# MPC-633
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**Project Title**

A Feasibility Study for Establishing a Regional Road Track Pavement Testing Facility in Wyoming

**University**

University of Wyoming

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**Research Needs**

Road testing provides a logical method to test pavement materials and structures under actual traffic loading and environmental conditions. While transportation agencies are facing limited funding for road maintenance and construction, engineers are expected to effectively design and maintain roadways in the most cost-effective manners. Therefore, collecting performance-related information of pavement through a real-world experiment can provide useful information for different design methods and specifications. For decades, different experiments of road testing track have been conducted in several states, including Illinois, Minnesota, Nevada, and Alabama. Yet, no road track testing facility has been developed in the dry-freeze climatic region for regional research. The state of Wyoming presents a unique opportunity to be the home for a regional facility of road testing track due to several reasons. Wyoming's Interstate 80 is located in the heart of the dry freeze region with approximately traffic loads of 2 million Equivalent Single Axle Load (ESAL) per year. Such high traffic volumes can cause accumulated damage on test sections in a timely manner. This proposal identifies the feasibility of building a regional facility of road testing track on Wyoming's I-80. The proposal will determine the benefit cost values of the testing facility and identify potential experiments of cutting-edge investigations in pavement materials, design, construction, and management.

## Research Objectives

The main objective of this study is to evaluate the cost-effectiveness of constructing a state of the art pavement testing facility in Wyoming to conduct pavement research studies for the dry freeze climatic region. The following objectives are aimed to achieve:

- Identify effective framework of building a transportation infrastructure testing facility for the dry freeze climatic region in Wyoming.
- Define methods to share resources and expertise to expand the evaluation of pavement performance in the region.
- Document best practices of design, construction, and instrumentation of pavement test sections.
- Identify and prioritize the research needs currently urgent for the improvement of pavement performance in Wyoming and surrounding states.
- Determine the feasibility of the testing facility in terms of expected benefits and associated costs.

## Research Methods

The proposed testing facility requires a significant investment in infrastructure and management. Hence, the study will be divided into two phases where the first phase will focus only on the feasibility study to obtain sufficient relevant information for building and operating the regional testing facility. In this phase, a comprehensive literature search will be conducted to find key concepts of pavement testing facilities currently existed across the country. All potential stakeholders and partners will be defined and coordinated to present beneficial participation. In conjunction with the literature search, a survey will be sent out to all potential partners defined previously to secure feedback about the research interests and needs. The results from the survey are expected to measure the level of partners' interests for the different type of research studies recommended regionally. They will also define different buildings and equipment required for testing and operating the proposed road track in Wyoming. In addition, potential locations of the testing facility will be determined where the proposed regional facility should be located in a representative climatic zone with adequate right-of-way. In terms of design of experiments, all types of pavements, structures, and materials will be investigated to prioritize the research activities according to the scope of the regional research.

After collecting all relevant information, the costs associated with constructing and operating the testing facility will be secured to assess the benefit-cost impact of the proposed road track. A detailed life-cycle cost analysis will be conducted to estimate the present values of costs including initial construction and annual operating costs. Then, all potential benefits will be evaluated to determine if the regional facility is financially feasible. The results from the feasibility study are expected to provide informed decisions for the implementation of pavement testing of the regional facility in the second phase.

## Expected Outcomes

The feasibility study will measure the level of readiness for building and implementing the proposed road track pavement testing in Wyoming. The results from the feasibility study will provide reliable technical information for the proposed regional facility, as well as beneficial pavement testing research proposals. Eventually, more realistic pavement performance models

will be developed to enhance pavement maintenance and design methods. The study will also provide feasible opportunities for manufacture to investigate innovative materials and cutting-edge maintenance techniques using real-world evaluation and unbiased testing. Moreover, more benefits will be obtained from future research of other infrastructure experiments on the road track, including applications in Intelligent Transportation System (ITS), road safety features, pavement marking, traffic sign performance, and bridge management.

**Relevance to Strategic Goals**

This project is anticipated to enhance the maintenance activities of pavement and other transportation infrastructure in a state of good repair. The key adjustments in the specifications of materials, management, and design for pavement and other transportation infrastructure will ensure that roadways are proactively maintained to increase the service life. Such sustainable infrastructure will be achieved using the performance-related results obtained from testing the road track of the proposed testing facility. In addition, this study aims at increasing the economic competitiveness. The feasibility study in the first phase will provide an economic evaluation of the testing facility by assessing the expected benefits of cost saving while design and maintaining roadways. Moreover, future research in the second phase will include real-world testing and life-cycle cost analysis of different pavement maintenance scenarios and materials on the road track. Such analysis will promote the maintenance policies and investments on pavement and other assets to increase effectiveness and reduce maintenance costs.

**Educational Benefits**

The results from this projects will provide many educational benefits to elevate pavement engineers' knowledge and experience in the full-scale testing of pavement and other transportation infrastructure. The project will require the contributions of a transportation engineering faculty member, a transportation engineering research postdoctoral associate, and a graduate student. Conducting field visits to the nation's major accelerated pavement track experiments will provide educational benefits. Professional organizations will demonstrate to the research team these facilities to increase the engagement and gain more effective learning. This task provides a unique opportunity to see innovation at work. In addition, the research collaboration between the University of Wyoming and Wyoming DOT (WYDOT) will provide practical training for students and pavement engineers in forms of professional certifications and employment opportunities.

**Technology Transfer**

By delivering progress reports and peer-reviewed articles, the results from the feasibility study will be transferred to all participating partners, including associations, universities, government entities, entrepreneurs, and consultants within Wyoming and surrounding states. The project will also connect with the asphalt and concrete pavement industry partners to provide engineering support. The findings and future research will be recommended for the benefits of implementing the proposed road testing track in Phase II. Eventually, necessary adjustments in the current practices of pavement design, construction, and materials standards will be disseminated to the partners and regional agencies in the dry-freeze region.

**Work Plan**

The objectives of the first research phase (Phase I) will be achieved by performing the following tasks:

- Select a study advisory group

The group will advise and support all the research stages and provide directions for the research team.

- Identify the research facility partnership

All potential partners of the proposed track facility will be identified including associations within Wyoming, collaboration from the surrounding states, and industrial support.

- Perform a literature search

The task will deliver a historical background of testing facilities to support potential research activities. This includes a well-description of existing facilities and details of operations and management.

- Identify potential testing of other transportation infrastructure

This task will search for the application and development of effective transportation infrastructure testing that can be adopted on the proposed regional testing facility. Among these infrastructures, different experiments under various conditions of weather, traffic, and pavement types will be investigated to address drivers' behavior and vehicle sensor performance for improving both safety and efficiency of roads. Other investigations will be conducted to potentially test road safety features and monitor the performance of these features under adverse weather conditions and high traffic volumes. More studies will be evaluated under this task.

- Conduct a partner survey

In conjunction with the literature search, a survey will be sent out to all potential partners to provide relevant information of testing and operating the proposed road track. Such information is critical to produce a reliable testing facility that provides beneficial and practical results while monitoring the performance of pavement in Wyoming.

- Organize field visits

The outcomes will be documented for the benefits of design, construction, and instrumentation of the proposed regional track in Wyoming. The number of visits will be determined based on the budget allocated for travel in this study.

- Identify potential locations for the road test track

After getting all related information to build an effective test track, the Principal Investigators will work closely with WYDOT to find an appropriate location of the facility on I-80. In

addition, the variation in pavement materials and subgrade soil types will be considered to study the pavement performance under diverse structural conditions.

- Estimate the costs of the test track facility

This task will assign a dollar value on the proposed regional road test track. A detailed cost information will be estimated for both constructing and operating the regional facility.

- Perform a benefit-cost analysis for the facility

A comprehensive evaluation will be performed for all potential costs and revenues that will be gained from the research efforts of the road track. The expected benefits are obtained from the contribution of testing pavement under actual conditions of loading and climate where more representative pavement performance will be developed. This will lead to important adjustments in the maintenance and design policies of pavement to reduce distresses/cracking and increase pavement service life. It will also provide opportunities for integrating innovative pavement treatments and materials. The outcomes of these efforts will be evaluated in forms of cost savings while design and maintaining roadways.

- Outline the relationship between WYDOT and University of Wyoming

The potential relationship between WYDOT and the University of Wyoming will be investigated to explore the effective manners to run the proposed facility. In addition, the expected benefits of jointly operating this research will be documented, including the educational benefits.

- Prepare a final report

A final report will be prepared summarizing all findings of the tasks. The report will also develop detailed recommendations regarding the implementation of testing and monitoring the proposed road track in Phase II.

This study is expected to be completed in 27 months.

**Project Cost**

The following costs are requested for the first year of the study:

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| Total Project Costs: | $170,630 |
| MPC Funds Requested: | $ 68,628 |
| Matching Funds: | $102,002 |
| Source of Matching Funds: | Wyoming Department of Transportation |

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