

**WYOMING DEPARTMENT OF
TRANSPORTATION
2019 STATE PLANNING AND RESEARCH
WORK PROGRAM REPORT
First Quarter**

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INTRODUCTION

The Wyoming Department of Transportation 2019 State Planning and Research Work Program Report (Work Program) is prepared 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 document 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 cost 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. Further, *Subpart (c), of Title 23 of the Code of Federal Regulations, Section 420.209*, requires research programs certify that their program is in full compliance with the requirements set out in Subpart B, of Part 420.

Research performed by Principal Investigators during fiscal year 2017 is included in this report. The Work Program shall be updated as new projects are authorized during fiscal year 2018. For work to be included, it must go through the WYDOT proposal process and fall under the above statutory requirements. During the proposal process, the Research Advisory Committee (RAC) reviews each proposal to determine whether it offers a cost benefit to WYDOT, and whether the proposal is in line with the WYDOT mission statement and goals. The RAC convenes quarterly (October, January, April, and July), and at other times as deemed necessary.

After the RAC determines that a proposal meets the above criteria, it is forwarded to the WYDOT Executive Staff and FHWA, who make the final determination on whether the project should be funded using State Planning and Research Funds. No research project can be conducted without written approval from both the Executive Staff and FHWA.

Proposals for and descriptions of current/active research projects can be found on the WYDOT Research Center website. Final reports for all closed research projects from 2009 forward are also archived on the WYDOT Research Center website. Research reports for projects between the years of 1969 to 2009 can be obtained by contacting the Research Center.

Title 23 C.F.R. Sec 420.209

Certificate of Compliance

I, Keith R. Fulton, P.E., Assistant Chief Engineer for the 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.



Keith R. Fulton, P.E.

Assistant Chief Engineer for Engineering and Planning

Table of Contents

Chapter 1. 2019 Budget Summary	1
Chapter 2. 2019 Funding Breakdown	3
2.1 National Cooperative Highway Research Program (NCHRP) Contribution	3
2.2 Transportation Research Board Correlation Service (TRB) Contribution.....	4
2.3 Technology Transfer (T2) Center at The University of Wyoming.....	5
2.4 Local Technical Assistance Program (LTAP) at University of Wyoming	6
2.5 Administration of Research.....	7
2.6 - Pooled Fund Projects Funding Summary	8
2.6.1 – TPF-5(193) Midwest States Pooled Fund Crash Test Program.....	9
2.6.2 –TPF-5(253) Member Level Redundancy in Built-up Steel Members.....	10
2.6.3 – TPF-5(317) Evaluation of Low Cost Safety Improvements.....	11
2.6.4 – TPF-5(337) Avalanche Research Pool.....	12
2.6.5 SOL 1474. Comprehensive Field Load Test and Geotechnical Investigation Program for Development of LRFD Recommendations of Driven Piles on Intermediate Geomaterials .	13
2.7 - State Research Projects Funding Summary (Obligated)	14
2.7.1 – RS06216 Development of Load and Resistance Factor Design Procedures for Driven Piles on Soft Rocks in Wyoming.....	16
2.7.2 – RS08216 Updating and Implementing the Grade Severity Rating System (GSRS) for Wyoming Mountain Passes	17
2.7.3 – RS09216 Design and Performance Evaluation of a Semiflexible Snow Barrier for Avalanche Protection.....	18
2.7.4 – RS11216 Effectiveness of Nighttime Speed Limit Reduction in Reducing Wildlife Vehicle Collisions.....	19
2.7.5 – RS02217 Structural Health Monitoring of Highway Bridges Subjected to Overweight Vehicles, Phase II – Field Deployment.....	20
2.7.6 – RS03217 Development of an Ultra Accelerated Test to Evaluate ASR Potential in Concrete	21
2.7.7 – RS06217 Site Characterization and Site Specific Seismic Ground Motions Analysis for Transportation Infrastructure in Wyoming.....	22
2.7.8 – RS07217 Field Testing and Long-Term Monitoring of Selected High-Mast Lighting Towers..	23
2.7.9 – RS08217 Implementation of SHRP2 Results within the Wyoming Connected Vehicle Variable Speed Limit System – SHRP2 Implementation Assistance Program (Round 4).....	24
2.7.10 – RS09217 Crash Modification Factors for Wyoming- Specific Conditions: Application of the Highway Safety Manual – Part D. Phase 2	25
2.7.11– RS02218 Revegetation Success and Weed Resilience of Wyoming Right-of-Way.....	26

2.7.12 – RS3218 Developing a New Barrier Condition Index (BCI) to Optimize Barrier Improvements in Wyoming	27
2.7.13 – RS4218 Human Machine Interface (HMI) for Connected Vehicle: Requirements, Development and Assessment.....	28
2.7.14 – RS5218 MASH-16 3-10 Crash Test of a Box Beam Guardrail.....	29
2.7.15 – RS6218 Safety and Operational Analysis with Mitigation Strategies for Freeway Truck Traffic in Wyoming	30
2.7.16 – RS7218 Assessment and Evaluations of I-80 Truck Loads and Their Load Effects: Phase 2: Service.....	31
2.7.17 – RS8218 Investigating Potential Solutions to the Barrier Effect of Interstate 80 Pronghorn Movements	32

Chapter 1. 2019 Budget Summary

This chapter sets out the proposed budget for fiscal year (FY) 2019¹.

1. State Planning & Research (SP&R) Funds	\$6,284,084
REVENUE	
2. SP&R RES Funds	\$1,571,021
3. LTAP Special Allocation (Fund 438)	\$150,000
4. FY2018 unobligated funds	\$150,000
5. Total Revenues	\$1,871,021
EXPENSES	
6. NCHRP (est.)	\$327,162
7. TRB Correlation Service (est.)	\$85,000
8. Technology Transfer to U.W. Fund 438	\$150,000
9. LTAP Funds RS01218	\$25,000
10. Administrative Costs (est.)	\$138,959
11. Pooled Fund	\$150,000
12. State Research Projects (80% Federal)	\$0.00
13. ICAP funds (80% Federal) (est.)	\$90,000
14. Total Expenses	\$966,121
TOTAL FY2019 FEDERAL FUNDS AVAILABLE	\$904,900

LINE NUMBER EXPLANATIONS:

1. Total *estimated* 2019 SP&R funds.

REVENUE

2. Pursuant to [23 U.S.C. 505\(b\)\(1\)](#), not less than 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 percent Federal funds.
3. See Local Technical Assistance Program (LTAP) and Technology Transfer (T²) 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. The National Cooperative Highway Research Program (NCHRP) contribution is 5.5 percent of the SP&R RES Funds. This obligation is 100 percent Federal funds.
7. The TRB Correlation Service is a pooled fund and obligated annually using 100 percent Federal funds.

¹ The funds set out in this budget summary are a guesstimate of the funds that will be available in FY 2019.

8. The University of Wyoming Technology Transfer Center's funding is contracted for and obligated annually. See Technology Transfer (T²) Center summary for financial breakdown.
9. LTAP funding is contracted and obligated annually. See Local Technical Assistance Program (LTAP) for financial breakdown.
10. See Administrative Cost summary for financial breakdown.
11. See Transportation Pooled Fund Projects summary for financial breakdown.
12. State research projects use 80 percent Federal funds. See State Research Projects summary for financial breakdown.
13. Indirect Cost Allocation Plan (ICAP) funds (an additional 8.23 percent for projects begun prior to FY2017, and 11 percent for projects begun in FY2017 and forward) added on to each contract (80 Federal/20 state split).
14. Summation of lines 6 through 14.

TOTAL

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

Chapter 2. 2019 Funding Breakdown

2.1 National Cooperative Highway Research Program (NCHRP) Contribution

Identification: TPF-5(419)

Contacts: WYDOT Representative:
Tim McDowell, P.E.
307-777-4177
WYDOT Programming
5300 Bishop Blvd.
Cheyenne WY 82009

Funding: \$327,162

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), 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 NCHRP. Support is voluntary and funds are drawn from the state's Federal-Aid Highway apportionment of 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.

NCHRP is 100 percent federally funded, requiring no state match.

2.2 Transportation Research Board Correlation Service (TRB) Contribution
Also known as the Core Program Services for a Highway Research,
Development, and Technology Program, 2019.

Identification: TPF-5(xxx)

Contacts: WYDOT Representative:
Tim McDowell, P.E.
307-777-4177
WYDOT Programming
5300 Bishop Blvd.
Cheyenne WY 82009

Funding: \$85,000 (est.)

Scope: The Research Correlation Service of the Transportation Research Board 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, FHWA authorized the yearly payment of the TRB Correlation Service using the FHWA-administered pooled fund mechanism. Starting in FY1995, FHWA allowed the TRB correlation service charge to be paid with 100 percent Federal funding, requiring no state match.

2.3 Technology Transfer (T2) Center at The University of Wyoming

Identification: LTAP018
 LTAP019
 FUND 438

Contacts:	Principal Investigator:	Project Champion:
	Khaled Ksaibati, P.E., Ph.D	Tim McDowell, P.E.
	307-766-6230	307-777-4177
	University of Wyoming	WYDOT Programming
	Laramie WY 82071	5300 Bishop Blvd. Cheyenne WY 82009

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 Centers to transfer research findings and new technology to the local-level end-user. Technology Transfer Centers have been established in each state to provide information, advice, and training to local agencies, with Wyoming's Technology Transfer 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 (Wyo. Stat. §21-17-110(a)(i)); Wyoming counties (Wyo. Stat. §21-17-110(a)(ii)); Wyoming cities and towns (Wyo. Stat. §21-17-110(a)(iii)); and the University of Wyoming (Wyo. Stat. §21-17-110(a)(iv)), in an annual amount not 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.

2.4 Local Technical Assistance Program (LTAP) at University of Wyoming

Identification: RS01219

Contacts: Principal Investigator: Project Champion:
 Khaled Ksaibati, P.E., Ph.D Tim McDowell, P.E.
 307-766-6230 307-777-4177
 University of Wyoming WYDOT Programming
 Laramie WY 82071 5300 Bishop Blvd.
 Cheyenne WY 82009

Funding Summary:

<i>Code</i>	<i>Funds</i>	<i>State Portion</i>	<i>Federal Portion</i>	<i>Budgeted 2017</i>
RS01218	Federal State Match	\$7,500	\$30,000	\$30,000 \$7,500
Total		\$7,500	\$30,000	\$37,500

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

2.5 Administration of Research

Identification: RES2219

Contacts: WYDOT Representative:
Enid White, Research Manager
307-777-4182
WYDOT Research Center
5300 Bishop Blvd
Cheyenne WY 82009

Funding Summary: (Project RES2219, Activity RES0)

Title	State Portion	Federal Portion	Budgeted 2019
Research Proposal Development	\$1,000	\$4,000	\$5,000
Research Printing	\$100	\$400	\$500
Research Office Supplies	\$150	\$600	\$750
Vehicle Usage	\$100	\$400	\$500
Research Library Materials	\$200	\$800	\$1,000
RAC Administration	\$9,100	\$36,400	\$45,500
Research Presentation	\$1,000	\$4,000	\$5,000
Travel	\$1,100	\$4,400	\$5,500
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	\$65	\$260	\$325
TOTAL	\$27,792	\$111,167	\$138,959

2.6 - Pooled Fund Projects Funding Summary

	Obligated 1995-2014	Obligated 2015	Obligated 2016	Obligated 2017	Obligated 2018	Obligated 2019	Total Obligated
TPF-5(193) Midwest States Regional Pooled Fund Project	\$360,000				\$195,000		\$555,000
TPF-5(253) Member-Level Redundancy in Built-up Steel Members	\$75,000						\$75,000
TPF-5(317) Evaluation of Low Cost Safety Improvements					\$30,000		\$30,000
TPF-5(337) Avalanche Research Pooled Fund			\$75,000				\$75,000
SOL (1474) Comprehensive Field Load Test and Geotechnical Investigation Program						\$150,000	\$150,000

Notes: Pooled Fund research projects are generally 100 percent Federal funds.

2.6.1 – TPF-5(193) Midwest States Pooled Fund Crash Test Program

Contacts: Lead Agency Contact:
 Jodi Gibson
 Nebraska Department of Roads
 402-479-3687

Project Champions:
WYDOT Bridge
5300 Bishop Blvd
Cheyenne WY 82009
307-777-4427

Bill Wilson, P.E.
WYDOT Engineering Services
5300 Bishop Blvd.
Cheyenne WY 82009
307-777-4216

Period of Study: Start Date: July 1, 2012
 Estimated Completion: Unknown
 Cleared by FHWA

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>).

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

Contacts:	Lead Agency Contact: Indiana DOT Division of Research Tommy Nantung tnantung@indot.in.gov Phone: 765-463-1521 ext 248	Project Champion: WYDOT Bridge 5300 Bishop Blvd Cheyenne WY 82009 307-777-4427
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Period of Study: Proposal Approved: August 2011
Estimated Completion: May 2018

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, very little experimental data is available to quantify the remaining fatigue life or strength of a member when one of the components fails. 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 fracture critical (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 high performance steel (HPS) components fastened using high strength (HS) bolts in new construction will also be explored.

Status: During the past quarter, the major steps included: 1) gained additional support from AASHTO T-14 and FHWA to prepare ballot items related to specifications for evaluating internal redundancy in built up members; and 2) design and testing for the second axially loaded specimen. In the next quarter, the project will:

- a) Continue working on parametric studies associated with axial members.
- b) Test additional prototype axial test specimen.
- c) Prepare a new ballot for evaluating flexural members for consideration by AASHTO T-14 for the August mid-year meeting in Denver.

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

Contacts: FHWA: Project Champion:
Roya Amjadi Joel Meena
Roya.amjadi@fhwa.dot.gov 5300 Bishop Blvd
202-493-3383 Cheyenne WY 82009
307-777-4374

Period of Study: Proposal Approved: April 2015
Estimated Completion: Cleared by FHWA

Scope: 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: The 2017 Annual Technical Activity Committee (TAC) meeting was conducted successfully on June 14-15. The Phase X study started in June of 2017 for:

- a. Adaptive Signal Control Technologies.
- b. Bicycle Lanes, Added by Reducing Land and/or Shoulder Width.
- c. Variable Speed Limits.
- d. Roadside Fixed Objectives.

Numerous reports were published from this project.

2.6.4 – TPF-5(337) Avalanche Research Pool

Contacts: David Reeves
Colorado DOT
David Reeses@state.co.us
303-757-9518

Lead Contact:
Tory Thomas
WYDOT
Jackson WY

Period of Study: Proposal Approved: November 2015
Estimated Completion: Cleared by FHWA

Scope: The study's mission is to support collaborative research efforts in the field of avalanche hazard assessment and mitigation, with the goal of improving the safety, efficiency, and quality of control efforts, along with providing better information gathering and analysis techniques and seamless integration of new technologies to further these goals. The participation of many transportation related agencies in this study will also further cooperation in this industry, leading to improved future development of beneficial technologies and improved sharing of information and avalanche data, greatly furthering the safety, efficiency, and quality of the work done in this field for all relevant agencies.

Status: The first project conducted was assessing the Gazex Avalanche Control Effectiveness with Terrestrial Laser Scanning.

2.6.5 SOL 1474. Comprehensive Field Load Test and Geotechnical Investigation Program for Development of LRFD Recommendations of Driven Piles on Intermediate Geomaterials

Contacts: Kam Ng
Assistant Professor
University of Wyoming
303-766-4388

Lead Contact:
Todd Sullivan, P.G.
Engineering Geologist
WYDOT
Cheyenne WY

Period of Study: Proposal Approved: October 2017
Estimated Completion: 2023

Scope: The overall goal of the proposed research project is to develop LRFD recommendations for driven piles on IGM.

Status: The research project will have several direct benefits to state DOTs, deep foundations industries, and other relevant stakeholders. This project will be closed out if 100% of the funds are not secured by April, 2019.

2.7 - State Research Projects Funding Summary (Obligated)²

Project Number	Title	Contract Amount	Federal SP&R Obligation 2012-2016 (80% of contract amount and 80% of ICAP*)	State Match 2012-2016 (20% contract amount, plus 20% ICAP)	Federal SP&R Obligation 2017/18 (80% contract, plus 80% ICAP ** funding)	State Obligation 2017/18 (20% contract, plus 20% ICAP funding)	Total Funds (SP&R, ICAP and State Match)
RS06216	Development of Load and Resistance Factor Design Procedures for Driven Piles on Soft Rocks in Wyoming	\$160,372			\$138,857	\$34,714	\$173,571
RS08216	Updating and Implementing the Grade Severity Rating System (GSRs) for Wyoming Mountain Passes	\$157,004	\$135,940	\$33,985			\$169,925
RS09216	Design and Performance Evaluation of a SemiFlexible Snow Barrier for Avalanche Protection	\$138,781	\$120,162	\$30,041			\$150,203
RS11216	Effectiveness of Nighttime Speed Limit Reduction in Reducing Wildlife Vehicle Collisions	\$320,226			\$277,249	\$69,312	\$346,561
RS02217	Structural Health Monitoring of Highway Bridges Subjected to Overweight Vehicles, Phase II – Field Deployment	\$220,374			\$195,692	\$48,923	\$244,615
RS03217	Development of an Ultra-Accelerated test to Evaluate Alkali-Silica Reaction Potential in Concrete	\$142,880			\$126,878	\$31,719	\$158,597
RS06217	Site Characterization and Site Specific Seismic Ground Motions Analysis for Transportation Infrastructure in Wyoming	\$140,500			\$124,764	\$31,191	\$155,955
RS07217	Field Testing and Long Term Monitoring of Selected High-Mast Lighting Towers	\$177,779			\$157,868	\$39,467	\$197,335
RS08217	Implementation of SHRP 2 Results within the Wyoming Connected Vehicle Variable Speed Limit System. SHRP 2 Implementation Assistance Program (Round 4)	\$364,162			\$320,920	\$8,648	\$364,162
RS09217	Crash Modification Factors for Wyoming – Specific Conditions: Application of the Highway Safety Manual – Part D. Phase 2	\$155,943			\$138,478	\$34,619	\$173,097

² Unless stated otherwise, all projects receive 80% federal funding and 20% state funding.

Project Number	Title	Contract Amount	Federal SP&R Obligation 2012-2016 (80% of contract amount and 80% of ICAP*)	State Match 2012-2016 (20% contract amount, plus 20% ICAP)	Federal SP&R Obligation 2017/18 (80% contract, plus 80% ICAP ** funding)	State Obligation 2017/18 (20% contract, plus 20% ICAP funding)	Total Funds (SP&R, ICAP and State Match)
RS02218	Revegetation Success and Weed Resilience of Wyoming Right-of-Way	\$151,270			\$134,328	\$33,582	\$167,910
RS03218	Developing a New Barrier Condition Index (BCI) to Optimize Barrier Improvement in Wyoming	\$179,645			\$159,525	\$39,881	\$199,406
RS04218	Human Machine Interface (HMI) for Connected Vehicle: Requirements, Development and Assessment	\$228,820			\$203,192	\$50,798	\$253,990
RS05218	MASH-16 3-10 Crash Test of a Box Beam Guardrail.	\$60,139			\$53,403	\$13,351	\$66,754
RS06218	Safety and Operational Analysis with Mitigation Strategies for Freeway Truck Traffic in Wyoming	\$143,187			\$127,150	\$31,788	\$158,938
RS07218	Assessment and Evaluation of I-80 Truck Loads and their Load Effects: Phase 2	\$177,420			\$157,549	\$39,387	\$196,936
RS08218	Investigating Potential Solutions to the Barrier Effect on Interstate 80 on Pronghorn Movement	\$142,680			\$126,700	\$31,675	\$158,375

*ICAP Rate 8.23%

**ICAP Rate 11%

2.7.1 – RS06216 Development of Load and Resistance Factor Design Procedures for Driven Piles on Soft Rocks in Wyoming



Source: Google Images

Contacts:	Principal Investigators:	Project Champion:
	Kam Ng	Mark Falk
	University of Wyoming	5300 Bishop Blvd
	Laramie WY 82071	Cheyenne WY 82009
	307-766-4388	307-777-4205

Period of Study: Proposal Approved: January 2016
Estimated Completion: June 2020

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (8.23% above Total Contract Amount)	Other Funds	Total Funds (Total Contract, state match, and ICAP funds)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of contract amount and 80% of ICAP)	Total State Match (20% of contract amount and 20% of ICAP)
2016	\$160,372	\$13,199		\$173,571	\$138,857	\$34,714

Scope: The overall goal of the proposed research project is to develop locally calibrated LRFD procedures for driven piles of soft rocks in Wyoming. Recognizing the design and construction challenges of piles driven on soft rocks, the research project is proposed to accomplish the following: a) advance the knowledge of design and construction of piles driven on soft rocks; b) alleviate the aforementioned design and construction challenges; and c) advance the current state of practice pertaining to the design and construction of piles of soft rocks.

Status: The project is 46 percent completed. The research team will be establishing a criterion to differentiate soil, intermediate geomaterials (IGM) and hard rocks, determine the statistical parameters of static analysis methods for subsequent Load and Resistance Factor Design (LRFD) calibration, and perform regression analysis to establish models to improve pile resistance estimations.

2.7.2 – RS08216 Updating and Implementing the Grade Severity Rating System (GSRS) for Wyoming Mountain Passes



Source: Google Images

Contacts:	Principal Investigators:	Project Champion:
	Khaled Ksaibati	James Evensen
	Dick Apronti	Joel Meena
	University of Wyoming	Matt Carlson
	Laramie WY 82071	5300 Bishop Blvd
307-766-6230	Cheyenne WY 82009	

Period of Study: Proposal Approved: April 2016
 Estimated Completion: January 2019

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (8.23% above Total Contract Amount)	Other Funds	Total Funds (Total Contract, state match, and ICAP funds)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2016	\$157,004	\$12,921		\$169,925	\$135,940	\$33,985

Scope: The study is aimed at achieving two main goals. First, the FHWA’s GSRS model will be updated to reflect the current truck population characteristics. This will be achieved by carrying out field tests with an instrumented vehicle to update parameters in the model that reflect current truck characteristics and braking systems. The second objective of the study is to evaluate Wyoming mountain passes and their warning systems with regard to truck downgrade crashes. By doing this, the best means of communicating with truck drivers to reduce the probability of runaway truck incidences can be recommended.

Status: The project is 36 percent completed. Data has been collected; an evaluation of the existing Wyoming mountain pass warning system was conducted; and a review FHWA GSRS model was conducted.

2.7.3 – RS09216 Design and Performance Evaluation of a Semiflexible Snow Barrier for Avalanche Protection



Source: Josh Hewes

Contacts:	Principal Investigators:	Project Champion:
	Josh Hewes	Tory Thomas
	InterAlpine Engineers, LLC	WYDOT
	24 West Quartz Rd Flagstaff AZ 86005	Rock Springs, WY

Period of Study: Proposal Approved: April 2016
Estimated Completion: December 2019

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (8.23% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP funds)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2016	\$138,781	\$11,422		\$150,203	\$120,162	\$30,041

Scope: The objectives of this study are to provide the necessary background information that will describe the relative performance of snow supporting umbrellas (SSU) in their ability effectively to mitigate the risk of avalanche release from the starting zone. The work will also provide a framework for engineers that will help guide them through each step of the design process on future projects where SSU are utilized on a larger scale to minimize avalanche danger to motorists.

Status: The Principal Investigator has developed a standardized design procedure that will be adopted by engineers for design of SSUs. The design shall be installed in August and/or September of 2017.

2.7.4 – RS11216 Effectiveness of Nighttime Speed Limit Reduction in Reducing Wildlife Vehicle Collisions



Source: Google Images

<p>Contacts:</p>	<p>Principal Investigators: Corinna Riginos Northern Rockies Conservation Jackson WY</p> <p>Marcel Huijser Western Transportation Institute Bozeman MT</p>	<p>Project Champion: Keith Compton District 3, WYDOT Rock Springs WY 307-352-3031</p>
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Period of Study: Proposal Approved: July 2016
 Estimated Completion: January 2019

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (8.23% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2016	\$320,226	\$26,335		\$346,561	\$277,249	\$69,312

Scope: The overarching objective of this project is to provide transportation planners with scientifically defensible and robust information about whether reducing nighttime speed limits is an effective means of reducing vehicle collisions with wildlife.

Status: This project is 33 percent complete. Field data has been collected; Principal Investigator has coordinated with WYDOT to gather carcass record data; and analysis of the data has begun.

2.7.5 – RS02217 Structural Health Monitoring of Highway Bridges Subjected to Overweight Vehicles, Phase II – Field Deployment



Source: Google Images

<p>Contacts:</p>	<p>Principal Investigators: Johnn Judd, Ph.D., S.E. Michael Barker, Ph.D., P.E University of Wyoming 1000 East University Avenue Laramie WY 82071</p>	<p>Project Champion: Paul Cortez, P.E. WYDOT 5300 Bishop Blvd Cheyenne WY 82009</p>
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Period of Study: Proposal Approved: October 2016
 Estimated Completion: July 2019

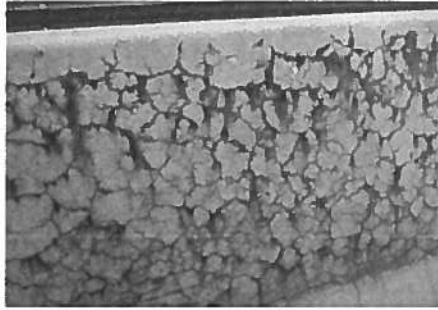
Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2017	\$220,374	\$24,241		\$244,615	\$195,692	\$48,923

Scope: The preliminary research in Phase I of this project demonstrated that the fiber Bragg grating (FBG) based sensor structural health monitoring (SHM) system is a viable concept with the potential of implementation and provided valuable data on bridge performance. In Phase II of the project, the FBG-based SHM system will be deployed and operated in the field.

Status: Field testing and deployment of an optical fiber sensor SHM system on the Bear River bridge on I-80, in Evanston will be conducted in late August, 2018. The SHM field system, data transmission, and triggering system have been developed.

2.7.6 – RS03217 Development of an Ultra Accelerated Test to Evaluate ASR Potential in Concrete



Source: Jennifer Tanner

Contacts: Principal Investigators:
Jennifer Tanner, Ph.D., P.E.
University of Wyoming
1000 East University Ave.
Laramie WY 82071

Project Champion:
Chris Romo, P.E.
Bob Rothwell, P.E.
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5300 Bishop Blvd.
Cheyenne WY 82009

Period of Study: Proposal Approved: October 2016
Estimated Completion: September 2020

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2017	\$142,880	\$15,717		\$158,597	\$126,878	\$31,719

Scope: A proposed test could potentially replace the year long concrete prism test with a weeklong test for evaluation of combinations of coarse and fine aggregates. The primary goal of this project is cost savings by producing durable concrete with an extended service life.

Status: No quarterly report has been received yet.

2.7.7 – RS06217 Site Characterization and Site Specific Seismic Ground Motions Analysis for Transportation Infrastructure in Wyoming



Source: Google Images

<p>Contacts:</p>	<p>Principal Investigators: Shawn Griffiths, Ph.D. University of Wyoming 1000 East University Ave. Laramie WY 82071</p>	<p>Project Champion: Jeff Booher, P.E. Kirk Hood, P.G. WYDOT 5300 Bishop Blvd. Cheyenne WY 82009</p>
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Period of Study: Proposal Approved: March 2017
Estimated Completion: July 2019

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2017	\$140,500	\$15,455	\$	\$155,955	\$124,764	\$31,191

Scope: Establish the procedures, steps, and training required for WYDOT personnel to perform site-specific ground motion analyses.

Status: Task 1 to develop a target response spectrum and find ground motions was completed in September of 2017. The data is being analyzed with the results from the surface wave data expected in by mid-2018.

2.7.8 – RS07217 Field Testing and Long-Term Monitoring of Selected High-Mast Lighting Towers



Source: Google Images

<p>Contacts:</p>	<p>Principal Investigators: Robert Connor Jason Lloyd Purdue University S-Brite Center 1040 South River Road West Lafayette, IN</p>	<p>Project Champion: Paul Cortez, P.E. WYDOT 5300 Bishop Blvd. Cheyenne WY 82009</p>
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Period of Study: Proposal Approved: March 2017
 Estimated Completion: March 2019

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2017	\$177,779	\$19,556		\$197,335	\$157,868	\$39,467

Scope: Determine the cause of fatigue damage in several high mast lighting towers.

Status: Data is being collected on this project. Monitoring systems have performed well, and the research team continues to monitor the system performance and review the data for indications of high amplitude vibrations.

2.7.9 – RS08217 Implementation of SHRP2 Results within the Wyoming Connected Vehicle Variable Speed Limit System – SHRP2 Implementation Assistance Program (Round 4)



Source: Google Images

<p>Contacts:</p>	<p>Principal Investigators: Mohamed Ahmed, Ph.D., P.E. Rhonda Young, Ph.D., P.E. University of Wyoming Laramie WY</p>	<p>Project Champion: Vince Garcia, P.E. Tim McDowell, P.E. WYDOT 5300 Bishop Blvd. Cheyenne WY 82009</p>
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Period of Study: Proposal Approved: June 2017
 Estimated Completion: August 2019

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Total Funds (SP&R Funds, state match, and SHRP2 Funding)	Breakdown of the Total Funds		
				SHRP2	SP&R Funds	State Match
2017	\$364,162	\$0.00	\$364,162	\$320,920	\$34,354	\$8,648

Scope: The primary objective of the second phase is to model driver’s responses to various adverse weather and road conditions.

Status: Four papers have been published from this project. Visibility identification using deep learning has been completed. Driver lane changing behavior was investigated.

**2.7.10 – RS09217 Crash Modification Factors for Wyoming- Specific Conditions:
Application of the Highway Safety Manual – Part D. Phase 2**



CRASH MODIFICATION FACTORS IN PRACTICE

Source: Google Images

<p>Contacts:</p>	<p>Principal Investigators: Mohamed Ahmed, Ph.D., P.E. University of Wyoming Laramie WY</p>	<p>Project Champion: Matt Carlson, P.E. WYDOT 5300 Bishop Blvd. Cheyenne WY 82009</p>
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Period of Study: Proposal Approved: June 2017
Estimated Completion: December 2019

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2017	\$155,943	\$17,154		\$173,097	\$138,478	\$34,619

Scope: This phase is to continue the validation of the applicability and transferability of the HSM to Wyoming-specific conditions.

Status: Work is progressing on this project.

2.7.11– RS02218 Revegetation Success and Weed Resilience of Wyoming Right-of-Way



Source: Google Images

<p>Contacts:</p>	<p>Principal Investigators: Kristina Hufford University of Wyoming Laramie WY</p>	<p>Project Champion: R. Scott Gamo WYDOT 5300 Bishop Blvd. Cheyenne WY 82009</p>
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Period of Study: Proposal Approved: October 2017
 Estimated Completion: November 2020

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2018	\$151,270	\$16,640		\$167,910	\$134,328	\$33,582

Scope: The objectives of this proposal are to evaluate different reclamation seed mixes over the years to determine the rate of reseeding success and better define combinations of species and site variables that contribute to successful revegetation outcomes. The proposal will also compare sites and seed mixes for resilience to invasion by high impact species, such as cheatgrass. Data will contribute to recommendations to maximize seeding success and minimize weeds, and will assist future evaluations of other vegetation factors, such as minimizing traffic/wildlife conflicts.

Status: A graduate student has begun assessing sites for WYDOT planting records and field data collections in the summer of 2018. In March 2018, a meeting occurred to discuss roadside revegetation records and steps to take to determine appropriate sites for field sampling.

2.7.12 – RS3218 Developing a New Barrier Condition Index (BCI) to Optimize Barrier Improvements in Wyoming



Source: Google Images

<p>Contacts:</p>	<p>Principal Investigators Khaled Ksaibati Amirarsalan Molan, University of Wyoming 1000 East University Avenue Laramie WY 82071</p>	<p>Project Champion Martin Kidner WYDOT 5300 Bishop Blvd. Cheyenne WY 82009</p>
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Period of Study: Proposal Approved: January 23, 2018
Estimated Completion: May 2020

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2018	\$179,645	\$19,761		\$199,406	\$159,525	\$39,881

Scope: This study is set up to evaluate the conditions of barrier systems in Wyoming. Improvement recommendations will be provided and optimized for each barrier system (segment) to upgrade the performance of the barriers in a cost effective way.

Status: Data collection on this project has begun and the literature review is almost complete. A comprehensive database for non-interstate roads is 60 percent complete.

2.7.13 – RS4218 Human Machine Interface (HMI) for Connected Vehicle: Requirements, Development and Assessment



Source: Mohamed Ahmed

Contacts:	Principal Investigators	Project Champion
	Mohamed Ahmed	Vince Garcia
	University of Wyoming	WYDOT
	1000 East University Avenue	5300 Bishop Blvd
	Laramie WY 82071	Cheyenne WY 82001

Period of Study: Proposal Approved: January 23, 2018
 Estimated Completion: March 2020

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2018	\$228,820	\$25,170		\$253,990	\$203,192	\$50,798

Scope: Develop a HMI that is effective in delivering critical information while minimizing distraction risks that might be posed by the system.

Status: A kickoff meeting was held in March of 2018.

2.7.14 – RS5218 MASH-16 3-10 Crash Test of a Box Beam Guardrail



Source: Google Images

Contacts:	Principal Investigators	Project Champion
	Matt Robinson	Bill Wilson
	Texas A&M Transportation Institute	WYDOT
	Bryan TX	5300 Bishop Blvd
		Cheyenne WY 82009

Period of Study: Proposal Approved: January 23, 2018
 Estimated Completion: March 2020

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2018	\$60,139	\$6,615		\$66,754	\$53,403	\$13,351

Scope: Contract with TTI to conduct a full scale, 62 mph crash test with the MASH small car. If ITT determines that the test meets all MASH criteria, they will prepare a justification to FHWA for an eligibility letter.

Status: The Principal Investigator has begun gathering the information that is needed to begin this project.

2.7.15 – RS6218 Safety and Operational Analysis with Mitigation Strategies for Freeway Truck Traffic in Wyoming



Source: Google Images

Contacts:	Principal Investigators	Project Champion
	Khaled Ksaibati	Matt Carlson
	Milan Zlatkovic	WYDOT
	University of Wyoming	5600 Bishop Blvd
	1000 East University Avenue	Cheyenne WY 82009
	Laramie WY 82071	

Period of Study: Proposal Approved: January 23, 2018
 Estimated Completion: March 2020

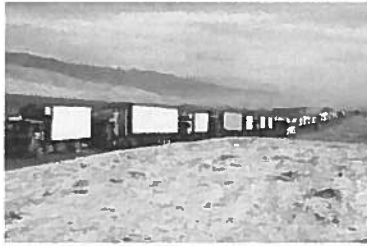
Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2018	\$143,187	\$15,751		\$158,938	\$127,150	\$31,788

Scope: The project will consist of safety analysis with CMF development, operational analysis, and recommendation of mitigation strategies along (I-80 in Wyoming. The project will attempt to determine the measures of effectiveness for freeway truck traffic. The Principal Investigator shall develop a toolkit that will include user-friendly tools for CMF and shockwave analysis, and customizable VISSIM models.

Status: This project is in the early stages and no quarterly report has been received.

**2.7.16 – RS7218 Assessment and Evaluations of I-80 Truck Loads and Their Load Effects:
Phase 2: Service**



Source: Google Images

<p>Contacts: Principal Investigators Jay Puckett Brian Goodrich BridgeTech, Inc. 302 S. 2nd Street Suite 201 Laramie WY 82070</p>	<p>Project Champion Jeffrey Booher Paul Cortez WYDOT 5300 Bishop Blvd. Cheyenne WY 82009</p>
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Period of Study: Proposal Approved: January 23, 2018
Estimated Completion: March 2020

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2018	\$177,420	\$19,516		\$196,936	\$157,549	\$39,387

Scope: The purpose of this study is to determine reliability indices and live load factors for archetype bridges for actual in-service loads.

Status: Additional parametric structure configurations have been developed. The process of obtaining the force effects from an analysis was automated. Work began on the reliability indices task.

2.7.17 – RS8218 Investigating Potential Solutions to the Barrier Effect of Interstate 80 Pronghorn Movements



Source: Google Images

<p>Contacts:</p> <p>Principal Investigators Bill Rudd Matt Kauffman Hall Sawyer Wyoming Cooperative Fish and Wildlife Research Unit University of Wyoming 1000 East University Avenue Laramie WY 82071</p>	<p>Project Champion Keith Compton R. Scott Gamo Thomas Hart WYDOT 5300 Bishop Blvd Cheyenne WY 82009</p>
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Period of Study: Proposal Approved: January 23, 2018
 Estimated Completion: December 2020

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds	Total Funds (Total Contract Amount, state match, and ICAP Funding)	Breakdown of the Total Funds	
					Total Federal SP&R (80% of total contract amount)	Total State Match (20% of total contract amount)
2018	\$142,680	\$15,695		\$158,375	\$126,700	\$31,675

Scope: The purpose of this study is to collect movement data and develop predictive models for pronghorn to aid WYDOT and agency partners in reducing wildlife vehicle collisions and conserving ungulate migrations along the I-80 corridor.

Status: This project is in the early stages and no quarterly report has been received.

