RESEARCH DEVELOPMENT, AND TECHNOLOGY TRANSFER AND DATA ARCHIVING GUIDELINES FOR THE WYOMING DEPARTMENT OF TRANSPORTATION RESEARCH CENTER

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Prepared by:

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RESEARCH CENTER

In cooperation with:

THE U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

The Research Development and Technology Guidelines for the Wyoming Department of Transportation Research Center (Guidelines) outline the research and development management process for reports and other research documents pursuant to subpart B of the *Planning and Research Program Administration* codified federal rules, *Research, Development and Technology Transfer Programs*[1]*;* the duties and responsibilities of the Research Advisory Committee (RAC), the Research Manager, and the Research Center (Research Center); the data management and metadata policies; and other conditions for the Research Center per federal and state rules, regulations and statutes. The Guidelines emphasize the research and development program interaction process; the research organizational structures for WYDOT and its federal partners; the program development process; the report writing process; the program evaluation and technology transfer process; and the data management process for digital materials and data. By following these Guidelines, WYDOT staff and stakeholders will be able to produce positive and meaningful results for research projects.

Authority for the administration of the Research Center and these Guidelines can be found in the following areas: a) *Fixing American's Surface Transportation Act (FAST Act)*[2], which authorizes federal surface transportation programs through fiscal year 2020; b) *Moving Ahead for Progress in the 21st Century Act (MAP-21)*[3], which allows for apportionment of Highway Trust Funds for research and education, as well as other matters*;* c) Chapter 5 of Title 23 of the United States Code, *Research, Technology, and Education*[4], which provides for activities leading to technology development and transfer by local departments of transportation and for input by stakeholders; d) Section 450 of Title 23 of the Code of Federal Regulations, *Planning Assistance and Standards, Statewide Transportation Planning*[5], which guides statewide transportation planning and programming; and d) Section 420 of Title 23 of the Code of Federal Regulations,

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[1] *23 C.F.R. 420, SubPart B (2002)*
[2] *http://uscode.house.gov/browse/prelim@title23&edition=prelim*
[3] *Public Law 112-141 – July 6, 2012 – 126 Stat. 405; 23 U.S.C.§ 505(a)*
[4] *23 U.S.C. §501 et seq.*
[5] *http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title23/23cfr450_main_02.tpl*

Planning and Research Program Administration[6], which grants WYDOT the authority to administer state planning and research funds.

Funding for the research projects and the Research Center, and requirements for the administration of those funds, can be found in *FAST Act*, and the Planning and Research Program Administration Federal Rules which require that two percent of "the sums apportioned to a State for fiscal year 1998 and each fiscal year thereafter … shall be available for expenditures by the State …" for various surveys, investigations projects, planning, development, implementation, studies, research, technology transfer activities, and training. The *FACT Act* further requires "not less than 25 percent of [the 2 percent]… be expended by the State for research, development, and technology transfer activities…"[7] and that the Federal share for state planning and research (SP&R) shall be 80 percent.[8]

Other responsibilities for the Research Center are set out in *Research, Technology, and Education*[9], which states:

> Surface transportation research and technology development shall include all activities leading to technology development and transfer, as well as introduction of new and innovative ideas, practices, and approaches, through such mechanisms as field applications education and training, and technical support.

Further, in keeping with the Federal digital data management plan guidelines and requirements which include: the Office of Management and Budget (OMB) Memorandum, dated May 9, 2013, entitled *Open Data Policy – Management Information as an Asset*[10]; the Office of Science and Technology Policy (OSTP) Memorandum, dated February 22, 2013, entitled *Increasing Access to the Results of Federally Funded Scientific Research*[11]; and the Deputy Secretary of Transportation memorandum, dated April 10, 2012, entitled *Implementation of Departmental Scientific Policy*[12]; *Plan to Increase Public Access to the Results of Federally-Funded Scientific Research Results*[13], and Wyo. Stat. §9-21-101, *Data Policies*, the Wyoming Department of Transportation (WYDOT) Research Center is incorporating a digital Data Management Plan (DMP) Section into these guidelines. The DMP section covers data creation, collection, documentation, analysis, preservation, security, and dissemination will be reliably and readily managed. The DMP section will set out transparent, evolving, and extensive policies and management structures that will assist the Research Center and WYDOT in maintaining public

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[6] *http://www.ecfr.gov/cgi-bin/retrieveECFR?n=pt23.1.420*
[7] *23 U.S.C. 505(b)(1).*
[8] *23 U.S.C. 505(d).*
[9] *23 U.S.C. §502(a)(1)*
[10] *https://www.whitehouse.gov/sites/default/files/omb/memoranda/2013/m-13-13.pdf*
[11] *https://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf*
[12] *http://www.rita.dot.gov/rdt/memo/scientific_integrity_policy.html*
[13] *https://www.transportation.gov/sites/dot.gov/files/docs/Official%20DOT%20Public%20Access%20Plan%20ver%201.1.pdf*

digital research data that are generated from research projects funded by state planning and research (SP&R) funds.

The DMP Section is also set out to assist Principle Investigators, Project Champions, and the Research Center in implementing a plan to archive, store and maintain data once either the project is finalized or the embargo period has expired. The DMP Section will be an ever-changing live document. With the assistance of the Research Advisory Committee (RAC), determinations will be made on the best practices and policies for a) archiving, sharing, and retention of data; b) securing intellectual property; c) sharing measures; and d) preservation and formatting practices. These discussions will ensure that data that are generated from the WYDOT research projects are open and available to the public.

In all, the Guidelines will provide the Research Manager, Principle Investigators, Project Champions, and the RAC with a better understanding of what is expected at all stages of the research project.

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SECTION 1: ADMINISTRATION

CHAPTER 1: PURPOSE, MISSION STATEMENT, GOALS, AND GUIDELINE CONTEXT

1.1 Purpose

The purpose of the Research Development and Technology Guidelines for the Wyoming Department of Transportation Research Center (Guidelines) is to provide a management process for the administration of the WYDOT Research Center (Research Center) and to ensure all research reports conform to the Communication Reference Guide (updated April 12, 2012)[14] (Reference Guide) and the U.S. Governmental Printing Office Style Manual (GPO Manual)[15]. The Guidelines are drafted to increase the effectiveness of research reports received by WYDOT, to identify the various administrative responsibilities of the Research Center, and to provide procedural instructions for research projects. The programs, projects, and products generated by the Research Center using these Guidelines are for the benefit of WYDOT, its employees, the citizens of Wyoming, and other transportation agencies and users.

The Guidelines further set out the regulations regarding digital data, data management, data storage, data archiving, metadata requirements, and open and public data sharing policies. The Research Center uses these guidelines to ensure that data, which are considered a state asset, are managed properly though their life cycle, improve data collection capabilities, and make data available to the public, when possible.

The categories of research performed by contractors for the Research Center fall into two areas: basic research, which involves the study of phenomena whose specific application has not been identified; and applied research, which involves the study of phenomena relating to a specific, known need in connection with the functional characteristics of a system.

1.2 WYDOT Mission, Goals, and Balanced Score Card

To ensure the effectiveness of the Research Center and the research management process, all research activities are aligned with the WYDOT Mission and Goals.[16]

The WYDOT mission is to provide a safe, high quality, and efficient transportation system. The WYDOT goals are as follows:

1. Improve safety on the state transportation system through education, engineering, enforcement, and other innovative methods.
2. Serve our customers by gathering feedback to anticipate and meet their needs.
3. Take care of all physical aspects of the state transportation system.

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[14] *http://www.fhwa.dot.gov/publications/research/general/03074/index.cfm*

[15] *https://www.gpo.gov/fdsys/pkg/GPO-STYLEMANUAL-2008/pdf/GPO-STYLEMANUAL-2008.pdf*

[16] *Wyoming Department of Transportation Strategic Plan 2012-2015, p. 4.*

4. Improve agency efficiency and effectiveness by identifying opportunities to improve processes and reduce redundancy.
5. Develop and care for our people.
6. Exercise good stewardship of our resources by:
    a. Wisely caring for the resources with which we have been entrusted.
    b. Using Asset Management and Long-Range Planning to support a pavement preservation strategy with MAP-21 requirements.
    c. Ensuring Department grants are fully expended in accordance with requirements.
    d. Ensuring all projects stay on or under budget.
    e. Better communicating the stewardship and accomplishments of the Department.

The Balance Score Card (BSC) for the Planning Department, of which the Research Center is a subunit, sets out that:

1. The Planning Department shall improve program efficiency and effectiveness as follows:
    a. Percentage of projects closed within three years of executed agreement date.
    b. Close out projects in a timely manner.
    c. **Seek new ways to ensure information is available to the public**.
    d. **Improve data collection efficiency and effectiveness**.
    e. Utilize the latest technologies and best practices.
    f. Improve communication to eliminate redundancy.
2. Develop and utilize a system wide approach to transportation planning.
3. Uphold present and future commitments.
    a. Clarify, interpret, and disseminate regulations and laws.
4. Performance based planning and programming.
5. Value our employees.
6. Customer outreach.
    a. Improve accessibility of data through Oracle platforms.
    b. Facilitate customer understanding by creating a visual representation of planning data.

1.3 Basic & Operating Policies for the Research Center

The Research Center's policies and procedures are detailed in WYDOT's Basic & Operating Policies manual at Policy Number 4-1 and all subparts thereto. Policy 4-1 sets out policies for the following areas:

- Purpose
- Research Advisory Committee
- Research Administration

- Research Procedures
- Research Results
- Product Evaluation

1.4 WYDOT Research Center

The core mission of the Research Center is to provide high quality research that aligns with the mission, values, and overall goals for WYDOT. The Research Center uses WYDOT's overall goals to meet strategic performance measures; balance scorecard measures; chosen program goals and objectives; and the needs of the state of Wyoming.

1.5 Wyoming Enterprise Technology Services (ETS)

Wyoming ETS assists in the core computing and communication needs of the state of Wyoming. Electronic records and transactions fall under the domain of ETS. Pursuant to Chapter 5, Sec. 3(a), *Electronic Transactions Electronic Records*, of the ETS current rules, agencies shall adopt procedures to protect the "reliability, authenticity, integrity, and usability of records." Section 3(b) goes on to state that:

> To accept, create, and store an electronic record, **a State agency must ensure the integrity of the information from the time it is first received and accepted, throughout the life cycle of the record**. The criteria for assessing integrity shall be whether the information has remained complete and unaltered…

Section 4, *Retention of Electronic Records*, of Chapter 5 of the current ETS Rules states:

> State agencies shall comply with all statutes and rules related to public records.
>
> a) For public records created and/or stored exclusively in electronic format, a State agency shall:
>
> i. **Maintain records so they are accessible, accurate, authentic, reliable, legible, and readable throughout the life cycle**.
> ii. Prescribe a procedure for converting information transmitted electronically to paper for persons requiring paper copies.

ETS's internal policies set out the following requirements for data.

> ETS 8100-P166 – Data Protection for Electronic Government Services
>
> **Agencies shall make available upon request, information about how data is protected, restricted, and used in e-Government transactions**. A link or other access to the State of Wyoming Privacy Policy would satisfy this requirement.

1.6 Data Policies, W.S. §9-21-101 (2016)

Every agency shall adopt, enforce, and maintain a policy regarding the collection, access, security, and use of data. The policies should include:

i. An inventory and description of all data required of, collected, or stored by an agency;
ii. Authorization and authentication mechanisms for accessing the data;
iii. Administrative, physical, and logical security safeguards, including employee training and data encryption;
iv. Privacy and security compliance standards;
v. Processes for identification of and response to data security incidents, including breach notification ad mitigation procedures; and
vi. In accordance with existing law, processes for the destruction and communication of data.

1.7 Wyoming Public Records Act

The Wyoming Public Records Act (W.S. §16-4-201 through 205), defines what constitutes a public record and details the responsibility for protection and disposition of those records.

1.8 Overview of the Manual

The Guidelines are set out in three sections and nine Appendices.

Section 1 Administration

Chapter 1	Purpose, Mission Statement, Goals, and Guideline Context
Chapter 2	Stakeholders
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Chapter 4	Annual Work Program Cycle and Requirement
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Chapter 8	Research Project Development Flow Chart
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CHAPTER 2: STAKEHOLDERS

Pursuant to Chapter 5, *Research Technology, and Education* of Title 23, United States Code[17]:

> Federal surface transportation research and development activities shall address the needs of stakeholders. Stakeholders include States, metropolitan planning organizations, local governments, tribal governments, the private sector, researchers, research sponsors, and other affected parties, including public interest groups.

The success of a research program is influenced by the Research Center staff's ability to develop strong and lasting interactive relationships with all participants and stakeholders. In fact, the goals of WYDOT and the Research Center cannot be met without involvement and interaction with stakeholders, which include: WYDOT employees; university and college level staff and professors; other Wyoming state agencies; companies affiliated with transportation matters, such as vendors and contractors; private engineering firms; other State Departments of Transportation; local governments in Wyoming and other states; FHWA; AASHTO; and the general public.

The Research Center hosts a Research Advisory Committee (RAC) meeting each quarter that is open to the public. This is a way for WYDOT and stakeholders to interact, and for stakeholders to learn more about which projects have been finalized, the progress on projects, and new and upcoming projects. The RAC's October meeting is held at the University of Wyoming, College of Civil, and Architectural Engineering.

The Research Center is involved with, and in support of, the activities performed by the Wyoming Technology Transfer (T^2) Center, located at the University of Wyoming. [18] The Local Technical Assistance Program (LTAP), within the T^2 Center, transfers research findings and new technology to Wyoming agencies and individuals by providing information on new and developing technology, responding to direct requests, providing reference materials, and conducting T^2/LTAP workshops. The T^2/LTAP Center is sponsored by FHWA, WYDOT, and Wyoming cities/municipalities and counties. Fifty percent of the funding for the T^2/LTAP Center comes from the FHWA Technical Transfer Program. WYDOT, Wyoming cities/municipalities and counties, and the University of Wyoming provide the necessary matching funds.[19] The T^2/LTAP Center may also submit proposals for SP&R funded research.

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[17] *https://www.gpo.gov/fdsys/pkg/USCODE-2010-title23/pdf/USCODE-2010-title23-chap5-sec502.pdf*
[18] *http://wwweng.uwyo.edu/wyt2/*
[19] *Wyo. Stat. §21-7-115*

CHAPTER 3: RESEARCH CENTER LIBRARY

A vast amount of research information is housed in the WYDOT Research Center Library (Library) and is available for loan to stakeholders and the public. This information is coded, catalogued, and entered into the Research Center's electronic intranet database by title, author, abstract, etc. The Research Center Manager also has access to federal and state databases, which house research reports, synthesis, digests, and other research materials. The Library is housed in the Planning office on the WYDOT Complex. Further, stakeholders and WYDOT employees may search the web for transportation related publications.

3.1 In-House Library

Materials found in the in-house library include federal and state publications, manuals, circulars, and other reference material. The Research Center staff can assist stakeholders in accessing any publication housed in the Library and on the web. The Research Manager will provide electronic and/or hard copies of publications, and/or conduct research upon request. (See Library Research Request Form, Appendix 9).

3.2 Electronic Library

3.2.1 Internet

For publications found on the web, there are many different databases available. Under the publication link on the Transportation Research Board website, cooperative research program series, TRB series, periodicals, annual reports, and other documents can be accessed. http://www.trb.org/Publications/Publications.aspx.

The resources link for the Federal Highway Administration web page has publications, laws, policies, and a link to the resource library. http://www.fhwa.dot.gov/.

The Research and Innovative Technology Administration (RITA) website houses state and federal research publications, data and statistics, and links viewers to various federal and state websites. http://www.rita.dot.gov/.

The USDOT Research Hub allows access to FMCSA, FAA, MARAD, FHWA, FRA, FTA, PHMSA, OST, and NHTSA, plus numerous other research sites.
http://ntlsearch.bts.gov/researchhub/index.do

3.2.2 WYDOT Library Database

An e-library, which contains abstracts from the research materials, can be accessed by WYDOT employees, in the WYDOT intranet at:
http://employees.dot.state.wy.us/ResearchLibrary/Home.jsp.

CHAPTER 4: ANNUAL WORK PROGRAM CYCLE AND REQUIREMENTS

In accordance with the requirements set forth in *Title 23 of the Code of Federal Regulations, Parts 420.207(a)(b), and 420.209(a)(b)*, the Research Center will prepare a research and development (R&D) annual work program report (Work Program) which will cover each study conducted in a fiscal year. Information on the study remains in the Work Program until either the study's final report has been accepted, or the study has been terminated. The Work Program is based on WYDOT's fiscal year, which begins on October 1 and ends on September 30 of the following year. Work Program is presented in four parts: a) the yearly budget summary; b) the FHWA Pooled Fund Projects Summary; c) the State Research Projects Summary, demonstration projects, federal aid experimental evaluation studies, and other special studies; and d) a listing of research projects completed within the last three years. The Work Program includes the following for each current research project:

- State study number.
- Study type.
- Study title.
- Budget estimate for the program year.
- Estimated cost for prior years of continuing studies.
- Principal investigator's name.
- Project Champion's information.
- Period of study.
- Scope.
- Present status.
- Funding levels and share (Federal, State, and other sources) for RD&T activities for the program year.

A yearly budget summary included in the Work Program, contains the following:

- Revenues for the current year.
- Funds carried over from previous years.
- Current revenue expenditures for prior years' projects, if any.
- TRB and NCHRP funding obligations, and any other program funds.
- Technology Transfer Center (T^2 Center) funding for the University of Wyoming.
- Administrative costs.
- Total remaining Federal funding available for research studies.

Finally, a certification letter attesting that the State of Wyoming is in compliance with all requirements set forth in *Title 23 of the Code of Federal Regulation §420.209(c)*, and contemplate no changes which would alter that compliance must be sent to the Federal Highway Administration yearly with the Work Program.

CHAPTER 5: AVAILABLE FUNDS FOR RESEARCH PROJECTS

The following are categories and various types of funding available or paid out by the Research Center to finance research activities to meet mandatory federal requirements.

5.1 SP&R – Federal[20]

Highway Trust Fund tax monies made available to the State of Wyoming under *Title 23 of the United States Code*, and *the Planning and Research Program Administration* Federal Rules[21] (Rules), with appropriate state matching funds established by federal law, and are currently the main source of funding for the Research Center. The Rules allocate two percent of the total annual transportation disbursement to each state for State Planning and Research (SP&R) activities[22]. The law further stipulates a minimum of 25 percent of the SP&R funds be reserved for state transportation research, development, and technology transfer efforts[23].

5.2 State Funds

Projects that are considered limited scope studies or local interest studies, or in case where there is a shortage of federal funds, are financed with state funds and not submitted to the RAC. These projects are undertaken independent of the research, development, and technology program, and are not required to follow the strict guidelines that projects that receive SP&R funds follow. This does not mean that districts or other divisions in WYDOT cannot use this document as a guide. It is recommended, however, that each branch or district notify the State Programming Engineer of the project for recordkeeping purposes.

State funds can also be used as matching funds for any federally funded projects

5.3 National Cooperative Highway Research Program (NCHRP)

The Research Center participates in the National Cooperative Highway Research Program and provides five and one-half percent of its SP&R funds yearly to NCHRP, which equates to approximately $282,000. Studies performed with NCHRP funding do not require a state match, and are usually high cost projects that have national implications. Solicitation for NCHRP projects begin in July of each year with FHWA and NCHRP evaluating all proposals. NCHRP also uses evaluation panels to assess the problem statements submitted in some of the more popular subject areas. Full details on the NCHRP solicitation process can be found at http://www.trb.org/NCHRP/NCHRPOverview.aspx. To obtain a copy of *Information*

[20] *23 U.S.C. §505; 23 C.F.R. 420 et seq.*
[21] *23 C.F.R. 420.103(a)(1)*
[22] *23 C.F.R. §420.103(1)*
[23] *23 U.S.C. 505(b)(1)*

and Instructions for Preparing Proposals for the Transportation Research Boards' Cooperative Research Programs, go to *http://onlinepubs.trb.org/onlinepubs/crp/docs/ProposalPrep.pdf*. Further, the *Procedural Manual for Contractors Conducting Research in the Transportation Research Board's Cooperative Research Program* can be found at http://onlinepubs.trb.org/onlinepubs/crp/docs/CRPProceduralManual.pdf.

5.4 Pooled Fund Projects[24]

The Transportation Pooled Fund (TPF) Program serves as a means for interested states, FHWA, and other organizations to collaborate when significant or widespread interest is shown in solving transportation related problems. Partners may use pool fund studies and other resources to solve these problems through research, planning, and technology transfer activities. To qualify as a pooled fund study, more than one state transportation agency, federal agency, or other agency, such as a municipality of metropolitan planning organization, college/university, or a private company, must find the subject important enough to commit funds or other resources to conduct the research, planning, and technology transfer activity. Federal and state transportation agencies may initiate pooled fund studies. Local and regional transportation agencies, private industry, foundations, and colleges/universities may collaborate with any or all of the sponsoring agencies to conduct pooled fund projects. Pooled funds are calculated at an 80/20 split just like SP&R projects, unless the pooled fund is set up for just federal funds or if the lead state requests a waiver for the state match requirement.

Generally, FHWA, TRB, NCHRP, or a state will act as the contracting agency for the pooled fund study. An advisory committee composed of representatives of each participating state and agency will be established to provide overall project direction and permit consideration of the cooperating states' views. This procedure is followed for national pooled fund projects.

5.5 Collaborative Research and Development

Collaborative Research and Development is a cost sharing process that includes states and local governments, foreign governments, colleges and universities, corporations, institutions, partnerships, sole proprietorships, and trade associations.[25] The federal share for these projects shall not exceed 50 percent. For the non-federal share, all costs directly incurred, including personnel, travel and hardware development costs, are included.

[24] *http://www.pooledfund.org/*
[25] *23 U.S.C. 502 §(c)*

5.6 Apportionment[26]

Title 23 of the United States Code Section 104 *et seq.* sets out the apportionment rules of all federal funding streams.

5.7 Future Strategic Highway Research Program Funds[27]

All programs established with these funds are based on National Research Council Special Report 260, entitled *Strategic Highway Research: Saving Lives, Reducing Congestion, Improving Quality of Life* and the results which are identified in the National Cooperative Research Program Project 20-58.[(28)] The purpose of this program is to promote research results and products developed under the future strategic highway research program administered by TRB. Funding may come from SHRP 2 implementation or a percentage of a state's SP&R funds. Eligible activities are based on the report submitted to Congress by the TRB on the strategies and administrative structure to be used for implementation of F-SHRP results. The federal share shall be 80 percent.

[26] *23 U.S.C. 104*
[27] *23 U.S.C. §503(a)(6)*
[28] *23 U.S.C. 510*

CHAPTER 6: NATIONAL AND REGIONAL FHWA POOLED FUND PROGRAMS AND OTHER NATIONAL RESEARCH PROJECTS

6.1 POOLED FUNDS

6.1.1 National Pooled Fund Program

FHWA sponsors the National Pooled Fund Program, and when a new project becomes available, a letter describing the proposed pooled fund projects is distributed to each state research center. The Research Center solicits opinions and comments from technical staff within the agency regarding the relevancy of the pooled fund project. Notices of pooled fund studies shall be sent out to RAC members as they are received by the Research Manager. If the RAC determines that it would be in the best interest of WYDOT to participant, the RAC determines the amount of financial support the project will receive and for what fiscal year the money will be obligated. The FHWA Regional Research Engineer is responsible for executing the funding transfer documentation. As a subscriber, the state may have a representative on the project panel that meets to determine the scope of work for the project, to evaluate proposals, if the research is performed by contract, and to review the final report of the effort. The total amount of annual pooled fund financial support is a line item in the SP&R budget.

6.1.2 Regional Pooled Fund Program

FHWA sponsors a Regional Pooled Fund Program that is more of a bottom-up than top-down Program. A group of states may determine there is a problem of mutual interest to them and join together to investigate the matter. The state DOT that champions the idea performs the initial and ongoing administrative duties. Each regional pooled fund effort varies in its financial protocol, which is based on the requirements of the lead state.

Although federal-aid funding of pooled fund efforts is at the traditional 80 percent level, if the project is determined to be of national interest, the FHWA Associate Administrator for Research and Technology may determine that the project is a 100 percent federal-aid funded project. Most regional projects are funded at the 100 percent level. As with national efforts, reimbursable travel funding may be included in the study funds.

6.2 NCHRP

State DOTs are the sole source of funding for NCHRP. The process for funding and proposing projects at the NCHRP level follows the following process. In July, AASHTO Standing Committee on Research (SCOR) solicits problems from a) AASHTO member transportation departments; b) the chairs of AASHTO committees and subcommittees; and c) the Federal Highway Administrator. Problem statements are accepted in September of each year. FHWA and NCHRP evaluate the problem statements. Evaluations are sent back to the Principle Investigators in November, and the Principle Investigator has until the end of December to decide whether he/she wishes to move forward or not. A report on the new problem statements

is sent to the SCOR and the AASHTO RAC with a ballet for rating the statements according to priority. The ratings are returned to the SCOR secretary and are translated into priority rankings based on the average ratings of SCOR and AASHTO RAC. A summary of this report is sent to the SCOR for review prior to its meeting in Washington DC. SCOR makes the final determination on which completed or ongoing projects should receive additional funding for further work, and which new problem statements should be funded. Announcements are sent out in April.

SECTION 2: OPERATING POLICIES

Chapter 7 State Planning & Research (SP&R) Administration Process Research, Development and Technology Interaction

CHAPTER 7: STATE PLANNING & RESEARCH (SP&R) ADMINISTRATION PROCESS RESEARCH, DEVELOPMENT AND TECHNOLOGY INTERACTION

The Research Center operates in accordance with the requirements found in the *FACT Act*, the Wyoming Statutes, Wyoming and Federal rules and regulations, and the Wyoming Department of Transportation Basic and Operating Policies. This Chapter outlines the requirements for managing the Research Center and the duties of the RAC, the Programming Engineer, and the Research Manager, as they pertain to the Research Center.

7.1 Wyoming Department of Transportation Research Center

The core mission of the Research Center is *to provide high quality research that aligns with the mission, values, and overall goals for WYDOT*. The Research Center uses WYDOT's overall goals to meet strategic performance measures; balanced scorecard measures; chosen program goals and objectives; and the needs of the state of Wyoming.

The administration of the Research Center is the responsibility of the Research Manager, under the direction of the State Programming Engineer, who is also the State Research and Development Engineer. The State Programming Engineer and the Research Manager monitor all SP&R research projects to ensure the projects are within the proposed budget and timeline, as set out in the contract. Changes in scope of work, key personnel, disengagement from a project for more than three months, transfers of funds in budget line items, and requests for additional funding, are tracked by the Project Champion and Research Manager, and brought to the attention of the Programming Engineer and/or the RAC, as necessary. Depending on the type of change, the RAC may either be informed of a change during the quarterly meeting, if the change is informational in nature, or the RAC may be contacted about the change via e-mail, if immediate action by the RAC is required. If the Principle Investigator or contractor is found to be non-compliant with the terms of the contract, the State Programming Engineer and the Research Manager investigate the non-compliance, and if it is found that the Principle Investigator or contractor cannot or will not become compliant, the State Programming Engineer and the Research Manager will work with the Wyoming Attorney General's office to determine if the contract can or should be terminated, and whether a new Principle Investigator should be considered.

The State Programming Engineer and the Research Manager maintain contact with other programs within WYDOT, with outside institutions, and with federal partners to ensure the most up to date federal and state rules and regulations are followed, and to determine the best research projects to bring to the RAC. They also provide advice and general guidance during formal project studies, and serve as an important conduit for the transfer of research results to stakeholders.

The Research Center houses the Research Library. Publications are catalogued and placed in the internal Research Library database, and finalized research projects and proposals outlining

current research projects are placed on the WYDOT website[29]. The Research Manager assists WYDOT employees in obtaining research material. It should be noted that the Research Center will not always be able to assist with fees for publications, but he/she may be able to find the publication at a lower price or in PDF format. The Research Manager also assists individuals in obtaining information from the Wyoming State Library and the University of Wyoming libraries.

7.1 Research Advisory Committee (RAC)

The RAC reviews, evaluates, and prioritizes all research development and technology transfer proposals and problem statements. The RAC convenes quarterly (October, January, April, and July),[30] and at other times as deemed necessary. In order to meet or to vote on proposals, a majority quorum (fifty-one percent, or four members of the sitting RAC) must be present, either in person, via video conference, or via phone. A call for proposals will occur at least 45 days prior to a scheduled quarterly meeting, and is sent out to the RAC as whole and other interested parties. During the quarterly meetings, the RAC shall review proposals for their merits; review the progress of current research projects to ensure they are timely and within budget; and review all innovative research projects for possible implementation.

Proposals shall be presented to the RAC as follows:

- The Project Champion or other interested party shall inform the Research Manager of a possible research proposal and/or question.
- The Research Manager shall place a proposal on the RAC agenda.
- Electronic copies of the proposal shall be forwarded by the Research Manager to the RAC members, the executive staff, and to the FHWA representative.
- The Project Champion and the Principal Investigator, or his/her designee, shall be present at the RAC meeting, either in person or via video conference.
- The Project Champion, Principal Investigator and/or his/her designee shall have 15 minutes to provide the RAC with an overview of the proposal.
- The RAC shall have 15 minutes to ask questions of the Project Champion, Principal Investigator and/or his/her designee.
- Voting on the project will occur at the end of the RAC meeting. Only sitting RAC members are allowed to vote on proposals.
- To determine the merits of the proposal, the RAC shall use of the proposal checklist for RAC (See Appendix 5). It should be noted that the template is an example only, and the checklist will be tailored to fit each proposal.

Further, to determine whether a project has sufficient merit to warrant further study, the RAC determines:

- Whether the proposed problem is adequately understood and defined.

[29] *https://www.dot.state.wy.us/home/planning_projects/research-center.default.html*
[30] *WYDOT, Operating Policy 4-1(II.C)*

- Whether the proposal is important and beneficial to the Wyoming stakeholders and WYDOT.
- Whether the proposal will have a positive long-term affect on WYDOT and the stakeholders, in other words, will the proposal provide a continuing, cooperative, and comprehensive impact that can be measured by WYDOT.
- Whether the proposal falls under at least one of the measures found in the Balanced Scorecard and meets at least one of the WYDOT goals.
- Whether the proposal sets out planned payoffs which the Project Champion intends to produce from the outputs and the long term results.

The sitting RAC is composed of permanent, non-voting members and rotating voting positions.[31]

- Permanent positions include the Research and Development Engineer (State Programming Engineer); State Research Manager; and a representative from FHWA representative.
- The State Research Manager is a non-voting member of the RAC. This individual acts as the chairperson of the RAC.
- The Development Engineer (State Programming Engineer) is a non-voting member of the RAC. This individual acts as the chairperson of the RAC in the absence of the Research Manager.
- The FHWA representative is a non-voting member of the RAC. This individual is invited to attend the meetings by virtue of his/her office or position. He/She acts as liaison between WYDOT and FHWA.
- Rotating positions include:
    - State Bridge Engineer.
    - Geographic Information System/Intelligent Transportation System Program Manager.
    - State Field Operations Engineer.
    - State Highway Development Engineer.
    - State Highway Safety Engineer.
    - State Materials Engineer.
    - State Planning Engineer.
    - State Traffic Engineer.
    - Chief Engineering Geologist.
    - Lands Management Administrator.
    - District Engineers.
    - District Maintenance Engineers.

Because the RAC membership is in addition to a member's normal workload, the Research Center rotates membership through senior staff position. Two district staff engineers and five program managers serve on the RAC each year. Membership on the RAC is by position and not

[31] *WYDOT Policy Number 4-1(II)(B)*

by person. In the event a position is vacant, the new person hired for that position assumes the RAC duties for the remainder of that rotational period.

The rotation process for the RAC is as follows:

- District Engineers: District Engineers will rotate sequentially for one-year appointments according to district number, beginning with District 1.
- District Maintenance Engineers: District Maintenance Engineers will rotate sequentially for one-year appointments according to district number, beginning with District 2.
- Program Managers: The Committee's membership is broad-based and includes most program managers, who serve a two-year appointment.

7.2 Research and Development Engineer/State Programming Engineer :

The State Programming Engineer supervises the overall operations of the Research Center. This individual coordinates all WYDOT research activities with TRB and AASHTO-RAC, which includes decisions of participation, membership expenses, and correspondence.

The State Programming Engineer also has the following responsibilities concerning the Research Center:

- Manages WYDOT's participation in regional and national research, development, and technology (RD&T) efforts, including TRB, NCHRP, and other cooperative projects with outside organizations.
- Makes decisions of participation, membership expenses, correspondence, and meeting participation for the Research Center, only. All travel decisions must follow the WYDOT internal policies.
- Ensures completion of research projects and distribution of results to applicable divisions and branches, and other state DOT's.
- Sits on the AASHTO SCOR Standing Committee on Research.
- Supervises the Research Manager and all aspects of the Research Center.
- Meets with executive staff and/or program supervisors regarding the Research Manager's duties and the operation of the Research Center.
- Is the primary contact with all program supervisors regarding Research Manager's duties and responsibilities, and the operations of the Research Center.
- Approves invoices from contractors.
- Approves no-cost extensions.

7.4 State Research Manager (RAC Chairperson)

The State Research Manager is responsible for the administration and operation of the Research Center. General duties and responsibilities of the State Research Manager are as follows:

- Provides literature reviews and searches for proposals, as needed.
- Monitors all SP&R funded research projects for WYDOT.
- Facilitates the exchange of research information with other agencies, researchers, state DOTs, and interested parties, and formulates strategies for technology transfer.
- Develops public and private research partnerships.
- Monitors national and international research for potential federally funded and sponsored projects.
- Prepares periodic status reports of research projects and conducts interim evaluations for the Research Center.
- Initiates requests for research proposals.
- Drafts research contracts and amendments for Attorney General's approval as to form.
- Reviews research proposals for accuracy, performance measures, and budget requirements.
- Reviews research invoices and forwards them on to the WYDOT budget office for payment.
- Monitors the yearly research-operating budget.
- Updates and publishes the yearly research work program.
- Distributes all research documents and reports to the federal repositories, the Wyoming State Library, the RAC and other stakeholders, as necessary.
- Maintains and archives project files from research studies.
- Monitors state and federal rules, regulations and statutes for changes, addendums and revisions in areas which affect the Research Center, research funding and research projects, including but not limited to general research, intellectual property, privacy, data management, metadata, archiving, guidelines, procurement, budgets, and evaluations.
- Writes and updates the Research Center mission statement and goals, performance measures, input and output measures, efficiency measures, and tracks all requirements and measures as set out in past evaluations for consistency.
- Maintains the publications housed in the research library and assures the publications are placed in the Research Center Library Database.
- Manages the Research Center web pages housed within the WYDOT website.
- Distributes transportation technology information to interested parties.
- Updates the Research in Progress (RiP) and Transportation Research Information system (TRIS) databases with Wyoming specific research information.
- Updates the Pool Fund sites for projects Wyoming is the lead state.
- Catalogues all data and metadata that is generated by the research projects.
- Tracks all performance measures and evaluation recommendations for the Research Center.
- Writes and updates the Guidelines.

The Research Manager is the chairperson of the RAC. At times and under such circumstances when the Research Manager is not available, the Research and Development Engineer shall act as chairperson of the RAC. As chairperson, the Research Manager does not vote on any proposals or other issues that affect the RAC. The duties of the Research Manager during RAC meetings are as follows:

- Calls, convenes, and chairs the RAC meetings.
- Arranges the agenda, time, and meeting room.
- Accepts problem statements and/or proposals for consideration by the RAC.
- Serves as the RAC secretary in meetings.
- Drafts and distributes RAC minutes.
- Monitors the presentations and the discussion section of the meeting.

7.5 Project Champion

The Project Champion is a WYDOT employee, who voluntarily or by assignment, assists the Principle Investigator in assuring the research project remains within budget, that the research project remains on track, answers technical and other questions the Principle Investigator may have, and addresses any changes in scope of work, key personnel, and disengagement from a project. The Project Champion further updates the Research Manager to any changes in the project, and is tasked with assisting with the implementation process for the research project.

SECTION 3: PROPOSALS AND REPORTS

CHAPTER 8: RESEARCH PROJECT DEVELOPMENT FLOW CHART

The following pages set forth the basic proposal process. As stated previously, the Research Center remains open to research suggestions from stakeholders, both internal to WYDOT and external. The following flow chart will assist stakeholders understand the process from proposal to implementation.

Flow Chart

1. Problem Statement
2. Literature Search
3. Proposal
    1. Pre-proposal
    2. Formal Proposal
4. RAC Evaluation
5. Executive Staff and FHWA Approval
6. Funding
7. Research Agreement
8. Authorization to Proceed with Research
9. Research Conducted/Deliverables
10. Recommendations for Implementation and Implementation Reports
11. Reports
12. Data Management Plan
13. Overall Program Performance
14. Disposal of Property

8.1 Problem Statement

A problem statement is simply a brief description of an existing need. To begin the research process, problem statements are submitted to the Research Center at least two weeks before a proposal is submitted. Problem statements normally range from either a few sentences to a couple of paragraphs, and must describe the problem in enough detail that a literature search can be performed with a high degree of confidence. Problem statements should not be long, complex, or hard to understand. Items that should be included in the Problem Statement are:

- Aspects of the problem that are significant.
- How the problem adversely affects transportation facilities or services.
- What the Principle Investigator hopes to gain through this proposal.
- The most pertinent findings from any literature review conducted.

8.2 Literature Search

After receiving the problem statement, the Research Center conducts a comprehensive literature search and provides feedback to the stakeholders. The literature search assists WYDOT and stakeholders to determine whether the question posed is essential; whether there are other reasonable options available; what aspects of the question have been addressed in previous projects; and whether the question needs to be revised. Literature searches may also be conducted by the Principle Investigator prior to formulating the problem statement.

8.3 Proposal

Proposals, whether pre- or formal, must be brought to the RAC by the Principle Investigator, with backing by a Project Champion who has expertise in the proposed research area. The Project Champion must a) agree to act as the liaison between the research project, contractors, and the Research Center; b) keep the scope of the research within the project's intent; c) answer technical questions when they arise; d) monitor financial expenditures and progress reporting; e) proofread the final report for technical accuracy; f) assist in assuring that the outcome based performance measures[32] set out for the project are being implemented; g) assist in implementing the data management plan; h) assist in implementation of the project findings, if necessary; and i) provide the RAC with an implementation report at the end of the project. No proposal will be accepted unless the Project Champion agrees to sponsor the project from proposal to the final report, and through implementation, if required by WYDOT.

Proposals should include all activities leading to the technological development sought, as well as introduce new and innovative ideas, practices, and approaches, when possible. Further, each proposal must tie to the WYDOT mission statement and goals which are applicable to the research project.(33) The steps Principle Investigators must follow when submitting a proposal can be found in Chapter 9.

8.3.1 Pre-Proposal

A pre-proposal is more than a problem statement and less than a formal proposal, but is still presented to the RAC for review. The intent of the process is to give the Principle Investigator a feeling of the RAC's opinion on the merits of investigating the problem further without consuming a large amount of time or effort. If a sufficient amount of interest is generated by the RAC, the Principle Investigator is asked to present a formal proposal. The Principle Investigator must submit a one to two page pre-proposal that briefly describes the problem that motivates the suggested research, and evaluates the topic's importance and urgency. The pre-proposal must provide enough information to allow the RAC to appreciate the significance of the problem, but does not require the elaborate details required of a formal proposal.

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[32] *23 U.S.C. 502(a)(7)*

[33] *http://www.dot.state.wy.us/wydot/site/wydot/lang/en/administration/strategic_performance/strategic_plans/mission_vision_values*

8.3.2 Proposal

A proposal is a systematic controlled inquiry involving analytical and experimental activities that primarily seek to increase the understanding of underlying phenomena. Proposals can be for statewide, regional, national, or in-house projects. In order for a project to be eligible for federal aid, a proposal must be written in such a manner to fully describe the research project process, schedule, and expenses. See Chapter 9 for full details on the submittal process for proposals.

8.4 RAC Evaluation and Funding Approval

Research proposals may be sent to the Research Manager anytime throughout the year. Projects requiring state planning and research funds (SP&R) are reviewed by the RAC during its quarterly meetings, and at other times, if the RAC deems necessary. Prioritization can only be properly conceived when all competing projects have been fully reviewed and scored by the RAC. Besides the criteria set out in Chapter 8 above, the RAC will weigh proposals using the Proposal Checklist for RAC Members that can be found in Appendix 5.

8.5 FHWA and Executive Staff Approval

Once a proposal has been reviewed by the RAC, and the RAC believes that there is sufficient merit to fund the project, the proposal is forwarded to FHWA and WYDOT Executive Staff for concurrent approval to proceed. Without approval by both FHWA and the Executive Staff, the proposal cannot proceed as an SP&R project. If the FHWA representative does not approve the proposal, but Executive Staff wants to proceed, non-Federal funding may be secured for the project

8.6 Funding

See Chapter 5 for information on funding and budgets.

8.7 Research Agreement

The Attorney General's office provides contract templates that WYDOT must use when executing contracts. Contracts and Interagency Agreements have been drafted to meet all current WYDOT and federal legal standards. The proposal becomes Attachment A to the contract and is incorporated therein by reference. If there is a conflict between the language in the contract and the language in the proposal, the language in the contract controls.

8.8 Authorization to Proceed with Research

Once the contract or agreement has been fully executed, and the budget office has obligated funding, a letter authorizing work to begin is sent to the contractor and the

Principle Investigator. No Principle Investigator may begin working on a project until they have received an "Authorization to Proceed" letter or e-mail from the Research Center.

8.9 Research Conduct/Deliverables

Contractors and/or Principle Investigators must keep WYDOT informed of all aspects of the research project. Principle Investigators must inform WYDOT and the Project Champion regarding changes in the scope of work; changes in key personnel; disengagement from the project for more than three months; transfer of funds; transferring or contracting out work; and the need for additional funding. Further WYDOT, through the Project Champion and the Research Center, shall monitor, and if necessary perform site inspections. Deliverables for each project are tailored to meet the needs of the Principle Investigator, contractor, and WYDOT, and any federal, state or other requirements specific to the research project.

8.10 Recommendations for Implementation and Implementation Reports

The implementation process is dependent on the exchange of information, which begins with clear, concise, and complete project reports. Though the Research Center does not normally fund implementation, it can assist in formulating working plans for implementation. This may include a proof of concept project, assistance in funding a part of implementation activities, etc. Parts of the implementation process may occur during the research process. Funding for the research project my include funding for partial implementation, if approved by the RAC. The Research Center is required to document benefits from implementation of research projects and track percentage of projects implemented, or document why a project was not implemented. At this time, recommendations to WYDOT on changes can come from the Research Center, but actual implementation is the responsibility of WYDOT. Appendix 6, Research Project Feedback Form Template; Appendix 7, WYDOT Research Project Evaluation Phase 1; and Appendix 8, WYDOT Research Project Evaluation Phase 2 are used by the Research Center to better track and improve the implementation processes for research projects.

8.11 Reports

Principle Investigators are required to provide the Research Center with various types of reports during the contract period. Reports will outline the progress and success of each project. See Chapter 10 for details on all reports.

8.12 Data Management Plan

Data Management Plans (DMP), metadata tracking, and data cataloging are required for all research contracts. Principle Investigators are required to maintain, archive, and share the data and/or datasets that are generated from the research project, and the Principle

Investigators shall provide the data and datasets to WYDOT within a reasonable amount of time. For further information on Data Management Plans and Metadata Schema's, please see Section 4, and Addendums 2 and 3.

8.13 Overall Project Performance

The expenditure of SP&R funds for research and development purposes is carefully scrutinized. The use of these funds must add value to and must improve the efficiency of operations of WYDOT. The Research Center tracks the progress of all research studies to ensure that performance measures, outcomes, outputs, and cost benefit analysis measures are included in each project. Further, all projects financed using SP&R funds are required to submit progress reports. See Appendix 1.

8.14 Disposal of Property

Contractor shall maintain records and provide WYDOT with an inventory of all equipment purchased with the contract funds. When the equipment is no longer needed for the original project, the following steps shall be taken:

- Determine if any program(s) within WYDOT has a need for the equipment.
- If no WYDOT Program has a need for the equipment, determine if any state, federal, city, county, or municipality has a need for the equipment.
- If no state, federal, city, county, or municipality has a need or a use for the equipment, dispose of the equipment pursuant to pursuant to the *Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards*, 2 C.F.R. 200.313(e). This may include, but not be limited to, disposal with the State Property Warehouse.

CHAPTER 9: RESEARCH PROBLEM STATEMENTS AND PROPOSALS

Drafting, submitting and presenting a proposal to the RAC is a multi-step process. Below are guidelines and steps that should be used when submitting a proposal.

9.1 Problem Statements

Two weeks prior to the submittal of a proposal, the Principle Investigator and/or Project Champion should submit a problem statement and a library research request form to the Research Center so a literature search can be conducted. This is a federal requirement to ensure that no research is duplicated causing federal funds to be unnecessarily wasted. The Research Manager shall review the problem statement prior to the literature review. Problem statements normally range from just a few sentences to a couple of paragraphs. Problem statements must describe the problem in enough detail to allow a thorough literature search. Problem statements should not be long, complex, or hard to understand and should lay out the following: a) aspects of the problem that is especially significant; b) how the problem adversely affects transportation facilities or services; and c) a summary of the most pertinent findings from the literature review.

9.2 Literature Review

All proposals must have a literature search performed by both the Principle Investigator and the Research Center. This step may take time, especially if the Research Center has to order research articles from another library. Research articles are intended to help the Principle Investigator investigate and narrow the problem statement; additionally, the literature search results and the Principle Investigator's subsequent investigation is an integral part of any future research proposal. After reviewing the articles, the Principle Investigator will decide whether he/she wants to proceed (it may be found that the research articles answers all questions and no further research is necessary). If the Principle Investigator's review does not answer the question, at least three weeks prior to the RAC's scheduled meeting the Principle Investigator can request a time slot on the RAC's meeting agenda. In addition, the written request must be accompanied by a copy of the problem statement and any supporting material.

9.3 Proposals

The research proposal should be a well-prepared document that defines the research problem and objectives, provide a detailed work plan for achieving the objectives, and indicate how the research findings are expected to be used. Additionally, proposals should simply and economically provide a straightforward description of the Principle Investigator’s ability to meet the requirements of the research.

Proposals for Pooled Fund projects must include the study number, lead agency information, funding request, estimated time frame, information on the study objectives and scope of work, the acceptance memorandum, service request forms, and any federal funding waiver documents. Pooled Fund studies should follow the requirements for proposals.

9.3.1 Pre-Proposal

The pre-proposal is a process by which the stakeholder presents their research question to the RAC in an abbreviated format. The pre-proposal must be in line with the WYDOT mission and goals, which are outlined in Chapter 1. The intent of the pre-proposal process is to predetermine whether the project has sufficient merit without consuming a large amount of time or effort. The pre-proposal is submitted in a one to two page report that briefly describes the matter that motivated the research suggestion, and assesses the topics importance and urgency. The report must provide enough information to allow the RAC to appreciate the significance of the matter, but does not require elaborate details. If the RAC feels that the pre-proposal has merit and warrants further study, it will request that a formal research proposal be prepared.

9.3.2 Formal Proposal

The formal proposal (proposal) is a request for support and funding. The proposal should address, in detail, what the Principle Investigator hopes to accomplish, how much the project will cost, and how long the project will take. The proposal must be in line with the WYDOT mission and goals, and the WYDOT Balanced Score Card, which are outlined in Chapter 1. Failure to follow the instructions set out in this Chapter could jeopardize the Principle Investigator's chances of selection. The Research Center will attempt to help the Principle Investigator address specific weaknesses in a proposal, if there are any, and the Research Center reserves the right to reject any proposal submitted which fails to follow these guidelines. Neither the Research Center nor WYDOT is responsible for any costs incurred by the Project Champion or the Principle Investigator, including proposal preparation, prior to the execution of a contract and funding approval by the WYDOT financial office. The Principle Investigator must submit an electronic copy of the proposal to the Research Center for distribution to the RAC.

*******The following subsections are intended to help Project Champions and Principle Investigators prepare a formal proposal that will be accepted with minimum change*.**

9.4 Title Page

The title page must contain all of the following information:

- Project Title: The title should be brief and should immediately convey to the reader what the proposed study is about. A good title will help

the reviewer better understand the proposal and will ensure that the RAC understands what the research project will focus on.

- Name and Address of the WYDOT Project Champion: Every research project must be sponsored by a WYDOT employee. The Project Champion, or his/her designee, acts as the research projects technical contact responsible for overseeing most of the research services being provided. Research project administration and payment tracking will be the responsibility of the Research Center.
- Name and Address of Principal Investigator: Provide the complete name and address of the Principal Investigator(s).
- Date: Date the proposal is sent to the Research Center.
- Table of Contents, Figures, Tables, and Appendices: On a separate page, list the proposal's sections and page numbers, list all tables and figures, and list appendices.

9.5 Problem Statement

The problem statement should set out all circumstances surrounding the current problem or issue that gives rise to the concern. If the problem statement is different than the one provided to the Research Center, the Principle Investigator should set out what the differences are and why the two are different. The problem statement should emphasize how the problem or issue effects operations of WYDOT, stakeholders, and Wyoming highways. The problem statement should tie the problem or issue to the WYDOT mission and goals. It is important that as much detail as possible be included in the problem statement, and an explanation of the inadequacy of a technique, material, or specification can help define the extent of the problem better.

9.6 Background Statement

The background statement should provide the RAC more information and history on the problem or issue to be studied. An explanation of the literature search and an explanation of how the issue affects WYDOT's current polices, rules and/or regulations should also be included in the background section.

9.7 Objectives

The objectives section defines what the Principal Investigator hopes to accomplish at the completion of the project, and sets out the goals that provide the optimum technique, material, or specification from a financial, operational, environmental, or social viewpoint. The objective section must include the following:

- Output measures: The direct or indirect link between the proposal and the WYDOT goals and/or TRB strategic plans.
- Outcome measures: The end result of the project. Outcome measures should explain how an action will improve efficiency, safety, or another measure while at the same time lower costs, accident rates or another measure.
- Goals: What will be accomplished by the proposed project.
- Performance measure: How to manage and/or improve a service or process, by what unit of measure, and by when. The performance measure should provide effectiveness, efficiency, quality, and/or timeliness of the project.

9.8 Benefits

To the extent possible, qualitative benefits from the proposed project should be stated. These might include:

- Estimated cost savings or cost avoidance.
- Estimated reduction in crashes and fatalities (*for those studies involving cost savings or avoidance and reductions in crashes and fatalities, a cost-benefit analysis is highly recommended*).
- How operational methods will be improved.
- How safety and mobility will be improved.
- What percentage of increased public user support will be realized.
- What specifications will be revised.
- What public relations should improve, and if so, how.
- The expected reduction in energy consumed, and how practices will be improved or simplified.
- Whether WYDOT's policies will be impacted, and if so, how.

9.9 Applicable Question

Project Champion and Principle Investigator should also address the following in their proposals:

- Are there any potential barriers to implementation (e.g. material, technology, vendors, legal/regulatory, public perception). For each potential barrier, identify strategies to mitigating these potential barriers.
- What is the expected time frame for implementation.
- Does the project involve action on Federal lands or other conditions that will require NEPA documentation (e.g. Categorical Exclusion or Environmental Assessment), and/or forest service or other permits.

- What are the major uncontrollable factors and/or unknowns in the project such as weather, wildlife, material properties, traffic, etc. For each uncontrollable factor, address whether there could be additional costs or delays.
- Should the project be segmented into phases with go-no/go decision points based on known unknowns (e.g. technology, partnerships, regulatory).
- If the project involves evolution of one or more technologies, is a technology road map provided showing how these technologies fit together.
- Will a Buy American Waiver be necessary.
- Will any data produced by this project be considered confidential or sensitive.
- Will the data and/or report from the final project be copyrighted, patented, or trademarked.

9.10 Statement of Work

The statement of work section should set out how the Principle Investigator plans to fulfill all deliverables for the research project. The statement of work area must include the following:

9.10.1 Work Plan/Scope

The work plan/scope area should demonstrate an understanding of the techniques and methods to be used to resolve the problem, and should contain all components necessary for the successful completion of the research. The work plan/scope section should set out the tasks to be performed and whether future phases will be necessary to reach the ultimate goal. The work plan will allow the reviewers an opportunity to more accurately judge the potential success and cost of the research.

All projects that will be used to build databases, software, or other computer type projects must include information on designs, computer programs needed or to be used, and storage capabilities.

9.10.2 Work Schedule

The work schedule and work plan are interrelated, and the work schedule should set out a calendar that reflects the times to accomplish each plan component. Milestones, decision points, and deadlines must be included in the work schedule. A bar chart or other graphical representation can be used to accomplish this item. Requests for extensions of time must be received no later than 60 days prior to the contract end date.

Any changes in the duration of the contract, in the work plan/scope, work schedule, or cost of the project must be in writing and may need approval by the RAC. The RAC has

authorized the Research Center to grant all no cost funding requests. If a proposal is approved, the Principle Investigator should provide the Project Champion and Research Manager with changes to the work plan/scope 30 days prior to the change, if possible. Changes that must be set out in writing include:

- Scope of work or objectives of the project.
- Changes in key persons.
- Disengagement from the project for more than three (3) months, or a Twenty-five percent reduction in time devoted to the project.
- The inclusion of costs that require prior approval.
- The transfer of funds between line items.
- The subawarding, transferring or contracting out of work.
- Changes in the approved cost sharing or matching.
- The need for additional Federal funds.

9.11 Budget

The budget for the project should be laid out in a format similar to that found in Figure 2. The budget is nothing more than cost estimation, which should be the best guess on what costs will be. Each component of the work plan represents estimates of salary, equipment, travel, and other costs. The work schedule and the cost estimate are interrelated. Again, the best cost estimates correspond to the work plan components describing the costs of each task in terms of salary, equipment, travel, etc. The cost estimate must include all monies requested for work that will be performed, whether that work will be billed against the grant funds or not. Additionally, the Research Center and the RAC require the costs be broken into fiscal year totals. All funding sources must be reflected in the budget.

******NOTE on request for additional funding.**

Requests for additional funding must be received from the contractor and Project Champion as soon as the need is known but no later than 60 days prior to the end of the contract term.

	Projected Project Costs	Percentage of Overall Project Budget	Indicator	Lower Range	Upper Range
Direct Costs	**$63,206**	83%		81%	96%
Total Personnel Costs	**$34,108**	45%		44%	72%
Principal Investigator	$15,208	20%		12%	46%
Other Personnel	$18,900	25%		23%	44%
Fringe Benefits	$6,083	8%		5%	12%
Research Travel		0%	•	2%	10%
Report Generation		0%	•	2%	11%
Equipment	$16,800	22%		3%	30%
Others	$6,215	8%		2%	9%
Technology Transfer	**$2,000**	3%		1%	5%
Conferences	$1,000	1%		1%	3%
Miscellanous Travel	$1,000	1%		1%	11%
Indirect Costs	**$11,138**	15%		12%	17%
Project Administration	$2,250	3%		1%	8%
Overhead	$8,888	12%		12%	17%
Total Project Cost	**$76,344**				

FIGURE 2: Example of the Research Project Budget Analysis

9.12 Implementation

The primary purpose and objective of the research project is to improve the operational responsiveness of WYDOT. Because the implementation process is lengthy and involved, assurances of a high probability of actual operational improvements assists in advancing a proposal. A broad and descriptive outline of the implementation process should be included in the body of the proposal. The proposal should also state who will logically be responsible for applying the research results, and specific standards or practices that might be affected by the research findings.

9.13 Technology Transfer

Another goal of conducting research is to improve or enhance transportation practices. In order for research results to be used, transfer of knowledge from the researcher must be made to new or potential user. This transfer can be seen as a process encompassing the dissemination of the research results and knowledge regarding any new processes, methods, and products that increases the technical quality. Like the implementation process, a broad but descriptive technology transfer outline should be written.

9.14 Data Management Plan

The proposal must set out how the data and/or datasets from the project will be maintained, archived, and shared. The DMP must contain information on maintaining data and/or datasets both during and after the project is completed. A DMP must be attached to the proposal. (See Appendix 2). The Principle Investigator should keep in

mind the following when drafting its DMP: a) what types of data the proposed research will generate; b) which data will have value to other research users; c) what data could be shared; and d) what data formats and quality standards will be applied to enable the data to be shared effectively. Further, a timeline should be considered which will allow the researcher and WYDOT reasonable, but not unlimited, time periods for exclusive use of the data. Changes to the DMP should be submitted to the Research Center 30 days prior to the change so that the Research Manager and the Contractor can discuss the change prior to implementation. All changes must be mutually agreed upon.

CHAPTER 10: RESEARCH REPORTS AND FORMATTING

There are various reports that must be submitted after funding is approved. Below is a list of the types of reports, and the requirements for each type of report. This Chapter also lays out the information that must be included in each final research report. Questions on any of the steps or for assistance in writing any of the reports please contact the Research Center at 307-777-4182.

10.1 Report Types

Below is a list of the types of reports and the overall requirements for each type.

10.1.1 Progress Reports

Principle Investigators submit progress reports to the RAC every three months until completion of the project. The information provided in the progress reports should allow a reviewer to determine whether the project is progressing satisfactorily or whether project revisions may be necessary. Progress reports will be due on or before the final calendar day in January, April, July, and September. To ease the effort of writing progress reports, a form has been developed and all areas of the form must be completed. See Appendix 1, Progress Report Template. In general, progress reports should be simple and brief, usually three or four pages, but the length of progress reports depends on the amount of activity that occurred during the reporting period, the nature of the topic, and the amount of interaction between the Principle Investigator and the Project Champion. Each task should be identified and discussed within the context of what was completed before the reporting period, what was accomplished during the reporting period, and what yet remains to be done. Problems that were encountered should also be explained, as should their solutions. Any changes in time or cost for the fiscal year, whether an increase or decrease, must be noted, and an explanation for the change must be provided. When there has been no progress during the quarter, progress report must explain why.

10.1.2 Interim Reports

Principle Investigators shall submit interim reports and make RAC presentations for each year that the project is open. Interim presentations are normally heard during the October RAC meeting. The Interim Report and the RAC presentation should cover the accomplishments for the project to date. Interim reports rarely exceed 20 pages in length and must cover much the same material found in the progress reports. The interim report shall advise the Research Center and the RAC of preliminary findings and recommendations that will influence the direction of the remainder of the project, or report findings that can be adopted prior to project completion. The front section and body of an interim report should be prepared in the same manner as a final report. The purpose of the interim report should be clearly stated and should focus on the work

performed to date, and should include sufficient background to establish context within the entire project. The interim report should explain how the findings were developed, how they relate to the study's original objectives, and how they will affect the remainder of the project.

10.1.3 Final Report

At least two months prior to the termination of the contract, Principle Investigators shall submit a draft final report to the Research Center. The Research Center will coordinate the review of the draft final report by the Project Champion and an outside proofreader. The report length will depend on the topics complexity and breadth, but usually a length of 20 to 100 pages is appropriate. In general, the organization of a final report should reflect the organization of the study's project statement and proposal. The draft report will be reviewed by the outside proofreader for grammar and formatting only. The Project Champion shall review the report for content and accuracy. Once both reviews are completed, and all changes have been implemented, the final report will be submitted for publication. Completion of the final report is required before final payment will be made. All reports must adhere to the standards for the preparation and publication of scientific and technical reports as outlined in the *Communications Reference Guide* (updated April 12, 2012) (Reference Guide). http://www.fhwa.dot.gov/publications/research/general/03074/index.cfm. All graphics (tables, figures, and photographs) must be embedded either within the text or at the end of the final report.

The Research Center provides electronic copies of all research reports to the Wyoming State Library, the University of Wyoming library systems, the University of Wyoming Technology Transfer Center, the TRID Database, National Transportation Information Services (NTIS), National Transportation Library (NTL), FHWA, Turner Fairbanks, Northwestern University, and University of California Berkeley. As such, all final reports must:

- Be freely available to the public.
- Be virus free.
- Assure that all links within the document are working properly.
- Be written in a clear, concise style, suitable for web format.
- Be proofread and edited in advance of submission.
- Be imprinted with meta tags. See the Metadata Schema, Addendum 3.
- Have attributes for all images and other artwork.

10.2 SECTION 508 OF THE *REHABILITATION ACT of 1973*, as amended (29 U.S.C. 794d)

Since the final report will be accessible on various state and Federal websites in electronic formats, all reports must be written in compliance with Section 508 of the

Rehabilitation Act of 1973[34]. All reports must be in plain language that will aid WYDOT in converting the report to meet Section 8 requirements, if necessary. Further all tables, figures, equations should be written with enough detail to describe what is in each insert. When inserting photos and other objects use high contrast, when possible. Other tips that may help can be found on page 8 of the Reference Guide.

Further, information on the Section 508 please see:

- Electronic documents, reports, brochures that are the main final product of FHWA (http://www.access-board.gov/sec508/guide/1194.22.htm – Web-based Intranet and Internet Information and Applications (1194.22).
- CDs and any electronic files. (http://www.access-board.gov/sec508/guide/1194.22.htm – Web-based Intranet and Internet Information and Applications (1194.22).
- PowerPoint Presentations, if they are distributed through CD, Web, etc, and if they contain graphic elements that need a test based alternative. (http://www.access-board.gov/sec508/guide/1194.22.htm – Web-based Intranet and Internet Information and Applications (1194.22).
- Converting documents to 508 compliant PDFs. http://www.adobe.com/content/dam/Adobe/en/accessibility/products/acrobat/pdfs/A9-accessible-pdf-from-word.pdf.

10.3 FRONT MATTER

The front matter section helps identify the report and describes its content and format. Front matter consists of the following elements: Front Cover, Disclaimer Notice and Acknowledgments, Technical Report Documentation Page (Form DOT F 1700.7), Metric Conversion Chart, Table of Contents, List of Figures (including equations), List of Tables, and List of Abbreviations and Symbols.

10.3.1 Front Cover: A sample of a front cover can be found in Figure 1 below. Parts of the front cover include:

- Sponsoring Agency(ies): The names and logos of sponsoring agencies are shown in the upper left corner of the front cover.
  - FHWA Logo: Copies of the logo can be found in Appendix M, page 97, of the Reference Guide: http://www.fhwa.dot.gov/publications/research/general/03074/index.cfm
  - WYDOT Logo: A copy of the WYDOT Logo can be obtained from the Research Center.

[34] *https://www.section508.gov/Section-508-Of-The-Rehabilitation-Act*

- Report Number: The report number is the FHWA assigned number followed by the letter designation "F" and is assigned by the Research Center. If the report consists of more than one volume, all volumes will have the same number.
- Illustration or Photograph: A relevant photograph or illustration may be used to communicate the subject of the study.
- Study Title: The report title is usually the study name used throughout the duration of the study. If the title in the report is different from that used in the proposal, the Principle Investigator should alert the Research Manager to such changes.
- Report Type: The phrase "Final Report" identifies the report as a final report. If the report is a draft, the phrase "DRAFT Final Report" must be used.
- Principle Investigator: The name and address of the contractor and/or the Principle Investigator. Names of individual investigators are listed in the Technical Report.
- Report Date: The publication month and year.

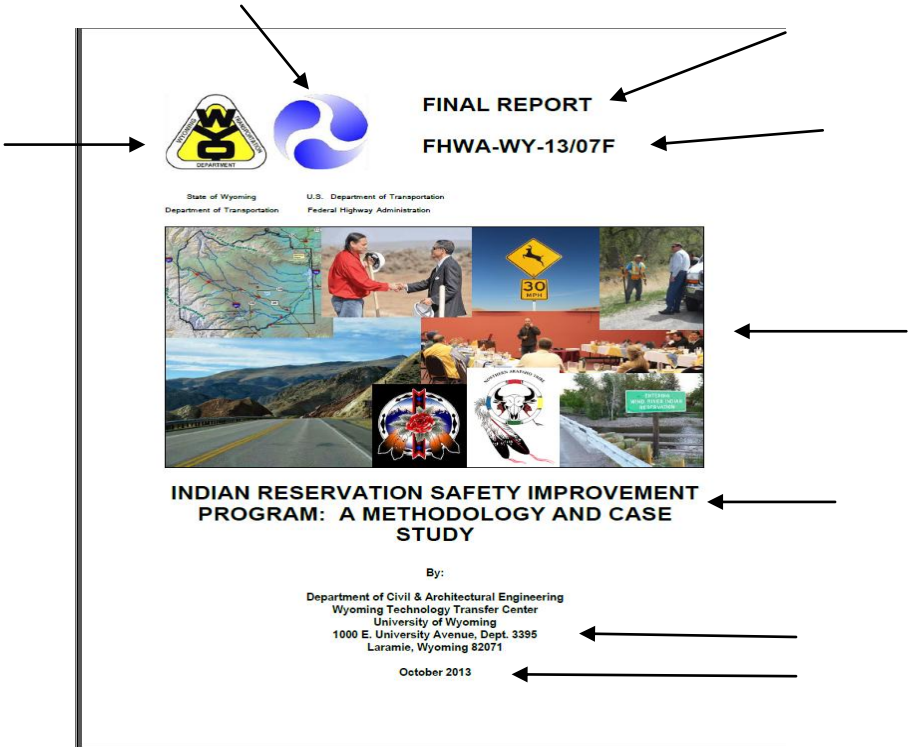

Figure 1: Example of Title Page

10.3.2 Forward: Information regarding the forward section can be found at page 25 of the Reference Guide.

10.3.3 Disclaimer Notice*:* A disclaimer notice, which matches that found on page 26 of the Reference Guide, must appear verbatim on the inside of the front cover of all reports. Further, if the report contains either confidential information or if any information in the report is subject to copyright, patent, or trademark requirements, the report must contain additional disclaimers, which may be obtained through the Research Center.

10.3.4 Quality Assurance Statement: A quality assurance statement, which matches that found on page 26 of the Reference Guide, must appear verbatim on the inside of the front cover of all reports.

10.3.5 Acknowledgments*:* Acknowledgments recognize the persons to whom the author(s) are indebted for guidance and assistance, including contributors, other researchers, managers, technicians, reviewers, editors, proofreaders, organizations. Acknowledgments are optional, but if given will appear below the Disclaimer with the heading "Acknowledgments." Gratuitous acknowledgments should be avoided. Paid consultants are not acknowledged. A sample of an acknowledgement can be found at, Appendix I, page 84, Reference Guide.

10.3.6 Standard Technical Title Page*:* The Standard Technical Report Title Page lists key study information in a tabular format used by FHWA and other agencies. It should be a single page numbered "i". [Form DOT F1700.7]. A sample of the standard technical title page can be found at Appendix B, page 78, Reference Guide.

10.3.7 Metric Conversion Chart*:* According to the *U.S. Code of Federal Regulations (23 C.F.R. 420.121(p))*, federal research reports must provide units of measurement using the SI (metric) system. The American Society for Testing and Materials publication, *Standard Practice for Use of the SI International System of Units: The Modernized Metric System* (ASTM E380-89a or later) should be used. Reports prepared under FHWA planning and research grants may contain dual units with metric units being listed first and English units in parentheses next to the metric unit. For further guidance on metric units, see the U.S. Government Printing Office Style Manual (GPO Manual) which can be found at: http://www.gpo.gov/fdsys/pkg/GPO-STYLEMANUAL-2008/content-detail.html. The metric conversion chart should be numbered page "ii,". An electronic version of the chart is available from the Research Center and a sample of the metric conversion chart can be found in Appendix E, pages 79-80, Reference Guide.

10.3.8 Table of Contents*:* The table of contents lists the chapters, sections, and subsections of the report with page references. The table of contents should begin on page "iii". See detailed instruction on page 28 of Reference Guide, and a sample of the table of contents can be found in Appendix F, page 81 of the Reference Guide. Additional information on the table of contents can be found on page 28, of the Reference Guide and in the GPO Manual.

10.3.9 List of Figures*:* The list of figures shows figure numbers, captions, and page numbers. The list of figures should begin on a separate page following the table of contents. A sample of the list of figures can be found in Appendix G, page 82, Reference Guide.

10.3.10 List of Tables*:* The list of tables shows table numbers, captions, and page numbers. The list of tables should begin on a separate page following the list of figures, unless the lists of figures and list of tables both fit completely on one page. A sample of the List of Tables can be found in Appendix H, page 83, Reference Guide.

10.4 REPORT BODY

The intellectual content of the report resides in logically organized sections of the report body. The report body consists of the following elements: Executive Summary, Problem Description, Objectives, Task Description, Findings and Conclusions, and Implementation Recommendations. Each section should be titled and should begin on an odd-numbered (right-hand) page to aid location. When drafting a report, utilize the Reference Guide and U.S. Government Printing Office Style (GPO) Manual. See page 29 of Reference Guide for more detail. All documents submitted to NTL must adhere to the GPO guidelines.

10.4.1 Executive Summary*:* The first chapter of the report should be a summary designed to inform the reader of the study's purpose, general approach, and significant findings, conclusions, and recommendations. The summary should concisely express the most important information about the project, without depending on references to other material in the final report. For consistency, conclusions and recommendations offered within the executive summary should match exactly those presented later in the final report. Because managers are likely to refer to the executive summary more often than to the full report, recommendations should be supported within the executive summary.

10.4.2 Problem Description*:* The second chapter should describe the problem that motivated the work. The researcher should supplement the description presented in the project's proposal with his/her own insights.

Often the discussion offered in the researcher's proposal or work plan, when updated to reflect insights gained during the investigation, comprises a good description of the problem.

10.4.3 Objectives*:* After the problem is stated, the study's defined objectives should be stated and explained. The chapter(s) should lay out the relationship of the research objectives to the problem stated in the proposal. If the researcher has added objectives, they should also be stated and explained. The degree to which the objectives were accomplished should be summarized and this section should include the output measures, outcome measures, goals, and performance measures.

10.4.4 Task Description*:* These chapter(s) should state the project's defined tasks and explain how they were accomplished. Usually, a task-by-task discussion is easiest to follow but it is up to the Principle Investigator as to how to write the report. The discussion must be sufficiently complete and clear to allow the study's sponsor to determine whether the project's tasks were accomplished fully, partially, or not at all, and to appreciate the technical significance of the work. Experimental plans should be clearly explained. Deviations from the defined tasks, either planned or to overcome problems, should be justified, explained and evaluated. The discussion should also explain the tasks' relationship to the study's objectives.

10.4.5 Findings and Conclusion: This chapter(s) should explain what was learned from the study and assess the reliability of the findings. Results of surveys, tests, analyses, and other experimental techniques should be stated along with explanations of their significance. Any limitations to the validity or applicability of the observations or analyses should be clearly stated.

10.4.6 Implementation and Other Recommendations*:* The researcher should state, explain, and justify any recommendations for implementation of the research. This can include specific changes in current processes; policy changes; training recommendations; procedural changes; and future research. To ensure that recommendations are correctly identified and properly stated, they should be numbered. The recommendation itself should consist of one to three concise sentences clearly stating what should be done, by whom and, if applicable, when. Recommendations should be sufficiently clear and complete to permit their understanding when quoted later outside of the context of the final report. After each recommendation is stated, it should be more fully explained and suitably supported by reference to the findings and conclusions provided earlier in

the report. Any limitations on the recommendation's applicability should be plainly stated.

10.5 BACK MATTER (REFERENCE MATERIAL)

Back matter may consist of the following elements: Appendices, Glossary, Bibliography, References, Index, Data Management plan, and Back Cover. Not all elements are required. See page 24 of the Reference Guide for more detail.

10.5.1 Appendices*:* Appendices should be reserved for material that is either lengthy or related to the research by reference. Appendices may contain voluminous tables or graphs, samples of survey or analysis forms, standards or other pertinent documents referenced in the report body. The Principle Investigators should refrain from including marginally related material in appendices, and should instead limit their use to pertinent information. Data spreadsheets or tables may be placed as an appendices in the report. All data spreadsheets and/or tables should be listed on the DMP.

10.5.1.1 Internal Appendices: If appendices are short enough to include in the same volume as the final report, they should appear after the report body in alphabetical order, and should be titled according to their content. appendix title and letter, should be listed in the report's table of contents, with the pagination continued consecutively from the report (do not use A-1, etc).

10.5.1.2 External Appendices*:* When appendices are too long to include in the final report, they should appear as supplemental, sequentially numbered volumes of the final report.

10.5.2 Glossary: The Glossary is an alphabetized list of uncommon or specialized words used in the text, and their definitions. Inclusion of a glossary is strongly encouraged.

10.5.3 Bibliography and References*:* Every report that makes use of other sources either by direct quotation or by reference must list those sources. All data that generates from an outside source shall be listed in this section. Each listed source must be accurate and complete enough for the reader to find in a library. References to unpublished sources must clearly indicate where the material may be found. References, or some other equivalent title, are used for a list that contains only those items that are actually referenced in the text. Bibliographies must include digital object identifiers (DOI), when available.

10.5.4 Index: An Index is an alphabetized list of key words representing information to be found in the text, and page number(s) where it may be found. An index is optional unless the document is unusually long or complex.

10.5.5 Back Cover*:* A back cover must be provided with both sides being blank.

******NOTE regarding inventory. The contractor shall provide an inventory of all supplies and equipment purchased for this project as a separate document at the same time as the final report.**

SECTION 4: DATA MANAGEMENT PLAN AND METADATA SCHEMA

CHAPTER 11: FEDERAL AND STATE REQUIREMENTS

Since the turn of the century, the Federal government and the state of Wyoming began implementing rules and regulations regarding digital data, data storage, data archiving, and open data sharing plans. This Chapter outlines the Federal and state requirements for data management and digital data.

11.1 American COMPETES Reauthorization Act of 2010

The *American COMPETES Reauthorization Act of 2010* (ACRA; Public Law 111-358)[35], was signed into law in 2011, and required the director of Office of Science and Technology Policy (OSTP) to establish a working group under the National Science and Technology Council (NSTC) direction to coordinate Federal science agency research and policies related to the dissemination of long term stewardship of the results of unclassified research, including digital data.

11.2 Office of Science and Technology Policy Memorandum, dated February 22, 2013

In February of 2013, OSTP released a memorandum entitled *Increasing Access to the Results of Federally Funded Scientific Research*[36] (OSTP 2013 Memorandum), which directed the heads of executive departments to develop a plan to support increased public access to the published results of research funded by Federal funding. The OSTP 2013 Memorandum provided guidance on federally funded scientific research, including peer-reviewed publications and digital data. The OSTP 2013 Memorandum further sets out that "Federal agencies investing in research and development must have clear and coordinated policies for increasing such access" and a plan should be developed to "support increased public access to the results of research funded by the Federal Government."

This plan directs all agencies to implement:

- A strategy for leveraging existing archives, where appropriate.
- A strategy for improving the public's ability to locate and access digital data.
- An approach for optimizing search, archival, and dissemination features, while ensuring long-term stewardship of the results.
- A plan for notifying awardees and other federally funded scientific researchers of their obligations.
- An agency strategy for measuring and enforcing compliance with its plan.

[35] http://www.nsf.gov/statistics/about/BILLS-111hr5116enr.pdf
[36] http://www.whitehouse.gov/sites/default/files/microsites/ostp/ostp_public_access_memo_2013.pdf

11.3 Executive Order 13642 dated May 9, 2013

The May, 2013, Executive Order 13642, entitled, *Making Open and Machine Readable the New Default for Government Information*[37] (EO 13642 Memorandum), states that government information shall be "managed as an **asset** throughout its life cycle to promote interoperability and openness… and to ensure that data are released to the public in ways that make the data easy to find, accessible and usable." [**Emphasis** added] In the EO 13642 Memorandum, the Office of Management and Budget (OMB) was directed to issue an Open Data Policy to advance the management of Government information. Agencies, including the USDOT, were directed to implement the requirements of the OMB Open Data Policy.

11.4 Office of Management and Budget Memorandum dated, May 9, 2013

In May of 2013, the OMB issued a memorandum entitled *Open Data Policy for Managing Information as an Asset* (M-13-13).[38] This memorandum required executive departments and agencies (Agencies) to "collect and create information in a way that supports downstream information processing and dissemination activities." which included using "machine-readable and open formats, data standards, and common core and extensible metadata for all new information creation and collection efforts." Agencies, including the USDOT, were required to ensure the use of "open licenses and review of information for privacy, confidentiality, security, or other restrictions to release." M-13-13 is in line with the *Paperwork Reduction Act,*[39] the *Privacy Act of 1974,*[40] the *Federal Information Security Management Act of 2002 (FISMA),*[41] the *Confidential Information Protection and Statistical Efficiency Act of 2002 (CIPSEA),*[42] the *Freedom of Information Act,*[43] and the existing OMB and the OSTP guidance policies. M-13-13 applies to all new information collection, creation, and system development efforts as well as major modernization projects that update or re-design existing information systems beginning in the early stages of the planning process, and management should continue throughout the projects life cycle.

11.5 USDOT Plan to Increase Public Access to the Results of Federally-Funded Scientific Research Results Version 1.1, dated December 16, 2015

[37] http://www.whitehouse.gov/the- press- office/2013/05/09/executive- order- making- open- and- machine- readable- new- default- government-
[38] http://www.whitehouse.gov/sites/default/files/omb/memoranda/2013/m- 13- 13.pdf
[39] Pub. L. No. 107-347, 116 Stat. 2899 (2002) (codified as 44 U.S.C. § 3501 note).
[40] 5 U.S.C. §552a
[41] 44 U.S.C. §3541, *et seq.*
[42] Section 503(a), Pub. L. No. I 07-347, 116 Stat. 2899 (2002) (codified as 44 U.S.C. § 350 I note); see also Implementation Guidance for Title V of the E-Government Act, Confidential Information Protection and Statistical Efficiency Act of 2002 (CIPSEA), available at http://www.whitehouse.gov/sites/default/files/omb/assets/omb/fedreg/2007/061507_cipsea_guidance.pdf
[43] 5 U.S.C. 552(a)(2)

The USDOT *Plan to Increase Public Access to the Results of Federally-Funded Scientific Research Results Version 1.1, dated December 16, 2015* (USDOT Public Access Plan)[44], was issued in response to the OSTP 2013 Memorandum. The USDOT Public Access Plan requires:

- Authors to submit to the NTL digital repository all publications that meet the scope criteria as set out on page 2 of the USDOT Public Access Plan.
- Publications to be freely available to the public no later than 12 months following publication.
- Public access to final research data, subject to restrictions that pertain to privacy, confidentiality, and homeland security.
- All DOT funded research proposals to include a supplementary document labeled "Data Management Plan" (DMP), and include long-term digital data set preservations and storage location information.
- Repositories to enable and allow public access and sharing.
- Full access to the DOT's scientific publications and digital data requirements for tracking of the research and data.
- Data to be entered into the NTL repository that serves as the permanent archive of technical reports. The NTL will provide a searchable database of data management plans.
- The USDOT Research Hub to serve as the linking mechanism for scientific publications and their underlying research data.
- All research project descriptions to be submitted to the Transportation Research Board Research-in-Progress database and ensure that the projects are updated.

The plan applies to all DOT employees and awardees from non-DOT organizations that publish scientific material or compile digital data sets resulting from research and development programs conducted under a DOT grant, contract, or other agreement.

11.6 FHWA - Data Capture and Management: Needs and Gaps in the Operation and Coordination of USDOT Data Capture and Management Programs

In 2010, the FHWA Office of Operations, Office of Transportation Management (HOTM) commissioned a white paper entitled, *Data Capture and Management: Needs and Gaps in the Operation and Coordination of U.S. DOT Data Capture and Management Programs* (HOTM White Paper). The HOTM White Paper focused on infrastructure, travel, and climate, and looked at data capture and management activities across various U.S. DOT program areas, and identified gaps and potential opportunities for filing the gaps and managing program activities. The HOTM White Paper recommended that HOTM should develop a data business plan (DBP) to address the gaps and to improve coordination among real time data capture programs within U.S. DOTs.

[44] https://www.transportation.gov/sites/dot.gov/files/docs/Official%20DOT%20Public%20Access%20Plan%20ver%201.1.pdf

In 2011, HOTM commissioned a DBP study to address gaps; to serve as a prototype for other U.S. DOT offices; and to provide leadership by offering or suggesting best data collection practices. In 2012, the FHWA Data Governance Council signed a charter that provided strategic review and oversight of all FHWA data collections efforts. The council signaled the need for improved data management within FHWA and its programs and allowed stakeholders to benefit from data programs.

11.7 USDOT - U.S. DOT Roadway Transportation Data Business Plan (Phase 1)

In 2013, U*.S. DOT Roadway Transportation Data Business Plan (Phase 1)* (U.S. DOT DBP), was written and focused on roadway travel mobility data, but also reviewed the above-mentioned papers and their recommendations and conclusions. The U.S. DOT DBP sets out practices and recommendations for the U.S. DOT based on experiences of other national and state agencies data management plans. The recommendations set out in U.S. DOT DBP followed best practices outlined in *NCHRP 666, Volume II: Guide for Target-Setting and Data Management*, Chapter 2: Guide for Data Management.

11.8 National Transportation Library DOT Public Access Guidelines

The NTL is the repository for USDOT information, serves as the portal for transportation data, and provides library services to USDOT employees. The NTL sets out that DMPs should conform to the USDOT Public Access Plan and that each plan shall include a narrative describing:

- The final research data to be produced in the course of the project.
- The standards to be used for data and metadata format and content.
- Policies for access and sharing the final research data.
- Policies and provisions for re-use, re-distribution, and the production of derivatives.
- Plans for archiving the final research data and other research products, and for preservation of access to them.

11.9 AASHTO

American Association of State Highway and Transportation Officials (AASHTO) is working on data management plans for research data, and the subcommittee of data is working on the core data principles proposed for use by state DOTs[45] regarding data management. The core data principles as set out by AASHTO are:

[45] Stickel, Jack; Anita Vandervalk, (2015) Data Business Plans and Governance Programs, TRR 2460. http://trrjournalonline.trb.org/doi/abs/10.3141/2460-17; AASHTO Core Data Principles, http://planning.transportation.org/Pages/Data.aspx

- Valuable: Data is an asset.
- Available: Data is open, accessible, transparent, and shared.
- Reliable: Data quality and extent is fit for a variety of applications.
- Authorized: Data is secure and complaint with regulations.
- Clear: There is a common vocabulary and data definition.
- Efficient: Data is not duplicated.
- Accountable: Decisions maximize the benefit of data.

CHAPTER 12: DATA MANAGEMENT PLAN POLICIES FOR THE WYDOT RESEARCH CENTER

Data is considered an asset and is valuable to Principle Investigators, WYDOT, stakeholders and the public. As such, Principle Investigators, Project Champions, and WYDOT become accountable for the quality of the data generated and they must ensure the data is accompanied with enough metadata to assist the public in accessing the data. Managing the data in a formal manner ensures that duplication of the data does not occur and that the research dollars are spent wisely.

This Chapter outlines the policies and procedures the Principle Investigator and Program Champion will follow when establishing their Data Management Plan (DMP). In developing the DMP and the policies, the Research Center balanced insuring the data was open to the public, the needs of the Principle Investigators and WYDOT, and insuring confidentiality and privacy. The Research Center is implementing the following policies and guidelines to be used for all research projects funded by the Research Center.

12.1 Steps for data management

All research projects shall follow the below timeline.

12.1.1 Prior to beginning a research project

A kickoff meeting shall be set up prior to or just as the contract is initiated. The kickoff meeting shall include reviewing the proposed DMP and necessary metadata to ensure all required data is archived and all parties understand how the data will be managed. Any changes to the DMP must be approved by the Research Center. The kickoff meeting will also ensure that the Principle Investigator(s) understands the deliverables set out in the contract. At this time, the parties will determine whether there needs to be disclosures or legal protection for the report and the data (PHI, PII, and/or sensitive data), and whether data needs to be scrubbed and/or deidentified. At this meeting, all rights to the data and/or datasets shall be determined. See Appendix 2, Template for Data Management Plan.

12.1.2 During the research project

During the research project, the Principle Investigator shall ensure that the data is maintained and backed up in a secure manner, and it shall be the Principle Investigator's responsibility to determine storage requirements. The Principle Investigator shall update the Metadata Schema (Appendix 3) during the life of the research project, as needed. The Principle Investigator shall also apply for an Open Research and Contributor ID (ORCID) number. Prior to providing the final report or publishing any publication based on the contracted research, the Principle Investigator shall discuss with the Research Center the need of a digital object identifier (DOI) for the report and/or data, and what DOIs have already been attached to derivative reports.

12.1.3 After the final report is written

The Principle Investigator, Project Champion, and WYDOT shall set the embargo period for the data; appraise the data inventory; organize the data and content files; process the data; ensure the Metadata Schema is complete; determine who will manage the data once the project is complete; determine what the retention period will be; determine who will budget for the retention of data; set out how to name the files and datasets; determine whether there are any outliers; determine how to cite the data and/or datasets; and determine what the data parameters and/or units of measure will be. If the data is sensitive, privileged, or confidential, the Principle Investigator and the Research Center shall determine who can access the data, who can reuse the data, and how to ensure confidentiality. It should be kept in mind that data formats may be different during the submission, distribution, and preservation phases.

12.2 What Data Are Archived and How is it Determined

For purposes of these Guidelines, the Research Center will use the following primary definition for data:

> "the recorded factual material commonly accepted in the scientific community as necessary to validate research findings."[46]

When determining what data should be archived, and what data should be linked to the final report, the Research Center, Project Champion and the Principle Investigator will review the data available, and determine what data and datasets to archive and link. Determining factors of what data to archive include:

- Will there be a demand for the data.
- How difficult will the data be to replicate.
- Are there barriers to future use.
- Is the data stored or archived somewhere that cannot guarantee long-term storage.
- Is the data the only copy.

The following forms of data/datasets should be reviewed when determining what data should be archived:

- Primary data used in the production of the report: Raw, verified data that has been obtained directly from a source. It can be captured through experimental, surveys, interviews, focus groups, or other direct interactions with individuals in the field.

[46] https://www.whitehouse.gov/omb/fedreg_a110-finalnotice

Does not include analysis data.

- Unpublished datasets: Materials and methods; clear description of the variables presented; supported by unpublished reports; and any other relevant material.
- Secondary Data: Pre-existing data not gathered or collected by the authors. Usually collected by another organizations or source.
- Metadata: Set of data that describes and gives information about the dataset – cataloging information.
- Dataset description document: Describes all variables in the dataset and the measurement units used.
- Codebook: A list of variable names, variable labels, and label values. Should specify the data position of each variable, describe the contents of each variable, and identify the range of possible codes and the meanings of the codes.
- Questionnaires: An unused copy of the questionnaire.
- Handbooks, guides, and manuals derived from research.

When determining what counts as data and what should be archived, it will depend on the Principle Investigator's knowledge of the data, and what he/she feels is valuable.

NOTE: It should be noted that data gathered and/or archived, will be determined on a case-by-case basis for each research project.

12.3 What Data Are Not Included

Data that does not need to be archived or saved includes preliminary analyses of a project, drafts, plans for future research, peer reviews, interoffice communications, e-mails, letter, or other forms of correspondence when looking at what data to archive. The Principle Investigator and the Project Champion will have the opportunity to discuss what data and/or other digital material should be excluded prior to finalizing the project.

12.4 Data Management Plan Template for Research Projects

Principle Investigators are required to complete a DMP prior to beginning a research project, and update the DMP throughout the life of the project. See Appendix 2.

12.5 Metadata Format and Content Template

All datasets, data and reports may need a Metadata Schema. Determination of what data will need a complete Metadata Schema will be determined on a case-by-case basis. Full details on the Metadata Schema can be found in the MARC21 Concise at http://www.loc.gov/marc/marcdocz.html, and the requirement from the National Transportation Library (NTL) can be found at http://ntl.bts.gov/publicaccess/index.html. The Research Center Metadata Schema can be found in Appendix 3.

12.6 Data Sharing Agreements

The Research Center and the Principle Investigator will execute a data sharing agreement, if one is required, or for intellectual property reasons. The data sharing agreement may include clauses on cleaning of the data; data sharing requirements; forms for sharing; formats of data; software requirement; and metadata requirements. Templates for data sharing during the time of the research project, and after completion of the project are available at the Research Center.

12.7 Locating and Accessing Digital Data Materials, Data, and Databases

For research projects that were completed prior to October 1, 2014, the Research Center shall link digital materials, data, and/or databases, if possible. If the data was not been turned over to the Research Center, and the Principle Investigator and/or Project Champion still has access to the data/datasets, the Research Center may ask for a copy for its files.

For research projects completed after October 1, 2014, the Research Manager shall work with the Principle Investigator and the Project Champion to ensure the Research Center receives an inventory of digital material, data and/or datasets that are relevant to the research project. All digital material, data and datasets will be copyrighted, if necessary. From the inventory, the Project Champion, Principle Investigator, and the Research Center will determine what data will be linked to the report.

12.8 Ensure the Public Can Read, Access, Download and Analyze Digital Data

Pursuant to the *Freedom of Information Act*[47], the *Wyoming Public Records Act*[48], and the numerous State of Wyoming digital data management rules and regulations, the Research Center is required to ensure that the public can read, access, download, and analyze digital data. The goal of the Research Center is thus to work with Principle Investigator, stakeholders, the Project Champion and the RAC to determine the best ways to accomplish this goal.
The Research Center shall archive data in a repository chosen by the Research Center, and link the data to the report that is stored in electronic form in the Wyoming State Library or though the NTL site. This will ensure the report and data are available to the public immediately. The Research Center does not wish to duplication storage efforts, and if data will be stored by the Principle Investigator or the Project Champion for the duration of its life cycle, the Research Center proposes to leave the data in those databases until such time as it is determine that the data should be either deleted or archived in a predetermined repository. The storage facility will be publicly accessible and will allow for linkage between the report and the data/dataset.

[47] *5 U.S.C. §552*
[48] *Wyo. Stat. §16-4-201 et. seq.*

12.9 Data Formats and Dissemination

Before data is archived, the Principle Investigator, Project Champion and Research Center shall determine what the best format for archiving the data is. It must be kept in mind that formatting may change from collection to archiving and as such, the Principle Investigator should be prepared to adjust the formatting where necessary. A plan for formatting and archiving should be set up either prior to or during the research process.

12.10 Storage, Archiving and Backup

All data gathered from research projects should be considered "open". This means that the data and/or datasets should be available to the public, unless there is a compelling reason not to release the information. Archiving will begin in the early stages of the research process and shall continue during the course of the project. When storing data, a backup must always be kept; security for the data must be incorporated during the project phase; and data must be organized in such a manner that it is easily accessible.

Archiving of the data could be a time specific endeavor or could be long term. Data must remain available for a minimum of three years after a project is complete, and it may be necessary to retain the data indefinitely. To ensure the availability of data, each set of data and report must have persistent identifiers or digital object identifiers (DOI) as set out by CrossRef.org. Data must also be formatted in such a manner that it can be stored and retrieved easily.

If the Principle Investigator and/or the Project Champion will be archiving and/or storing data, the DMP shall describe physical and cyber resources, and facilities that will be used for the effective preservation and storage of research data. In collaborative proposals or proposals involving sub-awards, the lead Principle Investigator is responsible for assuring data storage and access for data gathered by the subrecipient.

If there is sensitive and/or confidential data gathered, the Principle Investigator is tasked with ensure that the storage, backup and security systems meet all HIPAA[49] and HITECH[50] requirements. When archiving sensitive and/or confidential data, please provide the following:

- A brief description of the data.
- Whether the data was original or was gathered from an existing database.
- Security and privacy information.
- Intellectual property rights for any data that comes from an existing database.
- How the data were managed during the project, with information about versions.
- What outliers are present in the data.

[49] *http://www.hhs.gov/hipaa/for-professionals/privacy/*

[50] http://www.hhs.gov/hipaa/for-professionals/special-topics/HITECH-act-enforcement-interim-final-rule/index.html

12.11 Intellectual Property Rights

The Research Center wants to ensure that we are able to collect data while at the same time protecting intellectual property rights of agencies and the private sector. The Research Manager, in conjunction with the Attorney General's office, will set out guidelines on who owns the intellectual property rights and proprietary interests for data, datasets, and other documents. The major questions to be kept in mind are:

- Who owns or has a valid license to the intellectual property.
- What steps should be taken to protect the intellectual property.
- When sharing data, how will the intellectual property rights be protected.

Issues such as disclaimers, open licenses and copyrights will be reviewed to ensure all data, datasets, etc. contain the proper coverage. All contracts for research projects will have specific language on respective rights and the obligations of all parties regarding the use, reproduction, and disclosure of the data, and will set out what data will be delivered to the Research Center. The type, quantity or quality of the data to be delivered will be set out in the DMP.

Data, which is first produced in the performance of the contract, must be copyrighted at the first instance. The copyright will list the contractor, the State of Wyoming and WYDOT as right owners, with all rights reserved. WYDOT retains an "unlimited, and irrevocable license to reproduce, publish, or otherwise use and to authorize others to use, for federal and state purposes: a) the copyright in any work developed during the contract period; and b) any rights of copyright to which the Principle Investigator and/or contractor purchases ownership using funds awarded". (Wyoming Contract Template)

The Programming Engineer and the Research Manger, or his/her designee, shall be responsible for handling intellectual property issues within the Research Center.

The Research Center, and the Principle Investigator will determine what intellectual property will be released to the public, if there is an issue with confidentiality, trade secrets, etc. The Research Center and Principle Investigator shall monitor and audit any agreements (e.g. CRADA) as well as any licensing compliance issues to identify intellectual property assets that are produced, used, or purchased as a result of the project. This shall include a review of any licenses and agreements with third parties to ensure that sufficient agreements are in place. The Research Center will set up an intellectual property catalog for all research reports. This will provide a comprehensive assessment of all forms of intellectual property owned by WYDOT. This should include expiration dates, maintenance fee due dates, license agreements with licensees, conception data, and potential intellectual property.

The Research Center will work with the Attorney General's office to determine if the intellectual property needs to be registered. The Attorney General's office will have the final say on registration of any intellectual property.

The Principle Investigator and the Research Center will make all determinations on whether the intellectual property should be excluded from use by others, if there is a need to control future use, licensing agreements, and how to keep the intellectual property in the public domain. As a note, if the report or data is release to the public domain without claiming intellectual property rights, the Principle Investigator and WYDOT could forfeit their rights.

Management decisions on any source codes will be made by the Wyoming ETS Department, the Principle Investigator, and the Research Center.

12.12 Disclaimer

When necessary, a disclaimer form will be provided to the RAC with the proposal and updated forms will be attached to the progress reports. Disclaimer forms will provide an overview and description of the invention, concept, work or idea proposed in the research project or set out in the research report with sufficient information to decide appropriately whether to pursue intellectual property protection. The disclaimer form shall include:

- A description of the technology, invention or creative work.
- What does it do. Key features and benefits.
- Are there any national security concerns.
- What is the funding source.
- The technology, invention or creative work to be protected by Intellectual Property.

Principle Investigator, Project Champion, the Research Manager will determine which data and/or datasets will require disclaimers. Disclaimers may be required for confidentiality issues, intellectual property rights, or other issues. Examples of Disclaimers can be obtained from the Research Center.

12.13 Selection and Retention Periods

Data from research projects can be large and cumbersome. The Research Center and Principle Investigator shall collaborate to determine what data should be retained and what data should be linked to the research report. All data collected during the research process shall be retained until the Principle Investigator, Project Champion and the Research Manager have an opportunity to discuss the data available and what will be needed for the final report. See Sections 12.2 and 12.3 for guidelines on what data should and should not be archived. Any data which is archived, should be machine-readable and in an open format. The Principle Investigator shall provide the Research Center with a data inventory, and if the data is not housed by the Research Center, the location and the custodian of the data should be provided to the Research Center. Further, the formatting of the data will be determined by the Principle Investigator, WYDOT, and/or the chosen data repository.

Retention periods for data shall be on a case-by-case basis. The minimal retention period is three years after conclusion of the award or three years after public release, whichever is later. Exceptions requiring longer retention periods may happen when data supports patents, when questions arise from inquiries or investigations with respect to research, or when a post-graduate student is involved. Research data that supports patents shall be retained for the entire term of the patent. The federal government, state of Wyoming, and ETS all require that data, records and other items be made available to the general public pursuant to *Section 508 of the Rehabilitation Act of 1973*.[51]

When determining data retention, data quality should be a major factor. The data should accurately represent the research project; have consistently defined data elements; be within acceptable ranges defined by the project; be provided to WYDOT in a timely manner; and be easily accessible, understandable and usable. The Principle Investigator will be required to provide clean data and data logs for any outliers.

Retention policies for all data, datasets, and other documents are approved by the WYDOT Records Department and the Attorney General's office, with recommendations from the Principle Investigator and the Research Center. At a minimum, all data, datasets, and documents generated from the project must be retained for three years. All other time limits shall be jointly determined by the Research Center and Principle Investigator.

If any data is deemed confidential or sensitive, it shall be retained in a secure storage center which adheres to the guidelines set out in HITECH and/or HIPAA, and shall only be retained as long as necessary. All sensitive and confidential data shall be disposed of in a manner that complies with either HIPAA or HITECH.

12.14 Embargo Periods

The Principle Investigator shall be allowed to maintain the data without releasing it to the public for a stated period not to exceed 1 year. This is known as an embargo period. On a case-by-case basis, the Research Center and Principle Investigator will entertain requests from outside sources for the release of data within the embargo period. Clear and convincing evidence of the need for the data must be presented to the Research Center in order to request copies of the data during the embargo period.

12.15 Ethics and Privacy

Principle Investigator, Project Champion and the Research Center must ensure ethics requirements, and data privacy rules and regulations are followed when working on research projects. All information gathering rules regarding date, datasets, software, etc must be

[51] https://www.fcc.gov/general/section-508-rehabilitation-act

followed. Though data gathered for these research projects should be transparent, this does not mean the rules for confidentiality and privacy should be ignored. If the project gathers data that is considered personal health information (PHI), personally identifiably information (PII), or sensitive material, precautions must be in place prior to beginning the project, and HIPAA and HITECH guidelines must be followed. Further, all legal permissions must be obtained and property storage must be acquired. Informed consent forms must be retained for the life of the data. Internal Review Boards may be necessary for any project where PHI, PII or sensitive materials are involved.

All individuals who will have access to any confidential and/or sensitive information must receive training on privacy, security, safeguards, encryption, breach notifications and mitigation procedures. Safeguards must be in place to ensure no unauthorized user has access to the data, and authorized users must use secure passwords to access confidential and sensitive data. The Principle Investigator must set out policies on how to identify the identity of all users.

12.16 Budget

Data storage shall be determined on a case-by-case basis. Data may be stored by the Principle Investigator, Project Champion, the Research Center, or an approved outside repository. The length of time for retention, the need for the data on a daily basis, and the type of data will dictate where the data is retained, and as such, the cost of storing the data. The entity which stores the data shall be responsible to keep the data operational and available, and for the cost of storage.

12.17 Digital Object Identifier (DOI), Open Research, and Contributor ID (ORCID)

Prior to publishing any paper or report using data or conclusions drawn from a research project, the Principle Investigator(s) must work with the Research Center to ensure that there is no duplication or conflicts with digital object identifiers. Derivative copies of reports from funded research projects must be provided to the Research Center with the reports DOI.

Principle Investigator and authors named on any report or paper must register for an ORCHID number at http://orcid.org/ prior to publishing any work that is derived from a research project. This number helps distinguish researchers who have similar names and allows Principle Investigator to attach their work to other works. The ORCID registry is available free.

12.18 Data Citation Index

Principle Investigator are required to provide the Research Center with a data citation index (Index). The Index should include all data gathered and datasets built during the life of the project. This will enable the Principle Investigator, Program Champion(s) and the Research

Manager to easily access the data and/or datasets. It will also enable the Research Center to better archive the data. The Index should include an attribution for the data object to the persons and/or institutes creating the data, and a standard form of citation for each piece of data.

12.19 Annual review of data management plan template

During the October RAC meeting, the Research Center will provide the RAC with an updated data management plan to be reviewed. Changes and comments to the plan will be discussed during the January RAC meeting each year.

12.20 Annual Review of Project Specific Data Management Plans, Data Clean Up, Scrubbing

The Principle Investigator and Project Champion shall meet yearly to discuss changes in the original and any revised DMPs. If there are any changes to the DMP, the Principle Investigator shall provide the Research Center with a copy of the revisions. The Principle Investigator shall be responsible for detecting, removing, and/or correcting dirty data (i.e. data that is incorrect, out of data, redundant, incomplete, or formatted incorrectly). Data cleansing allows for consistency in the data and can include data auditing, workflow specification, workflow execution, and post-processing and control.

12.21 Licensing

Terms and conditions for software, codes, and data are essential to ensure ownership and rights. All research projects, which are funded specifically for building or the maintenance of software, codes and some other types of database, must have a license attached to the report before the software is made publically available. All licenses must:

- Have full attribution for the Principle Investigator, WYDOT and FHWA.
- Must be open source.
- Must be considered copyleft.
- Must be for non-commercial purposes.
- Must be approved by WYDOT prior to finalizing.

The best form of license to use is a General Public License (GNU).[52] When attaching the license, a copy must be attached to the research report as an appendix. For all electronic copies of the data and/or software, there must be a rights statement that appears prior to the stakeholder obtaining the data and/or software. Rights statements are very short and usually state that the database and/or software is made available under the license number "X", which text can be found at (specific location).

[52] http://www.gnu.org/licenses/gpl-3.0.en.html

APPENDICES

1 Progress Report Template
2 Data Management Plan Template
3 Metadata Schema for Research Projects
4 Data Dictionary
5 Proposal Checklist Template for RAC Members
6 Research Project Feedback Form Template
7 WYDOT Research Project Evaluation Phase 1 Template
8 WYDOT Research Project Evaluation Phase 2 Template
9 Library Research Request Form Template

Appendix 1 Progress Report Template

<table>
<tr><td colspan="3">Project Title:</td><td colspan="2">WYDOT Project Number:</td><td>Period:
From:
To:</td></tr>
<tr><td colspan="3">Research Agency:
Wyoming Department of Transportation
5300 Bishop Blvd., Cheyenne, WY 82009-3340
WYDOT Research Center 307.777.4182</td><td colspan="2">Organizations and or collaborators who have been involved with this project.</td><td>Report Type
[] Quarterly
[] Interim</td></tr>
<tr><td colspan="3">Principal Investigator and all other individuals who have worked on the project (include ORCID number for each):</td><td colspan="2">Percent Overall Work Complete</td><td>[] Ahead of Schedule
[] On Schedule
[] Behind Schedule</td></tr>
<tr><td>Start Date</td><td>Comp. Date</td><td>Contract Days</td><td>Days Elapsed</td><td>Percent Time Used</td><td rowspan="3">Prepared By:</td></tr>
<tr><td colspan="2">Funds Authorized</td><td colspan="3">Funds Expended</td></tr>
<tr><td>Total Project:</td><td>Current FY:</td><td>Total Project:</td><td>Current FY:</td><td>Quarterly:</td></tr>
</table>

Activities and Accomplishments: The information provided in this section allows WYDOT to assess whether satisfactory progress has been made during the reporting period. Please be as detailed as possible, but try to keep your report to three to four pages in length, if possible.

1. What are the major goals and objectives of the project?
   List major goals, milestones, target dates for important activities or phases of the project. Show actual completion dates or the percentage of completion. If goals have been revised from the last reporting period, list the revised goals and objectives.

2. Describe what was accomplished under these goals.
   a) Major activities.
   b) Specific objectives.
   c) Significant results (both positive and negative).
   d) Key outcomes and other achievements.
   e) Goals not met.

3. What opportunities for training and professional development has the project provided?
   If the research is not intended to provide training and professional development, state "Nothing to Report". Otherwise, describe opportunities for training and professional development, training activities, and professional development.

4. How have the results been disseminated to communities of interest?
   Describe what results have been disseminated and in what manner, including publications, conference papers, and presentation.

5. What do you plan to do during the next reporting period to accomplish the goals and objectives? Describe briefly what you plan to do during the next reporting period to accomplish the goals and objectives.

6. List any products resulting from the project during the reporting period. Include in this list:
   a) Publications, conference papers, and presentations.
   b) Website(s) or other internet sites (List the URL).
   c) Technologies or techniques.
   d) Inventions, patent applications, and/or licenses.
   e) Other products, such as data or databases, physical collections, audio or video products, software or NetWare, models, educational aids or curricula, instruments or equipment.

7. Impact:
   a) How will this project impact WYDOT?
   b) How will this project impact other agencies?

8. Changes to Scope of Work. Provide the following changes, if applicable:
   a) Scope of work or objectives of the project.
   b) Changes in key persons.
   c) Disengagement from the project for more than three (3) months, or a twenty five (25) percent reduction in time devoted to the project.
   d) The inclusion of costs that require prior approval.
   e) The transfer of funds between line items in the budget.
   f) The subawarding, transferring or contracting of work.
   g) Changes in the approved cost sharing or match.

Signed : Date:

Appendix 2 Data Management Plan

Name of Contractor	
Name of project	
Project Duration	**Start date :** **End:**
DMP Version	
Date Amended, if any	
Name of all authors, and ORCID number for each author	
WYDOT Project Number	
Name of all peer reviewed publications which have been generated using data from this project	
Any Digital Object Identifier (DOI), including any CROSSREF number, which has been assigned to any peer reviewed publication or data generated by this project	
URLs for all peer reviewed publications which have been generated using data from this project	
RiP RH Display ID Number	
Dataset URL, if available	

What constitutes data will be determined by the Principle Investigator, Project Champion, and the Research Manager. In general, your plan should address final research data. This includes recorded factual material commonly accepted in the scientific community as necessary to validate research findings. Final research data do not include laboratory notebooks, partial datasets, preliminary analyses, drafts of scientific papers, plans for future research, peer review reports, communications with colleagues, or physical objects, such as gels or laboratory specimens. See Chapter 12, subsections 12.2 and 12.3 for full details on what data to retain. As part of your research, you may also generate unique data, which are data that cannot be readily replicated. Your DMP should also address unique data that may arise from your research.

WYDOT expects the timely release and sharing of data to be no later than the acceptance for publication of the main findings from the final dataset, unless the Principle Investigator will be embargoing the data. In such a case, the data cannot be embargoed for a period longer than twelve (12) months. See Chapter 12, subsection 12.13 and 12.14 for information on retention and embargos.

1. Introduction

The purpose of this research project is to:

2. Definitions

a. Code or scripts include code used in the collection, manipulation, processing, analysis or visualization of data, but may also include software developed for other purposes.

b. Copyright is a set of legal rights extended to copyright owners that govern such activities as reproducing, distributing, adapting, or exhibiting original works fixed in tangible forms.

c. Data means the recorded factual material commonly accepted in the scientific community as necessary to validate research findings, but not any of the following: preliminary analyses, drafts of scientific papers, plans for future research, peer reviews, communications with colleagues. Recorded material excludes physical objects (e.g. laboratory samples). Research data also does not include trade secrets, commercial information, materials necessary to be held confidential; and personnel and medical information and similar information the disclosure of which would constitute a clearly unwarranted invasion of personal privacy.

d. Data Archive is a site where machine-readable materials are stored, preserved or possibly redistributed to individuals interested in the materials.

e. Data Management Plan is a document that specifies your plans for managing your data and files for a research project.

f. Dataset means collection of data.

g. Metadata refers to structured data about data that helps define administrative, technical, or structural characteristics of the digital content.

3. Data Types and Storage

The types of data and/or datasets generated and/or used in this project include …

Provide a description of the data that you will be gathering in the course of your project. You should address the nature, scope, and scale of the data that will be collected. Describe the characteristics of the data, their relationship to other data, and provide sufficient detail so that reviewers will understand any disclosure risks that may apply. Discuss value of the data over the long-term. Please provide the name of all repositories where the data will be housed during the lifetime of the project.

Checklist

- o What type of data will be produced?
- o How will data be collected? In what formats?
- o How will the data collection be documented?
- o Will it be reproducible? What would happen if it got lost or became unusable later?
- o How much data will it be, and at what growth rate? How often will it change?
- o Are there tools or software needed to create/process/visualize the data?
- o Will you use pre-existing data? From where?
- o Storage and backup strategy?

4. Data Organization, Documentation and Metadata

The plan for organizing, documenting, and using descriptive metadata to assure quality control and reproducibility of these data include …

Your DMP should describe the anticipated formats that your data and related files will use. To the maximum extent practicable, and in accordance with generally accepted practices in your field, your DMP should address how you will use platform-independent and non-proprietary formats to ensure maximum utility of the data in the future. If you are unable to use platform-independent and non-proprietary formats, you should specify the standards and formats that will be used and the rationale for using those standards and formats.
NOTE: Attach the Metadata Schema, URL for data generated, and all peer reviewed publications from this project.

Checklist

- o What standards will be used for documentation and metadata?
- o Is there good project and data documentation format/standard?
- o What directory and file naming convention will be used?
- o What project and data identifiers will be assigned?
- o Is there a community standard for metadata sharing/integration?

5. Data and/or Database Access and Intellectual Property

What access and ownership concerns are there…

Protecting research participants and guarding against the disclosure of identities and/or confidential business information is an essential norm in scientific research. Your DMP should address these issues and outline the efforts you will take to provide informed consent statements to participants, the steps you will take the protect privacy and confidentiality prior to archiving your data, and any additional concerns. If necessary, describe any division of responsibilities for stewarding and protecting the data among Principal Investigators.

If you will not be able to deidentify the data in a manner that protects privacy and confidentiality while maintaining the utility of the dataset, you should describe the necessary restrictions on access and use. In general, in matters of human subject research, your DMP should describe how your informed consent forms will permit sharing with the research community and whether additional steps, such as an Institutional Review Board (IRB), may be used to protect privacy and confidentiality.

Checklist

- o What steps will be taken to protect privacy, security, confidentiality, intellectual property or other rights?
- o Does your data have any access concerns? Describe the process someone would take to access your data.
- o Who controls it (e.g., PI, student, lab, University, funder) ?
- o Any special privacy or security requirements (e.g., personal data, high-security data) ?
- o Any embargo periods to uphold?

6. Data Sharing and Reuse

The data will be released for sharing in the following way …

Describe who will hold the intellectual property rights for the data created by your project. Describe whether you will transfer those rights to a data archive, if appropriate. Identify whether any copyrights apply to the data, as might be the case when using copyrighted instruments. If you will be enforcing terms of use or a requirement for data citation through a license, indicate as much in your DMP. Describe any other legal requirements that might need to be addressed.

Checklist

- o If you allow others to reuse your data, how will the data be discovered and, shared?
- o Any sharing requirements (e.g., funder data sharing policy) ?
- o Audience for reuse? Who will use it now? Who will use it later?
- o When will I publish it and where?
- o Tools/software needed to work with data?

7. Data Preservation and Archiving

The data will be preserved and archived in the following ways …

Describe how you intend to archive your data and why you have chosen that particular option. You may select from a variety of options including, but not limited to:

- Use of an institutional repository.
- Use of an archive or other community-accepted data storage facility.
- Self-dissemination.

You must describe the dataset that is being archived with a minimum amount of metadata that ensures its discoverability. Whatever archive option you choose, that archive must support the capture and provision of the National Transportation Library metadata requirements. In addition, the archive you choose must support the creation and maintenance of persistent identifiers and must provide for maintenance of those identifiers throughout the preservation lifecycle of the data. Your plan should address how your archiving and preservation choices meet these requirements.

Checklist

- How will the data be archived for preservation and long-term access?
- How long should it be retained (e.g., 3-5 years, 10-20 years, permanently) ?
- What file formats? Are they long-lived?
- Are there data archives that my data is appropriate for (subject-based? Or institutional)?
- Who will maintain my data for the long-term?

NOTE:

Researchers evaluating data repositories as the option(s) for storing and preserving their data should examine evidence demonstrating that the repository:

a. Promotes an explicit mission of digital data archiving.
b. Ensures compliance with legal regulations, and maintains all applicable licenses covering data access and use, including, if applicable, mechanisms to protect privacy rights and maintain the confidentiality of respondents.
c. Has a documented plan for long-term preservation of its holdings.
d. Applies documented processes and procedures in managing data storage.
e. Performs archiving according to explicit workflows across the data life cycle.
f. Enables the users to discover and use the data, and refer to them in a persistent way through proper citation.
g. Enables reuse of data, ensuring appropriate formats and application of metadata.
h. Ensures the integrity and authenticity of the data.
i. Is adequately funded and staffed, and has a system of governance in place to support its mission.
j. Possesses a technical infrastructure that explicitly supports the tasks and functions described in internationally accepted archival standards like Open Archival Information System (OAIS).

Appendix 3 Metadata Schema

Title[53]	Human-readable name of the asset. Should be in plain English and include sufficient detail to facilitate search and discovery. A name given to the publication or data element. All substitute or alternative titles must have a different Metadata Transmittal Schema.
Creator/contact point	An entity/person(s) primarily responsible for making the content of the resource. Contact person's name, ORCID number, and email for the asset.
Publication Date(s)	The date associated with the final report/dataset.
Description/Abstract	Human-readable description (e.g., an abstract) with sufficient detail to enable a user to quickly understand whether the asset is of interest. May include abstract, table of contents, reference to a graphical representation of content or a free text account of the content.
Subject and Keywords	The topic of the content of the resource. Tags (or keywords) help users discover your dataset; please include terms that would be used by technical and non-technical users.
Identifier[54] **and/or source**	A unique identifier for the dataset/publication. Examples: URI, URL, DOI, ISNB, ISSN.
Collection and Related Documents	If there is a secondary dataset, cite source. The collection of which the dataset is a subset should be listed. Include all identifiers and/or sources.
Edition	Most recent date on which the dataset was changed, updated or modified.
Related Documents	Related documents such as technical information about a dataset, developer documentation, etc.
Coverage	Spatial location, temporal period, jurisdiction.
Language	The language of the dataset/publication.

[53] *To include alternate title; conference title; and journal title if they are different.*

[54] *To include record numbers; report numbers; NTIS number; TRIS Accession Number; OCLC Number; ISBN; ISSN; contract number; and DOI if available .*

Publisher/Distributor	FHWA and Wyoming Department of Transportation List all other publishing companies that this publication has been sent to.
Funding agency	FHWA and Wyoming Department of Transportation
Access Restrictions	The degree to which this dataset could be made publicly available, *regardless of whether it has been made available*. Choices: public (Data asset is or could be made publicly available to all without restrictions), restricted public (Data asset is available under certain use restrictions), or non-public (Data asset is not available to members of the public).
Intellectual Property and Other Rights	This may include information regarding access or restrictions based on privacy, security, or other policies. This should also serve as an explanation for the selected "accessLevel" including instructions for how to access a restricted file, if applicable, or explanation for why a "non-public" or "restricted public" data asset is not "public," if applicable.
License	The license or non-license (i.e. Public Domain) status with which the dataset or API has been published.
Code and software needs	List all code specific information. Is there specific software needed to run the database or data.
Format	The machine-readable file format. May include media type or dimensions. Used to determine the software, hardware or other equipment needed to display or operate the resources.
Choice of Repository	If you have a preference, list the repository where you will archive your data/datasets.

NOTE: Each separate report, dataset, collection, existing collection, and software developed must have its own table. All fields in this Schema must be completed at the time of the final report.

Appendix 4 Data Dictionary

Archive
A site where machine-readable materials are stored, preserved, and possibly redistributed to individuals interested in using the materials.[55]

Balance Score Card (BSC)
Strategic planning and management system to align activities to the vision and strategy of the organization, improve communications, and monitor organization performance against strategic goals. The Research Center is linking research to WYDOT's Balanced Score Card.

Catalog
Collection of data and/or datasets.

Completion date
The termination data of the contract.

Copyright
A statutory right that grants creators (authors) certain exclusive rights in their creations for a legally established duration of time. [56]

Copyleft
A general method for making a program (or other work) free, and requiring all modified and extended versions of the program to be free as well.[57]

Creator
Person who creates or generates the data or dataset.

Data
The recorded factual material commonly accepted in the scientific community as necessary to validate research findings.

Data Archiving
The systematic retention and re-use of transportation data that is typically collected to fulfill real-time transportation operation and management needs. Data archiving is also referred to as data warehousing or operations data archiving. Transportation operations and their respective sensors and detectors, and other data collection processes, are a potentially rich and detailed source of data about transportation system performance and characteristics. (Note: Insert the phrase "and other data collection processes" to address private-sector data collection.) [58]

[55] https://www.lib.umn.edu/dp/glossary
[56] https://www.lib.umn.edu/dp/glossary
[57] http://www.gnu.org/copyleft/copyleft.en.html
[58] http://onlinepubs.trb.org/onlinepubs/circulars/ec166.pdf

Data Management
The development, execution, and oversight of architectures, policies, practices, and procedures to manage the information lifecycle needs of an enterprise in an effective manner as it pertains to data collection, storage, security, data inventory, analysis, quality control, reporting and visualization.[59,60]

Data Owner
A Data Owner is the authority, individual, or organization having legal rights to specified data. The legal rights of a Data Owner include their personal information, copyright and intellectual property rights, as well as the rights to exploit and/or destroy the data. The rights of the Data Owner apply even when the owned data is collected by a third party and/or combined with data owned by others. [61]

Data Set
A collection of data presented in tabular or non-tabular form.[62]

Digital Object
An object composed of a set of bit sequences.[63]

Digital Object Identifier
A digital object identifier (DOI) is a unique alphanumeric string assigned by a registration agency (the International DOI Foundation) to identify content and provide a persistent link to its location on the Internet. The publisher assigns a DOI when an article is published and made available electronically. All DOI numbers begin with a *10* and contain a prefix and a suffix separated by a slash. The prefix is a unique number of four or more digits assigned to organizations; the suffix is assigned by the publisher and was designed to be flexible with publisher identification standards.[64]

Digital Preservation
All the activities undertaken to ensure that the digital content is maintained in usable formats and can be made available in meaningful ways for current and future uses over time.

Intellectual property rights (IPR)
Conceptual property that has commercial value, including copyrighted or trademarked property such as literary or artistic works or information such as patents, business methods, or industrial processes. [65]

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[59] Vandervalk, A., D. Snyder, and J.K. Hajek. U.S. DOT Roadway Transportation Data Business Plan (Phase 1). Publication FHWA-JPO-13-084. FHWA 2013, p. 38.
[60] *NCHRP 666, Volume II: Guide for Target-Setting and Data Management,* Chapter 2: Guide for Data Management, p. II-31
[61] WYO ETS
[62] M-13-13
[63] https://www.lib.umn.edu/dp/glossary
[64] http://www.apastyle.org/learn/faqs/what-is-doi.aspx
[65] WYO ETS

Metadata
Data about other data. Preservation metadata Implementation Strategies (PREMIS) data dictionary is a metadata dictionary developed for preservation.[66] Describes characteristics or attributes of data. Metadata provides relevant information about the data.

Metadata: Preservation
The contextual information necessary to carry out, document, and evaluate the processes that support the long-term retention and accessibility of digital content. Preservation metadata documents the technical processes associated with preservation (*Migration/Refreshing*), specifies rights management information, establishes the authenticity of digital content, and records the chain of custody and provenance for a digital object.[67]

Metadata: Rights Management
Administrative metadata that indicates the copyrights, user restrictions, and license agreements that might constrain the end-use of digital content (including metadata files). [68]

Metadata: Structural
Information that provides information on how the digital object is organized or how compound objects are put together or related. This may include the page or chapter order of a book, its table of contents or indexes. Structural metadata is often used by software programs. [69]

Non-disclosure Agreement (NDA)
A legal contract that outlines confidential materials or knowledge that the parties wish to share with one another for certain purposes, but restrict from other use without proper authorization. It is a contract through which the parties agree not to disclose information covered by the agreement. [70]

ORCID
ORCID provides a persistent digital identifier that distinguishes you from every other researcher and, through integration in key research workflows such as manuscript and grant submission, supports automated linkages between you and your professional activities ensuring that your work is recognized.[71]

Open Data
Publically available data structured in a way that enable the data to be fully discoverable and usable by end users.[72]

[66] http://www.loc.gov/standards/premis/
[67] https://www.lib.umn.edu/dp/glossary
[68] https://www.lib.umn.edu/dp/glossary
[69] https://www.lib.umn.edu/dp/glossary
[70] WYO ETS
[71] http://orcid.org/
[72] M-13-13

Open Source
Open source refers to software in which the source code is available to the general public for use and/or modification from its original design. Open source code is typically created as a collaborative effort in which programmers improve upon the code and share the changes within the community.[73]

Retention Schedule
A list classifying public records by type and detailing the life cycle of these records, including the length of time records must be retained by the agency, and their eventual disposition. [74]

Rights Owner
An individual, group, or organization that holds intellectual property rights to specific digital resource(s). See also: *Copyright*. [75]

Start Date
The date that the contract went into effect.

Wyoming Public Records Act
Sections 16-4-201 through 205 of Wyoming statutes that define what constitutes a public record and details the responsibility for protection and disposition of those records. [76]

[73] https://www.lib.umn.edu/dp/glossary
[74] WYO ETS
[75] https://www.lib.umn.edu/dp/glossary
[76] WYO ETS

Appendix 5 Proposal Checklist for RAC

The proposal checklist will be completed be each sitting RAC member after review of the proposals and after hearing the presentation by the principal investigator. The below checklist is an example only. Checklist will be tailored to each proposal.

Proposal Checklist for RAC Members
Proposal Name: _____
Amount Requested: _____
Number of Years Proposed: _____
Approval: ☐ Yes ☐ No

Proposal type:
Full: _____
Partial: _____
Literature Review: _____
Pooled Fund: _____
Extension Time/Funds: _____
NCHRP: _____
Proposal Score: _____
Proposal Ranking: _____
RAC Member: _____

PART I.

1. Is the proposed problem adequately defined and outlined?
☐ Yes ☐ No

2. Is the proposal important and beneficial to the Wyoming stakeholders and WYDOT?
☐ Yes ☐ No

3. Will the proposal have a positive long-term affect on WYDOT and the stakeholders, in other words, will the proposal provide a continuing, cooperative and comprehensive impact?
☐ Yes ☐ No

4. Can all significant barriers to implementation be overcome?
☐ Yes ☐ No

5. Is there a clearly defined and sufficient budget for the proposal?
☐ Yes ☐ No

If your answer to all questions above is no, do not continue forward.
PART II.

Criteria/ Output	Details	Points	Score Range Definitions			Total Points and Comments
	Details – What are the expected outcome measures, goals and performance measures for this project.		1-6	6 to 12	12 to 20	
Cost Benefit/Savings (cost savings or cost avoidance)	Does this project have a significant cost or performance savings or avoidance.	20	Minimal productivity / savings/ improvement	Division wide productivity / savings/ improvement	Statewide productivity/ savings/ improvement	
Safety	Will this project enhance, benefit, or improve safety (which could include avoiding hurt, injury or loss; risk; and manners in which to keep the public safe).	20	Increase safety in one area	Increase safety in multiple areas	Increase safety across WYDOT and the State	
New engineering knowledge or methodology implemented	Will this project provide new engineering knowledge or implement a new methodology?	20	Does not propose new engineering knowledge or methodologies	Moderately changes existing knowledge or methodologies	Changes existing knowledge or methodologies	
State of Good Repair	Ensure WYDOT Proactively Maintains Critical Transportation Infrastructure in a State of Good Repair.	20	Does not provide for maintenance of critical transportation infrastructure.	Moderately provides for maintenance of critical transportation infrastructure.	Significantly assists WYDOT in the maintenance of critical transportation infrastruct	

					ure.	
Positive Impact on Environment/Environmental Sustainability	To what extent does this project have a positive impact on the environment?	20	Does not impact	Improves some relations	Totally improves relations	
TOTALS						

PART III. Implementation

1. Could the results from this project be implemented immediately?
2. Whose responsibility would it be to implement this project?

Appendix 6 Research Project Feedback Form Template

This form should be finalized within 3 months after the final report is published.

Researcher Feedback Form

Researcher: _____
Organization: _____
Project Title: _____
_____
WYDOT Sponsor: _____
Survey Date: _____

Proposal Process	Rate your satisfaction with the proposal process:	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied
	What did you like about the proposal process?	
	What did you dislike about the proposal process?	
Research Program Staff	Rate your satisfaction with the Research program staff:	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied
	As a researcher, what suggestions can you provide to improve the management and administration of the program?	
Project Sponsor	Rate your satisfaction with the Research program staff:	☐ Very Satisfied ☐ Satisfied ☐ Dissatisfied
	What suggestions can you provide to improve the interaction with the program sponsor?	

Lessons Learned	Briefly, what are the three most important and transferrable lessons learned from this project? 1. 2. 3.	
Follow-up Research	Is follow-up research warranted?	☐ Yes ☐ No
	If yes, please explain why:	
Continuous Improvement	Please provide other suggestions to improve the Research program.	

Appendix 7 WYDOT Research Project Evaluation Template Phase 1

This evaluation shall be completed nine months after the final report is published.

/YDOT Research Project Evaulation - Phase 1

Project I.D.: _____

Date: _____ WYDOT Program: _____

Principal Investigator: _____ WYDOT Sponsor: _____

* This form is to be completed immediately at the end of a research project, select one corresponding box for each question.

1) Were all of the proposed objectives of the research project fulfilled?

- ☐ All objectives were fulfilled.
- ☐ Some objectives were fulfilled.
- ☐ No objectives were fulfilled.

2) Expected Level of implementation with in WYDOT.

- ☐ Full Implementation.
- ☐ Partial Implementation.
- ☐ No Implementation.
- ☐ Results do not recommend implementation.

3) External technology transfer.

- ☐ Any National, Regional, or Local presentations, publications, etc.
- ☐ No external technology transfer.

4) Internal technology transfer.

- ☐ Presentations created and used by the Research Center or relevant departments within WYDOT.
- ☐ No internal technology transfer.

5) Was a research report created?

- ☐ A professional and concise research report was created, meeting WYDOT's expectations.
- ☐ No research report was created or an inadequate research report was submitted.

6) Was the research project completed within its proposed timeline?

- ☐ The project was completed within its proposed timeline or within approved extensions.
- ☐ The project was completed within one month of its proposed timeline.
- ☐ The project was completed after one month of its proposed timeline, or the project was not completed.

7) Was the research project completed within its proposed budget?

- ☐ The project was completed within its proposed budget or within an approved funding increase.
- ☐ The project was not completed within its budget.

8) Was the Researcher Feedback Form completed?

- ☐ Yes
- ☐ No

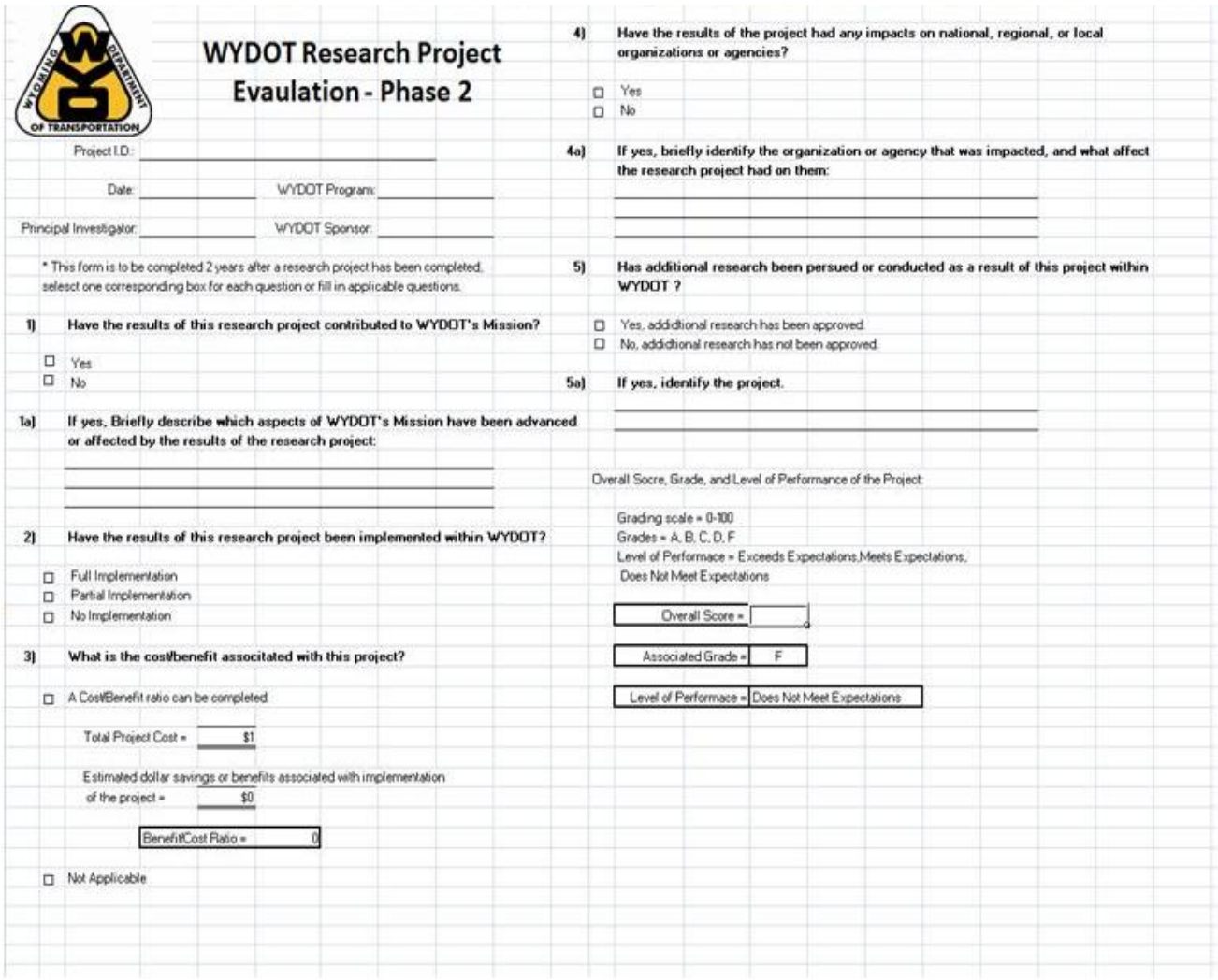
Overall Socre, Grade, and Level of Performance of the Project:

Grading scale = 0-100
Grades = A, B, C, D, F
Level of Performace = Exceeds Expectations,Meets Expectations, Does Not Meet Expectations

Overall Score =	
Associated Grade =	F
Level of Performace =	Does Not Meet Expectations

Appendix 8 WYDOT Research Project Evaluation Template Phase 2

This evaluation shall be completed three years after the final report is published.



WYDOT Research Project Evaulation - Phase 2

Project I.D.: _____

Date: _____ WYDOT Program: _____

Principal Investigator: _____ WYDOT Sponsor: _____

* This form is to be completed 2 years after a research project has been completed. selesct one corresponding box for each question or fill in applicable questions.

1) Have the results of this research project contributed to WYDOT's Mission?

- ☐ Yes
- ☐ No

1a) If yes, Briefly describe which aspects of WYDOT's Mission have been advanced or affected by the results of the research project:

_____

_____

_____

2) Have the results of this research project been implemented within WYDOT?

- ☐ Full Implementation
- ☐ Partial Implementation
- ☐ No Implementation

3) What is the cost/benefit associated with this project?

- ☐ A Cost/Benefit ratio can be completed

Total Project Cost = $1

Estimated dollar savings or benefits associated with implementation of the project = $0

Benefit/Cost Ratio = 0

- ☐ Not Applicable

4) Have the results of the project had any impacts on national, regional, or local organizations or agencies?

- ☐ Yes
- ☐ No

4a) If yes, briefly identify the organization or agency that was impacted, and what affect the research project had on them:

_____

_____

_____

5) Has additional research been persued or conducted as a result of this project within WYDOT ?

- ☐ Yes, addidtional research has been approved.
- ☐ No, addidtional research has not been approved.

5a) If yes, identify the project.

_____

_____

Overall Socre, Grade, and Level of Performance of the Project:

Grading scale = 0-100
Grades = A, B, C, D, F
Level of Performace = Exceeds Expectations,Meets Expectations, Does Not Meet Expectations

Overall Score = _____

Associated Grade = F

Level of Performace = Does Not Meet Expectations

Appendix 9 Library Research Request Form Template

Name and Contact information:
Problem Statement: Aspects of the problem that are significant. How the problem adversely affects transportation facilities or services. The most pertinent findings from any literature review already conducted.
Keywords:
Time frame:

GLOSSARY OF TERMS

ADMINISTRATIVE TERMS, DEFINITIONS AND ORGANIZATIONS ASSOCIATED WITH THE RESEARCH CENTER AND RESEARCH LIBRARY

Airport Cooperative Research Program (ACRP)
ACRP is an industry-driven, applied research program that develops near-term, practical solutions to problems faced by airport operators. ACRP is managed by the Transportation Research Board (TRB) and sponsored by the Federal Aviation Administration (FAA). http://www.trb.org/ACRP/ACRP.aspx

American Association of State Highway and Transportation Officials (AASHTO)
AASHTO works to educate the public and key decision makers about the critical role that transportation plays in securing a good quality of life and sound economy for our nation. Representing all 50 states, the District of Columbia, and Puerto Rico, AASHTO serves as a liaison between state departments of transportation and the Federal government. AASHTO is an international leader in setting technical standards for all phases of highway system development. Standards are issued for design, construction of highways and bridges, materials, and many other technical areas. One of the important standing committees that directly influences national research objectives is the AASHTO Standing Committee on Research. http://www.transportation.org/Pages/default.aspx

Annual Research and Development Work Program
The Annual Research and Development Work Program (Work Program) is a detailed yearly budget for the Research Center, which is mandated by the *Planning and Research Program Administration Federal Rules* (*23 C.F.R., Part 420.111(a)),* and which includes a description of proposed work programs and costs, and must summarize all funding as follows: a) federal share by type; b) matching rate by type; c) state and/or local matching share; and d) other state or local funds. See also *23 C.F.R. Part 420.111(b)(1).*

Applied Research
The study of phenomena relating to gained knowledge or understanding necessary for determining the means by which a recognized need may be met; the primary purpose of this kind of research is to answer or solve a problem. *23 C.F.R. Part 420.203.*

Asset Management
A strategic and systematic process of operating, maintaining and improving physical assets, with a focus on both engineering and economic analysis based upon quality information, to identify structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the life cycle of assets at a minimum practicable cost. *MAP-21, Pub. Law 112-141 – July 6, 2012 – 126 STAT. 419, Sec. §1103.*

Basic Research
The study of phenomena and of observable facts, without specific applications towards processes or products in mind; the primary purpose of this kind of research is to increase knowledge. *MAP-21, Pub. Law 112-141 – July 6, 2012 – 126 STAT. 419, Sec. §1103.*

Consultation Services
Consultants refer to engineering firms, architectural firms, surveying firms, educational institutions, and other firms or individuals engaged in providing consulting or other professional services. The term architectural and engineering services in this context means professional services or an architectural or engineering nature performed by contract that are associated with research, planning, development, design, construction, alteration, or repair of real property. WYDOT Engineering Services is responsible for administering all consultant services and agreements except those for research contracts sponsored by the RAC.

Demonstration Project
A formal research project that is conceived to apply specific research results to an actual highway construction project, maintenance operation, or operating procedure. This type of project is intended to demonstrate the value and applicability of specific research results. This type of project may include experimental evaluation projects, applied demonstrations, implementation projects, and operational tests. As with all research projects using state planning and research (SP&R) funding, demonstration projects also require the designation of a WYDOT Representative to supervise the project.

Exploratory Advanced Research
Research that falls under this category is usually long term, higher risk research with potentially dramatic breakthroughs for improving the durability, efficiency, environmental impact, productivity, and safety aspects of highway and inter-modal transportation systems. *23 U.S.C. §502(e).*

Federal Highway Administration (FHWA)
The Federal Highway Administration (FHWA) is an agency within the U.S. Department of Transportation that supports state and local governments in the design, construction, and maintenance of the nation's highway system (Federal Aid Highway Program) and various federally and tribal owned lands (Federal Lands Highway Program). Through financial and technical assistance to state and local governments, FHWA is responsible for ensuring that America's roads and highways continue to be among the safest and most technologically sound in the world. FHWA is headquartered in Washington, D.C., with field offices across the United States. , including the Wyoming field office in Cheyenne, Wyoming. http://www.fhwa.dot.gov/.

The FHWA performs its mission through two main programs: 1) The Federal-Aid Highway Program, which provides Federal financial assistance to the States to construct and improve the national highway system, urban and rural roads, and bridges; and 2) the Federal Lands Highway

program, which provides access to and within national forests, national parks, Indian reservations and other public lands. To support these program areas, FHWA conducts and manages a comprehensive research, development, and technology program.

Final Report
A report documenting a completed RD&T study or activity.[77] See Chapter 9 for full details on the final report.

Fiscal Year WYDOT
A twelve-month period beginning on October 1 each year and ending on September 30 of the following year.

Hazardous Materials Cooperative Research Program (HMCRP)
HMCRP conducts research intended to advance current knowledge and practice relating to hazardous materials transportation.

In-House Research Project
A formal type of study undertaken by a WYDOT program, generally without the contracted aid of an outside investigator.

Local Technical Assistance Program (LTAP)
A national network of technology transfer centers that provides training, technical information, workshops, problem solving assistance, newsletters, video libraries, etc. to local city and county agencies in an effort to improve safety and efficiency.[78] LTAP and Tribal Technical Assistance Program (TTAP) are composed of a network of 58 Centers – one in every state, Puerto Rico and the regional centers serving tribal governments. The LTAP/TTAP Centers enable local counties, parishes, townships, cities and towns to improve their roads and bridges by supplying them with a variety of training programs, an information clearinghouse, new and existing technology updates, personalized technical assistance and newsletters. http://www.ltap.org/.

National Cooperative Freight Research Program (NCFRP)
National Cooperative Freight Research Program (NCFRP) is sponsored by the US Department of Transportation's Research and Innovative Technology Administration (RITA) and managed by the National Academies, acting through its Transportation Research Board (TRB). NCFRP carries out applied research on problems facing the freight industry that are not being adequately addressed by existing research programs. http://www.trb.org/NCFRP/NCFRP.aspx.

National Cooperative Highway Research Program (NCHRP)
This research program is sponsored by the state departments of transportation and the Federal Highway Administration. NCHRP is administered through the National Academy of Sciences'

[77] *23 C.F.R., Part 420.203*.
[78] *23 C.F.R. §504(b).*

Transportation Research Board (TRB). Funds are provided to support this program through an annual agreement allocation devised by the AASHTO and FHWA. The annual agreement currently requires that each state department of transportation contribute five and one-half percent of its total Federal SP&R appointment. The AASHTO Board of Directors has the prerogative to set or adjust this apportionment rate. http://www.trb.org/NCHRP/NCHRP.aspx.

National Research Advisory Committee (National RAC)
The RAC to the AASHTO Standing Committee on Research supports the activities of SCOR and is committed to a proactive committee promoting quality and excellence in research and in the application of research findings to improve state transportation systems. Each AASHTO Member Department is represented on RAC.
http://research.transportation.org/Pages/AboutSCORandRAC.aspx

Peer Exchange
A review conducted periodically (generally every three years) with the assistance of other state research managers as an aid to help maintain conformance with Federal requirements regarding the management of the SP&R research program. The purpose of the peer exchange is to review processes currently in place, share WYDOT's successes, and to exchange information on how these processes could be improved. *23 C.F.R .Part 420.203.*

Performance Based Research
All surface transportation research and development projects shall include a component of performance measurement and evaluation and shall be outcome-based. *23 U.S.C. §502(a)(7).*

Pooled Fund
Cooperative funding of a research project by two or more state and/or federal highway agencies, and possibly other entities. A study is given pooled fund designation by FHWA. http://www.pooledfund.org/. See Chapter 8 for full details on Pooled Funds.

Pre-Proposal
The intent of the pre-proposal is to give the presenter a feeling of the RAC's opinion on the merits of investigating the problem through a research project, without consuming a large amount of time or effort. See Chapter 9 for full details on pre-proposals.

Principal Investigator (PI)
The lead researcher who is responsible for the technical direction of the work. Because the PI is expected to have the primary responsibility, he/she is expected to be available and actively involved in the research efforts for the full contract period. Principal investigators are approved by the Research Advisory Committee (RAC).

Project Authorization
Authorization to proceed letter which, when forwarded to the principle investigator by the State Research Manager, authorizes the research project to begin. This letter can only be sent after

proper legal instruments have been signed by WYDOT's legal staff, WYDOT's Executive Staff, the contractor, and funding approval is received from FHWA and WYDOT's budget office.

Project Budget.
That portion of a research proposal that depicts the total funds required for work accomplishment over an entire study's duration. The budget is divided into line items that depict both direct costs and indirect costs, and is subdivided by fiscal years. For information on budgets see 2 C.F.R. 200 *et seq.*

Direct Costs
Elements of a budget which include salaries, wages, fringe benefits, supplies, materials, travel, expendable equipment, non-expendable equipment, equipment rental, laboratory use fees, and data processing expenditures.

Indirect Costs
Elements of a budget which cover clerical, accounting, bookkeeping, procurement, and other administrative services for which no charge is identified or allowable elsewhere in the direct costs. Indirect Costs are also referred to as overhead. Indirect costs also cover university administrative costs for research projects sponsored by WYDOT.
See Chapter 7 for full details on Budgets.

Project Champion
A WYDOT employee who voluntarily or by assignment assists the principle investigator in assuring the research project remains within budget, that the research project remains on track, answers technical and other questions the principle investigator may have, and addresses any changes in scope of work, key personnel, and disengagement from a project for more than three months. The Project Champion further updates the Research Manager to any changes. The Project Champion also is tasked with assisting with the implementation process for the research project.

Proposal
A proposal is a systematic controlled inquiry involving analytical and experimental activities that primarily seek to increase the understanding of underlying phenomena. Both WYDOT employees and concerned stakeholders can submit proposals for review by the RAC. Proposals may be for statewide, regional or national projects. Requests for procurement are not used when preparing proposals and pre-proposals, and the format for submitting proposals is listed below in Chapter 9.

Research
A systematic controlled inquiry involving analytical and experimental activities that primarily seek to increase the understanding of underlying phenomena. Research can be basic or applied. *23 C.F.R .Part 420.203.*

Research Advisory Committee (RAC)
The RAC reviews, evaluates, and prioritizes all proposals and problem statements for WYDOT Research Center projects for which SP&R funding is required. *WYDOT Policy Number 4-1(II).* See Chapter 5 for details on the RAC duties.

Research, Development, and Technology Transfer (RD&TT)
This term encompasses all activities necessary to the generation, investigation, communication, and application of new or innovative transportation technologies. *23 U.S.C. §502(b).*

Research in Progress (RiP)
TRB online database of active transportation research projects. http://rip.trb.org/.

Strategic Highway Research Program 2 (SHRP II)
SHRPII's mission is to deliver efficient, practical solutions to plan, renew and operate the nation's highway network through the collaborative efforts of the FHWA, AASHTO, and TRB.

Stakeholder
Stakeholders can include states, metropolitan planning organizations, local governments, the private sector, researchers, research sponsors, and other affected parties, including public interest groups. *http://rip.trb.org/.* For the purpose of this document, the term stakeholder also includes WYDOT personnel.

Standing Committee on Research (SCOR)
AASHTO relies on SCOR to represent the Associations' interests in all research activities for all transportation modes. The Committee makes reports and recommendations on the National Cooperative Highway Research Program (NCHRP) and other activities to the AASHTO Board of Directors. http://research.transportation.org/Pages/default.aspx

State Research Project
A research project using 80 percent federal SP&R funding and a 20 percent state match. *23 U.S.C. §505(c).* State research projects generally do not involve participation by other states.

State Research and Development Engineer (also the State Programming Engineer)
The person responsible for the overall management of the Research Center. See Chapter 5 for details on State Research and Development Engineers.

State Research Manager
The person directly responsible for the workings of the WYDOT Research Center.
See Chapter 5 for details on State Research Manager.

Technology Transfer
Activities that lead to the adoption of a new technique or product by users and involve dissemination, demonstration, training, and other activities that leads to eventual implementation. *23 C.F.R .Part 420.203.*

Transit Cooperative Research Program (TCRP)
A national transit research program authorized in July 1992 and administered under the cooperative agreement by the National Academy of Sciences' Transportation Research Board, the Federal Transit Administration, and the Transit Development Corporation Incorporated. This program is funded by the Federal Transit Administration.
http://www.trb.org/TCRP/Public/TCRP.aspx.

Transportation Research Board (TRB)
A unit of the National Research Council (NRC). The NRC is a private, nonprofit institution that is the principal operating agency of the National Academy of Sciences and the National Academy of Engineering. TRB's mission is to promote innovation and progress in transportation by stimulating and conducting research, facilitating the dissemination of information, and encouraging the implementation of research results. http://www.trb.org/Main/Home.aspx.

Transportation Research Information Service (TRIS)
A database containing numerous records of published transportation research. TRIS Online is a collaborative effort between the Transportation Research Board, National Research Council, National Academies, the Bureau of Transportation Statistics, and U.S. Department of Transportation, and provides a public-domain, web-based version of the bibliographic database as a component of the National Transportation Library, and enhances transportation research , safety, and operations by sharing knowledge and information. http://www.tcrponline.org/.

University Transportation Centers (UTC)
Under the management of the U.S. Department of Transportation (USDOT) selected universities are chosen as international centers of transportation excellence and mandated to advance U.S. technology and expertise in the many disciplines comprising transportation through the mechanisms of education, research and technology transfer. http://www.rita.dot.gov/utc/home.

Work Program
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 sub-recipients with FHWA planning and research funds. *23 C.F.R. Part 420.103.*

WYDOT Executive Staff
Individuals authorized to oversee the workings of WYDOT. The Executive Staff is comprised of the Director, Chief Engineer, Aeronautics Administrator, Engineering and Planning Engineer, Highway Patrol Administrator, Support Services Administrator, and Technical Services Engineer.
http://www.dot.state.wy.us/wydot/administration/executive_staff/exec_staff_profile.

WYDOT Project Manager The Department of Transportation employee designated to oversee the conduct of a specific research project investigation. This individual has a direct interest in the outcome of the research project investigation. This designated employee shall be responsible for

the project from its approval date to the completion of all formal reporting, implementation, and technology transfer activities.

WYDOT Research Center (Center)
A program within the programming unit charged with administering research projects using SP&R funds. The Research Center manages over one million dollars in research projects annually; is set up to assist in research studies for WYDOT projects; and is federally mandated.[79] The Research Center tracks the progress of all research studies, progress reports, yearly reports and final reports to ensure that performance measures, outcomes, outputs, and cost benefit analysis measures are met when funding research studies. The Research Center also houses the WYDOT Research Center Library (Library) and monitors the available electronic libraries (E-Library).

[79] *23 U.S.C. §501, Research, Technology, and Education*; *23 U.S.C. §101 et. seq., Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA:LU); 23 C.F.R. Part 450.100, Planning Assistance and Standards; 23 C.F.R. Part 420, Planning and Research Program Administration; and Pub. L. 112-141, July 6-2012, 126 Stat. 405, Moving Ahead for Progress in the 21st Century Act (MAP-21)*