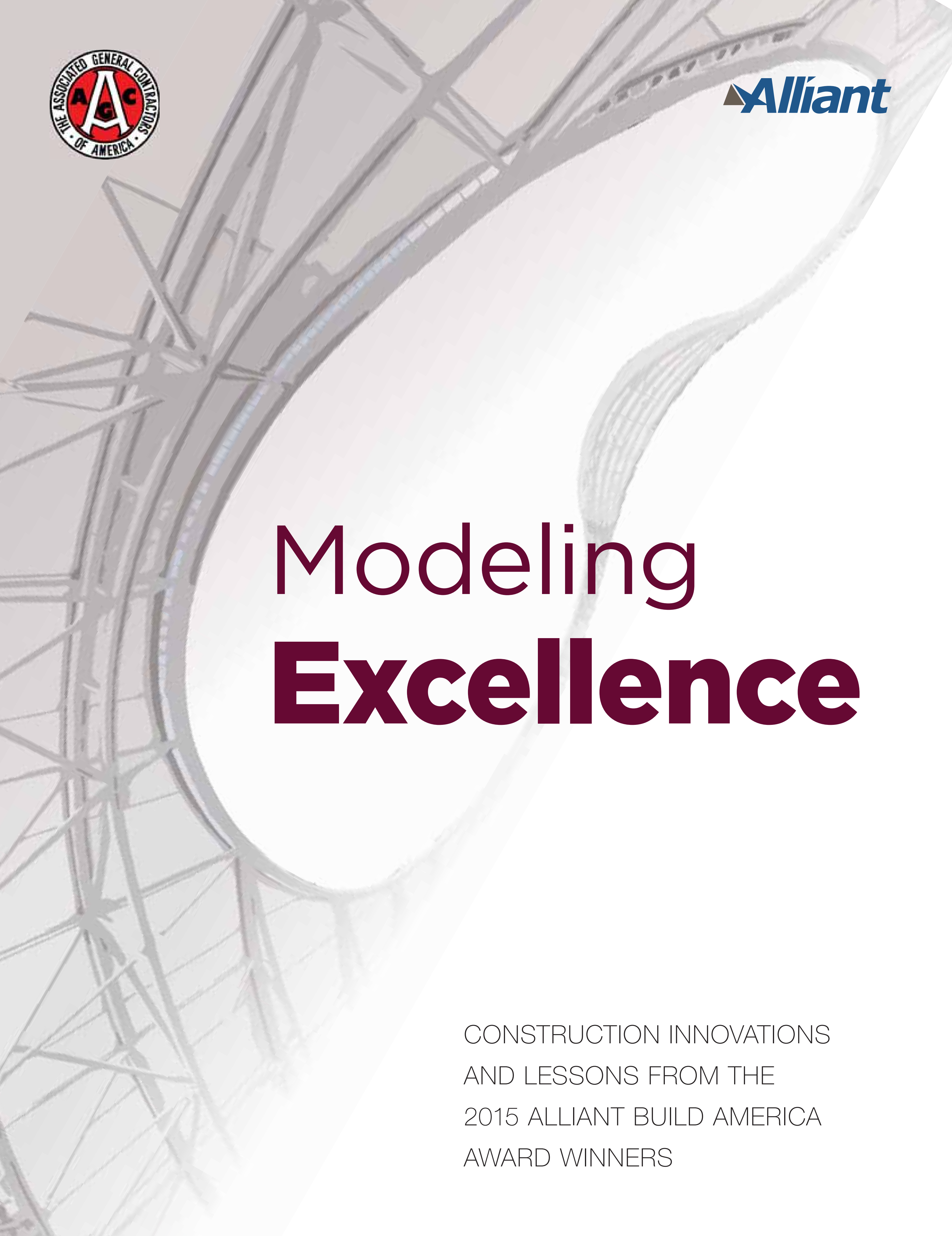

Modeling **Excellence**

CONSTRUCTION INNOVATIONS AND LESSONS FROM THE 2015 ALLIANT BUILD AMERICA AWARD WINNERS

EXECUTIVE SUMMARY

FROM HUNDREDS OF AGC/ALLIANT Build America Award entries, judges from the construction industry selected 21 projects that highlight Associated General Contractors of America members and their remarkable construction of the nation's most impressive projects. Nominations came from the building, highway and transportation, utility infrastructure, and federal and heavy divisions.

The roads, bridges and structures themselves present tangible evidence of the significance of these projects. The winners excelled in project management, safety, client service, community relations, environmental sensitivity, partnering, and innovation in construction techniques and materials. This report aims to identify construction practices and trends that made these award-winning jobs.

The AGC/Alliant Build America Award winners accepted challenges and changed the status quo to complete their projects in a timely fashion within the owners' budgets and specifications.

Collaboration and communication among members of the ownership-design-construction teams rose to the foreground as a recurrent theme. Only through teamwork and the synergy of everyone pulling in the same direction toward a common goal were the contractors able to complete these complicated and intriguing projects.

Looking deeper, additional trends surfaced. Many members employed Lean methodology to eliminate waste, streamline processes and build more efficiently. From scheduling to phasing to value stream mapping, the contractors employed as many Lean techniques as possible.

All of the award winners expressed a healthy respect for technology and a willingness to try new software, devices and other equipment that helped the project proceed more smoothly. That included the use of electronic plan rooms and building information modeling (BIM) for more than simple clash detection. BIM helped with designs, coordination and communication with owners.

BIM also allowed for prefabrication of a variety of components, everything from mechanical, electrical and plumbing systems to sheer towers and glass roof structures. Prefabricating saved the winning contractors time, created safer environments for crews and improved quality by building in a controlled environment with frequent quality inspections.

Many of the award-winning contractors used mock-ups to ensure quality and owner satisfaction with the final structures. Mock-ups helped in controlling risk and enhancing the final products.

The uniqueness of the various projects created opportunities to reshape "business as usual." Many construction firms delivered on their commitment to education by coordinating on the writing of a white paper, inviting students to participate in a work-study program and mentoring youth.

Through the experiences of the constructors themselves each of these areas is explored in more detail. Discover what is working for others and improve your end results.

Each winning project highlights the professionalism of AGC member contractors. As AGC/Alliant Build America Award winners, these projects excelled in safety, quality, community support, client communication and representation of AGC.

For more information about the AGC/Alliant Build America Awards, please visit www.agc.org/awards.

INTRODUCTION

THE 2015 AGC/ALLIANT BUILD America Awards showcase Associated General Contractors of America members building the nation's most impressive construction projects, ranging across the building, highway and transportation, utility infrastructure, and federal and heavy divisions. While the roads, bridges or structures present tangible evidence of the significance of the projects, this report aims to identify construction practices and trends that made these award-winning jobs. For more information about the AGC/Alliant Build America Awards please visit www.agc.org/awards.

AGC/Alliant Build America Awards generate a sense of pride among the award winners. Their client service, innovation and workmanship have earned national recognition.

In this white paper, award winners share how they employed various techniques to quickly and efficiently deliver significantly complicated projects in record time. While many members may not build projects of the winners' scale, every contractor should be able to draw ideas from the winners' experiences that will pay off in the future.

One of the first recurrent themes amongst the most successful projects was the **communication and collaboration** among members of the ownership-design-construction team. Members completing these challenging and complex projects cited a commitment among all parties to deliver a finished project that would make everyone involved proud of his or her participation.

Yet playing nice with others does not solely explain how these projects rose to the top of each category. A deeper analysis of the entries also found that members employed **Lean methodology** to reduce waste and build more efficiently. The other key commonalities between the best of the best included **technology**, **modeling** and electronic plan rooms; **prefabrication**; and **mock-ups** to identify concerns before proceeding with construction. Through the experiences of the constructors themselves each of these areas is explored in more detail.

Advances in construction excellence raise expectations, and the leaders plan to continue innovating to make their project more efficient, their companies more successful and the industry stronger. Discover what is working for others and improve your end results.

BOOSTING EFFICIENCY

Many award winners were tasked with completing projects in record time, and they accepted the challenge. Through careful planning and thinking about the job differently, they succeeded.

Turner Construction Co. of New York brought in a consultant and provided everyone on the construction team at the $389 million, 745,000-sq-ft Martin Army Community Hospital in Columbus, Georgia, a "boot camp" education in Lean methodology to minimize waste in the construction process and save time. The team had only 1,200 calendar days to design and build the hospital. It used a last planner, reverse pull planning scheduling process to meet milestones in small pieces.

Martin Army Community Hospital Turner Construction Co.

"They figured out who would go first and who would follow," explained Marty Miller, project executive for Turner. "We developed a fairly comprehensive schedule based upon small controllable batches."

The company also designed and constructed the project in several fast-track phases, starting with site work, a utility package and then construction of the two parking garages. That way, Turner could use those parking decks for construction workers and storage of equipment.

Early construction of a detached central utility plant and an exterior skin package enabled Turner to install finishes in a dry, climate-controlled environment, as part of its moisture control plan.

"We did everything we could to make it a successful job," Miller added. "All of these Lean techniques and ideas had been done before, we just did them all in a collaborative environment that included the entire planning-design-construction team, and we got it done on time."

Skanska USA Building in Boston also embraced Lean principles on the $239.5 million 32 Quincy Street Expansion and Renovation project of the Harvard Art Museums at Harvard University in Cambridge, Massachusetts.

"The Lean target value design is based on having an estimate before you have a design," said Jim Craft, senior project manager for Skanska. "We try to understand what the design team is looking to build. We build an estimate based on that understanding."

As the design moved forward, Skanska gave continuous feedback to manage the process without having to increase the budget. That required cutting back in some places to afford enhancements in other areas.

32 Quincy Street Expansion and Renovation Skanska USA Building

Washington University in St. Louis Olin Business School Expansion Tarlton Corp

Tarlton Corp. of St Louis employed Lean scheduling on its $90 million, 175,000-sq-ft Olin Business School Expansion at Washington University in St. Louis (Knight and Bauer Halls).

"It's a way to break the projects into small components and get buy in from those teams, rather than dictating the schedule," said Matt Pfund, senior vice president and project executive at Tarlton. "It eliminates waste and time. It's an efficiency tool. You have a plan of milestones, and people doing the work come up with the day-to-day and hour-to-hour schedules."

The company worked with the university on developing a white paper about the advantages of Lean scheduling.

West 7th Street Bridge Sundt Construction, Inc.

Sundt Construction's San Antonio, Texas office, also used Lean scheduling with critical subcontractors on the $25.4 million West 7th Street Bridge in Fort Worth, Texas. Throughout the project, the team's supervisors monitored the Lean plan and procedures weekly to ensure work was progressing according to the schedule everyone had agreed upon. This close monitoring gave them the ability to react and address any issues that came up immediately to keep the work progressing within the allotted time frame.

Sundt's Phoenix office employed several Lean techniques at the Ocotillo Site Brine Reduction (OBRF) Design Build Project in Chandler, Arizona. The team used value stream mapping to find ways to improve processes. To eliminate wasted steps and time, and accelerate operation, the team mapped processes step by step. For example, on an RFI log, the team initially mapped 35 steps and up to three months before an answer was given. Team members then value streamed the process to remove nonessential people and steps. It also value streamed the submittal and commissioning procedures, reducing processes from as many as 40 steps to 10, which accelerated the operation and made it much leaner.

Ocotillo Site Brine Reduction Design-Build Project Sundt Construction, Inc.

Another Lean procedure the team incorporated on the OBRF project was the work package process, which breaks the project down to component elements, so they are easier to track and install. Each element of construction was identified as a work package. The team assigned a label to each work package, for example, B1. Material was ordered through vendors specifically denoting that work package.

When the material was received, it arrived with that number. The team organized all of those materials and stored them together on a pallet. When the foreman was ready for the material, he or she would go to the warehouse, request the B1 work package, and it was all prepared and ready to go to the field with everything needed to complete that work.

The team also developed an electronic "book" for each work package, which included test reports, isometric drawings, red line drawings, RFIs, submittals, etc., to give to the owner at the project's conclusion. While it required significant planning at the front end of the project to create these work packages, as well as coordinate and collaborate how the work would be installed, it ultimately expedited the construction process, which helped the team achieve the client's goal, getting the system up and running as quickly as possible.

When JP Cullen of Janesville, Wisconsin, built the 832,000-sq-ft Deep Space Auditorium for Epic Systems Corp. in Verona, Wisconsin, it divided the project into eight subprojects each with its own management team. The seating bowl, the front of house, the back of house and other sections became separate projects.

"We started breaking it down into pieces that people who do not build 800,000-sq-ft buildings every day could get their arms around, and it worked out very well," said Jim Schumacher, Epic Division manager for JP Cullen.

More than 1,800 people worked on the project during its 22 months. The eight construction teams, design professionals, city inspectors and owner worked out of the same construction office building on the Epic campus.

Epic Deep Space Auditorium
JP Cullen

TAPPING TECHNOLOGY

All of the award winners expressed a healthy respect for technology and a willingness to try new software, devices and other equipment that helps the project proceed more smoothly.

"We don't want to be on the cutting edge but just after the cutting edge," Schumacher explained. "Because of the speed of what we did, we had to rely on the latest technology."

JP Cullen required subcontractors to use the latest software so integration did not create problems. Seventy-seven project team members carried iPads with up-to-date drawings, and the company installed two fixed, 36-inch screens, which held the plans for those not carrying iPads.

"We had a true electronic plan room," added Dan Swanson, executive project manager with JP Cullen for the Epic Deep Space job.

Gregory A. Zinberg, project executive at Clark Construction Group in Irvine, California, described the Hall of Justice project as nearly paperless. The company used Constructware to store and transfer submittals between all parties in the project and archive documents. Bluebeam Revu tracked all documents and transferred new information to the correct members of the team. Field staff and project engineers walked around the job with drawings on iPads, while two workstations displayed drawings, models photos and training videos.

"It was a compact way of managing data on the project," Zinberg said. "In the field, at any point, you could use the model to everyone's benefit."

Hall of Justice
Clark Construction Group

The photographs featured images of all the historic elements and fabric, with descriptions of how each element was removed, so Clark could return them properly to the right spot when the project was nearing completion, explained Hope Hall, senior project manager for Clark on the Hall of Justice project.

"When we had the database vs. the construction documents, merging those two pieces together made the historic retrofit more accurate," Hall said.

Zinberg added, "By making it so convenient to pull up the documents and cross check between documents so efficiently and quickly, people were doing it. We had superintendents, engineers, owner's reps looking at the information, making sure we were getting it right."

Turner also used Bluebeam for document storage, hyperlinking and easy retrieval of drawings at the Martin Army Hospital. Miller estimates the cost of one electronic plan table was one-fourth the cost of a set of paper drawings. With the official construction drawings being provided electronically via wireless computers and tablets, the drawings available in the field were always the current approved version, resulting in less rework. Views of the BIM model were also available to the field crews, to help visualize the more complex assemblies.

Skanska created a website for the electronic plans at 32 Quincy, with hyperlinks to the specific details. All superintendents and foremen from major subcontractors used iPads to access the 4,500 drawing sheets. Mobile document resource stations with large-sized monitors were placed at central locations within the building for trade use and within the site trailer. As a testament to the system's effectiveness, many subcontractor foremen whose companies did not provide them with an iPad, purchased their own, so they could fully participate.

"There was limited paper use, and the subcontractors had the latest drawings," Craft said.

Tarlton developed and constructed a new electronic plan box that utilized PlanGrid on site at the Olin Business School project. The technology enabled foremen or supervisors to attach photographs of changes and punch list items and electronically send notification of the change or challenge to the appropriate person.

"If an architect changed something, as soon as the project team received it, the drywall crews and everyone else had it, live in the field," Pfund said. "The full communication cycle was reduced to 24 to 48 hours from the more typical five to seven days."

MODELING FOR SUCCESS

Building information modeling (BIM) has become the norm for many contractors, but the award winners widened the scope of work that modeling could tackle.

Sundt took the Texas Department of Transportation's two-dimensional design of the West 7th Street Bridge and modeled the arches in BIM to show where the rebar, stainless steel members, lighting and post-tensioning ducts would fit. The first time Sundt ran the arch model, before building anything, it found 26 conflicts in the design. It also used modeling to help sequence the floor-beam system and determine final adjustments to the bridge deck elevations.

"By doing it ahead of time we were able to move things around and make small adjustments," said John Carlson, senior vice president of Sundt. "It saved us time and money. It was a good planning tool."

Additionally, Sundt's heavy haul erector, Burkhalter of Columbus, Mississippi, used modeling for the sequencing of picking up the arches, rotating them and placing them in a storage area within the casting yard. It helped in determining how to lift and rotate the arches, the capacity needed based on the tower crane gantry system, and the best way to place them into storage for curing and to make space for casting the next arch.

Kiewit also appreciated the value of BIM on its $374.8 million Denver Union Station Transit Improvements project, even though the owner did not required modeling. The 3D model developed for the underground bus concourse allowed the team to design the entire structure for a perfect fit for city buses to flow in and out of the structure with ease and eliminate the need for the owner to ventilate

Denver Union Station Transit Improvements
Kiewit Infrastructure Co

excessive interior space. This approach also saved time and money by facilitating clear communication with mechanical, electrical and plumbing (MEP) subcontractors regarding the location of their systems in relation to others, resulting in an extremely neat and orderly MEP layout.

For Kiewit, the investment in BIM and a thoughtful design process paid off. Through a collaborative approach between the contractor, its design partners and key subcontractors that focused on constructability as much as aesthetics and function, the team achieved substantial completion 87 days early and received an early completion bonus of $870,000.

JP Cullen employed BIM for design of all of the mechanical and electrical work at the Deep Space auditorium, with subcontractors contributing weekly to the design, integrating around the structural elements to determine where to install the mechanical and electrical in as compact a space as possible. The company's structural engineer and steel fabricator also used BIM through the use of a Tekla model to design the roof trusses. This allowed the teams to work simultaneously, in the same model, to design and detail in unison. There was no duplication of modeling effort.

"We cut the shop drawing time out," Schumacher said.

Turner used BIM as part of the primary "design development vehicle" at the Martin Army Hospital. The team cut the drawings as viewpoints from the model, but still had to submit signed and sealed paper drawings for approval and sign-off. The Martin Army Hospital project used 200 individual models, prepared by more than two-dozen modelers in 13 different software platforms. Turner's two on-site BIM coordinators combined all of the models in Navisworks, to create a whole building BIM model for coordination. The team also used the model to explain the building to the owner's representatives, demonstrate the construction execution plan and coordinate the work in the field. Miller described BIM as a Lean method.

"BIM enables a tremendous amount of Lean initiatives," Miller said.

Turner used the Martin Army Hospital model to coordinate logistics in the field, plan safety and perform layout. Coordinate points were pulled from the model into a robotic surveying instrument, and that information was used to lay out the work. All foundation pilings and the hangers for overhead rough-in supports were accomplished with this method. The overhead rough-in hangers and supports were drilled and dropped into the metal deck of the floor above before rebar and concrete were placed, dramatically improving productively and safety.

"It's a whole lot faster, and it reduced the cost of each hanger by a significant amount," Miller said. "It would be hard to do that without the BIM model, because you wouldn't know where the hangers belonged.

The BIM model identified fire safety-rating priority walls. Turner built them first and caulked the top, bottom and perimeter, and set the sleeves and penetrations. Then the team asked the fire inspector to sign off on it before adding the overhead rough-ins or other walls around it.

"It made those walls accessible, so they could be properly constructed," Miller said. "And because we built it early, it made it easy for the fire inspector to look at and sign off."

Lambeau Field North & South End Zone Stadium Improvements
Miron Construction Co

Miron Construction Co. of Neenah, Wisconsin, employed BIM to model all MEP and fire protection systems to develop routing and eliminate conflicts between trades and with architectural design prior to installation at the $114 million Green Bay Packers Lambeau Field North & South End Zone Stadium Improvement project. Miron's virtual construction team also assisted with site logistics planning for each phase of work to convey parking and traffic patterns to the owner and other contractors.

"We used BIM for walking through spaces to understand what the team was building, to forecast and to look ahead," said John Murphy, project executive for Miron.

At the Hall of Justice, Clark used BIM to incorporate modern electrical, mechanical and fire suppression systems into an aging structure, which was previously void of these elements. The model included the original 1925 drawings, which showed where the structural steel was located.

"Given that the spaces were never designed to have that much stuff, BIM was really important," Zinberg said. "It was a useful tool for cramming as much stuff in as quickly as possible."

Likewise, Craft found BIM an essential tool in the coordination of MEP systems at Skanska's 32 Quincy Street Expansion and Renovation project. The air distribution equipment and 400,000 pounds of ductwork were packed tightly into the basement to minimize the need for access into gallery ceilings, to reduce noise and to avoid running water over galleries.

"The MEP upgrade was expansive," Craft said. "It required a massive amount of layered duct work to construct, and we used 3D modeling successfully for clash detection."

At the conclusion of the Ocotillo project, Sundt took an overlapped laser scan of the site with the BIM model of the plant and included the operation and maintenance manuals, submittal data, all RFIs and electronic documentation, startup checklists and training information and embedded the files into the model. The deliverable was a 4D as-built record. Operators can look at the file on their tablet, "walk through" the plant in the virtual model and see all of the underground utilities and a complete as-built of the entire plant. For example, someone can look at a pump, click on it and see a drop down menu with all of the information and material data associated with that pump available instantly. The file also shows the differences between as-built conditions and the original design conditions, and will be a tremendous tool to support future construction/maintenance at the site.

PREFABRICATING

Prefabricating components saved winning contractors time, created safer environments for crews and improved quality by building in a controlled environment with frequent quality inspections.

Tarlton used BIM to design the Olin expansion, which enabled the team to precast the shear towers off site. Crews brought the pieces to the job, set them with the steel and welded them together.

"It would not have been possible without modeling," Pfund said. "We had the same firm erect the panels that erected the steel. They set the shear tower as they went up with the steel. It saved erection time in the field."

MEP systems, ductwork and piping assembly for the Olin expansion also were prefabricated off site and brought in large components using a just-in-time delivery system.

Additionally, crews built the glass and steel atrium roof structure, which covers a five-story atrium, connecting the new and old buildings, off site. Revisions were made to the structure while at the fabricator, before it was taken apart, painted and hauled to the project in sections. Electrical and other trades added hangers and other components to the massive skylight system before it was lifted into place by a crane 60 feet to 80 feet above the ground.

"We knew everything would fit and go together quickly," Pfund said.

The glass roof for the 32 Quincy Street Renovation Expansion Project was designed in a collaborative environment with the design team, Skanska and the subcontractor. The subcontractor was brought on board during the design development phase and worked with the team in a design assist capacity to develop constructible details while maintaining the intent of the design and ensuring budget certainty.

The custom high-performance system was fabricated in Germany after the integrity of the system was confirmed through performance testing. The fabrication was based on the BIM model that was shared back and forth with the design team on a regular basis during the design development phase. The components were shipped prefabricated to the extent that was possible, with finish coatings, and lifted by crane into place. Fabricator plant visits were performed regularly monitoring progress and supporting the "just-in-time" concept. Designers accommodated the off-square existing building, which supported the new glass roof.

Skanska also prefabricated much of the ductwork, but not as much as it would have liked given the project was a renovation. In the areas where possible, the company saved time and money with prefabrication.

JP Cullen prefabricated the roof trusses for the Epic Deep Space facility. The fabricator completely built the trusses in Minneapolis to ensure they would go together, before bringing them to the Epic campus, where JP Cullen built the roof structure on the ground, including the trusses, catwalks, fire protection, duct work, piping and electrical, and hoisted it into place using strand jacks.

“We allowed everyone to work at a point of 13 feet to 30 feet, before hoisting it 60 feet off the ground,” Schumacher explained. “It was considerably safer.”

When the engineers told the project team the strand jacks could carry more load, members became creative and found ways to pack as much as possible into the roof structure. It weighed more than 8 million pounds.

“Had we not done that and were satisfied with just doing the structural steel and doing things the normal way, we would have been five months longer in the project,” Swanson said. “The important thing is [letting the tradespeople] know what we could do with the strand jacks and the technology.”

Building mechanical and electrical components in a warehouse and trucking them to the site for installation reduced schedule and manpower on location at the Epic auditorium.

“It improves the quality, because everything is put together offsite, on the floor, at waist height,” said Swanson. “It can be inspected. It can be done well, because it’s easy to work on. The pieces were fit together to make sure everything [lined up and then] disconnected to bring to the site.”

While that work was taking place, Otis Elevator was assembling the auditorium’s 42 escalators at a warehouse in Madison, Wisconsin. The main parts came from China. Otis put the rails, belts and other components into place, ensured they were operational and brought all 42 escalators to the site wrapped in plywood and plastic. Crews lifted them into the prefunction area in dry wells and connected the motors.

“That was slick,” Schumacher said. “The time savings was considerable.”

A normal schedule for 42 escalators would have been 24 weeks, yet JP Cullen cut the time to nine weeks on the site. Prefabricating the escalators at the warehouse also eliminated the need to dedicate assembly space within the under-construction building.

At the Martin Army Hospital, Turner used the BIM model to prefabricate the plumbing and piping in the walls in a shop about five miles from the Army post and brought them in as assemblies and hung them on racks. It also prefabricated the duct work in Texas. The electrical conduits were prefabricated in Virginia. Prefabrication resulted in higher quality rough-ins, at lower cost, with less rework in the field. The hangers were there, and crews could lift the components into place.

“We had very few conflicts in the field,” Miller said.

On the West 7th Street Bridge, Sundt prefabricated the 163-ft-long arches, starting one year prior to beginning construction on the bridge, at a casting yard four blocks from the site. Crews cast the arches lying flat on their sides, and then post-tensioned them using a three-step process. The crews also installed the stainless steel rods that run from the top of the arch to the bottom section of the arch. After the arches had cured to a concrete strength of 6,000 psi, the erector used a crane to rotate each arch into a vertical position with a gantry system and strand jacks, and shifted the arch into the storage area where it was detensioned back to the final design requirement. Each arch took approximately four weeks to complete.

When it was time to install the 300-ton arches, crews moved them on a special dolly system to reach the bridge. Each arch was loaded onto two self-propelled modular transport trailers one on each end of the arch using wing dollies. The transports were slowly “driven” by remote control across the bridge. Twin Liebherr 1400 cranes with superlift, stationed off the old bridge, then lifted them into place onto columns constructed just off each side of the existing bridge. Each arch placement took 30 days to complete.

“We used the existing bridge for access,” Carlson explained. Then once the arches were in place, Sundt had 150 days to close the existing bridge and finish the project. Carlson credits extensive planning with helping the company complete it 30 days early.

Guam MACC Builders, A JV at the $88.9 million Apra Harbor Wharf Improvements Phase 1 project at the Naval Base in Guam used on-site fabrication of the bulkhead “Top-Hat” system for two wharves. This included welding, sand blasting and coating the steel beam and sheet pile materials and preassembling system components on the ground before installing them. The beams and sheet piles were bundled separately to greatly reduce the shipping volume, which saved transportation costs from Japan and ensured timely delivery of the materials.

Project P204, Apra Harbor Wharf Improvements Phase 1, Naval Base, Guam
Healy Tibbitts Builders, Inc. (Guam MACC Builders, A JV partner

"It saved everyone a lot of headaches and money and produced a first-class product," said Rick Heltzel, president of Healy Tibbitts Builders in Aiea, Hawaii, lead partner on the Guam MACC Builders' Apra Harbor project.

CREATING MOCK-UPS

Many of the award-winning contractors used mock-ups to ensure quality and owner satisfaction with the final structures.

"We used the mock-up program to control risk and enhance the product," said Zinberg about the Hall of Justice project. "Even though it's expensive to do mock-ups, we were able to leverage it in our buyouts. We were able to give specific instructions to the prequalified bidders, so we were not getting contingencies on contingencies and controlled cost."

Before restoring the 1,600 windows, Clark hired a subcontractor under a separate contract to create the mock-up.

"We knew this was a large and important element with a real possibility of a price swing, if we didn't do it right," Hall said. "We used the results of the mock-up to help write the specifications."

Clark created nearly 100 mock-ups of historic elements at the Hall of Justice to help guide the restoration efforts. Once each mock-up was done, Clark invited everyone from the owners to the subcontractors to view the mock-up and discuss how to proceed and agree how to move forward.

"We had to plan this out, because you cannot wait to the 11th hour to figure out what process you are going to use," Hall said.

As part of the restoration, Clark needed to restore the exterior, which had not been appropriately maintained. A layer of filth built up over time. The bridging documents called for using a product with hydrofluoric acid as the primary agent, but that chemical would etch the granite.

"When you do historic restorations, the first tenet should be do no harm," Hall said.

Therefore, Clark completed a series of small- and large-scale mock-ups to try a variety of cleaning methods on one section of the building. Clark looked at the building through a microscope to assess for any damage, invisible to the naked eye. Clark then showed that portion of the wall to the owner, while describing cost, environmental risks, scheduling and other variables for each method.

The team settled on Quintek, a cleaning method using low-pressure to spray microabrasive glass beads, which blows the dirt off the building. In addition to not harming the building, Clark did not need to protect people or the environment from a harsh chemical.

"It produced a magnificent result," Hall said. "That was an innovation decision the team made."

Kalamazoo College in Michigan desired a unique look for the Arcus Center for Social Justice Leadership that reflected the diversity in the community. When the architects decided on cordwood masonry as the exterior envelope of the facility, Miller-Davis received special training from cordwood experts to ensure proper installation. Carpenters cut 2,000 logs into 16,000 pieces, which were set in mortar to look like a brick wall. Every piece of cordwood was a different color, shape and size, reflecting the diversity of the population the Arcus Center would serve.

The masonry contractor was required to use the same crew throughout the project to ensure a uniform look and feel. In addition, each log was meticulously examined to ensure the proper mixture of size and color prior to installation. For quality control purposes, the team constructed several mock-ups, which included the porthole windows, to establish compliance with design intent. If there were any questions about the cordwood installation, the team could go back to the mock-up and see what was approved, explained Michele Wreggelsworth, Miller-Davis senior project manager.

Miron Construction created a mock-up of the luxury suites at Lambeau Field, manufactured from sign form board, with the colors and textures, outlets, ceiling diffusers and doors, to provide the owner with an early look at the finished product. The owners made minor adjustments but did not significantly change the size of the suites.

Arcus Center for Social Justice Leadership
Miller-Davis Co

“When you walked it, it offered a three-dimensional glimpse of what it would be in the future,” Murphy said.

JP Cullen considered mock-ups critical while developing a theme for the Epic Deep Space building, which is a cave and natural landscape that resembles a nearby state park. The team took a trip to that park, photographed the rock cliffs and mimicked them in sculptured concrete for the exterior facade. The company also mocked up window systems, LED screens and interior finishes. Mock-ups allowed designers and tradespeople to display their creativity, and then let the owner look at and bless it.

“It’s best to always show a mock-up and move on to make sure we have it right,” Schumacher said. “It’s better to mock it up than to rebuild it.”

UNIQUENESS DRIVES INNOVATION

While this paper highlights several construction techniques that made these winning entries in the AGC/Alliant Build America Awards competition, this is by no means an exhaustive list. The uniqueness of the various projects created opportunities to reshape the status quo. For instance, a commitment to building the Arcus Center with a diverse workforce led to people joining the team who brought a fresh set of eyes and different perspectives to the project. Building in Guam required training a local workforce and a major mobilization effort to import the heavy equipment, problems that did not exist for projects in major U.S. metropolitan areas.

Skanska painstakingly removed and preserved historic frescoes at the Harvard museum, while demolishing the roof above and floor below. Then the contractor suggested the university document the process of moving a 15-ton fresco, so others could learn from the experience.

Clark delivered on its commitment to education by partnering with a local college preparatory school in Watts to place several students in a work-study program during the renovation of the Hall of Justice. Each member of the project team took time out of his or her schedules to teach the students new skills and mentor the young people.

Nearly all projects incorporated energy-efficiency, high safety standards and collaboration. At the same time, many organizations made genuine efforts to involve the community in their jobs, providing tours and working with universities to guide the next generation of contractors.

CONCLUSION

Each winning project highlights the professionalism of AGC member contractors and their ability to take on challenging projects and deliver them on time and within budget. As 2015 AGC/Alliant Build America Award winners, these projects excelled in safety, quality, community support, client communication and representation of AGC.

Award-winning contractors choose not to simply receive plans and build what they were asked to construct. They took extra steps to be in charge of the process from beginning until end, collaborating with others to ensure success.

Many winning entries sought efficiencies in operations. Some employed Lean methodologies to streamline processes and eliminate waste. Almost all enjoy a healthy appreciation of technology as a way to enhance the building process. They are finding new and exciting ways to employ BIM, which made it possible for many contenders to prefabricate elements of their projects. And they used mock-ups to investigate new methods and gain support for their innovations.

If you are not doing the same, it’s time to learn about Lean, to investigate software and new ways to use BIM, to gain experience in prefabrication, and to create mock-ups.

Are you already embracing these innovations and more? If you are constructing an award-winning project and would like to compete for an AGC/Alliant Build America Award, visit www.agc.org/awards for more details.

APPENDIX

2015 AGC/ALLIANT BUILD AMERICA AWARD WINNERS

32 Quincy Street Expansion and Renovation
Skanska USA Building

Arcus Center for Social Justice Leadership
Miller-Davis Co.

D/B Renovation of PACAF Headquarters
Caddell Construction Co.

Denver Union Station Transit Improvements
Kiewit Infrastructure Co.

Epic Deep Space Auditorium
JP Cullen

Greenway Parkway Bridge
Hunter Contracting Co.

Hall of Justice
Clark Construction Group

I-5 Willamette River Bridge (Whilamut Passage)
Hamilton Construction Co.

Lambeau Field North & South End Zone Stadium Improvements
Miron Construction Co.

Martin Army Community Hospital
Turner Construction Co.

McAlpine Creek WWMF Design-Build Effluent Filter Upgrade and Expansion
Crowder Construction Co.

Myrtle Banks Development
Ryan Gootee General Contractors

New US Embassy in Malabo, Equitorial Guinea
Caddell Construction Co.

Ocotillo Site Brine Reduction Design-Build Project
Sundt Construction, Inc.

Project P204, Apra Harbor Wharf Improvements Phase 1, Naval Base, Guam
Healy Tibbitts Builders, Inc. (Guam MACC Builders, A JV partner)

Simon Solar Farm Photovoltaic Facility
Crowder Construction Co.

SouthEast Connector Phase 1 CMAR
Kiewit Western Co.

SR 31 Ione Bridge Rehabilitation
West Company

Tobin Center for the Performing Arts
Linbeck Group

Washington University in St. Louis Olin Business School Expansion
Tarlton Corp.

West 7th Street Bridge
Sundt Construction, Inc.