

Transportation technology solutions yield improved project outcomes

By Tom Culotta

Within the dynamic transportation market, new challenges and solutions will continue to evolve. Learn how Autodesk is tackling some of the tough questions transportation professionals are grappling with daily.

Q: What are the top level challenges in the transportation industry today?

A: With the challenges faced in the current economy, today's transportation agencies and their consultants face tight timelines and even tighter budgets. Now more than ever, it is essential to complete infrastructure and transportation projects on time, within budget, and up to specification, while reducing material waste and increasing environmental responsibility.

Driven by the recent economic stimulus plans, there is a call for more transparency and greater accountability regarding transportation infrastructure projects. It is imperative that project managers deliver end results that are accurate in order to efficiently reduce or eliminate rework. Autodesk, Inc., provides a comprehensive infrastructure lifecycle solution that maximizes the investment made in the project design from construction and into maintenance and operations.

Q: Design is often only a small proportion of the total cost of an infrastructure project. So, how can design professionals — and their design tools — notably impact project costs?

A: While it is true that the largest financial component of a project is construction and not design, a design process that is model-based optimizes project performance in order to reduce construction and Operations and Management (O&M) costs of projects through visualization, simulation and analysis. Design development costs typically account for 7-8% of the overall cost of a major highway project, while the real estate, utilities, construction and construction inspection account for the remaining 92-93%.

However, the designer's ability to impact project cost and performance over the project lifecycle is at its maximum at the beginning of the project, but sharply decreases as we move through the phases into construction. At the same time, the cost of making and executing changes to the design is very low during conceptual design, and sharply increases as we progress into construction. You want mistakes to be found and mitigated during design and not in the field. Greater accuracy in the design phase can have a more notable impact on overall project budgets by helping to reduce construction costs.

Design software, such as AutoCAD® Civil 3D®, provides tools where design, analysis and documentation are interconnected so that a change in one component results in changes

to the others. The result is a reduction in errors and omissions, which reduces construction costs of infrastructure projects. Unanticipated clashes, change orders, and redesigns consume a significant portion of construction costs. Having tools to design, visualize, and simulate the project helps the engineer to design for constructability and to reduce additional costs. The primary goals of design development are to design the highest quality and safest project, while making the design process more effective at reducing the costs of construction. Design accuracy can help reduce costly errors and omissions.

Q: What role do you think BIM will play in the future design of road and highway projects?

A: Road and highway designed in an antiquated 2D environment has a number of limitations for civil engineering. First, design and documentation are disconnected, which can lead to coordination problems and costly errors and omissions in the field. Second, a 2D, drafting-centric environment makes the evaluation of multiple design alternatives cost prohibitive. Finally, collaboration between the different disciplines involved is often minimal.

Building Information Modeling (BIM) is an integrated process built on coordinated, reliable information about a project from design through construction and into operations. While it has its roots in architecture, the principles of BIM apply to everything that is built, including roads and highways, and the benefits of BIM are being experienced by civil engineers in the same way that they are enjoyed by architects. BIM is not just about 3D (although that is part of it). BIM allows you to more easily predict the performance of projects before they are built; respond to design changes faster; optimize designs with analysis, simulation, and visualization; and deliver higher quality construction documentation.

The most immediate benefits of BIM for road and highway design is the ability to optimize project performance, increase efficiency and productivity. Because design and construction documentation are dynamically linked, the time needed to evaluate more alternatives, execute design changes and produce construction documentation is reduced significantly. This is particularly important for transportation agencies because it can shorten the contract timeline resulting in projects being completed sooner and within more predictable timetables. Because BIM is an integrated process that allows architects, engineers, and builders to explore a project digitally before it is built, project performance can be optimized, which supports a sustainable, economically viable built environment. Coordinated, reliable information is used throughout the process to design innovative projects, accurately visualize appearance for better communication, and simulate



Roadway model rendered in Autodesk® 3ds Max® Design 2010

real-world performance for better understanding of important characteristics such as cost, scheduling, and environmental impact. Discovering errors in a preliminary design phase or even the detailed design phase of a project will result in a substantial cost savings, versus discovering these same errors during construction.

Beyond the design development process, the rich information model created by a BIM approach can be used directly by downstream operations, including cost estimating, bidding, construction modeling, and operations and maintenance. This holistic approach creates an infrastructure design and modeling process that can be used by all parties to help improve collaboration, coordination and overall decision support across all projects and proposals from planning to design to construction to operations and back around.

Q: 3D renderings and visualization are great tools to help the public understand complex infrastructure projects, but how can they be used more effectively to minimize design and construction problems and help keep projects on schedule?

A: Pictures are incredible assets enabling understanding and enhancing communication. Everyone can more easily comprehend a 3D picture and its intent. The same is not true for paper or 2D CAD files. These files are best understood by those that created them. All the project stakeholders cannot fully know what the intent of a 2D drawing is, and any assumption made, can result in a errors with serious negative downstream impact

Design, visualization and simulation tools are becoming critical for helping to communicate proposed projects to the public, and as an instrument assisting the designer in evaluating different design scenarios. Many of the issues that cause construction delays, change orders, and redesigns can be better anticipated and forestalled through more accurate 3D modeling and visualization.

With current 3D dynamic design capabilities more accurate renderings are produced as an output from the engineering work. The inherent ability to produce a dynamic 3D model with current software allows rendering to be produced at no

incremental cost. Additionally 3D models in products, like Autodesk® Navisworks® 2010 software, support clash detection at any stage in the project, thereby reducing problems uncovered in construction, when the cost to rectify is highest. The end result is a project being constructed better, faster and more economically.

3D renderings and visualizations derived directly from the model deliver a more cost-effective and practical way to prioritize infrastructure investments; based on sustainable design, visualization, simulation, and analysis. Errors or problems can be identified early in the process, and the design information that goes to the construction team is more accurate. 3D Modeling minimizes many of the mistakes and confusion that often causes rework and delays in projects. Staying on schedule means executing on the designs, not debating them until the construction is done.

Furthermore, the 3D visualizations are vital to owners and managers of infrastructure for ongoing lifecycle operations and inspections. They help create an infrastructure that performs as designed, not only during construction but also during use. Mistakes are most costly once a piece of infrastructure is put in place and use begins. Visualization is part of the process from planning right through operations. ●



AutoCAD Civil 3D 2010 rendered image of a partial clover leaf interchange

Learn more about 3D modeling, BIM, and other transportation-related topics at <http://www.adskmedia.com/theroadahead/>

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