Michigan Department of Transportation
RESEARCH Administration

RESEARCH SPOTLIGHT

Project Information

REPORT NAME: Digital Collaboration Using IFC and BIM Technology

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PROJECT COST: $96,750

COST SHARING: 20% MDOT, 80% FHWA through the SPR, Part II, Program

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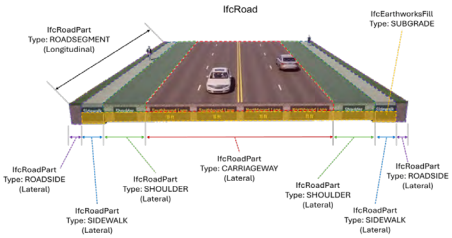
Evolving digital technologies improve asset management collaboration

Managing transportation assets depends on generating, storing and sharing data with stakeholders at each stage of an asset's life cycle, from design and construction to operation and maintenance. However, different formats and representations of this information can create inconsistencies in data accuracy and availability. A review of the Michigan Department of Transportation's (MDOT) asset data workflows identified data inconsistencies and possible solutions using digital technologies and tools.

PROBLEM

Designing, constructing, operating and maintaining transportation assets can generate a substantial amount of data over each asset's life cycle. Evolving digital technologies have allowed significant increases in the amount and formats of data that can be generated and transferred, which has created a more complex data management environment. Varying data file types, databases and storage practices may make sharing asset data difficult among MDOT staff, contractors and other stakeholders who require this information during different phases of a project, leading to outdated information and inefficiencies across the asset's life cycle.

Advanced digital data technologies and software could provide consistent and accessible asset information, efficient workflows and effective data exchanges. This study examined three potential digital solutions:



Digital tools capture and store project elements in accessible formats for improved transportation asset data management.

- Building Information Modeling (BIM) software, which creates 3-D models of assets, complete with all attributes.
- Industry Foundation Classes (IFC), an open data standard that facilitates data exchange between different platforms.
- Connected Data Environment (CDE), which offers a centralized data platform to improve data management across an asset's life cycle.

MDOT was interested in exploring these tools to improve practices for generating,

(continued)

> *"This project increases MDOT's understanding of digital tools to support the data needs of all stakeholders involved in construction and ongoing asset management."*
>
> **Luke Arnold, P.E.**
> Project Manager

tracking and sharing data from several assets of varying complexities.

RESEARCH

The study began with a review of the current state of the art in digital technologies, including BIM, IFC and CDE. Then investigators surveyed state DOTs about their experience using digital technologies for asset data management. Next, MDOT staff helped identify assets to demonstrate the capabilities of these technologies. The assets – including pavements, pavement markings, signs, guardrails and culverts – represented a range of complexities, and each requires sufficient data and has a defined workflow.

MDOT staff from multiple areas provided researchers with data types and workflows used throughout asset life cycles. Interviews with contractors identified needed and generated data through the construction processes, and experiences and perceptions using 3-D models relative to standard 2-D plans.

Information from these interviews was used to develop process maps and data exchange tables that demonstrated data management throughout the asset life cycle, including responsibilities at each stage, data transfer practices and tools used for handling the data. These visual representations illustrated areas of potential data loss, lack of continuity and other inefficiencies. Finally, researchers demonstrated how BIM, IFC and CDE might improve asset management workflows and identified potential challenges of the technologies.

RESULTS

Inefficiencies and challenges identified across asset workflows included points where data showed other continuity issues due to factors such as storing data as text on drawings, not including updated information in as-built plans or not updating information after maintenance actions.

Most state DOTs responding to the survey have similar experience with digital delivery technologies as MDOT. Mixed feedback from contractors included beliefs in the capacities of technologies to assist in tasks and concerns over fieldwork compatibility, workforce training needs, technology costs and potential inconsistencies between digital and hard copy plans. In addition, a case study applied the use of IFC to a pavement-focused pilot project.

Researchers found that BIM, IFC and CDE could reduce manual data handling errors and improve data quality:

- BIM can function both as a design tool and a centralized data repository for improved asset data translation and sharing. All stakeholders accessing the information, however, need to use the same version of the same software.
- IFC provides a standardized format to improve data consistency, accuracy and accessibility across various software applications, including BIM models. IFC is an evolving tool, and developers need to continue to ensure compatibility with relevant software platforms. MDOT can work to map asset elements to the IFC structure.
- CDE provides a unified data platform. Further exploration of software platforms and operational details would ensure consistent accessibility for all users.

IMPLEMENTATION

Demonstrating digital tools using MDOT examples illustrated the challenges and potential solutions in collecting, storing and transferring data among stakeholders. MDOT will continue refining its digital vision toward a "data-agnostic" future through development of BIM standards for asset designers, implementation strategies and ongoing asset data assessment. Collaboration with contractors will also continue to ensure a thorough understanding of asset life cycle data needs.

Research Administration

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The final report is available online at
MDOTjboss.state.mi.us/TSSD/tssdResearchAdminDetails.htm?keyword=SPR-1756.

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