Road Design Section
Discovery Review Findings Summary

November 5, 2021

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ACHIEVE MORE.

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Montana Department of Transportation
Road Design Section
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Thank you for taking the time to complete the U.S. CAD Discovery Review Process. During this journey your team has helped us gain a deeper understanding about the Road Design Section. By reviewing the Autodesk's Discovery Documentation and the information you provided during our Discovery Review Session, we've compiled the information and summarized the findings within this document.

Our goal through this process is to help the Road Design 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 you will find 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 Road Design Section.

Best Regards,

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EXECUTIVE SUMMARY

Montana Department of Transportation (MDT) enlisted U.S. CAD to gather information about your Road Design Section and provide recommendations based on our experience and knowledge. Prior to U.S. CAD's Discovery Review Session, the Road Design Section participated in a thorough discovery process performed by Autodesk. Through our Discovery Process, U.S. CAD was able to verify existing workflows and uncover insights about how the Road Design Section performs business, technologies currently used, required deliverables, existing pain points, objectives, and goals. The information gathered from the completed Autodesk's Discovery Documentation and U.S. CAD Discovery Review Session was used to help us better understand these areas of your organization and to prepare this document.

During our review of your Autodesk Discovery Documents, and while performing the Discovery Review Session we identified/noted the following items:

- Limited collaboration between design functional areas
- Cross Section workflow in current software is not dynamic
- A desire to have the ability to target design surfaces during corridor modeling
- Established and documented workflows and best-known practices (BKP's)

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 observed several immediate opportunities that would allow the Road Design Section to utilize the AEC Collection. Note, in the future, once other bureaus have completed their migration to the Autodesk AEC Collections, there could be potential opportunities for increased cross collaboration.

This report is broken out into the following sections:

Department Profile	The organizational structure of the division and interactions with internal and external teams.
Recommendations	In this section we provide our specific recommendations on process and solutions based on our findings during the Discovery Process.
Training Program	This section identifies the potential training opportunities based on the team's wish list items, pain points, goals, and objectives.
Next Steps	In this section we provide our specific recommendations on process and solutions utilizing a Production Project where additional "Fit Gaps" may be exposed requiring additional training.

DEPARTMENT PROFILE

The Department Profile section provides our understanding of the organizational structure, key staff within the organization, departmental relationships, and how the Road Design Section interacts with other internal MDT bureaus/departments.

During the Discovery process, U.S. CAD was introduced to several staff members who are integral components of the MDT Road Design Section. These employees have immense knowledge and skills working within the Road Design Section ecosystem and related disciplines. Their knowledge of the inner workings of MDT's Road Design Section and outside entities, provided us with the needed details for a thorough understanding of day-to-day operations. The key staff members, along with the additional Road Design Section staff create, consume, and share data within the necessary MDT design functional areas.

The Road Design Section is responsible for designing roadway projects, preparing plans and documentation supporting the roadway design, and creating roadway design specifications and estimates. During the roadway design process, the Road Design Section consumes data from various design functional areas within MDT, included but not limited to Survey, Right-Of-Way, Hydraulics, Bridge, Environmental, and Traffic bureaus. They then leverage this data to complete their roadway design process and deliver the project, Plan Specification and Estimate (PS&E) to Engineering Construction Contracting Bureau (ECCB) for letting.

The Road Design Section has a complex workflow that includes input and data consumption from various MDT functional design areas. During the preliminary work phase the Road Design Section begins setting up their plan sheets, including but not limited to title sheets, standard details, typical sections in MicroStation and summaries in Microsoft Excel. Once the Road Design Section is notified from the Survey Section that the projects survey data is complete, they begin by reviewing the survey data. A survey request is sent to the Survey Section if additional survey data is needed. The Survey Section delivers a .tin of the project as well as a .dgn file, in some cases multiple files are delivered. The Road Design Section may have to merge the surveys together and annotate the survey features within the .dgn file once received.

Existing Present Travel Way (PTW) paint markers are used for establishing the roadway centerline as well as as-built data. The Road Design Section begins compiling their design and consuming data from other MDT functional design departments including, but not limited to, Geotechnical, Environmental, Bridge, Hydraulics and Right-of-Way. After this compilation of data is done within OpenRoads and Geopak, the Road Design Section can begin their design of the project. The design of the project includes generating alignments, profiles, corridors, cross section, details, and plan production. Quantities are added to AASHTOWare as well. This gets the Road Design Section to their thirty percent milestone and the plans are printed to PDF using DocuPlot.

There is an Alignment and Grade Review (AGR) meeting to review the thirty percent project package and any review comments are then included in the plans. A Scope of Work (SOW) report is generated, and the Road Design Section begins working towards there next milestone of sixty percent plans. The workflow during this milestone includes ditch design, approaches, permanent erosion control, variances, and design exceptions in OpenRoads and Geopak. Quantities are also created using Microsoft Excel. Data is consumed from various MDT functional design sections including, but not limited to, Right-Of-Way, Hydraulics, Traffic, and Environmental. The sixty percent milestone is submitted, Plan in Hand, and review comments are incorporated. It is very important to have design limits and details set for the Right-of-Way Section at this milestone.

An authorization notification is received from Right-of-Way and the Road Design Section begins refining their design to accomplish their ninety percent milestone of Final Plan Review (FPR). The comments from the FPR are made to the design plans and submitted to the plans checker for final review. The final submittal package to Engineering Construction Contracting Bureau (ECCB) for review includes, but not limited to, a project transmittal form, design plans, special provisions, Estimates known as Plans,

Specifications and Estimate Review (PS&E). Any final edits and reviews occur and the final PS&E submittal of one hundred percent is returned to ECCB.

Some of the tools currently used by the Road Design Section include:

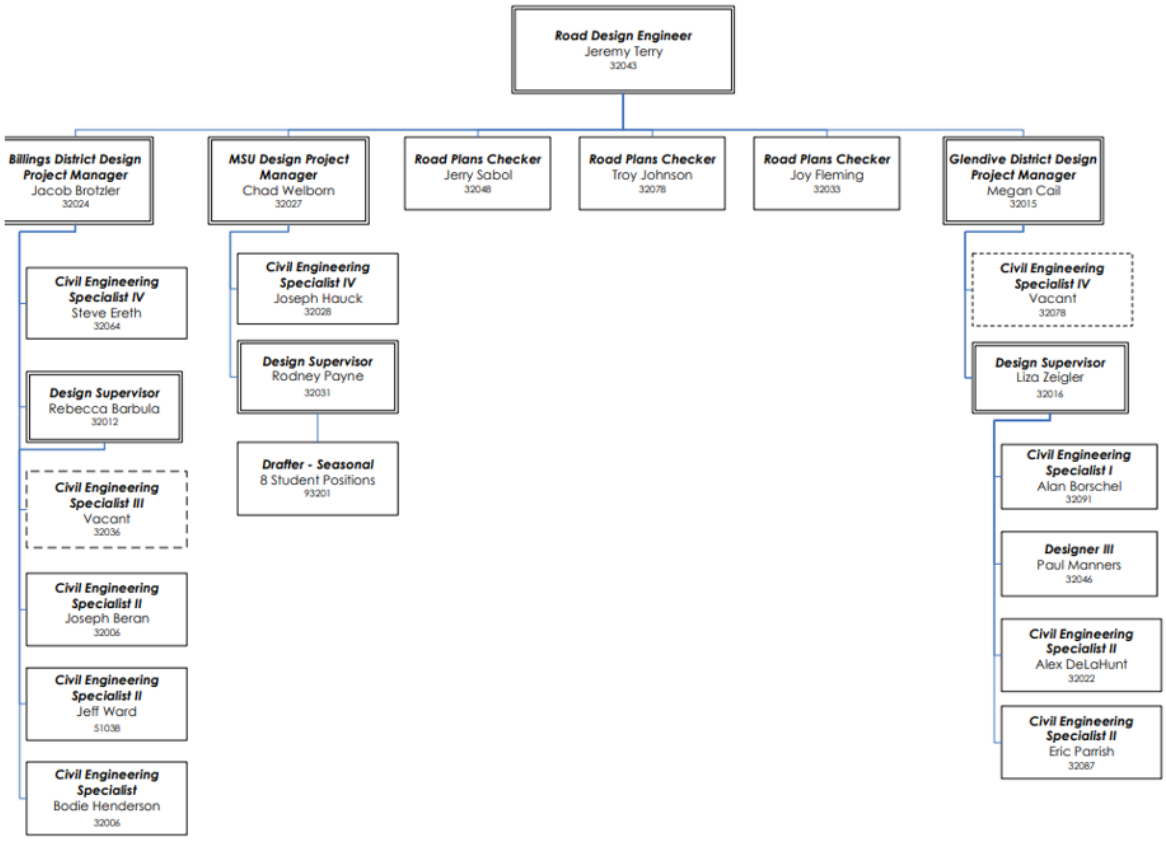
Activity	Solution(s)	Additional Solution(s)
Preliminary Project Work	MicroStation	Microsoft Excel
Project Design	OpenRoads, GeoPak	
Quantities	AASHTOWare	Microsoft Excel
Project Transmittal (ECCB submittal)	Microsoft Word	
Deliverables / Reports	MicroStation (.dgn), Adobe (.pdf)	PCMS, Adobe Share

Internal MDT maps and plans (as-builts) are also leveraged for data in paper and digital form.

While performing the Discovery Workshop staff members voiced several concerns, challenges, and fears they have for the software migration as shown:

- Letting go of current workflows
- Will need training to accelerate the learning curve
- Converting .dgn files to .dwg format and will it work after the conversation
- Lingering OpenRoads, Geopak projects
- Vetting of current workflows
- Meeting project deadlines while in the software transition

Below is the Organizational Chart of the MDT Road Design Section supplied by MDT.



RECOMMENDATIONS

Based on the information shared by the Road Design Section through the Autodesk's Discovery process and U.S. CAD's Discovery Workshop, we have prepared a summary of our recommendations the Road Design Section as discussed below. 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.

U.S. CAD believes that integrating the use of the products included in the Autodesk AEC Collection in all relevant bureaus and having one localized set of standards for all MDT project data would provide easy access to all MDT sections and external entities if shared. The true intent of standardization would be to provide accurate and consistent data/plans for users to access and reduce the possibility of errors and omissions. The capabilities of the AEC Collection would improve collaboration by providing access to maps, specific project site data, current/past projects, as-built plans, etc. Incorporating this information into the existing projects and utilizing automated processes in the AEC Collection's products would reduce rework and provide for faster project turnaround, inherently improving the workflow for the Road Design Section.

Currently, the Road Design Section design software doesn't contain the dynamic updating capabilities contained in the AEC Collection of software. The Road Design Section could, however, benefit from utilizing the automated and collaboration tools available within the Autodesk AEC 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. The current process of incorporating AASHTO constraints and criteria into project designs is a very manual process and Civil 3D leverages these constraints automatically within the software. U.S. CAD believes the software that will be leveraged most often by the Road Design Section would be Civil 3D, Infraworks, and BIM 360. Specific capabilities for each software recommendation are listed below.

Civil 3D

As the crown jewel of the AEC Collection, Civil 3D takes the process of designing in a 2D environment and instantly turns elements into intelligent 3D model components that are dynamic in nature. As a result of this dynamic capability, designers can make a change in one area of the project, and several other connected areas will be updated as a result. This can save a tremendous amount of time by reducing the editing process as well as eliminating potential errors. Civil 3D also automates the process of reporting as a result of utilizing intelligent Civil objects that not only are inter-connected but also possess a rich collection of data.

Infraworks

Infraworks can be used for preliminary research, importing, and exporting data from Civil 3D, Map 3D, GIS applications and additional software platforms. This makes Infraworks an excellent resource for starting projects that do not have survey data to begin with. Various data sources can be integrated into the Infraworks model during the life cycle of the model as well. As a result, Infraworks can create intelligent 3D project models that can be shared with design functional areas to create collaboration between MDT bureaus.

BIM 360

The Autodesk cloud collaboration tool, BIM 360, will be a crucial piece to the Road Design Section future workflow. Being able to share, review, and manage data in one centralized location will be a huge benefit. As part of the AEC Collection workflow, BIM 360 can consume Civil 3D data from the cloud in the same manner as if the data were stored locally, thereby improving connect ability among team members. Autodesk's BIM 360 provides access to data anywhere and anytime as well as design collaboration, project management and document management tools.

The following table outlines the Road Design Section current activities, recommended Autodesk solutions, as well as additional solutions to be implemented.

Activity	Solution(s)	Additional Solution(s)
Preliminary Project Work	Civil 3D / InfraWorks	Microsoft Excel
Project Design	Civil 3D	
Quantities	AASHTOWare	Civil 3D QTO Manager
Project Transmittal (ECCB submittal)	Microsoft Word	BIM 360, PCMS
Deliverables / Reports	Civil 3D (.dwg), Adobe (.pdf)	BIM 360, PCMS

These solutions are the basis for the proposed Training Program outlined in the section below.

TRAINING PROGRAM

U.S. CAD recommends the following training courses for the Road Design Section staff.

- **101 AutoCAD Fundamentals for Bentley Users** – This course, intended to assist those who have utilized Bentley products and have limited or no Autodesk AutoCAD experience, is focused on basic interface and functions within the AutoCAD product.
- **201 Civil 3D Fundamentals I** – This course will introduce the Civil 3D user interface and terminology and provide an understanding of Parcels, Surfaces and Survey.
- **202 Civil 3D Fundamentals II** – This course continues creating the knowledge of Civil 3D features and their functions.
- **203 Civil 3D Fundamentals III** – This course delivers insight into Sections, Section Views, Templates, Styles, Data Shortcuts, Printing, Sheet Setup, Sheet Set Manager and Quantities.
- **601 InfraWorks I** – This course covers the steps on how to import and configure data from within InfraWorks and utilize available tools to create, leverage, and analyze design alternatives for 3D design concepts and visualizations.
- **301 BIM360 Collaborate Pro for Infrastructure I** - This course provides an overview of what the web- based collaboration tool has to offer and how it can be leveraged to collaborate with internal divisions, field personnel and consultants.

By exposing the Road Design Section to the Autodesk software tools included in the list above, staff will have the knowledge needed for making informed decisions on what data is available and how to access it. Providing the Road Design Section with tools to import, utilize and share data in their current workflows is key to removing existing inefficiencies and frustrations within the Section. It is equally important for the Road Design Section to export data capable of being consumed by other MDT Bureaus.

NEXT STEPS

A Production Project will be identified by the MDT CAD Implementation Executive Team. A Production Project provides opportunity for MDT to refine proposed future MDT workflows, identify gaps, and give insight into configuration needs. This process has already led to the creation (and implementation) of the MDT State Kit. The State Kit was utilized on prior Pilot Projects giving deeper insight into how best to update and configure the solution. The Production Project will also provide insight into the requirements for additional content that needs to be included in MDT's State Kit as well as other key configuration elements that will help with production efficiencies.

The MDT CAD Implementation Executive Team have identified early adopters within each functional design area. U.S. CAD will work closely with the early adopters to develop workflow processes and procedures, as mentioned in our recommendations, to ensure their portion of the project can be completed utilizing Autodesk's AEC Collection. U.S. CAD will provide support and mentoring throughout the production project.

- During this phase additional "Fit Gaps" may be uncovered. If there are, additional training may be recommended.
- U.S. CAD and Autodesk will remain engaged with MDT to ensure successful implementation and Production Project completion.
- U.S. CAD and Autodesk will arrange regular meetings with MDT staff to assist them in attaining their goals and objectives.
- Upon completion of the Production Project, MDT will meet with U.S. CAD and Autodesk to explore expanded implementation options and identify the most effective path forward to meet MDT's larger BIM goals.

In addition to the Fit Gap Production Project, Workflow Road Maps will be developed and presented to MDT. With several MDT Pilot Projects already completed, (or currently being executed) the process of refining the workflows based on MDT feedback can begin. The goal is to confirm workflows that will be included in the initial stages of the broader implementation and training at MDT. The Workflow Road Maps are important to gain clarity of the scope and schedule of the Training and Implementation requirements, as well as the configuration needs for MDT's state-wide rollout of the AEC Collection solution.