COMPANY
American Structurepoint, Inc.

LOCATION
Indiana and Iowa

SOFTWARE
Autodesk® AutoCAD® Civil 3D®
Autodesk® 3ds Max® Design

BIM increases efficiency

Model-based visualization and simulation improves project communication—helping to save time and money.

We are experiencing a 30 percent schedule reduction by using BIM workflows on our infrastructure projects… and those savings jump to almost 45 percent on our racetrack projects. Numbers like these speak for themselves.

— **Jack Lashenik, P.E.**
Vice President
American Structurepoint, Inc.

Completed $70-million Iowa Speedway. Image courtesy of American Structurepoint, Inc.

Overview

American Structurepoint, Inc. is a multidisciplinary consulting and design firm headquartered in Indianapolis, Indiana. Founded in 1966, the firm offers expertise in transportation, civil engineering, architecture, planning, forensics/investigative, construction inspection, structural engineering, environmental, land surveying, and information technology services.

American Structurepoint uses Autodesk® solutions to help design, analyze, visualize, and document its infrastructure and building projects. The firm recently used Autodesk software on two very different roadway projects, albeit both circular in nature: a series of traffic roundabouts for the Keystone Parkway in Carmel, Indiana; and the Iowa Speedway in Newton, Iowa.

Project summary: Keystone Parkway

Built in the late 1960s, the Keystone Parkway (formerly known as Keystone Avenue/SR 431) was a four-lane, divided state roadway that had seven at-grade signalized intersections. Over the years, growth in the area caused the road to become increasingly sluggish and dangerous. In 2007, the City of Carmel assumed ownership of the roadway and began its redevelopment.

Seeking a minimally disruptive, long-term solution, city officials proposed a 4-lane parkway with grade-separated, full-access interchanges. The City collaborated with American Structurepoint to refine and implement its vision for Keystone Parkway.

The challenge

"City engineers and officials wanted the road lowered, with roundabout interchanges at each major cross street to make intersections safer and increase mobility for vehicles, pedestrians, and bicyclists," explains Cash Canfield, vice president for American Structurepoint.

The firm evaluated a variety of interchange configurations and geometries to understand the effect on adjacent properties. One design alternative quickly rose to the top: teardrop roundabouts. "Although numerous roundabout interchanges have been constructed in the United States over the past several years, this project's teardrop roundabout design was unique," says Canfield. "It was the first double-roundabout

Up to 45 percent increase in project efficiency

interchange in the state of Indiana, and no other state or municipality in the country had integrated roundabouts into an interchange design with such a tight configuration."

The solution

American Structurepoint used Autodesk® AutoCAD® Civil 3D® software—and its predecessor, Autodesk® AutoCAD® Land Desktop software—to create intelligent 3D models of the roundabouts. The firm also used Land Desktop to create 2D side-by-side displays of other interchange alternatives, such as tight diamond and single-point urban interchanges, giving the public greater insight into the impact of each alternative on the environment and the surrounding properties.

Test drive your project virtually

Designing and visualizing a complex project in 3D not only helps accelerate the planning and design process, it also produces a higher-quality design," says Canfield. "There's just no comparison between experiencing your design in a 3D model versus looking at it on 2D plan sheets." American Structurepoint imported their design models into Autodesk® 3ds Max® Design software to create near-photorealistic project visualizations and then used real traffic counts and traffic pattern data to help illustrate how this unique configuration could meet the public's needs in the year 2025.became highly visual and effective media for public engagement, helping to communicate the design, look, and benefits of the motorway to project stakeholders and the wider community." (See image, page 1) The firm even added aerial photography, landscaping model elements, and other contextual information extracted from GIS to produce photorealistic still images and animations that brought the project to life for viewers.

The use of an intelligent 3D model–based process proved effective for helping to communicate the design to city officials. "Instead of displaying construction documents, we used our model-based simulations to allow virtual test drives of the new road and roundabouts," says Canfield.

The 3D visualizations and simulations also proved to be an invaluable tool for the City of Carmel to use in its outreach efforts. "Using the design model to develop more realistic animations of each and every interchange allowed the citizens of Carmel to envision what the end product could look like and how it could function once completed," says city engineer Michael McBride from the City of Carmel. "Citizens quickly became excited about the proposed corridor improvements, because they were able to visualize the benefits the project could offer."

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>
> **— Michael McBride, P.E.**
> City Engineer
> City of Carmel, Indiana

Design greener infrastructure

In addition to addressing capacity and safety concerns, the team at American Structurepoint was able to design a sustainable, low-impact project. Using intelligent infrastructure models,

The redesigned Keystone Parkway in Carmel, Indiana, features the state's first teardrop roundabout interchanges. Image courtesy of American Structurepoint, Inc.

More easily visualize designs and communicate project intent to stakeholders

the firm's engineers developed a plan that did not require taking any homes. "In the end, only one commercial building had to be relocated," reports Canfield. "If we had used a larger configuration, dozens of homes, businesses, and churches at each interchange would have been relocated." In addition, the removal of traffic signals through the corridor reduces electricity consumption and motorists' emissions are lower because there is no longer any need for frequent starting, stopping, and idling.

The result

Construction of the Keystone Parkway project began in 2008 and was finished at the end of 2010. The overall project cost was $112 million—significantly less than the City's original budget. "One of the project's main goals was improving safety and access for pedestrians and bicyclists," says Canfield. "The new roundabouts have added substantial capacity, connectivity, and safety for all modes of transportation. In fact, within a few months of the roadway's reopening, city officials reported a 78 percent reduction in personal injury accidents at these intersections."

The project created a sustainable transportation system that will benefit the city for years to come. North-south traffic flows freely without any signals, and six new teardrop roundabouts capably manage east-west traffic over the Parkway. "Overall, the design proved so effective that the Indiana Department of Transportation [the original owner of the roadway] is considering the teardrop configuration for some of its other projects," reports Canfield.

American Structurepoint designs a sustainable, low-impact infrastructure project. Image courtesy of American Structurepoint, Inc.

An animation of a traffic simulation to help evaluate appropriate design alternatives. Image courtesy of American Structurepoint, Inc.

The perspective from American Structurepoint is that model-based design processes were essential for the success of the project. "The ability to visualize our design and then communicate that vision to the project stakeholders was the true value of these tools on the Keystone Parkway project," says Canfield. "Without that vision, this project would not have become a reality."

Project summary: Iowa Speedway

The $70-million Iowa Speedway is a 7/8-mile asphalt-paved tri-oval racetrack and motorsports facility that opened in 2006. The facility includes 25,000 permanent grandstand seats and hosts NASCAR, IndyCAR, and stock car races, as well as other events such as concerts. The innovative track design features variable banking with a lot of 'grip,' allowing for a much more competitive racing environment. It was also the first track in the United States to protect fans and drivers using Steel and Foam Energy Reduction (SAFER) barrier technology around the entire perimeter of the track.

Working under the guidance of racing architect Paxton Waters Architecture, and former NASCAR driver Rusty Wallace, American Structurepoint provided civil, structural, and architectural design services for the project. "We completed this project before we implemented Civil 3D and used a 2D approach for design and documentation, as was the case for all of our racetrack projects at that point," explains Jack Lashenik, vice president of American Structurepoint. "When we began using Civil 3D for our infrastructure projects, we saw the value of building information modeling (BIM) and wanted to test drive it on a racetrack design."

BIM helps achieve 30–45 percent schedule reduction

The challenge

"Racetrack projects can be very challenging due to the large amount of changes and tweaking that happens late in the process," says Lashenik. "There are multiple alignments and profiles required to create a competitive racing surface. Even a minor change, such as the transition between the pit area and the main racetrack, impacts the banking degrees, the profiles, the super-elevated curves, and the grading—changing the project's overall earthwork estimates and storm infrastructure documentation."

In the past, in order to accommodate the design changes, American Structurepoint manually performed all the earthwork calculations and updated the drawings by hand. "But we knew from experience on other project types that we could help avoid that manual updating by using Civil 3D. If one aspect of the model is changed, the software dynamically updates the related parts of the model automatically, as well as the affected storm structure tables and earthwork calculations," says Lashenik. "There was no question it would help streamline our design workflow for racetracks—but by how much?"

The solution

To quantify efficiency improvements of adopting BIM workflows, American Structurepoint decided to re-engineer a completed project: the Iowa Speedway. The firm repeated the original design process, but this time it used AutoCAD Civil 3D software. "We modeled the racetrack and barrier from scratch, and created all the same drawings," says Lashenik. "Along the way we even replicated design changes from the original project."

The designers used Civil 3D to perform the earthwork calculations—versus the manual process used during the original project. In addition, the firm used Autodesk 3ds Max Design software to help visualize architectural models and renderings of the speedway's spectator suites.

The result

"The Iowa Speedway pilot project lasted a little over four months and resulted in a significant savings over the time it took to design the project originally—even with the training curve," reports Lashenik. "It's unbelievable what Civil 3D software can do. We now use it exclusively on all our racetrack projects."

Summary

Based on its successful pilot of AutoCAD Civil 3D software on the Iowa Speedway, American Structurepoint now embraces Autodesk BIM for Infrastructure solutions and the benefits they provide. "We are experiencing a 30 percent schedule reduction by using BIM workflows on our infrastructure projects," says Lashenik. "And those savings jump to 45 percent on our racetrack projects. Numbers like these speak for themselves."

To learn more about BIM for Civil Infrastructure, visit, www.autodesk.com/industry/civil-infrastructure/transportation-infrastructure **www.autodesk.com/civil3d** or **www.autodesk.com/ids**.

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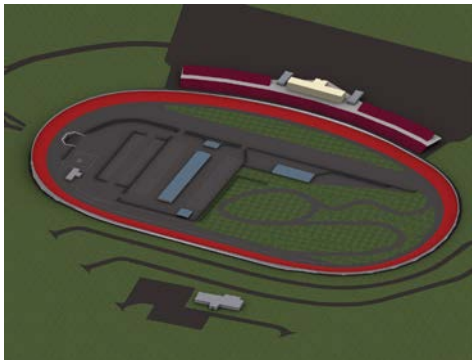

American Structurepoint now embraces Autodesk BIM for Infrastructure solutions and the benefits they provide. Image courtesy of American Structurepoint, Inc.

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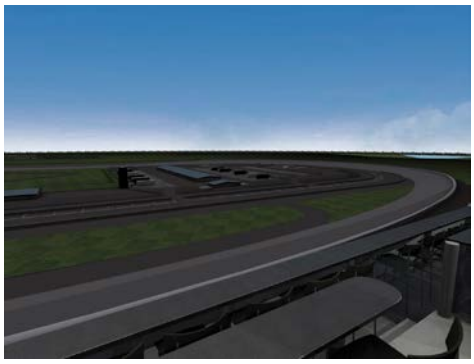

The track design features variable banking allowing for a much more competitive racing environment. Image courtesy of American Structurepoint, Inc.