

COMPANY

PBS&J**TLC Engineering for Architecture**

Clients:

U.S. Army Corps of Engineers

LOCATION

Tyndall Air Force Base, Florida

SOFTWARE

Autodesk® Revit®**Autodesk® Navisworks® Manage****Autodesk® AutoCAD® Civil 3D®****Autodesk® AutoCAD® MEP**

BIM supports government projects by helping them stick to budget and schedule. As we saw on the project, BIM also makes it easier to develop and refine more energy efficient, sustainable designs.

— **Rashid Siddiqui**
National BIM Manager
PBS&J

Rebuild with confidence

New Air Force fitness center aims for LEED Platinum certification—and lower than expected construction costs



Exterior rendering of the Tyndall Fitness Center.

Project summary

The Tyndall Fitness Center at Tyndall Air Force Base, Florida, won't open its doors until early 2010, but it's already attracting attention. With construction costs under \$17 million, the two-story, 75,278-square-foot fitness center will feature three racquetball courts, two levels of weight and cardio equipment, four group exercise rooms, two full-size gymnasiums, and more. The U.S. Army Corps of Engineers (USACE) is providing program management and construction administration services to the U.S. Air Force on the project. The project was one of two Energy Demonstration Fitness Centers promoted by the Air Force Center for Environmental Excellence (AFCEE), and recently won a Merit Award-Concept Design from the U.S. Air Force. The project is expected to exceed its original target of a LEED Silver rating and instead achieve LEED Platinum certification—the highest possible LEED certification for environmentally sustainable construction.

Throughout the project, the design team from the firm of PBS&J has relied on building information modeling (BIM) to explore and refine its ideas—quickly and efficiently. PBS&J turned to BIM

solutions from Autodesk, including Autodesk® Revit® Architecture software, Autodesk® Revit® Structure software, Autodesk® AutoCAD® Civil 3D® software, and Autodesk® Navisworks® Manage software, to help reduce errors and miscommunication and keep the project on budget and on schedule. With this project on track to be completed under budget, PBS&J sees Autodesk BIM solutions playing a prominent role on government projects well into the future.

The team

As the program manager, the USACE reviewed the detailed project designs, managed the budget, and selected the design and construction teams. The AFCEE and U.S. Air Force also played review roles on the project. Gaining LEED certification was a priority for the USACE, the AFCEE, and the U.S. Air Force from the very beginning. In fact, the AFCEE wanted the fitness center to highlight the military's commitment to achieving cost-effective, high-quality sustainable design. U.S. Air Force personnel at Tyndall Air Force Base collaborated with the design team to help ensure that Tyndall Fitness Center would meet their exercise and recreational needs.

Maximized usable space and reduced building footprint

Following a competitive bidding process, the USACE tapped PBS&J to provide the architecture and engineering design services on the Tyndall Fitness Center project. Founded more than 45 years ago, PBS&J delivers design projects with a range of services that span disciplines. The firm brings together architects, civil engineers, structural engineers, and mechanical engineers along with planners, surveyors, and technical specialists. PBS&J has a history of working with government agencies on large-scale building and infrastructure projects, from highways to military facilities to transportation hubs. To round out the Tyndall Fitness Center design team, PBS&J engaged TLC Engineering for Architecture to complete the project's mechanical, electrical, and plumbing (MEP) designs.

The challenge

Before engaging PBS&J, USACE designers developed preliminary concepts for Tyndall Fitness Center. PBS&J was retained to design the center as a design-bid-build project. As the first order of business, PBS&J conducted a week-long scoping and design charrette with the USACE, AFCEE, and Tyndall Air Force Base staff. The result of this effort was a project design package that provided a program and conceptual plans that were in budget, and a schedule that enabled the project to meet the design completion date of July 1, 2008. PBS&J successfully reduced the project's program square footage, proposing a design that met the goals of the U.S. Air Force without compromising mission capabilities.

Keeping the heat out

The design and construction of an energy-efficient building located in hot, humid Florida presents a

number of challenges—and Tyndall Fitness Center was no different. Using Revit Architecture software, the project architects developed and evaluated multiple approaches for shading the building while maximizing the harvesting of natural sunlight to minimize the need for artificial lighting, resulting in both lower “first in” costs and annual operating expenses.

“From the outset, we knew that shading would be important to achieving an energy-efficient design,” says Mark Cuddy, an architect at PBS&J. “When shading plays a prominent role on a building, it has to be appealing because it impacts the overall look and feel of a building. It's important that the client like the shading strategy before you build. That helps ensure they will be pleased with the end result.

Familiar obstacles

Beyond project-specific challenges, any large project faces long odds when it comes to staying on schedule and on budget. In part, this is because big projects require large, multidisciplinary design teams. “When teams rely exclusively on traditional 2D processes, they must devote countless hours to coordinating disparate designs, identifying interferences, and managing changes,” explains Siddiqui. “Even then, conflicts between building systems and structural elements often surface as construction begins, leading to time-consuming requests for information (RFIs) at best—and to construction change orders at worst. We were determined to avoid those problems by using BIM.”

The solution

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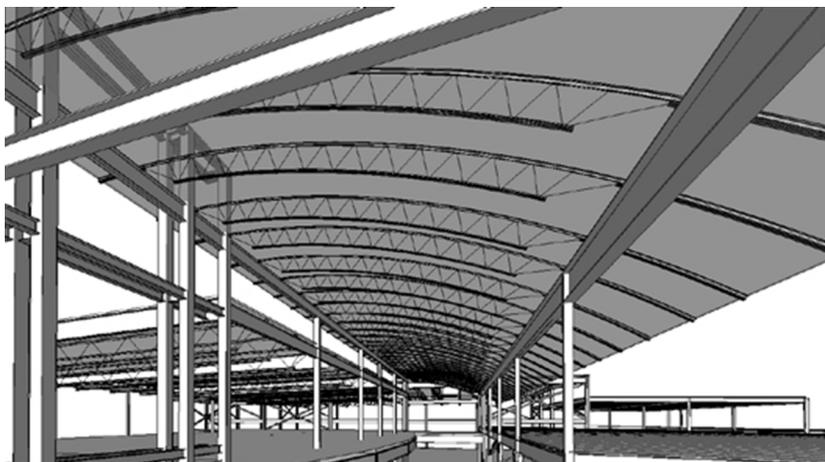
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National BIM Manager
PBS&J

Moving quickly to align the design to the project's goals and funding, the architects at PBS&J created a building model for Tyndall Fitness Center using Revit Architecture software. The team based this initial model on the USACE's preliminary drawings, but planned to modify it as they developed an approach that fit the project's goals and budget.

Optimizing the design

To develop an effective concept, PBS&J architects first interviewed key project stakeholders within the Air Force and the USACE to determine the essential operational requirements. Then, they modified the model based on this information.

“Revit Architecture software helped us to explore various options more easily,” says Hufnagle. “We maximized usable space and reduced the building footprint by adding a second story.” This enabled the building to sit on a more limited site, avoid the need to alter traffic patterns and minimize site disturbance. Those approaches allowed the team to develop a concept that better matched the existing site constraints and available funding. Hufnagle adds, “BIM helped us explore and advance ideas efficiently.” Contrasting BIM software with traditional software, Cuddy says,



Revit Structure model of supports for sunshades. Image courtesy of PBS&J

Civil team designs underground infrastructure quickly with BIM

For example, as you make changes, the software automatically updates the elevations and floor plan. If you do the same thing in a traditional process, you must add the change to dozens of sheets. Especially at the schematic design phase, when changes are frequent, parametric change management software can help save a significant amount of time. I am constantly delighted by what Revit Architecture software can do.”

BIM goes underground

As the design concept took shape, the civil engineering team began planning the site, including parking, approaches, and water and sewer connections. Tyndall Air Force Base is an older base, with a significant amount of underground infrastructure, even under the area chosen for the fitness center. “It can be a challenge to design around existing underground infrastructure, especially the fiber optic communication networks common on military installations,” says Laura Ford, a civil engineering technician with PBS&J. “Doing spacing calculations for every place pipes or cables cross is extremely time-consuming with 2D tools.”

Civil 3D, Autodesk’s BIM solution for civil engineering, helped the PBS&J team to create a 3D model of the existing underground infrastructure. “With Civil 3D software, we had a dynamic model that more accurately represented underground elements,” explains Ford. “The software also calculated the exact spacing and slope of each pipe as we designed. We were able to place the pipes very quickly, and when we made a change, the whole model updated automatically. Civil 3D helped to turn Tyndall Fitness Center into a very

straightforward project from a civil engineering perspective.”

Cool and bright

From the earliest stages, the Tyndall Fitness Center design incorporated numerous sunshades. Some of the shades attached to the side of the building over the windows. However, the most prominent shades extended from the roof, protecting the gymnasiums and glass curtain walls at the entrance from direct sunlight. While keeping direct light out, the shades allowed natural light in. The shades’ cooling and lighting effects were the most obvious contributors to energy efficiency in the design. Enhancing the appeal of the shades, PBS&J secured the Air Force’s permission to use its iconic eagle symbol in the design of the sun shade over the main entrance.

Throughout the project, the USACE and the Air Force were especially concerned about how the shades would look and function. With the visualization and daylighting study capabilities of Revit Architecture software, PBS&J put them at ease. “With BIM, we can show our clients a 3D model that more realistically represents how the building will look,” explains Siddiqui. “On Tyndall Fitness Center, the clients could see how the shades fit with the overall design. While the clients initially had many questions about the shades, in the end, they were excited by the shades’ contribution to the building’s aesthetic and energy efficiency.”

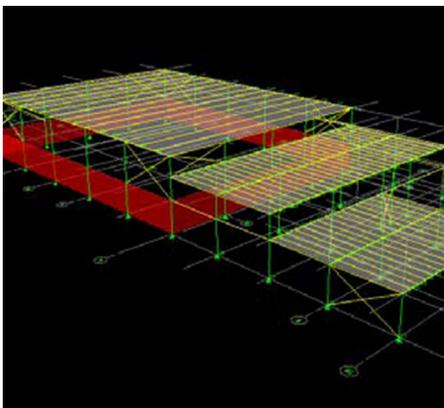
Strength to support innovation

The structural engineering team on the project used Autodesk Revit Structure software to complete every aspect of the structural design, and

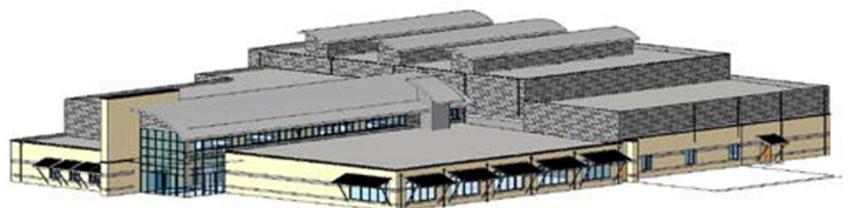
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— **Laura Ford**
Civil Engineering Technician
PBS&J

the team credits BIM with helping to accelerate the process. Srikanth Mangalampalli, senior structural engineer with PBS&J and the structural engineer of record on the Tyndall Fitness Center project, explains, “We completed 100 percent of the structural work on Tyndall Fitness Center within Revit Structure software. In the end, we completed the structural work on the project in approximately 20 percent less time than anticipated.”



Screenshot of structural analysis.



Revit Architecture model of exterior.

Spotting and addressing clashes early leads to fewer RFIs

To help illustrate how the time savings added up on the project, Mangalampalli points to the way changes are incorporated into the Revit Structure model. "When we make a change, Revit Structure software automatically updates all the affected areas of the design and the documentation," Mangalampalli says. "You save time on the change, and on coordinating the change with the rest of the design team. Take the sunshades, for instance. As the shades evolved, we could design and modify appropriate supports and attachments simultaneously."

The structural engineers on the project appreciated that they could export their Revit-based model to third-party analysis software for further assessment. When complete, they imported the changes back into the Revit Structure model. "Converting back and forth between Revit Structure software and our analysis application worked quite well," says Mangalampalli. "The software's compatibility with our structural analysis application definitely helped to save time."

Saving time on conflict detection

As the project progressed, PBS&J held regular coordination meetings to identify and address conflicts and interferences. Before each meeting, PBS&J combined the models from the various teams with Navisworks. This allowed PBS&J to aggregate and review the designs for interferences.

Cuddy, who led the meetings for PBS&J, notes that spotting interferences with Navisworks is easier than using traditional methods. "With 2D, even significant interferences, such as duct work running

through a steel support, can be hard to spot before the construction documentation phase," he says. "On Tyndall Fitness Center, Navisworks software helped us address conflicts earlier in the design phase. Thanks to Navisworks, I estimate we spent 50 to 75 percent less time identifying interferences. And when we moved into bidding and construction, there were at least 20 percent fewer RFIs than might be expected on a project of this size."

While collaborating with PBS&J, the MEP engineers from TLC Engineering soon recognized the advantages of a BIM process during the Navisworks software reviews. "We used AutoCAD® MEP to design the building systems for Tyndall Fitness Center," says Jeremy Parker, a mechanical engineer with TLC Engineering. "After seeing the power of BIM, we plan to also incorporate Revit MEP software into our workflow. We believe that by using BIM, we'll be able to do more efficient building performance analysis, especially on large government projects."

The result

With construction on Tyndall Fitness Center more than 50 percent complete, the project is exceeding the goals set by the USACE and Air Force for the fitness center. "Originally, we were contracted to design to the LEED Silver standard at minimum, but everyone on the project aimed higher," says Hufnagle. "We anticipate that the project will achieve LEED Platinum." Not only will the project top energy and environmental design expectations, it will likely come in under budget. "The construction budget is 10 percent less than

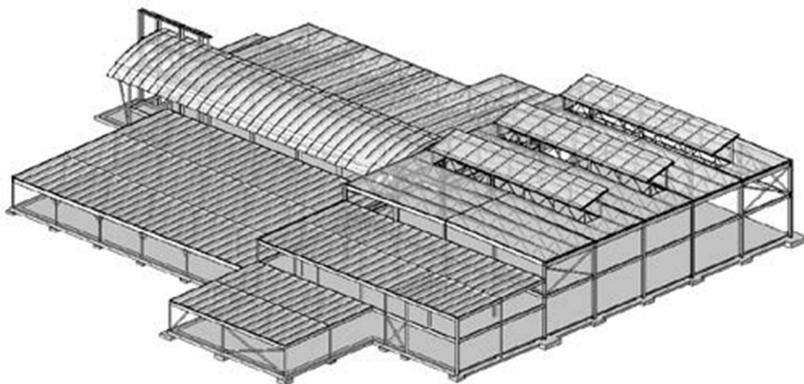
The construction budget is 10 percent less than anticipated, which is great for a project that started with funding concerns. The Tyndall Fitness Center project demonstrates that sustainability and affordability can go together, especially with BIM for design and collaboration.

— **John Hufnagle**
Senior Architect
PBS&J

anticipated, which is great for a project that started with funding concerns," continues Hufnagle. "The Tyndall Fitness Center project demonstrates that sustainability and affordability can go together, especially with BIM for design and collaboration."

According to Mangalampalli, BIM allowed the teams to efficiently refine the design in concert and thus deliver outstanding work to the clients. He says, "Using BIM helped our multidisciplinary teams to enhance the design together. Many times, I collaborated in real time with architects around a computer. It is not necessary to explain an idea and hope it's clear. Everyone can visualize it by looking at the model." For PBS&J, the Tyndall Fitness Center project also reinforced the firm's belief that BIM will help it further the goals of its government clients. "BIM supports government projects by helping them stick to budget and schedule," adds Siddiqui. "As we saw on the project, BIM also makes it easier to develop and refine more energy-efficient, sustainable designs."

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



Revit Structure model of roof and exterior