IOWA DOT

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DIGITAL DELIVERY IMPLEMENTATION PLAN

CONTENTS

Digital Delivery Implementation Plan

Executive Summary

The Iowa Department of Transportation (DOT) is committed to leveraging data and digital workflows to support business functions across the enterprise. This implementation plan describes how the DOT will achieve the Tactical Goals (TG) outlined in the **Iowa DOT Digital Delivery Strategic Plan**. This Digital Delivery (DD) Implementation Plan provides guidance on how to approach digital transformation over the next decade. This plan builds upon years of previous work by the DOT to digitize workflows and standardize data management at the organizational and project level.

"At Iowa Department of Transportation, we're continually pursuing new ways to make our projects safer and more efficient. Digital Delivery hits at the heart of this pursuit. In fact, it goes beyond delivering projects — it will deliver value to our state.

Iowa DOT has been planning for Digital Delivery since 2022. This work is complex and requires input from staff and stakeholders all across the project lifecycle. However, I'm confident that this ongoing digital transformation will succeed in achieving the strategic and tactical goals laid out in this plan.

The future of project delivery is digital, and Iowa is proud to be on the leading edge of these efforts."

Charlie Purcell
EXECUTIVE SPONSOR, DIGITAL DELIVERY

Our Vision

DD workflows will enhance the Iowa Department of Transportation's ability to share information seamlessly across the enterprise, significantly improve how assets are managed throughout their lifecycle, and provide greater value to internal DOT users and external partners like construction contractors and suppliers.

ENHANCING IOWA DEPARTMENT OF TRANSPORTATION INFORMATION SHARING THROUGH DIGITAL WORKFLOWS

Our Mission

The mission of the DD Program (the Program) is to enable streamlined data sharing and active collaboration between different Divisions, Bureaus, as well as the public and other external stakeholders.

ENABLING STREAMLINED DATA SHARING THROUGH ACTIVE COLLABORATION

Our Values

The Iowa DOT DD Program is committed to the following values.

Safety First — Keeping DOT staff, Iowa travelers, and partners safe by leveraging technologies that enable smart work zones.

Collaboration — Valuing input from staff, stakeholders, and partners to develop DD implementation strategies.

Innovation — Empowering Iowa DOT business and technical subject matter experts to develop and implement DD best practices.

Customer Focused — Exploring the right technology and data needs to deliver the best product for our customers.

Stewardship — Setting responsible implementation timelines to achieve desired outcomes.

NOTE: Activities and schedules in this implementation plan may be updated as initiatives progress.

Program Goals and Priorities

The key objective for the Program is to advance the maturity of digital workflows and data used for project concepts and final design, construction delivery, and maintenance and operations activities.

Through the Program, Iowa DOT is transforming the way information is exchanged into more robust and sustainable methods that leverage digital workflows. Priority goals are:

- Use 2D and 3D modeling technology to develop project models that can be used as legal documents.
- Leverage existing technology and explore new tools to support specific uses.
- Expand data collection to manage assets by developing digital models that represent as-built conditions.
- Develop and implement data management processes aligned with data management goals.

These goals will be achieved through careful planning, communication, and dedicated resources to manage change. DD transformation will happen in phases over the course of a decade but is already underway through pilot projects.

Overview of Tactical and Strategic Goals

A total of five Tactical Goals (TG) and three Strategic Goals (SG) were established in the Strategic Plan. These goals are the basis for implementation activities and strategies. This section provides a summary of the TG and SG desired outcomes, strategies, focus areas, and potential funding sources. Detailed descriptions of each goal's specific activities can be found in subsequent sections of the Plan.

TG Tactical Goals

1. Develop a stakeholder communications and engagement plan.
2. Define organizational requirements.
3. Develop a prototype for exchanging priority asset data.
4. Update project and exchange requirements to advance digital maturity.
5. Expand the use of e-Ticketing.

SG Strategic Goals

1. Develop standards to incorporate or connect data harvested from design models through digital as-builts into authoritative systems.
2. Review the current plan for replacing the electronic records management system (ERMS) and make updates to improve data searching and reporting.
3. Improve the transfer of data between various department systems.

Focus Areas

Implementation strategies will be guided by the following focus areas:

- Data Requirements, Standards and Guidelines
- Technology Implementation
- Data Collection and Storage
- Workforce Development Outcomes
- Workflow Efficiency
- Collaboration and Engagement

The overall Program strategy leverages both state funds and federal grants to fund the implementation tasks described in this document. Iowa DOT is leveraging the Accelerated Innovation Demonstration (AID) and Advanced Digital Construction Management Systems (ADCMS) grants to fund certain activities, many of which are occurring concurrently.

TG1 Stakeholder Communications and Engagement

A Communications and Engagement Plan was developed during the first year of the Program. This document provides guidance and tactics to continuously monitor progress, collect and evaluate feedback, and build support for ongoing stakeholder engagement and conference presentations. The Communication and Engagement Plan will be updated annually.

Goal Outcomes

- Enhanced knowledge of DD goals and objectives.
- Improved communication of key information.
- Increased engagement from stakeholders.
- Improved support from industry partners.

Strategies

- Provide an accessible, digital platform for continual information sharing.
- Develop educational materials to communicate general DD concepts.
- Facilitate events (e.g., workshops, webinars) to engage with stakeholders.
- Provide Program status updates on a regular basis.

Funding Sources

- Federal Aid and ADCMS grants.

Focus Areas

Workforce Development Outcomes

Collaboration and Engagement

Key Milestones

2024: Initial stakeholder and engagement plan (completed)

2024: DD website (completed)

2024–2026: DD information materials

2025: Detailed DD implementation and deployment plan (completed)

On-going: DD webinars, workshops and peer exchanges, and program reporting

TG2 Operational Requirements

Organization Information Requirements (OIR) describe the content and nature of information an organization needs to maintain and operate its assets. Iowa DOT currently has extensive OIR for bridges, pavement as well as mature databases for some ancillary assets. The Asset Data Strategy Framework project (with State research funds) will establish the OIR for ancillary assets through creating a high level asset condition management framework, a data collection plan template, and will prepare data collection plans for priority assets. Where the data collection plan indicates project delivery as a source of asset data, there is a need for design activities to align with the data structure and language of the same features. The AID and ADCMS grants will fund activities to implement the data collection for selected assets. The AID grant will be able to provide input on the feasibility of DD to provide robust asset information and insights into the costs associated with collecting point and linear asset information in project development.

Activities to achieve this goal will focus heavily on defining asset information requirements (AIR) that align with Iowa DOT's asset data strategies project, which will:

- Establish a framework for managing each asset class.
- Identify data needed based on selected management approach.
- Define how data is collected and who is responsible for each step in the process.

Goal Outcomes

- Expanded requirements for asset data information.
- Improved data alignment between systems.
- Enhanced data collection guidance.

Strategies

- Identify and define AIR.
- Develop standards for data schemas and model-derived information.
- Determine data collection methods and procedures.

Funding Sources

- State funding for developing a framework for the Iowa DOT asset data strategy and asset condition management.
- Federal AID and ADCMS grants used to develop AIR for signs, lighting, traffic barriers, bridges, and pavement.

Focus Areas

Data Requirements, Standards and Guidelines

Key Milestones

2025: Process, Technology and Data Management Assessment (AID/ADCMS Funds)

2025: Asset Data Strategy Framework (State Research Funds) (Phase 1 completed)

2025–2026: Data Standards Development (AID/ADCMS Funds)

Future Initiative: Expansion of Information requirements and Data Standards (NOT FUNDED)

TG3 Prototype for Exchanging Priority Asset Data

To achieve this goal, activities will focus on exploring mechanisms that facilitate the automated or semi-automated exchange of asset data from the handoff between design to construction and construction to operations. The activities will be divided into two categories:

1. The development of a prototype application to validate and exchange ancillary asset data from CADD-to-GIS using Feature Manipulation Engine (FME) software
2. Exploring the use of Industry Foundation Classes (IFC) schema and Application Programming Interface (API) connections to facilitate the transfer of other asset data types from the modeling system to non-GIS databases and systems (e.g., AASHTOWare products, project management, and bidding systems)

Goal Outcomes

- Improved data exchanges.
- Enhanced CADD software configuration.
- Expanded procedures and use of automated tools.

Strategies

- Define data standards and schemas for multiple exchanges.
- Create tools that automate validation of data sets.
- Develop and deliver training for pilot project teams.
- Provide technical support to pilot project teams testing the prototype.

Funding Sources

- Federal AID and ADCMS grants for developing prototype tools and procedures specific to signs, lighting, traffic barriers, bridges, and pavement.
- Funding to expand the prototype application to other asset types has not yet been identified.

Focus Areas

Key Milestones

2024–2026: CADD Workspace Development and Standards Validation– Ancillary Assets (AID/ADCMS Funds)

2025–2027: CADD Workspace Development and Standards Validation – Bridges and Pavements (ADCMS Funds)

2025–2026: CADD-to-GIS Field Data Collection Application Development. (AID/ADCMS Funds)

2025–2027: Field Data Collection Tool Testing, Training and Pilot Projects (AID/ADCMS Funds)

2025–2026: Bridge OpenBIM Standards Pilot Projects (ADCMS Funds)

2025–2027: Field to Asset Management Data Exchanges (AID/ADCMS Funds)

2027–2028: GIS-to-CADD Data Exchanges (AID/ADCMS Funds)

Future Initiative: Expansion of Data Exchanges for Other Asset Classes (NOT FUNDED)

TG4 Project and Exchange Requirements

Project information requirements (PIR) identify and define information required for key decisions during project delivery. Examples of PIR include: What is the purpose of information being delivered; what deliverables should be submitted at specific milestones; and what is the format in which they are provided?

The exchange information requirements (EIR) define the details of information standards, methods, and procedures for the development of 3D model deliverables. PIR and EIR should be developed for different types of projects. For example, requirements for a resurfacing project will differ from those for a bridge replacement.

Goal Outcomes

- Expanded model authoring capabilities.
- Improved design quality.
- Enhanced data visualization.
- Improved project delivery process (design and construction).
- Optimized contractor bidding and automation processes.

Strategies

- Update modeling standards to align with open data standards schemas.
- Provide procedures and guidelines for producing digital deliverables.
- Develop guidelines for verifying the quality of digital deliverables.
- Explore the use of software to enable the use of digital deliverables in construction.
- Develop and deliver training for affected staff, stakeholders, and customers.

Funding Sources

- ADCMS Grant funding bridge open data standards solutions for project deliverables.
- Funding source for creating additional asset classes standards and guidelines for digital deliverables has not yet been identified.

Focus Areas

Data Requirements, Standards and Guidelines

Workflow Efficiency

Technology Implementation

Workforce Development Outcomes

Key Milestones

2027: Bridge Open Data Standards Project Design Solutions

2027: Bridge Guidelines for Delivering Digital Deliverables

2026–2027: Bridge DD Training and Field Testing

Future Initiative: Updating Modeling Standards, Creating DD Guidance, and Training (NOT FUNDED)

TG5 Expansion of e-Ticketing

Efforts to advance and institutionalize e-Ticketing are currently in place. The development of a hub to integrate e-ticketing information from DocExpress software is already underway. Activities to achieve this goal include identifying uses of e-Ticketing for other materials and assets, defining data requirements to update e-Ticketing workflows, and identifying programmatic changes needed to improve the use of e-Ticketing.

Goal Outcomes

- Improved work zone safety.
- Enhanced quality and quantity documentation.
- Improved asset materials information.

Strategies

- Prioritize asset materials.
- Define data requirements.
- Identify programmatic changes.

Funding Sources

- ADCMS Grant funding the development of GIS tools for automated data migration and identification of programmatic changes to improve e-ticketing.

Focus Areas

Key Milestones

2025–2026: Audit Current e-Ticketing Processes and Information Exchanges

2026: Additional e-Ticketing Uses Identification and Recommendations

IMPLEMENTATION APPROACH AND CONSIDERATIONS

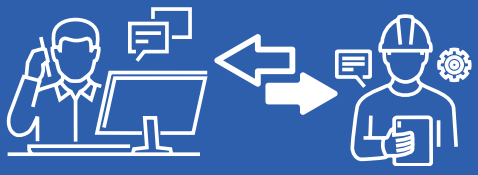
Implementing DD at the organizational level requires many resources with a variety of expertise, as well as the appropriate time to dedicate to implementation activities. Iowa DOT has chosen a technical approach that will run concurrent activities to accelerate the implementation of DD and meet the commitments made to FHWA under AID and ADCMS grant work. Iowa DOT is using the AID and ADCMS grants to partially fund activities in this plan.

Roles and Responsibilities

As Iowa DOT implements DD, it is important to clarify and formalize roles and responsibilities for the Program and project teams.

As the Program grows, it will be important to have a designated DD Program Manager for the agency for whom this is their primary job. This individual will oversee the successful planning, coordination, and execution of all initiatives that make up the Department's DD Program. This position will work closely with management and cross-functional teams, including developers, designers, inspectors, asset managers, operations, and contractors to ensure the timely and efficient delivery of high-quality digital data lifecycle for transportation development and operations.

Project teams will need guidance to clarify their roles and responsibilities in managing, creating, reviewing, and using digital deliverables. While most project team members' roles and responsibilities will not change, designated resources are needed to coordinate BIM execution for road design and construction like the current Bridge BIM engineer position in the Bridge Bureau. These positions would manage the digital design process and digital outputs with all appropriate stakeholders on the project level. They would also coordinate with the DD Program Manager to implement department initiatives into projects effectively.



A discipline BIM coordinator is responsible for supporting the project team with the digital design procss and digital outputs.

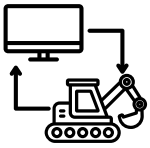
A Project Digital Construction Manager is responsible for performing activities during construction related to using surveying equipment and modeling software, and assisting construction inspectors with verification of locations, elevations, and measurement of quantities using digital means. This person would also serve as the DD coordinator between the construction, the contractor, and the design teams.

Use Cases

Defining the purpose for the project models or how they will be used is the first step in determining information requirements to create a model. Use case requirements are based on scenarios that consider the information needs of the receiver. Scenario-based requirements articulate how the information delivers value to the receiver using simple, non-technical language that people creating or delivering the information can understand. Examples of use cases for a model may include:

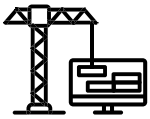
3D Design Coordination and Clash Detection: A federated model that combines (or federates) individual discipline models to visualize the project, assess design progress, and enable the project team to make design intent decisions viewing the design as a whole. This federated model can also be used to determine field conflicts via clash detection software or visual inspection.

Quantity Take Off (QTO): The process of extracting quantities directly from 2D and 3D models for project cost estimation. Cost analysis/estimation is implied to be part of this use case.

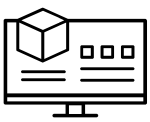


Construction Layout and Automated Machine Guidance: A discipline model that represents alignments, profiles, 3D points, 3D features, and surfaces that can be used by the contractor for construction layout as well as automated equipment to guide real-time positioning equipment for activities such as earthwork and paving.

Construction Management and Inspection (Construction): A federated model that can be used by construction management staff, including field inspectors and office staff, to locate, measure, verify, and document pay items being installed by the contractor to authorize payment.



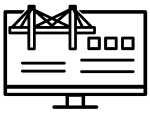
Construction Simulation: A federated model produced by the contractor to visualize the sequence of construction activities based on the work breakdown structure used in the critical path method schedule. The schedule may also be cost-loaded if requested.



Design Authoring: A discipline model based on specific discipline design criteria to convey design intent for construction. Each discipline determines the details to develop and analyze design elements. Discipline models identified include survey, geotechnical, roadway, bridges and structures, hydrology/hydraulics and drainage, utilities, traffic, and safety .

Record Model: A federated model that represents the built conditions as accepted during construction, including status (removed, installed, etc.), geospatial location (stationing, GPS coordinates, log mile), asset geometry (2D or 3D), asset attributes, asset materials details, pay item cost information, and dataset metadata that can be consumed by asset inventory and management systems. This model may be used to inform asset management decisions and plan maintenance activities. It is also expected that the record model should be updated as the asset is inspected or when maintenance or construction activities occur. Deliverable file format will depend on the specific type of object but should be GIS-compatible.

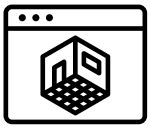
Environmental and Social Impact Analysis: A federated model that captures both existing and proposed features that geospatially contextualize the impact to the environment, right-of-way, and the community within the footprint of the project. This model can be used for analyzing alternative design options, visualizing the project footprint impact, deriving documentation for external agency permits, and reports.



Fabrication Detail: A discipline model created by the fabricator. The model provides geometric layout and material properties needed for structural steel and precast concrete fabrication. Often includes reinforcing elements and other structural components such as bearings and joints. The fabricator would transmit this model to Iowa DOT to augment or replace shop drawings.

Quantity Takeoffs (for Engineer's Estimate): A federated or discipline model that enables the project engineer to derive quantities directly from the model that are used to prepare an engineer's estimate based on Iowa DOT pay item structure.

Quantity Takeoffs (for Contractor Bidding): A federated or discipline model that enables the contractor estimating team to derive quantities directly from the model that are used to prepare a bid list based on Iowa DOT pay item structure.



Visualization for Public Involvement: A discipline model used by public information teams to communicate the scope and details of a project through detailed renderings and simulations throughout the project's lifecycle.

Technology and Digital Workflows Considerations

Technology implementation does not come without challenges. It's harder than ever to keep a technology portfolio current and relevant to meet evolving data and user needs. Iowa DOT recognizes that enterprise technology implementation management plans must be flexible when reviewing new tools. Today's users are looking for technology that makes their job easier, enables real-time collaboration, provides an easy-to-use interface, and enables mobility. In other words, the technology solution must satisfy the needs of the intended user. Key recommendations include testing and implementing new versions of software with more capabilities as well as exploring new technology. Technologies and processes should be tested via pilot projects with a key focus on finding the right solutions for the intended user while meeting budgetary constraints. Technology is changing so rapidly that it requires organizations to explore new business processes for replacing hardware and updating and retiring outdated systems. As part of this Plan's strategies, Iowa DOT will:

- Assess the current software stack for compatibility of digital information exchanges, identify any gaps that exist, and work with software vendors to determine short- and long-term solutions.

For new software, Iowa DOT will:

- Define software evaluation criteria that consider the functionality, configuration, and workflow for data exchanges that minimize data loss between systems transactions.
- Consider user interface and ease of use for the intended audience.

Another consideration for successful technology implementation is standardizing and documenting the processes for digital workflows. It is important to develop workflows that do not add significant work versus current ones, while simultaneously balancing return on investment and the functionality of Iowa DOT's technology stack.

An example of this decision matrix approach would be investing in new technology for field staff to collect and validate the installation of underground electrical facilities for DOT lighting, signals, and other electrical devices. The digital workflow may add some time to the inspection process but reaps massive dividends in the future when needing to understand the underground utility infrastructure that may be affected by future projects. Iowa DOT will need to evaluate the cost of the new technology and additional labor to collect the data, how this benefits future DOT planning and maintenance work, as well as how the available technology supports both the activity and the Program holistically.

Pilot Project Program

Goals

For several years, Iowa DOT has been piloting the use of different technology and tools with an ad-hoc approach. This has proven to be informational and it is time to evaluate lessons learned from these experiences so they can be applied to future pilot projects. The goals for the pilot project program are to:

- Create and deliver asset objects (2D or 3D) that meet the standardized PIR and AIR.
- Supply data sets to construction staff that will enable them to meet the requirements of their tasks, such as locating assets being constructed, verifying elevations, measuring quantities (pay items), and documenting outcomes of construction.
- Validate, update (if necessary), and document the as-built condition for each asset being inspected.
- Publish data sets with desired asset information to the DOT's systems of record.

Considerations

Key strategies to achieve the pilot project program goals include:

- Establishing project-selection criteria for specific use cases and technologies. See **Appendix A** for previously developed preliminary project selection criteria.
- Selecting projects with a scope of work that includes asset types being evaluated and a timeline that is acceptable for the project team.
- Designating the level of model development and information needed for each asset type being evaluated in the pilot project. This includes informing model development early in the design process.
- Defining the roles and responsibilities for key activities such as the development and quality management of the project models during design, updates to the models during construction, and data collection methods for field activities.
- Determining technology to be piloted throughout the project phases and agree on a timeline for specific activities based on the roles and responsibilities previously defined.
- Updating or creating development specifications for construction that clearly spell out the expectation for the collection and validation of asset data and deliverables at the end of construction.
- Working closely with construction teams to collect asset information for underground utilities prior to being covered. Trenchless utility lines should be collected as the installation is performed.
- Considering pilot projects for the collection of digital as-built information without modeling the assets during design. There is value in collecting as-built information on projects that are currently being constructed without model-based information.

Data Standardization

Iowa DOT has invested significant time and funds to advance the use of industry standards, particularly open data standards to improve interoperability between systems. The DD Implementation Plan considers using as many international and national industry standards as possible to guide the development of information requirements and data schema, (management of data being exchanged between stakeholders and their systems). Each standard plays a critical role in the successful implementation of DD and helps organizations standardize their digital transformation.

International Standards

ISO 29481 Series Building Information Modeling – Information Delivery Manual (IDM). This three-part series provides guidance regarding methodology for developing information requirements, considerations for describing coordination activities using digital information exchanges throughout the lifecycle of a given asset, and specifications for creating a standard machine applicable, readable, and transferable (SMART) data schema for the efficient development, management, and reuse of IDM specifications. Iowa DOT will use this standard to inform the development of Iowa DOT authoritative IDMs related to pavements, bridges, and ancillary assets.

ISO 19650 Series Building Information Modeling. This five-part series specifies principles and high-level requirements based on the UK Building Information Modeling (BIM) Framework. Specifically, the series offers recommendations for developing Organization Information Requirements (OIR), PIR and AIR; and considerations for enabling the collaborative exchange of information between project teams and stakeholders using a secure and controlled environment for hosting and managing data. The standard also offers considerations for generating, checking, reviewing, approving, and accepting information according to key principles. Iowa DOT will use this standard to inform updates to the project development process that will enable the successful use of digital workflows and data, enhance collaboration, and adhere to cybersecurity policies.

ISO 16739 Industry Foundation Classes for data sharing in the construction and facility management industries. This standard establishes the data schemas, their documentation, the property and quantity set definitions, and the mechanism for exchanging information using a structured file format. Iowa DOT will use this standard as the basis for defining the schema for model objects created during the project development phase and exchanged with other systems downstream.

ISO 7817 (Part 1) Building Information Modeling – Level of Information Need. The newest of BIM related standards is based on the European standard BS EN 17412 due to its specificity. This standard builds upon what the ISO 29481 series lacks, providing more details about how to define requirements for levels of geometric and alphanumeric information to incorporate, based on model object breakdown structure, as well as the necessary documentation to support data models. Iowa DOT will use this standard to establish modeling standards for digital deliverables that support construction and asset management functions.

ISO 19115. This standard provides guidelines for geographic information metadata structure and is typically followed by GIS professionals when delivering geospatial data. While this standard does not define data schema standards, Iowa DOT will use to define a standardized way for applying metadata.

National Standards

ASCE 75. The American Society of Civil Engineers (ASCE)'s Utility Engineering and Survey Institute (UESI) is working on a national data schema for collecting the installed condition of underground utility facilities. This data schema will provide the blueprint for creating utility as-built data standards for Iowa DOT.

AASHTO IDM for the Design to Construction Data Exchange for Highway Bridges, 1st Edition. As the first authoritative standard set of information for bridge construction published by the American Association of State Highway and Transportation Officials (AASHTO), this standard defines the exchange requirements for bridge model-derived information in a comprehensive set of tables. The tables will be evaluated to establish the model object organizational break down structure with the appropriate IFC classification and schema rules.

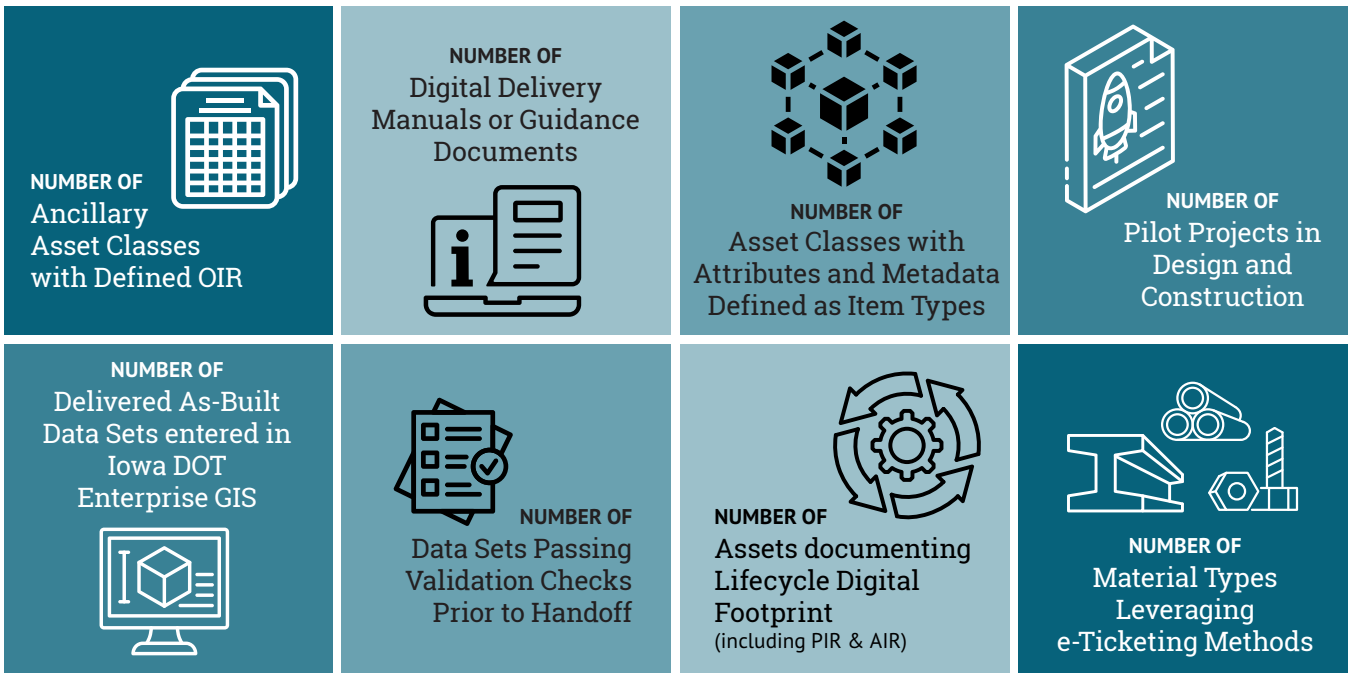
AASHTO Standard Specification for Material Delivery Management Systems, First Edition. This specification provides haulers, agencies, contractors, suppliers, and vendors with a standardized format for digitalized communication of data associated with the delivery of material to a contract. The specification will be used to inform the data schema for exchanging e-Ticket information.

Education and Training

As with any change management strategy, the education and training of staff affected by DD are critical success factors for implementation. Pilot projects provide the opportunity to receive real world feedback on possible process changes, which allows the team to develop and refine training materials that can be upscaled at the conclusion of the piloting period. Training modules should be developed for specific job functions being affected by DD. The content should be created for each of the systems being used regardless of ease of use to provide the best user experience and increase success of adoption.

Progress Monitoring

Specific metrics will be established to assess the progress and the effectiveness of DD implementation activities. Metrics should be realistic and the data needed for reporting results should be easy to acquire. Metrics should be re-evaluated annually and adjusted as digital maturity increases. Metrics to consider include, but are not limited to:



TG1: COMMUNICATION AND ENGAGEMENT TASKS

A Communications and Engagement Plan has been drafted for Iowa DOT's DD Program. As the Program matures, this plan will be updated as needed.

Tasks and Activities

Communication and engagement activities will focus on establishing and executing strategies and tactics to share information related to the Program and its status; educate people about DD; engage staff, stakeholders, and customers; facilitate conversations; and receive feedback.

TASK 1.1

STAKEHOLDER AND COMMUNICATION PLAN

The key activities include:

- Creating a stakeholder communications plan that includes key messages, tools, and tactics.
- Developing templated resources (e.g., Microsoft PowerPoint and Word) that reflect a unique visual identity within the established Iowa DOT brand.
- Creating graphics and content for presentations and documents developed by the technical teams.
- Evaluating and updating the stakeholder and communication plan on an annual basis.

TG1

TASK 1.2

DIGITAL PLATFORM MANAGEMENT

The key activities include:

- Developing a webpage hosted within the Iowa DOT's existing website to offer a comprehensive overview of DD and serve as an information hub for internal staff and external industry stakeholders.
- Managing website content to keep information up-to-date or upload new informational materials provided by technical subject matter experts.
- Providing updates to Department leadership and staff and external stakeholders who subscribe to email updates.

TASK 1.3

DIGITAL DELIVERY INFORMATIONAL MATERIALS

The key activities include:

- Developing white papers on a variety of topics based on DD Committee input.
- Creating an infographic explaining the value of DD for the asset management lifecycle.
- Preparing PowerPoint presentations for engagement events.

TASK 1.4

DIGITAL DELIVERY ENGAGEMENT EVENTS

The key activities include:

- Identifying, planning, and facilitating annual virtual and/or in-person events.
- Planning and facilitating webinars as identified in the annual Program engagement plan.
- Coordinating with peer state DOTs to plan and facilitate peer exchanges.
- Planning and facilitating industry engagement events, such as workshops and forums.
- Presenting at Iowa industry meetings, such as ACEC and AGC events.

TIMELINE / SCHEDULE

TASK / ACTIVITIES	2024				2025				2026				2027				2028				2029				2030			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TG1. Communications and Engagement Tasks (Task 6 AID Grant Activities)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
Task 1.1 Create initial stakeholder and communication plan (Task 6.1 AID Grant - Completed)		■																										
Task 1.2 Develop digital platform management			■	■																								
Task 1.3 Develop digital delivery information materials (Task 6.2 AID Grant)		■	■	■	■	■	■	■	■	■																		
Task 1.4 Plan and facilitate digital delivery engagements (on-going annual events) (Task 6.3 AID Grant) (Task 5 ADCMS Grant)			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■										
Task 1.5 Develop detailed implementation and deployment plan for digital delivery (Task 1 AID Grant)				■	■	■																						

TG2: ORGANIZATIONAL INFORMATION REQUIREMENTS (OIR)

Implementation Tasks

TASK 2.1

IDENTIFY AND DEFINE OIR

Activities under this task are specific to identifying and defining the asset classes and types that would require asset data to implement the management strategy. This task includes two foundational activities:

- Establish a general classification of assets.
  This is a key piece of information needed to create data schema standards that will enable the data flow between systems to be more seamless. This work is being conducted as part of the Asset Data project.
- Define the condition management strategy for each class and type.
- Define the type of data needed for each asset class and type to implement the condition management strategy using the data collection plan template.
  Some of the information will be applicable to all asset classes and types, whereas other data will be unique to an asset class and type. Table 1 provides three examples of the type of information that may be needed.

THE DESIRED OUTCOME FOR THIS TASK IS A SERIES OF TABLES LISTING THE AIR FOR EACH ASSET CLASS TO IMPLEMENT THE MANAGEMENT STRATEGY.

TG2

Table 1. Example of Information Requirements to Support Asset Management

ASSET CLASS	INFORMATION TYPE		INFORMATION DETAILS
All classes	Location information	Asset identifier Road/route identifier Road/route name Construction stationing	GPS coordinates LRS mile measure Date of installation Etc.
Pavement	Segment geometric attributes	Pavement thickness Base thickness Material layers (identifier, thickness, etc.)	Material layers (identifier, thickness, etc.) Etc.
Bridges	Deck information	Deck structure type Deck surface type Deck membrane type	Deck width Deck condition rating Etc.
Utilities	Facility type	Communication (fiber/cable) Electric Gas	Water Sewer Etc.
Barriers	Barrier type	Concrete Box beam W-beam	Cable Etc.

TASK 2.2

DEVELOP STANDARDS FOR PROJECT DELIVERY PHASE EXCHANGES

Activities under this task provide a technology-neutral framework for developing standards for model-derived asset data. The included assets will have identified project delivery sources on the asset's data collection plan. The sequence of activities to develop the data standards is:

- Prioritize data sources within a business area.
- Determine information that can be derived from a design model.
- Categorize model-based information as geometry-derived, or attribute generated.
- Identify existing data standards currently used and identify gaps.
- Define data schema standards and definitions to enable interoperability of data between systems.
- Define standard naming conventions for model-based and other project data.
- Create a list of attributes and metadata for design models (to be used for configuring item types).
- Refine the standards through piloting on projects.

TASK 2.3

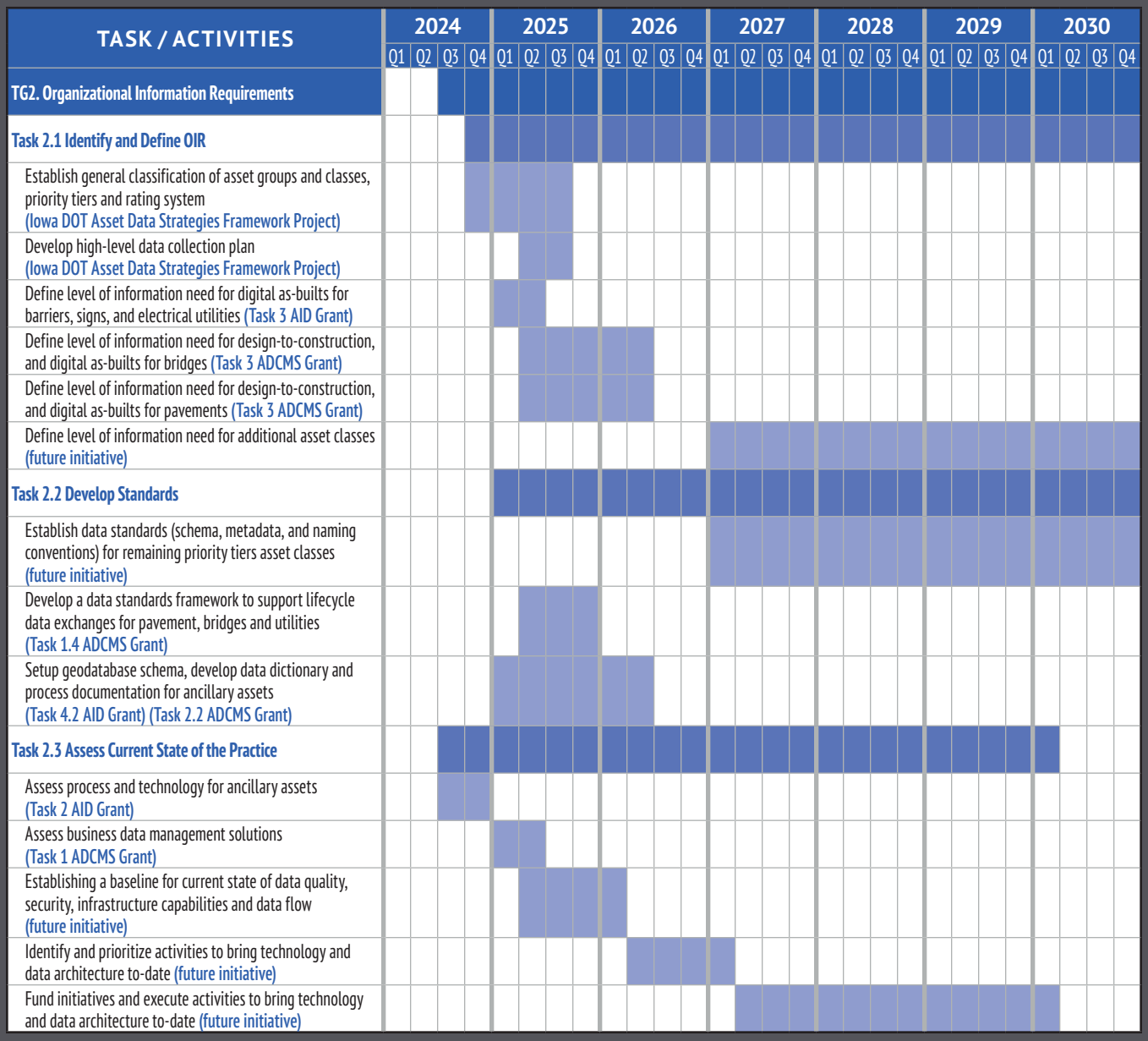
ASSESS CURRENT STATE OF THE PRACTICE

Activities under this task include an assessment of Iowa DOT's current state of the practice as it relates to data sources; data collection and validation methods; and maintenance of the databases. This is a prerequisite to determine if the current technology/systems; data collection methods and procedures; and data management standards need to be established or updated. Activities include:

- Assess process and technology to enable digital workflows for ancillary assets.
- Assess business data management solutions.
- Performing an assessment to set a baseline for the current state of data quality, security, infrastructure capabilities, and data flow.

- Identifying and prioritizing activities to bring technology and data architecture up to date.
- Provide feedback on the costs and outcomes of collecting asset information on the pilot projects to inform asset data collection plans.

TIMELINE / SCHEDULE



TG3: PRIORITY ASSET PROTOTYPES FOR LIFECYCLE DIGITAL DELIVERY

Implementation Tasks

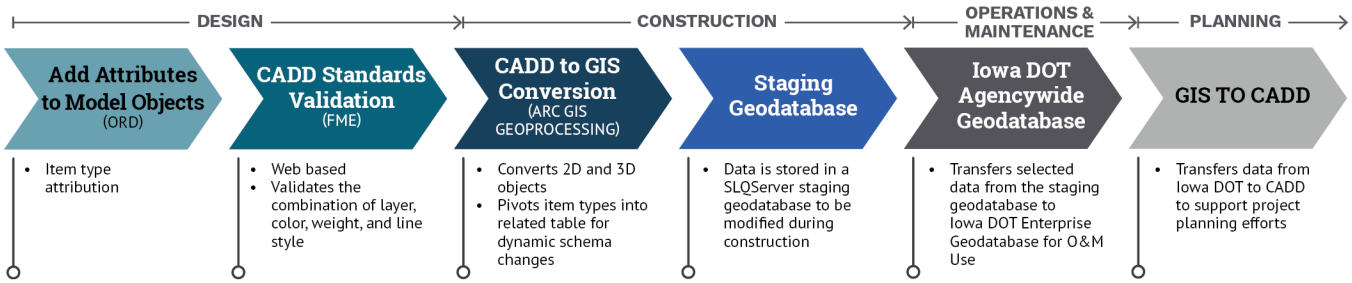
The purpose of this task is to develop a prototype tool and explore commercial applications that facilitate the exchange of model-based information from design to construction as well as the handoff of digital as-builts from construction to asset operations and maintenance. The findings from this task will inform the methodology to achieve SG1: Develop Standards to Incorporate or Connect Data Harvested from Digital Design through Digital As-Builts into Authoritative Systems.

TASK 3.1

DEVELOP PROTOTYPE FOR EXCHANGES BETWEEN CADD AND GIS

The activities under this task will focus on the development of a prototype that will include documentation of data schemas and workflows, a validation routine, and a migration tool to extract data from CADD files, transform and load to GIS using Feature Manipulation Engine (FME) software. The prototype will be piloted on three asset types (i.e., electrical state-owned utilities, traffic barriers, and signs). Once the prototype has been developed and tested through pilot projects, the framework will be expanded to other applicable asset types.

Since Iowa DOT has determined that Bentley's civil design application will serve as the design model authoring platform, the prototype will use



the Bentley Item Types technology to add attributes to model objects created during the design phase that can be passed on to downstream users, such as construction, operations, and maintenance using GIS applications. The following list summarizes the sequence of steps:

- Create or update configuration of civil modeling software to incorporate defined data standards, schemas and data dictionaries for the three selected priority assets.
- Develop a validation tool that automatically compares the data sets being exchanged against the data standards.
- Establish processes for creating and reviewing models against the defined standards.
- Develop and/or explore tools that enable the exchange of data sets between systems.
- Identify pilot projects and provide training specific to the prototype being piloted.
- Evaluate the effectiveness of the prototype through pilot projects and provide recommendations for implementation.
- Create a plan for upscaling deployment for statewide standardization (SG3), which includes determining criteria for project selection, updating training materials, and planning for user training deployment.

TASK 3.2

DEVELOP PROCESS FOR EXCHANGING DATA SETS FROM CADD-TO-RELATIONAL DATABASE SYSTEMS

The focus of this effort is to create a process to exchange information from CADD data sets to non-GIS relational database type systems (i.e., AASHTOWare products). Procedures will be based on the IFC standard schema, and the tools to be explored may include API connections, or other middleware technologies that facilitate the exchange of data files most efficiently. The following steps provide the sequence of activities for creating other assets.

- Identify which asset classes and types need libraries of 2D and 3D components, and templates not currently available in the modeling software.
- Create additional content for the library items identified in the previous step, following the data classification established as part of TG2.
- Develop item types in the modeling software using the data standards and schemas established as part of TG2.
- Evaluate different validation tools that may be helpful for validating data sets for different types of data standards, including compliance with:
  - » Iowa DOT CADD data standards.
  - » IFC schema.
  - » Discipline specific AIR (**Figure 1**).
  - » Establish processes for creating and reviewing models for specific asset classes and types as identified through the Asset Data Strategies project.

- Explore technologies and methods to exchange or connect data from CADD to other systems.
- Pilot the process through pilot projects and document challenges and lessons learned.
- Evaluate findings and expand the process to include other asset types.

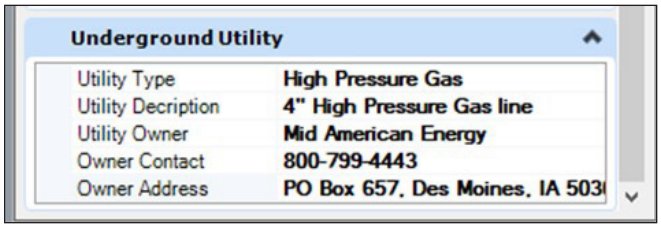


Figure 1. Iowa DOT Utility Item Type Example

TIMELINE / SCHEDULE

TASK / ACTIVITIES	2024				2025				2026				2027				2028				2029				2030			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TG3. Priority Asset Prototypes for Lifecycle Digital Delivery																												
Task 3.1 Develop Prototype for Exchanges between CADD and GIS																												
Develop CADD standards validation prototype application for ancillary assets (Task 4.1 AID Grant)																												
Develop CADD workspace (object libraries and Item Types) to support ancillary assets (Task 4.1 AID Grant)																												
Update CADD workspace (object libraries and Item Types) to support ancillary assets (Task 2.1 ADCMS Grant)																												
Develop CADD workspace (object libraries and Item Types) to support pavement projects (Task 3.1 ADCMS Grant)																												
Develop and validate design to database translations for ancillary assets (CADD-to-GIS) (Task 4.2 AID Grant) (Task 2.3 ADCMS Grant)																												
Develop process and prototype application to support design-to-construction exchanges for ancillary assets (CADD-to-GIS) (Task 4.3 AID Grant) (Task 2.4 ADCMS Grant)																												
Develop process and prototype application to support construction-to-asset management exchanges (GIS-to-GIS) (Task 4.3 AID Grant) (Task 2.5 ADCMS Grant)																												
Develop prototype application to support asset management to pre-design exchanges (GIS-to-CADD) (Task 2.6 ADCMS Grant)																												
Develop training materials for pilot projects (Task 5 AID Grant) (Task 2.7 ADCMS Grant)																												
Evaluate effectiveness of prototype application from pilot projects and provide recommendations for full implementation (Task 7.2 AID Grant) (Tasks 6.2 ADCMS Grant)																												
Task 3.2 Develop Process for Exchanging Data Sets from CADD-to-Relational Database Systems																												
Develop CADD workspace (object libraries and Item Types) to support bridge (Task 3.1 ADCMS Grant)																												
Setup database schema and metadata for pavements and bridges (Task 3.2 ADCMS Grant)																												
Validate design-to construction data exchanges for pavements (Task 3.3 ADCMS Grant)																												
Test solutions for data sharing from design-to-construction using openBIM standards (bridge projects) (Task 3.4 and Task 4.1 ADCMS Grant)																												
Explore/develop solutions for data sharing from design-to-construction for pavement projects (Task 3.4 ADCMS Grant)																												
Explore/develop solutions for data sharing from CADD/IFC models to Bridge and Pavement Management Systems (Task 3.5 ADCMS Grant)																												
Explore/develop solutions for data sharing from Bridge Management System to CADD system (Task 3.6 ACMS Grant)																												
Develop training materials for pilot projects (Task 3.7 ADCMS Grant and Task 4.1 ADCMS Grant)																												

TG4: PROJECT AND EXCHANGE INFORMATION REQUIREMENTS

Implementation Tasks

Activities under this task focus on advancing the state of the practice regarding the development and delivery of design models to support specific uses. The highest priority for Iowa DOT is to establish minimal viable PIR to produce models that can be delivered contractually to:

- Visualize design intent.
- Extract quantities directly from the models to prepare engineer's estimate and contractor bids for every pay item included in the models.
- Use automated machine guidance.
- Locate asset features being built, measure quantities, and verify pay items being installed to authorize payment.

In addition to PIR, activities to achieve this goal will include the development of EIR, which define how and when information needs to be exchanged. The activities under this task include the development of standards, procedures, and guidance.

TASK 4.1

DEVELOPING AND UPDATING MODELING STANDARDS

Modeling standards are a foundational component for successful implementation of DD. These standards provide the rules for structuring and producing data-enriched models that enable digital exchanges between design and construction. The following are key activities under this task for developing and updating modeling standards:

- Evaluate model element breakdown structure (MEBS) workbooks developed by others.
  Other state DOTs and the Joint Technical Committee on Electronic Engineering Standards (JTCEES) have produced MEBS workbooks. Reviewing those documents will be beneficial for identifying how the defined categories align or do not align with Iowa DOT's data schema standards established in TG1.
- Establish a MEBS to include in Iowa DOT modeling design standards.
  It is important to note that a MEBS that aligns with a standard data schema will improve the interoperability between systems. Once the structure is defined, assigning information requirements for each model feature is easier.
- Define modeling design specifications for each model element in the MEBS in terms of:
  - » Level of development (LOD), which defines level of geometric detail on a scale from 100–500 based on the AIA, BIMForum, and JTCEES fundamental definitions.
  - » Level of information, which defines non-geometric data that is required by a downstream user.

  The Level of Information Need (LOIN) standard, ISO 7817-1:2024, provides methods for describing both LOD and level of information. By following ISO 7817-1, the Iowa DOT will end up with a comprehensive level of model development (LOMD) standard that will provide much-needed guidance to design teams.
- Update the modeling guidance manual to include the established MEBS, modeling design specifications, and requirements for model progression for milestone deliverables.
  The modeling guidance manual may be a comprehensive guidance document or phased to coincide with the use cases for model development and delivery as determined by Iowa DOT. Updates and modifications can be added as the DD initiative progresses.

TASK 4.2

CREATE PROJECT-LEVEL BIM GUIDANCE DOCUMENTS

For successful implementation of DD during the project development and delivery phase, teams will need key guidance documents. The activities under this task will focus on developing these documents, which are intended to be a compliment to the modeling standards created in Task 4.1 and will be used throughout every stage of a project, from survey to as-built collection. The following documents are planned as part of this task.

DD Execution Plan Template: A document that can be used by project teams to describe their approach for design production, including but not limited to:

- Defining roles and responsibilities specific to the project.
- Listing the modeling standards applicable to the project.
- Identifying model uses and establishing a federated strategy for combining discipline models.
- Production methods and procedures, such as technology requirements (including specific software versions), data management, coordination of activities, and digital deliverable requirements.

Model Review Guidelines: A document that provides project teams with specific procedures for performing several types of reviews. This document will be based on the recommendations published in the NCHRP 10-113; Quality Management for 3D Model-Based Project Development and Delivery, when it becomes available.

Digital Project Deliverable Index: Project-specific list of deliverables, digital or other, that a contractor

and construction inspector can use to understand what is being delivered, in what format, and how that information is intended to be used.

TASK 4.3

CREATE TRAINING MATERIALS AND DELIVER TRAINING

Activities under this task will establish a robust DD training curriculum for all staff and industry stakeholders that will utilize model-based information. Training delivery can be in-person or virtual instructor-led meetings, webinars, online documents, or a combination. It is recommended that field staff receive in-person, hands on training. Below are common steps to follow for developing a training program.

- Identify topics for training to upscale staff based on job function.
- Identify and determine instructional design (delivery method, length of training, activities, etc.).
- Develop training materials.
- Deliver training.

Priorities for content development include, but are not limited to:

- Defining positional accuracies and point densities to manage the risk of the project. This will enable the surveyor to determine the data collection means and methods to achieve desired results (e.g., LiDAR, GPS, drones).
- Describing specific information needs for each group within the models. This may be accomplished by creating plan cross walks with SMEs from each group to determine the information required to do their job, and how that information can be found within a model (geometry and model properties); spreadsheets (tabular data); annotation; model measurements; etc.
- Providing clear instructions to those responsible for creating the models, from survey to discipline-specific design activities that are suitable for construction use cases. The intent is to create a federated construction contract model that the contractor can rely on for bidding and building the project.

DD TRAINING COURSES OR MODULES MAY INCLUDE TARGET AUDIENCES SUCH AS:

- Project management
- Survey
- Road design
- Landscape design
- Drainage design
- Right of way and utilities
- Environmental
- Traffic design
- Bridge and structure design
- Architectural design
- Contract procurement
- Construction
- Contractors
- Sister agencies and external parties

OTHER TRAINING TOPICS TO CONSIDER:

- Data collection strategies for pre-construction
- Advanced bridge modeling
- Quality management of pre-construction surveys Project Management
- Quality management (design reviews, model integrity reviews, standards reviews, etc.)
- Advanced roadway modeling
- Quality management (design reviews, model integrity reviews, standards reviews, etc.)
- Contract advertising deliverables
- Contractor bidding
- Construction inspection
- Contractor use of models
- Data collection of digital as-builts

- Providing clear instructions to the receivers of information, (i.e., contractors), to instill confidence in the model and present it in a way that the contractor can leverage the data for their intended use (e.g., machine control, fabrication, planning construction activities).

TIMELINE / SCHEDULE

TASK / ACTIVITIES*	2024				2025				2026				2027				2028				2029				2030			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TG4. Project and Exchange Information Requirements																												
Task 4.1: Developing and Updating Modeling Standards																												
Develop/update model element breakdown structure (MEBS)																												
Develop/Update software modeling standards manual																												
Task 4.2: Create Project-Level Digital Delivery Guidance Documents																												
Develop/update digital delivery execution plan template																												
Develop/update model review guidelines for each discipline																												
Develop/update digital project deliverable index																												
Task 4.3: Create Training Materials and Deliver Training																												
Identify training topics by job function and determine instructional strategy																												
Develop and deliver training for each discipline/job function																												

*These activities may already be underway by Iowa DOT staff efforts. Dates for subtasks should be provided by Thomas Hamski and his counterparts in Design and other divisions.

TG5: EXPANSION OF E-TICKETING

Iowa DOT is invested in the use of e-Ticketing applications and systems to streamline the inspection, validation, payment of, and recording of installed materials. Iowa DOT has piloted and implemented the HaulHub solution for two materials, concrete and asphalt, with limited usage for aggregate. The DOT has also demonstrated a connection to other construction applications such as Propeller. Currently, the DOT is working on the expansion of the materials (particularly aggregate and steel) within HaulHub and building a database for storing this information long term.

Activities to achieve this tactical goal will expand the use of these technologies and applications and connect model-based information to the e-Ticketing process.

TASK 5.1

AUDIT CURRENT E-TICKETING PROCESSES AND INFORMATION EXCHANGES

Activities under this task will focus on documenting e-Ticketing information and processes currently in place and identify any gaps and opportunities for improvement. The documentation should focus on:

- Listing the types of material(s) currently being tracked electronically.
- Describing the data schema currently used to exchange e-Ticketing information.

- Listing the system of record for the e-Ticketing information (e.g.,HaulHub E-DOT Inspector).
- Identifying any gaps to be considered for the activities under TG 5.2.

TASK 5.2

EXPAND USE OF E-TICKETING TO INCLUDE ADDITIONAL MATERIALS

Activities under this task will focus on expanding the use of e-Ticketing. Strategies to complete activities may include but are not limited to:

- Developmental specification being piloted on all projects.
- Standard specification planned to be launched Fall 2025 (October 2025).
- On-going pilot projects testing the E-DOT System (connected equipment) in partnership with Delaware DOT through their ADCMS grant.
- E-DOT System is now connected to AWP, next step is to figure out how to tie-back to AWP. Exploring with Infotech.
- Developmental specification being piloted on all projects.
- Standard specification planned to be launched Oct 2025.
- On-going pilot projects testing the E-DOT System (connected equipment) in partnership with Delaware Department of Transportation through their ADCMS grant.
- E-DOT System is now connected to AWP, next step is to figure out how to tie-back to AWP. Exploring with Infotech.
- Investigating digital applications and workflows to connect data collected in the field to Department systems.
  - » Connect alignment and stationing to the e-Tickets.
  - » Explore Work Zone Safety Feeds to push Work Zone Data Exchange (WZDx) data to the public.
  - » Explore the Virtual Inspection add-on with thermal profile, vibrator monitoring, length, width, slope, etc.
- Exploring digital connections between model-based information and the e-Ticketing system.
- Identifying additional needs for software development for the current e-Ticketing system to achieve the desired level of maturity.
- Creating a detailed plan for making programmatic changes to expand the use of e-Ticketing from its current state to desired level of digital maturity. (Completed)
- Develop and deliver a training program to standardize expanded uses of e-Ticketing. Potential topics may include, but are not limited to:
  - » Overview of e-Ticketing. (Completed)
  - » Using the e-Ticketing specification.
  - » Data collection, verification, and documentation procedures. (Completed)
  - » Connection between e-Ticketing and digital as-builts. (In process)
  - » Search and retrieval of e-Ticketing information once a project has been closed. (Completed)

TIMELINE / SCHEDULE

TASK / ACTIVITIES*	2024				2025				2026				2027				2028				2029				2030			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TG5. Expansion of e-Ticketing																												
Task 5.1: Audit Current e-Ticketing Processes and Information Exchanges																												
Document details about material types and systems being used today																												
Identify gaps to be considered for implementation																												
Describe/document the data schema being used today																												
Task 5.2: Expand Use of e-Ticketing to Include Additional Materials																												
Identify and prioritize material types for the next round of e-ticketing deployment																												
Determine/define data requirements to be collected by e-ticketing																												
Investigate/explore connections/applications to connect field data to other systems																												
Develop a detailed plan for making programmatic changes to expand the use of e-ticketing																												
Develop and deliver training to standardize the expanded uses of e-ticketing																												

SG1: STANDARDS FOR CONNECTING DATA THROUGH LIFECYCLE DELIVERY

Implementation Tasks

Activities for achieving the long-term goal of DD will focus on implementing standards and guidelines to enable geospatial data connections across Department systems. Activities under this task will be informed by the data structure and standards developed under TG2 and TG4 and should align with Iowa DOT's Data Management Implementation Plan. Activities may include, but are not limited to:

- Establishing data standards policies for priority assets and digital workflows and developing a deployment plan for these polices.
- Identifying, developing, testing, and deploying data connection/integration solutions between authoritative systems.
- Creating, testing, and standardizing procedures for data validation, sharing, and integration.
- Developing, testing, and delivering user trainings that include basic literacy concepts, such as the ability to read, analyze, create, and talk about data. Data literacy is knowing why data is important, what story it [data] is trying to tell us, and whether we should believe it.
- Developing, testing, and delivering training specific to key individuals that manage data for their own business groups, including topics such as:
  - » Understanding how users prepare data sets for delivering projects or collecting field data.
  - » Validating compliance with Department standards.
  - » Understanding Department protocols for managing data.

SG1

SG1

TIMELINE / SCHEDULE

TASK / ACTIVITIES*	2024				2025				2026				2027				2028				2029				2030			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SG1. Standards for Connecting Data through Lifecycle Digital Delivery																												
Establish technical strategies for data management																												
Updating organizational data management policies																												
Develop data catalog template																												

SG2: IMPROVING DATA SEARCHING AND REPORTING

Implementation Tasks

The activities to achieve this strategic goal focus on improving the capabilities for searching business data within the various systems of record and creating reports efficiently. Iowa DOT uses various applications, geospatial databases, and common data environments to house project-related files and information, along with enterprise-level inventory data. This SG will be informed by TGs 2–5, as well as **SGs1 & 3.** Much of the work for SG2 will evolve over time as Iowa DOT reaches digital maturity and various systems are connected.

Iowa DOT is implementing a content services platform (Hyland On-Base Content Management System) that organizes, manages and optimizes organizational content by:

- Capturing process business information (data or documents) from various sources based on a specified classification strategy, and organizational retention and records management policies.
- Deploying processes to automatically route documents based on configurable workflows and business rules.
- Making content available to users based on security permissions through a variety of search capabilities.

SG2

This system will be one hub of information that will be considered for ease of access and searchability.

Potential activities include, but are not limited to:

- Identifying and prioritizing business information records to be configured for secure and optimal accessibility through On-Base.
- Implementing file naming conventions established as part of Iowa DOT's data management standards (TG2).
- Determining workflows for design, construction, maintenance and operations data sets based on their status.
- Identifying and deploying a data set/document indexing strategy to enable easier searchability within the system once the records have been uploaded to On-Base. For records that are associated with non-traditional business documents (i.e., CADD, GIS or IFC), an evaluation criterion should be added for each application or system that vets the ability to search for information easily within the file or data storage location (another system or database outside of On-Base).

TIMELINE / SCHEDULE

Scheduled determined by the ERMS project implementation plan.

TASK / ACTIVITIES*	2024				2025				2026				2027				2028				2029				2030			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SG2. Improving Data Searching and Reporting																												
Identify and prioritize business information records to migrate to On-Base using approved data management standards																												
Establish workflows for design, construction, and asset management records																												
Implement a records indexing strategy to enable easier searchability																												
Develop and deliver user training for the new content management system																												

*Some of these activities may already being planned as part of the implementation of the On-Base content management system – not sure who can provide timelines about that project.

SG3: IMPROVING DATA TRANSFER BETWEEN DEPARTMENT SYSTEMS

Implementation Tasks

The focus of the implementation tasks to achieve this strategic goal is developing automation tools over time to streamline processes for data sharing between systems, including, but not limited to:

AASHTOWare Project

AASHTOWare BrM

Bid Express

ProjectWise

Masterworks Project Management System

Activities may include:

- Identifying the type of data to transfer between systems.
- Developing procedures for transferring data between systems.
- Creating automation tools to enable the efficient transfer of data between systems.
- Developing training on using the new automated tools.

SG3

SG3

TIMELINE / SCHEDULE

TASK / ACTIVITIES*	2024				2025				2026				2027				2028				2029				2030			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
SG3. Improving Data Transfer between Department Systems																												
Identify type of data to transfer between systems (future initiative)																												
Develop data migration procedures based on the lessons learned from the AID and ADCMS prototype applications (future initiative)																												
Expanding the use of automated tools to facilitate digital exchanges between systems (future initiative)																												
Formalize workflows piloted through AID/ADCMS grants to expand to selected assets																												
Develop and delivery user training for using any new automated tools to transfer data from one system to another (future initiative)																												

APPENDIX A: PILOT PROJECT INITIATIVES AND SELECTION CRITERIA

Pilot Initiative 1: Visualization for Public Involvement

DESCRIPTION

The process of developing visual representations for use with non-technical audiences, including stakeholders and the general public.

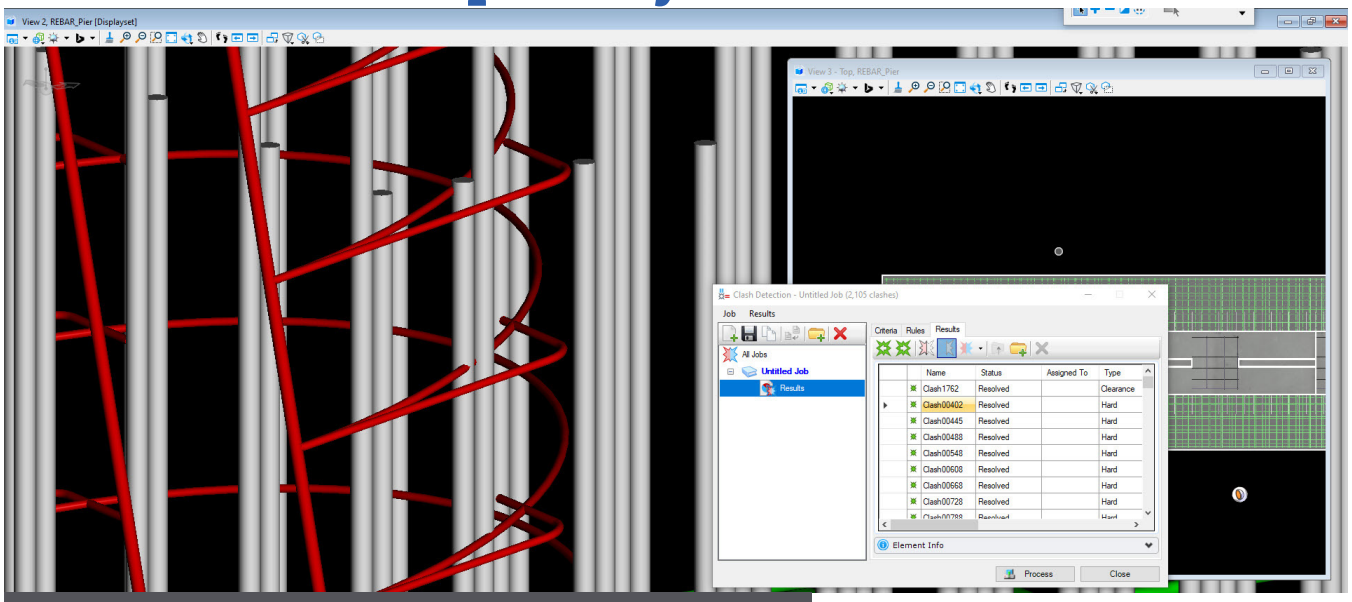
CONSIDERATIONS

3D models being produced from either conceptual or detailed design 3D software may be used as the base product for the renderings. If a higher level of detail is required, it is best to create the base model using design software, such as Bentley's OpenRoads Designer or OpenBridge Modeling. Specialized skill sets and CADD workstations are typically needed for performing this task. Access to high-rendering visualization products, such as Bentley LumenRT will be needed for producing these types of products.

SELECTION CRITERIA

The most suitable projects for this pilot initiative include those with a high level of involvement with local agencies, regulatory agencies, and the community at large, including both roadway and structural projects. Highly rendered visualizations reduce the need for technical understanding of engineering designs, allowing the stakeholder community better understanding of the impacts of the proposed project in the context of the existing environment, making decisions to meet NEPA and right-of-way requirements more transparent.

Pilot Initiative 2: Clash Detection and Multi-Disciplinary Collaboration



DESCRIPTION

The process of using 3D design software to analyze a federated model using rule sets to identify collisions between design elements and/or visual inspection to identify potential spatial design issues. This use case is critical to proactively work across silos to mitigate construction issues during the design authoring process. Clash detection is also used for analyzing structure models with complex reinforcing details.

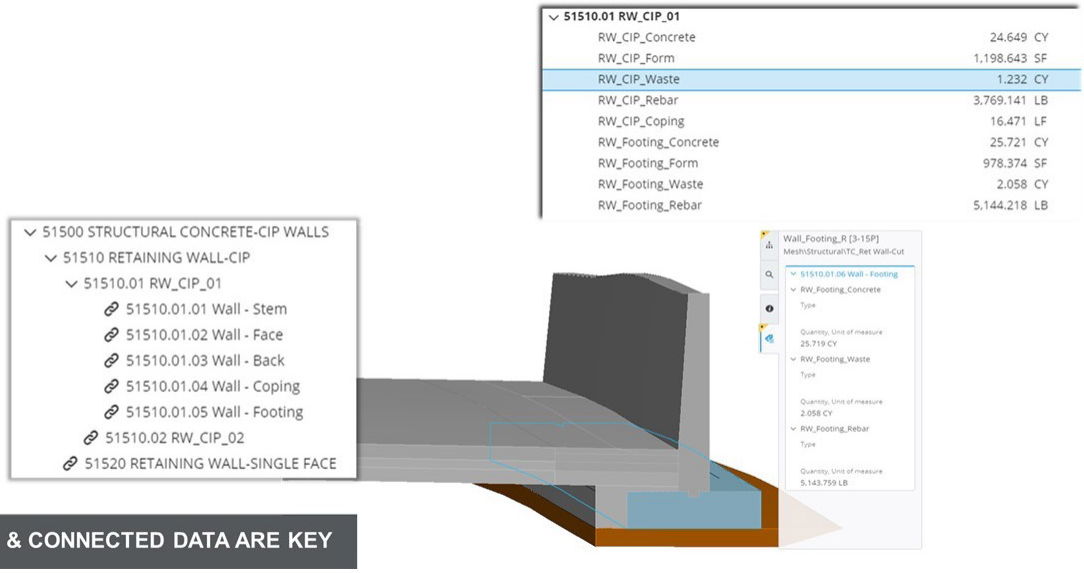
CONSIDERATIONS

All disciplines need to create a 3D model to perform this task. Roadway, drainage, structures, and utilities 3D models are the minimum requirements for this use case to be piloted. Other 3D models such as signals, signing, and lighting should also be modeled if required on the project. Geotech modeling may also be needed.

SELECTION CRITERIA

The most suitable projects for this pilot initiative include those with a high risk of utility clashes or those requiring a high level of coordination between roadway, structures, and drainage disciplines. Other projects that would benefit from clash detection are those that include structures with non-standard concrete components with congested reinforcing.

Pilot Initiative 3: Automated Quantity Takeoffs and Bidding



STRUCTURED & CONNECTED DATA ARE KEY

Image courtesy of HDR

DESCRIPTION

The process of using the software to automate the calculation of quantities directly from the model to develop a schedule of bid items. The summary of quantities can then be used to develop engineer's estimates.

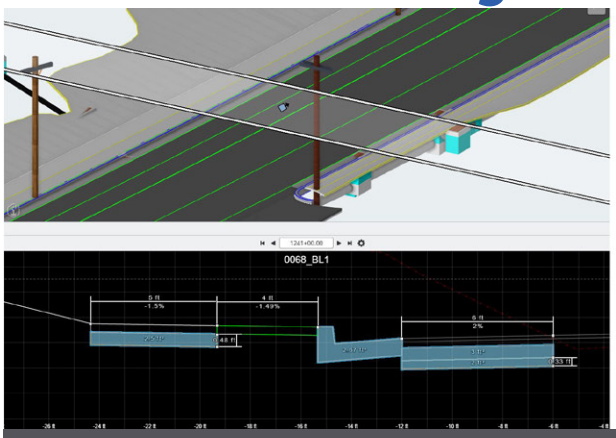
CONSIDERATIONS

Any object needing volumetric quantity computations must be modeled in 3D. In addition, the software must be set up with pay item attribution(s) to automate the process of estimating quantities for each engineering system and their specific model components per a model element breakdown structure. The use of Bentley Item Types is a prerequisite for this use case to be piloted.

SELECTION CRITERIA

The most suitable projects for this pilot initiative include those with a significant level of bid items included in the contract. The project should have multiple categories of bid items with different types of units of measure including each, linear, area, and volume. Bid items should also include different types of classified excavation (e.g., general roadway vs. embankment benching vs. structural earthwork, etc.).

Pilot Initiative 4: Model as the Legal Deliverable (MALD)



DESCRIPTION

The process of documenting the existing conditions and all disciplines involved in the design of the project in a model-based environment to replace traditional 2D deliverables. Data must be reliably extracted from the model objects with limited use of notes or special details.

CONSIDERATIONS

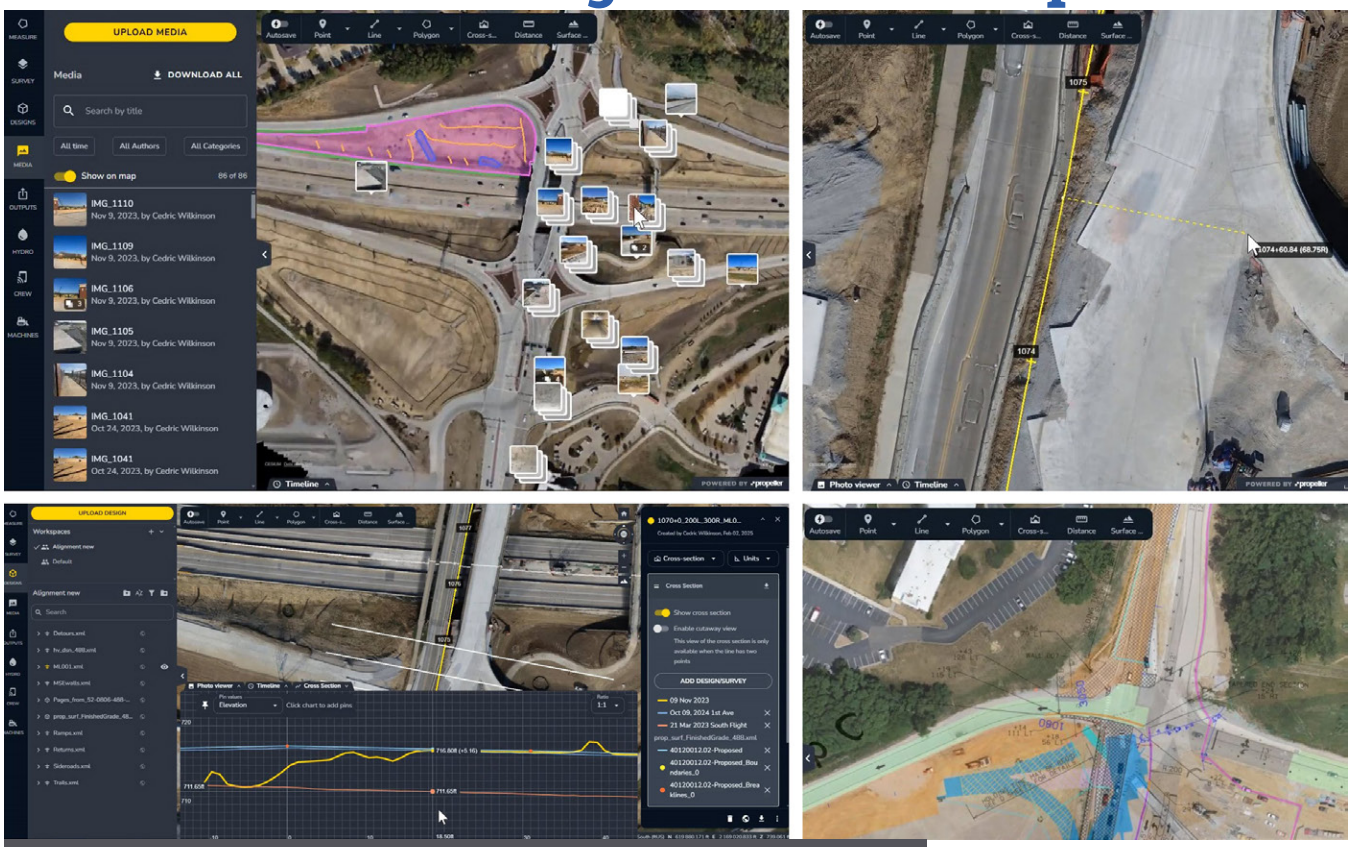
The data needed to communicate the design intent, prepare bid quantities, and facilitate construction (including fabrication) must be represented in the model for this use case to be piloted. The data represented in the model must include all model objects needed to be bid per the bid item schedule. All disciplines should be modeling project features to the level of detail and information agreed upon for the pilot projects.

SELECTION CRITERIA

The most suitable projects for this pilot initiative should include those with a scope of work that has one or more of the following characteristics:

- Roadway widening and lane additions, realignments, or new alignments.
- Full bridge replacements and new bridges.
- Installation of new drainage structures and other utilities.

Pilot Initiative 5: Construction Management and Inspection



DESCRIPTION

The process whereby a construction inspector accesses design information from a model instead of traditional plan sheets to verify that the project is being constructed per plan and in accordance with the pay item quantities and specifications.

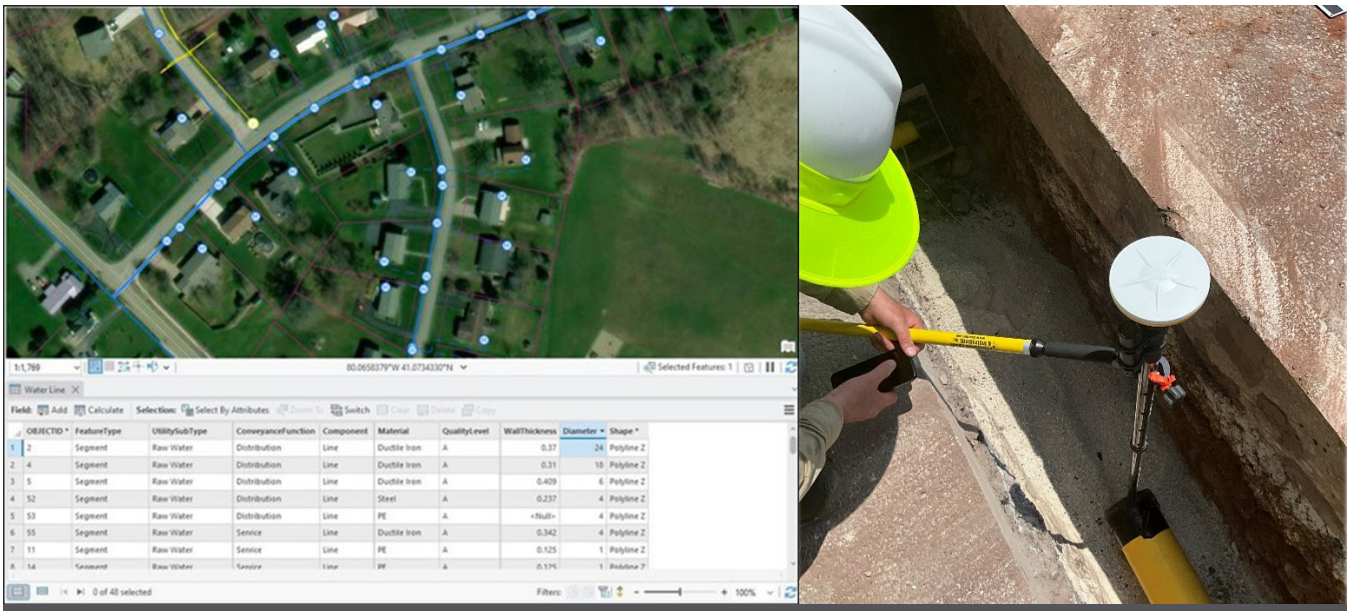
CONSIDERATIONS

The use of 3D model viewers and positional instruments to measure elevations and locate assets being installed are a prerequisite for this use case to be piloted. Inspectors should have access through the models to the same information that would have been traditionally conveyed in a set of plans, such as locations, elevations, quantities, and notes. Additional work would have to be completed to establish best practices to display information in an easily accessible manner.

SELECTION CRITERIA

The same criteria set for Pilot Initiative 3 could be used for this pilot project initiative.

Pilot Initiative 6: Digital As-Builts



DESCRIPTION

The process of collecting digital information that represents the built environment. A digital as-built may contain geometric (2D and 3D) and non-geometric (information about an object) models. A digital as-built is the final construction documentation, a snapshot in time that gets handed over for operation and maintenance activities, including asset management.

CONSIDERATIONS

Getting input from Asset Management and District Maintenance decision makers and data stewards to answer the following questions:

- What are the priority assets that should be modeled in design and updated during construction?
- What is the classification for those priority assets (e.g., category, class type)?
- What information do you need for each priority asset, and why? This is particularly important because design models contain significantly more information than is likely needed for asset management. Thus, understanding information delivery requirements will ensure data models passed on to Operations and Maintenance are appropriate for the harvesting systems.
- Who is responsible for collecting, validating, storing, and maintaining the information?
- What is the IT infrastructure needed to host the information once it has been collected?
- How does the IT infrastructure limit the format in which digital as-built information is delivered? This usually determines data collection options, but if the requirements for deliverables are set based on the information, it can be set up as a performance-based specification.

SELECTION CRITERIA

The most suitable projects for this pilot initiative include those with the installation of priority assets being selected by Iowa DOT. Ancillary assets to be considered for this pilot initiative include signs, barriers, culverts, and utilities.

APPENDIX B: KEY TERMS AND REFERENCES

ACRONYMS

AASHTO — American Association of State Highway and Transportation Officials
ADCMS — Advanced Digital Construction Management Systems
AID — Accelerated Innovation Demonstration
AIR — Asset Information Requirements
API — Application Programming Interface
BIM — Building Information Modeling
CADD — Computer-Aided Design and Drafting
DD — Digital Delivery
DD Plan — Digital Delivery Implementation Plan
DOT — Department of Transportation
EIR — Exchange Information Requirements
ERMS — Electronic Records Management System
FME — Feature Manipulation Engine
IDM — Information Delivery Manual
IFC — Industry Foundation Classes
GIS — Geographic Information System
JTCEES — Joint Technical Committee on Electronic Engineering Standards
LOD — Level of Development
LOIN — Level of Information Need
LOMD — Level of Model Development
MALD — Model as the Legal Deliverable
MEBS — Model Element Breakdown Structure
NEPA — National Environmental Policy Act
OIR — Organization Information Requirements
PIR — Project Information Requirements
SMART — Standards Machine Applicable, Readable, and Transferable
SG — Strategic Goals
TAMP — Transportation Asset Management Plan
TG — Tactical Goals

GLOSSARY

3D Features. See also: Component. *Category: Modeling.* A component of a model that represents a physical object (e.g., a sign) or abstract concept (e.g., alignment, north arrow).[1]

Ancillary Asset. See also: Asset, Asset Class. *Category: Strategy.* All physical assets other than pavements and bridges, as defined by 23 U.S.C. 119, that a transportation agency wishes to or does manage. [2]

Application Programming Interface (API). See also: Middleware. *Category: Data*. A type of software interface that exposes information needed to enable data transfer between systems without manual intervention. [3]

Asset. *Category: Strategy.* A physical roadway infrastructure item that has value. Assets are sometimes referred to as roadway "furniture" or "features." An asset may be a single item, such as a sign, or a linear item, such as a road or guardrail section. An asset may also be a spatial item such as a rest area or mowable acreage. [2]

Asset Class. See also: Ancillary Asset, Asset. *Category: Strategy.* Assets with the same characteristics and function (e.g., bridges, culverts, tunnels, pavements, or guardrail) that serve a common function (e.g., roadway system, safety, Intelligent Transportation, signs, or lighting). [2]

Automated Machine Guidance (AMG). *Category: Business Uses*. The use of real-time positioning equipment with 3D digital data to guide or control the blade on construction equipment, resulting in real-time construction layout without the need for physical markers such as stakes or hubs. [4]

Clash Detection. See also: Component. *Category: Business* Uses. A technique used in BIM or digital delivery processes to identify conflicts or collisions between various model elements. [1]

Component. See also: 3D Features, Model. *Category: Modeling.* A representation of a physical object (e.g., a sign) or abstract concept (e.g., alignment, north arrow) within a model using a range of data structures like 3D points, line strings, polygons, mesh surfaces, or other parametric objects.

Computer-Aided Design and Drafting (CADD). See also: Model. *Category: Modeling.* CADD is the process of creating computer models defined by geometric parameters. The models represent a part or a system of parts that can be changed by adjusting the parameters. [5]

Data Dictionary. See also: Exchange Requirements. *Category: Data.* A data-semantic dictionary specifying concepts (entities, properties, classification and other concepts) and their relations. A data dictionary defines entities and properties uniquely, understandable and machine readable. It is possible to connect different data dictionaries and to harmonize the understanding of the content we want to share. [6]

Data Management. *Category: Data.* Data management encompasses defining data, creating data architecture, modeling data, collecting or gathering data, processing data, storing and securing data, ensuring the quality of data, defining reference data, documenting metadata, ensuring data integration and interoperability, performing document and content management, designing and implementing data-warehousing solutions, and maintaining business intelligence. [5]

Data Schema. *Category: Data*. The definition of the structure to organize data for storage, exchange and sharing, using a formal language. [7]

Data Structure. *Category: Data.* The structure of and relationships among data elements. [5]

Data Validation. *Category: Data*. The process of verifying the quality of data by checking the integrity, accuracy, and structure of data.

Development Specifications. See also: Model. *Category: Modeling*. A method for specifying the requirements for using software to create models that deliver the required level of information need for each model element when present in the design.

Digital As-builts (DAB). See also: Record Model. *Category: Business Uses*. A digital record of the constructed condition in a format that is electronic, searchable, extractable, and durable. [8]

Digital Delivery (DD). *Category: Strategy*. A modernized approach to project delivery processes and contract media that incorporates digital data. Simply stated, construction projects have the ability to be bid using 3D technology and no longer only be delivered in a traditional construction plan format. [4]

Digital Delivery Execution Plan (DDEP). See also: Digital Delivery. *Category: Modeling*. A plan to manage the use of digital technology and data, especially collaboration and information delivery, to accomplish project goals. [1]

Discipline Model. See also: Federated Model, Model. *Category: Modeling*. A model or linked models related to a single discipline. The superstructure model, substructure model, and detailing models are linked together into a federated Structural Discipline Model. [1]

e-Ticketing. See also: Digital Delivery. *Category: Business Uses*. An electronic means to produce, transmit, and share materials data and track and verify materials deliveries. [9]

Exchange Requirements. See also: Data Dictionary. *Category: Strategy*. A non-technical description of the information needed by a business process to be executed, as well as the information produced by that business process. [10]

Feature Manipulation Engine (FME). *Category: Data*. A platform that streamlines the translation of spatial data between geometric and digital formats. It is intended especially for use with geographic information system (GIS), computer-aided design (CAD) and raster graphics software. [5]

Federated Model. See also: Discipline Model, Model. *Category: Modeling*. A model compiled by referencing models together using a common spatial reference frame. A federated model most commonly is used to combine all discipline-specific models together to represent the project as a whole. However, when an individual discipline uses multiple models to develop a discipline-specific design, a federated model could be used to represent a single discipline. [1]

Geographic Information System (GIS). *Category: Data*. A technology that is used to create, manage, analyze, and map all types of data. [11]

Item Types. See also: Model-Based Information. *Category: Modeling*. A feature within Bentley® software that facilitates storing information about elements in the form of properties. [12]

Legal Document. See also: Digital Delivery. *Category: Business Uses*. A collection of clearly identifiable documents that describe the requirements and terms for a project. Legal documents typically include plans, specifications, and working drawings. The specification defines plans and working drawings, as well as how to coordinate contract documents in the case of a conflict. Models and/or CADD documents may be included in the definition of Plans and Working Drawings or defined as specific contractual entities in the Specifications or Special Provisions. [1]

Level of Development (LOD). See also: Level of Information Need. *Category: Modeling*. A framework to specify and articulate with a high level of clarity the content and reliability of models at milestones in the project delivery process. [13, 14]

Level of Information Need (LOIN). See also: Level of Development. *Category: Modeling*. A framework that defines the extent and granularity of information used to establish the minimum requirements for each model element within a discipline and/or project model(s). LOIN defines both the level of detail of the geometry and the level of information attached to model elements. [1]

Library. See also: Workspace. *Category: Modeling.* A software resource file that provides configuration or utilities to aid in the use of the software. A library may contain object definitions, styles, scripts, property sets, configuration data and more. Generally, libraries are developed to reflect the agency's model development standards and packaged into the modeling software configuration. [1]

Lifecycle Digital Footprint. *Category: Strategy.* A digital record of an asset from creation to retirement that includes all the significant events in the asset history that informed maintenance and rehabilitation actions or significant risk events.

Middleware. See also: Application Programming Interface. *Category: Data.* A type of software application that provides services to software applications not provided by the operating system. Middleware is often used to manipulate data to facilitate exchange when the APIs are not directly compatible.

Model. *Category: Modeling.* A representation of a system that allows for investigation of the system properties. [15]

Model Authoring. *Category: Business Uses*. The process of creating a specific model element or group of model elements to represent the design intent. [1]

Model-Based Information. See also: Item Types, Level of Information Need, Model. *Category: Data.* Non-graphical data that is part of a model element definition. Modern modeling software includes property fields that can be used to embed pay item numbers as attributes to elements in a 3D model. [1]

Model-Derived Information. See also: Model. *Category: Data.* Data conveyed or calculated using shape and arrangement and/or location in space. Graphical data includes spatial data and non-spatial data. [1]

Open Data Standards. See also: openBIM®. *Category: Data.* Standards for structuring data according to a schema has been published in a format that is free to use and redistribute. Open data formats are frequently supported by software products, enabling the exchange of data. [1]

openBIM®. See also: Open Data Standards. *Category: Strategy.* openBIM® enables seamless data sharing and collaboration across platforms and stakeholders, while empowering you to maintain full flexibility in defining your own workflows. [16]

Organization Requirements. See also: Exchange Requirements. *Category: Strategy.* Information requirements in relation to organizational objectives. [13]

Project Requirements. See also: Exchange Requirements. *Category: Strategy.* Information requirements in relation to the delivery of an asset. [13]

Record Model. See also: Digital As-builts. *Category: Business Uses*. A model that represents a culmination of the process of documenting any changes to the design, specifications, and quantities into a comprehensive record of the as-built condition. [17]

Relational Database. *Category: Data.* A type of database that organizes data into tabular formats with rows and columns. Tables may be joined to facilitate queries using a structured query language.

Workspace. See also: Library. *Category: Modeling.* A customization of a software environment using a specific set of resource files and configurations. [18]

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