ADVANCING DIGITAL DELIVERY IN TEXAS

Volume 1 Technical Application

Fiscal Year 2024 Advanced Digital Construction Management Systems

ADVANCED DIGITAL CONSTRUCTION MANAGEMENT SYSTEMS	
Entity Type	State Department of Transportation
Organization Name	Texas Department of Transportation
Project Name	Advancing Digital Delivery in Texas
Previously Incurred Project Cost	$0
Future Eligible Project Cost	$0
Total Project Cost (from all funding sources)	$10,000,000
ADCMS Program Funding Request	$5,000,000
Non-Federal Share for ADCMS Program Funding Request	$2,500,000
Total Federal Funding (Including ADCMS Program)	$7,500,000

Texas Department of Transportation

Submitted by the Texas Department of Transportation

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2.0 PROJECT DESCRIPTION

2.1 Project Background

The Texas Department of Transportation (TxDOT) is responsible for over 80,720 centerline miles of state highway system and supports the state's maritime, rail, and public transportation system. To efficiently handle the hundreds of transportation-related construction projects, TxDOT is beginning a shift into a more data-driven, digital approach for planning, designing, bidding, constructing, maintaining, and operating future and existing infrastructure. Digital delivery has a comprehensive impact on all disciplines within the organization, including roadway, drainage, structures, and more. It also influences and brings about changes in every stage of a roadway's lifecycle, ranging from planning and design to estimates, construction, maintenance, and asset management.

For over 100 years, TxDOT has been a prominent institution, adapting to the evolving landscape of technology and development. TxDOT consistently embraces advancements to improve operations. Now, as TxDOT embarks on the next phase of this journey, the transition to digital delivery represents a significant milestone. This move towards digital innovation not only promotes greater accuracy and efficiency in design and construction processes but also paves the way for enhanced collaboration and communication across all stakeholders involved. As TxDOT continues to forge ahead, this transition will undoubtedly shape the future of transportation infrastructure in Texas.

By investing in Texas, FHWA creates a national laboratory for digital delivery implementation. The lessons learned, systems developed, and successes achieved in Texas will significantly accelerate the adoption and effectiveness of digital delivery across the country, maximizing the return on investment.

2.2 Project Overview

The overarching objectives of this project are to integrate digital delivery into all aspects of TxDOT's business operations, standardize processes and technologies across the organization, and manage and leverage data throughout all stages of the infrastructure lifecycle while training the existing and incoming workforce of TxDOT and other transportation organizations for a fully digital transportation industry. Over the next four years, TxDOT will implement digital delivery and digital twin processes and tools while actively engaging staff. The digital twin process provides a virtual representation of a physical object used to simulate, predict, and optimize the performance of the real-world counterpart. With the digital twin process, project efficiency, accuracy, and collaboration opportunities are enhanced. TxDOT is in the midst of **five pilot projects for digital delivery**, allowing the team and transportation partners to shape a successful statewide deployment.

Digital delivery improves all stages of the infrastructure lifecycle, including strategic investment decisions, planning, design, construction, and asset management processes. This shift from traditional paper plans to more data-rich models and digital files allows system users to interact with this data-based model and extract the information needed to more efficiently complete project-related activities. With digital delivery, projects are planned and designed using three-dimensional techniques, allowing a level of visualization not possible with traditional two-dimensional design plan sets. **This technology allows construction documents to shift to Building Information Modeling (BIM), allowing contractors, inspectors, and engineers to share data in real-time to create digital representations of the physical characteristics of projects.** Field reviews and construction decisions can be tracked through digital models. All project details, from the concept through the completed construction, can be linked to the digital model, providing a foundation for more reliable as-built information and asset maintenance data than current methods.

In addition, this project will include statewide deployment of mobile connectivity devices to allow for high-speed internet statewide. With dozens of area offices across 254 counties and 25 TxDOT districts, internet connectivity is vital.

The project will identify priority assets for digital as-builts to support project lifecycle use. The priority assets will be chosen by defining the lifecycle information requirements and analyzing data for asset management purposes. Results will be visualized through a data flow diagram. **Digital as-built workshops for priority assets will be provided along with the development of an Information Delivery Manual to provide training not only in Texas but also allow information sharing with other state DOTs.** Workspace enhancements will be deployed as well as the creation of pilot project objectives from the development of the data and process documentation for priority assets. Also, from the data and process documentation, pilot project objectives will be created, and the project selection process will be documented.

As stated in the Associated General Contractors of Texas Chief Executive Officer Jennifer Woodard's Letter of Support included in the Additional Supporting Documentation attachment, **"Our members have expressed the need to advance TxDOT's implementation of the technology for a more efficient and cost-effective construction process. The AGC of Texas has been working closely with TxDOT to better design systems and processes for the implementation of these technologies. We support the implementation of the technology for project plan data for all industry, not just AGC of Texas members, in a way that increases competition and fairness for everyone. To that end, we support TxDOT's grant application and your approval of funding to assist with implementation."**

The project will explore new software and hardware solutions. These new technologies will provide internal training and piloting, recommendations for data collection software and hardware solutions, and engagement with internal stakeholders. By implementing the most up-to-date technology solutions, information-sharing will be more streamlined and productive.

Pilot projects are strategic tools for testing, learning, and refining initiatives and would ultimately lead to more sound decision-making. This project will implement various pilot projects to provide valuable information such as risk mitigation, cost-effective practices, data insights, training, and improved productivity. Having this insight propels TxDOT to develop the best, most productive practices.

The project will explore software solutions for a common data environment. Open data formats will be leveraged when available. These solutions will assist with internal training and support pilot projects. Internal stakeholders, such as data governance and strategic planning staff, will be engaged via access to a common data environment. This common data environment will maximize interoperability with other systems and departments.

Lastly, TxDOT is hosting a series of Digital Delivery Roadshows at the 25 district offices across the state. The Roadshows include hands-on demonstrations and collaboration opportunities. New users meet with project teams and workgroup leads to address any questions, comments, or concerns about the new technologies prior to their implementation. The purpose of the Roadshows is to introduce TxDOT's digital delivery program and how it will support various disciplines and teams. Future Roadshows will be more in-depth and refined as the program progresses. The Digital Delivery Roadshows flyer is shown in **Figure 1**.

TxDOT's digital delivery program is currently using pilot projects to gradually develop and deploy these digital practices with overwhelming success and support. The San Antonio District led the charge by piloting TxDOT's first digital delivery project. The pilot includes testing and validating processes for design, letting, inspection, operations, and asset management.

The major milestones of this project are summarized as follows:

1. **Identify priority assets** for digital as-builts to support project lifecycle use.
   a. Hold digital as-builts requirements workshops for selected priority assets.
   b. Document required attributes by asset type.
2. **Define lifecycle information requirements** as attributes for priority assets to create data flow diagrams.
   a. Gather data requirements for improved asset management.
   b. Peer exchange with other state departments of transportation to enhance data flows for project lifecycle management.
   c. Provide a second round of Digital Delivery Roadshows across the district offices to provide hands-on demonstrations and collaboration opportunities as shown in **Figure 1**.

Figure 1: *Digital Delivery Roadshows Flyer*

3. **Deploy workspace enhancements** identified in the development of the data and process documentation for priority assets.
4. **Use data and process documentation** to establish pilot project objectives.
   a. Document the pilot project selection process as it relates to pilot components
   b. Explore software and hardware solutions for data collection and digital construction management.
   c. Internal training and piloting.
   d. Provide recommendations for software and hardware solutions.
   e. Engagement with stakeholders such as contractors and application developers.
5. **Explore software solutions** for common data environment, leveraging open data formats when available.
   a. Provide internal training and piloting.
6. **Expand pilot project program**.
7. **Provide recommendations** for common data environment software solutions.
8. **Engagement with internal stakeholders** (e.g., data governance, strategic planning, global ionospheric maps (GIM), and geospatial and asset management staff). Validate the recommended common data solution.
9. **Develop guidance documentation and training** material for new process and technology solutions.
   a. Update existing regulations for digital as-built processes.

2.3 Project Objectives

The overarching objectives of this project are to integrate digital delivery into all aspects of TxDOT's business operations, standardize processes and technologies across the organization, and manage and leverage data throughout all stages of the infrastructure lifecycle while training the existing and incoming workforce of TxDOT and other transportation organizations for a fully digital transportation industry.

Specifically, the project will move TxDOT towards a unified Asset Management System supported by implementing digital delivery workflows throughout design, construction, and maintenance phases of the project lifecycle. The project milestones will result in a defined data dictionary for priority assets and preferred technology solutions for a common data environment and data collection methods. The goal of the pilot projects and stakeholder engagement is to confirm the preferred technology solution and ensure user adoption.

2.3.1 ADCMS Goal Alignment

The following describes how this project aligns with each of the ADCMS project goals.

1. Accelerate the adoption of ADCMS throughout the project lifecycle

The digital opportunities TxDOT is implementing will be integrated into the existing, seven-step project lifecycle shown in **Figure 2**. This image outlines the current project lifecycle and the digital opportunities that TxDOT is implementing through digital delivery and other innovations for each step in the lifecycle. For example, in the Operations & Maintenance phase, Geographic Information Systems (GIS) software will be one of the tools used in the development of a digital Asset Management System.

Organizing various assets within a digital application allows TxDOT staff and contractors to easily view needed data. By including digital lifecycle opportunities, TxDOT will improve data quality, simplify access, and enhance safety with more accessible schematics. The project will gleam from best practices from other DOTs when selecting the preferred technology solution for data collection, transfer, and storage.

2. Promote timely information sharing among stakeholders and reduced reliance on paper

This project will promote efficient information sharing through the expansion of the pilot for new field data collection tools and tracking of asset information. The pilots will help demonstrate improved efficiency in the field, decreased data collection time, and increased accuracy of data collected due to data standards and increased positional accuracy.

Piloted projects of technology solutions and applications provide widespread access to digital design models and data during construction projects. Users will be able to make edits, take notes, and make changes while in the field. Information can then be shared in real-time through applications across multiple stakeholders, such as TxDOT field and office staff and contractors. Success stories

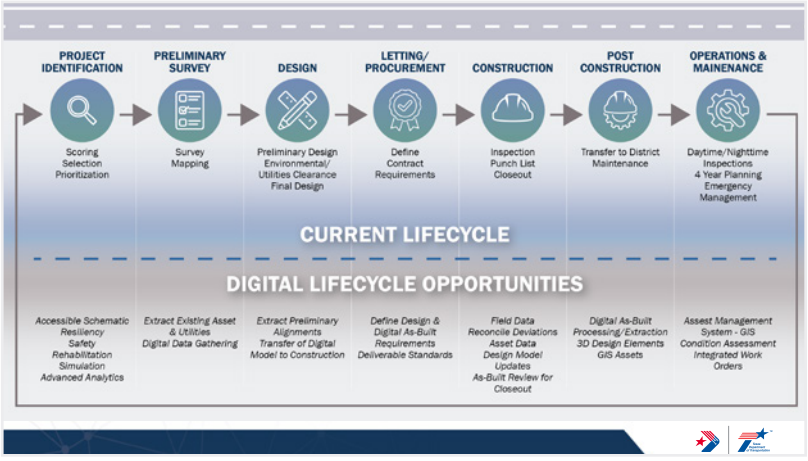


Figure 2: *Digital Lifecycle Opportunities*

from the benefits of information sharing across stakeholders will be documented and deployment champions will share these best practices across TxDOT districts and peer states.

TxDOT will integrate digital delivery and digital twin processes throughout numerous business operations including using technology to create efficient and accurate designs, bid documents, as-builts, and asset records. Digital delivery will help remove information silos so relevant data is available across the different stages of infrastructure planning, design, construction, operations, and management. Automated access to updated data will be implemented, maintained, and enhanced for transportation assets. The digital twin process provides a virtual representation of a physical object used to simulate, predict, and optimize the performance of the real-world counterpart. With the digital twin process, projects' efficiency, accuracy, and collaboration opportunities are enhanced. Ultimately, the implementation of digital tools and technology will facilitate seamless access and use of key data among stakeholders for more productive information sharing while also reducing reliance on paper.

3. Leverage the use of digital technology by contractors

TxDOT will expand the implementation of digital construction management systems such as Trimble software and Moasure in each TxDOT Area Office. Trimble's multiple software solutions assist with positioning, modeling, connectivity, and data analytics. Moasure produces motion-based technology designed to simplify the process of taking measurements in the field.[1] Both companies have been successful in technological innovation in the fields of construction and beyond, including successful pilots at TxDOT Area Offices. A federally compliant competitive procurement process will solicit proposals to implement improved digital management systems to achieve the goal of faster, safer, and more accurate construction projects. Potential solutions will include:

- *Expand already existing Terra Solid software,*
- *Provide photogrammetric-capable computers for TxDOT Districts so they can more easily develop 3D photogrammetric models,*
- *Explore geotagging and augmented reality applications,*
- *Build on new efforts using sensors to monitor hits on crash attenuators,*
- *Mobile, terrestrial, and aerial LiDAR,*
- *TxDOT is currently acquiring a rover for pavement analyses and asset management,*
- *Real-Time Kinematic (RTK)-capable drone and LiDAR sensor or photogrammetry camera,*
- *Additional Unmanned Aircraft Systems (UAS) for redundancy,*
- *Aquatic systems for monitoring bridge piers,*
- *Licenses for automatic image recognition software to identify road features, and*
- *Technology that can monitor bridge joints, settlement, and cable barrier tension.*

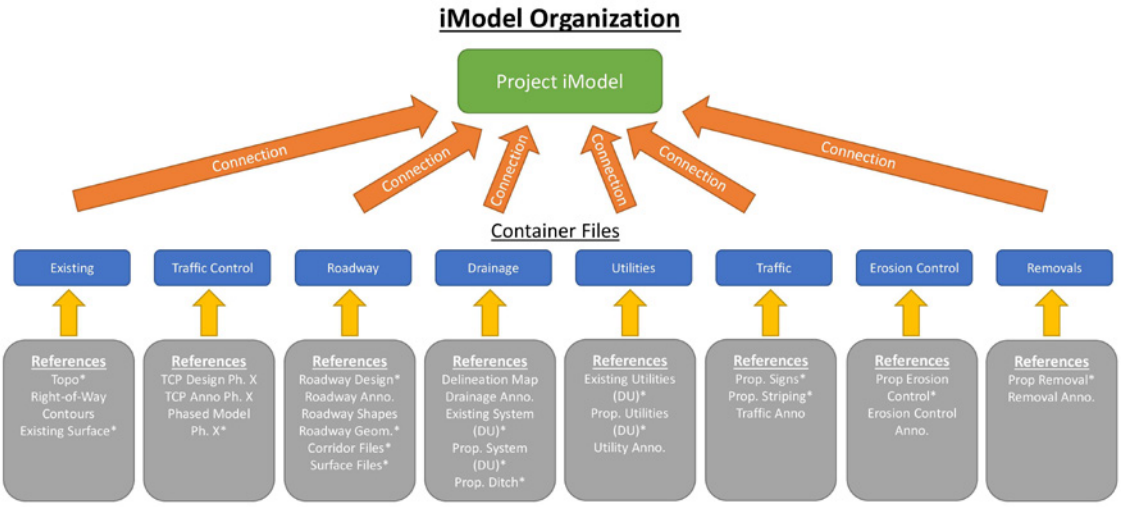
Additionally, to develop and deploy best practices in digital construction management, TxDOT is developing a Strategic Plan for Mobile Mapping to be funded with this grant application.

4. Develop and deploy best practices

During the investigation of new technologies and workflows, the project team will consider best practices from the industry and modify them to meet the needs of TxDOT. Upon recommendations and adoption of technology solutions, guidance documentation similar to **Figure 3** will accompany stakeholder engagement to inform users of the purpose of the change and how to implement it in their area of work. The project will use stakeholder engagement to collect feedback on the documentation and revise best practices according to the needs and concerns of the districts.

1 Moasure - Motion based measuring technology

An example of best practices for digital management systems would include methods to effectively accelerate construction or decrease project costs. For example, by implementing BIM as a best practice, construction projects would save money through design accuracy, reduced rework, and improved project coordination. According to Trimble, using BIM can result in an almost 20% reduction in the time taken to complete projects and a 40% reduction in costs due to fewer errors.[2]



* May contain a 3D component included

Figure 3: *iModel Best Practice Guidance*

5. Increase technology adoption and deployment

Increasing technology adoption and deployment in projects yields numerous benefits. Over time, investments in technology lead to cost savings by reducing labor costs, optimizing resource utilization, and minimizing operational inefficiencies. TxDOT will incorporate the use of various technologies into contracts for pilot projects to develop project budgets and compare them to project budgets without technology. Project teams will document lessons learned to better understand the cost benefits of technology use on projects.

The project will also consider licensing structure for financial impact and access control when recommending new technology solutions. The ideal technology solutions for data collection, transfer, and digital construction management will allow the contractor to maintain their means and methods while incorporating them into the TxDOT common data environment and management system.

Figure 4: *Trimble SiteVisionSite*

2 https://investor.trimble.com/files/doc_presentations/2023/09/20/Trimble-Investor-Overview-September-2023.pdf

6. Technology training and workforce development

TxDOT staff and project partners will undergo a variety of technology training and workforce development to shift to a digitally driven culture. The goal is to prepare the existing and incoming workforce for a fully digital transportation agency. Capturing processes from multiple perspectives will help provide a better understanding of how to best integrate digital delivery across TxDOT divisions, groups, and districts to optimize benefits. By being well trained, personal technical competence will improve and leverage the ability to use more advanced tools, better understand project requirements, and plan effectively. Increased confidence in technology will foster credibility and leadership to provide staff with clarity and support.

Figure 5: *Digital Technology Use in the Field*

7. Guidance development to assist in updating State regulations

Regulation changes will be identified to support the integration of digital as-built data into business systems. Incorporating digital as-builts into the construction process will include a review of existing State regulations and drafting any needed updates. Piloting the use of digital data formats, including open data formats, on pilot projects will include an evaluation of the efficiencies that may be achieved through increased accuracy and uniformity of data.

8. Reduce congestion

BIM technology can significantly reduce congestion at a construction site and improve a project's efficiency and reduce emissions. BIM enables construction workers to visualize the construction process prior to work beginning. Tasks can be scheduled more effectively so teams are not working in the same area simultaneously and can work more efficiently, reducing time. BIM also supports prefabrication and modular construction by providing accurate models. Components of a job site can be manufactured off-site and assembled on-site to reduce the amount of congestion within the work zone and improve site safety. With the enhanced planning capabilities, heavy construction equipment will be used for shorter periods of time reducing emissions.

Digital construction management tools will be piloted to evaluate their ability to perform the model visualization and construction inspection processes. Inspectors will be able to identify work outside of environmentally cleared areas more quickly through model visualization tools and a robust data dictionary for environmental assets that enables the model elements to track data about the permitting requirements.

9. Enhance safety

Using technology in the office will allow employees to reduce time in the field exposed to traffic. BIM technology will increase the efficiency of fieldwork, so work zone exposure is minimized, benefiting workers and public safety. For example, BIM allows for detailed 3D modeling and simulation of construction sites and processes. Potential risks can be identified and avoided. The use of drones will help reduce the number and duration of work zones, improving safety for employees and the traveling public. Drones can fly into and access areas that may be difficult to safely access for collecting data and images used for 3D modeling, for example.

2.3.2 Administration Goal Alignment

This project achieves all goals defined in the Notice of Funding Opportunity (NOFO). Investment in this technology in Texas provides significant economies of scale based on the volume of infrastructure and projects administered by TxDOT. As detailed in the TxDOT Popular Annual Financial Report for the Fiscal Year that ended on August 31, 2023, TxDOT had 9,392 construction projects in progress (and/or starting soon) valued at an estimated $30.4 billion. More than 28% ($4.2 billion) of TxDOT's government fund revenues are federal, so the familiarity with administering federal aid is exceptional. The following section details how this project advances each of the FHWA's goals outlined in the NOFO.

NOFO Project Goal: Safety

This project consists of using innovative construction tools that will allow for more efficiency in the field. In turn, construction workers will spend less time exposed to work zones. Another technology is the use of drones, allowing for safer data collection. With better field tools and BIM visualization, the length and duration of work zones can be decreased. This increases safety for construction workers and members of the public who may be impacted by the placement of work zones.

NOFO Project Goal: Climate Change and Sustainability

TxDOT will integrate digital delivery into many aspects of business and operations. This includes using technology to create efficient and accurate designs, bid documents, and asset records. Additionally, tools and technology will be implemented to facilitate seamless digital access to updated data. The transportation and construction industries are increasingly digitizing. This digitization of data helps reduce the reliance on paper documentation.

BIM technology can significantly reduce congestion at construction sites and improve project efficiency. BIM enables construction workers to visualize the construction process prior to work beginning. Tasks can be scheduled more effectively so teams are not working in the same area simultaneously and can work more efficiently, reducing time. BIM also supports prefabrication and modular construction by providing accurate models. Components of a job site can be manufactured off-site and assembled on-site to reduce the amount of congestion within the construction zone and improve site safety. With the enhanced planning capabilities, heavy construction equipment will be used for shorter periods of time reducing emissions.

Digital delivery for asset management purposes allows TxDOT to perform resiliency planning to a higher level of efficiency. Assets most vulnerable to environmental impacts will be considered during the asset prioritization phase as the project builds out a robust data dictionary and asset management system. This asset information can be used during resiliency planning and emergency response.

NOFO Project Goal: Workforce Development, Job Quality, and Wealth Creation

The implementation of new technology will be accompanied by a comprehensive training program to equip TxDOT employees with the knowledge and technical capabilities to implement the department's digital delivery program. Knowledge and skills about digital delivery will foster professional development among TxDOT employees as these skills are becoming more important in the digitizing construction industry. In the future, these trained workers will be able to educate incoming employees on digital delivery, and they will be able to transfer these skills to other work that involves the use of these technologies or similar technological environments. TxDOT's approach to workforce training could serve as a template for other states, addressing the nationwide challenge of upskilling the construction industry to perform work with improved ease, efficiency, and accuracy.

NOFO Project Goal: Equity

Texas has a highly diverse population. The growth rate in Texas is 15.9% - more than double the national growth rate of 7.4%. Minorities accounted for over 95% of the population growth in Texas.[3] In 2021, 40.2% of the Texas population was Hispanic and Latino American according to Census data. In 2022, 14% of Texas households earned below the Federal Poverty Level (FPL) and 29% earned above FPL but not enough to afford the basics in the communities where they live. These percentages are highest for Black and Hispanic households.[4] TxDOT will use group public engagement to receive feedback on the project's public impact. This data will be used to promote fairness throughout the project life cycle. **An investment in Texas is an investment in one of the most culturally and ethnically diverse states in the country.**

2.4 Monitoring Plan

TxDOT will monitor the progress of this project with quarterly progress reports on deliverables. The reports will include cost savings, project delivery time reductions, congestion reductions, and safety improvements. Expected outcomes and benefits will be reported, including time and cost savings, reduction in rework, reduced congestion, and improved safety. In addition, TxDOT staff responsible for asset management and maintenance will be consulted to identify existing workflow and data gaps and further improve efficiency.

Pilot projects will have defined parameters that lead to improved testing scenarios and a greater distribution of digital technologies. Consistent reporting on the number of pilot projects, their objectives, data elements or assets, and data tools will propel project adoption throughout TxDOT. The efficiencies of collected data, the data's quality, and the data's ease of use on pilot projects will also be reported. To create a common data environment, asset management recommendations and streamlining opportunities will be identified. Success stories will be collected across TxDOT departments to provide insight into project effectiveness.

3.0 PROJECT TEAM INFORMATION

The digital delivery program has established work groups with specific focus areas that will be responsible for their areas of expertise, as seen in **Figure 6**. As detailed in the TxDOT Digital Delivery Program Strategic Plan draft (a portion of which is included in the Additional Supporting Documentation), TxDOT has dedicated staff champions and key resources to move the department's digital delivery program forward. This multifaceted team includes TxDOT senior leaders, Division and District leadership, and consultant support. Change Management and Leadership work groups are addressing internal and external communications, training, and providing feedback to leadership and other work groups. Discipline-specific work groups are established to examine digital delivery needs, priorities, and risks and are addressing implementation as well as unique needs across disciplines. Technology and Digital Twin work groups are addressing data management, GIS, data governance, and hardware and software considerations. Process Development work groups are focused on

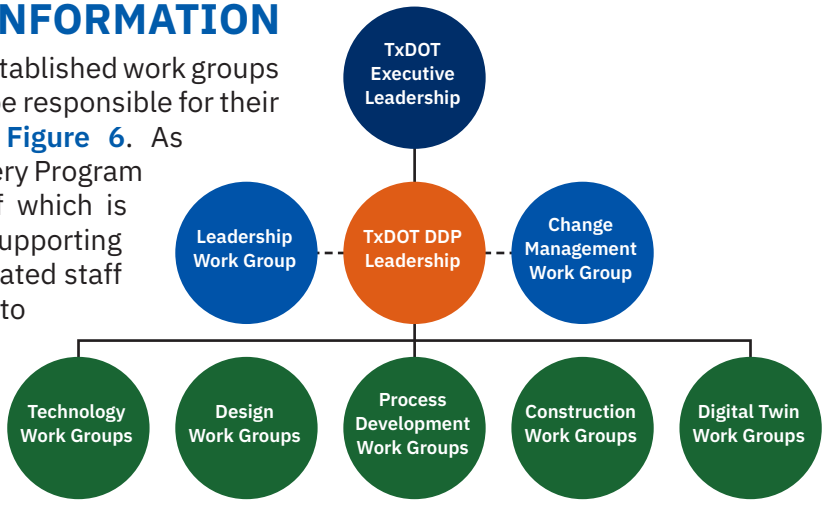


Figure 6: *TxDOT's Digital Delivery Team*

3 Texas Economic Strength | Texas Economy Growth | TxEDC (businessintexas.com)
4 Texas | UnitedForALICE

project development and letting. Work groups are comprised of staff from TxDOT divisions and district representatives from across the state. **This structure provides TxDOT with the perspectives and champions to move digital delivery forward and achieve the strategic goals for the digital delivery program**.

Name and Position	Project Duties and Experience	2025	2026	2027	2028
S. Jacob Tambunga, P.E. Director of Digital Delivery, October 2018 - present	**TxDOT Digital Delivery Program Lead** Currently leads and manages TxDOT's statewide Digital Delivery Program, including the statewide adoption of 3D design, adoption of Digital Project Delivery, and the development of an Asset Management Digital Twin of TxDOT's system. Also leads TxDOT/AGC joint 3D Task Force workgroup and TxDOT statewide implementation of upgraded 3D design software. Participates in AASHTO Joint Committee JTCEES and FHWA BIM for Infrastructure fund and participated in NCHRP synthesis panel. Currently serves on Board of Directors for the Highway Engineering Exchange Program (HEEP) and served on the Digital Model workgroup with Texas Board of Professional Engineers and Land Surveyors.	90%	90%	90%	90%
Jennifer Lash, PMP Director of Geographic Information Management, December 2022 - present	**Lead Digital Delivery Data Integration** Leads TxDOT's Journey to Enterprise Data Integration (JEDI) Project, directs and supervises GIS professionals, participates in statewide committees and enterprise project regarding advancement of digital programs, supervises development of enterprise integration systems, oversees development of statewide GIS data, manages TxDOT's GIS budget as part of FHWA's Statewide Planning and Research program, serves as a system owner for TxDOT's ArcGIS Enterprise Systems, serves as a liaison between TxDOT divisions and IT.	65%	65%	65%	65%
Jason Duncan, P.E. Deputy Director of Construction Division, May 2021 - present	**Lead Digital Delivery Construction Implementation** Supervises CMISD section which is in charge of AASHTOWare SiteManager software, supervises Construction Training and Development section, supervises Management Analyst group, administers construction pilot projects, evaluates research proposals, subject matter expert on several concluded and ongoing projects, assists with development and implementation of statewide standards and required processes on construction projects.	30%	30%	30%	30%

4.0 PROJECT READINESS

4.1 Technical Feasibility

With the support of TxDOT leadership, digital delivery is well-positioned for successful deployment. TxDOT is committed and has already invested in implementation through an $11.7 million current contract award for implementation of the TxDOT Digital Delivery Program. TxDOT investment to date for this contract alone is $4.5 million. Extensive staff time for Digital Delivery Roadshows and pilots further support TxDOT's dedication to fully implement the project. This prior investment is not included in this funding application but provided to show TxDOT's commitment to successful digital delivery implementation.

4.2 Project Schedule

Activity Name	2025				2026				2027				2028			
Task 1. Identify priority assets for digital as-builts																
1.1. Digital as-builts requirements workshops																
1.2. Document required attributes by asset type																
Task 2. Define lifecycle information requirements for priority assets																
2.1. Gather data requirements for improved asset management																
2.2. Peer exchange with other DOTs for data flow enhancement																
2.3. Provide a second round of Digital Delivery Roadshows across districts																
Task 3. Deploy workspace enhancements for priority assets																
Task 4. Establish pilot project objectives																
4.1. Document pilot project selection process																
Task 5. Explore software and hardware solutions for data collection and digital construction management																
5.1. Internal training and piloting																
5.2. Provide recommendations for software and hardware solutions																
5.3. Engagement with stakeholders																
Task 6. Explore software solutions for common data environment																
6.1. Internal training and piloting																
Task 7. Expand pilot project program																
Task 8. Provide recommendations for common data environment software solutions																
Task 9. Engagement with internal stakeholders to validate recommended solution																
Task 10. Develop guidance documentation and training materials for new processes and technology solutions																
10.1. Update existing regulations for digital as-built processes																

4.3 Project Risks and Mitigation Strategies

TxDOT has identified the following potential project risks and coinciding mitigation strategies.

Risk	Description	Mitigation Strategy
Change in Software	Software may change during evaluation and piloting making it difficult to accurately assess value to TxDOT and stakeholders.	TxDOT will create an evaluation plan that includes increased vendor coordination during evaluation, a review of documented vendor roadmaps, and defined pilot objectives.
Internal Conflicts	There may be internal resistance to change in technology usage.	TxDOT will foster clear and consistent outreach across all districts through internal communication and district Digital Delivery Roadshows, select pilot projects with engaged and supportive teams, and publicize outcomes to encourage the learning of new technology.

Risk	Description	Mitigation Strategy
Large Project Scope	Taking on too many simultaneous tasks can make it difficult to accomplish tasks within a reasonable timeframe.	TxDOT's project teams will focus on the priority assets, and work will be phased into achievable parts to easily achieve quick wins.
Change in Hardware	Hardware is continuously changing and staying current can be difficult as timely updates can be difficult to maintain.	Identifying hardware as service opportunities will help mitigate the challenge of rapidly upgrading or replacing hardware.
Facilitating Widespread Adoption	Widespread adoption of new tools or methods depends on pilot project distribution.	TxDOT will use criteria to identify pilot projects that will help prioritize the distribution of new tools across multiple districts.

5.0 RESPONSIVENESS TO MERIT CRITERIA

Criterion #1 – Technical and Management Approach

Merit Criteria Evaluation Factors	Description of How Evaluation Factors Are Met
1. Builds on existing framework or is identified as a need in existing data plans.	This project builds on the current OpenRoads Designer (ORD) workspace and will enhance it to support lifecycle asset management through construction and asset management. It also advances the use of Building Information Modeling (BIM) for infrastructure through workspace and data discovery, data dictionary development, and data interoperability efforts. This project builds on BIM as it includes the expansion of the design workspace to support data flow into construction. Additionally, it establishes data dictionaries and processes to support data exchanges between systems, from construction to asset management, for lifecycle asset management.
2. The outcome will fill a critical need for the organization and support future phases of the proposed project or subsequent projects.	The project will help TxDOT capture critical information from construction as-builts and will support future phases and subsequent projects through asset prioritization, the development of data dictionaries, technology recommendations, and lessons learned.
3. Staff assigned to the project have related expertise and experience.	The experience, expertise, and dedication of the TxDOT Digital Delivery Team is unparalleled. Additional information is provided in the Additional Support Documentation Attachment.
4. Staffing structure is adequate.	Digital Delivery will be led by TxDOT's Digital Delivery Team with support from consultant resources. The use of district and division champions will facilitate successful statewide adoption.
5. Applicant is committed and has the resources to fully implement the project.	TxDOT is committed and has already invested in implementation through an $11.7 million current contract award for implementation of the TxDOT Digital Delivery Program. TxDOT investment to date for this contract alone is $4.5 million. Extensive staff time for Digital Delivery Roadshows and pilots further support TxDOT's dedication to fully implement the project. This prior investment is not included in this funding application but provided to show TxDOT's commitment to successful digital delivery implementation.
6. Risks are well understood, and mitigation strategies are comprehensive and implementable.	Project risks and mitigation strategies are detailed in Section 4.3 of this application.

Criterion #2 – Promotes Efficient Information Sharing Among Stakeholders

Merit Criteria Evaluation Factors	Description of How Evaluation Factors Are Met
1. Promotes efficiencies and will result in time savings during project development or construction.	This project will promote efficient information sharing through the exploration and piloting of new field data collection tools and drones. This is expected to improve efficiency in the field and decrease data collection time during construction. This will also increase the accuracy of data collected, providing additional project efficiencies.
2. Will eliminate or substantially decrease the use of paper documentation.	Integrating digital delivery into all aspects of TxDOT's business and operations will improve how TxDOT uses technology to create designs, bid documents, and asset records. Automated access to updated data assets will be implemented, maintained, and enhanced. By using digital delivery for these functions, information will be created and stored online, which will significantly reduce paper documentation.
3. Will improve information sharing and the likelihood it will result in improved decision making when issues arise during project development or construction.	Digital delivery will remove information silos so that relevant data is available across the different stages of infrastructure planning, design, construction, operations, and asset management. Automated access to updated data assets will be implemented, maintained, and enhanced.
4. Will provide benefits to both project owners and contractors in either time or cost savings.	Digital delivery benefits are substantial and will promote ADCMS Program Goals and Advancing BIM for Infrastructure: National Strategic Roadmap.

Criterion #3 – Accelerate Technology Adoption and Deployment

Merit Criteria Evaluation Factors	Description of How Evaluation Factors Are Met
1. Creates a process that can be used by other transportation organizations.	The implementation of digital delivery is a transformation taking place across the industry. TxDOT recognizes the importance of collaboration and knowledge-sharing, actively communicating with other states to identify best practices and collectively engaging with industry partners. With the aspiration of serving as a national leader in digital delivery, TxDOT remains committed to engaging with other agencies and industry partners as it progresses in this exciting journey.
2. Process enhancement can be used by other entities without the need for significant capital investment.	A common data environment will be used to minimize the need for significant capital investments by other entities.
3. Process enhancements address missing electronic data connections identified by multiple organizations.	Open data formats will help promote information sharing and data gap reductions across multiple organizations.
4. Results in an open data format or eliminates the need for data conversion for use by other software/data systems.	During the software and hardware evaluation and pilot period of this project, work can be done using open data formats. This project seeks to establish a data requirement for assets and digital as-builts that can be software agnostic and will leverage open data standards as they are developed.
5. Improves budgeting or cost control.	Digital assets are effective tools to assist in managing project budgets.

TxDOT plans to advance the state-of-practice for digital delivery by partnering with peer states and industry. Peer exchange with other State Departments of Transportation will allow TxDOT to gather useful information regarding digital delivery in other organizations while also sharing lessons learned within TxDOT. Collaboration with the Minnesota Department of Transportation (MnDOT) and the Utah Department of Transportation (UDOT) has already started.

Criterion #4 – Safety

Merit Criteria Evaluation Factors	Description of How Evaluation Factors Are Met
1. Eliminates or mitigates the amount of time workers are in hazardous situations gathering data adjacent to active roadways.	Using enhanced technology in the field will reduce work zone durations, reducing the amount of time workers are in hazardous construction zones. Additionally, tools such as drones will allow for fast, accurate data collection to help keep workers safe.
2. Reduces the time a work zone needs to be in place	Using better technology in the field, such as Trimble tools and BIM visualization, will allow for more efficient construction. This will reduce construction timelines and reduce the time work zones need to be in place.
3. Improves quality and timeliness of information to the public, thereby making travel through a work zone safer.	The integration of technology for smart work zones is enhanced by a rich dataset from digital delivery implementation.

Criterion #5 – Workforce Development, Job Quality, and Wealth Creation

Merit Criteria Evaluation Factors	Description of How Evaluation Factors Are Met
1. Provides training on new technology to the workforce and increases workforce skillsets.	TxDOT will implement a robust and comprehensive training program to equip TxDOT staff with the knowledge and technical capabilities to sustain the department's digital delivery program. TxDOT will also empower champions and discipline-specific workgroups to identify where new training is needed and optimal methods for integrating required technical training into new employee onboarding.
2. Workforce skills obtained as a result of the proposed project are transferable to other career paths.	New employee onboarding and employee ongoing career development training will equip workers with skillsets to adapt them to the increasingly digitizing transportation industry.

Criterion #6 – Environment, Climate Change and Sustainability, and Equity

Merit Criteria Evaluation Factors	Description of How Evaluation Factors Are Met
1. Reduce right of way for project construction.	By leveraging Building Information Modeling (BIM) visualization during construction, the layout and placement of construction can be optimized, allowing for more efficient use of space. This will reduce the right of way and time needed for project construction.
2. Communication of environmental and equity commitments made during preliminary design.	TxDOT will use group public engagement to receive feedback on the project's public impact. This data will be consolidated with AI so the data can be well understood and used to maintain equity throughout the project lifecycle.
3. Identification and avoidance of environmentally sensitive areas.	BIM visualization helps reduce the time needed for project construction, minimizing environmental impacts to surrounding areas. Additionally, the data lifecycle workflow enhancements for planning throughout the design and construction phases will improve the consumption of environmental information from the field, as it will be consolidated and geolocated.
4. Reduced work zone congestion.	BIM visualization allows for less time and space needed for construction, also leading to reduced work zone congestion.
5. More efficient utilization of construction equipment, requiring fewer machine hours of operation.	BIM visualization assists with construction equipment scheduling efficiencies, ultimately providing savings to taxpayers.

By leveraging BIM visualization during construction, the layout and placement of construction can be optimized, allowing for more efficient use of space. This will reduce the right of way and time needed for project construction and, in turn, minimize environmental harm or disruption to surrounding areas. With less time and space used for construction, work zone congestion will also decrease. Additionally, the data lifecycle workflow enhancements for planning throughout the design and construction phases will improve the consumption of environmental information from the field, as it will be consolidated and geolocated. Data decisions can be stored by geolocations with this common data environment.

ADDITIONAL SELECTION CONSIDERATIONS

TxDOT is dedicated to facilitating a robust information exchange with other state DOTs, local governments, and private industry including technology providers, engineering consultants, and contractors. Innovation and leadership are part of the culture at TxDOT, and we pride ourselves in serving as a testbed for large scale deployments. This project promotes the FHWA National Strategic Roadmap for Advancing BIM for Infrastructure. Using data from innovative digital technologies throughout the lifecycle of transportation assets is vitally important to success.

By expanding digital delivery deployment statewide, TxDOT is positioned to revolutionize project development and asset management. These outcomes benefit TxDOT and - more importantly - contribute to a safer and more efficient transportation system for Texans.

Investment in expanded digital delivery in Texas is compelling for many reasons.

1. **Economic Significance:** Texas has the second-largest economy in the nation and the eighth[5] largest in the world.
2. **Population Growth:** Texas is one of the fastest-growing states, putting increased demands on infrastructure.
3. **Strategic Location:** Texas is a hub for cross-border trade with Mexico and central to domestic logistics, connecting the East and West coasts.
4. **Innovation Culture:** Texas is a leader in transportation technology innovation. Successful implementation by TxDOT could serve as a model for other states.
5. **Large Transportation System:** Texas has the largest highway system in the nation, offering significant opportunities for implementing and scaling digital delivery.
6. **Resilience Needs:** Texas faces various weather challenges (hurricanes, floods, extreme heat), requiring innovative infrastructure solutions.
7. **Track Record:** TxDOT has a history of successful large-scale projects and innovations.

Investing in Texas will allow the FHWA to impact a significant portion of the nation's transportation infrastructure, potentially setting standards and best practices for other states. The scale and diversity of Texas' transportation system make it an ideal candidate for showcasing the benefits of digital delivery implementation.

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