

Haynes Whaley Associates
WHR Architects
SpawGlass

Customer Success Story

Autodesk® Revit® Structure
Autodesk® Revit® Architecture
Autodesk® Revit® MEP
Autodesk® Navisworks

The integrated approach really benefited everyone. The intelligent 3D models proved valuable for communicating with the team and the owner, and helping them to truly 'see' the structural design.

—Steve Wilkerson PhD, P.E.
Director of Technology
Implementation
Haynes Whaley Associates

Artful Engineering

Integrated project team delivers \$38.5-million Performing Arts Center with help from Autodesk BIM solutions.



The James and Nancy Gaertner Performing Arts Center
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Project Summary

Haynes Whaley Associates offers structural engineering services to a broad range of commercial, public, and institutional clients throughout Africa, Asia, the Caribbean, and the United States. Since 1976, the firm's professionals have contributed to thousands of projects, including numerous expressed-structure facilities, such as The Menil Collection by Renzo Piano, the Brochstein Pavilion by Thomas Phifer, and the Hobby Center for the Performing Arts by Robert A.M. Stern. The firm's exclusive focus on structural engineering has driven it to constantly seek new ways to deliver creative, cost-efficient, and constructible designs. That's why Haynes Whaley adopted Autodesk® Revit® Structure Building Information Modeling (BIM) software in 2005. Under the direction of Steve Wilkerson PhD, P.E., director of technology implementation, the firm first used the new software within internal project teams. Then, in 2006, Haynes Whaley began to use Revit Structure as a collaborative tool to facilitate interdisciplinary communication and deliver higher-quality, complex projects faster.

The Challenge

One of the firm's first opportunities to work collaboratively with the software was a new academic building for the College of Humanities and Social Sciences at Sam Houston State University (SHSU) in Huntsville, Texas. Haynes Whaley relied upon the BIM process and an intelligent, 3D structural model to complete the project with WHR Architects and SpawGlass, a general contractor. "The integrated approach really benefited everyone," says Wilkerson. "The intelligent 3D models proved valuable for communicating with the team and the owner, and helping them to truly 'see' the structural design."

As a result of this early success, SHSU selected the team to design the James and Nancy Gaertner Performing Arts Center (PAC) for the College of Fine Arts. This new, \$38.5-million public facility includes a recital hall, a dance theatre, an 800-seat concert hall, and an outdoor performance area, as well as beautiful public-space art and practice rooms for dance and music.

Using Revit Structure, Haynes Whaley provided preliminary structural drawings in one third the anticipated time frame.

The Solution

SHSU selected the PAC project team—including SpawGlass as Construction Manager at Risk—very early in the design process. From the project outset, all three team members committed to maximum integration of their respective models to facilitate communication and make the project easier to design and build. Haynes Whaley used Revit Structure, while WHR Architects used Autodesk® Revit® Architecture software. SpawGlass used Revit Architecture, Autodesk® Revit® MEP, and Autodesk® Navisworks software, as well as BIM solutions from Innovaya. Close and early integration of the models was particularly vital on this complex project, which involved a steeply sloping site and two adjacent buildings.

“Due to the complexity of the foundation and superstructure, we knew that the other team members would find our structural model to be very helpful,” says Adam King, project engineer from Haynes Whaley. For example, although SpawGlass would prepare its own construction model, it would be able to reference the structural model when selecting the construction joints between slab pours. “Obviously the structural model was a valuable resource for them.”

Deliver Projects Faster

With the full team in place so early, Haynes Whaley was able to provide preliminary structural drawings and a working model much earlier—at just two weeks versus a more customary six. The engineers enhanced the structural sets with numerous views, adding 3D images throughout and providing a detailed rendering of the completed facility’s structure on the cover sheet. “The end product looked more like an architectural rendering set than a traditional structural set,” says King.

“Visualization of design intent was key for the whole team, including the owner, architect, engineer and contractor,” says King. “When our drawings reflect a facility’s structure more realistically—as opposed to showing generic sections and details—those outside of the engineering profession are better able to understand and relate to the structure.”

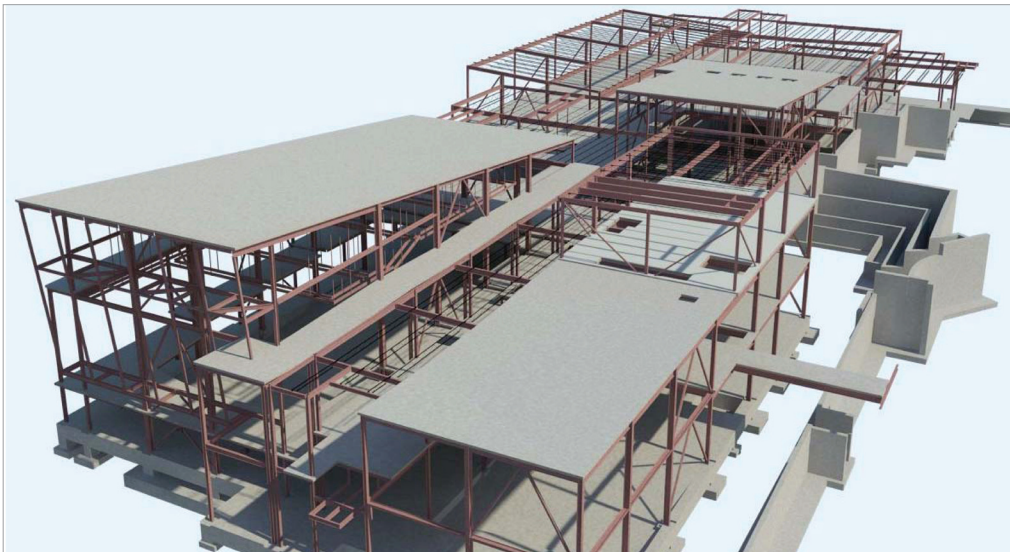
With the early development of the structural models, King was able to participate in working design meetings. At these regular meetings, the architects, MEP engineers, civil engineers, and contractors used the structural model to more easily visualize the facility’s structural system and identify problem areas. The ability to zoom in on complex areas and cut sections through building elements as necessary proved to be immensely valuable in communicating design intent, especially in areas that were difficult to design or build.

With help from BIM, we are able to understand unforeseen situations and resolve them on the fly—in most cases before beginning construction.

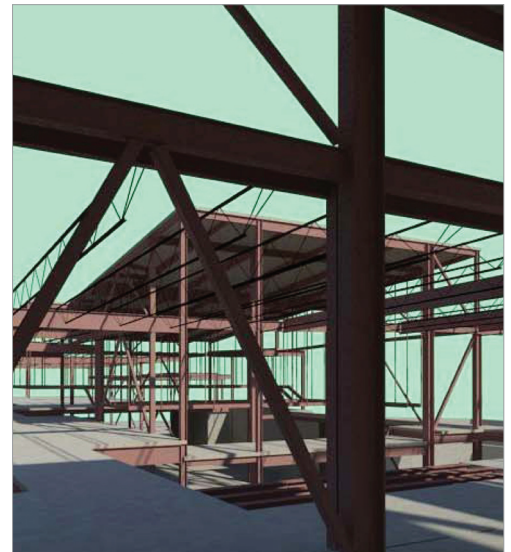
—Amit Kale
BIM Specialist
SpawGlass

Reduce Costly Construction Conflicts

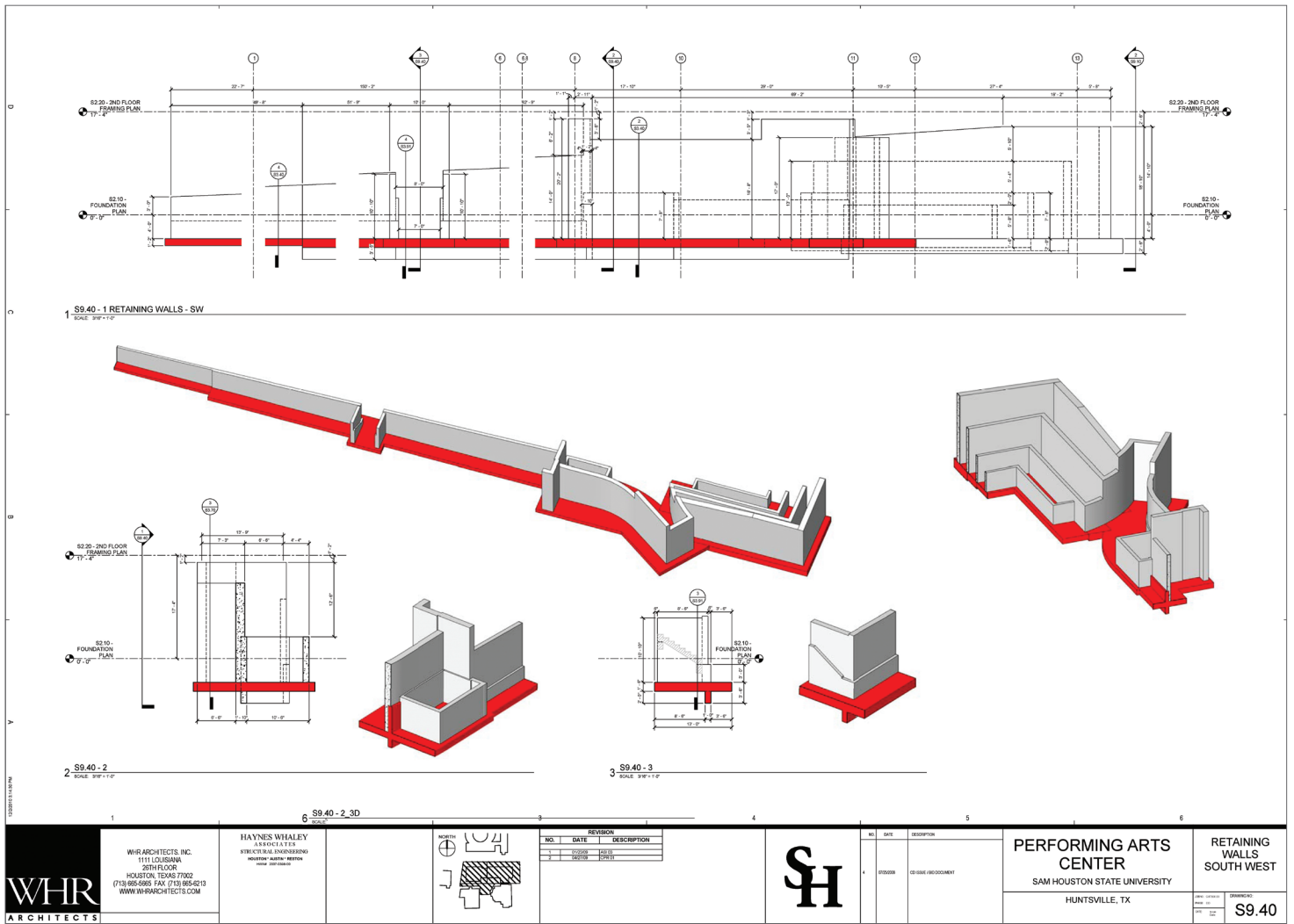
“Having both Haynes Whaley and WHR Architects using Revit® products significantly enhanced our coordination process,” says Mark Green, PAC senior project architect for WHR Architects. “Together we conducted coordination sessions and were able to make improvements to the design in real time.” As a result, conflicts related to structural and architectural coordination were significantly minimized during the construction phase. Green anticipates that in the future the team’s architects and engineers will devote even more time to modeling more building components with greater ease, thereby further reducing costly conflicts.



Isometric exterior/overhead rendering
Image courtesy of Haynes Whaley



Perspective interior rendering of structure
Image courtesy of Haynes Whaley



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Retaining wall study
Image courtesy of Haynes Whaley

On every project, Haynes Whaley pursues constructability as a primary goal. The increased and early use of Revit® models enhanced the firm's ability to help the team with numerous aspects of the PAC project and increased the project's overall constructability. For example, King worked closely with SpawGlass during construction, providing elevation drawings at near-shop-drawing levels of detail. King also provided an accompanying model of the basement walls that SpawGlass used to create an accurate representation of the entire wall. On site, the concrete subcontractor could see details in multiple views, including plan, elevation, and 3D, and, as a result, more easily lay out the wall—despite multiple grade changes and complex interfaces.

“Our team’s ability to use BIM to detect clashes and draw dynamic schedules empowers us with additional knowledge to coordinate our construction activities,” says Amit Kale, BIM specialist at SpawGlass. “With help from BIM, we are able to understand unforeseen situations and resolve them on the fly—in most cases before beginning construction.” As a result, the team avoided many coordination and design errors on site and, thereby, saved considerable time and greatly reduced cost overruns.

BIM also helped contractors to link data from the model with scheduling software, thereby enabling the team to visually depict construction sequencing in step-by-step, 4D graphic representations. “We found this feature to be very useful in delineating information to our subcontractors, tracking material delivery schedules, and explaining our progress in owner-contractor meetings.”

Involvement by Haynes Whaley in the early design process helped the architects better understand how the facility’s structure would impact its configuration and, thereby, better utilize space within the PAC. For example, using the structural model, the team identified a dead space on the side of the PAC. In this location, the contractor would be unable to backfill because the exterior wall of an existing adjacent building was not designed to retain earth. Haynes Whaley worked closely with WHR to craft a creative, design-enhancing solution. “Since we had to keep the fill below the level of the adjacent building’s floor slab, we would have ended up with a large hole in the ground in this location,” says Marie Hoke, Principal and Sr. Designer at WHR. “Adam King from Haynes Whaley worked with us to design an elevated deck to span the hole and allow it to become more usable and attractive.”

Haynes Whaley also used the Revit model to communicate multiple scenarios to SpawGlass and optimize construction sequencing. For example, by modeling portions of the two existing buildings flanking the PAC, Haynes Whaley identified areas that would present difficulty to builders trying to drill and pour concrete piers. Using the results of this modeling, SpawGlass was able to carefully plan a sequence of slab pours that would allow drilling access in all affected areas.

To facilitate the exchange of models and aid in tracking updates and revisions, SpawGlass maintained a dedicated, online BIM portal where project team members could safely store and update their models during the preconstruction and construction phases of the project. When desired, the project owner could also monitor the status of the design and construction processes by viewing the project-tracking sheet located on the portal.

Using Revit Structure Haynes Whaley played an integral role throughout the entire design and construction process.

The Result

Ultimately, Revit Structure, Revit Architecture, and the BIM process helped the team deliver a higher-quality product to the client. The final deliverables included a completely integrated information package containing numerous hyperlinks to the various submittals.

“On some projects, you can visit the site and see a completed project that looks different than what you had envisioned,” says King. “This discrepancy occurs because 2D drawings almost always fall short of expressing the full intent of the design team. By modeling a facility’s structure, architectural elements, mechanical systems, and site grading, we’re able to prevent most of those discrepancies and help ensure that design intent is satisfied. As a result, we spend less time on RFIs and last-minute—and unexpected—design changes during the construction phase.”

Revit Structure was clearly a beneficial resource for the entire project team throughout the project lifecycle—from the earliest design phase through construction closeout. More importantly, the owner benefited from the improved quality of the finished product had greater insight into the project, much earlier in the process.

Beyond these obvious benefits, Haynes Whaley enjoyed many less-tangible benefits, including the increased exposure that its skill with Revit Structure and the BIM process facilitated. “We are extremely pleased with the role that Revit Structure played in our success on the PAC project and in giving us a higher profile,” says Wilkerson. “If engineers just play a passive role, the structural design process won’t ever evolve and we will simply respond, rather than proactively provide ideas. Revit Structure allows us to be more integrally involved in the design and construction process.”

The Future

Haynes Whaley intends to continue its investment in the BIM process to deliver higher-quality projects on time and at a lower cost. “Many firms are trying to harness the potential within BIM,” says Wilkerson. “It’s imperative that structural engineers continue to invest the time and money to keep learning.”



PAC at night
Copyright Aker/Zvonkovic Photography, Houston, Texas



800-seat concert hall
Copyright Aker/Zvonkovic Photography, Houston, Texas

The buildings we design are getting more complex while the schedules seem to be shrinking. It’s becoming increasingly necessary to be more efficient and collaborative with all members of the design and construction team. BIM has been a great change agent not only in the product we deliver but also in how we work together.

—Marie Hoke
Principal
WHR Architects