Montana Department of Transportation
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Memorandum

To: RRC Members
Steve Albert/WTI
Debbie Alke, Administrator/Aeronautics Division
Mike Bousliman, Administrator/Information Services Division
Jeffery M. Ebert, P.E./District Administrator-Butte
Larry Flynn, Administrator/Administration Division
Dwane Kailey, Administrator/Highways and Engineering Division
Bob Seliskar/FHWA
Jon Swartz, Administrator/Maintenance Division
Mike Tooley/Director
Duane Williams, Administrator/Motor Carrier Services Division
Pat Wise/Deputy Director
Lynn Zanto, Administrator/Rail, Transit, and Planning Division

From: Susan C. Sillick, Manager
Research Programs

Date: October 31, 2016

Subject: October 28, 2016 RRC Meeting Notes

RRC Members Present: Jeff Ebert, Dwane Kailey, Sue Sillick, Jon Swartz, Duane Williams, Pat Wise, and David Jacobs for Lynn Zanto

Others Present: Kris Christensen, Lisa Durbin, David Hedstrom, Jeff Jackson, and Shane Pegram

1. **Budget Report:** Attached

   No discussion

2. **Research Projects – current listing**

   No discussion

3. **Reports:** Available on Research website

   a. Statewide Rockfall Hazard Rating Process Update - Task 3 report
   b. Speed Limits Set Lower Than Engineering Recommendations (13-006)- Project Summary and Final reports

No discussion

4. **Proposals:** None

5. **Pending Research Projects:** Project champions were asked to prepare a document addressing the new project prioritization criteria. The champions were present to discuss these documents and answer questions.

    a. **15-013:** Effective Production Rate Estimation and Monitoring of Controlling Activities Using Daily Work Report Data – Lisa Durbin

    Lisa was present to discuss this project.

    A production rate is a quantity of production accomplished over a specific period of time and realistic production rates are the key in determining reasonable contract times. The production rates of major construction activities also play an important role in the planning of resources and tracking project progress as these activities typically fall in the critical path of the project schedule. Thus, the accuracy and reliability of the estimated production rates are crucial for effective contract administration.

    The overall goal of this project is to enhance MDT's current contract time determination procedures by developing a historical data driven production rate estimation system using data available in daily work reports (DWR). The tools developed in this study will be based on Microsoft Excel. Also a workshop-style training will be provided as part of this project.

    FHWA recommends that in estimating production rates of work items, an accurate database should be established by using normal historical rates of efficient contractors. It further states the most accurate data can be obtained from site visits and/or review of project records (i.e., field diaries and other construction documents) where the contractor's progress is clearly documented based on work effort, including work crew makeup during a particular time frame.

    For most DOTs, data collection from site visits may not be a financially feasible solution because the data should be collected from a significant number of projects across the state throughout the year. Also, FHWA recommends the data should be updated every two to three years, which can be a financial burden. An excellent alternative approach is to use a well-organized and recorded dataset of completed highway projects, where a project's progress is clearly documented. The DWRs in AASHTOWare Project SiteManager include a variety of project related data and is recorded on a daily basis by construction personnel. The DWRs contain information about project characteristics, the entire list of work items, daily quantity of work accomplished for each work item, start and end date of each work item, labor and equipment usage information, weather, significant communications with contractors, etc. This digital data set provides very rich and useful data appropriate for production rate estimation.

The results of this project are expected to significantly improve MDT's current contract time determination procedures and the progress monitoring of major construction activities during construction. The product of this project will provide more accurate contract time determination calculations, a basis for better planning of resources for highway projects, data driven and verifiable documentation for a stronger defense in contract time disputes, and allows less experienced personnel to gain confidence as they learn how to consistently estimate reasonable production rates and determine contract times.

The product from this research project can be easily implemented and the implementation of the results will affect the process of determining contract times of highway projects.

Dwane asked if it would be easier to use past schedules. He also stated we have more data if we used schedules. Lisa responded that we only have this information for larger projects. She also explained that with the DWR, MDT has useable data for 10 years on all kinds of projects and, therefore, we will be able to get production rates on a variety of work elements.

Lisa stated she sent the researchers a data set and they were able to determine production rates from it and the data elements that MDT collects. ISU was able to do the same for the OKDOT. Lisa sent Colorado State University (CSU), who contacted Chad Richards about their research project, the same data set as ISU. They were unable to come up with production rates. The CSU project also includes sequencing recommendations (same as Task 6) and should be done within the next year. Prior to moving forward with Task 6 now, the panel would like to review the results of this study first.

Duane asked how public involvement delays fit into this effort. Lisa responded that per se it doesn't fit into this project. After contracting, liquidated damages come into play. Dwane responded we don't want to give contractors too much time, but don't want to give them too little either.

Duane asked about the researchers. David Jeong and Doug Gransberg from Iowa State University are the co- principal investigators.

Dwane asked if FHWA is requiring this. Lisa said no, but FHWA recommends it and it is a labor intensive task that keeps falling back because of more pressing needs. This will develop a tool that is not so labor intensive and can be easily updated.

The cost of this project is about $145,000 (including ICAP).

b. **15-003:** Evaluation of Bridge Deck International Ride Index (IRI) and Best Practices to Meet IRI Criteria – Shane Pegram

Shane Pegram was present to discuss this project.

Currently, MDT uses a 10′ straight edge to measure bridge profiles. IRIs are collected on state-maintained roads, but the bridges and 50′ on either side of the bridges are excluded.

The overall objective of the proposed research is to develop an integrated bridge smoothness methodology and associated specifications to improve ride quality on Montana bridges. This project objective will be met through a comprehensive literature and review to determine the state-of-the-practice for collecting and using road profile data on bridges, as well as a review of available software used to process bridge roughness data. Existing bridge smoothness specifications will be documented and a procedure to collect data that is compatible with Montana's bridge design and construction practices will be recommended.

Researchers will use existing bridge profile data to evaluate MDT's software and ProVAL, which is used by Ohio, to determine the benefits and downsides for each. Corrective action plans made with each program will be compared to determine variations in grinding locations and depths.

Ohio implemented a specification for bridge deck smoothness. Montana and others are looking to Ohio to help guide them through this process.

The benefits of improving the initial bridge ride quality include reduced wear and tear on vehicles, minimized damage to cargo and freight, and improved perceptions from the traveling public. More importantly, safety is enhanced by reducing distractions and discomfort caused by a rough bridge crossing. The benefits of improved bridge surface smoothness include:

1) **Improved safety** by reducing driver distractions and discomfort.
2) **Reduced maintenance costs** by extending maintenance intervals and improved snow and ice removal efficiency.
3) **Reduced vehicle wear** on tires and suspension components.
4) **Longer service life** through reduced roughness, creating resources for other maintenance and construction activities.
5) **Improved public perception** of Montana's highway and bridge structures.
6) **Improved service** by establishing an efficient process for evaluating and improving smoothness characteristics of bridge decks.

A strong business case may also include incentive/disincentive pay adjustments for contractors based on smoothness specifications for entry/exit pavements, approach/exit slabs, and the bridge deck. Baseline road profile and IRI data from existing bridges can be used to identify structures with the poorest ride-quality. These bridges can be prioritized for maintenance activities specifically addressing the roughest surface features. Finally, efficient bridge roughness corrections will enable limited maintenance resources to be used in other areas, resulting in increased service lives of other department assets.

A draft bridge smoothness specification, consistent with MDT's current specification format, will be ready for implementation at the conclusion of this project. Additional profiles and grinding plans should be created for different types of bridges not considered in this study to confirm the results are applicable.

MDT will likely implement this bridge ride specification by including the specification from the research project (mentioned above) as a special provision into selected contracts. The special provision will be increasingly included into bridge contracts as the contracting community and MDT become more familiar with the process.

Duane asked about joints and how we deal with them in a specification. Shane responded that we don't; bridge decks and 50' on either side, including the joints, are not profiled.

Jon asked about limiting the length of bridges in a specification. Shane responded that it would only be valid for bridges of a certain length or longer.

Ohio staff is using IRI for bridge decks, but they are still having issues with the contractors, who were opposed to it initially. A part of the proposed MDT project is to help work through some of these issues ahead of time; also, there are contractors on the technical panel.

The cost for this project is about $210,000 (including ICAP).

c. **15-008:** Guidelines for Chemically Stabilizing Problematic Soils – Jeff Jackson

Jeff Jackson was present to discuss this project.

Problematic sub grade soils (primarily silts and clays) are encountered throughout the state of Montana and are especially prevalent east of the Rocky Mountains. Stabilization of these types of soils by incorporating calcium based products (cement, lime, fly ash) has generally not been performed at MDT, but is common in other areas of the United States.

A complication to the use of this technology is the presence of soils containing concentrations of soluble sulfate. These soils are known to exist in Montana and are primarily also located east of the Rocky Mountains. Adverse chemical reactions between the sulfate bearing soils and calcium based products can cause detrimental distress to a pavement section under certain conditions when not properly identified or designed.

The primary goal of the proposed research project is to establish protocols for conducting efficient chemical stabilization design for problematic soils with and without soluble sulfates. Significant work and literature exists regarding this subject, however nearly all of that work is not specific to the Rocky Mountain region and in areas with a wetter overall climate.

The importance of this research project is to further study and evaluate calcium based chemical stabilization techniques in order to potentially include these options to MDT's "tool box" to address these situations.

The stabilization design protocols developed as a part of this project can help MDT more effectively determine if chemical stabilization is a viable method for Montana specific soils. By conducting this research MDT will gain the knowledge in chemical stabilization of problematic soils specific for Montana conditions.

- This research will help quantify the necessary resources (i.e. investigation frequency, lab testing, design protocols, construction testing, and contract administration) that would be required to effectively assess whether chemical stabilization can be incorporated with an acceptable level of risk while considering the existing MDT resources.
- Stabilization of the poor soils would increase their strength and ability to support traffic long term, thus the cost for designed pavement sections could be reduced. Quantifying monetary savings of using chemical stabilization in place of conventional methods such as digouts, geosynthetics, or thicker pavement sections is very difficult to quantify at this time, until further research is completed.

Successful implementation will require active participation within several areas of MDT including both design and construction. It is anticipated (with all things being equal) that geotechnical investigation, testing, and analyses during design of projects will need to increase and material or construction Quality Assurance (QA) testing will also need to increase. Assuming staffing levels remain consistent; this ultimately means a need for increasing efficiency with different processes, outsourcing this work, accepting some higher level of risk, or some combination thereof. Jeff believes implementation can primarily be accomplished with increased efficiency by evaluating and modifying existing processes. This could require "buy-in" by several different areas within MDT.

A next step after the research is done would be to test it in a project.

Dwane stated that this could result in some real savings by reducing gravel thickness. Lisa added that there have been some pretty hefty change orders that might be avoidable in the future.

Jeff also added that this process, once developed, could help MDT to investigate and evaluate other new products.
The cost of this project is about $178,000 (including ICAP).

On a different subject, Jeff added that 2008 USGS models were used for a pooled fund in which we participated titled *Simplified SPT Performance-Based Assessment of Liquefaction and Effects*. However, 2014 models are now available. It will cost $2,000 to update the models for MT.

Dwane asked Jeff to work with Planning to make sure we have this GIS reference layer.

Jon made a motion to support this request. Dwane seconded the motion. All RRC members present voted in favor of the motion.

d. **15-015:** Regional Regression Equations Based on Channel-Width Characteristics to Estimate Peak-Flow Frequencies at Ungaged Sites – David Hedstrom

Dave Hedstrom was present to discuss this project.

The purpose of this research is to develop regression equations to estimate peak flow rates based on the existing channel width characteristics. The active and bank full channel width characteristics of a stream or river are formed by the actual flow rates experienced in each drainage basin. Therefore, the channel dimensions can be correlated to the actual flows and used to estimate the peak flood frequencies in other similar streams or rivers.

Regression equations based on channel width characteristics can be used to estimate peak flood frequencies individually or, they can be weighted with drainage basin regression equations to improve the uncertainty in flood frequency estimates.

Keeping up with the latest climate-based science is very important for MDT due to Executive Order 13690 which requires that a higher Federal Flood Risk Management Standard (FFRMS) be implemented for critical federally funded structures.

FEMA recently issued a new rulemaking proposal to implement new higher standards on projects affecting FEMA floodplains. We are still commenting on the proposal but it is clear that for critical structures, the new standards will include;

- Adding 2 feet to the 100 year water surface,
- Designing to the 500 year event, or
- Utilizing the latest climate based science.

This research project would be considered utilizing the latest climate based science since the resulting equations will be based on current stream data and field conditions. Of the three options, climate based science far outweighs the other options. Therefore, it is critical to continue investing in climate based research for immediate use and to establish a baseline for future analysis of climate change.

Benefits include:

1. Economical hydraulic design. Updating and publishing the channel-width regression equations will allow MDT to use the most current hydrologic methodology based on recent data and will:

a. Assist designers in accurately selecting proper culvert sizes and bridge openings, and reduce the risk of over- or under-sizing.

b. Reduce construction costs that result from oversized culverts and bridge openings based on outdated hydrologic data.

2. Establishment of road grades and low beam elevations. Setting road grades is predicated upon establishment of accurate flood-elevation data. Updated channel-width regression equations will allow MDT staff to more confidently provide the appropriate level of service to the road user, and evaluate risks to the road facility and upstream properties during flood events.

3. Defending against lawsuits. It is important to be able to technically justify the specific frequency estimates used in various design applications. Design flows based on up-to-date data and methods are defensible and reduce the risk of costly litigation.

4. Securing floodplain permits. Permitting MDT facilities in floodplains with FEMA involvement is becoming increasingly common. The authorization of construction in floodplains is scrutinized by local floodplain authorities, FEMA and DNRC engineers. Up-to-date data and hydrologic methods (climate based science) are required for the permitting process especially when the higher FFRMS standards are in place.

5. Stream restoration and fish passage. MDT projects sometimes require stream relocation and/or mitigation to reduce environmental impacts and allow fish passage. The design and implementation of mitigation activities requires up-to-date data and hydrologic methods that can withstand review by other agencies. Replicating active and bank full channel widths is critical to stream restoration designs.

6. Preliminary engineering and planning process. Up-to-date data and hydrologic methods will allow MDT to make good planning level decisions and preliminary engineering cost estimates for system facility upgrades or reconstruction efforts.

The results of the proposed project will be available immediately for use to MDT and other users to aid in determining flood characteristics critical to structure design. Developing new peak-flow regression channel width equations will ensure that MDT is up to date with the latest climate based science for use in design.

USGS is cost-sharing 40% of the total cost. The cost of this project to MDT is $150,000 (including ICAP).

The RRC members present discussed the ranking of these four projects. There is a total of $786,000 available for federal fiscal year (FFY) 2017 (through 9/30/2017). The total cost is $683,000; however, Sue stated she wouldn't be comfortable going above $600,000. It was asked

if project 15-013 (see project numbers above in this same section) is research. Sue stated it is, but any future updates would not be considered research. Duane indicated his top two projects are 15-008 and 15-013. Sue noted these two projects total $323,000. Dwane indicated that, due to potential for cost savings, his top two are 15-008 and 15-015 (totaling $328,000), with 15-013 number three on Dwane's list. Sue noted these three projects total $473,000 (not including 15-013 Task 6). Jon indicated his top two are 15-008 and 15-015 (totaling $328,000). Dwane made a motion to move 15-008, 15-013, and 15-015 forward. Duane seconded the motion. All present, except for Jon, voted for the motion. Jon voted against the motion. The motion passed. Proposals for these three projects will be sent to the RRC for final funding approval when they are ready. Dwane asked Sue to update the Pending projects spreadsheet to reflect this information. Dwane asked Shane to keep up with what other states are doing, including Ohio, related to this topic and to submit it again, if appropriate, for funding in federal fiscal year 2018.

6. **Research Project Idea Prioritization, Selection, and Development –** Revised document and e-mail regarding intermodal definition attached

   Bob requested clarification from FHWA-DC as to the eligibility for Aeronautics projects. Sid Stecker, RD&T State Partnership Program Manager at Turner Fairbanks Highway Research Center, responded that SPR funds are not allowable for modes other than highways, and for public transportation and/or intermodal transportation systems. SPR funds are given maximum possible flexibility within this context. Projects specific to the aeronautics mode are not eligible

   Duane expressed his concern that all modes are connected in the current world of freight.

   Sue used track changes to modify the new Research Project Identification, Prioritization, and Selection process document. She asked the RRC to review to make sure the changes are correct. In particular, highlighted text should be reviewed.

   Sue suggested tying the definition of "quick response/small projects" to the Montana Partnership for the Advancement of Research in Transportation (MPART) contracts. So that as time passes and dollar and time limits of the contracts change, the process language does not need to change. The RRC agreed to this change.

   Sue asked the RRC to consider the language change in Recommended Change #2, as it is different than discussed at the September RRC meeting, but takes into account research ideas submitted by non-MDT staff.

   Finally, Sue stated there were a couple of suggested changes that the RRC was going to revisit at the September meeting, but forgot to go back to these items. In addition, Sue still needs to review the Commission procedures as directed in the September meeting.

   Jon asked if our next meeting will be in May 2017. Sue responded that she'd like to have another meeting to finalize the procedures prior to the May RRC meeting.

7. **Implementation/Performance Measures/Technology Transfer:** None

8. **Department/Division Hot Topics – RRC Members Roundtable Discussion**

If you have any additions to the agenda, please contact me at 444-7693 or ssillick@mt.gov. You will be notified of any last minute additions to the agenda by E-mail.

Copies: Craig Abernathy/Research Section
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