

3D ENGINEERED MODELS FOR CONSTRUCTION

Three-dimensional (3D) modeling in transportation construction is a mature technology that serves as a key building block for the modern-day digital jobsite. The technology allows for faster, more accurate and more efficient planning and construction. As the benefits are more widely recognized, many in the U.S. highway industry will transition to 3D modeling.

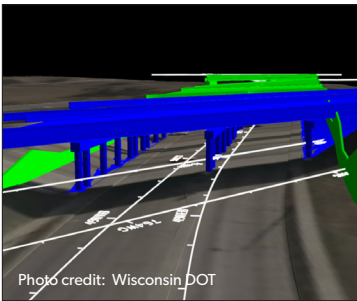


Photo credit: Wisconsin DOT

Three-dimensional modeling combines the horizontal and vertical aspects of a construction project into an integrated digital model. Using the 3D software, design and construction teams

can connect virtually to develop, test and alter designs throughout the design and construction phases.

Intricate design features can be viewed geospatially, in three dimensions, from multiple perspectives, and simulations can be run to detect and correct design flaws and profile issues before and during construction. Data, exported from the 3D models, can be transferred to global positioning system (GPS) machine control equipment that guides and directs construction equipment like bulldozers, pavers, rollers and excavators. The connectivity allows workers to receive and work with the most accurate, up-to-date models even if mid-cycle design changes are made.

BENEFITS

When procedures are standardized and agreed upon, work progresses more efficiently. Benefits include:

- ▶ **Faster project completion with improved quality and safety.** GPS-enabled construction equipment can run all day and night with the guidance from 3D model data and achieve accurate grades on the first pass. First-pass accuracy of GPS machine control equipment reduces waste and economizes resources.

- ▶ **Significant productivity increases.** Productivity can be improved by up to 50 percent for some operations, and survey costs can be cut by up to 75 percent using the combined technologies of 3D modeling and GPS machine control. Reduced equipment, idle time and less rework reduces fuel consumption and greenhouse gas emissions by up to 40 percent.
- ▶ **Reduction of manual tasks and machine-like precision.** Automation decreases the need for certain tasks like staking, stringing lines, drawing fill lines and setting grade stakes. Additionally, the reduced number of workers onsite during construction increases project safety.
- ▶ **Effective real-time control and monitoring of movement and location.** Control of constant movement and location changes can be achieved using “intelligent” technology, including 3D models, GPS machine control and on-site laser-based positioning systems. Machine operators can also conduct grades, cuts and fills to a high level of precision either automatically or with the guidance of an onboard system. Automated machine control is also used for effective Portland cement concrete and hot mix asphalt paving.



CURRENT STATE OF THE PRACTICE

Industry is already deploying 3D modeling and realizing improved efficiency, shorter scheduling and reduced costs. As Building Information Modeling has become the standard for design and construction of major commercial and industrial buildings, Civil Integrated Management with similar modeling is also becoming common practice in highway project design and construction. As part of this trend, 3D modeling and the transfer and use of 3D model data in GPS machine control equipment has been successfully demonstrated and used in numerous states nationwide. The technology is a cost-effective method for accelerating highway design and construction.

SUPPORT AND AVAILABLE TOOLS

To learn more about 3D Engineering Models, please visit:

- ▶ Every Day Counts Three-Dimensional Modeling Website, <http://www.fhwa.dot.gov/everydaycounts/edctwo/2012/3d.cfm>



For additional information, please contact:

Bryan Cawley
Construction Management Team Leader
bryan.cawley@dot.gov



Every Day Counts (EDC), a State-based initiative of FHWA's Center for Accelerating Innovation, works with State, local and private sector partners to encourage the adoption of proven technologies and innovations aimed at shortening and enhancing project delivery

 U.S. Department of Transportation
Federal Highway Administration