> AutoCAD Civil 3D has given us a significant productivity boost—enabling us to complete our designs faster.
>
> —Luke Arnold
> Project Engineer
> City of Beloit

Fast and flexible.

AutoCAD® Civil 3D® software gives the City of Beloit the dexterity to accommodate changing project priorities and schedules.

Beloit, Wisconsin

The City of Beloit, Wisconsin, with a population approaching 37,000, is located on the southern border of the state, on the banks of the Rock River and within driving distance of both Chicago and Milwaukee. The city boasts a lively riverfront development, vibrant residential neighborhoods, a historic downtown, and thriving business districts. In fact its downtown renovation and continuing economic redevelopment are the hallmarks of the city's rebirth, enticing new businesses to relocate to Beloit, convincing existing corporations to expand, and fueling residential growth—all of which are keeping the city's Engineering Division very busy.

With a staff of five engineers, three aides, and two GIS professionals, the Engineering Division is responsible for providing a variety of services related to capital improvement projects, including design, plan review, and inspection services. Most of the division's work is on urban reconstruction projects and utility or local roadway extensions. "Our biggest challenges are changing project priorities and schedules," explains Michael Flesch, city engineer. "We're involved with a lot of economic development projects, which have many different stakeholders. We need to be reactive and accommodating to those interests, particularly when it comes to new or potential commercial development projects."

With so many stakeholders, it's not uncommon for a project to be two-thirds of the way done and then change suddenly—the schedule, the time frame, scope of work. The Engineering Division needs to respond quickly, with civil engineering software that can react as quickly as they do.

Autodesk®

The Engineering Division had been using AutoCAD® Land Desktop software for many years and in 2005 considered whether to upgrade to the latest version of the software or move to a different software platform. "As a longtime Autodesk customer, we were very comfortable with AutoCAD and had heard about AutoCAD Civil 3D," reports Luke Arnold, project engineer. "We knew that AutoCAD Civil 3D is the next generation of civil design software and therefore should be the next step for our group."

They also knew that the software's model-based approach to design and documentation—so very different from AutoCAD Land Desktop—would make for a bumpy transition. "We felt that, in the long run, AutoCAD Civil 3D would make us more efficient and more productive," says Flesch. "We looked at other software packages, but our staff was familiar with AutoCAD, and they all wanted to stick with an AutoCAD-based product. We all felt that the automatic link between design and documentation would give us the dexterity we needed to make changes mid-design and still meet our schedules and deadlines. So AutoCAD Civil 3D went to the top of our list."

Planning the Transition
With the software selected, the Engineering Division waded right in to the migration. "We decided to go 'cold turkey' and move all our users and all our work to AutoCAD Civil 3D all at once," remarks Arnold. They sat down with their Autodesk reseller, to develop an implementation plan that mapped out a schedule for training, software loading and

configuration, and so forth. Before any training began, the reseller and Arnold also customized the standard AutoCAD Civil 3D styles, templates, and libraries so that the training and course material would reflect the actual work environment. "This was money well spent," remarks Flesch. "Without this level of preparation, the transition wouldn't have been as successful as it was."

Training began with a two-day, on-site AutoCAD® refresher class, followed by a four-day introductory AutoCAD Civil 3D training class. The class was customized to meet their specific needs—based on their own templates, taught in their own office on their own hardware and software, and focused on just those areas that the Engineering Division would need for its project types: cross-sections, vertical and horizontal alignments, corridors, and so forth.

With the training completed, the Engineering Division started right in on its first project. From the beginning the decision was made to eliminate access to AutoCAD Land Desktop software—removing the temptation to retreat to familiar ground. "There was no turning back. We all went straight to AutoCAD Civil 3D and have used it ever since," reports Arnold. "This was critical to our success. We were all in it together and learned from each other."

Road to Success
One of the first projects that the Engineering Division tackled using AutoCAD Civil 3D was the design of a new 1,150-foot roadway called Sager

Lane located in an existing industrial park. The project included the design and construction of the new concrete road as well as the curbs and gutters, sidewalks, and sanitary sewer, storm sewer, and water mains. "The project itself wasn't all that technically challenging," remarks Flesch, "except that a few days before construction was scheduled to start, a major mistake was discovered. The right-of-way we used was off by 10 feet."

The original project had been started in AutoCAD Land Desktop and then put on hold. When the Engineering Division started working on it again, the design was migrated to AutoCAD Civil 3D and the group picked up the design where it had been left off. The roadway was designed to fit inside an 80-foot right-of-way. But just before construction, a surveyor noticed that his plat showed a right-of-way of 70 feet, but the city's plan showed 80 feet, so he informed the Engineering Division of the discrepancy. "I went into scramble mode, called the survey crew, and told them that the information we sent them was bad and I would send them a new set of plans by the end of the day," recalls Arnold.
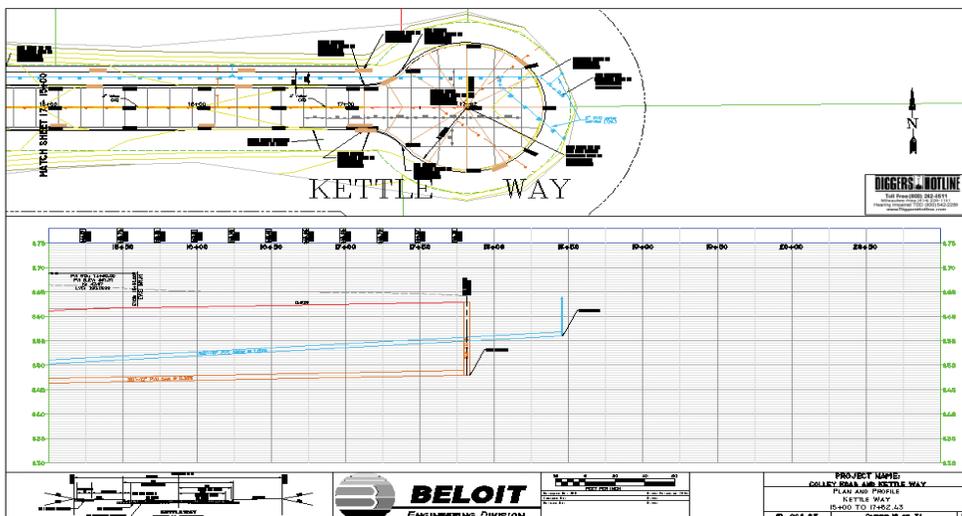
Improve Productivity

The design of the road was mistakenly offset from the real center of the right-of-way, and the sidewalk was completely outside it. "I had to go back and redesign all of the storm sewer piping, water mains, and road alignment to move everything over 10 feet, and then I had to realign the sidewalk to be 5 feet closer to the back of the curb to fit within the 70-foot right-of-way," explains Arnold. And on the day he was doing that, the contractor was already moving equipment to the site, so Arnold had little time to make these changes.

"Using AutoCAD Civil 3D, it took me about three and a half hours to redesign the project. That same effort would have taken at least three or four days in Land Desktop. This delay would have forced the contractor to start work on another project—impacting the start date of our project and ultimately its completion date," reports Arnold. By the end of the day, he emailed the new plans, alignment data, and coordinates for the structures to the contractor for his team to start staking out the correct locations. "In the end, there were no additional expenses incurred and no delays in the project," says Arnold.

Kettle Way

Another project where the AutoCAD Civil 3D software proved its value—particularly with regards to enhanced productivity and communication—was the design and construction of a new cul-de-sac, Kettle Way, in a local industrial park. The project was a new 850-foot, 37-foot-wide urban street and the
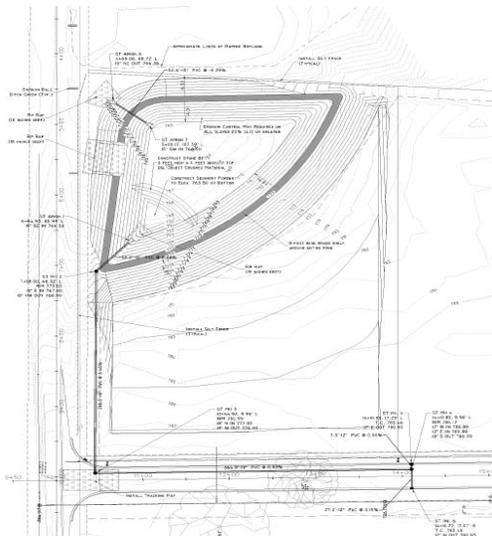
reconstruction of a 900-foot portion of an existing rural street to a 43-foot-wide urban section. The project also included design and construction of water mains and services, sanitary sewers, storm sewers, and sidewalk on one side. "The earthwork entailed some fairly significant cuts, and we had a really short time frame to get the design work done. In fact the whole project—from concept to bid—was only six weeks," says Flesch.

"Another challenging aspect to this project was that it included moving some of the material cut from this site and using it to cap an old wastewater treatment plant site with two feet of fill," says Flesch. So in addition to the quick turnaround time on the project itself, the Engineering Division had to produce the additional documentation required by the Wisconsin Department of Natural Resources (WDNR) for the capping to demonstrate that the thickness of the cap met a two-foot minimum.

Finally, after construction had begun—in fact, when the underground utilities were already in and the construction crew was beginning the roadway—the owner wanted to increase the size of an additional lot off the end of the cul-de-sac. This change necessitated a major redesign of the cul-de-sac from a

balanced bulb to an offset bulb. AutoCAD Civil 3D software helped the Engineering Division meet all of these challenges: the tight time frame, the additional documentation burden, even the very late design change.

Communicate Design Clearly

"We finished the original project design on time, and also used the software to determine what all the earthwork volumes were, so we knew how much cut from that project we could use for the two-foot cap that we needed," says Arnold. The site of the cap was originally surveyed to determine fill requirements. After the site was capped, another survey was done to verify the thickness of the cap. The survey data was used in the AutoCAD Civil 3D software application to create a volume surface, which represented the exact difference between the original and new surfaces. The group then color-coded the volume surface by depth and used a grid-pattern style to display the depth at each intersection point on the grid. "This form of presentation made it very simple for WDNR to visualize what we had done and give us closure for the site without the need for any additional documentation." says Arnold.

Produce a Quality Design in Less Time

AutoCAD Civil 3D also helped the Engineering Division accommodate the Kettle Way's late-stage design change. Of the 20 hours required for that redesign effort, most of the time was spent on conceptual design issues rather than actual drafting revisions.

"For example, I spent approximately four hours looking at different strategies for draining the new cul-de-sac. I changed the profiles or edge of pavement alignments seven or eight times, and checked how those changes affected other parts of the design such as pavement and gutter slopes, drainage inlet locations, driveways, and slope intercepts," reports Arnold. "Only a small part of that time was actually spent revising the drawing files. With AutoCAD Civil 3D, I was able to produce a high-quality design that was fine-tuned to fit the conditions. And I did it in less time than it would have taken me to just get a basic design done using Land Desktop."

Share Designs More Efficiently

In addition to using the software for ongoing design work, the Division is now using DWF™ files to share digital design information beyond the design team with developers, surveyors, contractors, and other constituents in the construction process or review cycle who aren't AutoCAD Civil 3D users or even CAD users.

For example, on a recent project the group uploaded DWF versions of plans, so that the local utility company could review the design and check the impact on existing power poles. The group is also starting to share topographic and alignment data with surveyors for better workflow efficiency.

The Result

Since early 2006, the City of Beloit's Engineering Division has standardized on AutoCAD Civil 3D, with six users who have worked on more than 22 projects. Through its styles-based drafting environment, AutoCAD Civil 3D software enables the City of Beloit's Engineering Division to produce more uniform, consistent project documentation—no matter which engineer has worked on it. In addition, the software enables engineers to react quickly to any changes that are thrown at them—no matter how late in the project those changes occur.

"AutoCAD Civil 3D has given us a significant productivity boost—enabling us to complete our designs faster," says Arnold. "AutoCAD Civil 3D allows us to focus more on the details of our design rather than spending time figuring out how to get the software to do what we need it to do," adds Flesch. "And when priorities or schedules suddenly change, we can accommodate them and keep the project moving forward—on target and on time."

To learn more about AutoCAD Civil 3D, visit www.autodesk.com/civil3d.
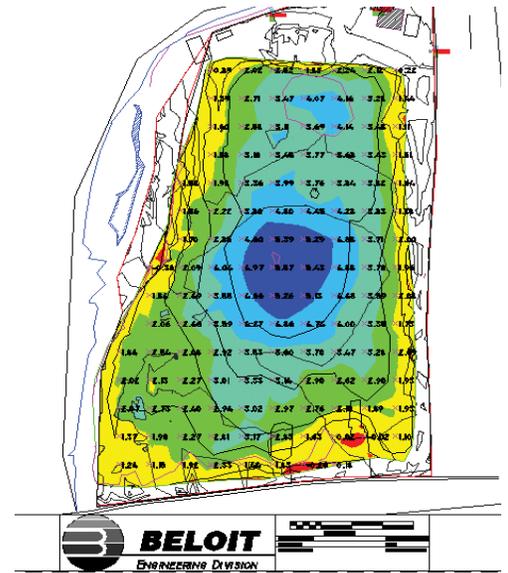
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