION

This Wyoming Department of Transportation Research Work Program is implemented in accordance with federal statutes, rules and regulations, and FHWA requirements. Work Program is defined in *Title 23 C.F.R Part 420, Sec. 103* as “a periodic statement of proposed work, covering no less than one year, and estimated costs that documents eligible activities to be undertaken by State DOTs and/or their subrecipients with FHWA planning and research funds.” *Title 23 C.F.R Part 420, Sections 111, 207 and 209* sets out that the Work Program should consist of a) a list of and description of the work and/or activities to be accomplished during the program period; b) an estimated costs for each eligible activity; c) a description of any cooperatively funded activities that are part of a national or regional pooled study, including the NCHRP contributions; and d) financial summaries which show the funding levels for each activity, which should include the federal and state share, and any matching funds for each individual project. *Subpart (c), of Title 23 of the Code of Federal Regulations, Section 420.213*, requires research programs certify that their program conforms to management processes.

The Wyoming Department of Transportation Research Work Program is broken down as follows:

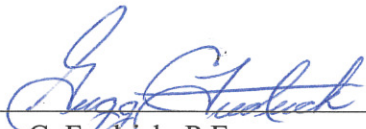
1. Budget Summary
2. Pooled Fund Project Funding Summary
3. State Research Projects Funding Summary
4. Completed/Closed Pooled Fund and State Research Projects





**23 CFR SEC. 420.209 CERTIFICATE OF COMPLIANCE**

I, Gregg Fredrick, Assistant Chief Engineer for Engineering and Planning Division, do hereby certify that the State is in compliance with the requirements of 23 C.F.R. 505 and its implementing regulations with respect to the research, development, and technology transfer program, and contemplate no changes in statutes, regulations or administrative procedures which would affect such compliance.



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Gregg C. Fredrick, P.E.

Assistant Chief Engineer for Engineering and Planning



## Table of Contents

<b>Chapter 1. 2016 Budget Summary .....</b>	<b>1</b>
<b>Chapter 2. 2016 Expense Summary.....</b>	<b>3</b>
<b>2.1 National Cooperative Highway Research Program (NCHRP) .....</b>	<b>3</b>
<b>2.2 Transportation Research Board Correlation Service (TRB) .....</b>	<b>4</b>
<b>2.3 Strategic Highway Research Program (SHRP II) .....</b>	<b>5</b>
<b>2.4 Technology Transfer Center (T2) at University of Wyoming.....</b>	<b>6</b>
<b>2.5 Local Technical Assistance Program (LTAP) at University of Wyoming .....</b>	<b>7</b>
<b>2.6 Administration of Research.....</b>	<b>8</b>
<b>2.7 - Pooled Fund Projects Funding Summary .....</b>	<b>9</b>
2.7.1 – TPF-5(054) Development of Maintenance Decision Support System .....	10
2.7.2 – TPF-5(145) Western Maintenance Partnership .....	11
2.7.3 – TPF-5(177) Improving Resilient Modulus Test Procedures for Unbound Materials .....	12
2.7.4 – TPF-5(189) Enhancement of Welded Steel Bridge Girders Susceptible to Distortion-Induced Fatigue .....	13
2.7.5 – TPF-5(193) Midwest States Regional Pooled Fund Project .....	14
2.7.8 – TPF-5(218) Clear Roads Winter Highway Operations Pooled Fund (continued from TPF-5(092)).....	15
2.7.9 – TPF-5(253) Member Level Redundancy in Built-up Steel Members .....	16
2.7.10 – TPF-5(310) 11th International Conference on Low Volume Roads and Peer Exchange .....	17
2.7.11 – TPF-5(317) Evaluation of Low Cost Safety Improvements .....	18
<b>2.8 - State Research Projects Funding Summary (Obligated) .....</b>	<b>19</b>
2.8.1 – RS03(209) Implementation of the Mechanistic-Empirical Pavement Design Guide in the Wyoming Department of Transportation.....	21
2.8.2 – RS04(211) Investigation of Silica Fume Concrete Bridge Deck Overlay Failures .....	22
2.8.3 - 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 .....	23
2.8.4 – RS11(211) Trapper's Point Wildlife Crossing Study.....	24
2.8.5 – RS03(212) Structural Health Monitoring of Highway Bridges Subjected to Overweight Trucks, Phase I – Instrumentation and Validation.....	25
2.8.6 – RS04(212) Evaluation of a Mitigation Site: Amphibian Population.....	26
2.8.7 – RS06(212) Evaluating the Risk of Alkali-Silica Reaction in Wyoming: Continued Evaluation of Field Specimens, Proposed Mitigation Strategies and Improving Existing ASTM Standards .....	27
2.8.8 – RS07(212) Jackson South Snow Supporting Structures Proposed Performance and Health Monitoring of WYDOT Project No. N104085, Teton County, Jackson, Wyoming.....	28
2.8.9 – RS08(212) Multi-Measure Performance Assessment and Benchmarking of the Divisions of the Wyoming Highway Patrol.....	29
2.8.10 – RS01(213) Developing a Database and Web Viewing Tool for Ungulate Migration in Wyoming .....	30

2.8.11 – RS04(213) Characterization of Material Properties for Mechanistic-Empirical Pavement Design in Wyoming.....	31
2.8.12 – RS06(213) Wyoming Low Volume Roads Traffic Volume Estimation.....	32
2.8.13 – RS03(214) Assessment and Evaluations of I-80 Truck Loads and Their Load Effects .....	33
2.8.14 – RS04(214) Developing Wyoming Specific Bridge Deterioration Models for Bridge Management....	34
2.8.15 – RS05(214) Safety Effectiveness of Regulatory Headlights Signs in Wyoming.....	35
2.8.16 – RS02(215) Evaluating the Effectiveness of Fly Ashes to Mitigate ASR and Using Recycled Concrete Aggregate in New Construction.....	36
2.8.17 – RS03(215) Planning-Support for Mitigation of Wildlife-Vehicle Collisions and Highway Impacts on Migration Routes in Wyoming .....	37
2.8.18 – RS04(215) SHRP II – Concept to Countermeasure – Research to Deployment Using the SHRP2 Safety Data .....	38
2.8.19 – RS05(215) Developing Mitigation Strategies to Reduce Truck Crash Rates on Wyoming Highways	39
2.8.20 – RS06(215) Historic Winter Weather Assessment for Snow Fence Design Using a Numerical Weather Model.....	40

### ***Chapter 3. Completed/Closed Research Projects.....41***

#### **3.1 - Completed Research Projects..... 42**

#### **3.2 - Completed Pooled Fund Projects ..... 43**

## Chapter 1. 2016 Budget Summary<sup>1</sup>

This chapter sets out the proposed budget for fiscal year (FY) 2016.

1. SP&R Funds	\$4,892,606
<b>REVENUE</b>	
2. SP&R RES Funds	\$1,198,152
3. LTAP Special Allocation (Fund 438)	\$125,000
4. FY2015 unobligated funds	\$506,924
5. Total Revenues	\$1,830,076
<b>EXPENSES</b>	
6. NCHRP	\$258,330
7. TRB Correlation Service (est.)	\$85,000
8. SHRP II	\$0.00
9. Technology Transfer to U.W. Fund 438	\$125,000
10. LTAP Funds RS01214	\$30,000
11. Administrative Costs (est.)	\$137,404
12. Pooled Fund	\$0.00
13. State Research Projects (80% federal)	\$0.00
14. ICAP funds (80% federal) (est.)	\$50,000
15. Total Expenses	\$685,734
<b>TOTAL FY2016 FEDERAL FUNDS AVAILABLE</b>	<b>\$1,144,345</b>

### LINE NUMBER EXPLANATIONS:

1. Total estimated 2016 SP&R funds.

### REVENUE

2. Under 23 U.S.C. 505(b)(1), at least 25 percent of the SPR funds must be used for research, development, and technology transfer activities. WYDOT presently obligates the minimum amount, which is made up of 100 percent Federal funds, i.e., 25 percent of line 1.
3. Federal program requiring 100 percent state funding match. See Local Technical Assistance Program (LTAP) & Technology Transfer (T<sup>2</sup>) Center summary for a complete financial breakdown.
4. Un-obligated Federal funds from previous fiscal year apportionments.
5. Summation of lines 2 through 4.

### EXPENSES

6. 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.

<sup>1</sup> The Wyoming Department of Transportation is under a continuing resolution and the funds set out in this budget summary are a guessimate of the funds which will be available in fiscal year (FY) 2016 and on what the carryover from FY2015 will be.

WYDOT presently contributes the full 5.5 percent, which is made up of 100 percent Federal funds. TPF-5(415).

7. The TRB Correlation Service is a pooled fund and obligated annually using 100 percent Federal funds. TRB-5(277).
8. SHRP II funds are no longer authorized. The Research Center will no longer pay SHRP II funding.
9. The Technology Transfer Center's funding (located at the University of Wyoming), is contracted for and obligated annually. See Technology Transfer (T<sup>2</sup>) Center summary for financial breakdown.
10. LTAP funding, is contracted and obligated annually. See Local Technical Assistance Program (LTAP) for financial breakdown.
11. Administrative Cost summary for financial breakdown.
12. Transportation Pooled Fund Projects summary for financial breakdown.
13. Federal funds only (80% of the contracted amount). See State Research Projects summary for financial breakdown.
14. Indirect Cost Allocation Plan (ICAP) funds (an additional 8.23% added on to each contract (80 federal/20 state split).
15. Summation of lines 6 through 14.

TOTAL

16. Total amount available for new research (revenue, less expenses).

## **Chapter 2. 2016 Expense Summary**

### **2.1 National Cooperative Highway Research Program (NCHRP)**

**Identification:** TPF-5(415)

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

**Funding:** \$258,330

**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.

## **2.2 Transportation Research Board Correlation Service (TRB)**

Also known as the Core Program Services for a Highway Research, Development, and Technology Program, 2015.

**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 WYDOT. 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 FY1995, the FHWA allowed the TRB correlation service charge to be paid at 100% federal funding, requiring no state match.



### **2.3 Strategic Highway Research Program (SHRP II)**

**Identification:** SHR-2(016)

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

**Funding:** \$0.00

**Scope:** Closed. WYDOT is no longer obligated for these funds.

## 2.4 Technology Transfer Center (T2) at University of Wyoming

**Identification:** LTAP(016)  
LTAP(017)  
FUND 438

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

### Funding Summary:

<i>Code</i>	<i>Funds</i>	<i>State Portion</i>	<i>Federal Portion</i>	<i>Budgeted</i>
LTAP (0438)	Local Tech. Assistance		\$125,000	\$125,000
HPRF	(WYDOT) SP&R RES	\$31,250		\$31,250
SCFM	SC Fund (4 cent)	\$31,250		\$31,250
CCOF	Municipal & County	\$31,250		\$31,250
CCOF	University of Wyoming	\$31,250		\$31,250
Total		\$125,000	\$125,000	\$250,000

**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 (T<sup>2</sup>) Centers to transfer research findings and new technology to the local-level end-user. T<sup>2</sup> Centers have been established in each state to provide information, advice, and training to local agencies, with Wyoming's T<sup>2</sup> 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.

## 2.5 Local Technical Assistance Program (LTAP) at University of Wyoming

**Identification:** RS01(216)

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

**Funding Summary:**

<i>Code</i>	<i>Funds</i>	<i>State Portion</i>	<i>Federal Portion</i>	<i>Budgeted 2014</i>
RS01216	Federal State Match	\$7,500	\$30,000	
Total		\$7,500	\$30,000	\$37,500

**Scope:** The Technology Transfer Center (T<sup>2</sup>) is part of the Federal Highway Administration's Technology Transfer Program. The T<sup>2</sup> Center transfers research findings and new technology to the local-level end-user. T<sup>2</sup> Centers have been established in each state to provide information, advice, and training to local agencies, with Wyoming's T<sup>2</sup> Center being established in 1985 at the University of Wyoming.

## 2.6 Administration of Research

**Identification:** RES2216

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

**Funding Summary:** (*Project RES2216, Activity RES0*)

<i>Title</i>	<i>State Portion</i>	<i>Federal Portion</i>	<i>Budgeted 2016</i>
Research Proposal Development	\$1,000	\$4,000	\$5,000
Research Printing	\$100	\$400	\$500
Research Office Supplies	\$100	\$400	\$500
Vehicle Usage	\$150	\$600	\$750
Research Library Materials	\$200	\$800	\$1,000
RAC Administration	\$100	\$400	\$500
Research Presentation*	\$10,000	\$40,000	\$50,000
Travel	\$854	\$3,416	\$4,270
National RAC Meeting	\$70	\$280	\$350
Employee Time Charges and Leave	\$14,107	\$56,427	\$70,534
Contract Management and Misc	\$800	\$3,200	\$4,000
Professional Fees			
<b>TOTAL</b>	<b>\$27,481</b>	<b>\$109,923</b>	<b>\$137,404</b>

\*Research presentations include the \$5,000 reserved for the 2016 Peer Review.

## 2.7 - Pooled Fund Projects Funding Summary

	Obligated 1995-2011	Obligated 2012	Obligated 2013	Obligated 2014	Obligated 2015	Obligated 2016	Total Obligated
TPF-5(054) Development of Maintenance Decision Support System (Closed)	\$200,000	\$25,000		\$25,000			\$250,000
TPF-5(145) Western Maintenance Partnership (Closed)	\$10,000						\$10,000
TPF-5(177) Improving Resilient Modulus Test Procedures for Unbound Materials	\$40,000						\$40,000
TPF-5(189) Enhancement of Welded Steel Bridge Girders Susceptible to Distortion-Induced Fatigue	\$75,000						\$75,000
TPF-5(193) Midwest States Regional Pooled Fund Project	\$360,000						\$360,000
TPF-5(218) Clear Roads Winter Highway Operations Pooled Fund (continued from TPF-5(092))	\$125,000						\$125,000
TPF-5(253) Member-Level Redundancy in Built-up Steel Members	\$75,000						\$75,000
TPF-5(310) – 11 <sup>th</sup> Annual International Conference on Low Volume Roads and Peer Exchange					\$8,000		\$8,000
TPF-5(317) Evaluation of Low Cost Safety Improvements					\$30,000		\$30,000

Notes: Pooled Fund research projects are generally 100% federal funds.

### 2.7.1 – TPF-5(054) Development of Maintenance Decision Support System

<b>Contacts:</b>	Lead Agency Contacts:	WYDOT Representative:
	Dave Huft	Jeff Frazier, P.E.
	South Dakota DOT	Field Operations, WYDOT
	605-773-3358	5300 Bishop Blvd.
		Cheyenne WY 82002
	Investigator:	307-777-4052
	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 the 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 budget.

This Project is scheduled to close on October 31, 2015.

### 2.7.2 – TPF-5(145) Western Maintenance Partnership

<b>Contacts:</b>	Lead Agency Contacts:	WYDOT Representative:
	Michael Fazio	Jeff Frazier, P.E.
	Utah DOT	Field Operations, WYDOT
	Mfazio@utah.gov	5300 Bishop Blvd.
	801-957-8595	Cheyenne WY 82002
		307-777-4052
	Daniel Hsiao	
	<a href="mailto:dhsiao@utah.gov">dhsiao@utah.gov</a>	
	801-386-4929	

**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 the Western Associate of State Highway and Transportation Officials (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 a sharing of field experience via hands on demonstration of features will be key elements of the annual meetings.

**Status:** The final report was filed in May of 2014 and the closeout letter was received November 3, 2014.



### **2.7.3 – 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, to provide 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:** The E-Portal for this project can be found at [www.resilientmodulus.com](http://www.resilientmodulus.com). Webinars for this project have been developed. The website does not reflect any work performed in either FY2014 or FY2015.



#### **2.7.4 – TPF-5(189) Enhancement of Welded Steel Bridge Girders Susceptible to Distortion-Induced Fatigue**

**Contacts:**      Lead Agency Contact:                      WYDOT Representative:  
Rodney Montney                      Keith Fulton, P.E.  
Kansas Department of Transportation      WYDOT Bridge  
rodney@ksdot.org                      5300 Bishop Blvd.  
785-291-3844                      Cheyenne WY 82002  
307-777-4427  
  
Investigator: [crb@ku.edu](mailto: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 foot 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 inch diameter). Testing taking place this quarter will include slightly larger crack-arrest holes (1/2 inch diameter) for the cracks that did reinitiate through the 1/4 inch diameter 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.

The final report was completed in October of 2014. Report No. FHWA-KS-14-03.

### **2.7.5 – 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  
                         5300 Bishop Blvd.  
                         Cheyenne WY 82001  
                         307-777-4216

**Period of Study:**   Start Date: October 17, 2006  
                                 Estimated Completion: June 2016

**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 (<http://www.pooledfund.org/Details/Study/418>).

**2.7.8 – TPF-5(218) Clear Roads Winter Highway Operations Pooled Fund  
(continued from TPF-5(092))**

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

**Period of Study:** Proposal Approved: October 2006  
Estimated Completion: Ongoing

**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 requested funding and support for a new Clear Roads project with this solicitation. See the Clear Roads Web site at [www.clearroads.org](http://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 to not fund this project in 2015.

### 2.7.9 – TPF-5(253) Member Level Redundancy in Built-up Steel Members

<b>Contacts:</b>	Lead Agency Contact:	WYDOT Representative:
	Indiana DOT	Keith Fulton, P.E.
	Division of Research	WYDOT Bridge
	Tommy Nantung	5300 Bishop Blvd
	<a href="mailto:tnantung@indot.in.gov">tnantung@indot.in.gov</a>	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:** Conducted fracture test on specimen 30-1 with thicker (1”) cover plate; conducted fatigue test on specimen 30-1; continued work on FE analysis; developed simplified models for characterization of load distribution of partially failed build up; developed draft of evaluation of guidelines for build-up members in bending; began assembly of 2 million pound testing machine; and reassembled west test setup load frame with repaired MTS actuator.

### **2.7.10 – TPF-5(310) 11th International Conference on Low Volume Roads and Peer Exchange**

<b>Contacts:</b>	Lead Agency Contact:	WYDOT Representative:
	Iowa DOT	Tony Laird, P.E.
	Vanessa Goetz	5300 Bishop Blvd
	Vanessa.goetz@dot.iowa.gov	Cheyenne WY 82002
	Phone: 515-239-1382	307-777-4134

**Period of Study:** Proposal Approved: April 2015  
Estimated Completion: July 15, 2015

**Scope:** The Iowa Department of Transportation (Iowa DOT) will serve as lead state for the execution of this Pooled Fund project. The Transportation Research Board (TRB) will facilitate all administrative duties associated with the project and will invoice the Iowa DOT for reimbursement up to the amount available in the Pooled Fund.

**Status:** Completed.

### 2.7.11 – TPF-5(317) Evaluation of Low Cost Safety Improvements

<b>Contacts:</b>	FHWA:	WYDOT Representative:
	Roya Amjadi	Joel Meena
	<a href="mailto:Roya.amjadi@fhwa.dot.gov">Roya.amjadi@fhwa.dot.gov</a>	5300 Bishop Blvd
	202-493-3383	Cheyenne WY 82002
		307-777-4374

**Period of Study:** Proposal Approved: April 2015  
Estimated Completion: 2017

**Scope:** This project is being created to convert Pooled Fund Project TPF-5(099) to the “New” Pooled Fund Procedures. The scope of the ELCSI–PFS is to conduct a research project of the priority strategies in the NCHRP Report 500 Guides. Originally a target of 20 strategies totaling \$4.38 million over 5 years was planned for ELCSI–PFS studies in four phases. Currently, this study has outperformed its original goals, and has added four extra phases for a total of eight phases. The original budget of \$4.38 million remains the same. To provide much needed reliable measures for effectiveness of various low-cost safety improvements, this study's performance period has been extended beyond 2017.

**Status:** This is a continuing project.



## 2.8 - State Research Projects Funding Summary (Obligated)

<i>Project Number</i>	<i>Title</i>	Contract Amount	Obligated 1995-2012 80% Fed/ 20% State	Obligated 2013 80% Fed/ 20% State	Obligated 2014-2015 80% Fed/ 20% State	Obligated 2016 80% Fed/ 20% State	Estimated ICAP Funds (8.23% total contract) 80% Fed/ 20% State
RS03(209)	Implementation of the Mechanistic-Empirical Pavement Design Guide in the Wyoming Department of Transportation	\$404,972	\$279,000	\$125,972			\$0.00
RS04(211)	Investigation of Silica Fume Concrete Bridge Deck Overlay Failures	\$129,500	\$139,988		\$170		\$10,658
RS06(211)	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	\$344,428		\$318,660	\$54,115		\$28,347
RS11(211)	Trapper's Point Wildlife Crossing Study	\$139,887	\$151,400				\$11,513
RS03(212)	Structural Health Monitoring of Highway Bridges Subjected to Overweight Trucks, Phase I – Instrumentation and Validation	\$153,863		\$133,221	\$33,305		\$12,663
RS04(212)	Evaluation of a Mitigation Site: Amphibian Population	\$86,562	\$93,686				\$7,124
RS06(212)	Evaluating the Risk of Alkali-Silica Reaction in Wyoming: Continued Evaluation of Field Specimens, Proposed Mitigation Strategies and Improving Existing ASTM Standards	\$103,283	\$111,783				\$8,500
RS07(212)	Jackson South Snow Supporting Structures Proposed Performance and Health Monitoring of WYDOT Project No. N104085, Teton County, Jackson, Wyoming	\$104,566		\$113,172			\$8,606
RS08(212)	Multi-Measure Performance Assessment and Benchmarking of the Divisions of the Wyoming Highway Patrol	\$173,452	\$71,639	\$116,088			\$14,275
RS01(213)	Developing a Database and Web Viewing Tool for Ungulate Migration in Wyoming	\$265,001		\$165,242	\$121,569		\$21,810
RS04(213)	Characterization of Material Properties for Mechanistic Empirical Pavement Design in Wyoming	\$317,759		\$149,881	\$194,030		\$26,152
RS06(213)	Wyoming Low Volume Roads Traffic Volume Estimation	\$148,945		\$54,155	\$107,049		\$12,258

<i>Project Number</i>	<i>Title</i>	Contract Amount	Obligated 1995-2012 80% Fed/ 20% State	Obligated 2013 80% Fed/ 20% State	Obligated 2014-2015 80% Fed/ 20% State	Obligated 2016 80% Fed/ 20% State	Estimated ICAP Funds (8.23% total contract) 80% Fed/ 20% State
RS03(214)	Assessment and Evaluations of I-80 Truck Loads and Their Load Effects	\$206,931			\$223,961		\$17,030
RS04(214)	Developing Wyoming Specific Bridge Deterioration Models for Bridge Management	\$82,973			89,802		\$6,829
RS05(214)	Safety Effectiveness of Regulatory Headlights Signs in Wyoming	\$95,592			\$103,460		\$7,868
RS02(215)	Evaluating Effectiveness of Fly Ashes to Mitigate ASR	\$65,975			\$71,405		\$5,430
RS03(215)	Planning-supporting for Mitigation of WVC and Highway Impact	\$29,201			\$31,604		\$2,403
RS04(215)	SHRP II – Safety IAP	\$126,835			\$137,274		\$10,439
RS05(215)	Developing Mitigation Strategies to Reduce Truck Crash Rates on Wyoming Highways	\$89,181			\$96,521		\$7,340
RS06215	Historic Winter Weather Assessment for Snow Fence Design Using a Numerical Weather Model	\$19,178			\$20,756		\$1,578



### 2.8.1 – RS03(209) Implementation of the Mechanistic-Empirical Pavement Design Guide in the Wyoming Department of Transportation

**Contacts:**      Principal Investigator:                      WYDOT Representative:  
                          Applied Research Associates, Inc.      Bob Rothwell, P.E.  
                          100 Trade Centre, Suite 200                      WYDOT Materials Lab  
                          Champaign, IL 61820                              5300 Bishop Blvd  
                          207-356-4500                                      Cheyenne WY 82002  
                             307-777-4071

**Period of Study:**      Proposal Approved: January 2009  
                                  Estimated Completion: March 2013  
                                  Revised Completion Date: August 2014  
                                  Second Revised Completion Date: September 2015

#### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$404,972	2009-2012	\$223,200	\$80,994		\$0.00
	2013	\$100,778			

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

**Status:**      No activity was completed during FY2015 due to the fact that the Principle Investigator is waiting for data from the University of Wyoming in another research project (RS04213 – Characterization of Material properties from MEPDG). Once the data is received, the Principle Investigator will be able to perform the calibration factors with both the LTPP and non-LTPP sites. The project is on hold until the University of Wyoming has completed its tasks. Tasks 1 through 6 have been completed. The only Tasks which are on hold are 7 – calibration and validation of MEPDG for Wyoming Conditions, and 8 – design sensitivity analysis and training.

## 2.8.2 – RS04(211) Investigation of Silica Fume Concrete Bridge Deck Overlay Failures



**Contacts:**      Principal Investigator:      WYDOT Representative:  
Kim Basham, Ph.D., P.E.      Robert Rothwell, P.E.,  
KB Engineering      WYDOT Materials  
1716 Capital Avenue      5300 Bishop Blvd  
Cheyenne, WY 82001      Cheyenne WY 82001  
307-777-4071

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

### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$129,500	2011	\$103,600	\$25,900	\$10,658	\$0.00

**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:** Due to an injury sustained by the Principle Investigator, this project is on hold. The only task left to perform is writing the final report.

**2.8.3 - 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**



<b>Contacts:</b>	Principal Investigator:	WYDOT Representative:
	Rand Decker, Ph.D., P.E.	John Eddins, P.E.,
	InterAlpine Associates, LLC	District 3, District Engineer
	83 El Camino Tesoros	Rock Springs, WY 82902-1260
	Sedona, Arizona 86336	307-352-3031
	928-202-8156	

**Period of Study:** Proposal Approved: October 2012  
Estimated Completion: September 2015  
First Revised Contract: September 2016

**Funding Summary:**

Total Contract, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$344,428	2013	\$254,928	\$74,555	\$28,346	\$0.00
	2014	\$43,291			

**Scope:** Develop a generic, broadly 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:** The Buy America Waiver, which approved Federal funds to be used to purchase the TAS O'BELLX gas blaster, took over a year to be finalized and delayed the project. The TAS OBELLX has been installed and test fired. The project was extended to 2016 and is about 80% complete.

#### 2.8.4 – RS11(211) Trapper's Point Wildlife Crossing Study



**Contacts:**      Principal Investigator:  
Hall Sawyer  
Chad LeBeau  
Western Ecosystems Tech, Inc  
200 South 2<sup>nd</sup> St., Suite B  
Laramie, WY 82070

WYDOT Representative:  
John Eddins, P.E., DE,  
District 3;  
Rock Springs  
307-352-3031

Thomas Hart  
Environmental Services  
5300 Bishop Blvd  
Cheyenne WY 82002  
307-777-4495

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

#### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$139,887	2011	\$121,120	\$30280	\$11,513	\$5,000

**Scope:** Determine how mule deer and pronghorn respond to newly-constructed underpasses and overpasses; and 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. The Principle Investigator has begun drafting the final report.

### 2.8.5 – 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:

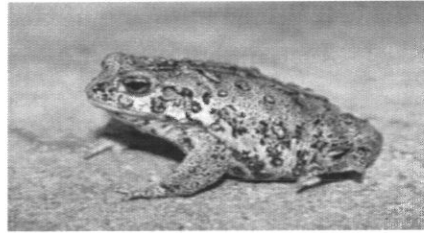
Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$152,863	2012	\$65,005	\$33,305	\$12,663	\$0.00
	2012	\$68,216			

**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:** This project is 95% complete. The Principle Investigator is working on data collection, processing and transmission, and validation of the laboratory tests.



## 2.8.6 – RS04(212) Evaluation of a Mitigation Site: Amphibian Population



**Contacts:**

Principal Investigator:	WYDOT Representative:
Erin Muths	Bob Bonds
U.S. Geological Survey	Environmental Coordinator
2150 Centre Ave. Bldg C	5300 Bishop Blvd
Fort Collins, CO 80526	Cheyenne WY 82002
970-226-9474	307-777-4364

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

### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$86,562	2012	\$74,949	\$18,737	\$7,124	\$0.00

**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:** The Principle Investigator hired and deployed a two-person field crew to Black Rock from May through July of 2015. Photos and data were collected, and are being analyzed. Data management and analysis will be completed during the fall of 2015 and the spring of 2016. Additional funding was secured through the University of Montana College of Forestry and Conservation , and OnXmaps.

**2.8.7 – 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 Professor  
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

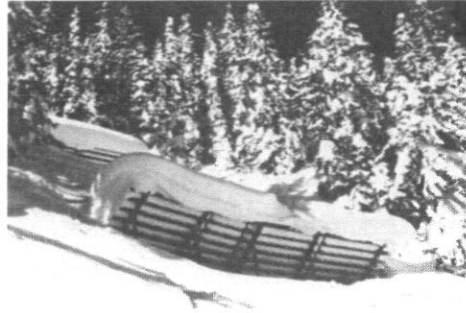
**Funding Summary:**

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$103,283	2012	\$89,426	\$22,357	\$8,500	\$0.00

**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:** The final report will be published by the end of September, 2015.

**2.8.8 – RS07(212) Jackson South Snow Supporting Structures Proposed  
Performance and Health Monitoring of WYDOT Project No. N104085, Teton  
County, Jackson, Wyoming**



**Contacts:**      Principal Investigator:                      WYDOT Representative:  
                         Joshua Hewes, Ph.D.                                      John Eddins, P.E.  
                         InterAlpine, Associates, LLC                              District 3 District Engineer  
                         83 El Camino Tesoros                                      307-352-3031  
                         Sedona, AZ 86336

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

**Funding Summary:**

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$104,566	2013	\$90,538	\$22,634	\$8,606	\$0.00

**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. The instrument array is now 100% complete and functioning as intended. The project is currently on schedule.



### 2.8.9 – RS08(212) 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:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$173,452	2012	\$68,732	\$37,545	\$14,275	\$0.00
	2013	\$81,450			

**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 other divisions. This should then leads to greater cost savings, greater safety benefits, and better public performance.

**Status:** The final report is being reviewed for grammar and formatting. The final report should be published at the end of October, 2015.

## 2.8.10 – 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, P.E.  
WYDOT District 3  
Rock Springs Wyoming  
307-352-3031

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

### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$152,617	2013	\$132,142	\$30,335	\$12,560	\$0.00
\$112,384	2015	\$97,307	\$24,327	\$9,250	\$0.00

**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:** WyGIS personnel have identified 47 potential datasets spanning 7 different wildlife species. The number of uploaded datasets has increased from 34 to 36. Work is continuing on the Beta version. The Atlas is a work in progress and the Principle Investigator is collaborating with lead cartographer Jim Meacham at the University of Oregon.

### 2.8.11 – 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:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$317,759	2013	\$119,905	\$68,782	\$26,152	\$50,010
	2014	\$80,000			
	2015	\$75,224			

**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 54% complete at this time. A paper "MEPDG Implementation in Wyoming Through Comprehensive Testing Programs and WYOMEP Database" was submitted to the Transportation Research Board and was accepted for presentation in 2015. Three theses were defended at the University of Wyoming in the spring of 2015. The back-calculation of in-place modulus based on the collected FWD data was completed using the MODCOMP software. All field data has been given to ARA for data analysis. A catalog of locally calibrated material properties has been prepared. The correlation between resilient modulus and R-value has been developed. ARA is preparing a report to summarize results from Phase II tasks 1 and 2.

## 2.8.12 – RS06(213) Wyoming Low Volume Roads Traffic Volume Estimation



**Contacts:**

Principal Investigator:	WYDOT Representative:
Dr. Khaled Ksaibati, P.E.	Martin Kidner
George Huntington, P.E.	State Planning Engineer
University of Wyoming	
Laramie Wyoming 82071	Mark Wingate
307-766-6230	Systems Planning Engineer
307-766-6783	5300 Bishop Blvd.
	Cheyenne WY 82009
	307-777-4411
	307-777-4180

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

### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$148,945	2013	\$43,324	\$32,241	\$12,258	\$0.00
	2013	\$85,638			

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

**Status:** This project is about 80% completed. Data has been gathered and cleaned.

### 2.8.13 – RS03(214) Assessment and Evaluations of I-80 Truck Loads and Their Load Effects



**Contacts:**      Principal Investigator:                      WYDOT Representative:  
Dr. Jay Puckett, P.E.                                      Keith Fulton, P.E.  
Brian Goodrich, P.E.                                      WYDOT Bridge  
302 S. 2<sup>nd</sup> Street, St. 201                                      5300 Bishop Blvd  
Laramie WY 82070                                      Cheyenne WY 82002  
307-721-5070                                      307-777-4427

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

#### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$206,931	2014	\$179,169	\$44,792	\$17,030	\$0.00

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

**Status:** WIM data was requested and 10 years of data was collected. Work began on the BRASS-GIRDER XML data files.



#### 2.8.14 – RS04(214) Developing Wyoming Specific Bridge Deterioration Models for Bridge Management



**Contacts:** Principal Investigator:  
Marc Maguire  
Utah State University  
4110 Old Main  
Logan UT  
435-797-1139

WYDOT Representative:  
Paul Cortez  
WYDOT Bridge  
5300 Bishop Blvd  
Cheyenne WY 82002  
307-777-4427

**Period of Study:** Proposal Approved: May 27, 2014  
Estimated Completion: May 30, 2016

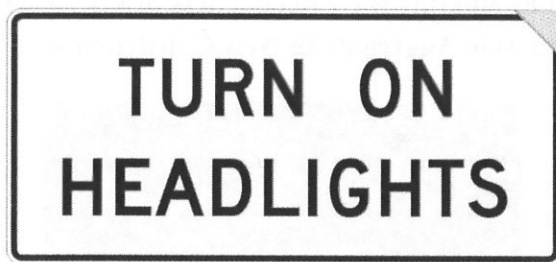
#### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$82,973	2014	\$71,842	\$17,960	\$6,829	

**Scope:** The purpose of this study is to develop deterministic Markov based deterioration models for WYDOT bridges.

**Status:** This project is in the early stages and no reports have been received.

## 2.8.15 – RS05(214) Safety Effectiveness of Regulatory Headlights Signs in Wyoming



**Contacts:**      Principal Investigator:      WYDOT Representative:  
Dr. Mohamed M. Ahmed      Matt Carlson  
Dr. Khaled Ksaibati, P.E.      WYDOT  
University of Wyoming      5300 Bishop Blvd  
Laramie Wyoming 82072      Cheyenne WY  
307-766-6230      307-777-4195

**Period of Study:** Proposal Approved: July 9, 2014  
Estimated Completion: June 30, 2019

### Funding Summary:

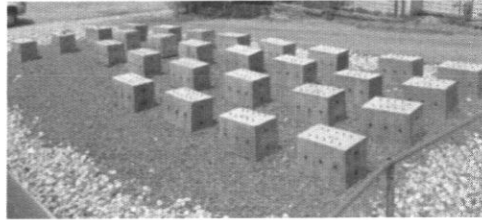
Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$95,592	2014	\$82,767	\$20,692	\$7,867	

**Scope:** U.W. shall perform a synthesis of existing research studies of the dynamic message signs (DMS) safety benefits; identify and rank hotspot locations of lane departure crashes, head-on and opposite sideswipe crashes on Wyoming roadways; evaluate the safety effectiveness of daytime running lights (DRL) using Wyoming crash data for DRL-equipped and non-DRL vehicles, and motorcycles; conduct a field study on current headlight signed hotspot locations to collect data about the compliance of DRL use and the newly 24-hour low beam lights in newer vehicles; develop a plan for state wide sign implementation; conduct a cost/benefit analysis; conduct a driving simulation experiment; field test the experiment; and finalize state wide implementation and cost/benefit analysis.

**Status:** Data have been collected to identify and rank hotspot locations of lane departure crashes, head-on and opposite sideswipe crashes on Wyoming roadways. The driving simulator has been delivered and is being used to gather additional data.



**2.8.16 – RS02(215) Evaluating the Effectiveness of Fly Ashes to Mitigate ASR and Using Recycled Concrete Aggregate in New Construction**



<b>Contacts:</b>	Principal Investigator:	WYDOT Representative:
	Jennifer Tanner	Chris Romo
	University of Wyoming	WYDOT
	Laramie Wyoming 82072	5300 Bishop Blvd
	307-766-2073	Cheyenne WY 307-777-4074

**Period of Study:** Proposal Approved: Nov. 19, 2014  
Estimated Completion: Sept. 30, 2018

**Funding Summary:**

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$65,975	2015	\$57,124	\$14,281	\$5,430	

**Scope:** U.W. shall conduct tests on fly ashes; evaluate moderately reactive, reactive and very highly reactive aggregates; conduct concrete prism testing; demolish blocks and make recycled concrete aggregate; and continue monitoring field specimens.

**Status:** The Principle Investigator has sieved and washed Brighton Aggregate and recycled concrete aggregates; shipped RCA to the University of Alabama, Pennsylvania State University, Georgia Tech, Oregon State University, Ryerson University, and the University of New Brunswick; C1260 measurements for round robin study have been completed; continued filed measurements; completed fireproofing a temperature controlled environmental chamber; crushed aggregate for C1293 prism tests; and began casting C1293.

**2.8.17 – RS03(215) Planning-Support for Mitigation of Wildlife-Vehicle Collisions and Highway Impacts on Migration Routes in Wyoming**



**Contacts:** Principal Investigator: WYDOT Representative:  
Corinna Riginos Thomas Hart  
Morgan Graham 5300 Bishop Blvd  
Holly Copeland Cheyenne WY 82009  
Teton Science Schools 307-777-4495  
Jackson Wyoming

**Period of Study:** Proposal Approved: Nov. 17, 2014  
Estimated Completion: Dec. 31, 2015

**Funding Summary:**

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$29,201	2015	\$25,283	\$6,321	\$2,403	

**Scope:** Principal Investigators shall define ways to provide transportation planners, conservation planners, and wildlife managers with statewide information that will help them evaluate the placement of current and future wildlife vehicle mitigation measures.

**Status:** This project is in the early stages and no reports have been received. The Principle Investigator has closed its research center, but the individual researchers have stayed on for the completion of this project.

#### 2.8.18 – RS04(215) SHRP II – Concept to Countermeasure – Research to Deployment Using the SHRP2 Safety Data



**Contacts:** Principal Investigator: WYDOT Representative:  
Mohamed M. Ahmed Tim McDowell  
Khaled Ksaibati 5300 Bishop Blvd  
University of Wyoming Cheyenne WY 82009  
307-777-4177

<b>Period of Study:</b>	Proposal Approved: January 1, 2015
	Estimated Completion: September 30, 2015

### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	SHRP II	Other Match Funds or Internal Funds
\$126,835	2015	\$0.00	\$26,835	\$100,000	

**Scope:** Principal Investigators shall examine the feasibility of using NDS data to improve the understanding of weather and visibility related to crashes.

**Status:** CTRE and RID data was received in March of 2015. The subaward with VTTI was approved in April of 2015. RID data was investigated; weather related crashes in Florida and Washington were extracted. Sample NDS data was received in June of 2015. Validation of data has begun.

### 2.8.19 – RS05(215) Developing Mitigation Strategies to Reduce Truck Crash Rates on Wyoming Highways



**Contacts:** Principal Investigator:  
Khaled Ksaibati  
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307-766-6230

WYDOT Representative:  
Matt Carlson  
5300 Bishop Blvd  
Cheyenne WY 82009  
307-777-4195

**Period of Study:** Proposal Approved: May 21, 2015  
Estimated Completion: June 30, 2017

#### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$89,181	2015	\$77,217	\$19,304	\$7,340	

**Scope:** Principal Investigators shall perform a comprehensive literature review; collect statewide crash data and perform analysis on three (3) zones; collect data on statewide citations issued by the Wyoming Highway Patrol (WHP) for motor carriers; review WHP policies and strategies for enforcement; compare relevant crash data and citations issued; develop GIS maps for crash locations and citation locations; meet with WHP representatives; review WHP resources; conduct a survey regarding funding contribution levels; and review Red Flag Violations and Crash Predictor Violations.

**Status:** This project is in the early stages and no reports have been received.



## 2.8.20 – RS06(215) Historic Winter Weather Assessment for Snow Fence Design Using a Numerical Weather Model



**Contacts:** Principal Investigator:  
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307-766-

WYDOT Representative:  
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Cheyenne WY 82009  
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**Period of Study:** Proposal Approved: September 11, 2015  
Estimated Completion: August 31, 2016

### Funding Summary:

Total Contract, Amendment, and Revisions	Fiscal Year	Federal	State Match	ICAP 8.23% 80/20 split	Other Match Funds or Internal Funds
\$19,178	2015	\$16,605	\$4,151	\$1,578	

**Scope:** Principal Investigators shall work with WYDOT to revise wind and winter precipitation tables for snow fence design using the WRF model; compare the existing wind and winter precipitation table, hereinafter referred to as the “Tabler Table” (©1997 Ronald D. Tabler. All rights reserved., and which became the property of WYDOT by written agreement dated February 14, 1994), with new data gathered by WYDOT and U.W. to gauge any significant changes in the data currently housed in the Tabler Table; assist WYDOT in setting up policies and practices which revolve around the Tabler Table regarding updates, archiving, implementation, and use of the wind and winter precipitation data.

**Status:** This project is in the early stages and no reports have been received.

### **Chapter 3. Completed/Closed Research Projects**

**Listings on the following pages are**

**Research Projects and Pooled Fund Projects**

**Completed within the last three years**

### 3.1 – Completed Research Projects

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

*RS09(210) Wyoming County Road Fund Manual – Update Research Funding Proposal – Phase 2 Completion: June 2011.*

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

*RS07(207) Performance of Reclaimed Asphalt Pavement On Unpaved 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*

*RS09(206) Evaluating the Risk of Alkali-Silica Reaction in Wyoming*

*RS03(310) Understanding Mule Deer Movement and Habitat use Patterns in Relation to Roadways in Northwest Wyoming*

*RS04(210) Rural Variable Speed Limit system: Phase II*

*RS06(210) Statewide Mesoscopic Traffic Simulation for Wyoming*



*RS05(211) Instrumentation and Analysis of Frost Heave Mitigation on WY-70*

*RS09(211) Developing a Roadway Safety Improvement Program for Indian Reservations*

*RS02(212) Managing Risks in the Project Pipeline: Minimizing the Impacts of Highway funding Uncertainties*

*RS05(212) Evaluating the Effects of Deer Delineators on Wildlife-Vehicle Collisions in Northwest Wyoming*

*RS05(213) A Literature Review of Approach Slab and Its Settlement for Roads and Bridges in Wyoming*

*RS02214 Developing an Effective Shoulder and Centerline Rumble Strips/Stripes Policy to Accommodate all Roadway Users*

### **3.2 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*

*TPF-5(002) Update to a Guide to Standardized Highway Lighting Pole Hardware*

*TPF-5(005) Study of Erection Issues and Composite System Behavior of the Full-Scale Curved Girder Bridge Currently Under Construction at the Turner-Fairbank Highway Research Center*

*TPF-5(192) Loop and Length Based Classification Pooled Fund*

*TPF-5(178) Implementation of the Simple Performance Tester for Superpave Validation*

*TPF-5(251) Relative Operational Performance of Geosynthetics used as Stabilization*



