

# **Montana Statewide Traffic Signal System Evaluation Technology and Innovation Deployment Program (TIDP) Accelerated Innovation Deployment (AID) Demonstration**

## **I. Project Abstract**

The Montana Department of Transportation (MDT) proposes a Statewide Traffic Signal System Evaluation Project (project) which includes the development of an abbreviated or “streamlined” Concept of Operations for Montana’s traffic signal control program, and then uses that information to evaluate 1-2 specific corridors in Montana’s 7 largest urban areas to determine the most effective way to advance our traffic signal control technology. The corridor specific evaluations will include development of a Concept of Operations and preliminary design for the corridor using the appropriate technology for Montana’s needs, including adaptive signal control when warranted. Evaluating and improving MDT’s signal control technology will help minimize and balance congestion, smooth traffic flow, and further enhance MDT’s capability to implement operations and maintenance strategies that maximize safety, efficiency, and reliability of the traffic signal system. Not only is developing a concept of operations new and innovative for MDT, if the need for adaptive signal control is identified, the implementation of it will truly create a statewide change in the way MDT maintains and operates its traffic signals in Montana.

## **II. Project Description**

MDT’s proposed project includes using consultant services, managed through MDT’s Traffic Signal Operations (TSO) Section.

The project will begin by reaching out to key stakeholders to understand their desired goals and objectives of MDT’s traffic signal control program. A great deal of time spent with the stakeholders will be used to educate them on MDT’s current traffic signal operational characteristics in addition to the options and possibilities to improve and enhance the program. Also, an abbreviated or “streamlined” Concept of Operations will be developed to match MDT’s needs and criteria taking all of the other information gathered into account. A white paper stating MDT’s position and policy regarding implementation of Adaptive Signal Control Technology (ASCT) will then be developed. Among other things, this white paper will set realistic expectations for the ongoing investment needed to keep adaptive signal control functional and also address minimum system requirements for an adaptive system.

The next step is to evaluate 1-2 corridors in each of Montana’s 7 largest urban areas to see whether adaptive signal control is appropriate. This evaluation will consist of an assessment of the current system in place and includes evaluating the existing communication, detection, and controller infrastructure for each corridor to determine whether more can be done with the existing system. MDT will then develop a Concept of Operations and Preliminary Design for the subject corridors.

The objective of this project is to determine what level of functionality is required to meet MDT's traffic signal operational objectives and how that functionality can be supported within the operations and maintenance capabilities of MDT. Currently, MDT is responsible for the management, operation and maintenance of approximately 460 traffic signals distributed all over the large state. MDT recognizes that properly designed, operated, and maintained traffic control signal systems yield significant benefits, and when MDT's traffic signal operations capability isn't operating at optimal levels, the results are frustrated drivers, excess fuel consumption, increased delays and degraded safety. In the past, MDT relied on complaints to drive the traffic signal program, which isn't a good indicator of system performance. Within the last year, MDT developed a Traffic Signal Management Plan which included prioritizing and creating a schedule to evaluate traffic signal timings and operations based on an established set of criteria. Even if the concept of operations finds that ASCT isn't appropriate for MDT, it will clarify the agency's objectives, identify its needs and define the constraints which will further enhance MDT's the foundation to transition from a reactive to a proactive operations and maintenance program.

Over the last several decades, the gap between the state of the art and the state of the practice in traffic signal operations has grown, and this is very true in Montana. MDT's past investment in the traffic signal control program hasn't been sufficient to keep the system infrastructure or technology current. MDT's dedicated staff has kept the system operating and repaired through the use of aging computers and a surplus of parts, but efficiency, optimization, and reliability have suffered. Recognizing the risk of continuing to operate with these antiquated systems, MDT's Highway Traffic Safety Bureau created the Traffic Signal Operations (TSO) Section, which is charged with bringing MDT's traffic signal program up to current standards - and preparing for the future.

In an effort to assess MDT's current traffic signal control program, and develop an action plan to direct its future, MDT's TSO section partnered with FHWA-MT and FHWA's Resource Center Operations Technical Service Team in 2012 to develop a program review entitled Traffic Signal Operations in Montana. The review indicated that while the condition of traffic signal management and operations in Montana has ample opportunity for improvement, receiving a score of D-, it should be viewed within the context of the state of the practice nationally, which only rated a D+ score on the 2012 National Traffic Signal Report Card. The review also clearly concluded that although MDT professionals are extremely dedicated to keeping the traffic signals operating, Montana faces significant challenges in regard to operations, maintenance and management of traffic signals, and if the situation isn't addressed with urgency, the state may experience a catastrophic system breakdown.

In response to the recommendations and outcome of the program review, MDT's recently adopted a Traffic Signal Management Plan provides MDT's decision makers a clear path forward and justification for continued investment through the systems engineering process to advance the traffic signal control technology. One of the goals in the Plan, which MDT has begun to address, is to replace all of the state's DOS based traffic signal controllers, which are outdated and no longer supported. At this time, MDT has replaced

approximately 50% of the DOS controllers with Windows based central systems software, and plans to complete replacement of all MDT signal controllers by 2018. This infrastructure replacement project will further enhance MDT's capability to implement operations and maintenance strategies that maximize safety, efficiency, and reliability of the traffic signal system.

Another conclusion of the review that ties back to this grant request is a recommendation for MDT to consider implementing Intelligent Transportation System Infrastructure, within a single point of accountability. Developing a Concept of Operation is the first step for MDT to follow through on that recommendation and address many of the risks associated with procurement of Adaptive Signal Control Technology, and confirm whether its expectations are realistic and achievable before committing to a system. Implementing ASCT without adequate resources or agency compatibility to support system operations and maintenance, or failure to properly align MDT and system operations objectives is risky and ultimately lead to failure.

MDT's traffic signal operations staff consists of five engineers who are involved in the development of the updated signal timing plan, two of which are responsible for the actual development for the entire state. As was mentioned earlier in this narrative, part of this project includes investigating the option of implementing adaptive signal control in Montana. Adaptive signal control, in conjunction with well-engineered signal timing, automatically adjust the timing of red, yellow and green lights to accommodate changing traffic patterns, reducing the frequency of the need to manually retune the signals. The technology also captures comprehensive data that the signal operator can use to monitor their performance. Essentially, traffic problems are addressed as they occur, which reduces citizen frustration and complaints. Improved signal timing can reduce intersection congestion, which in turn can lessen crashes by up to 15% and reduce fuel consumption. Reducing stops, queues and delays also reduces the number of intersection conflicts to travelers.

The vision of the Every Day Counts ASCT Initiative is to mainstream the use of ASCT, suggesting that when traffic conditions, agency needs, resources and capability support the use of ASCT it should be implemented. Because implementation of ASCT qualifies as an Intelligent Transportation System project and would be funded in whole or in part by Highway Trust Funds, federal regulation (23 CFR 940.11) requires that the project must be based on a systems engineering analysis. A Concept of Operation is the first piece of the required systems engineering documents, and describes the needs and objectives of the stakeholders in order to determine what functions the proposed system must be capable of fulfilling. A Concept of Operation is critical to the success of any subsequent traffic signal operations project MDT undertakes, because all related documents must be traced back to the statements of need in the Concept of Operation document.

### **III. Innovation Performance**

MDT's Traffic Signal Operations Section will monitor the project, and to be effective, the project necessarily requires the participation of other internal (information services, planning, maintenance, communications) and various external stakeholders including FHWA, local government entities, Metropolitan Planning Organizations (MPO), and possibly Emergency Medical Service providers. Involvement of other stakeholders ensures a coordinated vision for the future of MDT's Traffic Signal Control Program. Monitoring, assessment, and performance measurement of the recommended traffic signal advancement plan will be detailed in the project being proposed in this application.

MDT is prepared to obligate awarded funds to the development of the project as described within 6 months of submitting this application. The project lays the foundation for MDT to move to the next step in the Systems Engineering Process "V Model" and develop the system requirements document which describes what needs to be achieved by the system. Each of the requirements must be linked to a corresponding need described in the Concept of Operations, making it a vital first step in accomplishing MDT's goal of defining and the needs and objectives of its traffic signal operations program. It is estimated that the project will take 6-12 months to complete.

### **IV. Applicant Information and Coordination with Other Entities**

The Montana Department of Transportation is the applicant for this Accelerated Innovation Deployment Demonstration grant, and will be the sole recipient; however, coordination with FHWA, local government entities and MPOs will also take place to ensure thoroughness and a coordinated vision of MDT's traffic signal program. The project point of contact is Danielle Bolan, P.E., MDT Traffic Operations Engineer. Danielle can be reached at (406) 444-7295 or [dbolan@mt.gov](mailto:dbolan@mt.gov).

### **V. Funding Request**

MDT's estimate for the cost of the proposed project is \$75,000 for the 1<sup>st</sup> step that includes reaching out to stakeholders, developing a white paper and creating a "streamlined" Concept of Operations. The cost estimate for the 2<sup>nd</sup> step which includes evaluating MDT's current traffic signal infrastructure for 2 corridors in Montana's 7 largest urban areas, and developing a Concept of Operations and preliminary designs for those corridors is \$30-75,000 per corridor. The range in costs recognizes the savings associated with developing a Concept of Operations and designs for corridors where adaptive signal control is not the chosen option. Also, for corridors where adaptive is chosen, there is efficiency with doing multiple corridors, particularly if MDT moves forward with one adaptive system. Therefore, for this part of the proposed project, MDT's estimate for the cost is \$1,050,000. This brings the total project cost to \$1,125,000. MDT would provide 20% match for any funds received, and our AID Grant Request is \$900,000. If adaptive signal control is not the chosen option for all 14 corridors, the remainder of the funds will fund evaluating additional corridors in Montana's remaining urban areas.

## **VI. Eligibility and Selection Criteria**

This project will allow MDT to document MDT's traffic signal operational characteristics, as well as an understanding of the goals and mission of MDT and its stakeholders. The project will provide MDT with a plan that clearly outlines MDT's goals and objectives, and whether the plan ultimately recommends ASCT or not, it will form the basis for up to date, good quality traffic signal control settings and appropriate plans which will improve highway efficiency, safety, mobility, reliability, and service life.

MDT will obligate awarded funds to the development of the proposed project within 6 months of application submission. MDT understands the necessity of participating in monitoring and assessment activities regarding the effectiveness of the proposed project and the subsequent technology transfer and information dissemination activities associated with it. MDT also welcomes and invites FHWA oversight of the development of the proposed project.

**Additional Attachments**       No    Yes (PDF files identified by Applicant and Project Title)

- 1. Cover Letter**
- 2. MDT Traffic Signal Management Plan**
- 3. FHWA Montana Signal Operations Review Final Report**
- 4. Cost Estimate**

Thank you for applying for the Accelerated Innovation Deployment (AID) Demonstration program. In reviewing the application submitted for the Statewide Traffic Signal System Evaluation project, we would like to get clarification on a few of the items in the application narrative in order to complete our evaluation.

- From the application narrative, it seems that the innovation is the use of Systems Engineering Analysis to make better decision making. Is this correct?
  - Yes, that is correct. The Systems Engineering Analysis process promotes up-front planning and system definition prior to technology identification, selection and implementation. Development of the concept of operations, which is part of the Systems Engineering process, is MDT's innovation. This approach is completely new to MDT and a method that has not been previously used. It will enable MDT to make the most informed and effective improvements to our signal control technology. In addition, the Systems Engineering process will provide MDT staff a framework for future improvements to Montana's infrastructure.
  
- The application narrative mentions using the innovation to evaluate "1-2 specific corridors in Montana's 7 largest urban areas". Please provide a listing of the urban centers and potential corridors within them that would be considered for this project.
  - The urban centers and corridors within them are as follows (see attached maps):
    - **Billings**
      - Main Street – 1<sup>st</sup> Avenue N. to MT 3
      - King Avenue – Midland Road to S. 32<sup>nd</sup> Street W.
    - **Butte**
      - Harrison Avenue/Front Street – Wal-Mart signal to Utah Avenue
      - Montana Avenue – Rowe Road to Granite Street
    - **Great Falls**
      - 10<sup>th</sup> Avenue S. – 6<sup>th</sup> Street/Fox Farm Road to 49<sup>th</sup> Street
      - 3<sup>rd</sup> Street NW – NW Bypass to 10<sup>th</sup> Street
    - **Helena**
      - Custer Avenue – Washington Street to Green Meadow Drive
      - Euclid Avenue – Last Chance Gulch to Joslyn Street
    - **Kalispell**
      - US 93 North – Wyoming Street to Reserve Drive
      - US 2 – Kalispell Bypass to S-317
    - **Missoula**
      - Reserve Drive – I-90 Interchange to Brooks Street
      - Brooks Street – Miller Creek Road to W. Beckwith Street E.
    - **Bozeman**
      - 19<sup>th</sup> Avenue – I-90 Interchange to Stuckey Road
      - Main Street – N. 7<sup>th</sup> Street to Ferguson Road
  
- As described in the NOFA outline for the project description and innovation performance sections of the narrative, please clarify what the performance goals and measures will be for the project.

- The goals of this project include:
  - To develop an outcome based process to guide MDT staff in effective and cost conscious decision making.
  - To determine the level of functionality required to meet the stakeholders and MDT's traffic signal operational objectives and how that functionality can be supported within the operations and maintenance capabilities of MDT.
  - To improve MDT's statewide traffic signal operations system by developing a plan to provide safe and efficient traffic signal operations by promoting mobility and effectively managing capacity.
- The measures of the goals of this project are:
  - The development of a statewide streamlined concept of operations, a white paper and a procedure/concept of operations for our traffic signal system. This will provide MDT the basic framework to make informed decisions.
  - The development of a concept of operations specific to the identified corridors. This will provide MDT the necessary information in order for MDT to advance further into design and implementation on these corridors.
- As stated in the Notice of Funding Availability (NOFA) basic outline of the description for the funding request portion of the narrative: "Summary of the funding request including the basis for determining the cost of the innovation in the project."

- While the Funding Request section in the application narrative and the cost estimate attachment mention broad categories and tasks, it does not provide the basis for determining the cost of this innovation. Please address by providing a more detailed cost estimate (line items and activities) for the project. [NOTE: Provide data that directly supports the requested funding amount. If funding for materials or other items is part of the innovation cost for an eligible project, the applicant will need to include it in the application for consideration.]
  - Please note that MDT is revising our grant request for the AID Demonstration program project application. Also, all funds are subject to Indirect Cost recovery.

The total project cost estimate was originally \$1,125,000, but after we broke down our broad category cost submittal at your request, we were able to fine tune the budget estimate, reducing the overall cost estimate to \$1,020,000.

MDT's revised funding plan is as follows:

\$816,000 – AID Grant Request

\$204,000 – MDT State Funds

\$1,020,000 – Total Project Funds

Please see the attached revised cost estimate spreadsheet.

- Please clarify, providing more cost detail for this portion of the funding request section: *"Also, for corridors where adaptive is chosen, there is efficiency with doing multiple corridors, particularly if MDT moves forward with one adaptive system. Therefore, for this part of the proposed project, MDT's estimate for the cost is \$1,050,000. This brings*

*the total project cost to \$1,125,000. MDT would provide 20% match for any funds received, and our AID Grant Request is \$900,000. If adaptive signal control is not the chosen option for all 14 corridors, the remainder of the funds will fund evaluating additional corridors in Montana's remaining urban areas."*

- Please refer to the answer to the bullet above, and see our revised cost estimate spreadsheet.
- In reference to procurement, please clarify whether this would be done as one project under a single contract, or would the project be completed using several separate contracts. What contracting method do you propose to use?
  - MDT will complete this project under one contract. MDT expects to use a traffic engineering term consultant to complete the project.
- The application narrative mentions "It is estimated that the project will take 6-12 months to complete." Please provide a more detailed outline of the schedule.
  - Phase I – Outreach, development of white paper and streamlined concept of operations will take **2 to 3 months**
  - Phase II – Corridor evaluation, development of concept of operations, implementation of plan and preliminary design will take **9 months**