

Executive Summary Wisconsin Department of Transportation 3D Technologies Implementation Plan

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Final Report

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VISION STATEMENT.

Adoption of three-dimensional (3D) methods and seamless data flows throughout initial survey, design, contracting, construction, as-built survey, and other applications included within the infrastructure lifecycle.

INITIATIVES, SHORT-TERM (1-3-YEAR) GOALS, AND LEAD SECTIONS.

1. Height Modernization Program (Passive and Active Networks).

Short-Term Goals:

- Prepare a work plan for meeting these short-term goals. Include a timeline for each goal.
- Develop a WisDOT support group that continues advocating internally for sustained resources for HMP efforts.
- Advocate formation of an external users group that works for sustained support at the local, state, and national levels for HMP efforts by communicating the importance of the technology and how it benefits their business needs.
- Complete construction of the active WISCORS network and bring it to full statewide operational status.
- Continue to raise the awareness of management and upper management within WisDOT of the significance of HMP to the overall mission of the department and to the State of Wisconsin.
- Ensure continued funding (e.g., user fees, program revenue) for both passive and active networks.
- Increase the awareness of upper management of funding mechanisms for completion of passive network construction and for operation and maintenance of the active network 24/7.

Lead Section: Bureau of Technical Services – Surveying and Mapping Section.

2. LiDAR and Digital Mapping Data Acquisition.

Short-Term Goals:

- Prepare a work plan for meeting these short-term goals. Include a timeline for each goal.
- Fill a LiDAR coordinator position as soon as possible. This position has been approved and the process for filling it is underway.
- Develop a contract with UW-Madison assistance for research on LiDAR technology and training issues and film versus digital mapping camera processes. The research should address technical aspects, costs, potential benefits, standards and specifications, personnel and training needs, options, and alternatives for adoption of LiDAR and digital mapping camera technology. The research should lay the groundwork for, and make recommendations concerning, development of a detailed implementation and transition plan. NOTE: This study should be coordinated with, and share information with, the broader department-wide study of LiDAR data applications proposed in Initiative 7.
- Building upon the UW-research, and in coordination with the Bureau of Aeronautics, develop and begin implementing a plan for adoption of LiDAR and digital mapping camera technology that includes both short-term and long-term components. Include budget costs for capital equipment, necessary personnel, and training. During plan development, consider the activities and findings of FHWA's Every Counts II initiative.
- Evaluate photogrammetric deliverables for 3D design practices.
- Revise Chapter 9 (Surveying and Mapping) of the FDM to bring it up-to-date.

Lead Section: Bureau of Technical Services – Surveying and Mapping Section.

3.1. Statewide 3D Design Process.

Short-Term Goals:

- Prepare a work plan for meeting these short-term goals. Include a timeline for each goal.
- Continue development and execution of the extended deployment plan for 3D design as described above.

- Require 3D Surface Models as a design deliverable on new project starts, and maintain 3D Surface Model content requirements as related to AMG practices.
- Require development of all new (in-house and consultant) WisDOT roadway design projects in Civil 3D.
- Fully retire CAiCE and Microstation in the Region offices for WisDOT roadway projects.
- Develop 3D Surface Model content requirements for pavement and concrete base course surfaces.
- Implement the addition of pipe networks and evaluate 3D utility representation in Civil 3D projects delivery requirements and develop necessary associated workflows.
- Evaluate adoption of software functionality for clash detection, including Navisworks software.
- Monitor Southeast Freeway's use of 4D and 5D Roadway Models and other advanced spatial technologies and evaluate applicability on a statewide basis.
- Conduct pilot projects to continue to evaluate robustness of 3D Surface Model standards and data flows to contractors.
- Develop and document the initial concepts of "Roadway Model".
- Initiate discussion with BITS concerning Roadway Model usage goals and concepts at the enterprise level.

Lead Section: Bureau of Project Development - Roadway Standards and Methods Section.

3.2. Southeast Freeways 3D Design Process.

Short-Term Goals:

- Prepare a work plan for meeting these short-term goals. Include a timeline for each goal.
- Design and begin development of a library of 3D templates and typicals.
- Develop and begin implementing a plan for in-house capacity for modeling and BIM functionality to include clash detection, design reviews, project staging, and public information applications. Use the Zoo Interchange as the practical platform.
- Evaluate Autodesk's Vault software for collaborative design, data management, and archiving.
- Investigate existing methods for determining qualitative and quantitative benefits of advanced spatial / temporal technologies. Modify, if necessary, and plan for application to Southeast Freeways' circumstances.

Lead Section: Southeast Freeways.

4. Automated Machine Guidance (AMG).

Short-Term Goals:

- Prepare a work plan for meeting these short-term goals. Include a timeline for each goal.
- Investigate conducting pilot projects to evaluate robustness of the quality assurance component of the AMG HMA base course specification. The pilot projects should also evaluate existing 3D Surface Model standards and data flows to contractors.
- Evaluate incorporation of the AMG HMA base course specification into WisDOT's standard specifications.
- Monitor and refine, if necessary, the AMG specification for grading.
- Monitor Wisconsin, Iowa, Illinois, and nationwide activities in AMG for concrete base course, asphalt paving, concrete paving, and initiate specification development.

Lead Section: Bureau of Project Development - Project Services Section and Roadway Standards and Methods Section.

5. Southeast Freeways Field Technology and Inspection.

Short-Term Goals:

- Prepare a work plan for meeting these short-term goals. Include a timeline for each goal.
- During 2013, pilot the use of ruggedized tablet computers on STH 100 at the Zoo Interchange. Determine effectiveness of interface with rovers and models, durability (field-worthiness), effectiveness and limitations of WiFi as applied to use of tablets, utility of image capture and referencing capabilities, best uses and overall effectiveness of tablet functionality.

- During 2013, pilot the use of electromagnetic (particularly, SPAR) technology for subsurface utility mapping on STH 100 at the Zoo Interchange. Do this as a component of Central Office's utility mapping initiative.
- Participate with the Surveying and Mapping Section in their LiDAR and digital mapping data acquisition initiative to help establish a path forward for more effective use of WisDOT's static LiDAR scanner and processing of its data.

Lead Section: Southeast Freeways.

6. Utilities.

Short-Term Goals:

- Prepare a work plan for meeting these short-term goals. Include a timeline for each goal.
- Upper management needs to make a decision on use of improvement dollars for SUE for preliminary design.
- Develop draft policy on implementation of SUE on specific WisDOT highway improvement projects.
- During 2013, select a few projects to begin using SUE on a test basis.
- Build upon findings from the 2012 Northeast Region's pilot project and the 2013 SUE pilot projects by conducting 3-5 additional pilot projects on use of the technologies.
 - Work with WTBA and a subset of utilities.
 - Preliminary identification of pilot projects to be raised at joint PDS Chiefs meeting in January, 2013.
 - Use SUE, electromagnetic SPAR technology, and possibly ground-penetrating radar.
 - Conduct mapping during preliminary survey so results can be used during design.
 - Conduct mapping as needed during construction.
- Develop and implement policy on including tracer placement in utility permits.
- Conduct outreach to utilities and contractors. Include them as participants in the activities of above goals.
- Stay informed on developments in research, implementation, and policy at the national level and within other state DOTs.

Lead Section: Bureau of Technical Services – Utilities Section; Bureau of Highway Maintenance - Permitting Section.

7. Roadway Lifecycle Uses of LiDAR Data.

- Prepare a work plan for meeting these short-term goals. Include a timeline for each goal.
- As soon as possible, form a study group for department-wide applications of LiDAR data.
- Have the study group conduct or oversee an investigation that addresses at least:
 - Applications and their required accuracies.
 - Whether or not the photolog van is an appropriate platform to support priority applications.
 - Costs and benefits.
 - Management of very large volumes of data generated by raw LiDAR data collection.
 - Feature extraction capabilities and requirements.
 - In-house versus consultant-based alternatives.
 - Opportunities for data sharing with other agencies and local governments.
 - Identification of options and development of recommendations.

NOTE: The proposed study should focus upon applications beyond those administered by the Surveying and Mapping Section which is conducting a detailed study of LiDAR at the engineering-survey-specification level (see Initiative 2). There should be coordination and information sharing between the two studies. Together, the two investigations should establish a path forward for adaptation of LiDAR technology and its uses on a department-wide basis.

- Based upon outcomes of the proposed investigation, prepare and begin executing an implementation plan for LiDAR technology. The implementation plan should identify dependencies, set priorities, and sequence the different applications of LiDAR data so they can

be addressed incrementally. Furthermore, the implementation plan should be coordinated with the plan to be developed by the Surveying and Mapping Section (see Initiative 2).

Lead Section: Bureau of State Highway Programs – Data Management Section; Bureau of Traffic Operations.

8. Information Technology Infrastructure.

- Prepare a work plan for meeting these short-term goals. Include a timeline for each goal.
- Perform a project to determine network capacity requirements to meet 3D needs and identify ways to increase capacity and performance. Study will include a recommendation for changes in technology to meet 3D requirements, expected costs, and a proposed timeline for implementing recommended technology.
- Perform a project to determine data storage needs for 3D and capacity at remote and central sites and identify ways to increase capacity, performance and sharing of data between regional and central office for DTSD. Study will include a recommendation of needed changes in technology for meeting upcoming 3D requirements, expected costs and a proposed timeline for implementing recommended technology.
- Perform a project to evaluate ESRI LiDAR extensions and usage at DOT. Provide recommendations on usage, data inter-relationships, any additional costs and a schedule of implementation if warranted.
- Determine architectural strategy for integration between 3D data and GIS applications and what additional services DOT will seek to provide with 3D data (e.g., 3D web services to DOT applications).
- Complete EDSM pilot and determine any related costs for full-scale implementation.
- Assist DTSD with their technology goals and provide guidance on issues related to Information Technology.
- Implement recommendations within reasonable time and budget from the network capacity or data storage projects.
- Continue to be involved and represented during execution of this 3D Technologies Implementation Plan.

Lead Section: Bureau of Information Technology Services – Application Development Support – Modal & Corporate Section.