pennsylvania
DEPARTMENT OF TRANSPORTATION

Digital Delivery Directive 2025 NEWSLETTER

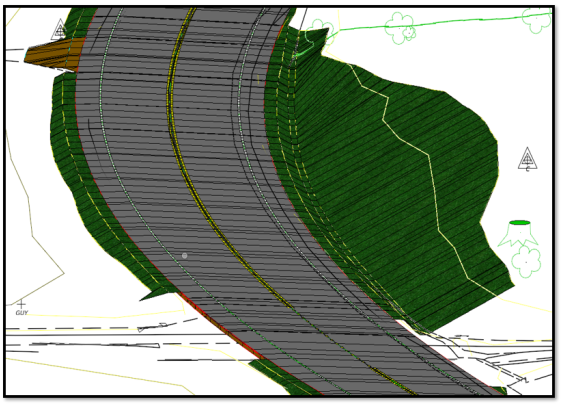
SPRING 2023 CONTENTS

District 1 Staff Tackle First Project with Model as a Legal Document (MALD) Component

In one of the Existing Ground Confidence Level (EGCL)/Roadway Authoring digital delivery pilots, the design team in District 1 was the first to incorporate MALD. This means that the digital model of the project was provided as a letting document, with the earthwork and paving taking the highest priority. In the past, the plans took precedence in order of importance; for this project, the model files took highest precedence.

According to Project Manager Ryan May, the project involves resurfacing and intersection site-distance improvements along SR 173 in Sandy Lake Township, Mercer County. The work includes mill and overlay, lane and

shoulder widening, superelevation correction, drainage and signing updates, and excavation.



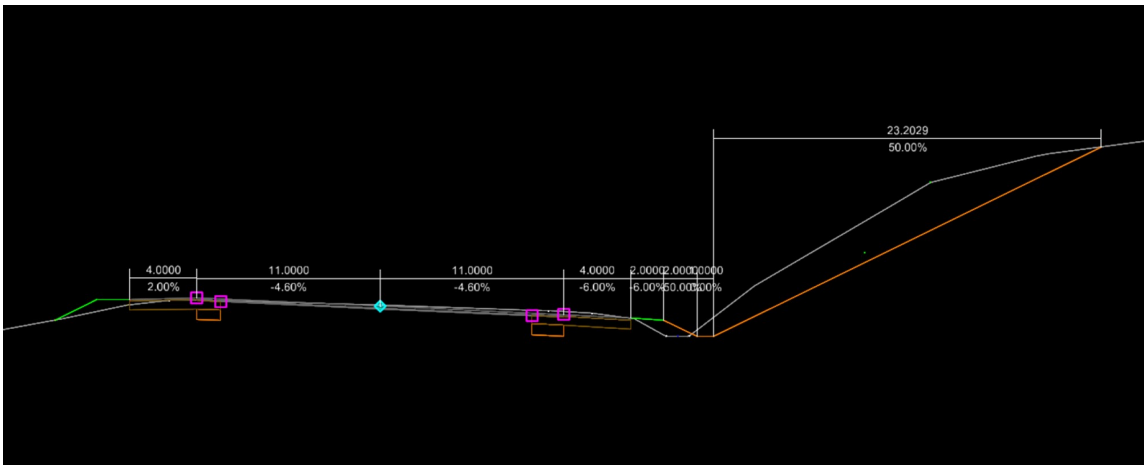
“Brody Guth, the project designer, developed a 3D model of the proposed roadway work and excavation, as well as the proposed inlets, pipes, and ditches for the project. Along with the model, a plan set was developed using the Single Project PDF roll plan for the plan sheet and profile.”

Guth points out that there were various challenges that went along with learning and using Open Roads Designer (ORD)—and to keep up with continual improvements to the software. “When the program did not perform a specified task, I would backtrack to determine whether the issue was user error or a bug within the program. I also had to familiarize myself with how the features can or should be utilized and understand the program’s limitations—that is, knowing what aspects of the design should be performed manually,” he says.

He also cites more specific challenges the team initially faced in using ORD. These involved ensuring that the design surface tapered smoothly and interacted effectively with various existing surface features, and adding constraints to various design features to make sure they stayed within the confines of PennDOT and FHWA design criteria and right-of-way limits.

Guth says that through this learning curve, he has come to recognize the capabilities of ORD. “I realize that ORD has many of the same basic tools and functions as our previous design platform. However, ORD has more features that allow for greater flexibility. Within the program, we can design, edit, and manipulate the model for meeting minimum/maximum design standards (such as annotation, placement of horizontal and vertical curves, and template drop edits) and in determining design thresholds for elements, such as fill slopes and cut slopes, throughout the project.” He adds that when cutting

several plan sheets or one single plan sheet that spans the length of the project, both options are more automated and easier to manipulate.



Guth appreciates that the 3-D model enables the design team to add features, including new ditch lines, shoulder backfill, embankment cuts, and drainage structures, within an x-y-z plane. “This enables us to see just how every aspect interacts, more clearly identify any design errors, and visually demonstrate where different criteria can or cannot be met,” he says.

The project was let on December 15, 2022, and the contract was awarded on December 21, 2022.

District 10 Designer Shares Experience with Open Roads Designer (ORD)

In 2022, PennDOT highway designers were tasked with incorporating ORD software files for 3D surfaces and topographical and right-of-way geometry. To date, three existing ground control level (EGCL)/Roadway Authoring pilot projects are underway. One of these pilots is the resurfacing, restoration, and rehabilitation of a 3.13 mile stretch of Route 28 in Butler County.

The project is scheduled to let in March of 2024.

District 10 Highway Designer Aaron Wozniak notes that the District is 3D-modeling the roadway portion and will add drainage and underground utilities to the model. “We are partnering with a consulting firm that will perform the drainage and utility design, but all the roadway work and associated modeling is being done in house.”

Wozniak notes that staff used V8i software in completing the right-of-way plan but then migrated to ORD. He adds, “This took some time and presented some challenges, but taught me a lot about the functionality of ORD, as opposed to V8i.”

One of these challenges related to the workflow associated with getting the surface to merge and display correctly in the cross-section view. With help from the Training Team, EGCL Pilot Team, and survey crews, Wozniak and the District staff used a scanned surface from the Trimble SX10 scanner for the roadway surface and supplemented conventional survey for everything outside of the roadway backbone. This helped to achieved greater accuracy throughout the roadway surface in the areas of the template that required more precision.

Wozniak is using ORD for modeling widening boxes with a separate corridor, while doing a variable-depth asphalt component to reestablish cross slope and superelevation with an overlay and stripping component. He says, “These aren’t necessarily new concepts, but just finding out how to handle these in ORD involves a learning curve. I am still finding things to change or modify.”

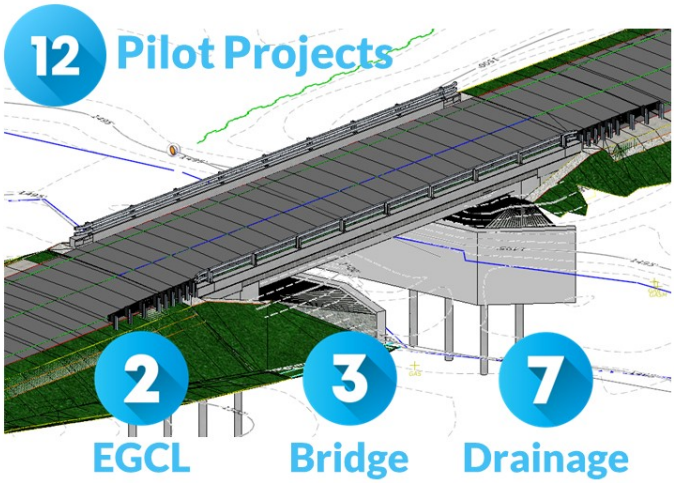
He adds that overcoming setbacks is an important element of the authoring pilot projects. “We are all learning how to shape the software to meet our needs. With each new release of ORD, and with the work of everyone involved with the pilot projects, we can meet our 3D2025

"I see great advantages to digital delivery and am really looking forward to when we can

goals. I see great advantages to digital delivery and am really looking forward to when we can integrate items and quantities. I feel that the key to success is teamwork, thinking ahead, and adjusting personnel and workflows to align with the changes digital delivery presents."

integrate items and quantities."

Project Progress



Since the launch of the 3D2025 Digital Directive in 2020, PennDOT has made significant progress in implementing key elements of the initiative. To date:

- Twelve selected pilot projects will provide 3D models as the contractual deliverables.
- Two roadway and existing ground and confidence level (EGCL) projects will move into construction in 2023. Although there are no cross sections included, the projects incorporate digital earthwork and pavement models as the contractual deliverable. Contractors will use the models to estimate, bid, and construct the projects.

- Three bridge projects will move into construction in 2023 and 2024. The projects will incorporate earthwork, pavement, and bridge models.
- Seven drainage projects are scheduled to go into construction in late 2023 and 2024. These projects include digital earthwork and pavement models, along with existing and proposed utilities and drainage. The models will use the latest workspace, with item types used to extract quantities from the models.

The digital delivery team is currently piloting the interim guidelines and associated documents, such as the Digital Delivery Execution Plan. The intent is to release an interim version of the guidelines in early 2023 through the PennDOT Digital Delivery website.

A Glimpse of 2025 and Beyond

By 2025, PennDOT and its partners will be able to design, construct, and maintain a 3D model-based designed project. The Department will have developed the standards and specifications that outline what will be included in the model and what data will be collected post-construction. Digital formats of deliverables will also be defined and standardized so that all digital delivery projects follow the same processes and workflows.

In 2025, PennDOT will initiate much broader implementation of digital delivery, with the understanding that certain project elements such as permits and right-of-way plans may not yet be available as 3D model deliverables. The goal, however, is to design in 3D and extract the 2D design data for these plans. Further, PennDOT is currently investigating industry guidelines and standards that will apply to digital delivery projects after 2025.

"As we continue down the path toward digital delivery, I cannot help but look back with amazement on the progress we have made. In 2018, as we were still working through our 3D challenges, I attended a meeting in District 9 to discuss this initiative. At that time, I could not imagine how entire PS&E packages could be delivered in a model-based format. Listening to the other Design ADEs, I started to get an understanding of what digital delivery actually is and now realize, with that meeting, we truly launched our

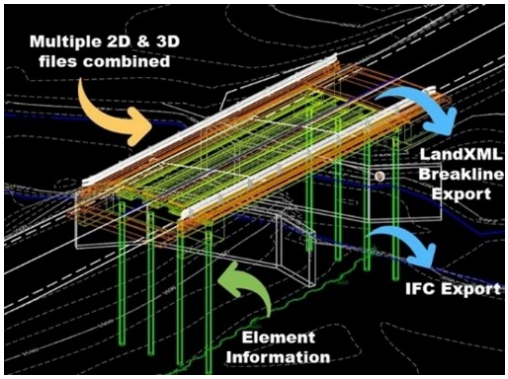
journey. By the middle of 2019, we had developed a mission and vision statement on our intent to bid projects using 3D technology by 2025. In June 2020, we began holding regional workshops and, by the end of 2020, we had a 3D2025 Strategic Plan. We began selecting pilot projects in 2021 and started delivering those projects in 2022! It has been a privilege to sit on the Digital Delivery Governance Committee, seeing what we have accomplished and getting a first-hand look at what we can expect in the future. We have come a long way since that meeting in 2018, and in doing so, established PennDOT as a leader in Digital Delivery. I am honored to be a part of 3D2025."

- Thomas J. Zurat, Jr., P.E.
District Executive
PA Department of Transportation
Engineering District 2

Tech Notes

Defining Digital Delivery

PennDOT's definition of digital delivery includes compiling and delivering electronic files that can be read by another system. The objective is to deliver data that that the receiver can readily use, such as 2D and 3D models, comma-separated values (csv) from spreadsheets, extensible markup language (xml), Industry Foundation Classes (IFCs), and so on. This approach is in contrast to PDFs; although PDFs are also electronic files, their data may not be in a consistent form (such as raster or vector images).

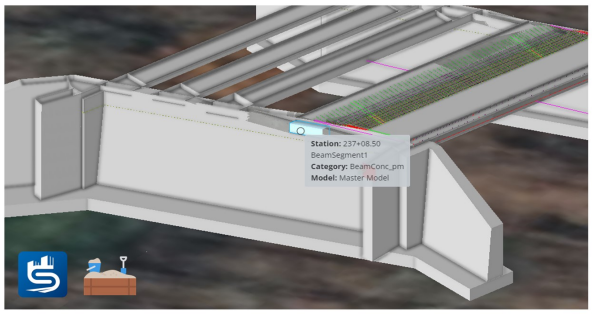


The digital delivery files will contain data that is exchangeable between computing systems (e.g., a grading model can be read directly by the automated software on grading equipment). Importantly, the delivered design-data set must contain all values necessary to accomplish the construction task, whether that be northing/easting (2D), northing/easting/elevation (3D), or ascii text.

PennDOT's digital delivery package will comprise graphical and textual data that can be manipulated by automated computer systems, without the need for human intervention. This may sound like science fiction, but in reality, the intent is to enable consistent access to up-to-date information, logically classified, searchable, and sortable.

PennDOT and Bentley Roll Out Sychro Sandbox

At the 44th annual APC Fall Seminar in 2022, PennDOT showcased its construction and inspection software complementing the Department's 3D2025 Digital Directive. The PennDOT/Bentley team's presentation featured Bentley Synchro, demonstrating the software's capabilities for a PennDOT sample pilot project in a "sandbox" environment.



In this environment, consultants, contractors, and inspectors can interrogate a 3D model, access project information, and be trained on how to use the contractual 3D models and pilot project information. This sandbox also allows contractors and inspectors to download the sample files to test their tools and workflows.

"The Digital Delivery Team was an extraordinary presence at this year's APC Fall Conference in Hershey.

I was impressed with everything — the interactive exhibit, first 3D newsletter, standing-room-only champion presentation, sandbox,

and even coordinated collared shirts. The team's communication was professional and open, encouraging feedback from contractors. PennDOT's path to replacing traditional paper-based plans with 3D digital technology is on point. "

- Troy A. Wolfgang
Project Manager/Chief Field Engineer
Francis J. Palo Inc.

If you would like to obtain more information about the Synchro sandbox, please email RA-PDDigitalDelivery@pa.gov.