



**WYOMING DEPARTMENT OF
TRANSPORTATION
2020 STATE PLANNING AND RESEARCH
WORK PROGRAM REPORT**

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Research Manager
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Cheyenne WY 82009**

INTRODUCTION

The Wyoming Department of Transportation 2020 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 that 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 2020 is included in this report. The Work Program shall be updated as new projects are authorized during fiscal year 2020. 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.

A handwritten signature in blue ink that reads "Keith R. Fulton". The signature is written in a cursive style and is positioned above a horizontal line.

Keith R. Fulton, P.E.

Assistant Chief Engineer for Engineering and Planning

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Chapter 1. 2020 Budget Summary

This chapter sets out the proposed budget for fiscal year (FY) 2020¹.

1. State Planning & Research (SP&R) Funds	\$6,284,084
REVENUE	
2. SP&R RES Funds	\$1,368,972
3. LTAP Special Allocation (Fund 438)	\$150,000
4. FY2019 unobligated funds	\$98,536
5. Total Revenues	\$1,617,588
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 Funds	\$0.00
12. State Research Projects (80% Federal)	\$0.00
13. ICAP funds (80% Federal) (est.)	\$90,000
14. Total Expenses	\$816,121
TOTAL FY2019 FEDERAL FUNDS AVAILABLE	\$801,387

LINE NUMBER EXPLANATIONS:

1. Total *estimated* 2020 SP&R funds.

REVENUE

2. Pursuant to [23 U.S.C. 505\(b\)\(1\)](#), not less than 25 percent of the state planning and research (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 2020.

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. 2020 Funding Breakdown

2.1 National Cooperative Highway Research Program (NCHRP) Contribution

Identification: TPF-5(420)

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

Funding: \$327,162 (est)

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, 2020.

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: LTAP019
 LTAP020
 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: RS01220

Contacts:	Principal Investigator: Khaled Ksaibati, P.E., Ph.D 307-766-6230 University of Wyoming Laramie WY 82071	Project Champion: Tim McDowell, P.E. 307-777-4177 WYDOT Programming 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>
RS01220	Federal		\$30,000	\$30,000
	State Match	\$7,500		\$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: RES2220

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

Funding Summary: (Project RES2220, Activity RES0)

Title	State Portion	Federal Portion	Budgeted 2020
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 1995-2015	Obligated 2016	Obligated 2017	Obligated 2018	Obligated 2019	Obligated 2020	Total Obligated
TPF-5(193) Midwest States Regional Pooled Fund Project	\$360,000			\$195,000			\$555,000
TPF-5(317) Evaluation of Low Cost Safety Improvements				\$30,000			\$30,000
TPF-5(337) Avalanche Research Pooled Fund		\$75,000			\$75,000		\$75,000
TPF-5(391) RS05219 Comprehensive Field Load Test and Geotechnical Investigation Program					\$150,000		\$150,000
TPF-5(393) RS04219 Pooled Fund for the Design, Development and Testing of a Box Beam Approach Guardrail Transition and an MSG Approach Guardrail Transition to a MASH TL-4 Three Steel Tube Bridge Rail					\$195,576		\$195,576

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. At this time there are 19 states tied to this pooled fund.

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(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: In 2019, a feasibility analysis for safety evaluation of the bike Lane configurations at intersections was conducted. The Phase XI study is set up to include a safety evaluation of mini-roundabouts; safety evaluation of bike lane configurations at intersections; safety evaluation of wrong way driving (WWD) low cost safety improvements; and conducting a one-day workshop for effective WWD countermeasures.

Numerous reports were published from this project.

2.6.3 – 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.

2.6.4 TPF-5(391). RS05219 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. The project is in the early stages and several meetings have been held with all the contributing states. Bridges are being selected in the various states.

2.6.5 TPF-5(393) RS04219 Pooled Fund for the Design, Development and Testing of a Box Beam Approach Guardrail Transition and an MSG Approach Guardrail Transition to a MASH TL-4 Three Steel Tube Bridge Rail

Contacts: Roger Bligh
Texas A&M
College Station TX
979-845-4377

Lead Contact:
William Wilson,
Standards Engineer
WYDOT
Cheyenne WY

Period of Study: Proposal Approved: December 2018
Estimated Completion: December 2020

Scope: Wyoming Department of Transportation (WYDOT) formulated a strategy for meeting the MASH compliance timeline and implementing standards and policies that offer to improve roadside safety in Wyoming. While many of WYDOT's roadside safety devices are considered MASH compliant, some barrier systems have yet to be updated to MASH. The compliance date for transitions, which is the roadside safety hardware category that is the focus of the proposed project, is December 31, 2019. This research is needed to provide crashworthy transitions systems for connection of common barrier types that are MASH compliant.

Status: The research project is in the early stages and a report will be provided in the next quarter.

2.7 - State Research Projects Funding Summary (Obligated)²

Project Number	Title	Contract Amount	Federal SP&R Obligation 2012-2019 (80% contract, plus 80% ICAP ** funding)	State Obligation 2019 (20% contract, plus 20% ICAP funding)	Federal SP&R Obligation 2020 (80% contract, plus 80% ICAP ** funding)	State Obligation 2020 (20% contract, plus 20% ICAP funding)	Total Funds (SP&R, ICAP and State Match)
RS09216	Design and Performance Evaluation of a SemiFlexible Snow Barrier for Avalanche Protection	\$138,781	\$120,162	\$30,041			\$150,203
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
RS03217 Amendment	Development of an Ultra-Accelerated test to Evaluate Alkali-Silica Reaction Potential in Concrete	\$70,509	\$78,265	\$62,612			\$15,653
RS07217	Field Testing and Long Term Monitoring of Selected High-Mast Lighting Towers	\$177,779	\$157,868	\$39,467			\$197,335
RS07217 Amendment	Field Testing and Long Term Monitoring of Selected High-Mast Lighting Towers	\$32,186	\$35,726	\$28,581			\$7,145
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 \$34,594	\$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
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

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

Project Number	Title	Contract Amount	Federal SP&R Obligation 2012-2019 (80% contract, plus 80% ICAP ** funding)	State Obligation 2012-2019 (20% contract, plus 20% ICAP funding)	Federal SP&R Obligation 2020 (80% contract, plus 80% ICAP ** funding)	State Obligation 2020 (20% contract, plus 20% ICAP funding)	Total Funds (SP&R, ICAP and State Match)
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
RS02219	Developing a Prototype System for Establishing Passing and No-Passing Zones of Two-Lane Highway	\$171,899	\$152,646	\$38,161			\$190,808
RS03219	Connected-Autonomous Traffic Signal Control Algorithms for Trucks and Fleet Vehicles	\$148,866	\$132,193	\$33,048			\$165,241
RS06218	Safety and Operational Analysis with Mitigation Strategies for Freeway Truck Traffic in Wyoming	\$143,184	\$127,147	\$31,787			\$158,934
RS07219	Characterization of Blowover Risk in the Wyoming Highway System	\$131,334	\$118,047	\$29,512			\$141,559

*ICAP Rate 8.23%

**ICAP Rate 11%

2.7.1 – 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: This project is near completion and a draft report will be submitted in October. The Principal Investigator is gathering final data during the summer months of 2019.

2.7.2 – 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: The final report is in draft format and the 508 compliance requirements are being checked.

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



Source: Jennifer Tanner

<p>Contacts:</p>	<p>Principal Investigators: Jennifer Tanner, Ph.D., P.E. University of Wyoming 1000 East University Ave. Laramie WY 82071</p>	<p>Project Champion: Chris Romo, P.E. Bob Rothwell, P.E. Greg Milburn, P.E. WYDOT 5300 Bishop Blvd. Cheyenne WY 82009</p>
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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: The project is moving forward. The Principal Investigator is preparing the aggregates for casting, completing the trial casting on Jobe aggregate to confirm quality control, preparing the outfitting structures lab to improve speed of processing aggregates, and continuing to monitor the maintenance on the autoclave.

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



Source: Google Images

Contacts:	Principal Investigators:	Project Champion:
	Robert Connor	Paul Cortez, P.E.
	Jason Lloyd	WYDOT
	Purdue University S-Brite Center	5300 Bishop Blvd.
	1040 South River Road	Cheyenne WY 82009
	West Lafayette, IN	

Period of Study: Proposal Approved: March 2017
 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)
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. Data is being archived, which will help WYDOT determine if the system is working correctly. The contract was amended in order to allow the contractor to amend the scope of the work so that the Principal Investigators could continue monitoring the HMLTs.

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



Source: Google Images

Contacts:	Principal Investigators:	Project Champion:
	Mohamed Ahmed, Ph.D., P.E.	Vince Garcia, P.E.
	Rhonda Young, Ph.D., P.E.	Tim McDowell, P.E.
	University of Wyoming	WYDOT
	Laramie WY	5300 Bishop Blvd.
		Cheyenne WY 82009

Period of Study: Proposal Approved: June 2017
 Estimated Completion: January 2020

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. A survey questionnaire was developed and reviewed with 85 questions covering different aspects of the VSL system from planning to implementation, and to set out lessons learned. This contract was amended to allow Principal Investigator additional time to review new data obtained.

2.7.6 – 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.

2.7.7 – 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. Several papers have been prepared from the research for this project. New analysis will be conducted to study safety performance on traffic barriers on horizontal curves.

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



Source: Mohamed Ahmed

Contacts:	Principal Investigators	Project Champion
	Mohamed Ahmed University of Wyoming 1000 East University Avenue Laramie WY 82071	Vince Garcia WYDOT 5300 Bishop Blvd 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 comprehensive literature review has been conducted. A stakeholder questionnaire survey was conducted. The IRB application was provided to the UW board for approval to conduct research involving human subjects. The application was approved. Six sensors were developed for commercial truck drivers to test the effectiveness of the different applications of the CV. Assessment of the HMI for commercial truck drivers was conducted Preliminary recommendations were made to WYDOT

2.7.9 – 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 final report is being reviewed by the Principal Investigator for 508 compliance.

2.7.10 – 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: Seventy-five percent of the work has been completed. The main literature review was completed and all the main data for the study was collected.

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



Source: Google Images

<p>Contacts:</p> <p>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: The Principal Investigator has continued on reanalyzing each of the seven different one- and two-span structures (14 total) for the corrected 5000 WIM trucks in either single truck, 10-foot headway, 50-foot headway, or variable-headway configurations using BRASS™ Route and BRASS-GIRDER™. The emergency trucks (EV2 and EV3) were added to the list of design vehicles. Work has continued on planning on how reliability indices would be calculated. Work began on a preliminary statistical library module that calculates the reliability index (beta) for a particular set of nominal values. Work began on revising BRASS-GIRDER™ to obtain nominal actions, stresses, and resistances for use in the Monte Carlo simulation engine.

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



Source: Google Images

Contacts:	Principal Investigators	Project Champion
	Bill Rudd	Keith Compton
	Matt Kauffman	R. Scott Gamo
	Hall Sawyer	Thomas Hart
	Wyoming Cooperative Fish and Wildlife Research Unit	WYDOT
	University of Wyoming	5300 Bishop Blvd
Laramie WY 82071	Cheyenne WY 82009	

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 Trail cameras continue to monitor potential wildlife use of underpasses at a variety of crossing structures. Pictures are being analyzed to determine wildlife usage and frequency in the crossings. GPS radio-collars continue to collect movement data on pronghorn. All movement data will be analyzed to assess the effect of I-80 on movements and will be used to model potential crossing points that pronghorn might be expected to use if they were migrating across the interstate.

2.7.13 – RS2219 Developing a Prototype System for Establishing Passing and No-Passing Zones of Two Lane Highways



Source: What is Meant by a “Two-Lane” Road (2018).

Contacts:	Principal Investigators	Project Champion
	Ahmed Farid, Ph.D.	Jeffery Mellor, P.E.
	Khaled Ksaibati, Ph.D., P.E.	Ryan Shields, P.E.
	Suresh Muknahallipatna, Ph.D.	WYDOT
	Victor Bershinsky, P.E.	5300 Bishop Ave
	University of Wyoming	Cheyenne, WY
	Laramie, WY	

Period of Study: Proposal Approved: October 31, 2018
 Estimated Completion: December 2021

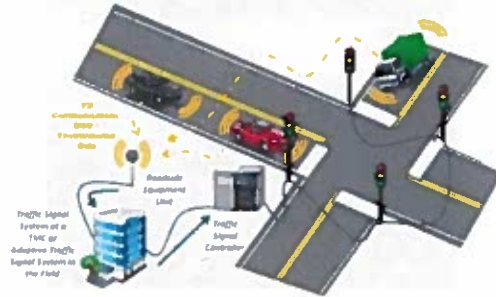
Funding Summary:

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)
2019	\$171,899	\$18,909		\$190,808	\$152,646	\$38,161

Scope: The purpose of this study is to develop a quick and functional prototype of the two-vehicle method for measuring the PSD on Wyoming’s two-lane highway.

Status: The Principal Investigator has purchased the core equipment of Prototype 1 from LEAR Corporation. No software license was required since all software codes developed for the project are open-source. The apparatus of Prototype 1 is in the process of development. Also, the field test locations were identified via an experimental design. Furthermore, Prototype 2’s equipment will be purchased once Prototype 1 is fully developed and tested.

2.7.14 – RS3219 Connected-Autonomous Traffic Signal Control Algorithms for Trucks and Fleet Trucks



Source: USDOT.

Contacts:	Principal Investigators	Project Champion
	Milan Zlatkovic, Ph.D.	Christina Spindler.
	Mohamed Ahmed, Ph.D., P.E.	WYDOT
	University of Wyoming	5300 Bishop Ave
	Laramie WY	Cheyenne, WY

Period of Study: Proposal Approved: October 31, 2018
 Estimated Completion: December 2020

Funding Summary:

Fiscal Year	Total Contract, Amendment and/or revision Amount	ICAP (11% above Total Contract Amount)	Other Funds MPC (\$60,000 and WYDOT state funds (\$42,000))	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)
2019	\$148,866	\$16,375	\$102,000	\$190,808	\$132,193	\$33,048

Scope: The purpose of this study is to create field ready, CAV-based traffic control programs that will improve operations and safety of trucks and fleet vehicles.

Status: The research team has reviewed major related literature to help advance the project. The team has obtained main traffic and signal data for the test-case locations. A complete VISSIM simulation model for the intersection of Curtis and McCue streets in Laramie has been developed and calibrated.

2.7.15 - RS7219 Characterization of Blowover Risk in the Wyoming Highway System



Source: Google Images.

Contacts:	Principal Investigators	Project Champion
	Noriaki Ohara, P.E.Ph.D.	Kathy Ahlenius.
	Rhonda Young	Clifford Spoonemore
	University of Wyoming Laramie WY	5300 Bishop Ave Cheyenne, WY

Period of Study: Proposal Approved: January 31, 2019
 Estimated Completion: April 2021

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)
2019	119,762	13,174		132,936	106,349	26,587

Scope: The purpose of this study is to assist WYDOT to better understand how wind, vehicle speed, load weights, and road geometry factor into rollover crashes, and to improve operations practices related to weather responsive road management.

Status: The project is in the early stages and the literature review and data filtering efforts have just begun.

