# Pavement Analysis Section
## Findings & Recommendations

October 25, 2021

# Table of Contents

October 25, 2021

Montana Department of Transportation
Pavement Analysis Section
2701 Prospect Avenue
Helena, MT 59601

Thank you for taking the time to complete the U.S. CAD Discovery Process. During this journey your team has helped us gain a deeper understanding about the Pavement Analysis Section. By taking the information you provided in the Discovery Workbook and through our Discovery Workshop, we've compiled the information and summarized the findings within this document.

Our goal through this process is to help the Pavement Analysis Section achieve more. We understand the challenges that exist within the industry and your significant investments to make your Department of Transportation great. Through this process we trust that you will have also gained more insight into your organization.

Herein are our findings and recommendations. We trust that you will find this information useful in your pursuit to achieve more as an organization.

We look forward to strengthening our partnership with MDT and the Pavement Analysis Section.

Best Regards,

Matthew Vega, P.E.                                    Melanie Zubok
National Director - Infrastructure/Government         Strategic Account Manager
matthew.vega@uscad.com                               melanie.zubok@uscad.com
877-648-7223                                         877-648-7223

# EXECUTIVE SUMMARY

Montana Department of Transportation (MDT) enlisted U.S. CAD to gather information about the Pavement Analysis Section and provide recommendations based on our experience and knowledge. Through our Discovery Process, U.S. CAD was able to uncover insights about how the Pavement Analysis Section performs business, technologies currently used, required deliverables, existing pain points, Section objectives, and goals. The information gathered from the completed Discovery Workbook(s) and Discovery Workshop was used to help us better understand these areas of your organization and to prepare this document.

During our review of your Discovery Workbook(s), and while performing the Discovery Workshop we identified/noted the following items:

- Data set integration, more consumable data for use throughout MDT
- Need for a streamlined document review process
- Close the loop between design and maintenance

This report highlights our understanding of the items listed above and our proposed recommendations as a part of the MDT CADD Implementation process.

U.S. CAD did not observe any immediate opportunities that would allow the Pavement Analysis Section to utilize the design software within the AEC Collection. However, in the future, once other bureaus have completed their migration to the Autodesk AEC Collections, there could be potential opportunities for increased efficiency and further cross collaboration.

This report is broken out into the following sections:

**Discovery Findings**    This section highlights key elements uncovered during the Discovery Process.

**Department Profile**    The organizational structure of the division and interactions with internal and external teams.

**Current State**    Current processes and solutions used, including pain points, receivables, and deliverables.

**Desired State**    This section captures our understanding of the team's desire state, wish list items, goals, and objectives.

**Recommendations**    In this section we provide our specific recommendations on process and solutions based on our findings during the Discovery Process.

# DISCOVERY FINDINGS

The following section highlights specific areas that were included in the Discovery process. Within each of the subsections below, U.S. CAD made specific notes regarding current challenges the Pavement Analysis Section faces, data used for analysis, and the collaboration of data between MDT sections/bureaus. These highlighted items are expanded upon in the Recommendations section further in the document.

The Discovery Findings have been summarized and included in the following sections:
- Department Profile,
- Current State, and
- Desired State.

The information documented in these sections provides the background for U.S. CAD's recommendations.
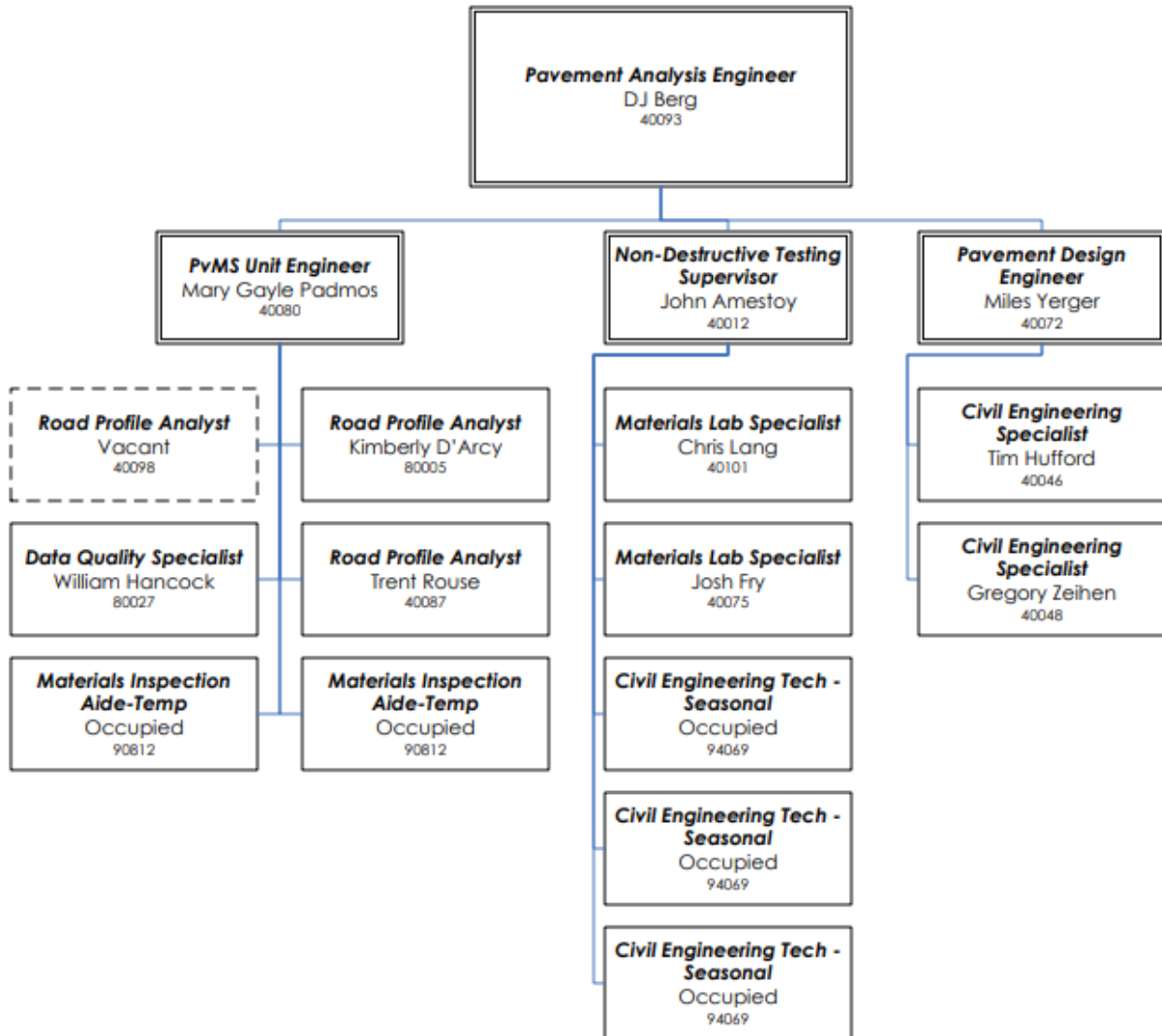
# DEPARTMENT PROFILE

The Department Profile section provides our understanding of the organizational structure, key staff within the organization, departmental relationships, and how the Pavement Analysis Section interacts with other internal MDT sections/bureaus, external agencies, and consultants.

The Pavement Analysis Section consists of three (3) Business Units; Pavement Management System Unit (PvMS), Non Destructive Testing Unit (NDT), and Pavement Design Unit. PvMS primarily focusses on collecting network level pavement distress data that is used throughout the entire department. NDT primarily focuses on collecting network and project level data that is used by the Geotechnical Section and for pavement design decision making. The Pavement Design Unit focuses on creating and delivering pavement designs for all projects in the State of Montana.

During the Discovery process, U.S. CAD was introduced to two (2) key staff members who are integral components of the MDT Pavement Analysis Section; DJ Berg and Miles Yerger. They both have immense knowledge and skills working within the Pavement Analysis Section ecosystem. Their knowledge of the inner workings of MDT's Pavement Analysis Section and outside federal agencies, provided us with the details needed for a thorough understanding of day-to-day operations.

The key staff members, along with additional Pavement Analysis Section staff, collect, consume, and share pavement related data with internal departments, federal agencies, and external consultants/customers. Some of the tools utilized by the Pavement Analysis Section include: PathWeb, Pathway software, AgileAssets database, and MS Excel.

Below is the Organizational Chart of the MDT Pavement Analysis Section supplied by MDT.

**Pavement Analysis Engineer**
DJ Berg
40093

**PvMS Unit Engineer**
Mary Gayle Padmos
40080

**Non-Destructive Testing Supervisor**
John Amestoy
40012

**Pavement Design Engineer**
Miles Yerger
40072

**Road Profile Analyst**
Vacant
40098

**Road Profile Analyst**
Kimberly D'Arcy
80005

**Materials Lab Specialist**
Chris Lang
40101

**Civil Engineering Specialist**
Tim Hufford
40046

**Data Quality Specialist**
William Hancock
80027

**Road Profile Analyst**
Trent Rouse
40087

**Materials Lab Specialist**
Josh Fry
40075

**Civil Engineering Specialist**
Gregory Zeihen
40048

**Materials Inspection Aide-Temp**
Occupied
90812

**Materials Inspection Aide-Temp**
Occupied
90812

**Civil Engineering Tech - Seasonal**
Occupied
94069

**Civil Engineering Tech - Seasonal**
Occupied
94069

**Civil Engineering Tech - Seasonal**
Occupied
94069

# CURRENT STATE

The Current State section captures our understanding of the existing workflow, processes, and solutions used within the Pavement Analysis Section. The Pavement Analysis Section does not develop or produce plan sets or construction drawings. They typically use Excel to develop pavement recommendations and use AASHTOWare to perform cost estimates. The Pavement Analysis Section traditionally issues pavement recommendation deliverables in the form of PDF memorandums. Currently, CAD related tasks and work is performed by the Road Design Section. The typical workflows for each Business Unit within the Pavement Analysis Section are summarized in the following sections.

## Pavement Management System (PvMS) – Current Process

Currently, PvMS begins the process by collecting field data for Highway Performance Monitoring System (HPMS) reporting required by the Federal Highway Administration (FHWA). Pavement distress data is typically collected during the summer months. Quality assurance is performed during the fall season. During the winter months, PvMS develops pavement recommendations to issue reports by February. The data, analysis, and findings are reported to the federal government for evaluation.

Distress data is collected annually utilizing two vans on every lane mile of Montana's highway system. Videos captured by the vans and are logged, then distributed to ISD. ISD uploads the data onto the MDT host for customers to access. PvMS analyzes the collected data to measure rut, ride, and cracking. PvMS is able to deliver a PDF report from a searchable database that can produce graphs, GIS information, and export Excel spreadsheets. It was noted that all data collected by PvMS is a valuable asset for departments within MDT and is utilized by multiple functional areas.

PvMS uses two supercomputers to process cracking data and rut information. A Pathway Services software is also used to perform the analysis and the distress data can be accessed using PathWeb, other web-based reports can also be captured. An AgileAssets database is used to manage the data and is utilized for treatment recommendation decision trees. There are typically three types of recommendations: preservation, rehabilitation, reconstruction.

A annual Pavement Condition report is distributed Department wide, the data is used to develop scenarios for funding. During the Review Session, it was stated that there are four buckets for funding:
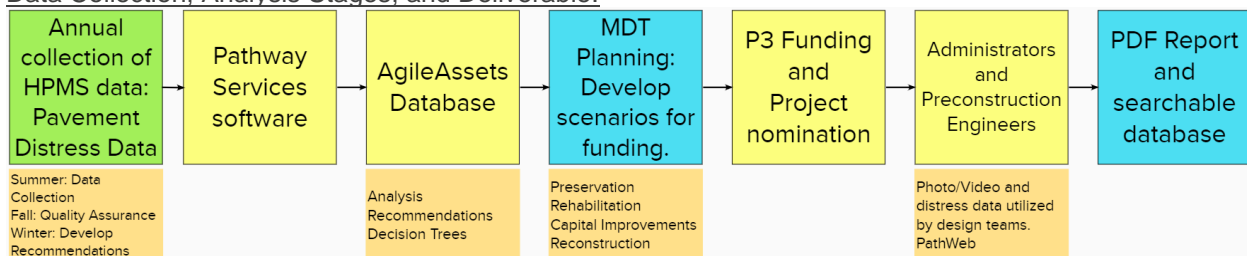- Pavement Preservation
- Pavement Rehabilitation
- Capital Improvement Projects, and
- Reconstruction Projects.

The data collected is used to define the budgets and is submitted to the Planning Division to run budgeting scenarios. The Planning Department is responsible for sending the reports to the federal government.

## Pavement Management System (PvMS)  – Current In House Workflow

The graphic shown below represents our understanding of the current workflow. The graphic was created using an on-line whiteboard during the Discovery Workshop with key staff.

Data Collection, Analysis Stages, and Deliverable:

| Annual collection of HPMS data: Pavement Distress Data | Pathway Services software | AgileAssets Database | MDT Planning: Develop scenarios for funding. | P3 Funding and Project nomination | Administrators and Preconstruction Engineers | PDF Report and searchable database |
|---|---|---|---|---|---|---|
| Summer: Data Collection Fall: Quality Assurance Winter: Develop Recommendations | | Analysis Recommendations Decision Trees | Preservation Rehabilitation Capital Improvements Reconstruction | | Photo/Video and distress data utilized by design teams. PathWeb | |

## Non Destructive Testing (NDT) – Current Process

NDT has two primary roles consisting of Network and Project Level data. The Network and Project Level data collected is used by the Geotechnical Section and by Surfacing Design.

A NDT project is initiated when Network Level data is requested or Surface Design requests Project Level (specific) data. NDT then collects the requested data using two different methods: Ground Penetrating Radar (GPR) and Falling Weight Deflectometer (FWD). GPR data is leveraged to determine the thickness of materials, namely, asphaltic concrete, aggregate base, gravel, etc. and FWD data is used to determine the stiffness of the materials. NDT can collect approximately one fifth of the state's network data on an annual basis, in addition to project level data collection.

NDT has different sources that are used for collecting data to be analyzed.

- Data collected by PvMS
- Ground Penetrating Radar (GPR) - RADAN
- Falling Weight Deflectometer (FWD) – ModComp or ModTag

Once NDT has collected all relevant data requested, the deliverables consist of the raw data, analysis, graphs, and Microsoft Excel spreadsheet(s). The deliverables are provided to Surface Design and Geotechnical Sections. Surfacing Design is the primary customer for NDT and the Geotechnical Section was noted as a secondary customer. The distribution of data and information is done by email, ShareDrive, and/or DMS.

## Non Destructive Testing (NDT) – Current In House Workflow

The graphic shown below represents our understanding of the current workflow. The graphic was created using an on-line whiteboard during the Discovery Workshop with key staff.

Project Initiation, Data Collection and Analysis Stages, Deliverables:
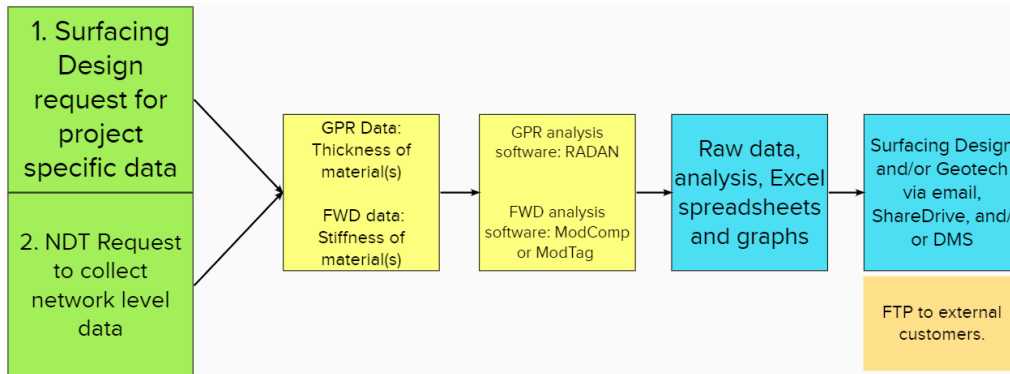


## Pavement Design – Current Process

Pavement Design gets involved during the Preliminary Field Review (PFR) stage of a project. They are typically notified by another Project Manager that a road design for a project is necessary. Depending on the scope of the project, a designer may research a significant amount of information prior to the issuance of the PFR and may make preliminary surfacing recommendations based on historical data and/or experience.

Pavement Design's coordination with the Geotechnical Section is determined on a project-by-project basis. When the Geotechnical and Surface Design Sections are involved on a project, communication is typically done by email and phone calls.

Pavement preservation project workflows are very condensed and were stated as, 'relatively simple'. Network level data may be used for recommendations but there is little to no CAD work done. Pavement preservation projects do not typically need the Geotechnical Section's involvement and treatments can often be determined in the field. A memorandum typically serves as the deliverable and is submitted less formally through email. These notifications are typically done with forms and specifications for project work then finalized with a memorandum.
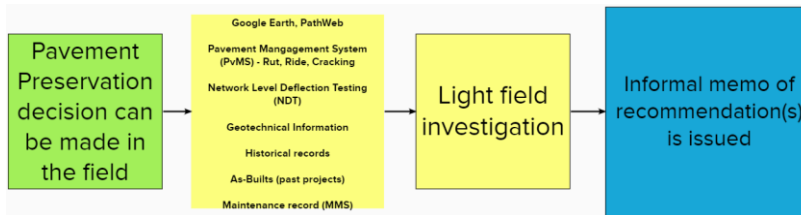
Rehabilitation and reconstruction projects require more involvement across the entire agency. There is more critical Pavement Design involvement prior to the Alignment and Grade Review (AGR). When the Road Design Section is compiling a project, they need a more established typical cross-section to use for the development of the AGR plans. Pavement rehabilitation projects will also include pavement investigations. After a preliminary, or initial, memo is issued to Road Design and the associated District, there may be a round of additional investigations done depending on the road alignment and proposed grade.

Collaboration continues throughout the project lifecycle and a final memo is sent to Road Design and the District. Pavement Design reviews the plans and then issues the memo review and final deliverable to DMS. This constitutes project sign off from the Pavement Design Section.

## Pavement Design – Current In House Workflow

The graphics shown below represent our understanding of the current workflows. The graphics were created using an on-line whiteboard during the Discovery Workshop with key staff.

Pavement Preservation, Investigation, and Deliverables:



Pavement Rehabilitation and Reconstruction Project Initiation, Investigation, and Deliverables:
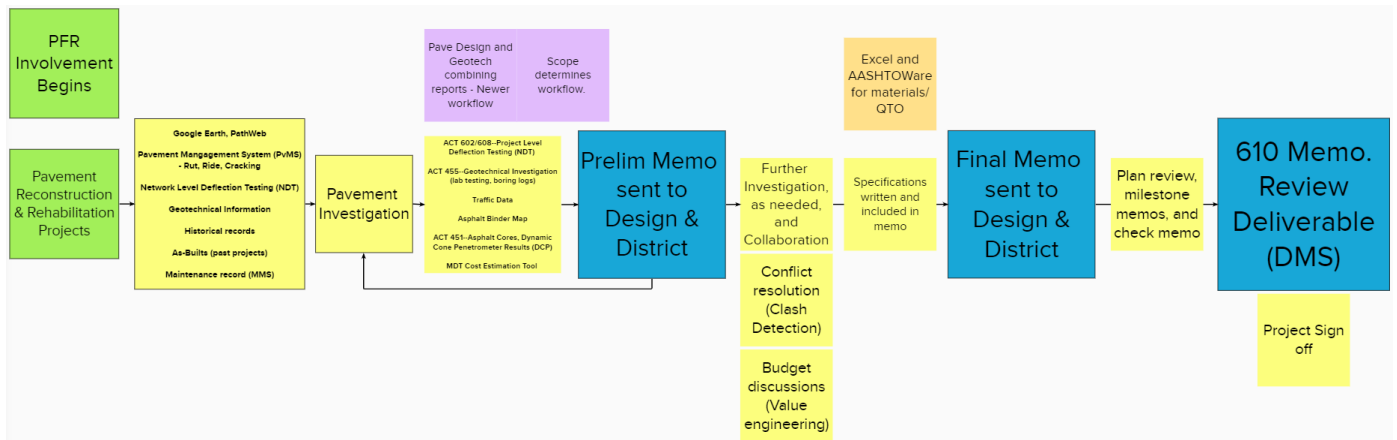
# DESIRED STATE

The Desired State section documents information shared by the Pavement Analysis Section regarding the future desired workflows, processes, and solutions. While it is understood that not all items shared by the team members during the Discovery Process are addressed with the implementation of the AEC Collection, this section identifies potential solutions and recommendations to help the Pavement Analysis Section move closer to achieving their goals. The potential solutions and recommendations are outlined and located under the Recommendations section of this document.

## <u>Pavement Analysis Section – Desired In House Workflow</u>

The Pavement Analysis Section is looking to further integrate with the Geotechnical Section in the future. It was noted that having the Geotechnical Section in the same functional area as the Pavement Analysis Section has increased efficiency.

Some additional topics noted during the desired workflow discussion are listed below:
- Document management and deliverable review process
- Integration of all data sets
- Consumable data across the organization and within the department
- Single data source location for use by the Geotechnical Section

It was also mentioned that MDT will be purchasing one van equipped with LiDAR technology and the collected data will be hosted by PathWay. Customers can interact with the data using the PathPoints software.

In addition, several items were outlined and identified during the Discovery Workshop as "Wish List" items:

## <u>Wish List Items</u>
- Historical data integration
- Resource management (staff and equipment)
- Upgrading pavement design software
- Replacement for NOS; ModComp, ModTag, 32/64 bit issues
- Asset performance analysis: Design, Construction, Maintenance, back to Design

# RECOMMENDATIONS

Based on the information shared by the Pavement Analysis Section through the Discovery Workbook and Discovery Workshop, U.S. CAD has prepared a summary of our recommendations. This information is prepared for you to consider as you make investments in moving forward toward your goals and objectives. We look forward to the discussions around these recommendations and next steps.

Currently, the Pavement Analysis Section does not utilize CAD software platforms for analyzing and preparing pavement data. The Section could, however, benefit from being made aware of the tools available within the Autodesk AEC software collection. Having knowledge of the available tools and how they are being leveraged within other MDT bureaus will help bridge the data gap and improve efficiencies between functional areas.

U.S. CAD believes that by integrating data into the BIM 360 platform, and having one source for all MDT data, will promote collaboration between all MDT bureaus and external entities, if shared. It is anticipated that the reporting, review, and document management tools within BIM 360 will be leveraged most often by the Pavement Analysis Section. BIM 360 will provide a single tool for communications and can streamline the document review process.

Incorporating pavement data into a GIS database would provide access to specific project pavement data, current/past projects, as-built plans, etc. By incorporating this additional information into the existing GIS foundation already in place and being used, the MDT GIS database would become an invaluable resource for all MDT departments, inherently improving the workflow for the Pavement Analysis Section.

The use of ReCap may enhance the Pavement Analysis Section's ability to view LiDAR data, take measurements, and annotate areas of interest. It is our understanding MDT has additional tools for performing these activities but the Pavement Analysis Section may benefit from a product demonstration of ReCap to see if there are opportunities to include it in their workflow.

## Future Considerations

U.S. CAD recommends the following training course and solution awareness for the Pavement Analysis Section.

Training:

- BIM 360

Solutions Awareness:

- ReCap
- InfraWorks
- Civil 3D Subassemblies (Pavement Sections)

By exposing the Pavement Analysis Section to tools within the AEC Collection being utilized by other functional areas, staff will gain an understanding of how they can possibly increase efficiencies for the benefit of MDT. In our experience, having a knowledge and understanding of how data is being utilized leads to making informed decisions on what data is available and how to access it efficiently.

## Next Steps

U.S. CAD will create and present a training outline that will specify the courses we feel the Pavement Analysis Section can benefit from. U.S. CAD will work with the MDT CAD Implementation executive team to assign dates and times for these courses and/or product demonstrations.