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COVER STORY

Nuclear Construction Revisited

ENR examines the broad issues in the nuclear construction sector, from what went wrong at the Vogtle and V.C. Summer plants to the billions of dollars of work ahead in decommissioning facilities to the active overseas market and the continuing promise of new technologies.

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NEWS

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Nov. 13	Web News and Updates
Nov. 20	Calaveras Dam
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What's on ENR.com

E-School, Reconsidered

Formal education, a vital part of every engineer's career, is never by itself all that an engineer needs. Greg Hudson, a mechanical engineer and project manager at RMF Engineering Inc. in Charleston, S.C., has some advice about what's missing—and no ENR.com viewer should miss his essay. Hudson describes the five lessons engineering school couldn't teach him. See if you agree with his ideas and post some of your own. Find it under the "Ideas" tab on ENR.com.

▶ **Rising Stars:** ENR has for the past seven years identified the best and brightest in its Top Young Professionals competition. This year, ENR's editors created a national competition from among the regional winners. Instead of presenting only brief summaries about who they are and what they do, we gave the rising stars a platform for their ideas on everything from the most exciting technologies now being adopted to how the different generations can best interact for the industry's benefit. Find the "Top 20 Under 40" feature under the "Business" tab on ENR.com and watch the up-and-comers talk about what's important to them in the video on ENR.com's homepage.

▶ **Tariff's Price:** Scott Canada, a senior vice president for McCarthy Building Cos.' Renewable Energy Group, warns about the effects of new tariffs on the solar-power construction market. They could double the cost of imported panels to protect domestic producers, possibly crippling the solar-PV energy market sector. Find it under the "Ideas" tab on ENR.com.

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Dems Oppose Two EPA Picks

President Trump's nominees for some key U.S. Environmental Protection Agency posts and the top Federal Highway Administration job have moved through committee in the Senate, but the panel's top Democrat is vowing to fight at least one pick: Michael Dourson, Trump's selection to head EPA's office of chemical safety and pollution prevention.

BARRASSO

CARPER

The Environment and Public Works Committee on Oct. 25 approved Dourson and attorney William Wehrum, nominated to lead EPA's air and radiation office, by a 11-10 party-line vote.

Committee Chairman John Barrasso (R-Wyo.) supported all the nominees, saying they are "well-qualified, experienced and dedicated public servants."

Dourson's and Wehrum's slim margins may signal that some Democrats will use procedural moves to slow their paths to floor votes. The panel's ranking Democrat, Tom Carper (Del.), said, "On the nomination of Michael Dourson, we will never give up in opposition to it."

At his Oct. 4 confirmation hearing, Dourson, founder of a nonprofit research organization, said in a statement that, if approved, "I will dedicate my mind, body and spirit to the work of this [EPA] office, to working with its staff, to the protection of the American public and its environment from overexposure to pesticides and chemicals." But Carper contended that, for much of Dourson's career, he "essentially sold his science to the highest bidder," recommending toxic-chemical standards much weaker than EPA's.

Other nominees sailed through the committee by voice vote, including former Iowa Transportation Dept. Director Paul Trombino, as FHWA chief; David Ross, director of the Wisconsin Dept. of Justice environmental protection unit, as EPA's water-office head; former Florida Dept. of Environmental Protection General Counsel Matthew Leopold, as EPA general counsel; and Jeffrey Baran, who would continue as a Nuclear Regulatory Commission member. ■

By Tom Ichniowski

Trump Signs $36.5B Disaster-Relief Bill; Another May Follow Soon

Enactment of a second major post-disaster aid measure provides billions of dollars in additional funds to help Puerto Rico and other areas recover from recent natural disasters. But it probably won't be the last such funding package this year.

The latest measure, which President Trump signed on Oct. 26, totals $36.5 billion. It Includes $18.7 billion for the Federal Emergency Management Agency's disaster relief fund and $16 billion in debt relief for the National Flood Insurance Program. It also has $576.5 million for wildfire-damaged areas in the West.

The legislation follows a $15.3-billion spending bill, enacted on Sept. 8. It provides $7.4 billion for FEMA's disaster relief fund and $7.4 billion for Dept. of Housing and Urban Development community development block grants. The HUD grants can go for a wide range of uses, including infrastructure.

But Sen. John Cornyn (R-Texas) said, "Much more will be needed in my state." Texas is recovering from Hurricane Harvey, which struck the state in late August and caused heavy flooding. Cornyn said Trump and Office of Management and Budget Director Mick Mulvaney told him that, in mid-November, the White House would send Congress another emergency spending request that would have additional funds for Texas. Cornyn said Texas lawmakers are working with representatives from areas damaged by Hurricanes Irma and Maria and from western areas hit by wildfires. ■

By Tom Ichniowski

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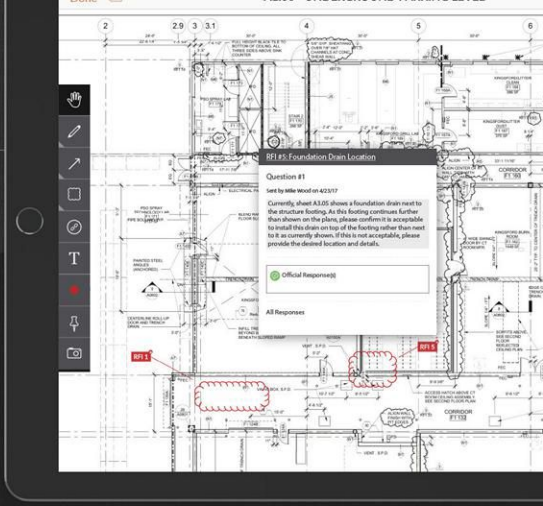

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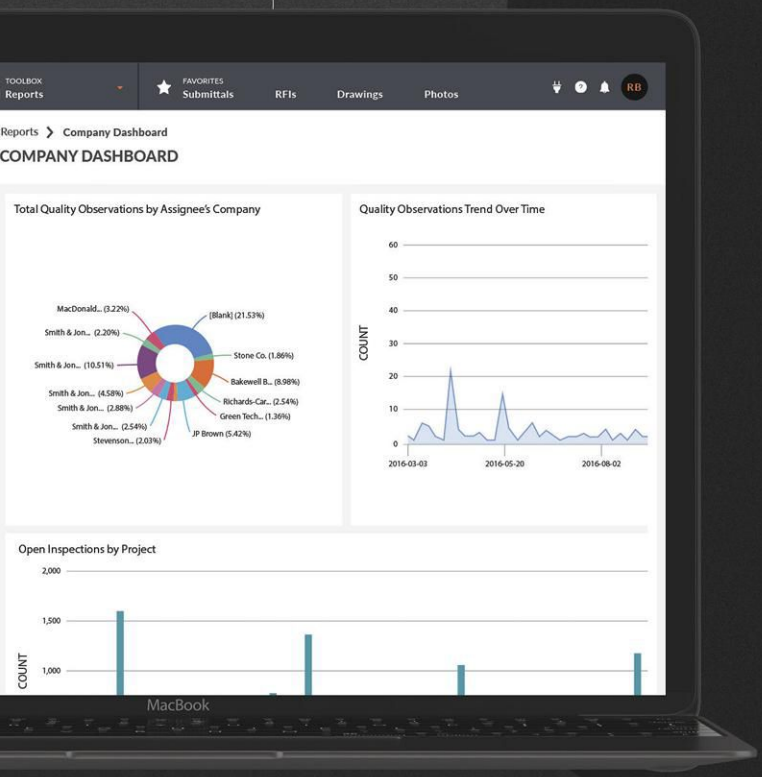

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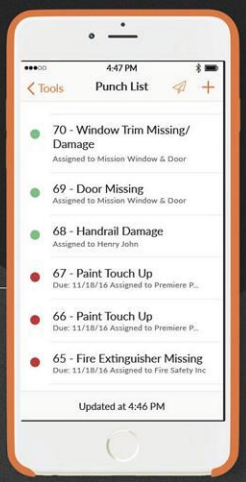

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Virginia DOT Awards Big D-B Contract To Improve I-64

The Virginia Dept. of Transportation has awarded a $409.6-million contract for improvements to I-64 in Chesapeake to the Tarrytown, N.Y.-based joint venture of Ganite Construction, Parsons and Corman Construction. The project, the agency's largest design-build award for infrastructure not involving a public-private partnership, includes construction of a three-lane bridge to parallel the existing four-lane High Rise Bridge, a 45-year-old bascule structure that currently carries 73,000 vehicles a day over the southern branch of the Elizabeth River. In addition, an eight-mile corridor of I-64 will be widened to six from four lanes to accommodate a new high-occupancy toll lane in each direction. Plans call for the new structure to provide 100 ft of clearance for marine traffic. The existing 65-ft-high bridge will remain in service to carry three lanes of westbound I-64 traffic until funds are available for a full replacement. The project is scheduled for completion in 2021. ■

Environment

Florida Governor Pushes Plan To Expedite Okeechobee Dike

Florida Governor Rick Scott (R) on Oct. 30 proposed to add $50 million in next year's budget to accelerate completion of the repairs to the Herbert Hoover Dike around Lake Okeechobee. The current budget includes $50 million for dike repairs. Scott's announcement adds momentum to the project following President Donald Trump's Oct. 26 instruction to the Office of Management and Budget to accelerate the work. Underway since 2001, the rehabilitation is more than a decade away from completion, according to the White House, but Scott hopes to finish it by 2022. The estimate for the remaining work is $800 million, meaning the accelerated schedule would require about $200 million per year, more than double the annual expenditure to date. Congress has not yet authorized or appropriated the funds. The lake's first dike was built around 1915. Designed for flood control, wildlife protection and water quality, it has been destroyed by storms and expanded and replaced periodically. ■

Technology

Team Converting Old Naval Air Station to Smart-City Test Site

The old Naval Air Station in South Weymouth, Mass., may soon emerge as a testing ground for smart-city technologies and sustainable development. In late October, GE and LStar Ventures—development partners of the 1,550-acre Union Point site, south of Boston—announced a plan to install experimental technologies in street lights, power equipment and other urban fixtures as build-out begins this month. Engineering firm Arup is partnering with LStar. Deb Frodl, GE global executive director, says GE is "using the latest design and technology concepts, giving GE an unparalleled opportunity to shape the future of smart, sustainable, resilient development." In addition to residential expansion of 850 existing housing units, LStar plans to develop 10 million sq ft of commercial space. ■

Safety

Trump Administration Taps FedEx Safety Chief for OSHA

President Trump has selected senior FedEx safety executive Scott Mugno to lead the federal Occupational Safety and Health Administration. Mugno, who must be confirmed by the Senate, is not well known in construction circles. He has worked for FedEx for 23 years, the past six as vice president for safety, sustainability and vehicle maintenance at FedEx Ground. If confirmed, Mugno would face important construction issues, including a long-delayed regulation for certifying crane operators and implementation of new limits for workers' exposure to airborne silica and beryllium. ■

PHOTO COURTESY OF MORTENSON

Raiders Moving Again

Oakland's NFL Franchise Breaking Ground in Las Vegas

A $1.9-billion football stadium for the relocating Oakland Raiders will break ground in Las Vegas on Nov. 13, as the joint venture between general contractors Mortenson and McCarthy Building Cos. solidifies its construction team and overcomes early obstacles. Paul Dudzinski of McCarthy Building Cos. has been named project manager, according to the contractor. In early September, the Clark County Commission unanimously approved permits, waivers and design reviews for the 65,000-seat facility. The completion goal is the start of the 2020 season. Other recently overcome challenges included getting Federal Aviation Administration approval, since the site is near McCarran Airport, and confronting an underground box channel. ■

DISASTER RECOVERY

Puerto Rico Rethinks Grid Rebuild

After a week of controversy, Puerto Rico says it will cancel its contract with Whitefish Energy and request mutual aid

PHOTO COURTESY OF WHITEFISH ENERGY

As private and public agencies continue to restore power to the 70% of Puerto Rico that is still without electricity, the island's government announced it will cancel a $300-million grid-reconstruction contract with Whitefish Energy. Also, the U.S. Army Corps of Engineers announced its intention to triple a contract with Fluor Corp.

The island's governor says he has requested mutual aid from New York and Florida utilities and hopes to have 1,000 crews working by Nov. 8. The Fluor contract details that the Puerto Rico Power Authority (PREPA) will perform 30% of the total electrical transmission and distribution power-grid restoration, while the Corps and its contractors will perform the remaining 70%.

Fluor's grid rebuild contract, initially pegged at $240 million on Oct. 19, will increase to $840 million, pending available funds, the Corps announced on Oct. 29. The six-month contract could go up to $1.3 billion, said Lt. Gen. Todd Semonite, commanding general of the Corps, in an Oct. 20 Pentagon briefing.

Meanwhile, although critics have called out both public agencies and private companies for the slowness of the recovery efforts, workers say the island's terrain and decrepit infrastructure make rebuilding a monumental task.

"I've never been a part of something on this grand a scale before. We call it a Type 1 configuration, meaning all available personnel are called upon," says Sgt. 1st Class Anthony E. Persina, of the Corps' 249th Engineers, or "Prime Power" battalion. "Type 1 hasn't happened since Superstorm Sandy."

Contract Concerns

Puerto Rico Gov. Ricardo Rosselló on Oct. 29 announced that PREPA would seek to cancel "immediately" its contract with Whitefish Energy. The announcement came two days after FEMA said it "has significant concerns with how PREPA procured this contract and has not confirmed whether the contract prices are reasonable."

U.S. politicians also called into question the costs detailed in the Whitefish Energy contract, which listed ironworker, linemen and heavy-equipment operator wages ranging from $138 to $400 per hour and allowing for a $400 per diem per worker. Fluor's Corps contract, which ENR obtained, had labor rates that were redacted.

"Taxpayers should pay a fair rate for the emergency repairs Puerto Rico desperately needs [and] not be gouged by Whitefish Energy or anyone else," said Sen. Maria Cantwell (D-Wash), ranking member of the Senate Energy and Natural Resources Committee, in an Oct. 29 statement.

Whitefish spokesman Chris Chiames noted that the company's small size allowed it to get on the ground on Oct. 2 and the company is partially responsible for turning on the lights in a half-million San Juan homes this week. "We secured the work in Puerto Rico because we got to the island quickly after Maria, built a plan with PREPA, earned their trust and confidence, and did not make financial demands that others were requiring," said Chiames.

On Oct. 31, Whitefish announced that any of its approximately 500 subcontractors who wish to remain can continue their work under PREPA or other management. Whitefish says it will manage the work during the wind-down process.

PREPA CEO Ricardo Ramos signed the Whitefish contract. Whitefish was the only company that submitted a bid waiving up-front payment; and although PREPA never held formal public bidding, several other companies approached Ramos, including PowerSecure Inc., which required $25-million

HIGH-WIRE WORK Whitefish has been working with about 500 specialty contractors to rebuild the electric grid in mountainous areas of Puerto Rico.

up front from the bankrupt utility, Ramos told CNN. PowerSecure later signed a $40-million contract with the Corps to provide additional support to repair the power grid in Puerto Rico, according to the Corps.

In the face of blistering news coverage, Ramos defended hiring Whitefish in a public speech, saying the company is "doing a great job. When Whitefish started working, everyone was cheering and clapping." After the "tabloid" news coverage of the contract, Puerto Rican citizens have been "throwing stones and bottles" at Whitefish workers, prompting Ramos to comply with the governor's request to cancel the contract, Ramos said.

Meanwhile, 31% of the country doesn't have a cell signal. Of Puerto Rico's 5,073 miles of roads, only 1,507 miles are open to vehicles, according to an Oct. 30 FEMA update. The Corps has installed 319 generators for critical infrastructure, with 52 more in the process of being installed. Weston Solutions soon will install a 50-MW generator at one of San Juan's main power stations, the Palo Seco Plant. ■

By Luke Abaffy

HAZARD MITIGATION

Seismic Tools Expected To Help Finger And Retrofit 'Killer' Concrete Buildings

Two Applied Technology Council hazard-mitigation projects targeting nonductile concrete buildings—often referred to as "killer buildings" because many are at risk of collapse in an earthquake—are benefitting from information gathered during an Oct. 9-13 reconnaissance trip to Mexico City, less than a month after the Sept. 19 magnitude-7.1 Puebla-Morelos earthquake. The 14-person ATC trip aided in the refinement of a new building-specific methodology to identify killer buildings by predicting their collapse potential. The trip also provided two specimens for a project aimed at evaluating the accuracy of seismic retrofit standards for nonductile concrete structures.

"ATC-78 Project Series: Identification and Mitigation of Nonductile Concrete Buildings" has developed relatively low-cost and easily implementable methodologies for estimating the probability of collapse of frames with or without walls, says William T. Holmes, senior adviser for Rutherford + Chekene and ATC-78 technical director. Still to come are methods for frames with brick infill.

The probabilistic method is "a new way of thinking and represents a significant advancement."

—William T. Holmes, ATC-78 Technical Director

The probabilistic, rather than deterministic, basis of the methodology is "a new way of thinking and represents a significant advancement," Holmes says.

The method, tested against real buildings, can be used to rank older concrete structures. Building officials can then set priorities for mandatory retrofits and owners can identify dangerous structures. "We are giving the engineer an efficient, standardized methodology, with minimal calculations," to figure out, for about $15,000, the collapse hazard, Holmes says. A more complicated, nonlinear time-history analysis would cost about $50,000.

The method, which presupposes available drawings for a building, estimates the probability of story collapse based on story-drift demand, column gravity-load-carrying capacity and other factors, extrapolating a collapse probability. The goal is to develop a methodology that is comparable to the U.S. seismic retrofit standard (known as ASCE-41) in terms of ease of use, but one that yields gradations of risk, rather than pass-fail results.

ASCE-41 is known to be conservative. "If you use ASCE-41 as a criteria, way too many buildings would require retrofits and way too much money would be spent," says Holmes.

The effort is funded by nearly $4 million from the Federal Emergency Management Agency, which next year will publish "FEMA P-1100: Seismic Evaluation of Older Concrete Frame, Frame-Wall, and Bearing Wall Buildings for Collapse Potential."

The other ATC effort, called "ATC-134 Performance-Based Seismic Engineering: Benchmarking of Existing Building Evaluation Methodologies" and funded by some $1 million from the National Institute of Science and Technology, is scheduled for 2019 completion. Using ASCE-41-17 and seismic retrofit codes in Europe, New Zealand, Taiwan and Japan, the team expects to assess objectively the accuracy of the codes' evaluation methods by modeling predicted damage—based on drawings of quake-damaged buildings and their nearby ground motions—and comparing the results to the actual damage, says Russell Berkowitz, senior associate at Forell/Elsesser Engineers Inc. and ATC-134 project director.

Three- to 20-story damaged buildings have been selected in Mexico City, Southern California, Taiwan and Japan.

"There is no sense ASCE-41 is not accurate, but there has been no systematic benchmarking to compare the [code] book versus the real world," says Berkowitz. ■

By Nadine M. Post

ELECTRICAL SAFETY

Workshop Tackles 'Silent Killer' as Fatalities Climb

In the past two decades, more than half of construction fatalities have been caused by electrical incidents, according to the U.S. Dept. of Labor's Bureau of Labor Statistics. In light of troubling statistics on electricity-related injuries and fatalities, the National Academy of Construction and the Institute of Electrical and Electronics Engineers are investigating how best to prevent future incidents.

GRUBBE

Calling electricity a "silent killer," Deborah Grubbe, chair of the NAC safety committee, tells ENR that BLS data show that the percentage of non-fatal injuries caused by electrical shock or burn—0.16%—is very small compared to other injury types, but that belies the issue. BLS data show that electricity-related injuries are the second leading cause of fatalities in construction and the second most costly in terms of workers'-compensation claims.

Of all industries, construction's electricity-related fatalities are climbing

45%	52%	60%
1998-2002	2003-2009	2015

SOURCE: ELECTRICAL SAFETY FOUNDATION INTERNATIONAL

Statistically, the problem is far more acute in construction than in other industries. Across all industries in 2015, 60% of fatal electricity-related injuries occurred in construction, according to the Electrical Safety Foundation International. The 81 fatal electricity-related injuries recorded that year were more than four times the number in the second-ranking source.

More troubling, while the total number of electricity-related fatalities generally have dropped every year during the past two decades, the rate is reducing more slowly in construction. Between 1998 and 2002, construction tallied 45% of all electricity fatalities; between 2003 and 2009, that rate rose to 52%. Crafts that are not directly trained in electrical safety may be at the most risk, with laborers most affected by electricity-related incidents.

NAC, an industrywide body of experts who work on critical national issues such as safety, and IEEE took a first step toward confronting the issue at an Electrical Safety in Construction Workshop, held in Washington, D.C., on Oct. 25-26. Through a series of brainstorming sessions, attendees identified dozens of issues and barriers and offered suggestions for how to overcome those challenges.

Over the next six months, the group will discuss broader proposals for action, Grubbe says. Already, NAC sees opportunities, particularly in leading and supporting education efforts such as including hazard identification and safety in university engineering curricula, she says. NAC and IEEE also are looking to collaborate with other organizations, such as working with the National Institute for Occupational Safety and Health on a "prevention through design" initiative.

Architect of the Capitol Stephen Ayers, who attended the workshop, says the issues raised were enlightening, especially after an electricity-related near-miss on one of his recent jobs. "We will take some of these ideas back to the office, change the way we work and change the way we approach our safety program," he says. "That's what this is all about." ■

By Bruce Buckley

BUILDINGS

Vegas Convention Center To Expand

Construction activity in Nevada is poised to accelerate after three design-team finalists made presentations to Las Vegas Convention Center stakeholders last week, vying to garner the $1.4-billion expansion-and-renovation contract and putting construction start on track for early 2018.

The presenting design finalists were RV Architecture-Friedmutter Group, TVS Design-Design Las Vegas and Populous-Klai Juba Wald-LGA-ZimmerRay. Final selection is expected on Nov. 15.

The three design teams had six weeks to work on presentations with parameters and needs determined by the Las Vegas Convention and Visitors Authority and its construction manager, Cordell Corp.

The design presentation was for phase two, which includes construction of 1.4 million sq ft of new structure, with 600,000 sq ft as leasable space. Construction is expected to be complete by 2021.

Phase one—the purchase and demolition of the former Riviera Hotel and Casino—was completed in 2016. Terry Jicinsky, senior vice president of operations with the Las Vegas Convention and Visitors Authority, says phase one cost about $187 million and cleared the site, leaving only utility connections at street level. It will be the primary building site for phase two.

Expected to begin in 2021, phase three will include renovations to most of the current facility and some new construction. Jicinsky notes that, when complete in 2023, current plans will result in a convention center of about 5.2 million sq ft.

Of the 50 states, Nevada construction employment growth was among the highest over the past year, according to the U.S. Bureau of Labor Statistics. It is likely the convention-center project will create the 14,000 construction jobs estimated, says Sean Stewart, CEO of the Nevada Contractors Association CEO.

Stewart says several firms are preparing to enter the general-contractor selection phase later in November. ■

By John Guzzon

TRANSPORTATION

Two Teams Certify Costs for Boston Green Line Extension

CERTIFIED DELIVERY Two teams hoping to build the light-rail extension have guaranteed their costs.

The joint venture of Walsh Group, Barletta Construction and Granite Construction appears to have been unable to certify a cost estimate at or below the $1.3-billion cost limit to build the long-awaited Massachusetts Bay Transportation Authority's Green Line Extension project in metropolitan Boston. The JV is out of the bidding, according to a source close to the procurement. (Walsh and an MBTA spokespersons did not respond before ENR's press time to confirm the bid status of the contractor and its team.)

The MBTA said at its Oct. 23 board meeting that only two of three short-listed design-build groups submitted certified cost proposals, but the agency said they would not be identified until the public price opening on Nov. 17. Besides the Walsh-led group, the other bidders include a Fluor Enterprises-led JV, comprising The Middlesex Corp., Herzog Contracting Corp. and Balfour Beatty Infrastructure, and a Lane Construction Corp.-led JV, comprising its parent firm, Judlau Contracting and LMH-C.M.C. di Ravenna.

The $2.2-billion light-rail project includes two new branches, from Lechmere Station in East Cambridge into neighboring Somerville and Medford. The project also calls for seven new stations.

"Certification of two of the short-listed design-build teams is a significant achievement toward extending the Green Line," MBTA General Manager Luis Manuel Ramírez said in a statement. "Certification of the project's affordability" ensures proposals are competitive and can be built within the set budget, continued Ramírez.

The MBTA also noted that the final request for proposal included a base scope of work and "additive options," which could include platform canopies, additional elevators at select stations, public art, additional community connection to the community path and an enhanced vehicle maintenance facility in Somerville.

The project was halted in 2015, when costs ballooned $1 billion over budget. The Federal Transit Administration, which has pledged $1 billion for the project, approved the new, scaled-down cost estimate in April. ■

By Justin Rice and Debra K. Rubin

TECHNOLOGY

US DOT Test Program Could Widen Construction's Drone Use

The construction industry's use of aerial drones could increase under the Trump administration's new pilot program, which seeks to expand the technology's overall use.

President Trump on Oct. 25 signed a memorandum that directs the U.S. Dept of Transportation to set up the new test program. It will include approving arrangements with at least five states, localities or tribal groups that submit proposals for wider use of unmanned aerial systems (UAS).

U.S. DOT said infrastructure inspections and monitoring are among the industries that "could see immediate opportunities" from the pilot program. Engineering and construction already are major drone-using industries. A March 2017 Federal Aviation Administration report said the construction, industrial and utility inspection sector and the real estate sector each account for 26% of total drone use. Only aerial photography, with a 34% share, outranks those two sectors.

U.S. DOT and FAA will establish the program by late January—within 90 days of the Trump memorandum. About six months after that, the department is slated to enter into agreements with the state and local agencies and other parties. The drone test program will last three years, unless the U.S. DOT secretary decides to extend it.

The new pilot program will study activities that are now generally prohibited, such as flights over people and beyond the operator's line of sight, said U.S. DOT.

John Palatiello, executive director of surveying and geospatial information group MAPPS, says, "Those are two of the most significant barriers right now to using UAS for geospatial data acquisition." He adds, "So, the faster the federal government can develop regulations to enable those kinds of activities, the better it will be for the geospatial community."

A 2016 FAA rule set limits on the commercial use of small—those weighing less than 55 pounds—drones. Such UASs are the most commonly used in engineering and construction.

Along with the ban on flights over people and the line-of-sight requirement, the regulation says drones may fly only at altitudes lower than 400 ft and only during daylight hours.

Palatiello says states or localities might propose looking at "the integration of UAS into air traffic control near an airport." He says drone use around airports now isn't banned, "but it is very, very limited." ■

By Tom Ichniowski

FILE PHOTO BY JUSTIN RICE FOR ENR

EMERGENCY MANAGEMENT

Houston Judge Calls for Major Flood-Control Improvements

Two months after Hurricane Harvey struck Houston, Harris County Judge Ed Emmett, who is also the county's director of emergency management, proposed a set of 15 responses, including some new construction and restoration work, aimed at mitigating future flood damage.

"Harvey's not a singular event. It followed two other major rain events in recent years. This area has seen three of these so-called 500-year rains in the past two years," Emmett said on Oct. 25.

While the idea of building a third reservoir to join the existing Addicks and Barker reservoirs had been under discussion, Harvey reframed that conversation. But Emmett says the third reservoir would protect Harris County's west and northwest sections. Proposing to pay for the reservoir out of the state's rainy-day fund, he suggests incorporating it into a larger project that would create a state or national park.

The U.S. Army Corps of Engineers should restore to a first-class condition the dams and detention areas of the Addicks and Barker reservoirs, including removal of dirt and vegetation within the reservoirs as necessary, recommends Emmett. He further calls for the Corps immediately to fund the four Harris County Flood Control District projects now ready for completion.

In mid-October, a Harris County Flood Control District study estimated that naturally restoring the Lower White Oak Bayou Channel would cost between $30 million and $60 million, less than replacing the aging concrete channel that runs north of downtown Houston. The work, which needs both a sponsor and a funding source, could take at least five to 10 years to complete.

The Texas Water Development Board on Oct. 17 announced that Harris County had received $47.2 million in financial assistance for a stormwater management project at the Brays Bayou watershed.

Emmett also called for a buyout and elevation program for all homes in the 100-year floodplain. Harris County commissioners OK'd a $20-million home buyout program in September. ■

By Louise Poirier

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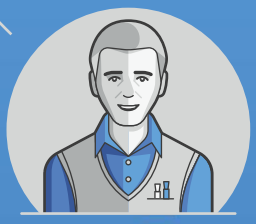

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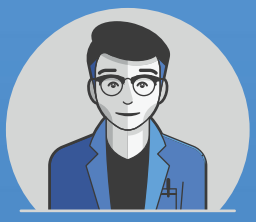

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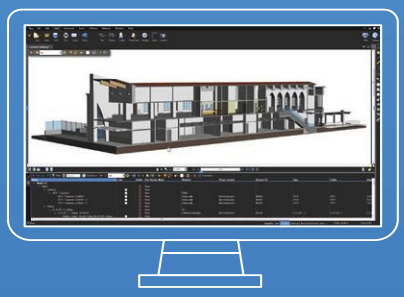

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AIRPORTS

Denver Adding More Gates

Citing continued growth in both flights and airlines, Denver International Airport is upping by 50% a previously announced gate expansion project. The airport now plans to add 39 gates across all three of its concourses by 2021. At a cost of $1.5 billion, the improvements would increase the airport's total gate count to more than 145.

Originally announced in August as a 26-gate expansion, the bond-funded project calls for extending the ends of existing concourses to accommodate the new gates. A similar approach was used to facilitate a $46-million, five-gate expansion at the west end of Concourse C, completed in 2014.

Project design and construction firms already have been selected, pending approval by Denver's city council and mayor. HNTB won a $65-million contract to design additional gates for the west ends of Concourses A and B, which will be built by a joint venture of Turner and Flatiron under a $700-million construction management-at-risk (CMR) construction agreement.

Jacobs was awarded a separate, $65-million design contract for projects at the east ends of Concourses B and C, with a Holder-FCI joint venture performing CMR services for $655 million.

All four contracts are for five years, with provisions for extensions if the scope of work should change.

WSP USA is providing program management services for the expansion under a $45-million contract awarded earlier this year. No changes to that deal will be made for the additional gates.

Construction would begin in 2018, with all gates scheduled to become operational by 2021. The project would be performed concurrently with a four-year, $650-million main-terminal makeover, being performed as a part of a $1.8-billion public-private partnership with a group led by Ferrovial Airports of Spain.

According to an airport spokesman, Denver International Airport expects its 2017 passenger volume to exceed 60 million, 20% above its design capacity. The original expectation that the majority of the airport's flights would be connections has changed; origination-destination passengers now account for about 60% of the airport's traffic. Denver International currently handles approximately 1,550 daily flights with 25 airlines. ■

By Jim Parsons

GLOBAL MARKETPLACE

Economies Are 'Fragile,' but Firms Push Robust Strategies

MOMENTUM Economist Basu says global economies are 'fragile' but on a roll through 2018.

Despite some positive signs and 3.6% world economic growth projected for this year, global economies remain "fragile," construction-industry economist Anirban Basu told Global Construction Summit attendees in New York City last month. U.S. growth was just 2.2% this year, with annual growth not hitting 3% since 2005, he told the Oct. 23 gathering, sponsored by ENR and Marcum LLP.

Russia's economy is set to rise just 1.8%, and while China is anticipated to see a 6.8% boost, the increase "is still the worst in a decade," said Basu, who is chief economist for Marcum, an industry financial adviser. While some small-business CEOS are optimistic, he notes that, without further deregulation, "companies are taking a wait-and-see attitude." Basu predicted that, in the U.S., "momentum should see us through 2017-2018. … I'm still nervous about the global economy going into 2019 and 2020."

Neil Bruce, president and CEO of Montreal-based design-build firm SNC-Lavalin Group Inc., predicted that construction-sector firms—including his own, which just completed the $2.6-billion purchase of U.K. design firm Atkins—will continue to pursue consolidation strategies. "Clients are pushing for a one-stop solution," he said, claiming it "can cut the risks of supply-chain conflicts and avoid the inefficiencies of managing too many supplier interfaces."

Bruce noted the Canadian giant's revamp of its global ethics program in the wake of its 2011 bribe scandal. While the firm still faces pending federal charges and trials have yet to start for key former executives facing bribery, fraud and other charges, he said SNC-Lavalin's ethics rules are "considered by external third-parties to be proactive and robust." Bruce also noted efforts to simplify the company's corporate structure and investment in technology such

as artificial intelligence. He says its AI push "will enable employees to focus on the parts of their roles that add the most value."

Cross-Border Deal

Cross-border mergers and acquisitions have strengthened in recent years, accounting for one-third of more than 150 deals brokered by consultant EFCG in the past three years, said Andrej Avelini, its managing director who moderated a session on those transactions. Foreign buyers' desire to gain market share and leadership expertise in the U.S., for example, have fueled more willingness to pay premiums in M&A deals. But one lesson learned in Danish engineer Ramboll's 2015 buy of U.S.-based environmental consultant Environ was the need for more aggressive brand introduction of the combined entity, said Frank Marrazza, a unit president of the now combined Ramboll Environ. (It will take the parent firm's name in 2018.)

PEOPLE MOVERS Leadership gurus predicted the need for more project-team autonomy.

Experts pointed to the need to boost success on larger global megaprojects through more cohesive leadership teams. "How to establish trust on a cross-cultural team" is critical, said Steven Coughran, strategy director of consultant Coltivar Group. "Other cultures manage conflict very differently than in the U.S."

Speaking of megaproject management, Thomas B. Crane, chief human-resources officer at Skanska USA, noted "the hard reality of the cultural change in our business" where "command and control doesn't work anymore." He emphasized the need for greater team autonomy and an "acceptance of digitalization." Guy Leonard, Mott MacDonald executive director of global strategy, said the highly digital design approach on London's Thames Tideway sewer-upgrade megaproject "is on the cutting edge, delivered for 70% of resources."

To attract the next generation of employees, McKinsey Vice President Tim McManus said investment in training and R&D is the construction sector's "biggest needed area of improvement." Crane said the trend of shorter employee longevity at firms could usher in an era of "construction free agency."

Christopher Burke, a partner in the law firm Varela, Lee, Metz & Guarino, said his firm sees a higher percentage of cases related to overseas projects. He reminded attendees that dispute clauses are

vital in cross-border contracts that typically call for international arbitration "if things go south." He compared these clauses to a prenuptial agreement, saying "it's something people don't like to talk about." Jim Schnieders, senior vice president for energy EPC projects at Black & Veatch, said many countries do have their own versions of anti-bribery laws, but "there is still a ways to go" on how these are interpreted and implemented. He said there will "always be practices that create imbalances … but I am encouraged to see the field leveling."

Referring to global project cost and productivity trends, Mark Chaves, international tax-services practice co-leader at Marcum, noted, "Many countries do not allow value-added tax paid on construction, buildings or real estate to be offset against VAT from corporations." Such tax paid by the developer to foreign countries becomes an added cost that contractors need to take into account, he added. David Hudd, North American cost consultancy principal at Arcadis, emphasized the importance of "time, scope and cost" in optimizing project financial success, stating, "You can buy two of the three, but the third is just a consequence of the other choices [the client] makes."

Megaproject Health

Elizabeth Sanborn, chief operating officer at Independent Project Analysis Inc., said about two-thirds of projects over $1 billion fail compared to smaller projects' 40% failure rate. "Megaprojects tend to fail more because they are more difficult to manage due to their high number of stakeholders, challenging locations and high level of turnover," she added. Stephen Cabano, president of Pathfinder LLC, stressed the importance for the owner to understand clearly a project's scope and lock it down before the project is fully funded.

"Leadership is key. You need to lead the project like a business," said Ken Gilmartin, senior vice president of life sciences, consumer goods and manufacturing at Jacobs. Strong leaders assemble the right project team, invest in the team to make sure the project partners are successful and allocate risk to the appropriate parties.

Large global EPC firms such as Bechtel leverage their global supply chains and take on ever-more self-performing services, from studies and planning to engineering and contracting to operations and maintenance, said Darren Mort, Bechtel's LNG general manager. ■

By Debra K. Rubin, Alisa Zevin, Janice L. Tuchman and Scott Blair

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EXECUTIVE NEWS

UK Contractor Carillion Names New CEO To Reverse 2017 Slide

DAVIES

U.K.based construction company Carillion plc. has named **Andrew Davies** as CEO following the July resignation of former chief **Richard Howson** in the wake of poor financial results. Set to join next April, Davies now is CEO of privately-owned U.K. contractor Wates Group Ltd; he also was a defense-industry executive. **Keith Cochrane** continues as interim CEO. He replaced Howson after the company reported losses on contracts in the U.K., Canada and the Middle East. In the first half of 2017, Carillion reported flat sales of $3.3 billion and a 40% drop in underlying profit. The firm has plans to sell nearly $400 million of non-core assets by the end of next year. Carillion's situation marks a dramatic reversal from three years ago, when it offered to merge with then-ailing contractor Balfour Beatty. That firm rebuffed the offer and has since substantially repaired its business under new CEO Leo Quinn.

John Elliott, managing director of U.K.-based tunneling-design specialist Alan Auld Group, will join global engineer Golder Associates Corp., Palm Beach Gardens, Fla., as a principal, following the latter firm's completed purchase of the former, set for mid-November. Auld, with offices also in Canada and the U.S., provides specialized design and construction for underground structures and complex shafts and tunnels. A Golder spokeswoman says the deal "will play a key role in advancing our tunneling strategy globally." Golder ranks at No. 40 on ENR's list of The Top 150 Global Design firms, reporting $897.2 million in global worldwide revenue last year.

Louis Berger has hired former Washington, D.C., Dept. of Transportation Director **Leif Dormsjo** as senior vice president for infrastructure asset management. Still based in that city, he will oversee management of the practice that operates and maintains a range of public and private transportation facilities and infrastructure assets for U.S. clients.

The Intelligent Transportation Society of America, an advocacy group for intelligent transportation deployment, has named **Shailen Bhatt** as president and CEO. He was executive director of the Colorado Dept. of Transportation. ■

By Peter Reina and Debra K. Rubin

HISTORIC PRESERVATION

Eyeing Makeover, Parliament Hits Big Ben's Snooze Button

Big Ben has been silenced, and its chimes will not be heard for four years while London's most famous bell tower is restored. With the $80-million project cost now more than double initial estimates, U.K. lawmakers are pondering how to manage renovation of the rest of the decrepit, 1,100-room Houses of Parliament, with a budget more than 60 times bigger.

Eroding stonework, leaking roofs, flooded basements, tangled wiring and wide-spread asbestos have left the of the House of Commons and the House of Lords "in a state of extreme disrepair," according to a Public Accounts Committee report filed a few months ago. "The risk of a catastrophic failure is high and growing."

To avert such a fate, officials over the past few years have devised a number of renovation options for Parliament members. Aiming to start work in 18 months, MPs will vote this year on the delivery approach, Andrea Leadsome, leader of the House of Commons, said in late October.

The most likely option, estimated to cost $5.2 billion, would be for everybody to relocate to nearby buildings, giving renovation contractors a clear run for six years. Keeping the buildings functional during renovation work could cost $7.5 billion and take more than 30 years, Leadsome added.

Since their completion some 150 years ago, the neo-Gothic Parliament buildings have never been seriously renovated, according to officials. The 300-meter-long Thames riverside complex replaced an original palace, which burned in 1834.

Only the 918-year-old Great Hall, with its 21-m by 73-m timber roof, survived. Numerous royal coronations and public trials have taken place there, including the one that led to the 1649 beheading of King Charles I.

CLIMBING HIGH Contract cost total for tower renovation rose to more than $80 million from $38 million between 2016 and 2017.

PHOTOS BY PETER REINA FOR ENR

HIATUS The favored option for the Parliament repair program would cost $5.2 billion and displace members for six years.

Covering 112,000 sq m, the parliamentary complex includes 100 staircases, 31 elevators and more than 3 kilometers of passages over seven floors. The building was bombed 14 times during World War II. The House of Commons' debating chamber was destroyed by an attack in 1941; after the war, the chamber was repaired and reopened, in 1950.

To manage the refurbishment, Parliament will likely create a sponsor entity to oversee a separate delivery unit, a strategy adopted on London's current Crossrail project and on the 2012 Olympic infrastructure work.

To help with essential preparatory work in an "option-neutral" manner before final decisions are made, officials this July recruited the local office of CH2M Inc. to advise on project and cost management, says a spokeswoman. BDP Ltd., Manchester, joined as the team's architect.

The new team could remain for the whole program of work. Meanwhile, by next spring, it is expected to spend approximately $16 million to plan future strategies and investigate the building's condition. "Effort put into early planning is rewarded later with financial savings," observes Brian Finnimore, managing director of Parliament's Strategic Estates.

In estimating renovation costs, "there is a high level of risk included," says a Parliament spokeswoman. But even the project's 40% to 50% contingencies would not have been enough to cover the surprise cost hike for the Big Ben renovation.

The clock-tower contract is preceding the main work, partly because it now fails to comply with fire regulations, which require the installation of a new elevator.

When locally based contractor Sir Robert McAlpine Ltd. was hired in 2016 for preconstruction services and to scaffold the bell tower, an in-house team had priced the renovation at $38 million.

But when McAlpine signed the main renovation contract in September, the price had risen to more than $80 million. Officials attributed some of the hike to the poor condition of stonework, greater complexity, more-than-expected groundwork to protect utilities and an increase in the budget contingency.

As well as repairs to the famous clock, the 96-m-tall stone Elizabeth Tower also needs attention. But Big Ben itself, which is actually the 13.8-tonne bell, is said to be in fine form. ■

By Peter Reina in London

CHRISTOPHER HARTZ,
FORMER NUCLEAR PROCUREMENT QUALITY-ASSURANCE MANAGER, SHAW NUCLEAR SERVICES

A former Shaw procurement quality-assurance manager describes how, in 2010, twin nuclear-reactor projects began a long slide to disaster

ORIGINS OF A HUGE NUCLEAR FLOP

BY RICHARD KORMAN

CHRISTOPHER HARTZ IS AN EARLY EYEWITNESS TO THE TWIN PROJECTS THAT PUNCTURED THE HOPE FOR A "NUCLEAR RENAISSANCE" AND DROVE WESTINGHOUSE INTO BANKRUPTCY.

For 14 tumultuous months, from late 2009 to 2011, Hartz worked for Shaw Nuclear Services, the main subcontractor to Westinghouse on its new Georgia and South Carolina reactor projects. With the South Carolina project now canceled and the Georgia project billions of dollars over budget and years late, Hartz's account of what he saw and experienced in Shaw Nuclear's Charlotte, N.C., office provides a new channel for understanding the traumatic infancy of a slow-developing disaster.

Shaw and Westinghouse believed they could ship the first modules—based on Westinghouse's heavily promoted new reactor design—to Georgia and South Carolina from the Lake Charles, La., fabrication plant of Shaw Nuclear's sister company, Shaw Modular Solutions. That goal proved to be an airy fantasy. During this time, Hartz was not familiar with any schedule that included quality-related activities—a big omission considering the major problems that would envelop the work. When Hartz's concerns about quality and compliance problems led to Shaw Nuclear shutting down work at the plant during critical months in the second half of 2010, Hartz says he and another Shaw employee were met with an angry outburst by one of the company's senior managers. In a hastily arranged meeting at Lake Charles about the impending stop-work order, the senior manager hurled a letter opener head-high in the two men's direction.

Looking back, Hartz now sees the incident as a symbol of all that was wrong in Shaw's approach to the projects. "It was a precursor," says Hartz. One of many,

as it turned out. To build the first new nuclear reactors in the U.S. in three decades—South Carolina's V.C. Summer Units 2 and 3 and Georgia's Plant Vogtle Units 3 and 4—the design and construction team would face a steep learning curve. However, says Hartz, learning wasn't much of a priority in the rush to start work at Lake Charles. "They were clueless" about the complex geometry of nuclear welds, the nuclear supply chain and the need for a nuclear safety culture, he notes, adding, "I wasn't a whistle-blower. I was just a senior procurement manager who was concerned."

Now 61 and retired, Hartz served as Shaw Nuclear's procurement quality-assurance manager, overseeing the firm's nuclear supply chain. A California resident for most of his adult life, Hartz had spent his childhood in Pittsburgh, where his father worked as a district chief of quality assurance for Stone & Webster. After moving out West, Hartz worked for 25 years at Pacific Gas & Electric's Diablo Canyon nuclear power plant. By 2008, nuclear power seemed to be headed back to the front ranks of U.S. energy. Hartz says he had just finished a graduate degree at California Polytechnic State University when Shaw was staffing up for the nuclear projects.

To be sure, Hartz's account is just one person's view (several former colleagues of Hartz failed to return calls requesting interviews). Although deeply critical of his former employer, Hartz doesn't put all the blame on Shaw for what happened in 2010. But correspondence between Shaw and the Nuclear Regulatory Commission, including notices of nonconformance with NRC standards, shows there already was serious trouble with Shaw's work in that year.

Baton Rouge-based Shaw Group, led by chief executive James Bernhard Jr., had elevated itself in the late 1990s from a profitable pipe-fabrication company supplying major industrial contractors to big prime-contracting roles on turnkey power jobs. At the time, federal subsidies to utilities encouraged new nuclear projects, and Shaw acquired the once-venerable Stone & Webster in 2000 and bought a 20% interest in Westinghouse Electric in 2006. Thus linked, the two companies tied their fate to Westinghouse's supposedly safer and easier-to-build AP1000 pressurized water reactors with passive cooling and safety systems. Shaw touted its nuclear strategy to investors.

The construction of a nuclear power plant, especially the nuclear island, reactor vessel and containment structure, has been described as a testament to human ingenuity. The effort requires discipline, too. To finish a nuclear power plant, the project's team must coordinate numerous hives of activity involving utilities, regulators, contractors and suppliers. Many attempts don't succeed. Out of 177 nuclear-reactor construction projects started in the U.S., 40 were abandoned at some stage of construction, according to the Bulletin of the Atomic Scientists, an anti-nuclear association. As early as Feb. 11, 1985, an issue of Forbes magazine proclaimed, "The failure of the U.S. nuclear power program ranks as the largest managerial disaster in business history."

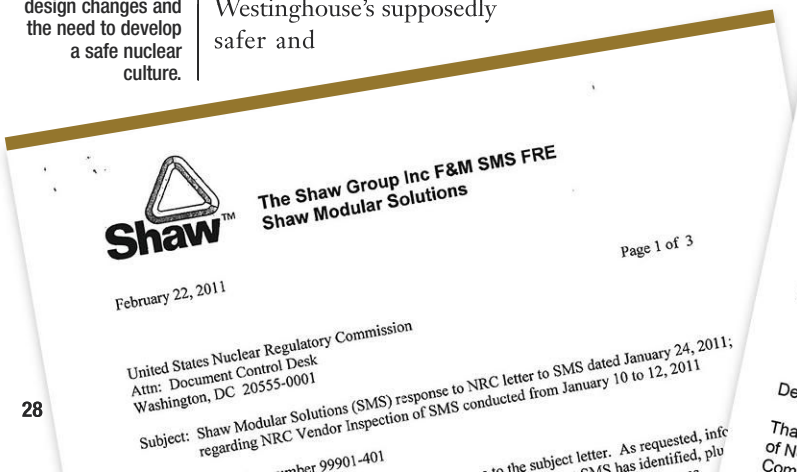
Sunny Forecasts

Mindful of nuclear construction's sad record, Westinghouse continued to generate sunny forecasts for the future of AP1000 nuclear reactors. Even after Hartz's team had stopped work at Lake Charles in 2010 and the NRC had sought to clamp down on what it saw as Shaw's lax quality control in its design-change process with Westinghouse, Westinghouse and the utilities reported optimistically about progress at the two projects. For example, at an American Society of Mechanical Engineers seminar in June 2011, Westinghouse's module fabrication manager presented a slide show that lauded all the design's benefits but made no mention of the developing problems. The seminar was titled "Blueprint for a Nuclear Renaissance."

Westinghouse lacked some simple logistical sense that could have helped to finish the incomplete design, Hartz says. Westinghouse should have had engineers working at the offices of both Shaw and Westinghouse, which would have speeded up communication and helped quality, Hartz suggests.

The projects got off to a poor start. Westinghouse would issue drawings to Shaw Nuclear in Charlotte. When Shaw reviewed the drawings and asked Westinghouse to correct a detail, problems

SLOW START The Nuclear Regulatory Commission and Shaw noted the company's trouble with compliant design changes and the need to develop a safe nuclear culture.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February 22, 2011

United States Nuclear Regulatory Commission
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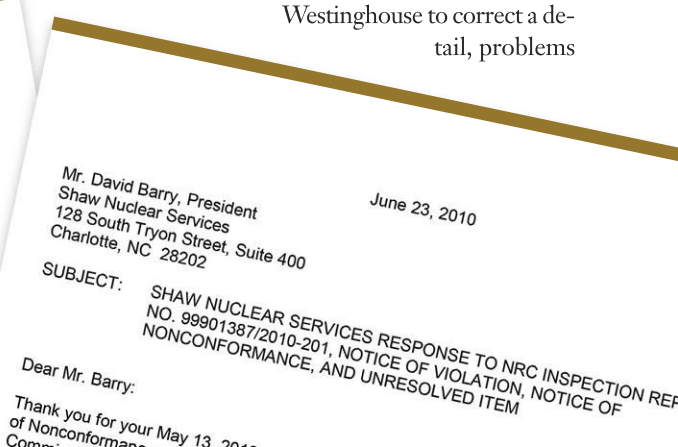
Mr. David Barry, President
Shaw Nuclear Services
128 South Tryon Street, Suite 400
Charlotte, NC 28202

June 23, 2010

SUBJECT: SHAW NUCLEAR SERVICES RESPONSE TO NRC INSPECTION REP
NO. 99901387/2010-201, NOTICE OF VIOLATION, NOTICE OF
NONCONFORMANCE, AND UNRESOLVED ITEM

Dear Mr. Barry:

Thank you for your May 13, 2010

ensued. The work processes were unnecessarily complicated by the separation of the team members. Giving an example of how the process got out of hand, Hartz says that, if a design called for a ⅜-in.-wide, 12-in.-long fillet weld, the welder might make it 14 in. long. "Instead of having Westinghouse right there saying, 'That's no problem,'" recalls Hartz, "we had to write a nonconformance report that was processed and reviewed by Shaw and then sent to Westinghouse for disposition. It was insane. From Lake Charles to Pittsburgh to Charlotte then back to Shaw Modular before the red nonconformance tag could be taken off, saying it's OK now."

He adds, "Each change went through the same tortuous path, taking months and months."

The NRC also played a role, failing, in Hartz's view, to place inspection staff on site or close to Lake Charles, which would have sped up the communication and review process. "They should have had a resident inspector in Lake Charles and in Westinghouse's Cranberry Township, Pa., office, near Pittsburgh, for a first-of-a kind design," says Hartz.

But the result was that the Westinghouse-Shaw relationship became toxic. Due to mistakes in design drawings, Shaw Modular started keeping track of the hours spent dealing with the errors with the intention of billing the cost back to Westinghouse's Cranberry office. Mistrust simmered.

The Westinghouse concept called for several dozen types of modules to be built from submodules, created at Lake Charles and shipped to the power-plant sites, where they were to be fitted together in assembly buildings. The largest module, CA20, consisted of 72 submodules welded into a single structure 70 ft high and wide and weighing 1.7 million lbs. Module construction was supposed to start in February 2010, and the first CA20s were due to be finished that year, some as early as August. It was presumed that Shaw Nuclear would be purchasing modules made by Shaw Modular, an arrangement that deprived the vendor and procurement quality-control staff of the arm's-length relationship that would have existed between two separate companies. That put Hartz in a bind. With Shaw Modular expected to be the supplier, the company needed to be on Shaw Nuclear's qualified supplier list. Hartz says he felt tremendous pressure to approve Shaw Modular. At the time, he says he told himself that, as soon as the sister company passed an audit, he would make it an approved vendor.

Hartz's initial visits to Lake Charles proved unsettling. Shaw Modular's management personnel saw no difference between more typical industrial welds and nuclear ones, Hartz says. Talking to one of the welders and welding managers, Hartz recalls, "He'd say, 'It's just black iron welding,' and I'd say, 'No, it's nuclear welding with very specific rules.'"

HAPPY DAY James Bernhard Jr., chairman of Shaw Group, announced plans to build a fabrication facility at Lake Charles, La., in 2008.

AP PHOTO/BRAD PUCKETT, AMERICAN PRESS

Since Shaw Modular had no welding standard in place, it needed to hire a degreed welding engineer with nuclear experience, in Hartz's view. "I asked about it, and they laughed at me," he said. Apparently, the Lake Charles management was satisfied that there was an American Welding Society (AWS) inspector, as well as other on-site welding engineers from equipment suppliers. Anticipating that some things would be fixed, Hartz granted Shaw Modular and Lake Charles conditional approval. "When they pass the audit, I thought, 'They'll be on the list'" of approved vendors, Hartz adds.

Later in spring 2010, Hartz decided to send a Shaw Nuclear team to Lake Charles to conduct a quality-assurance performance-based audit. Southern Co., one of the V.C. Summer project's owners, also sent an inspector. Arriving in June, the 10-member team planned to work Monday through Wednesday. The team spent the three days gathering information about everything related to welding, including watching welds being made. Says Hartz, "We also talked to people buying weld rod, saw how it was stored and checked training documents and design documents."

"It quickly became apparent there were serious problems. There were inferior welds and untraceable weld filler material," he says. Even worse, welders were stamping welds that they hadn't made themselves—an infraction that ultimately prompted the NRC to penalize Shaw.

The visiting audit team gathered Wednesday afternoon to talk about what it had found. With everyone understanding the potential pitfall of work falling behind schedule if Shaw Nuclear were to exercise its

stop-work authority over Shaw Modular, the audit team voted 9-1 to stop work.

To avoid springing the decision on Shaw Modular management at an exit meeting—"a professional courtesy," says Hartz—he told some of the local managers about the vote. They were unhappy but couldn't do anything about it. Then, Hartz and one of the Lake Charles managers went to the office of a more senior Shaw Modular manager. The senior manager "threw books and smashed a chair" before he sent flying the letter opener, Hartz claims. "It just missed." Back in Charlotte, the procurement quality manager says he went through channels to solve "the behavior and the welding problem. All I wanted was an apology, but I never got one."

Instead, he says, he was bombarded with requests to lift the stop-work order; nevertheless, Hartz says his team did not lift the order, keeping module fabrication at a standstill for the following months. The hold on all fabrication and rework at Shaw Modular lasted until the final quarter of 2010, according to a report filed by SCANA Corp., co-owner of the V.C. Summer plant in South Carolina. Eventually, Shaw Modular got Shaw Nuclear to lift the stop-work order, says Hartz, who adds that he left the job in November. And Shaw did convince the NRC that its quality-control and safety culture had been fixed.

Inspections and audits are routine in nuclear power. But the welding problems persisted beyond the 2010 hold on the work. William R. Jacobs Jr., the project monitor hired by the Georgia Public Service Commission for Plant Vogtle, testified in December 2012 that, when the steel for the submodule had been changed to require full penetration, Westinghouse and Shaw Modular failed to use the correct, code-compliant weld on certain modules. Done incorrectly, the welds needed to be repaired at the Vogtle site. The quality-assurance paperwork had so many missing signatures and illegible notes that resolution sometimes "took longer than fabrication of the submodule," Jacobs stated.

The modular advantage proved illusory as the modules ended up being "stick-built" in Georgia and South

IS VOGTLE THE LAST GASP OF AMERICA'S NUCLEAR REVIVAL?

The construction, engineering and fabrication issues raised by Christopher Hartz and detailed here by ENR applied to both the Plant Vogtle and V.C. Summer nuclear expansion projects. Currently, though, those projects are facing very different political environments.

In South Carolina, a political firestorm continues to surround the cancellation of the V.C. Summer expansion by project co-owners South Carolina Electric & Gas (SCE&G) and Santee Cooper. On Oct. 28, for example, SCANA Corp.—the parent of SCE&G—was adamantly denying a report that the utility had "ousted" chief executive Kevin Marsh and COO Stephen Byrne as a result of the bungled project.

"No senior executives were terminated, nor did any resign or retire," a SCANA spokesman told ENR.

That was just the latest dustup. Politicians are continuing to hold hearings in Columbia about the bungled job and its impact on ratepayers, and the Charleston Post & Courier has reported that SCANA is in "preliminary talks" with the state about how much ratepayers will be forced to pay.

The impact on ratepayers was a primary factor in Santee Cooper's decision to cancel the project, since roughly 18% of customers' monthly bills go toward the nuclear expansion's costs. As Santee Cooper spokeswoman Mollie Gore told ENR at the time it canceled the project: "We would have to raise rates an additional 41% to complete both units and 37% to finish just one unit."

Meanwhile, in Georgia, an unusually long three-day stretch of hearings before the Public Service Commission is expected to result in the state body approving Georgia Power's request to continue moving forward with construction. Usually limited to a single day, the PSC has extended the latest round of hearings to give time to first-time "intervenors," including

LOOMING DECISION The Georgia Public Service Commission will announce its decision on the future of the Vogtle nuclear expansion project in February 2018.

PHOTOS COURTESY OF GEORGIA POWER

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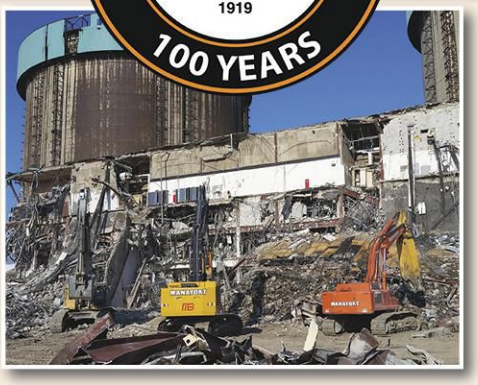

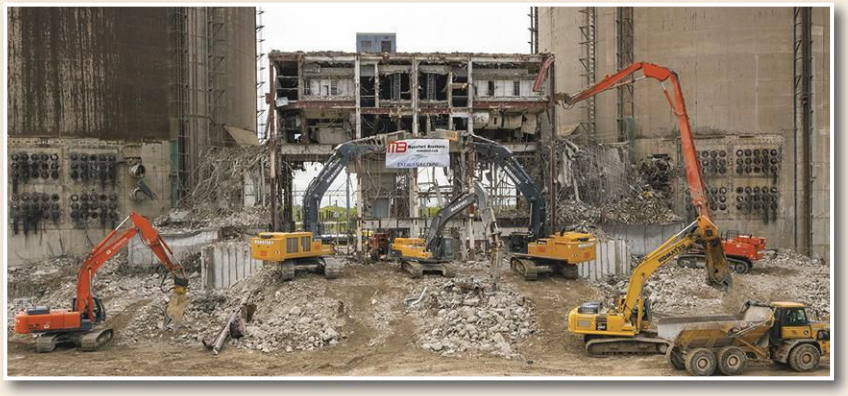

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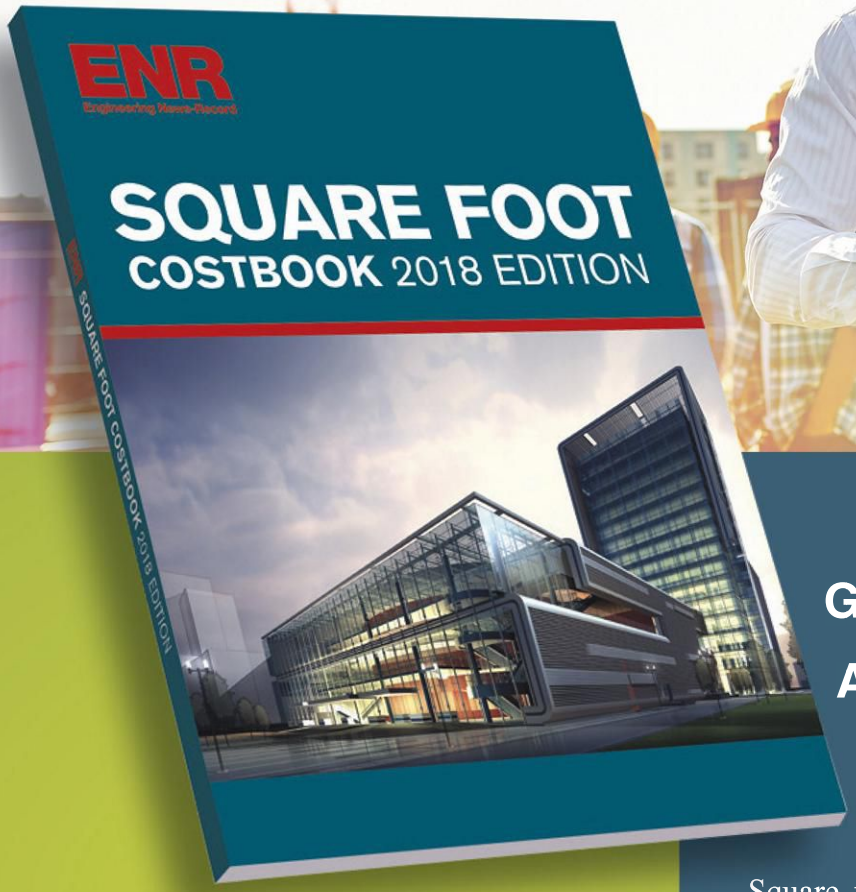

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Carolina, according to Hartz. He blames Shaw's Bernhard for what he witnessed. "Quality comes from above. It starts with the chief executive officer," he says. ENR did not receive replies to questions submitted to Bernhard, who now operates Bernhard Capital Partners, in Baton Rouge. Another former Shaw Module senior manager did not return a call for comment. In 2012, Shaw Group sold itself to Chicago Bridge & Iron, which, after bleeding cash trying to turn the nuclear projects around, sold those project contracts to Westinghouse. Before retiring, Hartz joined Bechtel National Inc. as a manager of procurement engineering. In 2014, he spoke at an NRC workshop on the nuclear supply chain and quality assurance.

If historians examine why the nuclear renaissance fizzled, they could cite Westinghouse's promise that AP1000 reactors needed "a short, 36-month construction schedule" from first concrete to core load. Or they could note that Shaw was unprepared for what it faced from its partner Westinghouse and the nuclear construction industry. The glittering promise that modular design would erase much of the risk of nuclear construction turned out to be just that, a glittering promise. The V.C. Summer and Plant Vogtle projects, instead of forming the basis of a nuclear renaissance, delivered a body blow to U.S. nuclear construction as devastating as any of the disastrous nuclear projects that are already in the history books. ■

SITEWORK
In Georgia, a worker in 2015 constructs a submodule for the Vogtle 3 and 4 reactor projects, which are ongoing.

the Nuclear Energy Institute, North America's Building Trades Union and other construction-related groups likely to argue in favor of the state permitting the project to proceed.

In late August, when Georgia Power issued its recommendation to continue construction, it also announced it was replacing Fluor Corp., its previous contractor, with Bechtel Corp. The utility also updated the planned commercial operation dates for the new units, extending them each by 29 months, to November 2021 for Unit 3 and to November 2022 for Unit 4. Those new dates are five years beyond the project's original commercial operation dates of 2016 and 2017 for Units 3 and 4, respectively.

At that time, Georgia Power reported its new estimate of $9.45 billion to complete the project, pushing the two-reactor project's total to roughly $19 billion. That date was based largely upon a cost and schedule assessment provided by Bechtel.

At the time, Steve Kuczynski, CEO of Southern Nuclear, told ENR the company was increasingly confident that Bechtel's takeover of the project would enable contractors to complete construction on this new schedule.

But Bechtel also noted several "key risks" to the cost and schedule assessment it provided. At the top of its risk list, the contractor noted: "Bechtel has not independently reviewed and validated the engineering design drawings and deliverables, which have been prepared by other entities, nor has it conducted constructibility reviews."

The contractor also noted that it had not conducted its own estimate of materials quantities, instead relying upon information from Southern Nuclear.

"Bechtel also understands that detailed engineering is not yet complete, and therefore there is the possibility that additional quantities will be identified as necessary for construction completion as engineering progresses," the firm's report added.

"If the existing quantity estimates that Bechtel has been provided prove to be inaccurate, or if quantity figures change as a result of changes to existing engineering or further engineering work, that could significantly impact Bechtel's cost and schedule assessment," the report continued.

Because Bechtel had not independently reviewed and validated the engineering design drawings or conducted constructibility reviews, it stated that any changes in these items could result in an increase in craft labor costs.

In announcing on Sept. 29 the Dept. of Energy's conditional approval of $3.7 billion in new federal loan guarantees for the project, Secretary of Energy Rick Perry stated, "I believe the future of nuclear energy in the United States is bright and look forward to expanding American leadership in innovative nuclear technologies."

The Georgia PSC is expected to announce its decision to approve or cancel the project on Feb. 6, 2018. ■

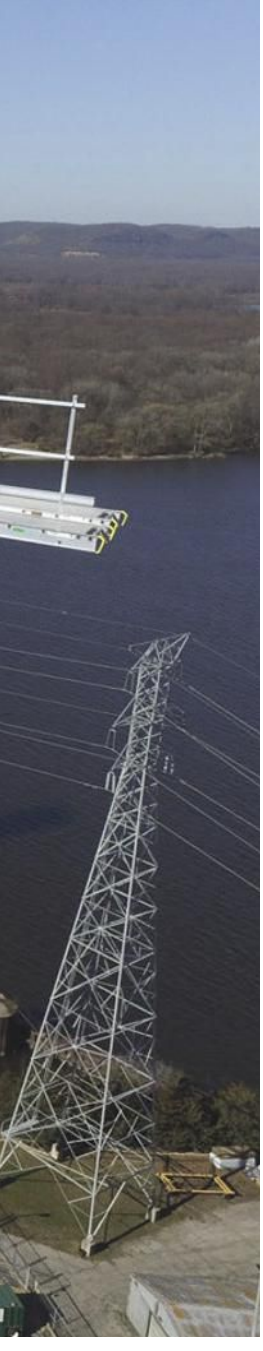
By Scott Judy

MARKET ON THE RISE:

TAKEDOWN

NUCLEAR-PLANT OWNERS AND CONTRACTORS EYE STRATEGIES TO DISMANTLE CLOSED PLANTS AND THOSE SET FOR THE HIT LIST. BUT WILL FUNDS AND STAKEHOLDERS SUPPORT THEM?

BY MARY B. POWERS, WITH SCOTT BLAIR AT SAN ONOFRE AND DEBRA K. RUBIN



UNDERWAY
In Wisconsin, the LaCrosse reactor closure continues under a 2015 license-transfer deal between a power co-op and EnergySolutions.

PHOTO, ABOVE, COURTESY OF ENERGYSOLUTIONS; PHOTO, RIGHT, SOUTHERN CALIFORNIA EDISON

Energy economics and politics may have derailed the "nuclear renaissance" and put operating plants in peril in the U.S. and elsewhere, but low natural-gas prices have accelerated a huge potential market—estimated at up to $200 billion—to clean up and take down nuclear facilities that are uncompetitive or at the end of their useful lives.

The market potential for D&D—decontamination and demolition—is compelling to industry firms with the skill and risk appetite for the work, as is the existence of federally required utility funding pools specifically set aside for the task. Financial consultant Callan LLC's latest annual review found that decommissioning "trust fund" balances rose 6%, to $64 billion, in 2016 from the previous year, aided by the strong stock market. But regulatory and community hurdles also could derail utility and contractor plans to clean up sites quickly rather than have them sit for 50 years to cool down. Nevertheless, regulatory risks and community opposition could extend and even derail prompt cleanup of certain plants, says Paul Patterson, an analyst with Glenrock Associates.

Even so, industry firms—buoyed by cleanup-fund availability at key sites and the potential of added billions of dollars in work abroad that is being driven by pressure for pre-closure, particularly in Europe and Asia—are forming joint ventures and pushing new financial strategies to pursue the market. Last December, Salt Lake City-based nuclear D&D leader EnergySolutions and AECOM, including its market veteran unit URS Corp., won a 10-year cleanup-and-demolition contract to clean up the San Onofre Nuclear Generating Station (SONGS), which closed in 2013. Sited in San Diego County, Calif., the estimated $4.4-billion project, awarded by lead utility owner Southern California Edison and others, will be one of the country's largest D&D efforts, the firms say. They are pursuing other takedowns, as well. "It is a growth market. In the next 10 to 20 years, there will be a continuous chorus of nuclear units that are shut down and decommissioned," says Matt Marston, AECOM senior vice president, who is supervising the operation.

New York City-based cleanup-and-demolition firm NorthStar Group and AREVA Nuclear Materials, a U.S. subsidiary of the French giant, are combining technical, management and regulatory expertise to take on large-scale D&D projects, too. The firms now are negotiating to buy the Vermont Yankee nuclear plant, in a move they say will speed dealing with regulators, boost cost-efficiency and lower risk. "For us, it's business as usual, and we can accelerate the decommissioning time," says AREVA unit CEO Sam Shakir, who notes the firm's global experience. "We have a business managing nuclear materials worldwide … from reactor to burial," he says. "We move fuel between countries and have a recycling facility in France." Other companies eyeing the burgeoning market include Bechtel, as well as Canada's SNC-Lavalin Group, which licenses the country's CANDU reactor technology and its more efficient uranium-fuel recycling.

The firm's just-completed buy of U.K.-based design firm Atkins adds personnel familiar with British nuclear sites set for D&D, as well as those in the U.S., says CEO Neil Bruce. The firm in July signed a teaming deal with U.S.-based Holtec International to pursue that market and work in small-modular-reactor development. Since a U.K. government report last month outlined private contractors' management problems at 12 Magnox plants, industry participants are watching how authorities will proceed in nuclear-cleanup procurement.

Moving to DECON

Firms eyeing the U.S. market are primarily interested in what the U.S. Nuclear Regulatory Agency calls "DECON," or accelerated immediate decommissioning, rather than "SAFSTOR," in which plants can sit for at least 50 years while radioactive material decays. "The market is huge, about $200 billion," says Ken Roebuck, EnergySolutions president of disposal and

TO COME
Getting started in California, the $4.4-billion San Onofre D&D project could be the largest in the U.S.

ON TRACK
The $1-billion decommissioning of the Zion nuclear plant in Illinois is 1.5 years ahead of its 10-year schedule, says a cleanup-team executive.

nuclear decommissioning. Decisions to seek D&D contracts are based on both technical and business factors. EnergySolutions' analysis shows funding to be "robust," with trust-fund earnings slated to reach $121 billion to $182 billion, plus the U.S. Energy Dept.'s $42 million to pay for spent-fuel management, says Roebuck. Plants do not need to go into SAFSTOR while trust-fund interest is accrued, he noted.

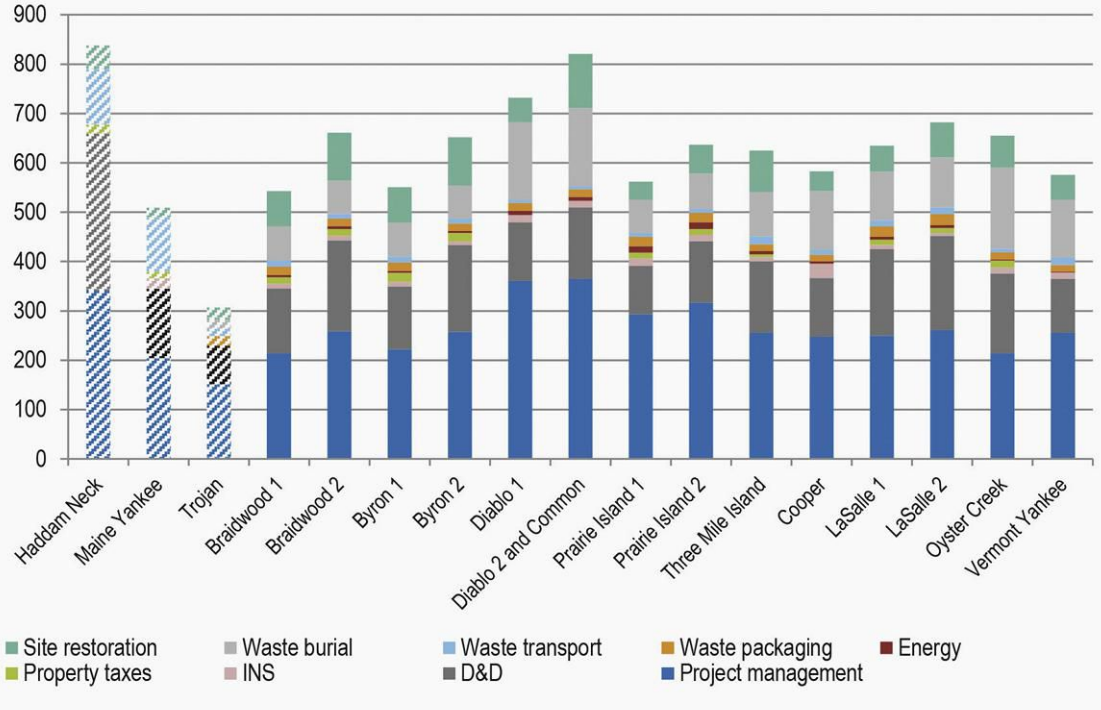
There are 13 plants that already have announced closings and 29 more are expected to close—all merchant plants that cannot compete with low natural-gas prices for power production without subsidies. Another 99 still are operating. EnergySolutions approached utility company Exelon, which owns a fleet of nuclear plants, to show that it could decommission a plant with a predictable cost and schedule. It hoped that its 10-year decommissioning of the two-unit, 2,080-MW Zion plant in Lake County, Ill., north of Chicago, which was begun in 2010, would jump-start the DECON market. The $1-billion project, the largest U.S. nuclear plant D&D to date, is one and a half years ahead of schedule and within $6 million of its expected cost, Roebuck says. "Zion has gone well, and it's a role model setting new standards," he contends. Exelon transferred Zion's nuclear license to EnergySolutions; it will be returned when decommissioning is complete, and the utility company will retain control of spent fuel stored on site.

EnergySolutions owns an integrated packing, transportation and logistics provider for radioactive and hazardous materials, as well as a processing plant near Oak Ridge, Tenn., and the Clive disposal site in Utah for power-plant waste and interim storage of spent fuel. DECON has been used at the Maine Yankee, Connecticut Yankee and enough other sites to better predict the cost and schedule (see chart), says AECOM's Marston. But selection of the decommissioning method depends on site circumstances. In Waterford, Conn., Dominion Energy's Millstone Unit 1 is in SAFESTOR because its two other units are still operating.

The most technically risky part of a project has been segmentation and disposal of the reactor vessel.

A LOOK AT U.S. NUCLEAR-SITE DECOMMISSIONING COSTS

SOURCE: PACIFIC NORTHWEST NATIONAL LABORATORIES



***FOOTNOTE** DATA IN CROSS-HATCHED BARS IS BASED ON ACTUAL COSTS; DATA IN THE OTHERS IS BASED ON ESTIMATES

PHOTO (TOP) COURTESY OF ENERGYSOLUTIONS

EnergySolutions completed the first large commercial reactor segmentation in the U.S. in 2015 at the Zion plant, cutting the structure with an oxy-prone torch connected to a robotic fixture outside of it. "Extensive design, analysis, mock-up testing and planning resulted in a fast-cutting sequence with no release of radiation," said John Sauger, then-executive vice president of Zion Solutions LLC, the EnergySolution unit managing the D&D. Cutting the vessel into smaller pieces also reduced risk in disposal and transportation. Roebuck says the task took two years of off-site and on-site engineering.

Veterans of Maine Yankee, Zion and D&D work at Energy Dept. former nuclear production sites have taken their lessons learned to the SONGS project to mix it with younger workers' penchant for new technology. "Knowledge transfer is a big deal for us," Marston points out.Once all permits have been approved, SONGS demolition is set to begin in 12 to 18 months. Southern California Edison in September settled a 2015 lawsuit filed by opponents of an on-site dry-storage plan, allowing the operation to proceed. Work will then begin to move 2,668 spent-fuel assemblies to a just-completed addition to an independent, on-site spent-fuel storage installation from pools in reactor Units 2 and 3.

The previous facility housed 51 stainless-steel canisters entombed in high-strength concrete; now in testing, the addition will house another 73. "The plant has the highest seismic qualifications of any nuclear plant in the country. The dry-storage pads have more than double that," says Maureen Brown, a SONGS spokeswoman. "Once all the spent fuel is removed from Units 2 and 3, that gives [the D&D crew] access to completely decommission the site," says James Madigan, technical adviser to the utility's chief nuclear officer, noting challenges, however, in the tight, 85-acre site.

Elsewhere in California, crews at the Humboldt Bay Power Plant near Eureka almost have completed demolition of its buried nuclear reactor. Located along the Pacific Ocean, Unit 3 was the first commercial nuclear power plant to feature a below-grade reactor core. Built in the late 1950s, the vessel, housed within a 60-ft-dia concrete caisson, was sunk 80 ft underground and nearly 66 ft below sea level.

Looking Ahead

NorthStar and AREVA have yet to begin Vermont Yankee D&D as part of a deal reached last November under which Entergy agreed to sell them the 620-MW plant and transfer its NRC license. Plans also include placement of all of the facility's spent fuel in dry-cask storage by 2018.

Despite continuing disputes over cleanup standards that could add to costs and even scuttle the deal, the firm expects it to close late next year. NRC and state regulators must approve the transfer. "They are asking us to take a leap before we know what we're leaping to," says Chris Recchia, former chairman of the state public service commission, noting that NorthStar has not done a complete nuclear D&D project before.

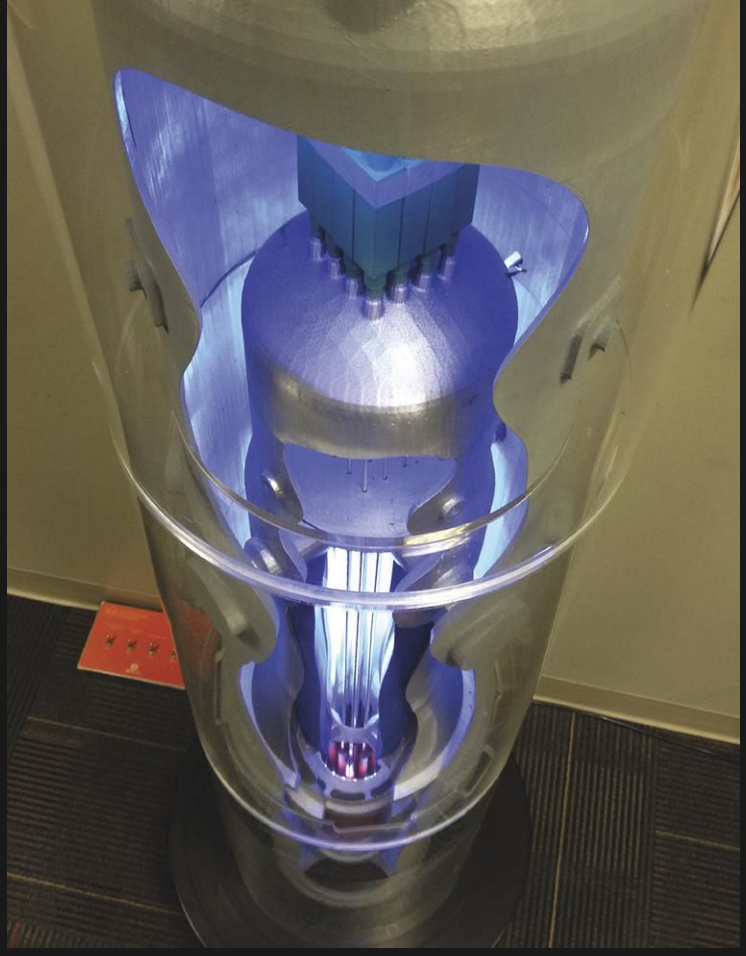
NEW PLATFORM
Crews from cleanup-demolition firm North Star work at an industrial site. The firm has partnered with global nuclear-waste giant AREVA to buy a U.S. nuclear plant and manage its decontamination and decommissioning.

Another question is whether NorthStar lowballed the D&D costs since Entergy's estimate was $57 million higher. "Entergy's estimate was based on an entirely different assumption and approach," NorthStar CEO Scott State says. "The major risk is project execution, and we have experience on projects larger than a nuclear plant and the nuclear owners do not," he contends. "It's a large industrial demolition project with a radiological component." The company's link with AREVA under one umbrella organization is an advantage, say the firms' chief executives.

NorthStar's other partners on the project are Burns & McDonnell and Dallas-based Waste Control Specialists, which will store Vermont Yankee spent fuel at an interim storage facility that awaits an NRC license. Entergy had chosen SAFSTOR for Vermont Yankee, with decommissioning to start in 2053, but NorthStar proposed to have it completed in 2026. As a general rule, DECON represents a 10% to 20% savings over SAFSTOR, State says, adding that Vermont Yankee's trust fund of about $580 million will cover the cost.

NorthStar prefers to buy the plants, which is the utility's only way to transfer the risk, says AREVA's Shakir. Entergy already has announced it will close the 690-MW Pilgrim plant in Massachusetts and the 805-MW Palisades unit in Michigan, although cleanup details have not been aired. But utility Vice President T. Michael Toomey, noting the cleanup firms' D&D experience, in-house labor force and vendor relationships, acknowledges that "Entergy's primary expertise is in operating nuclear power plants, rather than decommissioning them." ■

PHOTO (TOP) COURTESY OF NORTHSTAR GROUP



NUCLEAR ENERGY UNDERGOES A POWER SHIFT

WHILE BIG NEW REACTORS IN THE U.S. ARE STALLED, SMALL REACTORS, NEWER TECHNOLOGIES AND WORK ABROAD MAY FILL THE GAP

BY PAM RADTKE RUSSELL

Don't tell Bill Gates, Fluor Corp. or China that nuclear power is on the wane. And certainly don't mention the trend to the companies that are developing more than 90 advanced nuclear technologies or the 15 countries building 60 reactors. While economic, construction, engineering and regulatory factors make it unlikely that—for years, if ever again—another large nuclear plant will be built in the U.S., several companies are spending millions of dollars to develop different nuclear technologies and small modular designs that may prove to be cheaper, easier to build and more flexible in their capacity. And the factors that make big nuclear difficult in the U.S., like cheap domestic natural gas, aren't hampering new builds in China, Korea, India and elsewhere.

INTEGRATED
The NuScale power module incorporates steam generation and heat exchange into a single unit.

"Internationally, in 2016, slightly under 10 GW of new generation was brought on line, the newest generation since the 1980s," says Matt Lee, director of nuclear operating-plant projects for Black & Veatch. "New nuclear is not dead. It is actually growing."

Indeed, as the U.S. is looking away from big new nuclear plants, India, China, Russia and other countries are turning to new nuclear to provide power to their growing populations and to reduce carbon emissions under the Paris Climate Accord.

In addition to the 60 reactors being built, 100 more are on order or planned, and more than 300 are proposed, according to the World Nuclear Association. The strongest market for new nuclear power is in Asia, specifically China, where 20 new reactors are under construction. In fact, China is on track to bring four AP1000 reactors on line next year. The Westinghouse-designed AP1000 was used to build the now-canceled V.C. Summer reactors in South Carolina, as well as the two Vogtle reactors in Georgia that now are scheduled to come on line starting in 2021.

'Gold-Plated' Plants

Compared to China's nuclear industry, U.S. players face a more rigorous regulatory authority at the federal level. "I think it costs less in China because of [Nuclear Regulatory Commission] scrutiny," says Aneesh Prabhu, senior director of U.S. energy infrastructure for S&P Global Ratings. In the U.S., "labor costs are more [and] material costs are more because you want to gold-plate the plant" to achieve NRC approval, he observes.

Further, other countries have a greater commitment to nuclear power than does the U.S., says Rex D. Geveden, president and CEO of BWX Technologies. BWXT and Bechtel earlier this year halted development of a small modular reactor called mPower because they determined there was little demand for the reactor.

"If you look at what's going on in China, India and the Middle East, those nations are committed to energy independence. They are committed to energy security," says Geveden. "When there's a national commitment to it, you can make it happen."

While Geveden doesn't see that commitment yet on these shores, the push toward new nuclear in other countries is a business opportunity for U.S. companies, including BWX, which is working in Canada as well as the U.S.

Black & Veatch sees opportunities as an owner's engineer in the United Kingdom, Argentina and South Africa—"That's our primary focus outside the U.S.," says Lee. But transferring U.S. nuclear technology and knowledge can prove to be difficult. Before U.S. companies can enter into a nuclear deal with another country, Congress must approve the "123" agreement with that country. The agreement, under the Atomic Energy Act, sets the terms for sharing U.S. peaceful nuclear energy technology, equipment and materials. The U.S. has such agreements in place with countries including Japan, Australia and South Africa, but not with Iran or India. Further, the Energy Dept. oversees exports and imports of nuclear materials under another law. "U.S. companies have limitations," Lee said.

The nonproliferation agreements make it costly and difficult—if not impossible—to work with other countries. The Nuclear Energy Institute (NEI), among others, says the restrictive regulations must change or the U.S. risks being shut out of oversight of nuclear programs in developing countries.

"The U.S. position generally comes from the 1950s, when the U.S. was the only one supplying the technology," says Marcus Nichol, a senior project manager at NEI. "Today, those same conditions don't exist."

Indeed, if a nonproliferation agreement has not been forged, a country seeking a U.S. company's technology must look elsewhere, Nichol notes. "There is a fundamental change that needs to happen," he says. If U.S. companies aren't supplying the technology to build the plants, "we're allowing China and Russia to dictate the standards."

The red tape, however, isn't keeping U.S. companies out of the international market. Earlier this year, Holtec and SNC-Lavalin agreed to develop and globally deploy

MOCK-UP
NuScale shows off a full-scale mock-up of the upper module of its small nuclear reactor.

"New nuclear is not dead. It is actually growing."
—MATT LEE
DIRECTOR OF NUCLEAR OPERATING PLANT PROJECTS FOR BLACK & VEATCH

PHOTOS COURTESY OF NUSCALE

NEW NUKES
The majority of new nuclear plants are being built in Asia, specifically China. This map shows the concentraiton of new nuclear plants in different countries.

small modular reactors, while GE Hitachi Nuclear Energy and Advanced Reactor Concepts, both based here, are working together to develop a reactor in Canada.

One company, NuScale, sees a market for the small reactors both internationally and in the U.S. and, since 2000, has invested almost $700 million to design and build the new reactor, says John L. Hopkins, CEO of NuScale and a former Fluor Group president. Fluor became majority owner of NuScale in 2011.

NuScale has an agreement with the Utah Associated Municipal Power Systems to build a 600-MW nuclear plant at the Idaho National Laboratory, using 12 of its 50-MW small modular reactors (SMRs). Earlier this year, NuScale submitted its design to the NRC. The application was partly financed through the Energy Dept.'s licensing and cost-share program. Design certification is expected to take 40 months. So far, the process is going well and ahead of schedule, Hopkins says.

"I'm pretty bullish that we're going to get through this," Hopkins says. The company expects to be operational in Idaho by 2024 or 2025. He says the company is "paving the way" at NRC for a host of other technologies, such as TerraPower's travelling wave reactor. A venture partly funded by Bill Gates, TerraPower hopes to have its first reactor operating in China by 2024.

NuScale and other modular developers tout the efficiencies of having a controlled factory in which to build modular reactors that can be shipped and installed in place on site. The streamlined process is tantamount to a large heavy-civil project. Ideally, the units would be mass-produced— similar to at Boeing, Hopkins says—and shipped in three pieces to the site. One hundred and twenty-six of the smaller units can fit inside the containment vessel at Vogtle, he notes.

The smaller, scalable nature of the units makes them more attractive than a 2,000-MW nuclear plant, says Prabhu of S&P. Hopkins says the 600-MW plant can be built on 32 acres for less than $3 billion, and owners can choose to build them in smaller, 50-MW increments.

NuScale, however, is not selling its technology as a replacement for traditional nuclear plants. "Our focus is not to compete against large reactors or renewables," Hopkins says. Instead, he thinks the reactors are best seen as a replacement for retiring coal plants. The SMRs could be installed on the same site as an aging coal plant and use the same transmission system. "Our sweet spot is between 300 to 600 MW," Hopkins adds.

NuScale sees other applications for its reactors, such as supplying affordable power for refining and desalination plants. "In the end," Hopkins says, "it's all about commercial viability."

Unlike larger reactors, which slowly start up and slowly shut down, the smaller reactors can be quickly ramped up and down, depending on what other electricity is being supplied to the grid. This feature makes them a more useful companion to wind and other renewable power. Currently, if older, larger nuclear plants are running when the wind is blowing, a nuclear plant often has to sell its power at the same price as wind, which can be below an operator's cost, Prabhu says.

Nichol says successful placement of a small modular reactor will demonstrate that they can be built on budget and on schedule. "We would expect, early on, somewhat slow development. No one wants to build the first. There are a number of utilities that would be happy to be the second," he says. "Roughly, we might expect five to be operational between 2026 and 2030. As long as we can demonstrate 'on time and on budget,' we should see the numbers grow." ■

SANMEN
China National Nuclear Corp. is testing its AP1000 Sanmen plant, which should be on line in 2018.

PHOTO (LOWER LEFT) IMAGINECHINA/AAP IMAGES

ENR 2017 Construction Anniversaries II

As Years Pass By

Celebrating successes in 2017

By Eda Galeno

WHAT'S INSIDE

Meeting New Challenges

As the years go by, new companies form, but not all of them pass the test of time. However, there are those that not only pass—they thrive. The celebration of a corporate anniversary is a testament to a company's ability to face and overcome challenges specific to its industry.

In construction, the growth of technology, a shrinking workforce, increased regulations and changes in project processes present new hurdles that not every company can maneuver.

"Twenty years ago, companies were getting used to discarding line drawings and blueprints in favor of computer-aided design (CAD) drawings. Since then, the industry has benefited from building information modeling (BIM) programs, 3D, 4D and even 5D CAD, and cloud-based communications technologies," says *ENR* Senior Editor Gary Tulacz. "All of these have aided in productivity, but they also all cost money and time to obtain the hardware, software and train people in their use."

Two reasons Tulacz cites for the industry's shrinking workforce are the aging baby boomer generation entering retirement and the reluctance of young people to enter the industry given its reputation of a place for hard manual labor.

"The first hints of this started appearing in the late 1990s, but its impact was blunted by the recession of 2000 in the wake of the dot-com bomb," he explains. "However, it became a major issue in the mid-2000s, when the market started overheating. The financial meltdown of 2008 and the industry recession put some of this problem in abeyance, but savvy companies strove to hold on to as many of their workers as possible even during the depths of the recession so they would be available when the market rebounded." Today, the staff shortages are as acute as ever.

Other obstacles within the past 20–30 years that successful contractors have overcome include changes in the actual construction process. "Large-scale general and trade contractors are increasingly becoming involved in construction earlier in the process with design-build so they have to develop skills such as design management," says Brian Bowen, chairman emeritus of the Construction History Society of America and professor of practice at Georgia Institute of Technology. "They're also interfacing with architects and engineers and getting involved in conceptual estimating and cost planning."

Construction of the Shasta Dam in California, 1940

> ***"The number of regulatory road blocks that stand between concept and construction have only grown."***
>
> —Brian Turmail,
> Senior Executive Director,
> AGC of America

As time progresses, regulations also tend to increase—posing yet another hurdle. "The number of regulatory road blocks that stand between concept and construction have only grown," says Brian Turmail, senior executive director of public affairs for Associated General Contractors of America. "And even after construction has started, most firms today are forced to dedicate considerable time, energy and personnel to complying with—and proving compliance with—countless regulations, many of which solve problems that don't exist or fail to address actual problems."

Secrets to Success

Bowen notes that many family-run businesses in the general contracting field seem to have cracked the code for continued success. "Turner has had at least four generations running the business since it began in 1902, and it is the largest building contractor in America. That's success," he says. "The secret is a good transition and set of family values passed on from generation to generation."

However, he notes that even when a family does have to turn over the reins, if the founding values remain intact, success usually continues. "Gilbane is a fifth-generation, family-owned business, but the current CEO is not a family member," Bowen explains. "However, he shares the family values that have been instilled by those generations."

"The construction market is not for the faint of heart," Turmail adds. "It takes hard work, a commitment to quality, dedication to detail, financial savvy, charisma, a willingness to embrace new technologies and new techniques, and a decent amount of luck for firms to enjoy continued success." ◆

PHOTO: COURTESY OF CONSTRUCTION HISTORY SOCIETY OF AMERICA

Anniversary Gallery

130 YEARS | **Founded 1887**

Sprung Instant Structures Inc.

5711 W. Dannon Way
West Jordan, Utah 84081
T: 800-528-9899 | www.sprung.com
Contact: Jim Avery | averyj@sprung.com

Sprung's durable, precision-engineered structures are a solution of choice for a broad range of industries needing a fast, reliable and cost-effective building solution.

Located in Salt Lake City, Sprung Instant Structures is a member of the Sprung Group of Companies in business since 1887, which has achieved international recognition by providing shelter solutions for thousands of different applications in more than 100 countries throughout the world. Sprung is the inventor of the stressed membrane structure, engineered to accommodate the world's need for enclosed space quickly and economically.

Phil Sprung Jr., President

"Sprung Structures evolved from Sprung Western Tent and Awning, which originally started in 1887 manufacturing and selling chuck wagon covers, teepees and unique shelters for Western settlers. In 1969, my father, Phil Sprung Sr., invented the tensioned membrane structure as a result of the resource industries needing a faster, more responsive building alternative. The company is now the largest manufacturer of fabric tensioned membrane structures, and in its fourth generation of Sprung family leadership and fifth generation of Sprung family employees. We pride ourselves on the quality of our product, the passion for what we do and the trust we have in the people that work with us."

90 YEARS | **Founded 1927**

Pepper Construction

643 N. Orleans
Chicago, IL 60654
T: 312-266-4700
www.pepperconstruction.com
Contact: info@pepperconstruction.com

Now in its third generation of family leadership, Pepper serves national clients from offices in Illinois, Indiana, Ohio and Wisconsin working in markets such as health care, senior living, manufacturing, data centers and interiors among others. One of the Midwest's largest contractors, the firm's current and recent projects include The 1060 Project at Wrigley Field, The Robey Hotel, The First Division Museum at Cantigny Park, Jenkins and Nanovic Halls at Notre Dame, Community Hospital East in Indianapolis and IKEA projects in Ohio, Indiana and Wisconsin.

Stan Pepper, CEO

"Since 1927, Pepper Construction has been privileged to build some of the most iconic projects across the country. While the values on which our company was founded have not changed, the tools we use to build are rapidly changing the possibilities. As our industry moves to the forefront of emerging technology, construction is one of the most exciting professions available to new working generations. The integration of diverse talent and techniques blended with our experienced thought leaders is creating a dynamic, forward-thinking organization. Together, we're looking forward to the next century of progress."

60 YEARS | **Founded 1957**

Penhall Co.

1801 Penhall Way
Anaheim, CA 92801
T: 714-772-6450 | www.penhall.com
Contact: Joe Morello, Vice President of Corporate Development
jmorello@penhall.com

Penhall Co. began operations in 1957 when Leroy Penhall realized an opportunity during Anaheim, Calif.'s development boom of the late 1950s.

What began as a single flat-saw operation 60 years ago has developed into an expansive offering of concrete solutions, including concrete cutting, scanning and breaking/removal, as well as roadway grooving/grinding, utility locating and seismic retrofitting services.

Today, Penhall is the largest U.S. supplier of concrete services. The company's capabilities and expertise span more than 40 locations in 18 states and Canada. With a world-class fleet and state-of-the art equipment, Penhall's dedicated team has the technology and resources to provide safe, high-quality, affordable concrete solutions for its customers—anytime, anywhere.

Joe Morello, Vice President of Corporate Development

"Through the efforts of all leaders and employees, past and present, Penhall Co. has built a world-class reputation as a leader in the concrete services industry for projects large and small. We maintain a deep commitment to safety and innovation, and we continually strive to increase our value to our customers. I am honored and proud to be a part of this great organization as we celebrate 60 years."

Celebrating 90 Years of Perspective and Value

Since 1927, Pepper Construction has had the privilege to work with clients of all types, bringing their ideas to life through the built world.

Stanley F. Pepper founded the company with the belief that every project is a place—an integral part of the community, often a catalyst for change and always full of potential. We believe that the impact these structures have on the people who live, work and play in them reaches far beyond construction, often strengthening the connection between communities and providing a place for every aspect of life.

In 1957, Richard and Roxelyn Pepper began leading the company and built on Stanley's legacy. This enduring perspective has led our team of craftsmen and thought leaders in shaping nearly a century of growth, from the restoration of iconic treasures to complex health-care facilities, state-of-the-art manufacturing facilities and data centers.

Over the past nine decades, Pepper has seen tremendous change in construction technologies. Today, our teams are pushing the boundaries of how virtual and augmented reality can improve customer experience, bringing life-cycle and total-cost-of-ownership conversations forward, considering how building performance affects human performance and opening the door for even more collaboration.

Pepper Construction's history is filled with iconic structures. It's currently restoring Wrigley Field, known as The 1060 Project.

PHOTO: MARK BALLOGG PHOTOGRAPHY

With third-generation leadership in place, Pepper serves national clients from locations in Chicago, Cincinnati, Columbus and Indianapolis. And the company continues to grow, announcing this month a new location in Milwaukee.

Innovation and progress would not be possible without our clients, our team and the communities we are privileged to serve. As we embark on the next chapter of our history, we celebrate the ideas and perspectives behind our projects. ◆

More Than a Century of Service

Beginning in 1887 with the manufacture of chuck wagon covers, teepees and unique shelters for Midwest settlers and Native Americans, Sprung's history is a small-business success story that typifies entrepreneurism. Over the decades, this family-run company has adapted to new technology, innovating new products for diverse and changing markets.

Sprung invented and patented the stressed membrane structure, an innovative alternative to conventional construction that utilizes architectural membrane panels under high tension within a non-corroding aluminum substructure. This technology allows for the quick design and delivery of structures for a wide variety of applications. Our ability to build quickly, without foundations, helps us meet the needs of clients facing difficult deadlines in places where conventional structures may not always be feasible.

Sprung structures are now utilized by leading businesses and organizations around the world. We provide structures for industries including global armed forces, the natural resource industry, homeless shelters, commercial gaming, faith organizations and disaster recovery organizations.

Sprung believes in giving back—especially in times of great need. We donated structures to the recovery efforts at Ground Zero after 9/11. We have also donated structures after tsunamis in the Philippines, and more recently to help relief efforts in Barbuda after the devastating effects of Hurricanes Irma and Maria. ◆

A Sprung factory from the early 1900s

PHOTO: COURTESY OF SPRUNG STRUCTURES

ENR's 20-city average cost indexes, wages and material prices. Historical data and details for ENR's 20 cities can be found at ENR.com/economics

Construction Cost Index

ANNUAL INFLATION RATE

+4.1%

NOV. 2017

1913=100	INDEX VALUE	MONTH	YEAR
CONSTRUCTION COST	10870.06	+0.5%	+4.1%
COMMON LABOR	22992.91	+0.2%	+3.7%
WAGE $/HR.	44.11	+0.2%	+3.7%

The Construction Cost Index's annual escalation rate rose to 4.1% from 3.7% last month, as the monthly labor cost component increased 0.5%.

Building Cost Index

ANNUAL INFLATION RATE

+3.7%

NOV. 2017

1913=100	INDEX VALUE	MONTH	YEAR
BUILDING COST	5901.86	+0.6%	+3.7%
SKILLED LABOR	10195.99	+0.3%	+2.7%
WAGE $/HR.	56.40	+0.3%	+2.7%

The Building Cost Index's annual escalation rate rose to 3.7%, while the monthly component increased to 0.6%.

Material Cost Index

MONTHLY INFLATION RATE

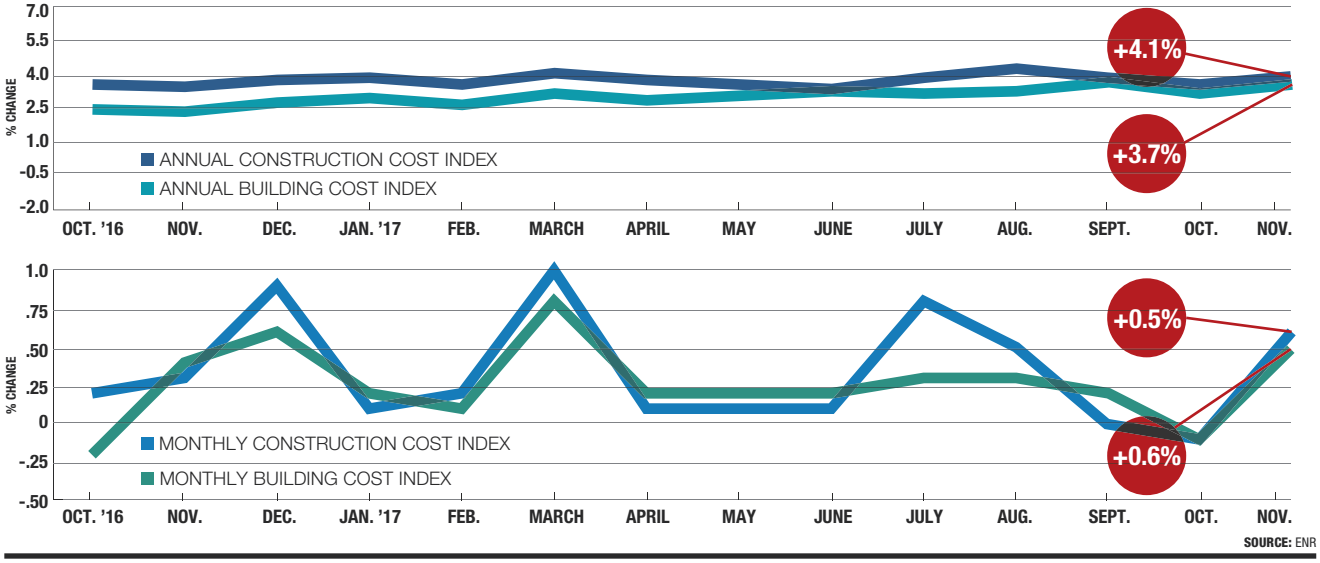
+0.7%

NOV. 2017

1913=100	INDEX VALUE	MONTH	YEAR
MATERIALS COST	3264.63	+0.7%	+3.7%
CEMENT $/TON	113.99	0.0%	+3.9%
STEEL $/CWT	51.54	0.0%	+3.7%
LUMBER $/MBF	579.18	+1.2%	+11.7%

The MCI increased 0.7% this month, with an annual escalation rate of 3.7%.

Inflation's Pulse Year-to-year and monthly percent changes for ENR's cost indexes



SOURCE: ENR

Cost Index Review

		CONSTRUCTION		BUILDING		SKILLED WAGES		COMMON WAGES	
BASE YEAR		1913	1967	1913	1967	1913	1967	1913	1967
2016	Oct.	10434.56	971.41	5681.63	840.98	9927.94	975.29	22172.53	1071.59
	Nov.	10442.61	972.16	5690.35	842.27	9927.94	975.29	22172.53	1071.59
	Dec.	10530.94	980.38	5722.81	847.08	10011.37	983.44	22394.25	1082.33
	Jan.	10542.01	981.42	5733.88	848.78	10011.37	983.44	22394.25	1082.33
	Feb.	10558.63	982.96	5742.06	849.93	10021.37	983.58	22416.64	1083.48
	Mar.	10667.39	993.09	5789.41	856.94	10021.37	983.66	22530.96	1089.02
	April	10678.15	994.09	5801.76	858.77	10061.45	984.14	22530.96	1089.02
2017	May	10692.17	995.39	5815.76	938.89	10061.45	984.14	22530.96	1089.02
	June	10702.81	996.38	5826.40	862.41	10061.02	984.14	22530.96	1089.02
	July	10789.41	1004.45	5844.30	865.06	10090.19	987.07	22783.30	1101.31
	Aug.	10826.31	1009.30	5862.24	867.72	10132.56	991.25	22904.05	1107.20
	Sept.	10822.92	1007.57	5872.80	869.28	10157.89	993.70	22926.95	1104.64
	Oct.	10817.11	1007.03	5866.92	868.41	10168.05	994.52	22949.87	1105.04
	Nov.	10870.06	1011.95	5901.86	873.58	10195.99r	1001.27	22992.91r	1110.36

INFLATION

+4.1%

Construction Cost Index

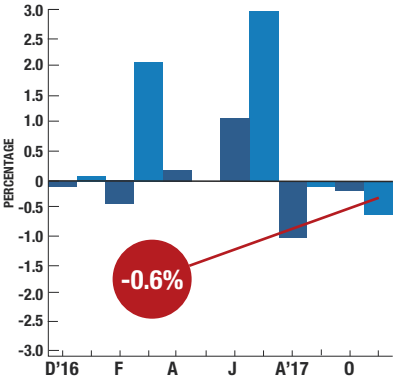
ANNUAL ESCALATION INCREASED TO 4.1% THIS MONTH, UP FROM 3.7% LAST MONTH, AND THE LABOR-COST INCREASE WAS 0.5%.

Cement prices fell 0.6% in September, following a decrease of 0.2% in August, according to the Bureau of Labor Statistics' producer price index. Annual escalation for the index dropped to 4.2% in September, after holding steady at 4.8% for two consecutive months. ENR's 20-city average price for portland cement did not change this month, while annual prices are up 4.6%. Masonry-cement prices increased 0.3% in November, while yearly prices are 10.9% higher than this time last year. All three types of crushed stone were above last year's prices.

PRODUCER PRICE INDEX

CEMENT

Monthly Percent Change



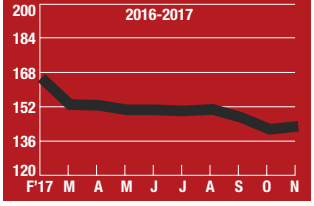
SOURCE: BUREAU OF LABOR STATISTICS

ENR's Materials Prices For November 2017

CONCRETE BLOCK

-3.2%

YEARLY PRICES FOR CONCRETE BLOCK ARE DOWN 3.2%, WHILE MONTHLY PRICES ARE UP 1.0%.

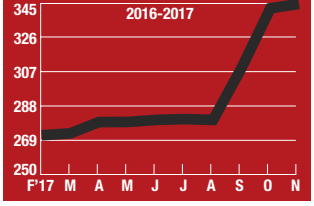


1992=100

READY-MIX CONCRETE

+2.4%

READY-MIX-CONCRETE PRICES ARE 2.4% ABOVE NOVEMBER 2016'S LEVEL.

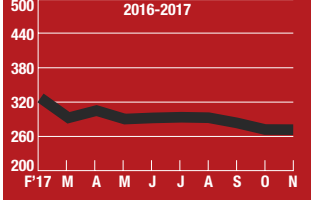


1992=100

ASPHALT PAVING

+2.1%

ASPHALT PRICES SLIPPED 0.1% THIS MONTH, WHILE YEARLY PRICES ARE UP 2.1%

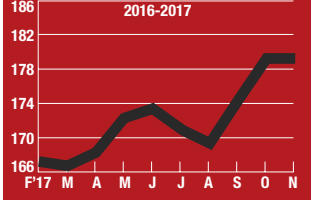


1992=100

PORTLAND CEMENT

+4.6%

PORTLAND CEMENT HELD STEADY IN NOVEMBER BUT REMAINS 4.6% ABOVE A YEAR AGO.



1992=100

20-CITY AVERAGE

ITEM	UNIT	$PRICE	%MONTH	%YEAR
ASPHALT PAVING				
PG 58	TON	378.05	–0.1	**+2.1**
Cutback, MC800	TON	385.88	+0.1	+0.1
Emulsion, RAPID SET	TON	358.45	0.0	–0.2
Emulsion, SLOW SET	TON	368.89	–0.1	+0.1
PORTLAND CEMENT				
Type one	TON	114.04	0.0	**+4.6**
MASONRY CEMENT				
70-lb	BAG	9.39	+0.3	+10.9
CRUSHED STONE				
Base course	TON	10.09	0.0	+0.4
Concrete course	TON	10.81	0.0	+0.2
Asphalt course	TON	11.13	0.0	+1.2
SAND				
Concrete	TON	9.10	+0.1	–0.4
Masonry	TON	10.99	+0.1	+0.6
READY-MIX CONCRETE				
3,000 psi	CY	114.61	+0.7	**+2.4**
4,000 psi	CY	132.82	+1.7	+14.4
5,000 psi	CY	149.55	+1.1	+22.4
CONCRETE BLOCK				
Normal weight: 8" x 8" x 16"	C	134.53	+1.0	**–3.2**
Lightweight: 8" x 8" x 16"	C	167.52	+1.3	+0.3
12" x 8" x 16"	C	178.82	+1.7	+2.3

SOURCE: ENR

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Please contact our YGS Group Account Manager Lauren Lau by phone at 717-430-2251 and by email at lauren.lau@theygsgroup.com.

Thank you,

Scott J. Seltz,
Publisher
ENR Engineering News-Record

ENR TOP OWNERS

DOWNTOWN Leo A Daly designed the 12-story, mixed-use Omaha Marriott Downtown Capitol District, in Omaha, Neb.

PHOTO COURTESY OF LEO A DALY

Owners Ramp Up Programs

The market continues to be strong, but the owners who write the project checks increasingly are concerned about costs By Gary J. Tulacz

TOP FIRMS WITH CONSTRUCTION IN PROGRESS

CHEMICALS AND ALLIED PRODUCTS

RANK	FIRM	($ MIL)
1	DOWDUPONT INC.	6,100.0
2	JOHNSON & JOHNSON	3,354.0
3	PROCTER & GAMBLE CO.	2,706.0
4	PFIZER INC.	2,127.0
5	MERCK & CO INC.	1,871.0
6	ELI LILLY AND CO.	1,797.5
7	MOSAIC CO.	1,737.6
8	PRAXAIR INC.	1,558.0
9	AIR PRODUCTS AND CHEMICALS INC.	1,528.0
10	E. I. DU PONT DE NEMOURS AND CO.	1,424.0

RETAIL STORES

RANK	FIRM	($ MIL)
1	WAL-MART STORES INC.	4,301.0
2	HOME DEPOT INC.	739.0
3	COSTCO WHOLESALE CORP.	701.0
4	LOWE'S COS INC.	464.0
5	KOHL'S CORP.	318.0
6	TARGET CORP.	200.0
7	FASTENAL CO.	152.5
8	DOLLAR TREE INC.	146.0
9	DOLLAR GENERAL CORP.	72.5
10	PRICESMART INC.	46.9

HEALTH SERVICES

RANK	FIRM	($ MIL)
1	HCA HEALTHCARE INC.	1,318.0
2	DAVITA INC.	480.4
3	TENET HEALTHCARE CORP.	339.0
4	UNIVERSAL HEALTH SERVICES INC.	278.7
5	LABORATORY CORP. OF AMERICA HOLDINGS	193.0
6	QUEST DIAGNOSTICS INC.	193.0
7	LIFEPOINT HEALTH INC.	178.3
8	SELECT MEDICAL HOLDINGS CORP.	164.5
9	ACADIA HEALTHCARE CO INC.	157.1
10	HEALTHSOUTH CORP.	95.2

ELECTRIC, GAS AND SANITARY SERVICES

RANK	FIRM	($ MIL)
1	SOUTHERN CO.	8,977.0
2	DOMINION ENERGY INC.	6,254.0
3	DUKE ENERGY CORP.	6,186.0
4	SCANA CORP.	4,845.0
5	NEXTERA ENERGY INC.	4,732.0
6	EXELON CORP.	4,306.0
7	SEMPRA ENERGY.	3,677.0
8	AMERICAN ELECTRIC POWER CO INC.	3,183.9
9	THE AES CORP.	3,057.0
10	PUBLIC SERVICE ENTERPRISE GROUP INC.	2,984.0

COMMUNICATIONS

RANK	FIRM	($ MIL)
1	VERIZON COMMUNICATIONS INC.	5,710.0
2	AT&T INC.	5,118.0
3	THE WALT DISNEY CO.	2,684.0
4	IRIDIUM COMMUNICATIONS INC.	2,655.7
5	T-MOBILE US INC.	2,613.0
6	SPRINT CORP.	2,316.0
7	DIGITALGLOBE INC.	948.5
8	FRONTIER COMMUNICATIONS CORP.	903.0
9	LIBERTY MEDIA CORP.	863.0
10	ZAYO GROUP HOLDINGS INC.	651.5

PRIMARY AND FABRICATED METAL

RANK	FIRM	($ MIL)
1	BALL CORP.	503.0
2	ALCOA CORP.	498.0
3	CROWN HOLDINGS INC.	406.0
4	NUCOR CORP.	224.7
5	SILGAN HOLDINGS INC.	118.0
6	COMMERCIAL METALS CO.	111.2
7	AK STEEL HOLDING CORP.	92.8
8	PARKER-HANNIFIN CORP.	74.6
9	STEEL DYNAMICS, INC.	70.6
10	TIMKENSTEEL CORP.	63.9

Owners continue to write the checks that support the expanding market. But many large customers are becoming more restive with their construction service providers as construction productivity improvements are lagging behind that of most other industries and construction firms are finding it increasingly tough to staff up jobs, putting pressure on schedules and wages.

For many owners, the construction process is becoming more inefficient, not less. Many owners see the process becoming more fragmented, with more players that favor their own interests crowding the field and introducing new levels of complexity to the jobsite.

This fragmentation has introduced new sources of inefficiency. "In the past, electricians used to do it all. Now, you have high-voltage, low-voltage instrumentation specialists and the like, all in their own silos," says Al Schwarzkopf, associate director of engineering at Merck. This arrangement complicates the construction and procurement process, he says.

Many owners now are looking to streamline the process, putting an emphasis on a team approach and providing construction firms with incentives to innovate and work more efficiently.

The need for efficiency has caused many owners to focus on lean construction techniques, which have worked well in manufacturing, and integrated project delivery (IPD) agreements, in which all parties share project risks and rewards.

"I have never seen more interest in lean construction and integrated project delivery than I have in the past year," says Greg Sizemore, executive vice president of the Construction Users Roundtable (CURT), Cincinnati.

Procter & Gamble is ramping up its use of IPD on projects. Last year, it successfully tested IPD on a $10-million warehouse expansion, near Greensville, S.C., and now is using the process for larger projects, says Mike Staun, associate director, capital management and engineering systems, for P&G.

"We now have 16 pilot projects going on [that use] some type of integrated form of agreement," Staun says. The biggest is a part of P&G's construction program at Tabler Station, near Martinsburg, W.Va. While Staun declined to release details of the project, he says the contract was carefully drawn up to make sure the parties' interests are aligned and the team integration practices are clearly defined.

Staffing Concerns

One of the biggest issues for owners is the availability of an adequate workforce to staff up projects. The growing severity of staff shortages in the industry can be seen from the results of ENR's Top 600 Specialty Contractors survey (see 10/23, p. 51). In addition to revenue questions, ENR asked subcontractors whether they have experienced staff shortages. In 2012, only 25.8% of the Top 600 said they were experiencing staff shortages. By last year, that figure had risen to 60.6%, and this

TOP FIRMS WITH CONSTRUCTION IN PROGRESS

PAPER AND ALLIED PRODUCTS

RANK	FIRM	($ MIL)
1	3M CO.	809.0
2	KIMBERLY-CLARK CORP.	488.0
3	SEALED AIR CORP.	227.5
4	GLATFELTER (P.H.) CO.	137.7
5	PACKAGING CORP. OF AMERICA	125.4
6	AVERY DENNISON CORP.	117.3
7	SONOCO PRODUCTS CO.	113.1
8	GRAPHIC PACKAGING HOLDING CO.	106.4
9	CLEARWATER PAPER CORP.	103.4
10	KAPSTONE PAPER & PACKAGING CORP.	99.2

FOOD & ALLIED PRODUCTS

RANK	FIRM	($ MIL)
1	PEPSICO INC.	2,082.0
2	KRAFT HEINZ CO.	1,600.0
3	ARCHER-DANIELS-MIDLAND CO.	1,213.0
4	MONDELEZ INTERNATIONAL INC.	1,113.0
5	BUNGE LTD.	765.0
6	KELLOGG CO.	686.0
7	CONSTELLATION BRANDS INC.	636.9
8	GENERAL MILLS INC.	553.0
9	MOLSON COORS BREWING CO.	413.4
10	TYSON FOODS INC.	290.0

BUSINESS SERVICES

RANK	FIRM	($ MIL)
1	ALPHABET INC.	8,166.0
2	FACEBOOK INC.	1,890.0
3	PAYPAL HOLDINGS INC.	268.0
4	INTUIT INC.	256.0
5	ORACLE CORP.	235.0
6	COGNIZANT TECHNOLOGY SOLUTIONS CORP.	169.0
7	EBAY INC.	160.0
8	GLOBAL PAYMENTS INC.	85.9
9	SPLUNK INC.	82.3
10	ALLIANCE DATA SYSTEMS CORP.	74.6

TRANSPORTATION

RANK	FIRM	($ MIL)
1	GENERAL MOTORS CO.	5,347.0
2	FORD MOTOR CO.	2,170.0
3	TESLA INC.	2,147.3
4	BOEING CO.	1,790.0
5	LOCKHEED MARTIN CORP.	976.0
6	ARCONIC INC.	783.0
7	PACCAR INC.	352.8
8	BORGWARNER INC.	338.2
9	GENERAL DYNAMICS CORP.	269.0
10	HARLEY-DAVIDSON INC.	214.4

ELECTRONICS & ELECTRIC PRODUCTS

RANK	FIRM	($ MIL)
1	INTEL CORP.	10,870.0
2	CORNING INC.	1,482.0
3	ECHOSTAR CORP.	1,438.8
4	VIASAT INC.	790.9
5	MICRON TECHNOLOGY INC.	475.0
6	EMERSON ELECTRIC CO.	318.0
7	QORVO INC.	304.0
8	CREE INC.	150.1
9	ROCKWELL AUTOMATION INC.	108.4
10	MICROCHIP TECHNOLOGY INC.	104.3

INDUSTRIAL MACHINERY & EQUIP.

RANK	FIRM	($ MIL)
1	CATERPILLAR INC.	771.0
2	CUMMINS INC.	662.0
3	DEERE & CO.	370.0
4	WESTERN DIGITAL CORP.	245.0
5	ILLINOIS TOOL WORKS INC.	104.0
6	APPLIED MATERIALS INC.	84.0
7	XYLEM INC.	76.0
8	ITT INC.	68.5
9	LENNOX INTERNATIONAL INC.	57.1
10	BRIGGS & STRATTON CORP.	51.5

year, 70.8% of the Top 600 said they were experiencing staff shortages.

An aging workforce is clearly a worry. "The Dow just hit 23,000, and that has an impact on us," says Sizemore. He notes that many baby boomers have investments and 401(k) plans tied to the stock market, and the recent surge in stock prices have many older workers feeling financially secure enough to retire.

Using its Construction Labor Market Analyzer (CLMA), Construction Industry Resources Inc., Lexington, Ky., in conjunction with CURT, has been collecting data for several years on project workforce demands and planning; as industry workforce shortages become more acute, CLMA is expanding.

Daniel Groves, CURT's director of operations and head of Construction Industry Resources, says CLMA is launching a new service in early 2018. Owners will be given access to not only workforce-availability data but also the CLMA staff's data analyses, geared specifically to their planning needs, says Groves. "Not every customer has the staff to fully analyze the data," he notes.

In addition, the CLMA is expanding into Canada for the first time. Groves says he is working with the Edmonton-based Construction Owners Association of Alberta to assist industrial owners in the province in their workforce planning.

Another area of concern for owners is the loss of knowledge and expertise as senior people retire. Younger professionals may provide a key to greater project productivity, which is why CURT created its Young Professionals committee. The "YP committee gives younger people in the industry a chance to gain some exposure and to openly express their ideas to improve the industry," says Sizemore.

Kelley Allison, a 34-year-old project manager for Duke Energy, is an example of how the YP committee is helping young people. "The YP program was set up to allow younger people like me to share our viewpoints with senior executives in the company and the industry," he says.

Allison says knowledge transfer is critical for young professionals, but most firms do not have a formal program for knowledge transfer. He suggests firms create a new position—"attrition planner"—to provide a structure for knowledge transfer and mentoring, instead of leaving it to the company's human resources department or individual managers.

Operating System 2.0

One of the most significant developments for owners and the industry as a whole is CII's research proposal for Operating System 2.0, spearheaded by CII Director Stephen Mulva. OS 2.0 aims to evaluate the entire construction process to drive waste out of the system. Debuted this past summer, the study is slated to take three years.

Mulva says there are numerous areas where transactional costs drive up the price and inefficiency of the process. "For example, on a large project, there may be

100 or more contracts with the various players, each negotiated individually and often signed without a focus on aligning them with the objectives of the project," he observes. Mulva wants to find effective ways to consolidate the legal process.

However, one of the biggest transactional costs for the owner is in the supply chain. "You have the raw-materials company, the manufacturer, the supplier, the distributor, then the subcontractors and the general contractor, each adding its overhead and profit margin to the overall cost before it gets to the owner. A piece of equipment that a manufacturer might sell for $80 may end up costing $300 by the time it gets to the owner," Mulva says.

Mulva likens the process to a farmers market, where the producer supplies the product directly to the consumer, rather than going through numerous intermediate steps that add costs without adding value before getting to the supermarket.

Past industry research has focused on specific elements of engineering or management of projects to add predictability or safety to the construction process, Mulva says. OS 2.0, however, is focusing on broader business, legal and economic issues in the construction process.

Mulva goes on to note that many industries have employed variations on these approaches, so OS 2.0 is not attempting to reinvent the wheel. He adds, "We want to know what works in construction."

Many groups have expressed interest in OS 2.0, including CURT; the National Center for Construction Education and Research, Alachua, Fla.; the Lean Construction Institute (LCI), Arlington, Va.; the Associated General Contractors, also Arlington, Va.; and the Associated Builders and Contractors, Washington, D.C.

Owners are enthusiastic about the project. "OS 2.0 is designed to break down many of the barriers in the industry that drive up costs. It's very exciting," says Schwarzkopf of Merck.

Staun of P&G also likes the proposal, saying it could drive the waste out of the supply chain. But he is especially pleased by the growing cooperation between industry groups. He adds, "Stephen Mulva is doing a great job [of aligning] the various industry groups—CII, CURT, LCI and the like—that often have divergent approaches."

Peter Dumont, vice president of global strategic projects for Pentair and CURT's president, notes that OS 2.0 is needed because owners can't trust that their capital projects will be delivered as planned. "The underlying management system is broken, and people in the industry are beginning to realize it," he says.

Dumont and Mulva have been working for years to lay the foundation for this transformation. But the changes envisioned in OS 2.0 will take time to develop and grow, warns Dumont, adding, "We are now taking the first step in the journey. Turning around the world's largest industry won't happen overnight." ■

CONSTRUCTION IN PROGRESS 2016 BY SIC CODE

IN $ MIL

DESCRIPTION	SIC CODE	NO. OF TOP 425 FIRMS	CONST. IN PROGRESS 2012
ELECTRIC, GAS AND SANITARY EQUIPMENT	4900	69	81,581.8
CHEMICALS AND ALLIED PRODUCTS	2800	58	37,178.9
COMMUNICATIONS	4800	28	27,316.8
ELECTRONIC AND OTHER ELECTRIC EQUIPMENT	3600	24	17,047.4
TRANSPORTATION EQUIPMENT	3700	20	15,411.0
OIL AND GAS EXTRACTION	1300	6	14,353.8
BUSINESS SERVICES	7300	15	11,676.0
FOOD AND ALLIED PRODUCTS	2000	25	11,402.3
METALS MINING	1000	6	8,545.7
RETAIL STORES	5200/5300	10	7,140.9
AMUSEMENT AND RECREATIONAL SERVICES	7900	8	4,398.2
TRANSPORTATION	4000/4400/4500	14	4,387.5
HEALTH SERVICES	8000	14	3,630.8
PETROLEUM AND COAL PRODUCTS	2900	8	3,597.6
PAPER AND ALLIED PRODUCTS	2600	13	2,593.4
INDUSTRIAL MACHINERY AND EQUIPMENT	3500	11	2,539.9
PRIMARY AND FABRICATED METAL	3300/3400	14	2,378.7
MISCELLANEOUS	5900	8	2,245.2
FOOD STORES	5400	3	2,217.7

SOURCE: S&P GLOBAL MARKET INTELLIGENCE, A UNIT OF S&P GLOBAL

How To Read the Tables

KEY TO COMPANY TYPE USING THE U.S. DEPT. OF COMMERCE'S STANDARD INDUSTRIAL CLASSIFICATION (SIC) CODES: 1000=Metal mining; **1300=**Oil and gas extraction; **1400=**Non-metallic minerals; **1700=**Construction-special trade contractors; **2000=**Food and kindred products; **2100=**Tobacco products; **2200=**Textile mill products; **2300=**Apparel and other textile products; **2400=**Lumber and wood; **2500=**Furniture and fixtures; **2600=**Paper and allied products; **2700=**Printing, publishing, and allied industries; **2800=**Chemicals and allied products; **2900=**Petroleum and coal products; **3000=**Rubber and miscellaneous plastics products; **3200=**Stone, clay and glass products; **3300=**Primary metal industries; **3400=**Fabricated metal products; **3500=**Industrial machinery and equipment; **3600=**Electronic and other electric equipment; **3700=**Transportation equipment; **3800=**Photographic, medical and optical goods; **4000=**Railroad transportation; **4200=**Trucking and warehousing; **4400=**Water transportation; **4500=**Transportation by air; **4600=**Transportation by pipeline; **4700=**Transportation services; **4800=**Communications; **4900=**Electric, gas and sanitary services; **5000=**Wholesale trade, durable goods; **5100=**Wholesale trade, non-durable goods; **5200=**Building materials and garden supplies; **5300=**General merchandise stores; **5400=**Food stores; **5500=**Automotive dealers and service; **5600=**Apparel and accessory stores; **5700=**Furniture and home furnishing stores; **5800=**Eating and drinking places; **5900=**Miscellaneous; **6000=**Depository institutions; **6100=**Non-depository institutions; **6200=**Security and commodity brokers; **6300=**Insurance carriers; **6500=**Real estate; **6700=**Holding and other investment offices; **7000=**Hotel and other lodging places; **7300=**Business services; **7500=**Automotive repair, services, and parking; **7800=**Motion pictures; **7900=**Amusement and recreation services; **8000=**Health services; **8200=**Educational services; **8700=**Engineering and management services; **9900=**Non-classifiable establishments.

BUILDING VALUE ADDED expenditures for building construction and acquisitions minus retirements.

BUILDING INVENTORY fiscal year-end balance of the cost of buildings owned by the firm on owned or leased land.

NM means "not meaningful."

NA means "not available."

SOURCE S&P Global Market Intelligence, a unit of S&P Global.

The Top 200 List

Companies are ranked here by capital expenditures, funds used for additions to a company's property, plant or equipment. These expenditures include capital leases, increases in construction funds, and reclassification of inventory to property, plant and equipment. They do not include capital expenditures of discontinued operations, changes resulting from foreign-currency fluctuations, decreases in funds for construction presented as a use of funds, or property, plant and equipment of acquired firms.

RANK 2017*	FIRM	FIRM TYPE**	CAPITAL EXPENDITURES 2016-2017† ($ MIL)
1	**GENERAL MOTORS CO.,** Detroit, Mich.	3700	29,166.0
2	**AT&T INC.,** Dallas, Texas	4800	22,408.0
3	**CHEVRON CORP.,** San Ramon, Calif.	2900	18,109.0
4	**VERIZON COMMUNICATIONS INC.,** New York, N.Y.	4800	17,059.0
5	**EXXON MOBIL CORP.,** Irving, Texas	2900	16,163.0
6	**BERKSHIRE HATHAWAY INC.,** Omaha, Neb.	9900	12,954.0
7	**APPLE INC.,** Cupertino, Calif.	3600	12,734.0
8	**HERTZ GLOBAL HOLDINGS INC.,** Estero, Fla.	7500	11,091.0
9	**WAL-MART STORES INC.,** Bentonville, Ark.	5300	10,619.0
10	**ALPHABET INC.,** Mountain View, Calif.	7300	10,212.0
11	**INTEL CORP.,** Santa Clara, Calif.	3600	9,625.0
12	**COMCAST CORP.,** Philadelphia, Pa.	4800	9,563.0
13	**EXELON CORP.,** Chicago, Ill.	4900	8,553.0
14	**MICROSOFT CORP.,** Redmond, Wash.	7300	8,343.0
15	**DUKE ENERGY CORP.,** Charlotte, N.C.	4900	7,901.0
16	**SOUTHERN CO.,** Atlanta, Ga.	4900	7,310.0
17	**GENERAL ELECTRIC CO.,** Boston, Mass.	9900	7,199.0
18	**FORD MOTOR CO.,** Dearborn, Mich.	3700	6,992.0
19	**AMAZON.COM INC.,** Seattle, Wash.	5900	6,737.0
20	**DOMINION ENERGY INC.,** Richmond, Va.	4900	6,085.0
21	**MICRON TECHNOLOGY INC.,** Boise, Idaho	3600	5,817.0
22	**AMERICAN AIRLINES GROUP INC.,** Fort Worth, Texas	4500	5,731.0
23	**PG&E CORP.,** San Francisco, Calif.	4900	5,709.0
24	**SANTANDER CONSUMER USA HOLDINGS INC.,** Dallas, Texas	6100	5,619.9
25	**CHARTER COMMUNICATIONS INC.,** Stamford, Conn.	4800	5,325.0
26	**FEDEX CORP.,** Memphis, Tenn.	4500	5,116.0
27	**AMERICAN ELECTRIC POWER CO. INC.,** Columbus, Ohio	4900	4,909.6
28	**CONOCOPHILLIPS,** Houston, Texas	1300	4,869.0
29	**WALT DISNEY CO.,** Burbank, Calif.	4800	4,773.0
30	**T-MOBILE US INC.,** Bellevue, Wash.	4800	4,702.0
31	**FACEBOOK INC.,** Menlo Park, Calif.	7300	4,491.0
32	**CHENIERE ENERGY INC.,** Houston, Texas	5100	4,355.6
33	**NEXTERA ENERGY INC.,** Juno Beach, Fla.	4900	4,240.0
34	**SEMPRA ENERGY,** San Diego, Calif.	4900	4,214.0
35	**PUBLIC SERVICE ENTERPRISE GROUP INC.,** Newark, N.J.	4900	4,199.0
36	**ENTERGY CORP.,** New Orleans, La.	4900	3,975.9
37	**DEVON ENERGY CORP.,** Oklahoma City, Okla.	1300	3,971.0
38	**SPRINT CORP.,** Overland Park, Kan.	4800	3,875.0
39	**DOWDUPONT INC.,** Midland, Mich.	2800	3,804.0
40	**EDISON INTERNATIONAL,** Rosemead, Calif.	4900	3,734.0
41	**KROGER CO.,** Cincinnati, Ohio	5400	3,699.0
42	**INTERNATIONAL BUSINESS MACHINES CORP.,** Armonk, N.Y.	7300	3,567.0
43	**ANADARKO PETROLEUM CORP.,** The Woodlands, Texas	1300	3,505.0
44	**UNION PACIFIC CORP.,** Omaha, Neb.	4000	3,505.0
45	**DELTA AIR LINES INC.,** Atlanta, Ga.	4500	3,391.0
46	**PROCTER & GAMBLE CO.,** Cincinnati, Ohio	2800	3,314.0
47	**HEWLETT PACKARD ENTERPRISE CO.,** Palo Alto, Calif.	7300	3,280.0
48	**ALLY FINANCIAL INC.,** Detroit, Mich.	6100	3,274.0
49	**JOHNSON & JOHNSON,** New Brunswick, N.J.	2800	3,226.0
50	**UNITED CONTINENTAL HOLDINGS INC.,** Chicago, Ill.	4500	3,223.0
51	**XCEL ENERGY INC.,** Minneapolis, Minn.	4900	3,195.0
52	**FIRSTENERGY CORP.,** Akron, Ohio	4900	3,067.0
53	**PEPSICO INC.,** Purchase, N.Y.	2000	3,040.0
54	**CENTURYLINK INC.,** Monroe, La.	4800	2,981.0
55	**UNITED PARCEL SERVICE INC.,** Atlanta, Ga.	4200	2,965.0
56	**DEERE & CO.,** Moline, Ill.	3500	2,955.1
57	**CATERPILLAR INC.,** Peoria, Ill.	3500	2,928.0
58	**PPL CORP.,** Allentown, Pa.	4900	2,920.0
59	**MARATHON PETROLEUM CORP.,** Findlay, Ohio	2900	2,892.0
60	**KINDER MORGAN INC.,** Houston, Texas	4900	2,882.0
61	**GOLDMAN SACHS GROUP INC.,** New York, N.Y.	6200	2,876.0
62	**PHILLIPS 66,** Houston, Texas	2900	2,844.0
63	**CONSOLIDATED EDISON INC.,** New York, N.Y.	4900	2,835.0
64	**SM ENERGY CO.,** Denver, Colo.	1300	2,813.7
65	**FREEPORT-MCMORAN INC.,** Phoenix, Ariz.	1000	2,813.0
66	**HCA HEALTHCARE INC.,** Nashville, Tenn.	8000	2,760.0
67	**CITIGROUP INC.,** New York, N.Y.	6100	2,756.0
68	**OCCIDENTAL PETROLEUM CORP.,** Houston, Texas	1300	2,717.0
69	**COSTCO WHOLESALE CORP.,** Issaquah, Wash.	5300	2,649.0
70	**BOEING CO.,** Chicago, Ill.	3700	2,613.0
71	**EOG RESOURCES INC.,** Houston, Texas	1300	2,582.8
72	**ANTERO RESOURCES CORP.,** Denver, Colo.	1300	2,495.4
73	**CONCHO RESOURCES INC.,** Midland, Texas	1300	2,457.9
74	**CSX CORP.,** Jacksonville, Fla.	4000	2,398.0
75	**AES CORP.,** Arlington, Va.	4900	2,345.0
76	**MGM RESORTS INTERNATIONAL,** Las Vegas, Nev.	7900	2,262.5
77	**COCA-COLA CO.,** Atlanta, Ga.	2000	2,262.0
78	**HESS CORP.,** New York, N.Y.	1300	2,251.0
79	**CVS HEALTH CORP.,** Woonsocket, R.I.	5900	2,224.0
80	**CF INDUSTRIES HOLDINGS INC.,** Deerfield, Ill.	2800	2,211.0
81	**AVIS BUDGET GROUP INC.,** Parsippany, N.J.	7500	2,147.0
82	**AMEREN CORP.,** St. Louis, Mo.	4900	2,131.0
83	**AIR LEASE CORP.,** Los Angeles, Calif.	7300	2,125.5
84	**CHESAPEAKE ENERGY CORP.,** Oklahoma City, Okla.	1300	2,120.0
85	**PIONEER NATURAL RESOURCES CO.,** Irving, Texas	1300	2,060.0
86	**WILLIAMS COS. INC.,** Tulsa, Okla.	4900	2,051.0
87	**DTE ENERGY CO.,** Detroit, Mich.	4900	2,045.0
88	**SOUTHWEST AIRLINES CO.,** Dallas, Texas	4500	2,038.0
89	**ORACLE CORP.,** Redwood City, Calif.	7300	2,021.0
90	**EVERSOURCE ENERGY,** Springfield, Mass.	4900	1,976.9
91	**PACCAR INC.,** Bellevue, Wash.	3700	1,964.9
92	**APACHE CORP.,** Houston, Texas	1300	1,949.0
93	**RYDER SYSTEM INC.,** Miami, Fla.	7500	1,905.2
94	**NORFOLK SOUTHERN CORP.,** Norfolk, Va.	4000	1,887.0
95	**PARSLEY ENERGY INC.,** Austin, Texas	1300	1,885.4
96	**CIT GROUP INC.,** Livingston, N.J.	6100	1,866.8
97	**PFIZER INC.,** New York, N.Y.	2800	1,823.0
98	**MCDONALD'S CORP.,** Oak Brook, Ill.	5800	1,821.1
99	**AVANGRID INC.,** New Haven, Conn.	4900	1,707.0
100	**UNITEDHEALTH GROUP INC.,** Minnetonka, Minn.	6300	1,705.0

FOOTNOTES: * = BASED ON DATA SUPPLIED BY S&P GLOBAL MARKET INTELLIGENCE UNIT OF S&P GLOBAL ** = FOR SIC CODES EXPLANATIONS, SEE PAGE 52 † = COVERS JUNE 2016-MAY 2017

RANK 2017*	FIRM	FIRM TYPE**	CAPITAL EXPENDITURES 2016-2017† ($ MIL)
101	**UNITED TECHNOLOGIES CORP.,** Farmington, Conn.	3700	1,699.0
102	**CMS ENERGY CORP.,** Jackson, Mich.	4900	1,672.0
103	**HOME DEPOT INC.,** Atlanta, Ga.	5200	1,621.0
104	**MERCK & CO. INC.,** Kenilworth, N.J.	2800	1,614.0
105	**SCANA CORP.,** Cayce, S.C.	4900	1,579.0
106	**TARGET CORP.,** Minneapolis, Minn.	5300	1,547.0
107	**NOBLE ENERGY INC.,** Houston, Texas	1300	1,541.0
108	**EQT CORP.,** Pittsburgh, Pa.	4900	1,539.5
109	**PDC ENERGY INC.,** Denver, Colo.	1300	1,514.1
110	**NISOURCE INC.,** Merrillville, Ind.	4900	1,475.2
111	**PRAXAIR INC.,** Danbury, Conn.	2800	1,465.0
112	**LOEWS CORP.,** New York, N.Y.	6300	1,450.0
113	**PUBLIX SUPER MARKETS INC.,** Lakeland, Fla.	5400	1,443.8
114	**TESLA INC.,** Palo Alto, Calif.	3700	1,440.5
115	**STARBUCKS CORP.,** Seattle, Wash.	5800	1,440.3
116	**WEC ENERGY GROUP INC.,** Milwaukee, Wis.	4900	1,423.7
117	**3M CO.,** St. Paul, Minn.	2600	1,420.0
118	**AMERCO,** Reno, Nev.	7500	1,419.5
119	**CENTERPOINT ENERGY INC.,** Houston, Texas	4900	1,414.0
120	**FRONTIER COMMUNICATIONS CORP.,** Norwalk, Conn.	4800	1,401.0
121	**LAS VEGAS SANDS CORP.,** Las Vegas, Nev.	7900	1,398.0
122	**AMERICAN EXPRESS CO.,** New York, N.Y.	6100	1,377.0
123	**NEWFIELD EXPLORATION CO.,** The Woodlands, Texas	1300	1,371.0
124	**INTERNATIONAL PAPER CO.,** Memphis, Tenn.	2600	1,348.0
125	**ROYAL GOLD INC.,** Denver, Colo.	6700	1,346.1
126	**UNITED RENTALS INC.,** Stamford, Conn.	7300	1,339.0
127	**WASTE MANAGEMENT INC.,** Houston, Texas	4900	1,339.0
128	**LEVEL 3 COMMUNICATIONS INC.,** Broomfield, Colo.	4800	1,334.0
129	**WALGREENS BOOTS ALLIANCE INC.,** Deerfield, Ill.	5900	1,325.0
130	**AMERICAN WATER WORKS CO. INC.,** Voorhees, N.J.	4900	1,311.0
131	**PINNACLE WEST CAPITAL CORP.,** Phoenix, Ariz.	4900	1,295.4
132	**VALERO ENERGY CORP.,** San Antonio, Texas	2900	1,278.0
133	**MORGAN STANLEY,** New York, N.Y.	6200	1,276.0
134	**KRAFT HEINZ CO.,** Pittsburgh, Pa.	2000	1,247.0
135	**MARATHON OIL CORP.,** Houston, Texas	1300	1,245.0
136	**NRG ENERGY INC.,** Princeton, N.J.	4900	1,244.0
137	**WYNN RESORTS LTD.,** Las Vegas, Nev.	7900	1,225.9
138	**MONDELEZ INTERNATIONAL INC.,** Deerfield, Ill.	2000	1,224.0
139	**BRISTOL-MYERS SQUIBB CO.,** New York, N.Y.	2800	1,215.0
140	**QEP RESOURCES INC.,** Denver, Colo.	1300	1,208.1
141	**OASIS PETROLEUM INC.,** Houston, Texas	1300	1,207.8
142	**ALLIANT ENERGY CORP.,** Madison, Wis.	4900	1,196.8
143	**DIAMONDBACK ENERGY INC.,** Midland, Texas	1300	1,191.2
144	**PHILIP MORRIS INTERNATIONAL INC.,** New York, N.Y.	2100	1,172.0
145	**LOWE'S COS INC.,** Mooresville, N.C.	5200	1,167.0
146	**CONTINENTAL RESOURCES INC.,** Oklahoma City, Okla.	1300	1,164.5
147	**SKYWEST INC.,** St. George, Utah	4500	1,154.0
148	**CISCO SYSTEMS INC.,** San Jose, Calif.	3500	1,146.0
149	**EQUINIX INC.,** Redwood City, Calif.	6700	1,141.5
150	**NEWMONT MINING CORP.,** Greenwood Village, Colo.	1000	1,133.0

RANK 2017*	FIRM	FIRM TYPE**	CAPITAL EXPENDITURES 2016-2017† ($ MIL)
151	**CORNING INC.,** Corning, N.Y.	3600	1,130.0
152	**ABBOTT LABORATORIES,** North Chicago, Ill.	2800	1,121.0
153	**SOUTHERN COPPER CORP.,** Phoenix, Ariz.	1000	1,118.5
154	**NIKE INC.,** Beaverton, Ore.	3000	1,105.0
155	**HONEYWELL INTERNATIONAL INC.,** Morris Plains, N.J.	9900	1,095.0
156	**WESTAR ENERGY INC.,** Topeka, Kan.	4900	1,087.0
157	**ATMOS ENERGY CORP.,** Dallas, Texas	4900	1,087.0
158	**LOCKHEED MARTIN CORP.,** Bethesda, Md.	3700	1,063.0
159	**AIR PRODUCTS AND CHEMICALS INC.,** Allentown, Pa.	2800	1,055.8
160	**ELI LILLY AND CO.,** Indianapolis, Ind.	2800	1,037.0
161	**TJX COS. INC.,** Framingham, Mass.	5600	1,024.7
162	**E.I. DU PONT DE NEMOURS AND CO.,** Wilmington, Del.	2800	1,019.0
163	**JETBLUE AIRWAYS CORP.,** Long Island City, N.Y.	4500	1,011.0
164	**GOODYEAR TIRE & RUBBER CO.,** Akron, Ohio	3000	996.0
165	**L BRANDS INC.,** Columbus, Ohio	5600	990.0
166	**WINDSTREAM HOLDINGS INC.,** Little Rock, Ark.	4800	989.8
167	**CENTENNIAL RESOURCE DEVELOPMENT INC.,** Denver, Colo.	1300	976.0
168	**RSP PERMIAN INC.,** Dallas, Texas	1300	963.0
169	**KENNEDY-WILSON HOLDINGS INC.,** Beverly Hills, Calif.	6500	949.6
170	**TRINITY INDUSTRIES INC.,** Dallas, Texas	3700	933.4
171	**REPUBLIC SERVICES INC.,** Phoenix, Ariz.	4900	927.8
172	**MURPHY OIL CORP.,** El Dorado, Ark.	1300	926.9
173	**RICE ENERGY INC.,** Canonsburg, Pa.	1300	924.8
174	**JABIL INC.,** St. Petersburg, Fla.	3600	924.2
175	**MONSANTO CO.,** St. Louis, Mo.	1000	923.0
176	**NORTHROP GRUMMAN CORP.,** Falls Church, Va.	3800	920.0
177	**CONSTELLATION BRANDS INC.,** Victor, N.Y.	2000	907.4
178	**ANDEAVOR,** San Antonio, Texas	2900	894.0
179	**ARCHER-DANIELS-MIDLAND CO.,** Chicago, Ill.	2000	882.0
180	**EXTRACTION OIL & GAS INC.,** Denver, Colo.	1300	876.3
181	**TENET HEALTHCARE CORP.,** Dallas, Texas	8000	875.0
182	**CROWN CASTLE INTERNATIONAL CORP.,** Houston, Texas	6700	873.9
183	**NORDSTROM INC.,** Seattle, Wash.	5600	846.0
184	**CALLON PETROLEUM CO.,** Natchez, Miss.	1300	844.7
185	**MOSAIC CO.,** Plymouth, Minn.	2800	843.1
186	**DAVITA INC.,** Denver, Colo.	8000	829.1
187	**ARCONIC INC.,** New York, N.Y.	3700	827.0
188	**HALLIBURTON CO.,** Houston, Texas	1300	798.0
189	**WESTROCK CO.,** Richmond, Va.	2600	796.7
190	**CAPITAL ONE FINANCIAL CORP.,** McLean, Va.	6100	779.0
191	**KIMBERLY-CLARK CORP.,** Dallas, Texas	2600	771.0
192	**KOHL'S CORP.,** Menomonee Falls, Wis.	5300	768.0
193	**GULFPORT ENERGY CORP.,** Oklahoma City, Okla.	1300	758.1
194	**ECOLAB INC.,** St. Paul, Minn.	2800	756.8
195	**EXPEDIA INC.,** Bellevue, Wash.	4700	749.3
196	**GILEAD SCIENCES INC.,** Foster City, Calif.	2800	748.0
197	**COMMUNITY HEALTH SYSTEMS INC.,** Franklin, Tenn.	8000	744.0
198	**SUNRUN INC.,** San Francisco, Calif.	3600	740.1
199	**AMGEN INC.,** Thousand Oaks, Calif.	2800	738.0
200	**ECHOSTAR CORP.,** Englewood, Colo.	3600	722.3

FOOTNOTES: * = BASED ON DATA SUPPLIED BY S&P GLOBAL MARKET INTELLIGENCE UNIT OF S&P GLOBAL ** = FOR SIC CODES EXPLANATIONS, SEE PAGE 52 † = COVERS JUNE 2016-MAY 2017.

The Top 50 List

The top 50 publicly held real estate investment trusts are ranked based on the 2016 construction-in-progress figures the trusts supplied to the U.S. Securities & Exchange Commission. The ENR Top 425 Owners list followed the same process (see p. 52). All the firms list their SIC code as 6700—that is, Holding and Other Investment Offices. The data were compiled by S&P Global Market Intelligence, a unit of S&P Global.

RANK 2017*		FIRM TYPE	CONST. IN PROGRESS		BLDG. VALUE ADDED		TOTAL BLDG. INVENTORY	
			2016 ($ MIL)	% CHG. VS. 2015	2016 ($ MIL)	% CHG. VS. 2015	2016 ($ MIL)	% CHG. VS. 2015
1	**AVALONBAY COMMUNITIES INC.,** Arlington, Va.	6700	1,882.3	+18	1,259	+70	14,315	+10
2	**PROLOGIS INC.,** San Francisco, Calif.	6700	1,432.1	-24	44	-99	17,906	+0
3	**VORNADO REALTY TRUST,** New York, N.Y.	6700	1,430.3	+17	136	NM	12,294	+1
4	**BOSTON PROPERTIES INC.,** Boston, Mass.	6700	1,038.0	+36	181	+320	11,891	+2
5	**DIGITAL REALTY TRUST INC.,** San Francisco, Calif.	6700	900.0	+29	391	-66	9,368	+4
6	**ALEXANDRIA REAL ESTATE EQUITIES INC.,** Pasadena, Calif.	6700	809.3	-12	1,020	+65	7,810	+15
7	**FOREST CITY REALTY TRUST INC.,** Cleveland, Ohio	6700	735.0	-17	-443	NM	6,460	-6
8	**EQUINIX INC.,** Redwood City, Calif.	6700	645.4	+84	402	+30	2,786	+17
9	**EQUITY RESIDENTIAL,** Chicago, Ill.	6700	637.2	-43	577	NM	16,913	+4
10	**FEDERAL REALTY INVESTMENT TRUST,** Rockville, Md.	6700	599.3	+38	NA	NA	NA	NA
11	**WELLTOWER INC.,** Toledo, Ohio	6700	506.1	+95	-1,026	-128	24,496	-4
12	**CROWN CASTLE INTERNATIONAL CORP.,** Houston, Texas	6700	456.7	-21	24	+68	111	+28
13	**AMERICAN CAMPUS COMMUNITIES INC.,** Austin, Texas	6700	410.7	+118	-170	-157	5,065	-3
14	**CYRUSONE INC.,** Dallas, Texas	6700	407.1	+76	104	+12	1,009	+11
15	**QTS REALTY TRUST INC.,** Overland Park, Kan.	6700	366.0	+6	344	+29	1,525	+29
16	**DUKE REALTY CORP.,** Indianapolis, Ind.	6700	347.2	+8	230	NM	4,971	+5
17	**KIMCO REALTY CORP.,** New Hyde Park, N.Y.	6700	335.0	+87	150	-84	7,353	+2
18	**CAMDEN PROPERTY TRUST,** Houston, Texas	6700	316.3	-12	-318	-181	5,967	-5
19	**HUDSON PACIFIC PROPERTIES INC.,** Los Angeles, Calif.	6700	308.2	+41	538	-80	4,502	+14
20	**TAUBMAN CENTERS INC.,** Bloomfield Hills, Mich.	6700	301.4	-17	532	-18	3,639	+17
21	**BRANDYWINE REALTY TRUST,** Philadelphia, Pa.	6700	297.5	+11	-37	NM	2,683	-1
22	**EPR PROPERTIES,** Kansas City, Mo.	6700	297.1	-22	435	-23	3,273	+15
23	**EASTGROUP PROPERTIES INC.,** Jackson, Miss.	6700	293.9	+72	42	-62	1,435	+3
24	**THE MACERICH CO.,** Santa Monica, Calif.	6700	290.0	+23	-1,241	NM	6,512	-16
25	**EDR,** Memphis, Tenn.	6700	289.9	+147	NA	NA	NA	NA
26	**HIGHWOODS PROPERTIES INC.,** Raleigh, N.C.	6700	279.6	+44	250	+12	4,313	+6
27	**LIBERTY PROPERTY TRUST,** Malvern, Pa.	6700	267.5	-26	-630	NM	4,502	-12
28	**GGP INC.,** Chicago, Ill.	6700	251.6	-19	-185	NM	15,785	-1
29	**UDR INC.,** Highlands Ranch, Colo.	6700	231.3	+403	245	-70	7,292	+3
30	**MID-AMERICA APARTMENT COMMUNITIES INC.,** Memphis, Tenn.	6700	231.2	+421	3,584	+1,945	10,524	+52
31	**PUBLIC STORAGE,** Glendale, Calif.	6700	230.3	+5	541	+113	10,182	+6
32	**WEYERHAEUSER CO.,** Seattle, Wash.	2400	213.0	+9	-419	NM	789	-35
33	**VENTAS INC.,** Chicago, Ill.	8000	210.6	+129	1,207	+191	21,516	+6
34	**CORPORATE OFFICE PROPERTIES TRUST,** Columbia, Md.	6700	206.0	-7	-213	-249	2,945	-7
35	**AMERICAN TOWER CORP.,** Boston, Mass.	6700	203.4	-15	14	NM	622	+2
36	**CUBESMART,** Malvern, Pa.	6700	202.3	+101	394	+72	2,928	+16
37	**OMEGA HEALTHCARE INVESTORS INC.,** Hunt Valley, Md.	6700	191.3	-2	440	-84	5,955	+8
38	**ESSEX PROPERTY TRUST INC.,** San Mateo, Calif.	6700	190.5	-21	308	-69	10,117	+3
39	**REGENCY CENTERS CORP.,** Jacksonville, Fla.	6700	180.9	-17	196	+84	3,092	+7
40	**CBL & ASSOCIATES PROPERTIES INC.,** Chattanooga, Tenn.	6700	178.4	+135	-345	-620	6,942	-5
41	**JBG SMITH PROPERTIES,** Chevy Chase, Md.	6700	151.3	-50	297	NA	3,047	+11
42	**COUSINS PROPERTIES INC.,** Atlanta, Ga.	6700	130.1	+1,555	1,257	+2,678	3,342	+60
43	**IRON MOUNTAIN INC.,** Boston, Mass.	6700	121.7	+8	195	+99	1,702	+13
44	**MONOGRAM RESIDENTIAL TRUST INC.,** Plano, Texas	6700	120.4	-64	187	-69	2,814	+7
45	**LEXINGTON REALTY TRUST,** New York, N.Y.	6700	111.8	+8	18	-87	3,050	+1
46	**INFRAREIT INC.,** Dallas, Texas	6700	107.2	-12	NA	NA	NA	NA
47	**DDR CORP.,** Beachwood, Ohio	6700	105.4	-55	-553	NM	6,413	-8
48	**URBAN EDGE PROPERTIES,** New York, N.Y.	6700	99.2	+62	20	NM	1,650	+1
49	**PENNSYLVANIA REAL ESTATE INVESTMENT TRUST,** Philadelphia, Pa.	6700	97.6	+52	-87	-8,090	2,697	-3
50	**HOST HOTELS & RESORTS INC.,** Bethesda, Md.	6700	86.0	-70	-163	-153	13,483	-1

The Top 425 List

RANK 2017*		FIRM TYPE**	CONST. IN PROGRESS 2016 ($ MIL)	CONST. IN PROGRESS % CHG. VS. 2015	BLDG. VALUE ADDED 2016 ($ MIL)	BLDG. VALUE ADDED % CHG. VS. 2015	TOTAL BLDG. INVENTORY 2016 ($ MIL)	TOTAL BLDG. INVENTORY % CHG. VS. 2015
1	**CHENIERE ENERGY INC.,** Houston, Texas	1300	12,995.1	-6	NA	NA	NA	NA
2	**INTEL CORP.,** Santa Clara, Calif.	3600	10,870.0	+16	NA	NA	NA	NA
3	**SOUTHERN CO.,** Atlanta, Ga.	4900	8,977.0	-1	22,931	+256	108,298	+27
4	**ALPHABET INC.,** Mountain View, Calif.	7300	8,166.0	+11	NA	NA	NA	NA
5	**DOMINION ENERGY INC.,** Richmond, Va.	4900	6,254.0	+13	NA	NA	NA	NA
6	**DUKE ENERGY CORP.,** Charlotte, N.C.	4900	6,186.0	+37	8552.0	+1	121926	+8
7	**DOWDUPONT INC.,** Midland, Mich.	2800	6,100.0	+40	1,142	NM	5,935	+24
8	**VERIZON COMMUNICATIONS INC.,** New York, N.Y.	4800	5,710.0	+16	1,530	+305	27,117	+6
9	**GENERAL MOTORS CO.,** Detroit, Mich.	3700	5,347.0	+15	1,093	+235	6,655	+20
10	**AT&T INC.,** Dallas, Texas	4800	5,118.0	-14	1,252	-21	35,036	+4
11	**SCANA CORP.,** Cayce, S.C.	4900	4,845.0	+20	1,318	+16	18,770	+8
12	**NEXTERA ENERGY INC.,** Juno Beach, Fla.	4900	4,732.0	-16	6,627	-2	87,013	+8
13	**EXELON CORP.,** Chicago, Ill.	4900	4,306.0	+40	16,910	+142	90,724	+23
14	**WAL-MART STORES INC.,** Bentonville, Ark.	5300	4,301.0	-5	1702.0	NM	98547	+2
15	**SEMPRA ENERGY,** San Diego, Calif.	4900	3,677.0	+33	5,424	+94	43,624	+14
16	**JOHNSON & JOHNSON,** New Brunswick, N.J.	2800	3,354.0	-5	283	NM	10,112	+3
17	**AMERICAN ELECTRIC POWER CO. INC.,** Columbus, Ohio	4900	3,183.9	-18	-3,445	-393	62,037	-5
18	**THE AES CORP.,** Arlington, Va.	4900	3,057.0	-0	NA	NA	2,034	NA
19	**PUBLIC SERVICE ENTERPRISE GROUP INC.,** Newark, N.J.	4900	2,984.0	+27	3,843	+17	39,337	+11
20	**FREEPORT-MCMORAN INC.,** Phoenix, Ariz.	1000	2,831.0	-29	28	-99	7,479	+0
21	**EDISON INTERNATIONAL,** Rosemead, Calif.	4900	2,790.0	-13	2313.0	-8	45806	+5
22	**PROCTER & GAMBLE CO.,** Cincinnati, Ohio	2800	2,706.0	-10	-324	NM	6,885	-4
23	**THE WALT DISNEY CO.,** Burbank, Calif.	4800	2,684.0	-55	NA	NA	NA	NA
24	**IRIDIUM COMMUNICATIONS INC.,** McLean, Va.	4800	2,655.7	+17	1	-68	32	+2
25	**MGM RESORTS INTERNATIONAL,** Las Vegas, Nev.	7900	2,628.6	+24	2,540	+2,078	11,970	+27
26	**T-MOBILE US INC.,** Bellevue, Wash.	4800	2,613.0	+6	-243.0	NM	1657	-13
27	**SPRINT CORP.,** Overland Park, Kan.	4800	2,316.0	+85	20	-55	818	+3
28	**PG&E CORP.,** San Francisco, Calif.	4900	2,184.0	+6	5,253	+23	72,593	+8
29	**FORD MOTOR CO.,** Dearborn, Mich.	3700	2,170.0	+24	NA	NA	NA	NA
30	**KINDER MORGAN INC.,** Houston, Texas	4900	2,161.0	-10	-387	-109	51,011	-1
31	**TESLA INC.,** Palo Alto, Calif.	3700	2,147.3	+210	306.9	+254	461	+199
32	**PFIZER INC.,** New York, N.Y.	2800	2,127.0	+19	206.0	-17	9810	+2
33	**NEWMONT MINING CORP.,** Greenwood Village, Colo.	1000	2,119.0	-25	NA	NA	NA	NA
34	**PEPSICO INC.,** Purchase, N.Y.	2000	2,082.0	+20	245	NM	8,306	+3
35	**MARATHON PETROLEUM CORP.,** Findlay, Ohio	2900	2,020.0	-11	NA	NA	NA	NA
36	**WILLIAMS COS. INC.,** Tulsa, Okla.	4900	2,015.0	-13	-127	-105	38,912	+0
37	**KROGER CO.,** Cincinnati, Ohio	5400	1,979.0	-6	NA	NA	NA	NA
38	**FACEBOOK INC.,** Menlo Park, Calif.	7300	1,890.0	+204	836	-2	3,109	+37
39	**MERCK & CO. INC.,** Kenilworth, N.J.	2800	1,871.0	+23	-715	NM	11,439	-6
40	**SOUTHERN COPPER CORP.,** Phoenix, Ariz.	1000	1,811.8	+25	648	-73	12,177	+6
41	**AMAZON.COM INC.,** Seattle, Wash.	5900	1,805.0	+18	NA	NA	NA	NA
42	**ELI LILLY AND CO.,** Indianapolis, Ind.	2800	1,797.5	+8	131	-51	6,918	+2
43	**BOEING CO.,** Chicago, Ill.	3700	1,790.0	-20	1,399	+122	13,796	+11
44	**MOSAIC CO.,** Plymouth, Minn.	2800	1,737.6	+18	202	NM	2,303	+10
45	**KRAFT HEINZ CO.,** Pittsburgh, Pa.	2000	1,600.0	+60	184.0	-83	1884	+11
46	**PRAXAIR INC.,** Danbury, Conn.	2800	1,558.0	+1	11	NM	1,096	+1
47	**AIR PRODUCTS AND CHEMICALS INC.,** Allentown, Pa.	2800	1,528.0	-33	40	NM	1,120	+4
48	**CORNING INC.,** Corning, N.Y.	3600	1,482.0	+23	36	+6	5,540	+1
49	**AVANGRID INC.,** New Haven, Conn.	4900	1,471.0	+10	1,451	-65	28,534	+5
50	**ECHOSTAR CORP.,** Englewood, Colo.	3600	1,438.8	+29	3	NM	371	+1
51	**E.I. DU PONT DE NEMOURS AND CO.,** Wilmington, Del.	2800	1,424.0	-18	27	NM	4,495	+1

RANK 2017*		FIRM TYPE**	CONST. IN PROGRESS		BLDG. VALUE ADDED		TOTAL BLDG. INVENTORY	
			2016 ($ MIL)	% CHG. VS. 2015	2016 ($ MIL)	% CHG. VS. 2015	2016 ($ MIL)	% CHG. VS. 2015
52	**ENTERGY CORP.,** New Orleans, La.	4900	1,378.2	-5	26	NM	48,640	+0
53	**XCEL ENERGY INC.,** Minneapolis, Minn.	4900	1,373.4	+9	2,543	-15	49,404	+5
54	**MONSANTO CO.,** St. Louis, Mo.	1000	1,367.0	+25	82	+290	2,225	+4
55	**FIRSTENERGY CORP.,** Akron, Ohio	4900	1,351.0	-44	-7256.0	-397	45118	-14
56	**HCA HEALTHCARE INC.,** Nashville, Tenn.	8000	1,318.0	+8	1,013	+71	13,546	+8
57	**ALLIANT ENERGY CORP.,** Madison, Wis.	4900	1,226.8	+37	1,036	+86	13,946	+8
58	**ARCHER-DANIELS-MIDLAND CO.,** Chicago, Ill.	2000	1,213.0	+28	-36.0	-177	4679	-1
59	**CONSOLIDATED EDISON INC.,** New York, N.Y.	4900	1,175.0	+17	2,409	+8	41,586	+6
60	**PPL CORP.,** Allentown, Pa.	4900	1,134.0	-14	-9	NM	36,221	+0
61	**MONDELEZ INTERNATIONAL INC.,** Deerfield, Ill.	2000	1,113.0	-12	48	NM	2,801	+2
62	**LAS VEGAS SANDS CORP.,** Las Vegas, Nev.	7900	1,094.0	-58	2169.2	+1,687	17478	+14
63	**PINNACLE WEST CAPITAL CORP.,** Phoenix, Ariz.	4900	1,019.9	+25	1,157	+46	18,917	+7
64	**EVERSOURCE ENERGY,** Springfield, Mass.	4900	1,012.4	-5	1784.0	+9	28073	+7
65	**UNION PACIFIC CORP.,** Omaha, Neb.	4000	987.0	-21	NA	NA	NA	NA
66	**LOCKHEED MARTIN CORP.,** Bethesda, Md.	3700	976.0	+10	257	-36	6,385	+4
67	**ABBOTT LABORATORIES,** North Chicago, Ill.	2800	962.0	+4	-167.0	NM	2602	-6
68	**MPLX LP,** Findlay, Ohio	4600	958.0	+2	NA	NA	NA	NA
69	**AMEREN CORP.,** St. Louis, Mo.	4900	956.0	-38	1,928	-2	31,074	+7
70	**DIGITALGLOBE INC.,** Westminster, Colo.	4800	948.5	+16	NA	NA	NA	NA
71	**HONEYWELL INTERNATIONAL INC.,** Morris Plains, N.J.	9900	940.0	+11	60.0	-13	3248	+2
72	**PHILIP MORRIS INTERNATIONAL INC.,** New York, N.Y.	2100	930.0	+10	113	NM	3,474	+3
73	**FRONTIER COMMUNICATIONS CORP.,** Norwalk, Conn.	4800	903.0	+138	973.0	+85,627	2300	+73
74	**GOODYEAR TIRE & RUBBER CO.,** Akron, Ohio	3000	887.0	+13	58	NM	2,288	+3
75	**LIBERTY MEDIA CORP.,** Englewood, Colo.	4800	863.0	+126	-20	-1,100	144	-12
76	**ATWOOD OCEANICS INC.,** Houston, Texas	1300	857.6	+19	0.0	NM	0	NM
77	**BRISTOL-MYERS SQUIBB CO.,** New York, N.Y.	2800	849.0	+28	415	NM	4,930	+9
78	**3M CO.,** St. Paul, Minn.	2600	809.0	+12	132	-25	7,252	+2
79	**VIASAT INC.,** Carlsbad, Calif.	3600	790.9	+34	0.0	NM	9	+0
80	**ARCONIC INC.,** New York, N.Y.	3700	783.0	-5	67	NA	2,296	+3
81	**WESTAR ENERGY INC.,** Topeka, Kan.	4900	773.1	+121	950	+122	14,151	+7
82	**CATERPILLAR INC.,** Peoria, Ill.	3500	771.0	-26	NA	NA	NA	NA
83	**BUNGE LTD.,** White Plains, N.Y.	2000	765.0	+6	94.0	NM	1934	+5
84	**CMS ENERGY CORP.,** Jackson, Mich.	4900	761.0	-50	1,319	-19	21,771	+6
85	**NIKE INC.,** Beaverton, Ore.	3000	758.0	+73	97	-55	1,564	+7
86	**AMGEN INC.,** Thousand Oaks, Calif.	2800	745.0	+0	2	-92	3,640	+0
87	**HOME DEPOT INC.,** Atlanta, Ga.	5200	739.0	+10	105	NM	17,772	+1
88	**UNITED PARCEL SERVICE INC.,** Atlanta, Ga.	4200	735.0	+169	321	-17	7,051	+5
89	**VALERO ENERGY CORP.,** San Antonio, Texas	2900	730.0	-38	49	NM	838	+6
90	**CARNIVAL CORP.,** Miami, Fla.	4400	725.0	-14	NA	NA	NA	NA
91	**BAXTER INTERNATIONAL INC.,** Deerfield, Ill.	2800	710.0	-15	97.0	NM	1486	+7
92	**COSTCO WHOLESALE CORP.,** Issaquah, Wash.	5300	701.0	-14	1,376	+1,333	13,994	+11
93	**NRG ENERGY INC.,** Princeton, N.J.	4900	697.0	+11	-1310.0	NM	24226	-5
94	**KELLOGG CO.,** Battle Creek, Mich.	2000	686.0	-1	-56	NM	2,020	-3
95	**NISOURCE INC.,** Merrillville, Ind.	4900	663.1	+46	421	NM	19,368	+2
96	**CUMMINS INC.,** Columbus, Ind.	3500	662.0	+9	NA	NA	NA	NA
97	**BIOGEN INC.,** Cambridge, Mass.	2800	658.6	+49	72	-18	1,108	+7
98	**CALPINE CORP.,** Houston, Texas	4900	658.0	+47	489	+127	18,878	+3
99	**ZAYO GROUP HOLDINGS INC.,** Boulder, Colo.	4800	651.5	-1	90	+15	277	+48
100	**GILEAD SCIENCES INC.,** Foster City, Calif.	2800	641.0	+16	393.0	+22	1713	+30
101	**EASTMAN CHEMICAL CO.,** Kingsport, Tenn.	2800	640.0	+8	108	+440	1,256	+9
102	**CONSTELLATION BRANDS INC.,** Victor, N.Y.	2000	636.9	-20	-73	-132	736	-9

FOOTNOTES: * = BASED ON DATA SUPPLIED BY S&P GLOBAL MARKET INTELLIGENCE, A UNIT OF S&P GLOBAL ** = FOR SIC CODES EXPLANATIONS, SEE PAGE 52

RANK 2017*		FIRM TYPE**	CONST. IN PROGRESS 2016 ($ MIL)	CONST. IN PROGRESS % CHG. VS. 2015	BLDG. VALUE ADDED 2016 ($ MIL)	BLDG. VALUE ADDED % CHG. VS. 2015	TOTAL BLDG. INVENTORY 2016 ($ MIL)	TOTAL BLDG. INVENTORY % CHG. VS. 2015
103	**WINDSTREAM HOLDINGS INC.,** Little Rock, Ark.	4800	618.8	+17	4	NM	609	+1
104	**CAPITAL ONE FINANCIAL CORP.,** McLean, Va.	6100	591.0	+15	284	+193	2,958	+11
105	**NORDSTROM INC.,** Seattle, Wash.	5600	554.0	-8	11	-93	1,198	+1
106	**GENERAL MILLS INC.,** Minneapolis, Minn.	2000	553.0	-21	13	NM	2,249	+1
107	**BALL CORP.,** Broomfield, Colo.	3400	503.0	+23	278	+460	1,301	+27
108	**ALCOA CORP.,** New York, N.Y.	3300	498.0	+3	430	NM	8,540	+5
109	**OGE ENERGY CORP.,** Oklahoma City, Okla.	4900	495.1	+78	588	+18	11,185	+6
110	**ALEXION PHARMACEUTICALS INC.,** New Haven, Conn.	2800	495.0	+18	198	+141	450	+78
111	**KIMBERLY-CLARK CORP.,** Dallas, Texas	2600	488.0	+8	75	NM	2,612	+3
112	**HUNTSMAN CORP.,** The Woodlands, Texas	2800	483.0	-48	29	NM	822	+4
113	**DAVITA INC.,** Denver, Colo.	8000	480.4	+43	54.0	-81	491	+12
114	**MICRON TECHNOLOGY INC.,** Boise, Idaho	3600	475.0	+9	1219.0	+331	6306	+24
115	**MOHAWK INDUSTRIES INC.,** Calhoun, Ga.	2200	472.2	+17	69	-52	1,189	+6
116	**LOWE'S COS. INC.,** Mooresville, N.C.	5200	464.0	-10	696	+241	18,147	+4
117	**CROWN CASTLE INTERNATIONAL CORP.,** Houston, Texas	6700	456.7	-21	24	+68	111	+28
118	**HEXCEL CORP.,** Stamford, Conn.	2800	454.4	-17	117.7	+504	523	+29
119	**NORWEGIAN CRUISE LINE HOLDINGS LTD.,** Miami, Fla.	4400	450.4	+50	NA	NA	NA	NA
120	**TARGA RESOURCES CORP.,** Houston, Texas	4900	449.8	-39	584	-89	12,519	+5
121	**ONEOK INC.,** Tulsa, Okla.	4900	434.3	-44	548	-41	15,078	+4
122	**COVANTA HOLDING CORP.,** Morristown, N.J.	4900	433.0	+63	NA	NA	NA	NA
123	**WEC ENERGY GROUP INC.,** Milwaukee, Wis.	4900	424.7	-48	1,021	-91	28,130	+4
124	**AMERICAN WATER WORKS CO. INC.,** Voorhees, N.J.	4900	419.0	+4	1,353	-14	18,736	+8
125	**MOLSON COORS BREWING CO.,** Denver, Colo.	2000	413.4	+236	396	NM	853	+87
126	**ABBVIE INC.,** North Chicago, Ill.	2800	410.0	+18	60	+7	1,344	+5
127	**CROWN HOLDINGS INC.,** Philadelphia, Pa.	3400	406.0	+77	-8	NM	1,001	-1
128	**IDACORP INC.,** Boise, Idaho	4900	405.1	+2	255	+10	6,145	+4
129	**GREAT PLAINS ENERGY INC.,** Kansas City, Mo.	4900	403.9	+16	437	-13	14,236	+3
130	**ANTERO RESOURCES MIDSTREAM MANAGEMENT LLC,** Denver, Colo.	4900	400.1	+30	399	NA	2,451	+19
131	**WESTLAKE CHEMICAL CORP.,** Houston, Texas	2800	389.4	-25	198	+797	465	+75
132	**PPG INDUSTRIES INC.,** Pittsburgh, Pa.	2800	383.0	+8	-137	NM	1,420	-9
133	**SEMGROUP CORP.,** Tulsa, Okla.	5100	380.7	+53	NA	NA	NA	NA
134	**LOEWS CORP.,** New York, N.Y.	6300	379.0	-23	NA	NA	NA	NA
135	**SEACOR HOLDINGS INC.,** Fort Lauderdale, Fla.	4400	370.5	-18	NA	NA	NA	NA
136	**DEERE & CO.,** Moline, Ill.	3500	370.0	+7	214	NM	3,303	+7
137	**SUNTRUST BANKS INC.,** Atlanta, Ga.	6000	357.0	+43	-45	-305	1,028	-4
138	**ROYAL CARIBBEAN CRUISES LTD.,** Miami, Fla.	4400	354.4	-52	NA	NA	NA	NA
139	**PACCAR INC.,** Bellevue, Wash.	3700	352.8	+42	72.4	NM	1134	+7
140	**ASHLAND GLOBAL HOLDINGS INC.,** Covington, Ky.	2800	349.0	+27	34	NM	744	+5
141	**ENLINK MIDSTREAM LLC,** Dallas, Texas	4900	345.7	+5	NA	NA	NA	NA
142	**ECOLAB INC.,** St. Paul, Minn.	2800	344.1	-7	206	+33	1,121	+23
143	**TENET HEALTHCARE CORP.,** Dallas, Texas	8000	339.0	+77	236	+743	7,277	+3
144	**BORGWARNER INC.,** Auburn Hills, Mich.	3700	338.2	-12	9	NM	671	+1
145	**BOSTON SCIENTIFIC CORP.,** Marlborough, Mass.	3800	338.0	+67	0	-100	981	+0
146	**HECLA MINING CO.,** Coeur d'Alene, Idaho	1000	330.8	+12	NA	NA	NA	NA
147	**REGENERON PHARMACEUTICALS INC.,** Tarrytown, N.Y.	2800	318.9	-45	380	+5	1,140	+50
148	**ALBEMARLE CORP.,** Charlotte, N.C.	2800	318.2	-24	-41	-149	257	-14
149	**EMERSON ELECTRIC CO.,** St. Louis, Mo.	3600	318.0	-23	-387	NM	1,867	-17
150	**KOHL'S CORP.,** Menomonee Falls, Wis.	5300	318.0	+90	5.0	-97	8004	+0
151	**PBF ENERGY INC.,** Parsippany, N.J.	2900	307.7	+105	16	+180	51	+48
152	**ORMAT TECHNOLOGIES INC.,** Reno, Nev.	4900	306.7	+23	150	-12	2,744	+6
153	**ILLUMINA INC.,** San Diego, Calif.	3800	306.7	+589	1	NM	9	+18

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154	**QORVO INC.,** Greensboro, N.C.	3600	304.0	+67	46.9	-45	385	+14
155	**WYNN RESORTS LTD.,** Las Vegas, Nev.	7900	299.7	-91	3647.6	+3,874	7623	+92
156	**LEAR CORP.,** Southfield, Mich.	2500	296.4	+8	88	+138	648	+16
157	**KANSAS CITY SOUTHERN,** Kansas City, Mo.	4000	293.4	+59	NA	NA	NA	NA
158	**CHEMOURS CO.,** Wilmington, Del.	2800	293.0	-64	77	NM	814	+10
159	**TYSON FOODS INC.,** Springdale, Ark.	2000	290.0	-23	81	+1	3,662	+2
160	**CF INDUSTRIES HOLDINGS INC.,** Deerfield, Ill.	2800	280.0	-92	607.1	+451	878	+224
161	**UNIVERSAL HEALTH SERVICES INC.,** King of Prussia, Pa.	8000	278.7	+45	495	+112	4,677	+12
162	**HOLLYFRONTIER CORP.,** Dallas, Texas	2900	273.2	-68	NA	NA	NA	NA
163	**WGL HOLDINGS INC.,** Washington, D.C.	4900	273.1	+30	539	+28	5,543	+11
164	**STARBUCKS CORP.,** Seattle, Wash.	5800	271.4	+12	47	-65	458	+11
165	**GENERAL DYNAMICS CORP.,** Falls Church, Va.	3700	269.0	-7	79	-47	2,745	+3
166	**PAYPAL HOLDINGS INC.,** San Jose, Calif.	7300	268.0	+102	NA	NA	NA	NA
167	**CELANESE CORP.,** Irving, Texas	2800	260.0	+0	16	+100	682	+2
168	**REPUBLIC SERVICES INC.,** Phoenix, Ariz.	4900	256.9	+18	62	-36	1,160	+6
169	**INTUIT INC.,** Mountain View, Calif.	7300	256.0	+36	211.0	NM	403	+110
170	**EXPEDIA INC.,** Bellevue, Wash.	4700	252.8	+54	0	NM	0	NM
171	**OWENS CORNING,** Toledo, Ohio	3200	250.0	-30	86.0	NM	874	+11
172	**WESTERN DIGITAL CORP.,** San Jose, Calif.	3500	245.0	-17	NA	NA	NA	NA
173	**COMPASS MINERALS INTERNATIONAL INC.,** Overland Park, Kan.	1400	243.6	+27	NA	NA	NA	NA
174	**KRATON CORP.,** Houston, Texas	2800	242.3	+45	84.8	NM	131	+183
175	**OWENS-ILLINOIS INC.,** Perrysburg, Ohio	3200	238.0	+0	-33	-227	1,090	-3
176	**TELEPHONE AND DATA SYSTEMS INC.,** Chicago, Ill.	4800	237.0	+8	5	-88	511	+1
177	**ORACLE CORP.,** Redwood City, Calif.	7300	235.0	+142	712.0	+2,058	3466	+26
178	**MACQUARIE INFRASTRUCTURE CORP.,** New York, N.Y.	4500	233.2	+15	1	+108	42	+2
179	**PILGRIM'S PRIDE CORP.,** Greeley, Colo.	2000	231.9	+52	39	-14	1,170	+3
180	**HERSHEY CO.,** Hershey, Pa.	2000	231.0	-49	154	+185	1,239	+14
181	**LEVEL 3 COMMUNICATIONS INC.,** Broomfield, Colo.	4800	230.0	+37	97	+4	2,679	+4
182	**LAMB WESTON HOLDINGS INC.,** Eagle, Idaho	2000	229.4	+235	131	+1,111	1,918	+7
183	**SEALED AIR CORP.,** Charlotte, N.C.	2600	227.5	+19	63	NM	665	+10
184	**LIBERTY EXPEDIA HOLDINGS INC.,** Englewood, Colo.	4700	225.0	+1,249,900	54	+5,359,044	68	+371
185	**NUCOR CORP.,** Charlotte, N.C.	3300	224.7	+14	135	+787	1,169	+13
186	**VISTRA ENERGY CORP.,** Irving, Texas	4900	224.0	-31	NA	NA	4,528	NA
187	**HAWAIIAN ELECTRIC INDUSTRIES INC.,** Honolulu, Hawaii	4900	222.5	+22	293.0	+6	6504	+5
188	**GAP INC.,** San Francisco, Calif.	5600	222.0	+19	NA	NA	NA	NA
189	**GLOBALSTAR INC.,** Covington, La.	4800	219.7	+20	NA	NA	NA	NA
190	**HORMEL FOODS CORP.,** Austin, Minn.	2000	218.4	+173	-9.8	-182	806	-1
191	**NEW JERSEY RESOURCES CORP.,** Wall, N.J.	4900	216.1	-7	333.0	+15	2955	+13
192	**HARLEY-DAVIDSON INC.,** Milwaukee, Wis.	3700	214.4	-23	10.8	NM	464	+2
193	**REGIONS FINANCIAL CORP.,** Birmingham, Ala.	6000	214.0	-4	-32	NM	1,730	-2
194	**PORTLAND GENERAL ELECTRIC CO.,** Portland, Ore.	4900	213.0	-61	642	+22	9,747	+7
195	**WEYERHAEUSER CO.,** Seattle, Wash.	2400	213.0	+9	-419	NM	789	-35
196	**ZOETIS INC.,** Parsippany, N.J.	2800	212.0	+15	49	NM	923	+6
197	**O'REILLY AUTOMOTIVE INC.,** Springfield, Mo.	5500	209.2	+3	202.0	+9	1805	+13
198	**PNM RESOURCES INC.,** Albuquerque, N.M.	4900	208.2	+2	646	+68	7,240	+10
199	**UNDER ARMOUR INC.,** Baltimore, Md.	2300	204.4	+38	0	-89	47	+0
200	**TARGET CORP.,** Minneapolis, Minn.	5300	200.0	-37	552	+24	27,611	+2
201	**TRAVELCENTERS OF AMERICA LLC,** Westlake, Ohio	5500	198.6	-4	55	-19	342	+19
202	**SPIRIT AEROSYSTEMS HOLDINGS INC.,** Wichita, Kan.	3700	193.7	-30	57	+357	643	+10
203	**LABORATORY CORP. OF AMERICA HOLDINGS,** Burlington, N.C.	8000	193.0	+7	11	-98	693	+2
204	**QUEST DIAGNOSTICS INC.,** Madison, N.J.	8000	193.0	+42	9	+200	379	+2

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205	**PUBLIX SUPER MARKETS INC.,** Lakeland, Fla.	5400	189.4	+27	599.7	+18	4067	+17
206	**ALLETE INC.,** Duluth, Minn.	4900	188.0	+71	202	-57	5,297	+4
207	**ATMOS ENERGY CORP.,** Dallas, Texas	4900	184.1	-34	931	+17	10,171	+10
208	**ROCKWELL COLLINS INC.,** Cedar Rapids, Iowa	3700	183.0	+2	39	+70	468	+9
209	**TIME WARNER INC.,** New York, N.Y.	4800	183.0	+5	22	-69	1,641	+1
210	**VULCAN MATERIALS CO.,** Birmingham, Ala.	1400	182.3	+17	2	NM	127	+2
211	**WPX ENERGY INC.,** Tulsa, Okla.	1300	180.0	-17	NA	NA	NA	NA
212	**CARMAX INC.,** Richmond, Va.	5500	179.9	-20	285	+9	1,935	+17
213	**LIFEPOINT HEALTH INC.,** Brentwood, Tenn.	8000	178.3	+49	242	+66	2,212	+12
214	**UNITED STATES CELLULAR CORP.,** Chicago, Ill.	4800	178.0	+25	2	NM	297	+1
215	**GENER8 MARITIME INC.,** New York, N.Y.	4400	177.1	-81	NA	NA	NA	NA
216	**AUTOZONE INC.,** Memphis, Tenn.	5500	176.7	+51	180	-4	3,170	+6
217	**CAMPBELL SOUP CO.,** Camden, N.J.	2000	176.0	-26	72	+125	1,488	+5
218	**WEST PHARMACEUTICAL SERVICES INC.,** Exton, Pa.	3000	174.1	+42	32.5	+1,254	443	+8
219	**TWENTY-FIRST CENTURY FOX INC.,** New York, N.Y.	4800	173.0	+59	9	NM	1,326	+1
220	**OLIN CORP.,** Clayton, Mo.	2800	171.0	+38	-5.4	-103	375	-1
221	**COGNIZANT TECHNOLOGY SOLUTIONS CORP.,** Teaneck, N.J.	7300	169.0	+47	18	-91	823	+2
222	**MARTIN MARIETTA MATERIALS INC.,** Raleigh, N.C.	1400	167.7	+31	7	NM	151	+5
223	**SELECT MEDICAL HOLDINGS CORP.,** Mechanicsburg, Pa.	8000	164.5	+12	10	-36	421	+2
224	**AQUA AMERICA INC.,** Bryn Mawr, Pa.	4900	163.6	+13	421	+11	6,509	+7
225	**HORNBECK OFFSHORE SERVICES INC.,** Covington, La.	4400	160.2	-67	0	NM	0	NM
226	**EBAY INC.,** San Jose, Calif.	7300	160.0	+22	NA	NA	NA	NA
227	**GENERAL COMMUNICATION INC.,** Anchorage, Alaska	4800	157.6	+69	NA	NA	NA	NA
228	**ACADIA HEALTHCARE CO INC.,** Franklin, Tenn.	8000	157.1	-19	754	+80	2,032	+59
229	**MATSON INC.,** Honolulu, Hawaii	4400	155.7	+136	NA	NA	NA	NA
230	**ASCENA RETAIL GROUP INC.,** Mahwah, N.J.	5600	155.1	+4	62	+439	251	+32
231	**MARRIOTT INTERNATIONAL INC.,** Bethesda, Md.	7000	155.0	+19	623	NM	1,352	+85
232	**EL PASO ELECTRIC CO.,** El Paso, Texas	4900	154.7	-47	41	-85	4,141	+1
233	**ATLAS AIR WORLDWIDE HOLDINGS INC.,** Purchase, N.Y.	4500	154.2	+289	0	NM	0	NM
234	**COOPER COS. INC.,** Pleasanton, Calif.	3800	154.1	-52	33.8	+64	260	+15
235	**COOPER-STANDARD HOLDINGS INC.,** Novi, Mich.	3700	153.9	+18	29	+96	266	+12
236	**OTTER TAIL CORP.,** Fergus Falls, Minn.	4900	153.3	+93	124	-7	2,225	+6
237	**FASTENAL CO.,** Winona, Minn.	5200	152.5	-24	26	-45	297	+10
238	**AVISTA CORP.,** Spokane, Wash.	4900	150.5	-26	325	-16	5,657	+6
239	**CREE INC.,** Durham, N.C.	3600	150.1	-16	NA	NA	NA	NA
240	**CELGENE CORP.,** Summit, N.J.	2800	148.6	-33	181	+1,160	489	+59
241	**MIDDLESEX WATER CO.,** Iselin, N.J.	4900	146.9	+2,462	45	+82	654	+7
242	**CLEAN HARBORS INC.,** Norwell, Mass.	4900	146.9	+29	29	+385	373	+8
243	**DOLLAR TREE INC.,** Chesapeake, Va.	5300	146.0	-26	139	-76	1,045	+15
244	**TRONOX LTD.,** Stamford, Conn.	2800	146.0	-44	120	+5,900	309	+63
245	**SIRIUS XM HOLDINGS INC.,** New York, N.Y.	4800	145.0	+43	1	-0	62	+2
246	**P.H. GLATFELTER CO.,** York, Pa.	2600	137.7	+135	NA	NA	NA	NA
247	**BLUEBIRD BIO INC.,** Cambridge, Mass.	2800	136.3	+108	0	NM	0	NM
248	**DARLING INGREDIENTS INC.,** Irving, Texas	2000	135.7	-4	16	+195	465	+4
249	**CATALENT INC.,** Somerset, N.J.	2800	134.1	+37	NA	NA	NA	NA
250	**CALIFORNIA WATER SERVICE GROUP,** San Jose, Calif.	4900	133.0	-6	223	+36	2,717	+9
251	**WYNDHAM WORLDWIDE CORP.,** Parsippany, N.J.	6500	131.0	-20	-5.0	NM	862	-1
252	**AXALTA COATING SYSTEMS LTD.,** Philadelphia, Pa.	2800	131.0	-6	31	+498	454	+7
253	**BIOMARIN PHARMACEUTICAL INC.,** San Rafael, Calif.	2800	126.4	-23	69	-35	511	+16
254	**LIVE NATION ENTERTAINMENT INC.,** Beverly Hills, Calif.	7900	125.4	+163	NA	NA	NA	NA

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255	**PACKAGING CORP. OF AMERICA,** Lake Forest, Ill.	2600	125.4	+5	76	NM	717	+12
256	**VISA INC.,** San Francisco, Calif.	6000	125.0	+4	36	+125	839	+4
257	**CONAGRA BRANDS INC.,** Chicago, Ill.	2000	124.9	-39	-1,680	NM	3,313	-34
258	**SEACOR MARINE HOLDINGS INC.,** Houma, La.	4400	123.8	+26	NA	NA	NA	NA
259	**INTERNATIONAL FLAVORS & FRAGRANCES INC.,** New York, N.Y.	2800	122.8	+62	-18.1	-114	520	-3
260	**PDC ENERGY INC.,** Denver, Colo.	1300	122.6	+8	NA	NA	NA	NA
261	**IRON MOUNTAIN INC.,** Boston, Mass.	6700	121.7	+8	195	+99	1,702	+13
262	**ALTRIA GROUP INC.,** Richmond, Va.	2100	121.0	-42	75	-10	1,481	+5
263	**ADVANCE AUTO PARTS INC.,** Roanoke, Va.	5500	120.8	+13	37	+16	924	+4
264	**BLACK HILLS CORP.,** Rapid City, S.D.	4900	120.4	-7	1,435	+247	6,412	+29
265	**SILGAN HOLDINGS INC.,** Stamford, Conn.	3400	118.0	-40	43.1	+2,915	365	+13
266	**CLEAN ENERGY FUELS CORP.,** Newport Beach, Calif.	5500	117.7	-16	NA	NA	NA	NA
267	**AVERY DENNISON CORP.,** Glendale, Calif.	2600	117.3	+73	-14.0	-1,373	565	-2
268	**SHERWIN-WILLIAMS CO.,** Cleveland, Ohio	2800	117.1	+44	19	NM	715	+3
269	**MCCORMICK & CO. INC.,** Sparks, Md.	2000	117.0	+62	43	+212	403	+12
270	**INVESCO LTD.,** Atlanta, Ga.	6200	117.0	+36	NA	NA	NA	NA
271	**NORTHWESTERN CORP.,** Sioux Falls, S.D.	4900	117.0	+55	237	-37	5,740	+4
272	**J.M. SMUCKER CO.,** Orrville, Ohio	2000	116.9	+28	39	-37	766	+5
273	**MDU RESOURCES GROUP INC.,** Bismarck, N.D.	4900	114.8	+29	-307	NM	6,510	-5
274	**AIR TRANSPORT SERVICES GROUP INC.,** Wilmington, Ohio	4500	113.5	+115	0	NM	0	NM
275	**SONOCO PRODUCTS CO.,** Hartsville, S.C.	2600	113.1	-3	-1	NM	479	+0
276	**CLOROX CO.,** Oakland, Calif.	2800	112.0	+72	9	+0	524	+2
277	**SOUTHWEST GAS HOLDINGS INC.,** Las Vegas, Nev.	4900	111.2	-7	330	-4	6,305	+6
278	**COMMERCIAL METALS CO.,** Irving, Texas	3300	111.2	+88	-2	NM	487	+0
279	**NEWS CORP.,** New York, N.Y.	2700	111.0	-11	-139	NM	1,793	-7
280	**WIDEOPENWEST INC.,** Englewood, Colo.	4800	110.5	+18	0.6	NA	45	+1
281	**AMERICAN AXLE & MANUFACTURING HOLDINGS INC.,** Detroit, Mich.	3700	109.9	+24	30	+2,400	346	+10
282	**ROCKWELL AUTOMATION INC.,** Milwaukee, Wis.	3600	108.4	+11	15	+374	334	+5
283	**NETFLIX INC.,** Los Gatos, Calif.	7800	108.3	+1,124	0	NM	41	+0
284	**GRAPHIC PACKAGING HOLDING CO.,** Atlanta, Ga.	2600	106.4	-32	24	+1,643	404	+6
285	**HILTON WORLDWIDE HOLDINGS INC.,** McLean, Va.	7000	105.0	+31	13	-99	6,423	+0
286	**MICROCHIP TECHNOLOGY INC.,** Chandler, Ariz.	3600	104.3	+5	41	+72	500	+9
287	**ILLINOIS TOOL WORKS INC.,** Glenview, Ill.	3500	104.0	+37	25	-65	1,297	+2
288	**CLEARWATER PAPER CORP.,** Spokane, Wash.	2600	103.4	+16	7.4	-20	328	+2
289	**LAUREATE EDUCATION INC.,** Baltimore, Md.	8200	103.2	+11	-75	NM	1,220	-6
290	**NEWMARKET CORP.,** Richmond, Va.	2800	102.3	-17	5	-63	162	+3
291	**ATN INTERNATIONAL INC.,** Beverly, Mass.	4800	102.0	+148	25.1	+5,338	44	+135
292	**LKQ CORP.,** Chicago, Ill.	5000	101.5	+26	26	+160	210	+14
293	**W.R. GRACE & CO.,** Columbia, Md.	2800	100.6	-3	-154	NM	375	-29
294	**DENBURY RESOURCES INC.,** Plano, Texas	1300	100.3	-12	NA	NA	NA	NA
295	**PINNACLE FOODS INC.,** Mountain Lakes, N.J.	2000	100.2	+64	26	-34	273	+10
296	**ZIMMER BIOMET HOLDINGS INC.,** Warsaw, Ind.	3800	99.8	-8	1	-100	1,790	+0
297	**KAPSTONE PAPER & PACKAGING CORP.,** Northbrook, Ill.	2600	99.2	+85	19	+189	178	+12
298	**AVIS BUDGET GROUP INC.,** Parsippany, N.J.	7500	99.0	+11	30	+1,400	597	+5
299	**FIFTH THIRD BANCORP,** Cincinnati, Ohio	6000	99.0	+16	-83	NM	1,672	-5
300	**HELMERICH & PAYNE INC.,** Tulsa, Okla.	1300	98.3	+3	0.0	NM	0	NM
301	**BROWN-FORMAN CORP.,** Louisville, Ky.	2000	96.0	+78	29	-41	497	+6
302	**SUNRUN INC.,** San Francisco, Calif.	3600	95.2	-16	0	NM	0	NM
303	**HEALTHSOUTH CORP.,** Birmingham, Ala.	8000	95.2	+86	83.2	-14	1270	+7
304	**US FOODS HOLDING CORP.,** Rosemont, Ill.	5100	94.1	+60	-109.8	-182	1047	-9

FOOTNOTES: * = BASED ON DATA SUPPLIED BY S&P GLOBAL MARKET INTELLIGENCE, A UNIT OF S&P GLOBAL ** = FOR SIC CODES EXPLANATIONS, SEE PAGE 52

RANK 2017*		FIRM TYPE**	CONST. IN PROGRESS 2016 ($ MIL)	CONST. IN PROGRESS % CHG. VS. 2015	BLDG. VALUE ADDED 2016 ($ MIL)	BLDG. VALUE ADDED % CHG. VS. 2015	TOTAL BLDG. INVENTORY 2016 ($ MIL)	TOTAL BLDG. INVENTORY % CHG. VS. 2015
305	**DOMTAR CORP.,** Fort Mill, S.C.	2600	94.0	-58	32	NM	1,007	+3
306	**FIRST SOLAR INC.,** Tempe, Ariz.	3600	93.2	+147	-32	-210	379	-8
307	**BLUE APRON HOLDINGS INC.,** New York, N.Y.	5900	93.1	+30,223	0	NA	0	NM
308	**TOWER INTERNATIONAL INC.,** Livonia, Mich.	3700	93.0	-3	-15	NM	177	-8
309	**AK STEEL HOLDING CORP.,** West Chester, Ohio	3300	92.8	-15	24	NM	490	+5
310	**CARBO CERAMICS INC.,** Houston, Texas	3200	92.7	-4	4	-56	87	+5
311	**QUALCOMM INC.,** San Diego, Calif.	3600	92.0	+28	1	-99	1,545	+0
312	**IHEARTMEDIA INC.,** San Antonio, Texas	4800	91.7	+33	-140	NM	2,685	-5
313	**GREIF INC.,** Delaware, Ohio	2600	91.3	+17	-20	NM	390	-5
314	**ARMSTRONG WORLD INDUSTRIES INC.,** Lancaster, Pa.	3200	90.8	-32	-120	-1,601	261	-31
315	**HYATT HOTELS CORP.,** Chicago, Ill.	7000	90.0	-64	227	NM	4,125	+6
316	**L BRANDS INC.,** Columbus, Ohio	5600	89.0	+10	16	-66	476	+3
317	**ERA GROUP INC.,** Houston, Texas	4500	89.0	+47	-2	-111	44	-4
318	**WOODWARD INC.,** Fort Collins, Colo.	3600	88.9	-65	156	-11	528	+42
319	**CABOT CORP.,** Boston, Mass.	2800	88.0	-17	3.0	NM	512	+1
320	**AMKOR TECHNOLOGY INC.,** Tempe, Ariz.	3600	87.0	-75	352	+407	1,362	+35
321	**BOYD GAMING CORP.,** Las Vegas, Nev.	7900	86.2	+103	376	+7,482	2,916	+15
322	**FRESH DEL MONTE PRODUCE INC.,** Coral Gables, Fla.	1000	86.1	+30	27	-5	526	+5
323	**GLOBAL PAYMENTS INC.,** Atlanta, Ga.	7300	85.9	+28	-2	-105	61	-3
324	**TREEHOUSE FOODS INC.,** Oak Brook, Ill.	2000	85.0	+247	239	+1,306	465	+106
325	**ALTICE USA INC.,** Bethpage, N.Y.	4800	84.3	-4	68	+260	390	+21
326	**JABIL INC.,** St. Petersburg, Fla.	3600	84.0	-6	53.6	+175	810	+7
327	**APPLIED MATERIALS INC.,** Santa Clara, Calif.	3500	84.0	+75	14	-30	1,261	+1
328	**TRINSEO SA,** Berwyn, Pa.	2800	83.1	+62	0	-90	58	+0
329	**ILG INC.,** Miami, Fla.	6500	83.0	+343	NA	NA	NA	NA
330	**DENTSPLY SIRONA INC.,** York, Pa.	3800	82.9	+45	100	+1,112	500	+25
331	**SPLUNK INC.,** San Francisco, Calif.	7300	82.3	+14	0	NM	0	NM
332	**ORCHIDS PAPER PRODUCTS CO.,** Pryor, Okla.	2600	81.1	+52	13	+1,053	37	+54
333	**AKORN INC.,** Lake Forest, Ill.	2800	80.0	+288	3.1	-86	89	+4
334	**SENSIENT TECHNOLOGIES CORP.,** Milwaukee, Wis.	2800	80.0	+28	-9	NM	265	-3
335	**EDWARDS LIFESCIENCES CORP.,** Irvine, Calif.	3800	79.6	+6	73.8	+224	367	+25
336	**COTY INC.,** New York, N.Y.	2800	79.6	+63	NA	NA	NA	NA
337	**CINTAS CORP.,** Cincinnati, Ohio	2300	79.4	-54	115	+1,422	625	+23
338	**POST HOLDINGS INC.,** St. Louis, Mo.	2000	79.2	+108	-174	-135	618	-22
339	**NAVISTAR INTERNATIONAL CORP.,** Lisle, Ill.	3700	79.0	+18	69.0	NM	562	+14
340	**VALVOLINE INC.,** Lexington, Ky.	2900	79.0	+318	14.2	NM	209	+7
341	**TIFFANY & CO.,** New York, N.Y.	5900	78.6	-18	2	NM	123	+1
342	**EMERGENT BIOSOLUTIONS INC.,** Gaithersburg, Md.	2800	77.8	-39	36	+835	147	+32
343	**FMC CORP.,** Philadelphia, Pa.	2800	76.7	-60	85	NM	375	+29
344	**RENEWABLE ENERGY GROUP INC.,** Ames, Iowa	2900	76.1	-44	31	+352	134	+30
345	**XYLEM INC.,** Rye Brook, N.Y.	3500	76.0	+65	NA	NA	NA	NA
346	**PARKER-HANNIFIN CORP.,** Cleveland, Ohio	3400	74.6	-20	-20	NM	1,438	-1
347	**ALLIANCE DATA SYSTEMS CORP.,** Plano, Texas	7300	74.6	-7	NA	NA	NA	NA
348	**TWITTER INC.,** San Francisco, Calif.	7300	74.3	-13	0	NM	0	NM
349	**SHENANDOAH TELECOMMUNICATIONS CO.,** Edinburg, Va.	4800	73.8	+102	8	+52	116	+7
350	**QUANTA SERVICES INC.,** Houston, Texas	1700	73.5	+68	21	-12	138	+18
351	**PERFORMANCE FOOD GROUP CO.,** Richmond, Va.	5100	72.7	+64	8	-43	411	+2
352	**DOLLAR GENERAL CORP.,** Goodlettsville, Tenn.	5300	72.5	-52	178	+416	1,013	+21
353	**RITE AID CORP.,** Camp Hill, Pa.	5900	72.0	-53	-9.2	NM	619	-1
354	**VISHAY INTERTECHNOLOGY INC.,** Malvern, Pa.	3600	71.8	-10	9	+604	571	+2

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355	**STEPAN CO.,** Northfield, Ill.	2800	71.1	-26	11	+349	185	+6
356	**STEEL DYNAMICS INC.,** Fort Wayne, Ind.	3300	70.6	-7	3	NM	710	+0
357	**SJW GROUP.,** San Jose, Calif.	4900	70.5	+55	130	+16	1,729	+8
358	**ONE GAS INC.,** Tulsa, Okla.	4900	70.3	+23	271	-4	5,404	+5
359	**UNITIL CORP.,** Hampton, N.H.	4900	70.2	+17	93	+1	1,173	+9
360	**BROOKDALE SENIOR LIVING INC.,** Brentwood, Tenn.	8000	69.8	-49	-208	-185	5,053	-4
361	**ROSS STORES INC.,** Dublin, Calif.	5600	69.8	-23	NA	NA	NA	NA
362	**ITT INC.,** White Plains, N.Y.	3500	68.5	+62	3	-80	245	+1
363	**RH,** Corte Madera, Calif.	5700	68.4	+34	0	-96	10	+3
364	**DISH NETWORK CORP.,** Englewood, Colo.	4800	68.2	-82	7	+371	94	+8
365	**ALNYLAM PHARMACEUTICALS INC.,** Cambridge, Mass.	2800	68.2	+5,206	0	NM	0	NM
366	**ADVANSIX INC.,** Parsippany, N.J.	2800	67.8	-9	3.0	-64	156	+2
367	**ALBANY INTERNATIONAL CORP.,** Rochester, N.H.	2200	66.9	+154	3	NM	214	+1
368	**GROUP 1 AUTOMOTIVE INC.,** Houston, Texas	5500	66.7	+14	49	+112	554	+10
369	**WILLIAMS-SONOMA INC.,** San Francisco, Calif.	5700	66.1	-51	NA	NA	NA	NA
370	**DEXCOM INC.,** San Diego, Calif.	3800	65.1	+188	6	NM	6	NM
371	**CABLE ONE INC.,** Phoenix, Ariz.	4800	64.8	-28	4	-40	89	+5
372	**FORTUNE BRANDS HOME & SECURITY INC.,** Deerfield, Ill.	2400	64.5	-22	22	-58	429	+5
373	**TIMKENSTEEL CORP.,** Canton, Ohio	3300	63.9	-15	2	-97	421	+1
374	**ADVISORY BOARD CO.,** Washington, D.C.	8700	63.4	+2,247	0	NM	0	NM
375	**AMERICAN STATES WATER CO.,** San Dimas, Calif.	4900	63.4	+1	93.0	+7	1684	+6
376	**PACIRA PHARMACEUTICALS INC.,** Parsippany, N.J.	2800	63.2	+29	0	NM	0	NM
377	**VECTREN CORP.,** Evansville, Ind.	4900	63.0	+5	455	+22	6,545	+7
378	**SONIC AUTOMOTIVE INC.,** Charlotte, N.C.	5500	63.0	+14	98	+1	778	+14
379	**DARDEN RESTAURANTS INC.,** Orlando, Fla.	5800	62.9	+57	250	NM	2,547	+11
380	**NORTHWEST NATURAL GAS CO.,** Portland, Ore.	4900	62.3	+58	121	+22	2,906	+4
381	**LA QUINTA HOLDINGS INC.,** Irving, Texas	7000	62.1	+1,684	-81	NM	2,622	-3
382	**BB&T CORP.,** Winston-Salem, N.C.	6000	62.0	-49	125	+74	1,628	+8
383	**TRIBUNE MEDIA CO.,** Chicago, Ill.	4800	61.2	+27	-58	NM	155	-27
384	**QUORUM HEALTH CORP.,** Brentwood, Tenn.	8000	60.1	+82	-108.7	-3,393	753	-13
385	**SKYWORKS SOLUTIONS INC.,** Woburn, Mass.	3600	59.9	-63	32	+189	134	+31
386	**QUAD/GRAPHICS INC.,** Sussex, Wis.	2700	59.5	+146	-17	NM	935	-2
387	**IPG PHOTONICS CORP.,** Oxford, Mass.	3600	59.4	+65	48	+117	215	+29
388	**BWX TECHNOLOGIES INC.,** Lynchburg, Va.	3400	59.3	+4	11	NM	157	+7
389	**INTEGRA LIFESCIENCES HOLDINGS CORP.,** Plainsboro, N.J.	3800	59.2	+17	0	-95	18	+0
390	**CLEAR CHANNEL OUTDOOR HOLDINGS INC.,** San Antonio, Texas	7300	58.6	+7	NA	NA	NA	NA
391	**AVNET INC.,** Phoenix, Ariz.	5000	58.0	-34	1	NM	123	+0
392	**SEABOARD CORP.,** Merriam, Kan.	9900	58.0	+53	81	+412	486	+20
393	**HRG GROUP INC.,** New York, N.Y.	3600	57.7	+11	NA	NA	NA	NA
394	**SPECTRUM BRANDS HOLDINGS INC.,** Middleton, Wis.	3600	57.7	+11	NA	NA	NA	NA
395	**CIENA CORP.,** Hanover, Md.	3600	57.6	+209	9	-33	23	+67
396	**CARLISLE COS. INC.,** Scottsdale, Ariz.	2900	57.5	+66	18	-55	343	+6
397	**LENNOX INTERNATIONAL INC.,** Richardson, Texas	3500	57.1	+14	6	NM	218	+3
398	**SUPERVALUE INC.,** Eden Prairie, Minn.	5100	57.0	-28	-278	-747	1,017	-21
399	**SHUTTERFLY INC.,** Redwood City, Calif.	2700	56.5	+0	0	NM	0	NM
400	**CHESAPEAKE UTILITIES CORP.,** Dover, Del.	4900	56.3	-10	162	-14	1,232	+15
401	**MERITOR INC.,** Troy, Mich.	3700	56.0	-10	17	NM	231	+8
402	**KNOLL INC.,** East Greenville, Pa.	2500	55.9	+70	1	NM	64	+1
403	**HAWAIIAN TELCOM HOLDCO INC.,** Honolulu, Hawaii	4800	55.6	+71	1	-59	116	+1
404	**LPL FINANCIAL HOLDINGS INC.,** Boston, Mass.	6200	55.6	+23	106	NM	106	NM

FOOTNOTES: * = BASED ON DATA SUPPLIED BY S&P GLOBAL MARKET INTELLIGENCE, A UNIT OF S&P GLOBAL ** = FOR SIC CODES EXPLANATIONS, SEE PAGE 52

RANK 2017*		FIRM TYPE**	CONST. IN PROGRESS 2016 ($ MIL)	CONST. IN PROGRESS % CHG. VS. 2015	BLDG. VALUE ADDED 2016 ($ MIL)	BLDG. VALUE ADDED % CHG. VS. 2015	TOTAL BLDG. INVENTORY 2016 ($ MIL)	TOTAL BLDG. INVENTORY % CHG. VS. 2015
405	**STERICYCLE INC.,** Lake Forest, Ill.	4900	55.3	+4	31	+27	197	+19
406	**MODINE MANUFACTURING CO.,** Racine, Wis.	3700	55.1	+50	34	+11,333	256	+15
407	**INTERNATIONAL SPEEDWAY CORP.,** Daytona Beach, Fla.	7900	55.0	-58	136	-18	1,832	+8
408	**CAESARS ENTERTAINMENT CORP.,** Las Vegas, Nev.	7900	55.0	-7	15	NM	4,149	+0
409	**VCA INC.,** Los Angeles, Calif.	7000	54.7	+146	17	+366	173	+11
410	**LEUCADIA NATIONAL CORP.,** New York, N.Y.	2000	54.7	+41	NA	NA	NA	NA
411	**TTM TECHNOLOGIES INC.,** Costa Mesa, Calif.	3600	54.5	+38	-10	-105	437	-2
412	**MICHAELS COS. INC.,** Irving, Texas	5900	54.3	+73	34.5	+17	515	+7
413	**SEAWORLD ENTERTAINMENT INC.,** Orlando, Fla.	7900	54.2	-42	27	-49	645	+4
414	**CVR ENERGY INC.,** Sugar Land, Texas	2900	54.2	-56	11.2	+250	65	+21
415	**ABERCROMBIE & FITCH CO.,** New Albany, Ohio	5600	54.1	+172	-5	-1,831	283	-2
416	**VISTEON CORP.,** Van Buren Township, Mich.	3700	54.0	-28	1	NM	65	+2
417	**CONDUENT INC.,** Florham Park, N.J.	7300	54.0	+108	-8	-900	20	-29
418	**BLUE BUFFALO PET PRODUCTS INC.,** Wilton, Conn.	2000	53.9	+1,367	0	-78	60	+0
419	**TRINITY PLACE HOLDINGS INC.,** New York, N.Y.	6500	53.7	+42	2	-50	6	+50
420	**NATIONAL HEALTHCARE CORP.,** Murfreesboro, Tenn.	8000	53.7	-1	45	+117	513	+10
421	**DAVE & BUSTER'S ENTERTAINMENT INC.,** Dallas, Texas	5800	53.6	+54	2	+5,418	16	+13
422	**GENERAL CABLE CORP.,** Highland Heights, Ky.	3300	53.5	+108	17	NM	207	+9
423	**GLOBAL WATER RESOURCES INC.,** Phoenix, Ariz.	4900	53.4	+18	24	NM	278	+10
424	**REVLON INC.,** New York, N.Y.	2800	53.4	+70	4	+388	89	+5
425	**HERMAN MILLER INC.,** Zeeland, Mich.	2500	53.3	-1	23	+39	229	+11

FOOTNOTES: * = BASED ON DATA SUPPLIED BY S&P GLOBAL MARKET INTELLIGENCE, A UNIT OF S&P GLOBAL ** = FOR SIC CODES EXPLANATIONS, SEE PAGE 52

By Bruce Buckley

Slowing Market Leads To Targeted Buildings

Multiuse, multifamily and office are strong, depending on city

MIXED USE Ryan Cos. is building a 1.2-million-sq-ft residential-office-retail development in Kirkland, Wash.

RENDERING COURTESY OF RYAN COS.

After years of slow growth through a construction cycle that, historically speaking, should be headed for a downturn, developers in the commercial and multifamily building sectors are in uncertain territory. Many are already taking a more conservative approach to both and are preparing to shift resources toward other opportunities.

Mason Mularoni, senior research analyst in project and development services at JLL, says the office sector is "generally in a good place," although with less volume under construction than during previous peaks. The commercial sector is eight years into the current "up" cycle, but, historically, cycles have lasted around seven years, he notes.

"The industry as a whole is worried about overbuilding," Mularoni says. "We're at a place that, historically, people aren't comfortable with. With that, we see more moves to build-to-suit or high levels of preleasing. A lot of these office properties require years to hit the market, and a lot of banks are starting to slow down on funding office projects, making it harder to get office loans."

Meanwhile, some companies are employing fewer people and compressing total square footage in office spaces, says Collin Barr, regional president at Ryan Cos. In the office sector, the firm has focused primarily on build-to-suit opportunities, recently completing large regional headquarters for insurer State Farm in Tempe, Ariz., and for Wells Fargo in Minnesota. Last year, Ryan broke ground on a new, 271,000-sq-ft regional headquarters for McKesson Corp.

Barr notes that, although many analysts are predicting multifamily residential is "near the end of its run," Ryan Cos. continues to see opportunities in specific markets, especially in the Midwest. The company recently completed Aurélien, a $100-million, 31-story luxury apartment tower in Chicago. In June, it started a new six-story multifamily project in Phoenix.

The company is also cautiously pursuing mixed-use properties. In December, it completed its 2.3-million-sq-ft Downtown East project in Minneapolis, which includes a mix of office, residential, hotel and retail. "When there is a strong multifamily market and build-to-suit opportunities, you can deliver," Barr says. "But we're very careful to not speculate on too many uses."

Dave Menke, president and CEO of The Opus Development Cos., agrees that the multifamily residential sector is "later in its cycle" but still shows demand in specific markets. In many cases, Opus Group develops mixed-use projects that are primarily residential space. "Being at an urban location with existing street retail, you want to have [the building] fit in with that fabric," he says.

In late 2016 in downtown Minneapolis, Opus Group started construction on a 30-story multifamily and retail development, dubbed 365 Nicollet. Also in the city, the company is building its Variant luxury mixed-use project, which features 14,000 sq ft of street-level retail, topped by five stories of apartments. ■

TOP BUILDING PLANNING PROJECTS REPORTED BY DODGE

RANK	PROJECT	CITY, STATE	VALUE ($ MIL)
1	FOXCONN ELECTRONICS MANUFACTURING BUILDING (DESIGN-BUILD)	MOUNT PLEASANT, WIS.	9,000.0
2	MIXED-USE BUILDING (EXPANSION, RENOVATION)	NEW YORK, N.Y.	7,200.0
3	INTEL FAB 42 SEMICONDUCTOR MANUFACTURING	CHANDLER, ARIZ.	7,000.0
4	30TH STREET STATION DISTRICT PLAN	PHILADELPHIA, PA.	6,500.0
5	DREAMPORT VILLAGES ENTERTAINMENT DESTINATION RESORT	CASA GRANDE, ARIZ.	4,090.0
6	DALLAS MIDTOWN (FORMERLY, VALLEY VIEW MALL)	DALLAS, TEXAS	4,000.0
7	STERLING RANCH COLORADO MIXED-USE DEVELOPMENT	LITTLETON, COLO.	4,000.0
8	HUDSON YARDS, PHASE TWO, WESTERN RAIL YARDS	NEW YORK, N.Y.	4,000.0
9	SOLEMIA MIXED-USE DEVELOPMENT	NORTH MIAMI, FLA.	3,500.0
10	FORBIDDEN CITY PALACE CASINO & HOTEL RESORT	LAS VEGAS, N.V.	3,500.0

SOURCE: DODGE DATA & ANALYTICS

By Jim Parsons

Airports Race To Handle Increase in Passengers

A wave of terminal expansions and renovations is underway

REVAMP Renovations will allow D.C.'s Reagan National to better handle its 26 million passengers a year.

The nation's major airports find themselves in the midst of a massive facilities makeover as rising passenger numbers, coupled with air-carrier stability, have spurred a spate of capital projects. According to U.S. Bureau of Transportation statistics, U.S. airlines' domestic and international passenger enplanements reached a seasonally adjusted all-time high of 71.6 million in July, part of a 12.6% systemwide increase recorded over the past three years.

And with route and service realignments from the most recent air-carrier mergers and acquisitions now settled, Christopher Oswald, Airports Council International-North America's vice president of safety and regulatory affairs, says many airports currently have "a high level of confidence that they can bank on stability and growth for some time."

Unexpected increases in passenger traffic led New Orleans to add five gates to its in-progress North Terminal project, securing its carriers' approval to delay completion of the now $993-million project until early 2019. In Chicago, O'Hare International Airport is developing a $7-billion expansion plan that calls for a new international terminal to complement the already announced gate additions to domestic terminals.

This summer, Washington, D.C.'s Reagan National Airport launched a $1-billion program to improve access inside terminals straining to handle 26 million passengers annually—nearly twice their design capacity.

Even relatively new airports find themselves in need of improvements. Pittsburgh International Airport has proposed replacing its 25-year old landside terminal as part of a proposed $1.1-billion overhaul. Denver International Airport (DIA), in operation for just over two decades, begins a $650-million renovation of its main terminal's Great Hall next summer to make better use of currently underused ticketing-area space. Existing counters will be replaced mostly with kiosks, freeing up room for advanced passenger screening systems on the same level.

"We have more origin-destination passengers than the facility was designed for and more airlines than ever," says Stu Williams, Denver project manager. Denver is also among the airports taking advantage of nontraditional project delivery methods. The Great Hall renovation is part of a 34-year, $1.8-billion public-private partnership; Madrid-based Ferrovial Airports is the P3's lead.

Similarly, the Port Authority of New York & New Jersey will rely heavily on private investment to complement state and local resources in funding a $10-billion suite of major projects to accommodate projected growth at JFK International Airport. Upgrades to LaGuardia Airport also are benefitting from Delta Airlines' self-financed, $4-billion renovation of its primary passenger facility.

Oswald observes that airports, like other public owners, have long wrestled with balancing P3 financing advantages with maintaining an acceptable level of operational control over the end result. Williams says DIA "had to work hard" to achieve a comfort level with its P3 plan, noting that, since design and construction oversight is similar to design-build and construction manager-at-risk, "that process is pretty much the same." ■

TOP AIRPORT PLANNING PROJECTS REPORTED BY DODGE

RANK	PROJECT	CITY, STATE	VALUE ($ MIL)
1	JOHN F. KENNEDY INTERNATIONAL AIRPORT REDEVELOPMENT	JAMAICA, N.Y.	10,000.0
2	PHILADELPHIA INTERNATIONAL AIRPORT EXPANSION	PHILADELPHIA, PA.	7,500.0
3	HJAIA EXPANSION AND RENOVATION PLAN	ATLANTA, GA.	6,000.0
4	TERMINAL 1 COMPLEX REDEVELOPMENT	SAN FRANCISCO, CALIF.	2,000.0
5	GREAT HALL TERMINAL UPGRADE, DENVER INTERNATIONAL AIRPORT	DENVER, COLO.	1,800.0
6	NEWARK LIBERTY INTL. AIRPORT, TERMINAL A	NEWARK, N.J.	1,250.0
7	TERMINAL AND LANDSIDE EXPANSION, RENOVATIONS	NASHVILLE, TENN.	1,200.0
8	NEW KANSAS CITY INTERNATIONAL AIRPORT TERMINAL (P3)	KANSAS CITY, MO.	964.0
9	SALT LAKE CITY INT. AIRPORT, NORTH CONCOURSE	SALT LAKE CITY, UTAH	740.0
10	LAX MIDFIELD SATELLITE CONCOURSE NORTH, PHASE TWO	LOS ANGELES, CALIF.	500.0

SOURCE: DODGE DATA & ANALYTICS

PHOTO COURTESY METROPOLITAN WASHINGTON AIRPORTS AUTHORITY

By Pam Hunter McFarland

School Districts Report Backlog of Projects

Many schools need revamping to keep up with teaching trends

INNOVATIVE TEACHING The Agua Caliente school in California will be built to meet new requirements.

Population shifts, along with ballot funding measures, are driving new construction at schools and universities. The number of education projects that broke ground increased 14% in September, according to Dodge Data and Analytics. Also in September, 10 educational facilities valued at $100 million or more broke ground, including a $243-million neuroscience building at the University of California, San Francisco; the $200-million renovation of the Mid-Manhattan Library in New York City; and a $150-million high school in Germantown, Md., Dodge reports.

In Colorado Springs' District 49, voters approved a $83.5-million mill-levy override to pay for necessary projects. Melissa Andrews, community and facilities planning manager for District 49, says that growth east of Colorado Springs prompted the need for more schools. "Much of Colorado Springs is landlocked, so all the growth is coming our way," she notes. The number of school-aged children in the district have jumped to more than 20,000 from 10,000 in 2005, she says.

The school district has three high-school additions either planned or underway. Falcon High School's $5.65-million addition will include a new academic wing specifically devoted to a career technical-education nursing program. J.E. Johnson is building the project. Two new elementary schools and 24 school modernization projects are also planned. "There are a lot of projects to update the schools because we don't educate children the way we used to," says District 49's Andrews. "The kids don't sit in a classroom and learn from a teacher talking at a blackboard any longer." Instead, she says, more schools are providing areas for group projects, labs and a lot of "maker spaces" for STEM and arts projects.

In California last November, voters approved Proposition 51 to provide $7 billion in school construction bonds, earmarked for new construction ($3 billion), modernization ($3 billion), charter school ($500 million) and facilities for career technical education ($500 million). Officials from the Clovis and Dublin Unified school districts have estimated that, over the next decade, California school districts will need $20 billion to build and modernize schools.

According to Julie Arthur, executive director of facilities planning for the Palm Springs Unified School District, there is a five-year backlog of state projects, estimated at about $2 billion, awaiting funding. However, California's Office of Public School Construction, which reviews and approves grant applications from school districts, says it now is reviewing 926 applications valued at $2.9 billion, according to an office spokeswoman.

Palm Springs is rebuilding the Agua Caliente elementary school to meet current seismic, environmental and technology requirements. The $46-million project is being built on the playground of the old school. Students will use the old building until March 2019, when the project will complete; then, the old building will be demolished to create room for a new playground.

For Arthur, the funds for projects on the waiting lists throughout California can't arrive soon enough. "There are more than 1,000 school districts in California," she says. "They all have different needs—aging out, population growth … but the lack of funding from the state has affected all districts." ■

TOP EDUCATION PLANNING PROJECTS REPORTED BY DODGE

RANK	PROJECT	CITY, STATE	VALUE ($ MIL)
1	COLUMBIA UNIVERSITY, MANHATTANVILLE EXPANSION	NEW YORK, N.Y.	5,000.0
2	SCHUYLKILL YARDS, DREXEL UNIVERSITY	PHILADELPHIA, PA.	3,500.0
3	FORDHAM UNIVERSITY, LINCOLN CENTER EXPANSION	NEW YORK, N.Y.	1,300.0
4	UC MERCED 2020 CAMPUS DEVELOPMENT	MERCED, CALIF.	1,142.0
5	NORTH TORREY PINES LIVING AND LEARNING NEIGHBORHOOD	LA JOLLA, CALIF.	490.0
6	BCTC COMM. AND TECH COLLEGE (NEWTOWN, EASTERN)	LEXINGTON, KY.	436.0
7	CHESTNUT HILL COLLEGE EXPANSION	PHILADELPHIA, PA.	425.0
8	KELLY PARK CROSSINGS, PHASE 3 (MIXED USE)	APOPKA, FLA.	300.0
9	COM INNOVATION PAVILION FOR RESEARCH AND LEARNING	HERSHEY, PA.	300.0
10	RFP-CM: BOND CONSTRUCTION MANAGER-AT-RISK SERVICES	HOUSTON, TEXAS	259.9

SOURCE: DODGE DATA & ANALYTICS

ILLUSTRATION COURTESY OF PALM SPRINGS UNIFIED SCHOOL DISTRICT

By Scott Van Voorhis

States Push Through Road, Bridge Projects

Despite presidential infrastructure promises, spending drops

AGING BRIDGE In Providence, R.I., the 1,290-ft-long bridge on the I-95 corridor is being replaced.

Although the presidential campaign raised hopes of a massive infusion of federal dollars into highways and bridges, spending has dropped by 7% in the past 12 months, according to Alison Black, senior vice president and chief economist of the American Road & Transportation Builders Association.

"We have definitely seen a bit of a pause in the strong, upward momentum," Black said. After bouncing back from the recession, growth in highway work also has stalled nationally over the past year to 18 months, she added.

Barring a major breakthrough on a federal infrastructure bill, 2018 promises more of the same, with a mix of heavy spending by some states offset by flat budgets or even declines in others. "It's a pretty status quo market," she said. However, that varies by state, with Florida, Georgia, Texas, Virginia, Pennsylvania, New Jersey and Washington increasing spending on roads and bridges, Black noted. The upward trend in these states is expected to carry forward through 2018.

Further, the California Legislature has boosted funding for work on roads and bridges, with the state Transportation Commission rolling out $328 million for projects aimed at relieving traffic congestion and repairing bridges, according to California's transportation department, also known as Caltrans.

"This list of multimodal and fix-it-first projects help us keep our commitment to Californians to maintain and improve the transportation system for economic and quality-of-life benefits," said Malcolm Dougherty, director of Caltrans, in a press statement.

Michael McArdle, chief development officer at engineering and design firm VHB Inc., says North Carolina should be added to the growth column, too.

VHB has been busy in the Tar Heel State working on bridges as well as highway safety and environmental projects, as North Carolina transportation officials are now required to farm out 70% of this work, he said.

Maryland raised its gas tax, freeing up more money for roads and bridges, while Virginia transportation officials are gearing up to seek bids early next year on the Fredericksburg extension, which would lengthen I-95 express lanes 10 miles south of Route 610, said Stephen Skippen, senior project manager at Skanska.

Sam Patel, project estimator for megaprojects at Fort Myer Construction Corp. in Washington, D.C., says there's a healthy workload ahead in 2018. In particular, his company is preparing to bid on more than $240 million in new highway work in Maryland.

Eric Rodriguez, senior consultant at Interface Consulting, predicts even more public-private partnerships in 2018. Examples include a new toll road in Tennessee and roadwork in the Houston area.

"Obviously, the reason for that is in response to costs," Rodriguez says. "It's a way do to it a little more efficiently and get everyone involved in the process and on the same page early on." ■

TOP ROAD, BRIDGE PLANNING PROJECTS REPORTED BY DODGE

RANK	PROJECT	CITY, STATE	VALUE ($ MIL)
1	GATEWAY TUNNELS PROJECT	NEW YORK, N.Y.	10,000.0
2	SEPULVEDA PASS TRANSIT CORRIDOR AND TUNNEL	LOS ANGELES, CALIF.	8,250.0
3	RFP-AE CROSS HARBOR FREIGHT TUNNEL AND RAIL IMPROVEMENTS	BROOKLYN-QUEENS, N.Y.	7,000.0
4	ILL. DOT: I-290 EISENHOWER EXPRESSWAY, ROAD IMPROVEMENTS	ILLINOIS	2,700.0
5	ENGINEERING SERVICES (PSB 16-3)	DOWNERS GROVE, ILL.	2,600.0
6	ILLINOIS ROUTE 53/120 NORTH EXTENSION	ILLINOIS	2,500.0
7	KY. DOT: BRENT SPENCE BRIDGE REPLACEMENT	COVINGTON, KY.	2,500.0
8	S.C. DOT: I-73 CORRIDOR (HORRY/DILLION/MARION/MARLBORO CO)	HORRY COUNTY, S.C.	2,400.0
9	DESIGN CORRIDOR MANAGEMENT (PSB 16-3)	DOWNERS GROVE, ILL.	1,670.0
10	RECOVERY ROADS PROGRAM (HURRICANE REBUILD)	NEW ORLEANS, LA.	1,390.0

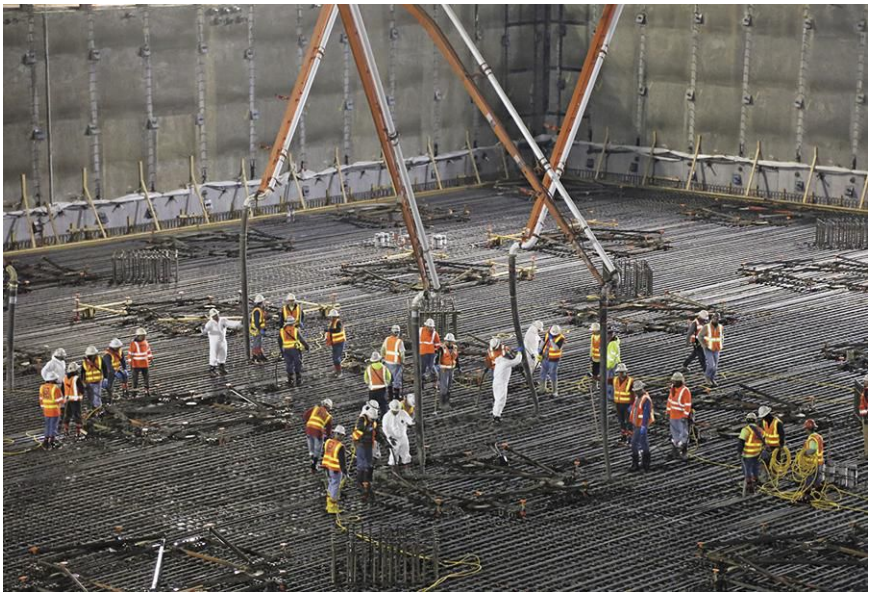
SOURCE: DODGE DATA & ANALYTICS

PHOTO COURTESY OF VHB

By Scott Lewis

Outpatient Facilities Dominate New Builds

Health-care providers also look to update existing campuses



EXPANDING Loma Linda University is building an adult hospital and expanding its children's hospital.

For hospitals across the country, lower occupancy rates and higher costs have caused health-care providers to reconsider how they deliver their services to their communities. One result is a rise in the construction of outpatient facilities, according to a survey by Health Facilities Management. Due to advances in technology, approximately half of all medical procedures no longer require an overnight stay at a hospital and can be performed at an outpatient facility.

"We're seeing a shift from a one- or two-day hospital stay to an outpatient setting," says Jesse Balok, principal at ECG Management Consultants, a strategic health-care consulting firm. "The health-care industry has recently been expanding their ambulatory and outpatient networks to provide health care to patients in the lowest-cost facility settings," says Jones Lang LaSalle, a real estate investment and property management firm. "We've seen this push realized in significant jumps in new construction in the outpatient field, as well as innovations in tele-medicine and at-home care."

One example of this trend is Aurora Health Care, a major nonprofit healthcare network in Wisconsin. Aurora completed an $82 million outpatient surgery center in Burlington, Wis., in fall 2016. Earlier this year, the company announced its intention to build a $130-million outpatient surgery center and medical office building in Kenosha as well as a $55-million outpatient surgery center and medical office building in Greenfield.

OUTPATIENT Aurora HealthCare is expanding its short-term facilities in Wisconsin.

A continuing trend is the rehabilitation of older facilities. "There's a need for regenerating medical campuses that were built in the 1960s or 1970s [that are now] past much of their useful life," says Balok.

"Many existing hospital towers of this era have double-loaded corridors and rooms that are not large enough to accommodate newer technologies, contemporary care practices or 'rooming in' of patients' families. Several organizations have [built] or are building critical-care towers—high-acuity facilities which accommodate the sickest patients with bigger medical teams and more-advanced technology."

An example of an older campus being updated, the Women & Children's Hospital of Buffalo (N.Y.) is being replaced by the John R. Oishei Children's Hospital, which is set to open this month. Turner Construction was the prime contractor on the $270-million facility. ■

TOP HEALTH-CARE PLANNING PROJECTS REPORTED BY DODGE

RANK	PROJECT	CITY, STATE	VALUE ($ MIL)
1	ST. JUDE CHILDREN'S HOSPITAL EXPANSION	MEMPHIS, TENN.	1,084.5
2	SCRIPPS MEMORIAL HOSPITAL EXPANSION	LA JOLLA, CALIF.	1,000.0
3	LYTLE FARM NEIGHBORHOOD MIXED-USE DEVELOPMENT	MIDDLETOWN, PA.	1,000.0
4	ROBLEY REX VA MEDICAL CENTER CAMPUS	LOUISVILLE, KY.	883.2
5	MIHS HOSPITAL AND HEALTH-CARE SYSTEM	MARICOPA, ARIZ.	829.0
6	WEST LOS ANGELES VA MEDICAL-CENTER MODERNIZATION	LOS ANGELES, CALIF.	750.0
7	METHODIST HOSPITAL EXPANSION AND NEW MEDICAL CENTER	INDIANAPOLIS, IN.	750.0
8	KAISER DUBLIN MEDICAL CAMPUS	DUBLIN, CALIF.	650.0
9	PROVIDENCE TARZANA MEDICAL-CENTER UPGRADES	TARZANA, CALIF.	624.0
10	VIRTUA HEALTH ACUTE-CARE HOSPITAL (330 BEDS)	WESTAMPTON, N.J.	527.0

SOURCE: DODGE DATA & ANALYTICS

PHOTO COURTESY LOMA LINDA UNIVERSITY MEDICAL CENTER; ILLUSTRATION COURTESY AURORA HEALTH CARE.

By Pam Radtke Russell

Water Projects Provide Exponential Benefits

Utilities look to solve multiple problems more cheaply

STORMWATER MULTITASKS Hampton Roads, Va., is building a skateboard park atop a water tank.

Designing skateboard parks isn't a typical task for a district sanitation engineer. But that's just one of many things Bruce Husselbee, director of engineering for the Hampton Roads Sanitation District in Virginia, is doing as the district—like many other water and wastewater utilities—tries to solve more complex problems with fewer resources and higher expectations from the public.

The proposed 20,000-sq-ft skateboard park would sit atop a 5-million-gallon stormwater tank, which is needed to hold stormwater during wet weather to prevent overflow in Virginia Beach. "We're challenged to find locations for these tanks. Neighbors don't want it in the city park," says Husselbee. So, partnering with the city's parks-and-recreation department, the district will foot the bill for the $23-million park, which provides a "good outcome" for everyone, Husselbee says.

Increasingly, water utilities are having to look at similar out-of-the-box solutions not only to solve traditional wastewater and water problems but also to provide benefits to the community. The Hampton Roads utility also is building out its program to highly treat and inject into the ground wastewater, reducing subsidence and saltwater intrusion and provide groundwater. It has a $1-billion plan to treat and inject 100 million gallons per day at seven plants within the decade.

In metro Atlanta, maximizing the amount of surface water available for future drinking water by returning treated wastewater to Lake Lanier and Lake Altoona is a key tenet of an integrated plan for the 15 counties and 110 water and sewer utilities in the region, says Danny Johnson, the Metropolitan North Georgia Water Planning District manager responsible for that management scheme. "An integrated approach values wastewater," he points out.

The district was an early embracer of integrated planning—the "one water" approach to water planning—that allows utilities and districts to examine more closely and plan what is being done with all forms of water. Such planning can lead to increased customer buy-in and cost savings for utilities, Black & Veatch says in its 2017 "Strategic Directions" report.

In this era of shifting, competing priorities, even the expansion of a drinking-water plant isn't just a simple expansion. In September, Houston started a seven-year, $1.4-billion expansion of its Northeast Water Purification Plant that will increase its capacity to 320 mgd from 80 mgd (ENR 6/26-7/3 p. 68). While the expansion is necessary for Houston's growing population, another equally important driver is to reduce subsidence by moving to surface water from groundwater.

Currently the world's largest such expansion, the project shows how utilities increasingly are looking at water holistically, says Ravi Kalagadi, Houston senior assistant director, project manager.

"We're getting into things you never would have expected," says Hampton Roads' Husselbee. "It takes more time, and it takes more thought. You really have to look for those win-win opportunities." ■

TOP WATER PLANNING PROJECTS REPORTED BY DODGE

RANK	PROJECT	CITY, STATE	VALUE ($ MIL)
1	NORTHEAST WATER PURIFICATION PLANT EXPANSION (DESIGN-BUILD)	HOUSTON, TEXAS	1,167.38
2	POSEIDON HB SEAWATER DESALINATION FACILITY	HUNTINGTON BEACH, CALIF.	650.0
3	AUGUSTIN PLAINS RANCH WATER RECLAMATION AND TRANSPORT PROJECT	DATIL, N.M.	600.0
4	PORTLAND CITY LABORATORY SERVICES FOR BULL RUN TREATMENT	PORTLAND, ORE.	500.0
5	LAKE RALPH HALL (WATER-SUPPLY LAKE)	TEXAS	369.0
6	RFP-AE: CAPITAL IMPROVEMENT PROGRAM MANAGEMENT ORGANIZATION (IQC)	DETROIT, MICH.	350.0
7	NORTH SYSTEM RENEWAL TREATMENT PLANT (NSRTP)	COLORADO	320.0
8	MONTEREY BAY REGIONAL WATER PROJECT	MOSS LANDING, CALIF.	300.0
9	CADIZ VALLEY WATER STORAGE AND PIPELINE	CADIZ CALIF.	250.0
10	BRUSHY CREEK REGIONAL WATER TREATMENT, PHASE TWO	CEDAR PARK,TEXAS	180.0

SOURCE: DODGE DATA & ANALYTICS

ILLUSTRATION COURTESY OF HRSD

Harbor Bridge in Corpus Christi, Texas, is one of many bridges currently under construction.

IMAGE: COURTESY OF FIGG

Bridges Today III

The Fine Art of Bridge Building

Equipment, technology and ingenuity are vital for improvements and renovations

By Kate Gawlik

WHAT'S INSIDE

Making Claims on Bridge Construction

A lot of companies and markets make claims about creating the biggest, strongest, longest or newest. When talking about bridges, some of these statements actually are true because of the amount of attention needed in this market. In the United States alone, the American Society for Civil Engineering believes $123 billion is required to address the current maintenance issues with bridges. Of the nation's more than 600,000 bridges, 56,007 (9.1%) were deemed structurally deficient in 2016.

Construction leaders are rising up to show their impact in this growing market. Their work is impressive, and their technology will make travel safer. Here, market experts share their insights into currents trends, challenges and progress.

What do you consider the greatest current innovation in the bridge market?

Jim Benzing, Project Manager, Structural Services: State-of-the-art heavy hydraulic towers can lift a whole span up and move it, allowing a crew to replace the old span with the new one within 24 hours. The new span is built a few miles away and transported to location using high-capacity trailers, and the old span is replaced with the new one using heavy hydraulic towers in a matter of a day. Coated rebar, composite material and concrete bridges are great innovations as well.

David Brodowski, PE, Vice President, Inventure Civil: Innovations in materials like high-performance concrete, steel and plastic, especially when prefabricated into customized components for the bridge, have resulted in multiple benefits for all stakeholders. These materials make it possible to span longer or use less components for the superstructure than conventional materials, drastically reducing labor and accelerating construction. Additionally, the resulting bridge is stronger and more durable while requiring less maintenance over time.

John Michael Pardo, Senior Vice President and Chief Human Resources Officer, Dragados USA: What is changing the industry now is accelerated bridge construction, the use of construction techniques that minimize impacts to areas underneath, the capacity to span longer obstacles and the impressive design life currently achieved by using the latest state-of-the-art materials.

What is challenging in the bridge market?

Benzing: The skilled labor shortage. It can be difficult to find highly skilled and safe workers. Thanks to Iron Workers, we have skilled ironworkers and welders, but we have trouble finding other skilled craftspeople.

Brodowski: Along with shorter project schedules to reduce disruption to traffic, the highest quality of materials and construction is also expected to ensure a long service life of 75 to 100 years. The industry will continue to be challenged to provide expertise in the design and supply of systems that help contractors build within these constraints.

Zachary Gorman, Midwest Regional Director, IMPACT: Bridges are not funded from state to state. Underfunded maintenance and replacement is a major issue.

Pardo: From the design side, we have seen how the increasingly powerful CAD techniques have allowed the optimization of the materials to a point where the construction process becomes critical. Furthermore, the current aesthetic requirements have forced the designers to produce more signature and complicated structures with very demanding construction schemes. And we have had to respond to these design advances with parallel advances.

Bridge design and construction is also facing the challenge of increased durability requirements and long-term behavior for new high-capacity materials. Environmental concerns are affecting the way in which bridges are being constructed, and we see an increase in the application of top-down construction technologies in environmentally sensitive areas.

Another major challenge today, which we look forward to, is the increase in design-build procurement for major bridge projects. This allows us to provide input to the design that results in faster, longer-lasting and more economical solutions, as well as tailor-made designs that best fit our means and methods approach and technology.

How does your company contribute to improvements in the market?

Brodowski: Inventure Civil has been partnering with contractors on some of the largest and most demanding infrastructure projects in the United States, providing innovation in MSE walls with the SINE WALL MSE Panel System. Just this year, the company introduced ClearCast Forms, a transparent stay-in-place bridge deck forming system from our TrueTech Bridge system. ClearCast Forms help contractors build the bridge deck quickly and safely, while the form's transparency allows bridge owners to comply with bridge inspection standards and maintain the bridge deck over time.

Pardo: Our company has built more than 1,500 bridges worldwide, including more than 400 signature bridges. Innovation has always been key to our success, as is our approach to continuous development of optimization.

Our team is focused on developing state-of-the-art and elegant solutions, which will create world-class landmark structures, perfectly integrated with their environments. A multidisciplinary team, led by experienced bridge designers, was actively involved from the conception to the final development,

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1) Bridge/Structural, 2) Architectural/Ornamental, 3) Reinforcing, 4) Industrial/Rigging/Machinery Moving and 5) Fabrication. Category winners will be recognized at the 2018 North American Iron Workers/IMPACT Conference, which will be held Feb 11 – 14, 2018 in Orlando, Fla. Projects must be completed within the calendar year Jan 1 – Dec 31, 2017 and submitted by midnight on Dec 31 by any staff member of an IMPACT partner contractor.

Log on to the IMPACT website and click on the Project of the Year link to begin.

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Harvey Swift, Southwest Regional Director, IMPACT: Our partner contractors and ironworkers build the bridges. Iron Workers' contractor-ironworker partnership, IMPACT, provides comprehensive training, including safety training for the ironworkers to ensure a job-ready skilled workforce.

How is the bridge market becoming more sustainable?

Benzing: The bridge market is using modern materials to build stronger and more sustainable bridges. It now uses stronger steel with 70 ksi and stronger concrete.

Pardo: Resiliency, aesthetics, environmental protection (including storm water treatment requirements), new materials, reduced maintenance and life-cycle considerations (design for 100 years or even longer) are getting more important in recent designs. This will result in a new era for bridge construction.

Innovative Leaders

Over the St. Lawrence River in Montreal, Quebec, Canada, construction is underway for the new Champlain Bridge. The previous structure was one of the busiest in the country, with about 40–60 million annual vehicle crossings. From a trade standpoint, more than $20 billion of cross-border goods annually pass this trade corridor.

Sarens was asked by Signature sur le Saint Laurent, a joint-venture company between SNC Lavalin, Dragados, Flatiron and others, to install 38 footings for the new bridge. In total, the bridge will be made up of 74 footings; 38 will be prefabricated at the jetty, and 36 other footings will be made by pouring concrete directly into foundations in the river bed. The weight of a single footing is 600–1,000 tons.

To complete the complicated project, Sarens designed and built special equipment for the project called the Floating Foundation Installer (FFI). The FFI is a self-propelled catamaran that can lift, transport and install foundations. It can operate in strong currents and lift and transport parts weighing up to 1,000 tons. The lifting apparatus has a turntable, allowing for a 360-degree rotation of parts.

Sarens Operations Manager Sven Janssens says, "Sarens undertook a daunting technological and operational feat by flawlessly handling the installation of the footings for the notable Champlain Bridge Project. It is by far the most challenging project I had the opportunity to be a part of at Sarens."

The Forth Replacement Crossing in Scotland recently opened to traffic, and it is a good example of Dragados' contribution to the improvement of the bridge market. The 1.7-mile (2.7-km) bridge is the longest three-tower, cable-stayed bridge in the world. It also is by far the largest to feature cables, which cross mid-span. The design provides extra strength and stiffness, allowing the towers and deck to be more slender and elegant. Pardo adds, "For the first time at this scale, the crossing cables technique has been employed to overcome the flexibility problems that multiple-span cable-stayed deck present."

Dragados also is working on the new six-lane Harbor Bridge in Corpus Christi, Texas. It will boast the longest cable-stayed span in the United States at 1661 ft and is slated for completion in spring 2020. It also will be the longest cable-stayed bridge in the world constructed with precast concrete box girders and a single centered plane of cables. The bridge will feature a clearance of 205 ft above water, enabling navigation for the new Panama class vessels.

Discover more about these and other projects, completed by the innovative minds in the bridge market, in the following pages. ◆

Shored MSE Wall Makes Difference

The Freemansburg Avenue Bridge over SR 33 in Easton, Pa., was a double-span bridge with abutments on piles. Each abutment was built with a mechanically stabilized earth (MSE) wall in front and flared MSE wing walls. The project involved widening the bridge to accommodate more traffic.

The abutment seat extension had to cross the interface of the existing and proposed MSE wall. To leave the existing MSE backfill undisturbed, the project team (PennDOT, Pennoni Associates, Borton-Lawson, JD Eckman and The Reinforced Earth Co.) designed a length of abutment footing from the last existing pile, spanning an extra distance to the new piles in the proposed MSE structure. This allowed the new pile installation to occur only in the zone of the new MSE wall backfill.

The interface of the new and existing MSE walls formed an acute angle, and the tight spacing of the new piles made a conventional MSE wall design in the corner not feasible. A zone of flowable fill was placed the full height of the wall, with MSE wall panels connected to the existing wall. It allowed for a stabilized wall segment until a conventional acute corner could be accommodated. What resulted was a "shored" MSE wall: a wall built in front of an existing structure while using the existing structure to stabilize or reduce loads on the new structure. ◆

A shored MSE wall stabilized the bridge.

PHOTO: COURTESY OF THE REINFORCED EARTH CO.

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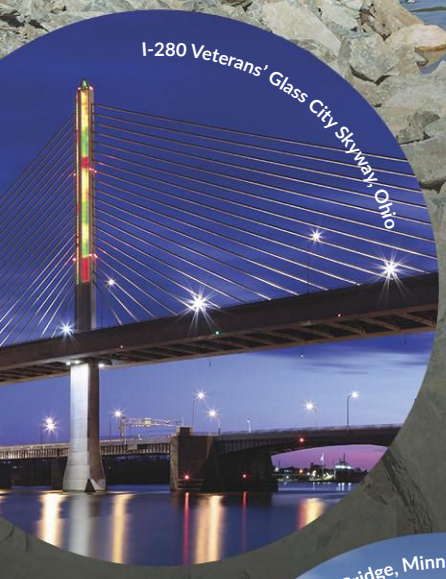
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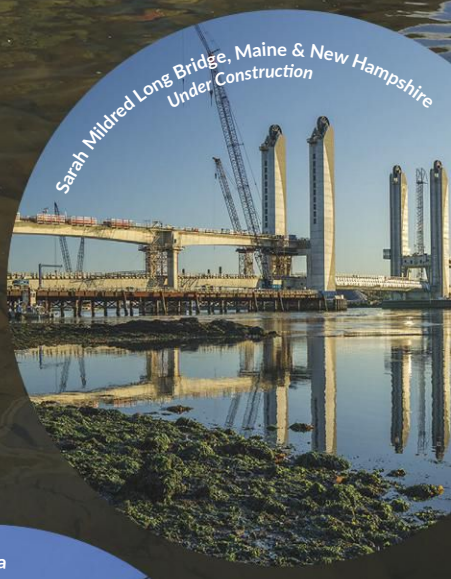
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Traylor Bros. Inc, a third-generation, family-owned contractor, set a goal to diversify its client base and develop turnkey services that provide clients with one-stop shopping for their most challenging projects. Through recent strategic investments, Traylor has done just that. Under its newly established parent company, Traylor Construction Group Inc., Traylor has invested in Sterling Boiler and Mechanical LLC, A & D Constructors LLC and Ballard Marine Construction with the goal of providing complete solutions for clients' heavy civil, mechanical, and marine engineering and construction needs.

Traylor is one of the nation's leading heavy civil contractors, building landmark bridges, tunnels and marine structures. Sterling and A&D provide boilermaker, structural steel, mechanical, electrical and shop fabrication to clients in the power-generation and industrial industries. Ballard delivers turnkey services in underwater construction, underwater inspection and surveying, environmental/remediation, plant maintenance, ships husbandry, and contaminated and potable water diving.

"The best part about the Traylor Family of Companies is the flexibility it provides when serving our clients," say Co-Presidents Mike and Chris Traylor. "Our structure is designed to allow us to work together or as individual companies, as best suits an individual client or project. We believe this is a unique and important benefit to the industry." ◆

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Award-Winning Segmental Bridge Features Longest Concrete Girder Span in Minnesota

The new I-90 Dresbach Bridge with twin 508-ft main spans demonstrates how segmental concrete can be used to create a beautiful, efficient, variable-depth, long-span bridge in sensitive environmental areas and harsh winter conditions, while achieving a new record concrete girder span length for Minnesota. The bridge has won five awards of excellence and was designed with community involvement in aesthetic features.

The New I-90 Dresbach Bridge is a highly utilized sustainable river crossing between LaCrescent, Minn., and LaCrosse, Wis., over the Mississippi River. This $81.5-million concrete bridge is part of a $187.5-million transportation project that opened in October 2016.

PHOTO: COURTESY OF FIGG

Located within the Upper Mississippi River National Wildlife and Fish Refuge, the Dresbach Bridge was created to exist harmoniously with the landscape and environment. Its context-sensitive design was developed to pay tribute to the features of the Mississippi River and its forested bluffs. Its twin wall pier shapes reflect the old-growth trees on the forested shoreline and, at the same time, enhanced the construction process. The twin wall pier design created engineering balance during the superstructure construction so that no temporary supports were needed in the river. This preserved the environment and kept maritime traffic moving.

The project was designed by FIGG Engineering Group to be a context-sensitive, low-maintenance, aesthetically pleasing bridge. To this end, it uses a performance concrete mix, bidirectional pre-compression of the entire concrete superstructure, stainless steel deck reinforcing and an integral wearing surface. The bridge has an enhanced lifespan of more than 100 years. ◆

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Longest Cable-Stayed Span Bridge Coming to the United States

Dragados and its team of professionals have delivered 19 cable-stayed bridges throughout the world. The new six-lane Harbor Bridge in Corpus Christi, Texas, will boast the longest cable-stayed span in the United States at 1661 ft when completed in spring 2020. It also will be the longest cable-stayed bridge in the world constructed with precast concrete box girders and a single centered plane of cables. The bridge will feature a clearance of 205 ft above water, enabling navigation for the new Panama class vessels.

Dragados, in partnership with the Texas Dept. of Transportation, the City and the Port of Corpus Christi, is committed to building this state-of-the-art facility in a way that is environmentally sensitive and community enriching. This iconic project is being designed and constructed to achieve a Platinum INVEST rating in the Project Development and Operations and Maintenance categories, which is the Federal Highway Administration's program to integrate sustainability into highway infrastructure projects. The concrete bridge design provides corrosion resistance and preventive maintenance, enabling the bridge to last more than 170 years.

Dragados set out to leave an equally lasting impression on Corpus Christi and its community. Among an array of initiatives, Dragados is committed to source a significant portion of the labor force from the local community, especially encouraging the participation of disadvantaged business enterprises and providing on-the-job training opportunities. This will have short- and long-term benefits to the Corpus Christi community, providing jobs and stimulating the local economy, as well as training and equipping a sustainable local labor force. ◆

The concrete bridge design for Harbor Bridge provides corrosion resistance and preventive maintenance, enabling the bridge to last more than 170 years.

IMAGE: COURTESY OF FIGG

Ironworkers Complete Evergreen Point Bridge Incident Free in Seattle

Iron Workers Local 86 (Seattle) with Rebar International, Kiewit (GC), Gerdau and NW Tower Crane worked more than 40,000 man hours and installed almost 17.8 tons of rebar without a recordable or lost-time incident on the Evergreen Point Bridge near Seattle. Ironworkers from Local 86 and their contractors worked with the community to employ local workers on the $1.3-billion project that provided job opportunities for five years during the recession (visit www.ironworkers.org for more information).

Dave Otey, Rebar International's corporate safety director and retired ironworker from Local 229 (San Diego), made safety a priority by developing a site-specific safety plan and job hazard analysis every day to identify unique safety requirements for working over water. Ironworkers wore life vests, and manned boats were positioned underneath the bridge and trestle. Safety railing was installed along the bridge, and ironworkers used complete fall-protection systems.

A lightweight yet strong and durable fiberglass-reinforced product was used in place of catwalks made of galvanized steel, which is prone to rust. Four cranes worked in coordination to feed the project with a constant supply of materials to maintain efficiency.

Pontoons were assembled and connected over several months with tension cables in the Tacoma assembly yards and floated through the locks to the location, while the west and east entrance ramps were built in place. Once the handrail and barrier rails were assembled, the bridge was open to the public while the crew wrapped up detail work.

Coordination and planning kept ironworkers from Local 86 safe while completing the Evergreen Point Bridge near Seattle.

The ironworkers ensured the lake had enough water to float components. "The sheer size of the component coupled with adverse weather created special challenges, but we were able to overcome those challenges through careful planning and skilled workmanship," says Chris McClain, business agent on the project from Local 86. ◆

PHOTO: COURTESY OF IMPACT

Bridge Utility Contractor Spans Infrastructure Market

From telecom to water, electric, gas and power systems, bridge utility work can be a complicated endeavor.

As the premier bridge utility contractor in the country, Aptus works with companies, governments and municipalities to design, furnish, install and maintain the nation's utility infrastructure. The company specializes in under-bridge conduit and piping installation, inspection and rehabilitation for multiple markets, including telecom, infrastructure security, natural gas, municipal utilities, and DOTs across the country for work on roads and bridges.

A ductile iron-forced water main was placed beneath this bridge.

The company has installed under-bridge systems, including natural gas lines, forced main sewers, ductile water mains and electrical conduit, as well as other necessary bridge infrastructure, such as telecom conduit cameras, navigational lighting and dry/pressurized standpipe fire-suppression systems.

With more than 250 years of combined management and construction experience, Aptus has worked on more than 2,300 bridges in 43 states.

"Along with our vast experience, we bring a commitment to a level of personalized customer service that is unique in the industry," says T. Edward Dill, human resources and talent development for Aptus. "Reach out to us, and let us earn your business!"

Using bridges to extend utilities is smart and efficient. It can also be complicated and risky. Know your regulatory limits, and look for an experienced installer with the right equipment and safety record. For more information, contact Aptus at 704-598-5684 or visit www.goaptus.com. ◆

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PHOTO: COURTESY OF APTUS

Four-Lane Bridge and Highway Improvements for Land Between the Lakes

Between Lake Barkley and Kentucky Lake is an area known as Land Between the Lakes. This area was designated a national recreation area by President John F. Kennedy in 1963. It is one of the largest tourist areas in western Kentucky, and it is the recreational home to boating, camping, fishing and hunting enthusiasts.

The two-lane truss bridge constructed in 1932 across the Tennessee River was deemed to be functionally obsolete, very narrow and a continuing maintenance issue, so plans for the replacement began.

A new, modern four-lane bridge was designed in association with a larger effort to widen and improve U.S. 68/KY 80 Aurora through the Cadiz bypass. The design of the bridge needed to meet the engineering, environmental and budget requirements of the project, which is located in a highly critical seismic zone. Skyline Steel produced 30-in. OD pipe pile with 1-in. wall thickness for the new bridge abutments.

> A new, modern four-lane bridge was designed in association with a larger effort.

Pipe piles with low diameter-to-thickness ratios are often used in areas with high seismic loads. The new bridge was opened to four lanes of traffic on Aug. 23, 2016. ◆

PHOTO: COURTESY OF SKYLINE

A two-lane truss bridge was replaced with a four-lane bridge designed with pipe piles with low diameter-to-thickness ratios for the seismic area in Kentucky.

Light Rail Extension Moves Charlotte Forward

The 9.3-mile Charlotte Area Transit System (CATS) Blue Line Extension is reducing congestion with a design that fits the surrounding artistic community. Tricor Construction, working under the general contractor Lane Construction, leveraged the SINE WALL MSE Panel System from Inventure Civil for more than 200,000 sq ft of walls on segments B/C of the light rail extension, which was completed in 2016.

Inventure Civil partnered with CATS and the contractor team to incorporate an intricate series of flower and plant designs across 18 walls in a system that meets the design structural requirements while expressing the vision of the project artist. In addition to the complex formliners, the project required acute corner bin walls, back-to-back walls and pilaster designs. The team successfully navigated the logistics of bridge and wall systems constructed in the middle of Tryon Street, one of the most heavily traveled in greater Charlotte. The innovative SINEstrip technology in SINE WALL systems enabled quick install and maximum design flexibility. The focus on innovation and aesthetics across project elements helped the team advance infrastructure in the greater Charlotte area and keep the project on track for completion in 2018. ◆

Inventure Civil's eye-catching precast panels at the CATS Blue Line Extension in Charlotte showcase a unique flower and plant design.

PHOTO: JOEL LASSITER

A Quick Turnaround for Bypass Construction

The I-140 Wilmington Bypass crosses the Cape Fear River in scenic and historic coastal North Carolina. Aptus Group USA was brought in by general contractor Balfour Beatty to complete a change order for the North Carolina Dept. of Transportation. The company is performing the bridge utility infrastructure work on the bypass.

Aptus pooled its resources to get the work done with a quick turnaround time. The contract called for the installation of 8,000 ft of 4-in. multicell pipe. The company performed a thorough preconstruction site visit to determine the true scope of work and the types of tools and equipment needed to perform the work in this unique environment. With the input of the Aptus engineering department, the project manager created checklists and timelines for workers, tools and equipment.

Aptus was called in for a change order and installed 8,000 ft of 4-in. multicell pipe on the I-140 Wilmington Bypass that crosses Cape Fear River.

PHOTO: COURTESY OF APTUS

The experienced crews were mobilized to the site with all the necessary tools and supplies. Aptus brought its specialized bridge access equipment to give its workers the best platforms to work from in a safe and efficient manner. Through daily toolbox talks and job hazard assessments, the Aptus teams were informed, safe and productive.

"We expect to have our work completed on time, with no safety issues, and with a level of quality and expertise that Aptus is known for," says T. Edward Dill, vice president of talent development for Aptus. "Let us earn your business!" ◆

Cofferdams' Role in Bridge Replacement

Built in 1924, the South Branch Road Bridge, which runs over a tributary of the Raritan River near Branchburg, N.J., was on the state list of structurally deficient and obsolete bridges. Looking to change that and make driving safer, the bridge was recently replaced.

"The purpose of this project is to restore the structural capacity of the bridge by complete replacement of the existing structure with a single-span, multi-stringer steel beam superstructure with reinforced concrete deck, supported on concrete abutments," according to Somerset County.

Portadam provided a temporary cofferdam to help contractor Konkus Corp. replace the bridge. Portadam provided 176 linear ft of a 7-ft-high system, which was completed in two phases.

The Portadam dive team overcame several challenges, including severe weather and a rocky river bottom. The crew's expertise allowed the project to remain on schedule without any incidents.

A drone video of the project at portadam.com/resources/videos/ shows how a temporary cofferdam makes a difference for bridge replacements. ◆

The South Branch Road Bridge was replaced with the help of a cofferdam, which kept the area dry during construction.

PHOTO: COURTESY OF PORTADAM

Hydra Platforms Provide Under-Bridge Access

Every day, 330 million people drive over 614,000 U.S. bridges.

Since President Eisenhower launched the interstate system in 1956, average daily traffic has grown exponentially, and bridges are bearing the load.

Anderson Hydra Platforms (AHP) understands what's at stake. As departments of transportation work tirelessly to maintain and preserve state assets, the company is here to serve. AHP delivers safe, efficient and fast under-bridge access to public and private bridge owners from coast to coast.

The four available models allow 1,400 to 4,600 sq ft of substructure to be inspected in a single placement (learn more at www.inspectabridge.com). The crossover platform remains horizontal during deployment to provide easy entry and exit from the platform, and AHP's patented Tower Separation System reaches over sidewalks and bridge railings to position crews safely beneath the deck. ◆

Pictured is the Long Key Bridge on the Overseas Highway in Florida.

PHOTO: CCOURTESY OF ANDERSON HYDRA PLATFORMS

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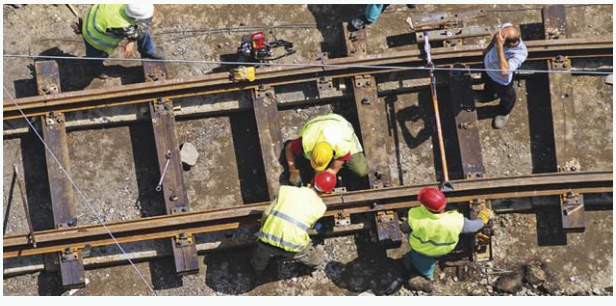

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For more information please contact your ENR Account Manager or Special Sections Manager Adam Palant at **palanta@enr.com**.

AUTOMATION

Tech Start-Up Sets Sights on Autonomous Earthmoving

On a jobsite in northern California, a skid-steer loader digs out a patch of dirt, depositing the spoils in a nearby stockpile. No one is in the cab, and no remote operator can be seen. Onboard software follows a preset dig plan, using LIDAR and GPS to navigate the site.

"Once the technicians sorted out its positioning, it was able to keep working without interruption," says David Warner, owner of San Rafael, Calif.-based Redhorse Construction. The contractor is running a pilot of a fully autonomous skid-steer system from tech start-up Built Robotics. The company has been working on autonomous equipment for two years and recently went public with its technology. With a host of Silicon Valley investors and former Autodesk CEO Carl Bass on its board, Built Robotics is looking to bring full automation to construction earthmoving equipment in the next year.

"Many automatic features available today in construction are the equivalent of adaptive cruise control on cars," says Noah Ready-Campbell, CEO and founder of Built Robotics. "We're building full autonomy, getting the operator out of the machine."

Once a work area has been defined, Built Robotics' control system uses GPS to ensure the skid steer does not leave the geo-fenced area. A 3D profile of what needs to be excavated is loaded in, and the system's LIDAR provides real-time mapping of the surrounding area and obstacles. Currently, the dig plan has to be custom-designed in the software, but Ready-Campbell says they will soon be able to import 3D models from earthmoving modeling software.

The system is designed to cease work if it encounters unexpected obstructions, and Ready-Campbell says the robot can work safely around humans. Warner says his team would try to trip up the robot on the pilot site. "We've been doing things like forcing a large rock into its way, just to see what it does." While a human operator would come up with a work-around plan, the robot can only stop and wait for an updated plan. But the software is being improved as Built Robotics gathers more data. "On the next test, we'll bury hidden pipes out in the field, just to see what it does then," says Warner.

NO OPERATOR REQUIRED Built Robotics' skid-steer package uses LIDAR and GPS to navigate sites.

ENR Future Tech

Built Robotics plans to take its system to larger earthmovers, including full-size excavators. While the start-up hasn't disclosed the price, Ready-Campbell says production gains from fully autonomous equipment will be worth the investment. "We'll be doing takeoffs from the CAD documents [and] loading them into the machines, and they can just go." ■

by Jeff Rubenstone

ENR FutureTech News, events, newsletters and special reports about technology for construction

PHOTO COURTESY OF BUILT ROBOTICS

PROJECT MANAGEMENT SOFTWARE

Primavera Tech and Marketing Vets Leave Oracle for Aconex

A team of eight veterans of Oracle's Engineering and Construction Global Business Unit have jumped ship and landed at the digital project-delivery platform service Aconex.

The late July exodus, which Aconex announced in a press release on Oct. 25, was led by Garrett Harley, who had been director of engineering and construction strategy for the unit for more than five years. The group was created to market and coordinate development and integration of Oracle's enterprise project-management and scheduling system, Primavera, which Oracle acquired in 2008. Harley now will serve as Aconex vice president of strategic accounts for the building sector.

Harley, who started with Primavera in 1997 after a brief stint as a Bechtel project controls engineer, came to Oracle as part of that acquisition. He brings with him to Aconex seven former Oracle co-workers whose new titles align them with sales, marketing and accounts management.

"These are folks that I have worked with for years, and keeping those teams together was important," Harley said, adding that he and the others were drawn to Aconex's Connected Cost initiative, which launched in April as an addition to its project-management platform.

Harley says Connected Cost is part of a broader set of linkages between functions the company envisions to extend its cloud-based, collaborative, centralized platform of services for project scheduling and management into the project financing and design phases and through operations and maintenance and beyond.

"The way it feels here, we have people and teams who understand the industry's problems and can translate that and put it into a platform where it is deployable," Harley says. ■

By Tom Sawyer

High Times

Today's power and energy market is alive and well. Here, we'll take a look at activities and trends across the nation.

Work on the Mariner East 2 Project

Nuclear

The United States is currently the world's largest producer of nuclear power, accounting for more than 30% of the world's nuclear electricity generation. As reported by the World Nuclear Association, the country's 99 nuclear reactors produced 805 billion kWh in 2016. In the past few decades, there has been hardly any new construction activity, but now work has begun on two new units expected to come online in the early 2020s.

The units under construction are known as Plant Vogtle Units 3 & 4, in eastern Georgia. Georgia Power has the largest ownership stake, and the plant will be the first in the industry to use the Westinghouse AP1000 advanced pressurized water reactor technology. This will allow cores to be cooled without mechanical assistance or operator intervention.

Certainly, nuclear power is not without controversy. Opponents deem it unsafe and note that it poses risks (like those that came to light at the 2011 Fukushima disaster in Japan). And David Hess, communication manager for the World Nuclear Association, says that there are certainly misconceptions—perhaps most commonly that nuclear plants contribute to climate change (when in fact they have among the lowest life-cycle greenhouse gas emissions of any energy technology).

Looking to the future, Hess is cautiously optimistic in light of record-low gas prices and some states' liberalization of wholesale electricity markets. He notes that the industry is focused on "keeping the existing fleet online." Hess also mentions that it is important that legislators understand, especially in light of recent severe weather events, that nuclear energy is resilient energy. "There are many positive signs for nuclear energy in the United States—watch this space," he says.

Wind

By all accounts, today's wind industry is going full steam ahead. As noted by the American Wind Energy Association (AWEA), the United States now has over 84,000 MW of land-based wind power capacity, which supports more than 100,000 American jobs.

Since 2009, the cost of wind energy has fallen by two-thirds thanks to several factors, including economies of scale, taller towers with longer blades and consolidation of the supply chain. As noted by Evan Vaughan, media relations officer for the AWEA, "By accessing higher winds, taller towers and longer blades open up more parts of the country for development."

Naturally, cheaper wind is good for business—and many Fortune 500 brands, along with American cities and universities, are taking advantage. In recent months, a variety of businesses have highlighted their decision to buy wind energy; these include Kimberly-Clark, Anheuser-Busch, General Motors and Mars (which purchases enough wind power each year to make all of the M&Ms produced globally).

As observed by Vaughan, "Wind isn't a fad; it's the energy source of choice for many of America's leading brands."

There are several large wind projects currently underway in the United States, including:

- Invenergy's development of a 2,000 MW wind farm for AEP in Oklahoma
- The Power Co. of Wyoming's development of the Chokecherry and Sierra Madre project, which will eventually total 3,000 MW
- Pacificorp's plans for roughly 2,000 MW of new wind capacity in Wyoming and Idaho
- Xcel Energy's proposal of 11 new wind farms in seven states

The outlook is bright for wind energy. Like Vaughan says, "The wind is always blowing somewhere," and that's a good thing. ◆

Mariner East 2 Project

Around the country, numerous power and energy projects are underway. At Fluor Corp.—a global engineering, procurement, fabrication, construction and maintenance company that designs, builds and maintains capital-efficient facilities for worldwide clients—things are especially busy. The Texas-based company is currently working on a project that includes procurement, construction and construction management services for the Mariner East 2 Project at the Marcus Hook Industrial Complex in Pennsylvania. Fluor reports that, "upon completion of new terminal facilities to store, chill, process and distribute propane, butane and ethane for domestic use and export, Mariner East 2 is anticipated to provide up to an extra 275,000 barrels per day of natural gas liquids (NGLs) for distribution."

PHOTO: COURTESY OF FLUOR

Flood Mitigation For Clean Power

A new, clean-energy power plant in Woodbridge, N.J., is protected from storm surge by a steel sheet pile structure.

PHOTO - COURTESY OF SKYLINE STEEL

The coastline of Central New Jersey is dotted with industrial parks and is home to many utility company power plants. New Jersey was reminded of the vulnerability of these plants when Hurricane Sandy swept through the eastern seaboard, wreaking havoc with tides and causing major flooding.

One of several flood mitigation projects that Skyline Steel contributed to was the Sewaren 7 Power Plant retaining wall in Woodbridge, N.J. This plant, owned and operated by PSE&G, is situated very close to the shoreline and needed protection from storm tide surges.

Skyline provided up to 19,000 tons of AZ 48-700 sheet piles, SKZ 23 sheet pile, 18-in. x 0.625-in. OD pipe pile and fabricated bent caps for this large construction job on the coast. The company was also able to provide value-added engineering support and changed the originally specified sheet pile, the AZ 48, to the AZ 48-700. This new sheet pile is part of a family of the largest sheet piles available.

The sheet piles were driven to an elevation of 20 ft above sea level to protect the facility from the rising tides. This was the first project using AZ 48-700 steel sheet piles. The AZ 48-700 is 20% wider and because of its design and shows a 6% drop in weight while maintaining the same tensile strength as the AZ 48.

Many of the products used for this project were produced domestically, which saved the customer time as well as money. The benefits of using the AZ 48-700 steel sheet pile were a shorter production schedule, local availability and fewer sheet piles needed to cover the same area due to their increased width. ◆


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WORK LIGHT: Collapsible Tripod for Easy Storage

The 20V MAX tripod light is capable of a maximum output of 3,000 lumens. The telescoping pole can be extended to 7 ft for overhead lighting of work spaces. The pole and tripod can be quickly collapsed for transport, with an integrated handle for easier carrying. The light is compatible with DEWALT's 20V MAX and FLEXVOLT batteries.

DEWALT; www.dewalt.com

AERIAL WORK PLATFORM: Improved Capacity

Genie has added four models to its line of XC telescopic booms with dual-lift capacities of 660 lb restricted and 1,000 lb unrestricted. The improved capacity allows for up to three people on the platform, with room for materials and tools. The platforms feature automatic envelope control, which retracts the boom as it nears the limits of its operational envelope and adjusts dynamically, depending on the load on the platform. **Genie; www.genielift.com**

BRUSH CUTTER: Large Cutting Width

Caterpillar's industrial brush-cutter attachment has a 72-in. cutting width and can handle material of up to 8 in. in diameter. It can be attached to skid-steer loaders, compact track loaders and compact wheel loaders using a universal coupler. The brush cutter's large capacity makes it well suited for site preparation and maintaining paths and access to sites. The attachment can work with multiple types of hydraulic configurations, including standard flow, XPS high flow or XHP high flow.

Caterpillar; www.cat.com

SELF-RETRACTING LIFELINE: Integrated RFID Tags

The Miller Falcon Edge self-retracting lifeline is available in 20-ft, 30-ft and 50-ft cable lengths and can support up to 420 lb. The lifeline can be secured at all heights above foot level, including horizontal, vertical and overhead mounting. Each lifeline has an RFID tag that allows safety managers to track production-information user training. Models are available with a flame-retardant shock absorber for welding applications.

Honeywell Safety Products; www.honeywell.com

Manufacturers can send information on new products to ENR.products@enr.com.

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Planning

ARIZONA Lucid Motors is planning to build an **electric-automobile manufacturing plant** on a 500-acre site in Casa Grande. The project is valued at $700 million. **Lucid Motors, Attn: Peter Rawlinson, Chief Technical Officer, 125 Constitution Dr., Menlo Park, Calif. 94025. DR#16-00712966.**

COLORADO Summit Green Apartments LLC is planning to develop **Summit Green Apartments,** in Broomfield. The complex will include two five-story apartment buildings, containing 184 units and two three-story townhouse buildings, containing 14 units, an outdoor pool and a clubhouse. Kephart & Associates Architects is the designer and TX Morrow Construction is the general contractor of the project, which has been valued at between $15 million and $25 million. Contact Kephart & Associates Architects. **Kephart & Associates Architects, Attn: Paul Campbell, Principal and CEO, 2555 Walnut St., Denver, 80205. DR#16-00674586.**

CONNECTICUT The Town of Manchester is planning to renovate the **Martin Elementary School.** The project is valued at between $10 million and $15 million. **Town of Manchester, General Services Dept., 494 Main St., Manchester, 06045. DR#17-00559897.**

ILLINOIS Kinzie Real Estate Group and Interstate Partners LLC are planning to develop **Watermark at the Grove apartments,** in Elgin. The project will comprise six four-story buildings, containing 282 apartments, including a resort-style 4,003-sq-ft clubhouse, fitness facility, theater room and outdoor pool. Amenities will include underground parking and four acres of open space with a dog park. Stephen Perry Smith Architects is the designer, and Carlson Construction is the general contractor. The project is valued at $48 million. **Kinzie Real Estate Group, Attn: Steven Spinell, President, 212 W. Kinzie St., Chicago, 60654. DR#15-00648992.**

WASHINGTON The City of Pasco is planning to develop **Osprey Pointe,** a 52-acre site on the Columbia River waterfront. The property is available for multifamily, mixed-use residential, office, commercial and light-tech manufacturing uses. The property was formerly a bulk fuel storage and distribution facility, which was decommissioned in the 1990s and environmentally remediated. The project has been valued at between $10 million and $50 million. **City of Pasco, Community Services Office, 525 N. Third Ave., Pasco, 99301. DR#17-00732041.**

Bids, Contracts, Proposals

FLORIDA Ranger Construction Industries Inc. has started a road-resurfacing project in Palm Beach County. The project will entail milling and resurfacing, signing and pavement markings, and traffic-monitoring sites along **state road 80 (U.S. 98/U.S. 441),** 14.8 miles east of the railroad to County Road 880 (East Canal Street South). The project's value has been estimated at $14.1 million. **Ranger Construction Industries Inc., 101 Sansburys Way, West Palm Beach, 33411. DR#17-00662260.**

TENNESSEE The U.S. Army Corps of Engineers has awarded a $240-million firm-fixed-price contract to AECOM Energy & Construction Inc. to carry out the **Chickamauga Lock Chamber replacement** in Chattanooga. The project team will construct an on-site batch plant; excavate 9,900 cu yd of rock; demolish 3,600 cu yd of existing, heavily reinforced-concrete spillway; install 43 reinforced-concrete drilled shafts, which are about 54 to 74 in. in dia; and place dental concrete and 19,315 sq yd of rock-foundation preparations for placement of 285,068 cu yd of concrete in the construction of monoliths for the new, 600-ft-long lock, including 6,936 tons of deformed steel bars. Also, the project includes installation of a chamber grout curtain, miter gates sections and culvert valves; and drilling, installation and water-tightness grouting and testing of 16 vertical 52-strand post-tensioned anchors averaging 177 ft in length. **AECOM Energy & Construction Inc., 6200 S. Quebec St., Greenwood Village, Colo. 80111. DR#17-00704684.**

Bid, Proposal Dates

TEXAS 11/16 The City of Houston is seeking bidders to carry out a **waterline improvement** project. The project involves the installation of 80,000 ft of 108-in.-dia waterline, which will provide up to 96 million gallons per day to the city and 269 mgd to local water authorities. Lockwood Andrews & Newnam Inc. is the designer of project, which is valued at $28.7 million. **City of Houston Dept. of Public Works, 611 Walker St., Houston, 77002. DR#15-00466145.**

NORTH CAROLINA 11/28 Union County is requesting qualifications from architectural firms to design the **Southwest Regional Library,** a 35,000-sq-ft building in Waxhaw. **Union County, 500 N. Main St., Monroe, 28112. DR#16-00686537.**

PENNSYLVANIA 12/7 The Pennsylvania Dept. of Transportation is seeking bidders to replace an existing railroad swing-truss bridge over the Schuylkill River in Philadelphia with a **pedestrian-scale swing-truss bridge.** Further, the project team will rehabilitate the existing approaches and center pier, install a new mechanical system and construct a control house to swing the bridge. The new bridge will connect the Grays Ferry Crescent Trail on the east side of the Schuylkill River to the Bartram's Mile Trail on the west side. The project is valued at between $10 million and $12 million. **Pennsylvania Dept. of Transportation, 7000 Geerdes Blvd., King of Prussia, 19406. DR#17-00821118.** ■

Much information for Pulse is derived from Dodge Data & Analytics, the premier project information source in the construction industry. For more information on a project that has a Dodge Report (DR) number or for general information on Dodge products and services, call **1-800-393-6343** or visit the website at **www.dodgeleadcenter.com.**

▶Official Proposal

METROPOLITAN WASHINGTON AIRPORTS AUTHORITY CONTRACTING OPPORTUNITIES

The Metropolitan Washington Airports Authority ("Airports Authority") will be advertising Solicitations for engineering and construction services associated with furnishing and installing the Dulles Airport Metrorail Station Windscreens ("Package G") and the Stormwater Management Facilities ("Package P") to be constructed as part of Phase 2 of the Dulles Corridor Metrorail Project ("Project"). The method of procurement to be used to award these contracts will be the Two-Step Invitation for Bid method. Design-build contracts ("Contract") will be awarded to the responsible and responsive Offerors that meet the Solicitations' technical requirements and have the lowest price.

The Airports Authority, in cooperation with the Washington Metropolitan Area Transit Authority, ("WMATA"), the Commonwealth of Virginia, Fairfax County and Loudoun County, is designing and constructing the Project, which is a 23.1-mile extension of WMATA's Metrorail System in Northern Virginia's Dulles International Airport Access Corridor. As part of the Project, Package G (Work) will be constructed at the Washington-Dulles International Airport Station and Package P (Work) will be constructed along the 11.5-mile Phase 2 rail alignment. The selected Contractors shall be responsible for providing a complete solution for Package G and Package P that addresses all design, functional, and maintenance issues. The Contractors are required to provide all equipment, materials and resources, temporary and permanent facilities, and labor needed to complete the Work and fulfill all Contract requirements. The Contractors are responsible for coordinating the requirements and activities among the various entities necessary to design and construct a fully integrated Package G and Package P. Package G consists of structural steel framing, glazing (on the south side), architectural louvers (on the north side), and integral screenwall-mounted light fixtures. Package P consists of seventeen (17) Best Management Practice Facilities (BMPs) including dry swales, filtering practices, bioretentions and constructed wetlands.

Additional information regarding these projects, to include solicitation documents, can be obtained by going to the Airports Authority's website at **http://www.mwaa.com/contracting** and clicking on "Current Contracting Opportunities" or by contacting Mr. Mike Giardina at (703) 417-8672

▶Official Proposal

Legal Notice
CSO Solicitation No. 2308
Request for Letters of Interest
Environmental Compliance Asbestos, Lead, Air Quality and Structure Demolition Compliance Services

The Connecticut Department of Transportation (Department) is seeking to engage one (1) professional consulting firm to provide task based services that include: conducting investigations for the presence of asbestos and lead, preparation of plans, specifications and estimates for asbestos abatement, lead abatement and structure demolition, inspection and compliance services during asbestos abatement, lead abatement and structure demolition and air quality compliance services. More detailed information regarding this assignment can be found at: **www.ct.gov/dot/business/consultant/selection**

Connecticut Department of Transportation
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▶Employment

Construction Recruiters Network
An association of independent recruiters located across the U.S. networking together to help you find quality personnel or a quality position. Visit our website www.constructionrecruiters.com

Project Manager
Proctek, Inc. in Bakersfield, CA seeks a Project Manager to supervise and coordinate all project activities. Must have exp. designing, building & installing automation & control systems using PLC & DCS. Education & travel required. Mail resume to Attn: Brenda Perez, 3651 Pegasus Dr., Ste. 117, Bakersfield, CA 93308. Put job code PM2 on resume.

Application Engineer / Account Manager
Application Engineer / Account Manager wanted in Troy, Michigan to manage program-related functional activities which include quoting, purchasing, product engineering, quality manufacturing, launch management, finance and budget. Mail resume to Christina Crawford, Human Resources Generalist, Magna Powertrain of America Inc., 1235 E Big Beaver Rd., Troy, MI 48083.

Engineer
CH2M Hill Engineers, Inc.; Lehi, UT, Engineer: Electrical circuit drawings & technical document package preparation. Mail resume to: Shelly Saitta, CH2M HILL, 9191 S. Jamaica St., Englewood, CO 80112; Job ID: 17-UT-3562.

Pass-Through Tax Limit Can Help Small Firms

The Republican majority is set to fill in the details of the Trump administration's tax framework. On its face, much of the framework is good for small businesses, limiting the tax rate for pass-through businesses—such as partnerships and S-corporations, in which revenue passes from the company level to the individual—to 25%, significantly lower than the rate is now.

These forms of business organizations are common among small construction companies, and there are many good reasons to cut their tax burden. Many of these company owners work hard, take big risks and create jobs.

But there is cause for concern about the complex tax reform that Congress and the White House are now pushing through. For instance, there are still many questions about the details of just the sections related to pass-through revenue. Indeed, along with many small businesses, many wealthy business owners stand to benefit from the limit on pass-through taxes.

Watch out for any part of the proposed reforms that blows too big a hole in the budget and expands the national debt.

No tax cut can be judged in isolation. Watch out for any part of the proposed reforms that blows too big a hole in the budget and expands the national debt.

Take the example of the alternative minimum tax, which could be eliminated. The Tax Policy Center says the alternative minimum tax contributed about $38 billion, or about 2.5%, of all individual tax revenue in 2017. That gives us pause. The alternative minimum tax always has served as a brake to prevent the wealthy from paying extremely little in taxes, and that revenue is critical to keeping the U.S. financially viable.

The estate tax is another matter, however. By raising the exemptions under the law in recent years so that it covers bigger and bigger estates and leaves smaller ones untaxed, Congress essentially has been phasing out the estate tax at the lower levels.

For decedents in 2017 with an exemption of $5.49 million, the Tax Policy Center estimates there will be only 5,500 taxable estates this year, based on estimates of how many people die, and that the tax liability will be $19.9 billion. While that's a lot of money, we support eliminating the estate tax. The tax is unfair in that it prevents the full fruits of a lifetime of labor from passing into the hands of heirs. This tax is a fundamentally flawed way of raising funds, especially in a culture that wishes to nourish entrepreneurial zeal.

As far as the pass-through tax limit is concerned, how much will it save small-business owners, and how much tax revenue will be lost? Once we know what the overall effects will be on the country's finances, along with all other reforms, it will be easier to judge. But by itself, the limit on pass-through taxes is one of the best tax ideas to come out of the Trump administration and the Republican Party. ■

8:20 PM

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ATLANTA BRAVES' SUNTRUST PARK

PHOTO BY RYAN LINTON

SOUTHEAST PROJECT OF THE YEAR

Ballpark Scores Big on Schedule

HONORING THE REGION'S BEST PROJECTS

Who We Are at OUR CORE

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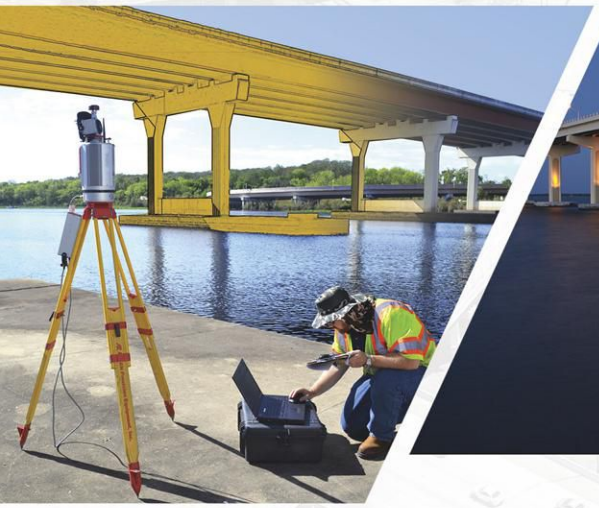
Water Resources/Stormwater Management



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CONTENTS

NOVEMBER 6/13, 2017

ALL STARS SunTrust Park was one of dozens of projects recognized by this year's Southeast Best Projects competition.

Features

On the Cover

The new home of the Atlanta Braves baseball team, SunTrust Park, was named Southeast Project of the Year.

PHOTO BY RYAN LINTON

CITY SCOOP
GREENVILLE

Rich Data From Dodge Data & Analytics* **SOUTHEAST**

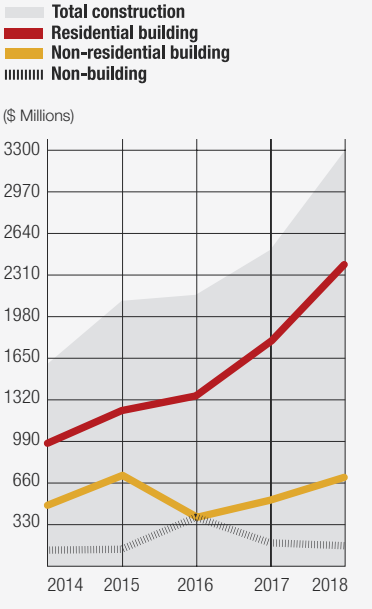
Total Construction Starts — Greenville, S.C.

TOTAL CONSTRUCTION	Actual 2014	Actual 2015	Actual 2016	Forecast 2017	Forecast 2018
($ Millions)	**$1,611**	**$2,110**	**$2,158**	**$2,506**	**$3,286**
NON-RESIDENTIAL	**$492**	**$729**	**$403**	**$532**	**$713**
Commercial and Manufacturing	$376	$248	$265	$300	$401
Stores and Shopping Centers	$77	$64	$41	$45	$58
Office and Bank Buildings	$30	$81	$62	$86	$107
Hotels and Motels	$70	$19	$19	$19	$29
Other Commercial Buildings	$56	$57	$95	$77	$124
Manufacturing Buildings	$144	$27	$49	$73	$82
Institutional	$115	$481	$138	$232	$312
Education Buildings	$58	$38	$38	$45	$77
Health-Care Facilities	$26	$44	$33	$45	$46
Other Institutional Buildings	$31	$399	$66	$143	$190
RESIDENTIAL	**$983**	**$1,238**	**$1,362**	**$1,779**	**$2,401**
Single Family	$867	$953	$1,097	$1,510	$2,118
Multifamily	$116	$285	$266	$269	$283
TOTAL NON-BUILDING	**$137**	**$144**	**$392**	**$195**	**$172**
Highways and Bridges	$68	$61	$286	$135	$96
Other Public Works	$38	$50	$68	$15	$22
Environmental Public Works	$25	$23	$36	$30	$40
Electric Utilities	$7	$10	$3	$15	$15

Total Picture

Greenville Total Construction Spending Expected to Expand Sharply in 2018

Strength in the non-residential and residential sectors will more than offset a decline in non-building work.



*Construction starts in City Scoop provided by Dodge Data & Analytics, the premier project information source in the construction industry. For more construction starts or general information on Dodge products and services, call 1-800-393-6343 or visit the website at www.construction.com.

Firm in Focus

Fluor
100 Fluor Daniel Dr., Greenville, S.C.
CHAIRMAN/CEO: David T. Seaton
EMPLOYEES: 60,000
FOUNDED: 1912

WHAT'S NEW: The U.S. Army Corps of Engineers's Huntsville, Ala., Engineering Center on Oct. 19th awarded Fluor a $240-million, six-month contract to help restore electric power to Puerto Rico.

City Grill

Cheryl Wiggins
Senior Manager, Community and Public Relations
Fluor

Greenville's construction market appears "vibrant" right now, says Wiggins, with the most prominent development being new roads, homes and public schools. "In addition to the downtown growth, it's good to see more focus on addressing the urgent need for safe, affordable housing," Wiggins says. "Additionally, there is major activity with the Interstate-85/I-385 connector as well as a focus on improving our mass transportation and creating more lanes and trails for biking and walking."

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- Andrew Hagood, Trident Construction

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OFFICES IN RALEIGH, NC AND GREENVILLE, SC

CITY SCOOP MEMPHIS

Rich Data From Dodge Data & Analytics* **SOUTHEAST**

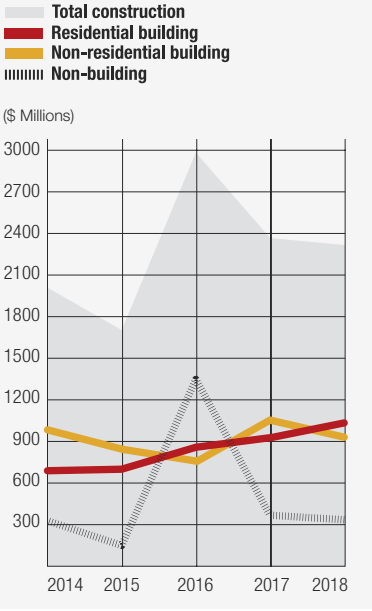
Total Construction Starts Memphis

TOTAL CONSTRUCTION	Actual 2014	Actual 2015	Actual 2016	Forecast 2017	Forecast 2018
($ Millions)	**$2,013**	**$1,708**	**$2,984**	**$2,370**	**$2,319**
NON-RESIDENTIAL	**$981**	**$850**	**$764**	**$1,060**	**$937**
Commercial and Manufacturing	$640	$528	$414	$442	$520
Stores and Shopping Centers	$74	$145	$137	$104	$122
Office and Bank Buildings	$146	$81	$144	$142	$126
Hotels and Motels	$12	$88	$32	$40	$44
Other Commercial Buildings	$309	$195	$102	$101	$159
Manufacturing Buildings	$99	$19	—	$54	$69
Institutional	$342	$322	$349	$618	$417
Education Buildings	$141	$118	$173	$178	$184
Health-Care Facilities	$86	$111	$131	$349	$129
Other Institutional Buildings	$114	$93	$45	$91	$103
RESIDENTIAL	**$696**	**$701**	**$868**	**$934**	**$1,040**
Single Family	$521	$563	$667	$831	$920
Multifamily	$175	$138	$201	$103	$119
TOTAL NON-BUILDING	**$336**	**$158**	**$1,353**	**$376**	**$343**
Highways and Bridges	$183	$110	$293	$234	$261
Other Public Works	$53	$18	$51	$75	$30
Environmental Public Works	$98	$25	$33	$40	$42
Electric Utilities	$1	$4	$976	$26	$10

Total Picture

After a Decline in 2017, Memphis Contracts Should Drop Further in '18

Dodge Data & Analytics expects declines in non-residential and non-building contracts next year.



*Construction starts in City Scoop provided by Dodge Data & Analytics, the premier project information source in the construction industry. For more construction starts or general information on Dodge products and services, call 1-800-393-6343 or visit the website at www.construction.com.

Firm in Focus

Chris Woods Construction
8068 U.S. Hwy. 70, Memphis
PRESIDENT: Chris Woods
FOUNDED: 1985

EXPRESS DELIVERY: The firm was awarded a $7.5-million contract by FedEx Express to renovate its flight simulator building and its former administration building and vehicle service facility.

City Grill

Skip Burks
Executive Director
AGC West Tennessee Branch

Contracts for future work may be declining, but not current construction activity. "The Memphis construction market is robust with several major projects underway or in the planning stages," Burks says. "By all accounts, the market is stronger in 2017 than in 2016, with all indications pointing to a better 2018." A "large amount" of infrastructure work—plus an expansion at Methodist Hospital, downtown revitalization and FedEx projects—is driving activity. "We expect continued growth in the local construction market through 2020," he says.

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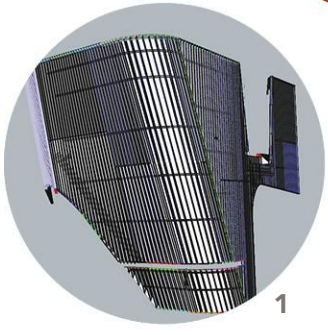

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2017 ENR Southeast Regional Best Project Award Winner, Category: Cultural/Worship
Frost Museum of Science, Miami, FL

1 RADIUS TRACK DIRECT FABRICATION 3D MODEL **2** CUSTOM CURVED FRAMING
3 FAÇADE INSTALLATION (Photo: Kenpat) **4** FINISHED PROJECT

ADVANTAGE: **PRECAST**

UNIQUE CHALLENGES ARE WHAT TINDALL LIVES FOR.

Total precast structures are unusual for coastal areas like Mt. Pleasant, South Carolina. But after the Shem Creek Office and Parking Structure project began, it became clear that precast was the ideal method — versatile enough to tackle the strict aesthetic demands of the build, tough enough to weather the harsh coastal environment. The blend of the exposed aggregate with the perfectly mimicked wooden shiplap created a visually stunning structure that is a testament to Tindall's ability to provide creative solutions to unique challenges.

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BEST PROJECTS

ENRSoutheast Best Projects Completed in the Past Year

PROJECTS SHINE WITH CONSTRUCTION SAVVY

Thirty-one projects earned Best Projects awards this year **BY SCOTT JUDY**

A residential tower featuring a first-of-its-kind car elevator that travels the building's 60 stories at 800 ft per minute. A project that lifted an entire South Florida neighborhood to higher ground. Two projects—one in Alabama, another in Florida—built to support the mission of human space flight. An ultra-challenging museum project featuring a 500,000-gallon saltwater aquarium that's viewable from underneath. These and dozens of other impressive projects comprise this year's Southeast Best Projects award winners.

FIRST PLACE
SunTrust Park, the new home of the Atlanta Braves, was named Southeast Project of the Year.

IMAGE COURTESY AMERICAN BUILDERS

Rising above even those stellar accomplishments, according to our judges, is this year's Southeast Project of the Year: SunTrust Park. The $500-million home of Major League Baseball's Atlanta Braves, the ballpark marks not simply the latest major sports facility to be erected. Instead of standing as a potential spur to future development, SunTrust stands as the centerpiece of an economic revitalization that includes the Atlanta Braves' concurrent development of an adjacent mixed-use complex. Even so, our judges decided that SunTrust Park stood alone for the challenges faced and the results achieved.

As we do each year, ENR Southeast assembles an independent group of judges to review, score and determine final winners. First, judges rated entries on these criteria: overcoming challenges and teamwork; safety; innovation and contribution to the industry/community; construction quality; and function and aesthetic quality of the design. They then met to discuss the projects and to come to a consensus on awards.

On behalf of this year's award-winning projects, ENR Southeast extends its gratitude for a job well done to this year's judges: Sean Buck of JE Dunn Construction, Nashville; Brent Darnell, Brent Darnell International, Atlanta; Keith Douglas, The Whiting-Turner Contracting Co., Atlanta; Ken Gerrard, T.A. Loving Co.; Ray Riddle, Holder Construction Co.; and Kim Shinn, TLC Engineering for Architecture.

ENR Southeast invites its readers to check out all of the Best Projects award winners in the following pages.

PROJECT OF THE YEAR ■ Submitted by American Builders 2017 & Populous

Atlanta's SunTrust Park Hits a Home Run

Builders of the Southeast Project of the Year overcame a daunting schedule and unexpected site challenges to deliver a standout facility **BY BRUCE BUCKLEY**

The Atlanta Braves opened the new $500-million SunTrust Park on March 31, defeating the New York Yankees in an exhibition game. The event was not only a win for the team and its fans, it was a victory for the design, construction and development partners who delivered the construction project under one of the fastest schedules in the history of major league sports.

"To be there on the opening day and experience the joy of people having fun in a facility that you poured your heart into, you forget all of the difficult things that happened," says Chris Britton, project director with American Builders 2017. "All of those challenges and sacrifices go away with that opening pitch."

American Builders 2017—a joint venture between Brasfield & Gorrie, Mortenson Construction, Barton Malow Co. and New South Construction Co.—completed the ballpark in 29 months, just in time for the start of the 2017 season. The construction team and its subcontractors logged more than 5.6 million work hours on the project.

Keeping the project on track proved to be a daunting task right from the start as the team encountered site conditions that jeopardized the schedule. The team began with limited information about the 57-acre greenfield site, located at the crossing of Interstates 75 and 285 in Cobb County. Three natural gas pipelines running through the main portion of the ballpark site had to be relocated. Deep rock near home plate required blasting approximately 50 ft into the rocky areas.

Crews also encountered soft soils in the outfield, which required up to 60 days of surcharging before work could continue.

The project was initially sequenced to start at home plate and progress into the outfield. To overcome site issues, the project was resequenced to start in the outfield while the pipeline relocation and blasting continued near home plate. Teams worked in both directions around the ballpark, meeting at home plate. Ultimately, teams worked in several areas simultaneously to make up time on the schedule. At peak, 14 cranes were active on the site.

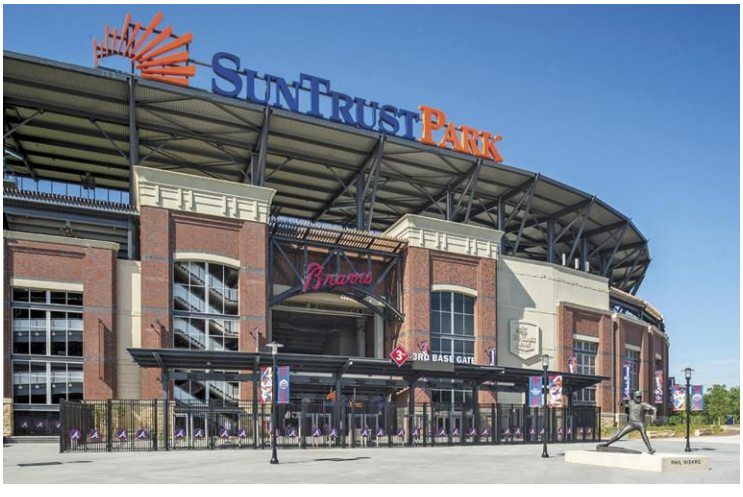
"There were many site logistics and site challenges that had to be addressed along the way," says Mike Plant, president of development for the Atlanta Braves. "Despite encountering these challenges

SUNTRUST PARK

Atlanta **BEST PROJECT, SPORTS/ENTERTAINMENT**

KEY PLAYERS

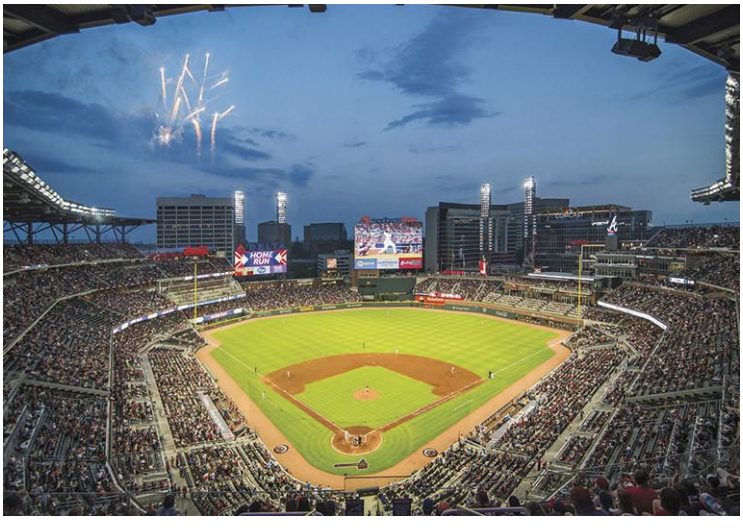
OWNER: Atlanta Braves
LEAD DESIGN FIRM: Populous
GENERAL CONTRACTOR: American Builders 2017
PROJECT MANAGER: JLL
CIVIL ENGINEER: Kimley-Horn & Associates Inc.
STRUCTURAL ENGINEER: Walter P Moore
MEP ENGINEER: ME Engineers
AUDIOVISUAL CONSULTANT: WJHW
FOOD SERVICE CONSULTANT: S2O Consultants



PHOTOS BY TIFFANY DANIELS

MIXED-USE **Offices of the Atlanta Braves staff are incorporated with the ballpark's amenities, including the XFinity lounge.**

TEAM HISTORY **Inside SunTrust Park, fans walk along a portion of the facility known as the Monument Garden.**



SCHEDULE CHALLENGE **Despite unforeseen site conditions, contractors completed construction in time for opening day of the 2017 Major League Baseball season.**

during construction, American Builders 2017 managed to keep the project on schedule, meeting or beating every turnover milestone date for occupancy."

Due to the fast-track schedule, construction began while some designs were still in the schematic phase. Key subcontractors were brought on in a design-assist role to work with the design team, led by Populous, to maintain quality while protecting the budget. One of the most innovative parts of the project, the sports lighting system, resulted from the project team's collaboration with GE in the development of its first full LED system in a major league ballpark.

The JV didn't reach a final GMP until nine months after groundbreaking.

Working with the design team, American Builders 2017 recommended a hybrid structure of concrete and steel for the 41,500-seat stadium, featuring concrete concourses with structural steel for the raker beams and canopy structure. A main goal of the structure's design was speed of delivery. The 37 steel raker trusses for the terrace level were prefabricated in Texas. More than 78 ft long, the rakers were shipped to the site in single pieces and picked from trucks for placement.

Crews poured more than 57,300 cu yd of concrete at the facility, which equates to more than 4,770 truckloads of concrete. The team also placed more than 5,600 tons of rebar, 6,800 tons of structural steel, 231,890 linear ft of piping, 502,000 concrete masonry units and 602,000 hand-set bricks.

The ballpark's design incorporates brick and stone, crowned by a steel structure that supports the largest shade canopy in Major League Baseball.

The ballpark acts as the anchor of The Battery Atlanta, a 60-acre mixed-use community. The ballpark was designed concurrently with the Battery to help seamlessly meld it into a unified development. The ballpark is conceived as "the living room for the entire community," according to Populous. Surrounding retail, residential and office spaces have views into the ballpark.

Bradd Crowley, project manager at Populous, says the strategy offered a unique opportunity to integrate with other designers. "If you're sitting in the ballpark and looking out toward left field, it's hard to tell where our project stopped and the other development begins," he says. "The styles blend very well. It all came together at one time."

ON THE WEB

For more information about projects under construction in the **Southeast,** visit *enr.com/southeast.*

SPORTS/ENTERTAINMENT & EXCELLENCE IN SAFETY ■ Submitted by DPR Construction

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LEAD DESIGN FIRM: Goodwyn, Mills and Cawood Inc.
SPORTS DESIGN CONSULTANT: HOK
GENERAL CONTRACTORS: DPR Construction; Sherman Construction
CIVIL ENGINEER: GMC
STRUCTURAL ENGINEER: MMSA Inc.
MEP ENGINEER: RMF Engineering

Built in 13 months, Clemson University's $55-million Allen N. Reeves Football Complex features a locker room with 25,000 sq ft of weight-training space and 50-person lunge and hydrotherapy pools.

The facility also includes a dining area; X-ray suite; an "outdoor village" complete with sand volleyball courts, a basketball court, miniature golf and an outdoor kitchen; coaches offices; conference spaces; and other amenities.

One major challenge included the site's shallow, 3-ft-deep water table, which affected design and construction of the 10-ft-deep hydrotherapy pools. The project team worked with the Army Corps of Engineers to mitigate the water table's impact on the project.

Contractors completed construction two weeks ahead of schedule.

The complex also won an award of merit for its safety performance. The project team implemented a number of safety measures, such as laying down a graded aggregate base that created a safer walking environment for the crew and installing a tent to serve as a break area that would shelter workers from intense South Carolina summer heat. Additionally, by installing the structural steel quickly, the site's canopy was able to be installed sooner, providing more shade during work hours.

The team also held daily, weekly and quarterly safety briefings and hosted safety stand-downs to remind crew members to remain alert and create a safe work environment.

AIRPORTS/TRANSIT ■ Submitted by Michael Baker International Inc.

MERRITT ISLAND AIRPORT RUNWAY 11/29 SAFETY AREA IMPROVEMENTS

Titusvlle, Fla. **AWARD OF MERIT**

OWNER: Titusville Cocoa Airport Authority
LEAD DESIGN FIRM/CIVIL ENGINEER/CONSTRUCTION MANAGER: Michael Baker International Inc.
GENERAL CONTRACTOR: Welsh Cos.

The Merritt Island Airport, a public general-aviation airport surrounded by the Banana River Aquatic Preserve, needed a 185-ft extension to its lone 3,601-ft-long runway.

The too-short runway had resulted in 34 reported incidents of airplanes rolling off into the river. Additionally, the runway's safety area was 185 ft short of the Federal Aviation Administration's standard design criteria.

The project team's challenge was to design and construct a resilient structure that minimized impacts to the river while filling, restoring and armoring the shoreline.

Looking for the most sustainable solution, Michael Baker International opted to utilize an open-cell articulating concrete block revetment with a lifespan of 75-plus years.

The project's mitigation plan included removal of four derelict vessels in the river; construction of a one-acre seagrass platform; enhancement and hydrological connection of a 23-acre, offsite mosquito impoundment wetland mitigation area; voluntary harvesting of seagrass that would have been impacted by the project; and partnering with a local university to utilize both mitigation areas as an outdoor classroom.

Crews placed native wetland plants along the shoreline of the safety area in order to provide enhanced stormwater runoff treatment.

PHOTOS: (TOP) BY MICHAEL ROBINSON; (BOTTOM) BY AERO PHOTO

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MANUFACTURING & EXCELLENCE IN SAFETY ■ Submitted by DPR Construction

BIOGEN LSM 3X CAPACITY UPGRADES

Research Triangle Park, N.C. **BEST PROJECT**

OWNER: Biogen

LEAD DESIGN FIRM/MEP ENGINEER: CRB Consulting Engineers Inc.

GENERAL CONTRACTOR: DPR Construction

STRUCTURAL ENGINEER: Fluhrer Reed PA

LEAD DESIGN/PROCESS ENGINEERING: IPS-Integrated Project Services LLC

While fast-tracked projects have become the norm, the $42-million design-build reconstruction of Biogen's biopharmaceutical manufacturing plant carried extra implications for the project team. As the capacity upgrade project would force a 14-week plant shutdown, any delays could result in a loss of pharmaceutical products, posing a risk to patients living with serious diseases.

After 18 months of collaborative planning using a variety of project management tools, the team developed a strategy for achieving the formidable schedule milestones without compromising quality or worker safety.

The project began with early release of long-lead procurement packages for precision equipment, including 12 vessels, six prefabricated process equipment skids, 1,000 sanitary diaphragm valves, 4,000 process instruments and 18,500 linear ft of hygienic piping. A custom database allowed all project stakeholders to view the status of approximately 5,000 parts, ensuring proper on-time delivery and installation. The project also included upgrades to HVAC, MEP and instrumentation and controls systems to support manufacturing process improvements.

Working on a 24/7 schedule in 12-hour shifts, workers reconstructed seven plant production areas totaling more than 100,000 sq ft, readying them for the meticulous process of installing the new equipment. Communication during shift handoff was critical, "with the supervisors meeting to understand the work status and any safety issues that had to be addressed," says Shawn Pepple, project manager at DPR Construction.

The meticulous planning effort mitigated a number of potentially risky time and safety hazards, such as the modification of sidewall nozzles on six existing seed train bioreactors and six media vessels to support a new advanced process controls program. By using prefabricated probe belts as part of the process, the project team cut welding needs in half, reducing vessel warpage and saving six days on the schedule. In addition, more than half of the project areas were completed ahead of schedule, with the remainder delivered on time and without any issues that disrupted Biogen's production timeline.

Though time and quality were of the essence, no shortcuts were allowed when it came to workers' well-being. A comprehensive all-phase safety program encompassing continuous reviews of daily job hazard analyses, incentives, root-cause assessments of "near misses" and other measures resulted in more than 251,000 project staff hours with no lost-time or recordable injuries. Pepple adds that jobsite walk-throughs by groups representing all project team members "were essential to monitoring and identifying potential safety issues and keeping all the trades engaged."

PHOTOS COURTESY OF DPR CONSTRUCTION

CULTURAL/WORSHIP ■ Submitted by Skanska USA Building, Hill International and Radius Track Corp.

PHILLIP AND PATRICIA FROST MUSEUM OF SCIENCE

Miami **BEST PROJECT**

OWNER: Phillip and Patricia Frost Museum of Science
OWNER'S REPRESENTATIVE: Hill International Inc.
LEAD DESIGN FIRM: Nicholas Grimshaw & Partners
CONTRACTOR: Skanska USA Building Inc.
ARCHITECT OF RECORD: Rodriguez and Quiroga Architects Chartered
CIVIL ENGINEER: A.D.A. Engineering Inc.
STRUCTURAL ENGINEER: DDA Engineers P.A.
M/E/P ENGINEER: Fraga Engineers LLC
LIGHT GAUGE DESIGN AND FABRICATION: Radius Track Corp.

PHOTOS: (TOP LEFT AND RIGHT) BY JUSTIN NAMON/RAHAUS; (MIDDLE LEFT) BY FROST MUSEUM OF SCIENCE; (BOTTOM) BY VERITAS DIGITAL PHOTOGRAPHY, JASON MARTIN

After surviving repeated delays, funding shortfalls and mid-project construction team changes, the four-building, 250,000-sq-ft museum complex adjacent to Biscayne Bay offers an aesthetically distinct, technically intricate setting rivaling the wonders of science and nature displayed within.

Among the museum's many structural features is the suspended 100-ft-wide, 500,000-gallon, inverted-conical saltwater aquarium, fenestrated underneath by a 30-ft-dia, 18-in.-thick acrylic viewing oculus. A continuous 25-hour bottom-up pour totaling 1,200 cu yd of specially developed concrete mix formed the aquarium's 28- to 56-in.-thick walls, some with slopes of as much as 44 degrees. Using modified equipment and skills honed during numerous practice sessions, workers vibrated the concrete at the proper angles around the grids of rebar and post-tensioning cables without cutting into the surface.

Stucco and a 40,000-sq-ft mosaic array of 3-in. round tiles form the aquarium's geometrically complex facade, which hangs curtain-like from the fourth-floor slab. Reminiscent of a seafaring vessel, the

facade's changing curvature with superimposed linear pattern was carefully chosen to prevent creating a distorted grid and to avoid cutting of any tiles. Laser scanning and 3D modeling verified the components' precise fit, while as-built stud coordinates were compared with design specifications to ensure installation accuracy. The entire facade system is capable of withstanding Class 5 hurricane winds and high-speed projectiles.

The self-supporting dome for the museum's 250-seat planetarium is formed by 32 concave orange-peel-like precast panels, each weighing 50,000 lb. Over two and a half weeks, the panels were lifted into place opposite one another with the aid of cranes and a 50-ft-center shoring tower and supported by a precast dome cap. Erected during the day, the panels were welded at night so that the process could be repeated the next day.

CULTURAL/WORSHIP ■ Submitted by Brasfield & Gorrie LLC

The three-story, 55,000-sq-ft expansion of the Hayes Barton United Methodist Church Family Life and Mission Center added 29 classrooms, 17 offices and 50 surface parking spaces. The design and construction of the building was particularly complicated, with eight floor levels, a five-stop elevator in a three-story facility and complex design features with four different construction types. The project also included demolition of approximately 34,000 sq ft of existing offices and preschool as well as detailed planning to ensure on-time deliveries to the tight site while minimizing disruption to neighbors and occupants. With the main church sanctuary and fellowship hall remaining active throughout the project, and construction work taking place adjacent to the main sanctuary, workers readily shifted daily construction activities to accommodate events.

HAYES BARTON UNITED METHODIST CHURCH - FAMILY LIFE & MISSION CENTER (THE WELL)

Raleigh **AWARD OF MERIT**

OWNER: Hayes Barton United Methodist Church
LEAD DESIGN FIRM: Skinner Lamm & Highsmith
GENERAL CONTRACTOR: A Joint Venture of Brasfield & Gorrie LLC and J.M. Thompson Co.
CIVIL ENGINEER: CMS Engineering
STRUCTURAL ENGINEER: Gardner & McDaniel Consulting Engineers
MEP ENGINEER: Progressive Design Collaborative LTD
STEEL CONTRACTOR: Steelfab of Virginia Inc.

ENERGY/INDUSTRIAL ■ Submitted by McCarthy Building Cos.

HAZLEHURST 72-MW SOLAR FACILITY

Hazlehurst, Ga. **BEST PROJECT**

OWNER: Silicon Ranch Corp.
LEAD DESIGN FIRM/GENERAL CONTRACTOR: McCarthy Building Cos.
CIVIL ENGINEER: Castle Contracting LLC
STRUCTURAL ENGINEER: Engineering Design Technologies
MEP ENGINEER: McCalmont Engineering
ELECTRICAL ENGINEER: Cleveland Electric

Built on a 425-acre site in southern Georgia, EPC contractor McCarthy Building Cos. delivered a 72-MW solar facility three months ahead of the original schedule, using mostly local labor that was not experienced in solar work. More than 300 workers on the project installed around 633,000 solar panels in under nine months.

McCarthy's renewable energy team was responsible for the design, procurement, construction, commissioning and handover of the Hazlehurst solar project to developer Silicon Ranch.

McCarthy initially planned a 12-month construction schedule, but a permitting issue pushed the original start date from January 2016 to April 2016. Despite the delay, the team remained committed to completing the project before the end of 2016. McCarthy worked closely with subcontractors and major equipment vendors to help the schedule stay on track. Medium-voltage cable installations finished nearly one month ahead of schedule.

Due to the project's rural location, a large skilled workforce wasn't available locally. McCarthy and its subcontractors recruited and trained more than 200 workers on how to properly install each component for the racking and modules. In order to keep the project on track, workers had to complete set-ups efficiently and effectively, perfecting their installation methods so that production could move quickly through the site.

Crews performed a total of 263,419 work hours to complete the facility, recording zero lost-time accidents and only one OSHA recordable incident. McCarthy's strategy included not only keeping workers safe and productive but also training a workforce for potential future work at the site.

McCarthy utilized BIM 360 to track issues and utilized the checklists for installation verification and commissioning. The contractor developed project-specific form templates for each definable feature of work and uploaded them—with current drawings—to field iPads. Issues were tracked and reports distributed at regular intervals to subcontractors. These reports were also reviewed and discussed during weekly trade coordination meetings to expedite resolution.

McCarthy leveraged internal resources from offices around the country to support the project, making clear lines of communication and authority essential. McCarthy took a progressive approach to team collaboration and integration so that the developer would be involved early on and understand schedule updates as the project progressed.

The developer had worked with McCarthy on numerous solar facilities across the U.S. Pete Candelaria, chief technology officer at Silicon Ranch, says a key to the team's success was McCarthy's ability to establish working relationships with neighbors, local leadership, local partners and the local community. "As long-term owners of all our projects, Silicon Ranch takes a long-term view of our roles and responsibilities in the communities we serve, and McCarthy has always been sensitive to and supportive of our company's values," he says.

PHOTOS: (TOP LEFT) BY AERIAL INNOVATIONS; (ALL OTHERS) BY MCCARTHY BUILDING COS.

GOVERNMENT/PUBLIC BUILDING ■ Submitted by Brasfield & Gorrie and Merrick & Co.

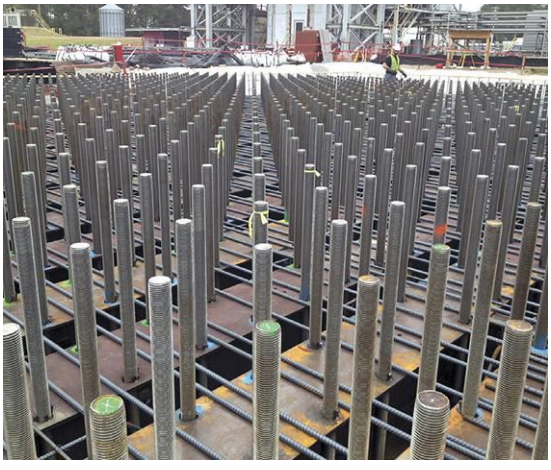
NASA SPACE LAUNCH SYSTEM (SLS) TEST STANDS

Marshall Space Flight Center, Huntsville, Ala. **BEST PROJECT**

OWNER: U.S. Army Corps of Engineers-Mobile District

LEAD DESIGN FIRM: Goodwyn Mills and Cawood/Merrick & Co. Joint Venture

GENERAL CONTRACTOR: Brasfield & Gorrie LLC



PHOTOS: (TOP RIGHT) BY MERRICK & CO.; (TOP LEFT) BY BRASFIELD & GORRIE; (MIDDLE LEFT) BY SELLERS PHOTO; (BOTTOM LEFT) BY NASA

When NASA's advanced Space Launch System (SLS) routinely propels human explorers to deep-space destinations at some future date, the vehicle's powerful rocket engines will trace part of their evolution to a pair of specially constructed propulsion unit test stand structures at the Marshall Space Flight Center.

Known officially as Test Stands 4693 and 4697, the two new structures are designed to support rigorous evaluations of fuel tanks up to 149 ft long by simulating the pressures and stresses of launch and flight. The structures can also be reconfigured as new missions and technologies emerge. As such, both test stands required foundations with substantial amounts of reinforcing steel, anchoring components and mass placements of custom concrete pads.

For the 221-ft-tall Test Stand 4693, workers had to first dig into an existing test stand originally built for the Saturn V rocket to expose rebar 17 ft below grade that would form part of the new foundation. Crews then installed a total of 415 tons of new rebar and 420 tons of embedded steel frames to support two welded structural steel towers connected at the top with large roof trusses that support a 1-million-lb movable crosshead frame.

The foundation for the 97-ft tall L-shaped Test Stand 4697 consists of 263 12-in.-dia concrete-filled pipe piles, 295 tons of rebar and 346 tons of embedded steel frames.

According to Brasfield & Gorrie senior project manager Michael Tuggle, the most formidable foundation-related challenge may well have been installing hundreds of 14- and 6-ft anchor rods on 18 in. centers, "all of which had to be precisely set to match the test stand structures."

Prefabrication proved essential in facilitating steel erection within a limited laydown area and in minimizing worker fall risks. Beginning with the uppermost section, the test stand towers were pre-assembled in seven tiers and stored until they were ready to be set in place. Similarly, Test Stand 4693's massive movable crosshead—including its 200-ton center-mounted positioning hoist, catwalks and handrails—was assembled on four temporary strand jacks, each with a lifting capacity of 557 tons.

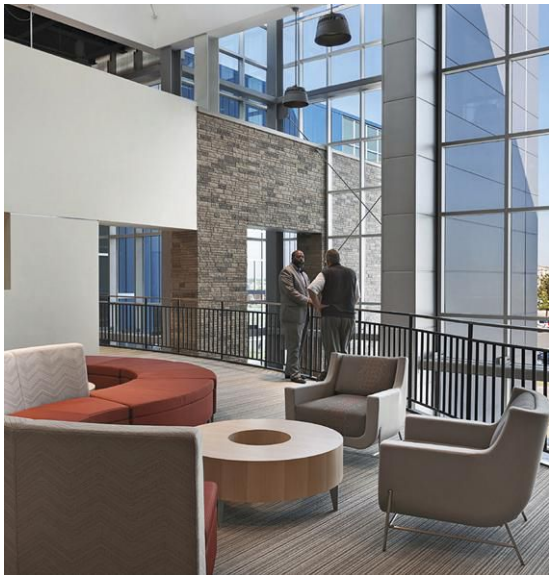
Appropriately for structures intended to validate components for safely transporting astronauts into space, safety underscored all aspects of the project, from controlled access and site-specific training to fully assessing work areas for unexploded ordinance left over from previous test programs. Tuggle says the "collaborative, overlapping safety oversight of the Corps, NASA and all contractors" paid off with zero lost-time incidents out of nearly a quarter-million work hours during 30 months of construction.

GREEN PROJECT ■ Submitted by M.B. Kahn Construction

INSTITUTE OF INNOVATION R2I2

Columbia, S.C. **AWARD OF MERIT**

OWNER: Richland School District Two
LEAD DESIGN FIRM: LS3P Associates
GENERAL CONTRACTOR: M.B. Kahn Construction
CIVIL ENGINEER: RB Todd Consulting Engineers
STRUCTURAL ENGINEER: ADC Engineering
MEP ENGINEER: Buford Goff & Associates
SOLAR CONTRACTOR: AGT Solar



The first of its kind in the nation, the 180,000-sq-ft, community-centered Institute of Innovation offers high school students the chance to take courses in supply chain logistics, computer applications development and hands-on energy courses. Nicknamed R2i2 for Richland School District 2 and innovation—the school features a curriculum emphasizing science, technology, engineering and math and is co-located with a public library and surrounded by a large retail development and private residences. The design-build team of M.B. Kahn Construction and LS3P worked to deliver the facility as a Green Globes-certified project. The building itself was designed as a teaching tool for students with a learning lab that showcases an exposed ceiling area with color-coded components such as HVAC, water, compressed air and fire alarm.

After the initial roof had been designed, the local utility company released special incentive rates that made solar panels more attractive. To take advantage of that, the team quickly re-worked the school's design to accommodate a 285-kW rooftop solar system. Despite the change, contractors were able to complete construction of the administrative and classroom areas in just 16 months, five months ahead of the original schedule, enabling the owner to move in early. The school's professional development area was occupied two months later. Contractors achieved the expedited construction schedule by utilizing additional construction crews that worked six days a week. The project team rewarded the crews for their productivity and safe work practices with several banquet lunches.

PHOTOS BY MATT SILK

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HEALTH CARE ■ Submitted by Skanska USA Building

UNC REX HEALTHCARE, HEART AND VASCULAR HOSPITAL

Raleigh **BEST PROJECT**

OWNER: UNC Rex Healthcare
LEAD DESIGN FIRM: WHR Architects Inc.
GENERAL CONTRACTOR: Skanska USA Building
CIVIL ENGINEER: Kimley Horn
STRUCTURAL ENGINEER: Stewart Engineering
MEP ENGINEER: RMF Engineering

A strategy that included design-assist of building systems and prefabrication of some building elements helped deliver the $190-million Heart and Vascular Hospital project six months ahead of schedule and more than $10 million under budget. Built for the University of North Carolina at Chapel Hill Rex Healthcare, the project included construction of a $135-million, 307,000-sq-ft, eight-story building that houses diagnostic and treatment floors; an outpatient diagnostic area to support the UNC heart program; eight cardiac cath labs; two operating rooms; and two hybrid operating rooms.

The facility also includes a five-floor patient tower housing 114 rooms and an intensive care unit. Renovations were required to the existing hospital to connect it to the new structure. Additional work included construction of a $24-million central energy plant, site infrastructure and a 400-car cast-in-place parking deck.

To meet the project's 42-month schedule and stay within budget, the team created a hybrid delivery method that utilized design assist and heavy prefabrication of building systems. A fully integrated team of Skanska, UNC Rex Healthcare, WHR Architects, RMF Engineering and design-assist subcontractors enabled use of offsite prefabrication to ensure safe and quality work. The addition of design-assist subcontractors allowed the team to coordinate the entire hospital in 3D while WHR Architects' design was still underway.

To ensure there were no conflicts, all mechanical, electrical, plumbing, medical gas and sprinkler systems were built virtually. All hanger supports for the above-ceiling MEP systems

were installed with the concrete slab pours by inserting anchors at the locations indicated in the 3D model. Crews installed more than 10,000 anchors before most of the walls were even built. While the anchors were being installed, above-ceiling MEP systems were prefabricated in roughly 20-ft long unistrut racks in an offsite warehouse. The method eliminated above-ceiling rework of MEP systems. Crews were able to install one floor of above-ceiling MEP rough-ins per week.

Every subcontractor accessed all contract documents via iPads and plan stations in the field. All quality issues were also tracked and closed virtually using iPads.

Early involvement from design-assist subcontractors during the design process also improved scope procurement, which created project savings that allowed the hospital to add almost $10 million in alternate facilities, including a conference center, café and a cardiac rehabilitation unit. Early engagement with city and state inspectors helped cut move-in time to two weeks from four months.

Chad Lefteris, vice president of operations at UNC Rex Healthcare, said the team's performance "exceeded our very high expectations from start to finish," noting that the leaders in the field were "some of the very best that I have ever worked with .... This combined team was always quick to jump in to ensure that quality and schedule were maintained and, whenever possible, improved."

PHOTOS BY NICK MERRICK © HEDRICH BLESSING

HEALTH CARE ■ Submitted by Robins & Morton

MIAMI CANCER INSTITUTE AT BAPTIST HEALTH SOUTH FLORIDA

Miami — **AWARD OF MERIT**

OWNER: Baptist Health South Florida
LEAD DESIGN FIRM: MGE Architects
GENERAL CONTRACTOR: Robins & Morton
CIVIL ENGINEER: David Plummer & Associates
STRUCTURAL ENGINEER: Bliss & Nytray Inc.
MEP ENGINEER: TLC Engineering for Architecture

Robins & Morton partnered early with project designers, subcontractors, the client and community stakeholders to construct the Miami Cancer Institute, which includes a 305,000-sq-ft outpatient cancer center and an adjacent 140,000-sq-ft clinical research building. The facility is the only North American cancer center to house every available treatment modality under the same roof and is also home to South Florida's first proton therapy center.

The project required construction of a 70,000-sq-ft radiation oncology department, a 350-ft pedestrian walkway connecting it to Baptist Hospital, two parking garage structures and a 15,000-sq-ft central energy plant, all built to withstand a Category 5 hurricane.

After the completion of construction documents, the owner handed contractors a significant challenge when it decided to add a proton therapy center. The decision prompted project team members to reconfigure the design, move buildings around, redo wind studies and change the building's structural design and program.

The scope redesign pushed back the construction start by four months. The team had expected a full building permit in June of 2014, but did not receive it until late September. By rephasing the project and overlapping some construction activities, contractors were able to complete construction in time for Baptist Health to open the facility three months early.

HEALTH CARE ■ Submitted by Batson-Cook Co.

NORTHSIDE HOSPITAL FORSYTH SURGERY AND PATIENT TOWER VERTICAL EXPANSION

Cumming, Ga. — **AWARD OF MERIT**

OWNER: Northside Hospital Forsyth
LEAD DESIGN FIRM: HDR Architecture
GENERAL CONTRACTOR: Batson-Cook Co.
STRUCTURAL ENGINEER: KSi Structural Engineers
MEP ENGINEER: EXP
PLUMBING CONTRACTOR: Art Plumbing, AC & Electric
ELECTRICAL CONTRACTOR: Inglett & Stubbs LLC

The vertical expansion at Northside Hospital Forsyth Surgery and Patient Tower was a 65,433-sq-ft, 64-patient bed addition to the existing facility. In addition to the new patient rooms, the project included a build-out of mechanical space, an upgrade to the central energy plant and installation of a new elevator. Maintaining continued operation of the existing five-story hospital—including operating rooms, intensive care unit and oncology patient rooms—required intensive planning.

Building vertically meant that the existing roof would become a built-out floor space. To protect the roof, crews first removed the rock ballast, exposing the EPDM membrane. Workers then placed high-density insulation, designed to carry the loads of the

forming system, atop the EPDM membrane, followed by a layer of plywood. The seams were taped and then lapped with strips of plywood to create a grid system that controlled lines. After the project was dried in, crews came back and exposed the existing roof structure and began the build-out of what was then the third floor. Despite starting construction with only limited structural drawings, the project team was able to complete work within the original 59-week schedule.

PHOTOS: (TOP) BY BEN TANNER PHOTOGRAPHY; (BOTTOM TWO) BY BATSON-COOK CO.

HIGHER EDUCATION/RESEARCH ■ Submitted by Gilbane Building Co.

UNIVERSITY OF SOUTH CAROLINA SCHOOL OF LAW

Columbia, S.C. **BEST PROJECT**

OWNER: University of South Carolina
LEAD DESIGN FIRM: The Boudreaux Group and SmithGroupJJR
CONTRACTOR: Gilbane Building Co.
CIVIL ENGINEER: RB Todd Consulting Engineers
STRUCTURAL ENGINEER: Johnson and King Engineers
MEP ENGINEER: Swygert and Associates Consulting Engineers
CONSULTANT: Brownstone Construction Group

Constructing a three-story, 187,500-sq-ft building designed for instructional flexibility in a highly constrained urban location required an agile construction team. Laydown space, already at a premium due to the proximity of several adjacent structures and busy city streets, had to be closely coordinated with the concurrent renovation of a historic home, one of several buildings that share the law school site.

With as little as 5 ft separating new construction from some of Columbia's oldest buildings, Gilbane took the initiative to incorporate additional subsurface safeguards into the foundation design via an earth retention system supported by auger piles. This installation approach eliminated the risk of potentially damaging vibrations from pile-driving operations.

Appropriately for a structure dedicated to the pursuit of justice, Gilbane more than doubled the university's specified participation goals for minority- and woman-owned businesses. Forty-two percent of the project team was composed of M/WBE firms, of which more than 28% were owned by African-Americans.

By incorporating subcontractor information into the project's BIM system, the project team was able to identify and resolve more than 250 clashes before construction began, yielding major time and cost savings.

A comprehensive safety program resulted in no lost-time injuries during construction, which spanned nearly three years and more than half a million work hours.

Despite its size, the new School of Law's limestone and brick exterior complements its history-rich environment, including nearby legal buildings such as South Carolina's State House and Supreme Court.

The building's four wings provide technology-enhanced, naturally lit spaces for classrooms, a law library, a 300-seat ceremonial courtroom, group study rooms and offices. In addition, the center courtyard features granite blocks salvaged from Columbia's now-closed historic prison. The wide variety of interior finishes includes restored woodwork recovered from several local historic buildings.

HIGHER EDUCATION/RESEARCH ■ Submitted by Clark Construction Group

Built by the joint venture team of Clark|Parent, Vanderbilt University's 235,000-sq-ft Engineering and Science Building features specialized laboratories, an innovation center, a two-story atrium and a 12,000-sq-ft Class 100 clean room, where 300 air changes occur every hour to prevent contamination. The building's footprint, which took up most of the site, challenged the construction team with the planning of crane location, drop-off zones and truck access. With little onsite staging area, the team planned and managed just-in-time deliveries of materials. Construction of the building—which features specialized spaces for biology, chemistry and computational laboratories—transformed a vacant space in the center of campus into a vibrant, multidiscipline academic and research space. The building is on track to become the 10th LEED Gold certified building on campus.

VANDERBILT ENGINEERING AND SCIENCE BUILDING

Nashville **AWARD OF MERIT**

OWNER: Vanderbilt University
LEAD DESIGN FIRM: Wilson Architects
GENERAL CONTRACTOR: Clark|Parent, a Joint Venture
CIVIL ENGINEER: Barge Cauthen Associates
STRUCTURAL ENGINEER: Structural Design Group
MEP ENGINEER: Phoenix Design Group
CLEAN ROOM ENGINEER: Thompson Consultants Inc.

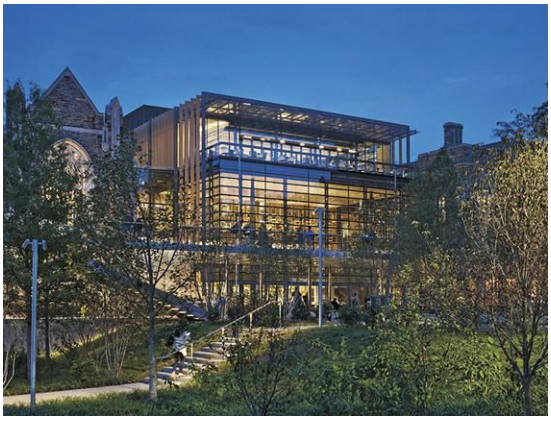
PHOTOS: (TOP TWO) ©2017 BRIAN DRESSLER; (BOTTOM) BY ANTON GRASSL PHOTOGRAPHY

HIGHER EDUCATION/RESEARCH ■ Submitted by Skanska USA Building and Roschmann Steel & Glass Constructions Inc.

DUKE UNIVERSITY-WEST CAMPUS UNION

Durham, N.C. **AWARD OF MERIT**

OWNER: Duke University Facilities Management
LEAD DESIGN FIRM: Grimshaw Architects
GENERAL CONTRACTOR: Skanska USA
CIVIL ENGINEER: Stewart Consulting Engineers
STRUCTURAL ENGINEER: Buro Happold Consulting Engineers
MEP ENGINEER: Vanderweil Engineers



Renovations to Duke University's West Campus Student Union, originally built in 1928, delivered a building that blends the school's traditional Gothic look with a contemporary design.

Skanska restored the existing structure's legacy spaces to their original architectural significance while demolishing the building's core and replacing it with a new open atrium space. This space supports the facility's organic food-centered dining program.

Renovations created a central core of nine dining venues, while multipurpose spaces at every level accommodate gatherings for dining and student activities.

The university's aggressive schedule proved the project's biggest challenge. Multiple design phase revisions resulted in a net setback of 14 months for the design deliverables.

Despite this, the construction schedule was only shifted by eight months, challenging Grimshaw and Skanska to absorb the additional six months. As a result, the team shifted to a fast-track delivery process, breaking out 10 design packages that were issued between fall 2013—when demolition began—and late 2014, at final issuance of construction documents.

Skanska procured multiple scopes to expedite the schedule, including design-assist packages for components such as the glass facade.

Midway through construction, Duke requested that Skanska complete the pub venue ahead of March Madness. The team resequenced work to support this milestone and successfully opened the pub six months early.

HIGHER EDUCATION/RESEARCH ■ Submitted by Brasfield & Gorrie

COLUMBUS STATE UNIVERSITY FRANK D. BROWN HALL

Columbus, Ga. **AWARD OF MERIT**

OWNER: Columbus State University
LEAD DESIGN FIRM: BGP Architects
GENERAL CONTRACTOR: Brasfield & Gorrie
CIVIL ENGINEER: French & Associates
STRUCTURAL ENGINEER: Wright Engineering LLC
MEP ENGINEER: NBP Engineers Inc.

The Frank D. Brown Hall project included demolition, renovation and expansion to the Columbus Ledger-Enquirer building in Uptown Columbus for the relocation of administration offices and academic facilities for Columbus State University. The project features a tiered 150-seat classroom, simulation labs for nursing and group learning spaces. The first phase included abatement work on the interior of the existing buildings to carefully remove any hazardous materials from the former newspaper site.

The second phase included demolition of a six-story tower as well as a warehouse, press bay and loading docks. The facility's exterior is clad in brick with cast stone accents. A two-story, glass-enclosed lobby connects the two sections of the complex.

Before the project began, the construction team discovered a sealed storage vault in an existing building that housed blueprints and pictures dating back to the early 1900s. Throughout construction, the project team also encountered the remnants of more than 15 different structures, including foundations, below-grade walls, abandoned utility vaults as well as an entire basement from a building that was abandoned nearly 50 years ago.

Despite the unforeseen below-grade conflicts, contractors were able to complete the project on schedule and under budget.

PHOTOS: (TOP) @ JAMES EWING/OTTO; (BOTTOM) BY SCOTT WANG

HIGHWAY/BRIDGE ■ Submitted by Skanska USA

CHOCTAWHATCHEE BAY BRIDGE (US 331)

Walton County, Fla. **BEST PROJECT**

OWNER: Florida Dept. of Transportation

LEAD DESIGN FIRM: Parsons Brinckerhoff

GENERAL CONTRACTOR: Skanska USA

CIVIL/STRUCTURAL ENGINEER: WSP - Parsons Brinckerhoff

GEOTECHNICAL/ENVIRONMENTAL ENGINEERING: Madrid Engineering Group

One in a series of projects aimed at expanding U.S. 331 to four lanes from two, the $118.5-million Choctawhatchee Bay Bridge project delivered a new 2.5-mile crossing over a sensitive marine environment. Built alongside the existing two-lane Clyde B. Wells Bridge, the new structure now serves as U.S. 331's northbound lanes.

The bridge is founded on 30-in.-sq piles measuring 80 ft to 160 ft in length with cast-in-place concrete footers and columns. The design called for a mix of hammerhead caps and precast-pile and precast-cap construction. The spans, which ranged from 142 ft to 200 ft in length, consist of 72-in. and 96-in.-deep Florida I-beams, cast-in-place deck with galvanized stay-in-place deck forms, a post-tensioned channel span and mass concrete substructure.

To help protect the bay, which is home to such endangered species as the giant gulf sturgeon and the Oskaloosa darter, the team's plan included noise monitoring, bubble curtain for in-water noise abatement during pile-driving and use of large diesel impact hammers.

Crews had a limited time

frame to drive precast piles to avoid a migratory fish window, during which time a moratorium was imposed on pile-driving for several months. Due to highly variable soil conditions, the design-build team utilized a thorough test pile program to establish pile lengths. A test pile was installed at every pier. An average of four restrikes, at varying depths, were performed on every test pile. Crews pushed through four months' worth of pile-driving in a few weeks, going seven days a week for 14 to 15 hours per day.

The project included construction of a 400-ft fishing pier, boat ramps and docks as well as relocating a local park and making deep ground improvements to the causeway surrounding the bridge. The scope of work also included fender system replacement and associated road work.

HIGHWAY/BRIDGE ■ Submitted by Arcadis U.S. Inc.

The design-build-finance approach to new road construction of State Road 9B from Interstate-95 to north of U.S. 1 included construction of approximately 2.8 miles of State Road 9B and a full cloverleaf interchange at I-95 and SR 9B. The project also involved widening 2.75 miles of I-95 to eight lanes from six, construction of a full access interchange at US 1 and SR 9B, full reconstruction of two miles of U.S. 1 and construction of eight bridges. A sound barrier was installed along with 15,000 linear ft of storm drainage and 2 million cu yd of embankment. During the bid process, Superior and Arcadis submitted an alternative technical concept (ATC) design that significantly reduced the bridge structure requirements for the SR-9B/I-95 interchange, resulting in overall cost savings.

SR 9B FROM I-95 TO NORTH OF US 1 NEW ROAD CONSTRUCTION

Jacksonville, Fla. **AWARD OF MERIT**

OWNER: Florida Dept. of Transportation, District 2

LEAD DESIGN FIRM: Arcadis U.S. Inc.

GENERAL CONTRACTOR: Superior Construction Co. Southeast LLC

LIGHTING/ITS/STRUCTURES SUPPORT: DRMP Inc.

GEOTECHNICAL ENGINEERING: AMEC

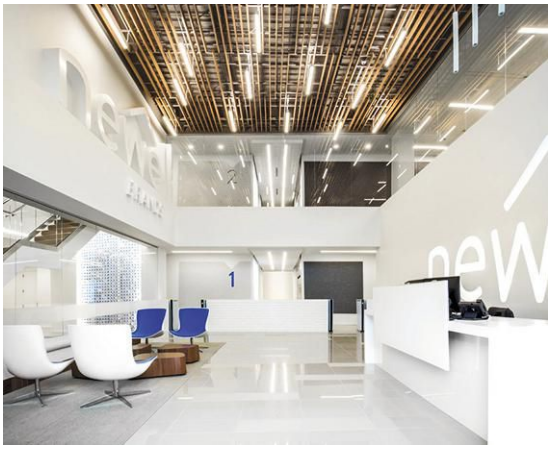
PHOTOS: (TOP THREE) BY SKANSKA USA; (BOTTOM) BY FDOT/SUPERIOR CONSTRUCTION/ETM

INTERIORS/TENANT IMPROVEMENT ■ Submitted by Choate Construction Co.

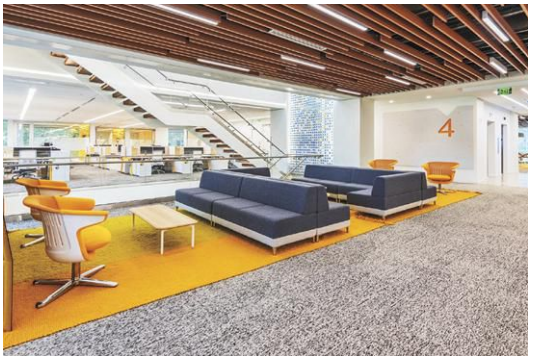
NEWELL BRANDS

Atlanta **BEST PROJECT**

OWNER: Newell Rubbermaid
LEAD DESIGN FIRM: Perkins + Will
CONTRACTOR: Choate Construction Co.
ELECTRICAL CONTRACTOR: Wayne J. Griffin Electric
MECHANICAL CONTRACTOR: Legacy Mechanical Services



PHOTOS BY CLEAR SKY IMAGES



Renovating the 100,000-sq-ft building into a distinctive corporate headquarters proved to be a race against time as the project team was tasked with opening the new corporate headquarters on the same day that Newell Rubbermaid completed its merger with Jarden Corp. That left little room for error in tackling a host of construction challenges.

But a strict schedule would not justify compromised quality. Throughout the project, Choate would hold all subcontractors to the same quality standards, mandating that the first 10 square feet or linear feet of any scope undergo full review and approval by the project superintendent, owner and architect before continuing. Products that did not meet those quality standards would be ripped out and restarted.

With a new steel structure needed to support a fully furnished rooftop party deck and 7,000-sq-ft green roof, contractors would have to create new shear walls by adding more than 1 million pounds of concrete to the building's diaphragm. Creating space for the formwork would require removing several existing walls and stairways, but the aggressive project schedule afforded insufficient time to safely relocate the building's electric service.

Choate's solution was to "slip form" the walls, essentially sliding the forms into place behind the electrical service. Close coordination from initial planning through inspection of the final pour prevented any concrete blow-outs or safety risks, allowing rooftop construction to get underway as soon as the new structural system passed inspection.

Another time-sensitive challenge involved the building's new decorative stairway, composed of hundreds of small tubes at different depths to indicate the specific floor level. Choate cut a large opening through each floor, adding tens of thousands of pounds of steel to strengthen the slabs. All of these structural improvements were completed at the same time as crews were installing Class A finishes. But because the stairway was the last major component scheduled for installation, new finishes had to be brought as close as possible to the openings, requiring many subcontractors to work at elevation.

As the clock ticked down to the project's scheduled completion date, workers painstakingly hand-installed the stairway's intricate components. Meanwhile, work proceeded nonstop to put the finishing touches on the building's many other high-end elements. In what might be the construction equivalent of a photo finish, Bo Webb, Choate senior superintendent, says the new headquarters received its temporary certificate of occupancy "with just 14 minutes to spare" to enable Newell to move in on the day it completed its merger.

OFFICE/RETAIL/MIXED-USE ■ Submitted by Brasfield & Gorrie

COMCAST AT ONE BALLPARK CENTER

Atlanta **BEST PROJECT**

OWNER: Braves Construction Co. L.L.C.

LEAD DESIGN FIRM: Wakefield Beasely & Associates

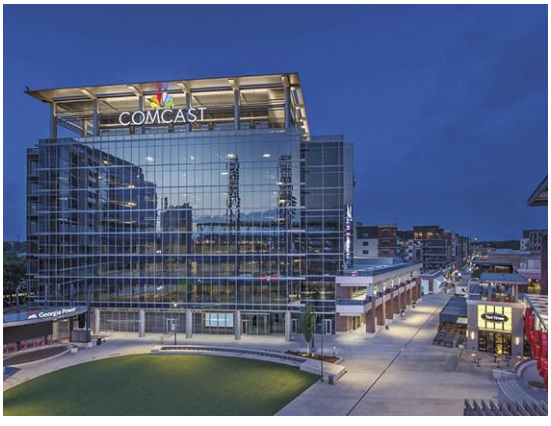
GENERAL CONTRACTOR: Brasfield & Gorrie LLC

CIVIL ENGINEER: Kimley-Horn

STRUCTURAL ENGINEER: Uzun+Case

MEP ENGINEER: McKenney's Inc.

ELECTRICAL CONTRACTOR: Henderson Electric Co.



Despite numerous design and scope changes during construction, Brasfield & Gorrie delivered Comcast's 440,00-sq-ft central division headquarters on time and under budget. Located adjacent to SunTrust Park, the new home of the Atlanta Braves, One Ballpark Center is a nine-floor Class A office building with 255,270 sq ft of office space and a two-level, 185,000-sq-ft partially below-grade parking garage.

The building's first floor includes 20,000 sq ft of restaurant and hospitality space facing SunTrust Plaza. Contractors turned the space over to the project owner, the Braves Construction Co., on an accelerated schedule for tenant build-out so that businesses could open in time for the inaugural Braves baseball season at the new ballpark.

One Ballpark Center was completed as a partial MEP design-build project between Brasfield & Gorrie, McKenney's, Henderson Electric and Advantage Fire. The project team faced substantial changes to the interior as the tenant's needs were not fully realized at the start of construction.

A nine-story stairwell was added to the project just weeks before second-floor framing was in place. Brasfield & Gorrie leveraged its self-perform and virtual design and construction capabilities to accommodate the stairwell. The team modified formwork and framing plans, reinforcing steel configurations and post-tension cable layouts in the field within days of receiving updated design documents.

Nearly eight months after construction started and one month after the structure was topped out, an elevator was extended two additional levels to service future elevated kitchen areas in the tower. Coordination efforts resulted in the successful extension of the elevator nearly six weeks early.

Due to its proximity to the then-ongoing SunTrust Park construction, the site offered minimal laydown room and contractor parking. The project team carefully scheduled deliveries to the half hour to minimize the need for storage and secured nearby parking spaces for subcontractors that implemented ride-share programs.

"Brasfield and Gorrie easily navigated the challenges associated with this project," says Dan Biber, senior director of construction services with Pope & Land Real Estate, a partner in the development. "Their ability to respond quickly to design changes and an accelerated schedule has resulted in a trusted camaraderie and a successful project completed on time and under budget."

PHOTOS: (TOP RIGHT) BY BRASFIELD & GORRIE/MORTENSON CONSTRUCTION; (TOP AND MIDDLE LEFT) BY SCOTT WANG PHOTOGRAPHY; (BOTTOM LEFT) BY AERIAL INNOVATIONS OF GEORGIA;

OFFICE/RETAIL/MIXED-USE ■ Submitted by PCL Construction Services Inc.

DISNEY SPRINGS

Lake Buena Vista, Fla. **AWARD OF MERIT**

OWNER: Walt Disney Imagineering
LEAD DESIGN FIRM: Stantec Architecture Ltd.
GENERAL CONTRACTOR: PCL Construction Services Inc.

Contractors utilized integrated project delivery for this project, which transformed the former Downtown Disney into the retail, restaurant and recreation development known as Disney Springs via two phases over a roughly three-year period. Phase 1 included new hardscape for the development's West Side along with transformation of the former Pleasure Island area into The Landing, which includes restaurants.

Phase 2 included the construction of new core and shell buildings for retail venues and Disney-owned restaurants in a neighborhood called Town Center as well as the creation of the 2.5-acre springs water feature. The new construction adds approximately 500,000 sq ft of retail venues to the property.

To function as an integrated team, project contractors and designers co-located in the same complex to enhance communication, which resulted in more efficient resolution of construction complexities. With more face-to-face communication as well as regularly scheduled collaborative meetings, contractors reduced the number of requests for information.

PCL was the leader in developing, vetting and revising schedules and logistics plans. Under the collaborative method of IPD, PCL's subcontractors were able to share both equipment and manpower among trades.

OFFICE/RETAIL/MIXED-USE ■ Submitted by Suffolk Construction Co.

CITYPLACE DORAL

Doral, Fla. **AWARD OF MERIT**

OWNER: Related Group - Miami
LEAD DESIGN FIRM: Arquitectonica - Miami
GENERAL CONTRACTOR: Suffolk
CIVIL ENGINEER: Ballbe & Associates
STRUCTURAL ENGINEER: McNamara Salvia Structural Engineers
MEP/ELECTRICAL ENGINEER: JALRW

The CityPlace Doral project, developed and owned by Miami's Related Group, is a 1.2-million-sq-ft multi-use complex consisting of seven different buildings: two residential towers, a 300,000-sq-ft retail center, a 36,000-sq-ft movie theater, two parking garages and a 30,000-sq-ft grocery store. Two eight-story residential towers include a total of 303 apartments and ground-level retail in each. The complex also has two precast concrete parking garages.

One major challenge arose near the project's close. All buildings share an engineered exterior framing with DensGlass cladding that was finished with stucco and paint. However, as final inspections began on the DensGlass cladding, city officials indicated that the material might not meet recent revisions to the state building code involving specific conditions for exterior cladding.

Ultimately, city officials directed contractors to reinstall plywood, stucco and paint atop all areas—a task that was completed in less than a month without impacting the project's schedule. Additionally, Suffolk Construction, the client and the design team spent numerous hours working with authorities to prove that the nearly 70,000 sq ft of installed DensGlass was compliant.

PHOTOS: (TOP) BY RANDLE COMMUNICATIONS; (BOTTOM TWO) BY MIAMI IN FOCUS

RENOVATION/RESTORATION ■ Submitted by Brasfield & Gorrie

PIZITZ BUILDING

Birmingham, Ala. **BEST PROJECT**

OWNER: Bayer Properties
LEAD DESIGN FIRM: Wisznia Architecture & Development
CONTRACTOR: Brasfield & Gorrie LLC
ARCHITECT: KPS Inc.
CIVIL/STRUCTURAL ENGINEER: LBYD
MEP ENGINEER: SSOE

After nearly three decades of dormancy, a 92-year-old downtown Birmingham landmark has been reborn as an 11-story mixed-use facility with 143 apartments, 13,000 sq ft of office space and a mezzanine-level open-concept food hall showcasing the city's best culinary entrepreneurs. A reconfigured mechanical penthouse offers amenities such as meeting space; a pool; exercise, steam and sauna rooms; and 360-degree skyline views.

The two-year process of transforming the historic structure, which had originally been designed as a department store, required extensive planning. Flanked by other buildings and major city streets, the site's limited laydown space required creative sequencing and scheduling of material deliveries. Laser scanning pinpointed imperfections in the existing structure that required design modifications, providing greater certainty to the cost and schedule of a project that had already overcome several financial hurdles.

Decades of exposure and neglect had taken their toll on the building's terra-cotta veneer, which had been built in phases with different types of anchor systems, complicating the repair and renovation strategy. Multiple design iterations yielded a cost-efficient combination of structural components to support the facade, including the application of fiber-reinforced polymer to strengthen deteriorated structural elements.

Although the building's original floors and most interior walls were retained, the need to bring natural light into spaces destined for new apartment units required creating a light well by cutting a 50-ft by 50-ft hole at each level from the roof to the second floor. Because of limited interstitial space above the mezzanine and a requirement to preserve the ground floor's historically significant plaster ceiling, pipes and drains were routed through 28-in.-high access flooring on the second floor.

Workers took special care to preserve the old building's many historic elements, including a covered-up clock that had once been a prominent feature in the original retail store. The clock was restored and given a prominent location in the now bustling food hall.

RENOVATION/RESTORATION ■ Submitted by Hoar Construction Co.

In renovating Birmingham's 1920s-era former Federal Reserve building—and a 1950s-era annex—into commercial office space, the owner tasked the project team with incorporating existing items into the project in order to qualify for historic tax credits from the state of Alabama. Hoar Construction worked with the National Parks Service to develop options for preserving historic features while also modernizing and bringing the structures up to current building standards. Crews salvaged and reinstalled black marble around the elevator lobbies. Builders also sand-blasted the building's original, massive steel vaults, restoring them to their original finish and then repurposing them to house restrooms and conference rooms. In the end, the project satisfied all state and federal historic preservation requirements.

FEDERAL RESERVE BUILDING

Birmingham, Ala. **AWARD OF MERIT**

OWNER: Capstone Real Estate Investments LLC
LEAD DESIGN FIRM: Williams Blackstock Architects
GENERAL CONTRACTOR: Hoar Construction Co.
CIVIL ENGINEER: Schoel Engineering Co.
STRUCTURAL ENGINEER: LYBD Inc.
MEP ENGINEER: RJ Mechanical Inc.
WINDOWS CONTRACTOR: Nelson Glass Co.
SURFACE RESTORATION: Architectural Surface Restoration LLC

PHOTOS: (TOP) BY MASON FISCHER OF FISCHER STUDIOS; (MIDDLE) BY WISZNIA ARCHITECTURE; (BOTTOM) BY CRAIG RODERICK AND SARA BECK, AMERICAN ROAD TRIP PHOTOGRAPHY

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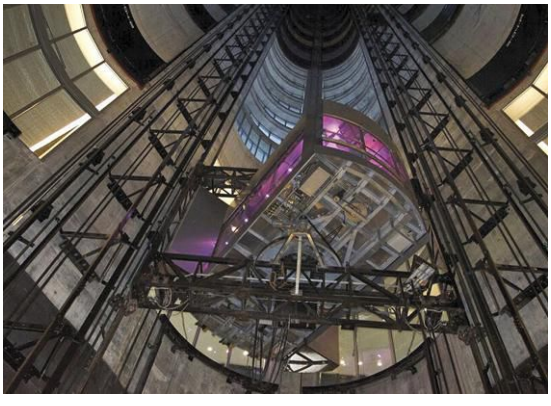
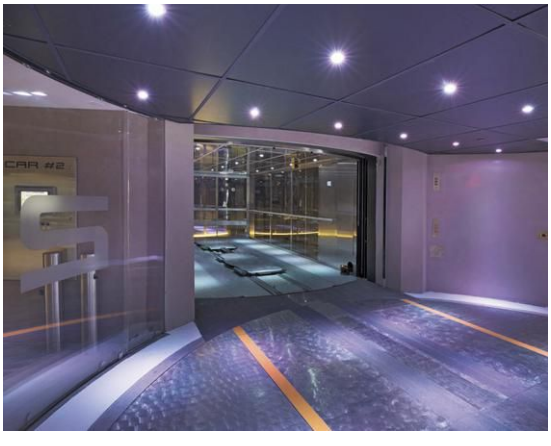
RESIDENTIAL/HOSPITALITY ■ Submitted by Coastal Construction

PORSCHE DESIGN TOWER MIAMI

Sunny Isles Beach, Fla. **BEST PROJECT**

OWNER: Dezer Development
LEAD DESIGN FIRM: The Sieger Suarez Architectural Partnership
GENERAL CONTRACTOR: Coastal Condominiums
CIVIL ENGINEER: Fortin, Leavy, Skiles Inc.
STRUCTURAL ENGINEER: CHM Structural Engineers LLC
MEP ENGINEER: Feller, Steven
LANDSCAPE CONTRACTOR: EGS2 Corp.





The 60-story, 132-unit condominium has the distinction of housing a first-of-its-kind automobile elevator lift system that delivers both residents and their vehicles directly to their luxury homes. The "Dezervator"—named after the building's developer, Gil Dezer—consists of three robotic elevators each capable of transporting a total weight of 40,000 lb at a speed of 800 ft per minute, along with a vehicle transfer device that delivers the auto into the homeowner's private garage.

Not surprisingly for such a cutting-edge system, a host of technical and constructibility issues had to be resolved to make this amenity feasible. A test building housing a working model of one elevator—complete with simulated apartment garages, custom-designed and manufactured garage doors, elevator cabin and all appurtenant equipment—proved instrumental in fine-tuning the system, its many new and adapted safety requirements and the surrounding structure. The elevator machine room floor, initially designed as a reinforced concrete structure, was redesigned as a structural steel floor to eliminate the time necessary for reshoring and concrete setting, thereby helping expedite construction.

The reinforced concrete radius walls of the elevator shafts required a consistent vertical tolerance of no more than 3 cm throughout the tower's 650 ft height. This required extensive measurement before, during and after each wall pour. Each level was formed in three staggered sections to allow continuous daily forming and concreting operations. Upon removal of the previously poured forms, each new wall set's vertical alignment was verified using level and transit instrumentation from multiple points on the working decks.

Even with the meticulous measurement requirements, the concrete contractor was able to maintain a five-day completion pour cycle on the building's 13,000-sq-ft floor decks. A movable protective barrier of steel beams and multiple layers of plywood allowed formwork to continue above while elevator crews worked in the shafts below. This work likewise required precise measurement to ensure the shaft above aligned with the elevator travel rails taking shape below, compensating for any tolerance deviations as the structure rose.

The efforts paid off. When the last pour was completed, shaft alignment was found to be within the tolerance threshold.

In addition to offering residents a unique amenity, the Porsche Design Tower's automobile elevator benefited the project in other ways. By incorporating parking on the residential levels, local zoning ordinances allowed for the design of a taller structure with more spacious layouts.

PHOTOS: (TOP RIGHT AND MIDDLE LEFT) COURTESY PORSCHE DESIGN TOWER; (TOP LEFT AND BOTTOM LEFT) BY MIAMI IN FOCUS

SMALL PROJECT (UNDER $10 MILLION) ■ Submitted by New South Construction Co.

ATLANTA BOTANICAL GARDEN - RENOVATIONS & ADDITION

Atlanta **BEST PROJECT**

OWNER: Atlanta Botanical Garden
LEAD DESIGN FIRM: Perkins + Will
GENERAL CONTRACTOR: New South Construction Co.
CIVIL ENGINEER: Long Engineering Inc.
STRUCTURAL ENGINEER: Buro Happold
MEP ENGINEER: Newcomb & Boyd

The newly expanded and renovated two-level Longleaf Café and Garden House was designed to seamlessly blend with the surrounding gardens, a feature that also constrained the contractor's ability to access the site and make the contemporary glass structure a reality.

Challenges began literally at the project's front door, with a narrow 0.17-mile access road that was also used for routine deliveries and a concurrent project being completed by another contractor. Proactive communication and daily coordination among all users kept conflicts to a minimum.

New South also had to react quickly to a previously undisclosed requirement for the restaurant to maintain its regular operating hours. By rearranging and resynchronizing the project implementation sequence, New South was able to suspend construction during prime lunch hours each day, allowing patrons to enjoy their meals without compromising a schedule already complicated by numerous weather delays and the garden's busy slate of events and exhibitions.

Additional surprises emerged as the project progressed, including inaccurate as-builts that showed kitchen footings to be 8 ft higher in elevation than anticipated. A quickly designed soil-nail system and hydraulic jacks stabilized the structure until new foundations could be poured and backfilled.

The original plan to use traditional gypsum ceiling tiles in the restaurant was revised to accommodate perforated acoustical panels. While creating a more pleasant dining environment, the panels added new installation challenges, such as aligning the perforations and carefully conforming their shape with light fixtures and sprinkler heads.

Some design changes proved beneficial to the project's cost and schedule. Instead of a precast chimney cap, which would have required a 130-ton crane and jib to install, New South suggested and designed a less costly fabricated metal cap that blends well with other exterior features.

PHOTOS: (TOP TWO) BY BRILLIANCE PHOTOGRAPHY; (BOTTOM) BY LEO RICHARD JOHNSON

SMALL PROJECT (UNDER $10 MILLION) ■ Submitted by West Construction Co.

Completed ahead of schedule in just 9 months, the $4.65-million Bouhan Falligant office building anchors the south end of Savannah's Forsyth Park with Chicago-style architecture.

While working within the constraints of Savannah's height ordinance and design guidelines of its Landmark Historic District, project team members opted for a detailed masonry exterior of brick and cast stone, with an interior featuring energy-efficient HVAC, LED lighting, impact-rated stainless steel entry door, structural steel framing and permeable pavers for parking.

Despite being impacted by Hurricane Matthew in 2016—during steel erection—contractors completed the new home for Savannah's oldest law firm 1% under budget and two weeks ahead of schedule.

BOUHAN FALLIGANT

Savannah, Ga. **AWARD OF MERIT**

OWNER: Bouhan Falligant LLP
LEAD DESIGN FIRM: Felder & Associates
GENERAL CONTRACTOR: West Construction Co.
CIVIL ENGINEER/STRUCTURAL ENGINEER: Thomas and Hutton
MEP ENGINEER: Chatham Engineering

SPECIALTY CONSTRUCTION ■ Submitted by Hensel Phelps

COMMERCIAL CREW TRANSPORTATION CAPABILITY – LAUNCH COMPLEX 41

Cape Canaveral Air Force Station, Fla. **BEST PROJECT**

OWNER: United Launch Alliance
LEAD DESIGN FIRM: Nishkian Dean
CONTRACTOR: Hensel Phelps
CIVIL ENGINEER: Nelson Engineering
MEP ENGINEER: Fives Lund

Retrofitting Launch Complex 41 to support the U.S.'s next generation of manned spaceflight systems required some literal and figurative rocket science throughout the project. As the complex is regularly used for launching satellites and deep-space probes atop Atlas V rockets, constructing a 250-ft-tall crew access tower with 60-ft hydraulic egress arm immediately adjacent to the pad had to be scheduled and performed within a series of work windows. Each required specific, meticulous procedures for demobilizing and remobilizing workers and equipment, and ensuring that in-progress construction work was fully protected from the rocket's 1.2 million lb of thrust. The coordinated planning paid off, with 17 successful, on-time launches conducted during nearly three years of construction.

The launch area's mechanical, electrical, plumbing and fire protection systems underwent a full retrofit to accommodate the one-of-a-kind crew access tower (CAT), which has a "white room" for storage of astronauts' gear and an environmental seal to control spaces that will surround the new CST-100 Starliner Capsule, scheduled to begin transporting astronauts to the International Space Station in 2019. With a 120.8-degree swing radius, the access arm will bring astronauts to within 10 in. of the capsule's outer platform.

Hensel Phelps built an offsite test stand replicating the CAT to validate the arm's hydraulic systems, function and constructibility in a controlled environment, unimpeded by the active launch schedule. After testing was complete, the arm was disassembled, transported to Cape Canaveral and lifted into place.

A variety of "space age" construction tools were used throughout the project, including 4D modeling analysis and BIM video editing to analyze and communicate potential prefabrication yard configurations and site access/logistics options as well as construction activities in sequence with scheduled launches. Laser scanning technology provided a quality verification tool during construction, ensuring full optimization of all work windows.

SPECIALTY CONSTRUCTION ■ Submitted by Baker Concrete Construction Inc.

Miami's Panorama stands 868 ft tall, the maximum height permitted by the Federal Aviation Administration. The 2.6-million-sq-ft, 85-story mixed-use development required 155,000 cu yd of concrete, provided by Baker Concrete, along with 23,000 tons of reinforcing steel and 2 million lb of post-tensioned cables. Constructing the building's mat foundation required nearly 11,700 cu yd of concrete, placed continuously for 23 hours, a record for the city of Miami. In all, Panorama's foundation required 14,700 cu yd of concrete and 3,500 tons of reinforcing steel, establishing a record as the largest foundation in the state of Florida. The project's 19-story podium structure, measuring more than 1 million sq ft, was built in 11 months and granted a temporary certificate of occupancy to allow for its use as a public garage, alleviating parking issues for the jobsite and for businesses in the area.

PANORAMA TOWER

Miami **AWARD OF MERIT**

OWNER: Florida East Coast Realty Inc.
LEAD DESIGN FIRM: Moshe Cosicher AIA; FONS Inc.
GENERAL CONTRACTOR: Tutor Perini Building Corp.
CONCRETE CONTRACTOR: Baker Concrete Construction Inc.
STRUCTURAL ENGINEER: DeSimone Consulting Engineers

PHOTOS: (TOP) BY UNITED LAUNCH ALLIANCE; (BOTTOM) BY KIA HAJIFATHALIAN

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WATER/ENVIRONMENT ■ Submitted by Lanzo Construction Co., Florida

SUNSET HARBOUR NEIGHBORHOOD IMPROVEMENTS

Miami Beach, Fla. **BEST PROJECT; AWARD OF MERIT, EXCELLENCE IN SAFETY**

OWNER: City of Miami Beach
LEAD DESIGN FIRM: Wade Trim Inc.
GENERAL CONTRACTOR: Lanzo Construction Co., Florida
CIVIL/STRUCTURAL/MEP ENGINEER: Wade Trim Inc.
LANDSCAPING CONTRACTOR: B&G Property Maintenance Inc.

The city of Miami Beach, situated between the Atlantic Ocean and Biscayne Bay, is made up of a series of natural and man-made islands. With a ground elevation generally ranging from 2 to 10 ft above sea level, the city is well known for its flooding problems during high tides and major rainstorms. In early 2014, Miami Beach significantly increased the specified design tailwater elevation for all stormwater projects.

With the ground elevation in the Sunset Harbour area among the city's lowest, contractors needed to create an alternative to the previous injection well system. The project team redesigned the pump stations for discharge to outfall structures in Biscayne Bay and designed and constructed collection system improvements to remove water from the streets faster and to tie the collection systems for each of the pump stations together for added reliability. Additionally, contractors raised street and sidewalk elevations to ensure they were above the anticipated sea level during seasonal high tides, known as king tides. The elevation change required unique harmonization features for each building entrance patio and driveway. To achieve community buy-in, Lanzo and Wade Trim presented renderings of the neighborhood improvements to the neighborhood association.

This year's safety judges also chose to honor the Sunset Harbour project with an award of merit for its safety efforts.

WATER/ENVIRONMENT ■ Submitted by Bergeron Land Development Inc.

PORT EVERGLADES WETLANDS RESTORATION, CMR

Broward County, Fla. **BEST PROJECT**

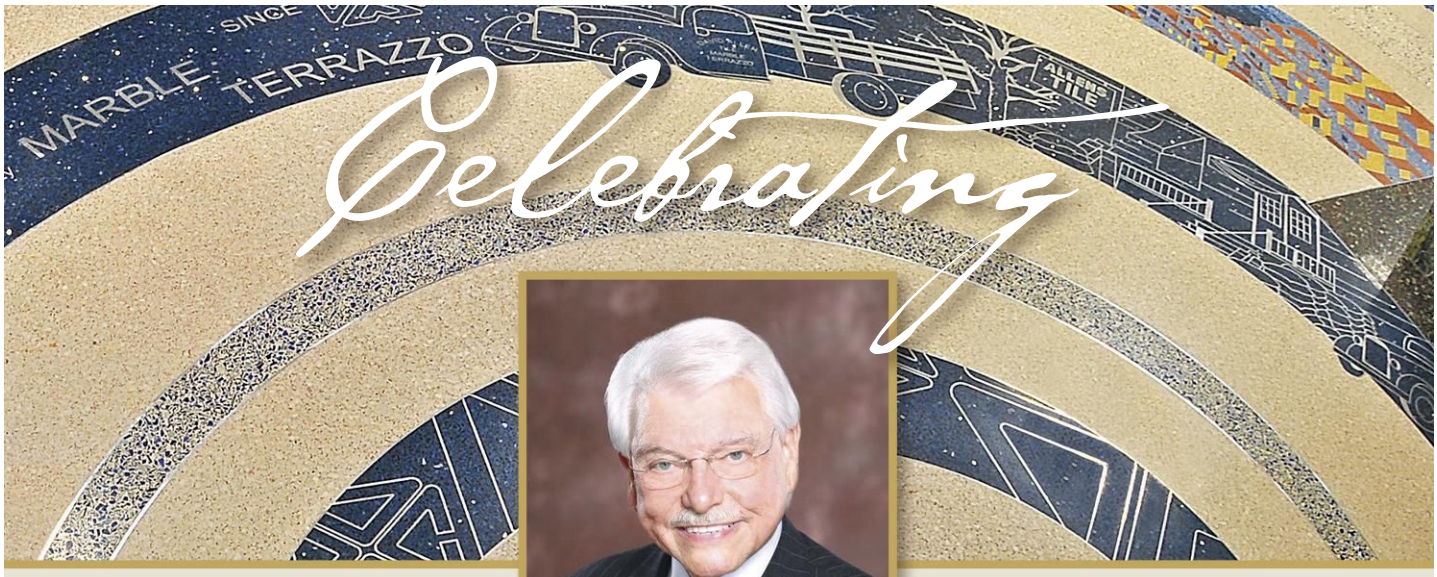
OWNER: Broward County
CIVIL/STRUCTURAL/MEP ENGINEER: DeRose Design Consultants Inc.
GENERAL CONTRACTOR: Bergeron Land Development Inc.
ENVIRONMENTAL ENGINEER OF RECORD: The Chappell Group Inc.

To expand Port Everglades, the facility arranged for the construction of the Southport Turning Notch, a series of five new berths designed to handle the future influx of Super Post Panamax Container cargo ships. However, with the seaport surrounded by environmentally sensitive mangrove and manatee habitats, Broward County needed approval from the Florida Dept. of Environmental Protection to destroy eight acres of existing mangroves residing in the footprint of the planned expansion site by first creating a 16-acre mangrove habitat as a mitigation strategy.

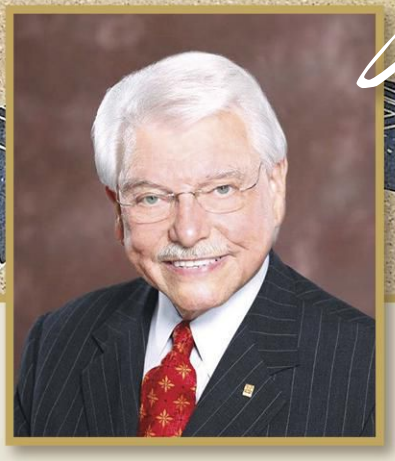
Destruction of the eight acres and construction of the Southport Turning Notch could only begin after the newly planted habitat had grown for 12 months.

Under a construction manager at-risk agreement, Bergeron Land Development agreed to build the mangrove habitat on an accelerated 13-month schedule. The project transformed the 16-acre site's terrain, which was largely overgrown with invasive vegetation and littered with decades' worth of construction and demolition debris. In July of 2016, the project team marked the habitat's one-year milestone, which indicated that the installed mangroves were sustaining proper growth necessary for long-term viability. As a result, Broward County approved removal of the existing mangrove easement, thus allowing the start of the turning notch expansion.

PHOTOS: (TOP) BY BLUEPRINT 22; (BOTTOM) BY BERGERON LAND DEVELOPMENT



Celebrating



Robert Roberson, Chairman

60 YEARS
OF LEADERSHIP

In 1957, Robert Roberson accepted a temporary job as the accountant with the company's founder, David G. Allen. Ten years later, he bought the company but retained Mr. Allen's values, work ethic, and focus on exceptional craftsmanship.

Over the years, the company has become one of the nation's largest terrazzo, tile, and stone contractors—a natural result of consistent performance and a desire to be a reliable and capable team member on every project.

Like the durable materials installed by the firm, Roberson himself has stood the test of time as the company celebrates its 97th year.

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A view from the 82nd floor of the Panorama Tower in Miami. CASF member Baker Concrete Construction was responsible for the turnkey construction of the concrete shell, which included the largest mat foundation in state history. When completed, the 85-story Panorama Tower will be the tallest building in Florida.

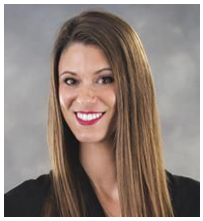
PHOTO: COURTESY OF CASF

RISING TALL IN SOUTH FLORIDA

CONSTRUCTION ASSOCIATION
OF SOUTH FLORIDA

WHAT'S INSIDE

Letter From the President



Mindy Szarowicz, President, CASF, and Director of Business Development, Baker Concrete Construction

It's a very exciting time to be a part of the South Florida construction industry. Wherever you look, cranes and new buildings silhouette the skyline. Our strategic location, quality of life, diverse population and absence of state income taxes has targeted the region as a market for global investment. The demand for development is strong across public and private sectors, and international interest continues to add to a healthy backlog.

As it has since 1950, the Construction Association of South Florida (CASF) continues to assume a leadership role in our region's commercial construction. CASF was founded by industry pioneers who developed South Florida. They had the vision to understand the importance of relationships and established the organization's guiding principles of building a trusted network and fostering industry growth.

CASF hosts more than 60 functions annually throughout the tri-county area, ranging from education and training to networking and team building. The variety and breadth of our events are calculated to offer the highest value to our members. Our partnership with OSHA, monthly sessions and quarterly seminars highlight CASF's commitment to safety. CASF has long been engaged in outreach programs to promote the skilled trades. We are proud to reach more than 50,000 South Florida students annually, and with our new multi-association agreement, we will expand that reach even further.

I am also pleased to announce that we have a new CASF executive director. Remy Mackowski brings a wealth of experience with associations to build on CASF's rich legacy. We are already upgrading our entire digital infrastructure from our association management software to a new website. Our members will also benefit from enhanced events and greater educational and training opportunities.

CASF's core principles and values will remain unchanged. However, in a rapidly shifting marketplace, we are evolving in order to continue offering the highest level of service to our members and the industry. ◆

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Building for the Future in South Florida

Looking back, 2017 may turn out to be a watershed year for the Construction Association of South Florida (CASF). The organization is introducing new leadership, implementing large-scale changes to its digital infrastructure, and creating a 501 (c)(3) nonprofit to generate funds that will expand its training and education offerings to the industry. These major changes are just the latest evolution of an association whose history coincides with the commercial construction industry it serves.

CASF's roots date back to 1950, when it was founded in Fort Lauderdale as the Broward Builders Exchange. Over time, the organization's reach extended throughout Dade, Broward and Palm Beach counties. In 1991, to better reflect its expanded role in the region's building industry, the organization renamed itself the Construction Association of South Florida (CASF).

In the years since, CASF has assumed a central role in the region's commercial construction industry. It annually hosts more than 60 events in the tri-county area—more than any other industry association. CASF staples include its monthly networking breakfasts featuring the region's top general contractors, its biannual Meet the GCs expos, bimonthly themed socials, and annual award galas recognizing the area's top craftsmen and safety professionals. In addition, many CASF committees host quarterly lunch and learns, as well as regular social and team-building events.

As 2017 comes to a close, CASF has already drawn plans to expand its events calendar in the coming year. The added agenda will focus specifically on relevant training and development opportunities for its members.

"As our industry's rate of change continues to accelerate, CASF is determined to serve our members by giving them resources and opportunities to help them succeed in this increasingly fast-paced environment," says Russell Anderson, CASF immediate past president and Turnberry senior vice president of preconstruction and procurement.

PHOTO TOP RIGHT: DREAM FOCUS PHOTOGRAPHY; BOTTOM LEFT: COURTESY OF CASF

The competition was fierce at the CASF Driving Challenge to fund construction scholarships, held September 2017.

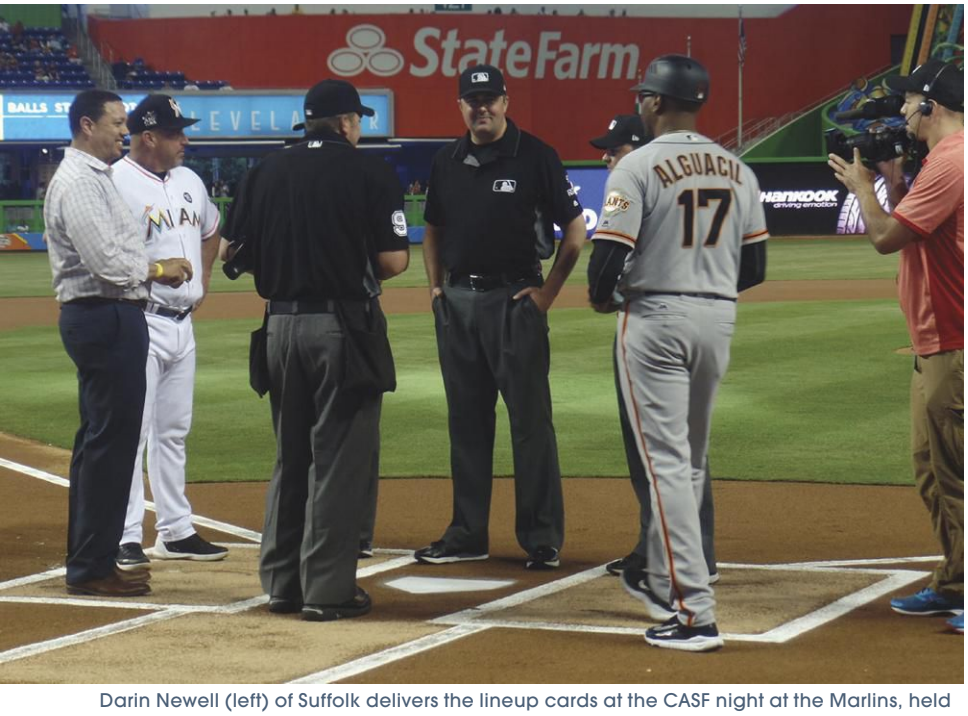
New Leadership

Remy Mackowski, Executive Director, CASF

For the first time in more than two decades, CASF has a new executive director. Remy Mackowski, formerly COO of the NFL Alumni, was brought in to build on CASF's legacy of service to its members and the industry. During his tenure with the NFL Alumni, Mackowski helped spearhead that nonprofit's growth to historic highs in membership, revenues and programs.

"We're very excited to have Remy join the team," says Mindy Szarowicz, director of business development, Baker Concrete Construction. "He understands our board's commitment to creating added value for our members and growth opportunities for our industry. More importantly, he has the skill set to help us deliver on those objectives."

Szarowicz herself reflects the change at CASF and the industry. In June 2017, at CASF's annual Installation Banquet, Szarowicz was sworn in as CASF's first-ever female president of the Board of Directors. She is joined on CASF's board by two other women, Balfour Beatty Construction's Maribeth Sitkowski and Suffolk's Jessica Chen. The diversity of CASF's 16-member



Darin Newell (left) of Suffolk delivers the lineup cards at the CASF night at the Marlins, held August 2017.

Kaufman Lynn Construction addresses CASF members at the August 2017 Networking Breakfast.

board is also evident in its mix of veteran executives, company principals and up-and-coming industry leaders.

This composition reflects the organization's active Young Leaders Committee and its CASF Women's Council. Both groups host quarterly seminars focused on timely industry topics and professional development.

"CASF has a deserved reputation as the organization for building industry relationships," says Miller Glass & Glazing President Sid Miller. "We accomplish that by striving to be the most inclusive association and connecting all the disciplines of the construction industry."

Commitment to Safety

CASF's dedication to safety is evident in that its largest and most active committee is devoted entirely to that topic. The CASF Safety Committee meets each month to dispense timely information and share best practices. Most meetings also include a local OSHA representative who participates in discussions and clarifies rules.

CASF formalized its relationship with OSHA in 2006 with a contractual partnership to provide "CASF members and others in the construction industry with information, guidance and access to training resources." Since then, CASF has worked with OSHA to develop training and education programs addressing a wide range of construction health and safety issues.

In addition to OSHA-related programs, the CASF Safety Committee hosts quarterly seminars.

These well-attended events focus on relevant topics, from scaffold safety and fall protection to mold remediation and hurricane preparedness. In 2017, the Safety Committee elected to focus its seminar series on professional development for safety personnel. Topics covered included effective communication techniques, crisis management and career advancement.

CASF's commitment to promoting a culture of safety extends to its annual recognition of South Florida's most effective safety professionals. The Safety Committee follows an extensive nominating and judging process to recognize contractors who have achieved the lowest on-the-job injury rates and demonstrated a sustained commitment to safety and safety training. CASF formally recognizes these honorees at its annual Safety Professionals of the Year Award ceremony.

Promoting Careers in Construction

CASF has long been responsive to the need to foster the industry's next generation of workers. From the Math at Work program CASF delivered in

Kent Long from Balfour Beatty takes part in the CASF Young Leaders Speaking Series.

PHOTOS: COURTESY OF CASF

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public high schools during the 1990s to its current JA Center construction 'storefront' that services 50,000 students annually, CASF has a continuous history of promoting career paths in skilled trades.

CASF's commitment to industry professionals extends from craftsmen to the executive suites. In 2003, after years of giving individual scholarships, CASF invested $62,500 to endow a fund that would provide an annual scholarship to a student engaged in coursework at the Florida International University (FIU) School of Construction.

CASF built on that initiative by entering into an agreement with the University of Florida (UF) Foundation to invest another $75,000 to create the Construction Association of South Florida Endowment. Income from that CASF Endowment is used to grant two scholarships each year to qualifying students entering their junior or senior year at UF's M.E. Rinker, Sr. School of Building Construction.

"I know first-hand how a scholarship like this can change your life," says Miller Construction Company Vice President Operations Jeff Slade. "I received a CASF scholarship at UF more than 20 years ago. After graduation, I planned to head to Atlanta to work with a company that recruited me straight out of college. But, because of that CASF scholarship, I interviewed and then accepted a position with a company in South Florida. After 20 years with Miller Construction, I have a career, family and roots here. I didn't know it at the time, but that scholarship was a major fork in the road for me."

CASF honored South Florida's top craftsmen at its 58th Annual Craftsmanship Awards Gala in November 2016.

PHOTO: DREAM FOCUS PHOTOGRAPHY

CASF's efforts to grow the region's construction labor force builds on other investments made by CASF member companies. Most recently and notably, Moss & Associates donated $10 million to FIU to create the School of Construction, Infrastructure and Sustainability. Moss Executive Vice President Chad Moss, an FIU graduate, formally presented the gift at a university gala in April 2017. In addition to funding the school of construction, the Moss donation will create a million-dollar endowment to promote diversity and opportunity in the industry through annual scholarships.

FIU President Mark B. Rosenberg responded to the gift by saying: "This generous and history-making donation will help us educate a new generation of construction professionals who will have an impact on our community and beyond."

Mike Fee (left) and his Lotspeich Co. of Florida Team helped the 2017 CASF Golf Tournament raise more than $100,000 for the Children's Aid Club and other charities.

A Legacy of Giving Back

CASF represents not just the bricks and mortar of South Florida communities but also their hearts and souls. CASF and its member companies annually donate millions of dollars and thousands of man hours in support of local charities.

"Active CASF members share a spirit of service to our companies, our industry and our communities," says John Moriarty & Associates Vice President Rick Shuerger. "Many of us are involved with and serve on boards of local nonprofits, and CASF gives us an opportunity to merge our twin passions. Giving back to the community is best for our companies and the industry as a whole."

CASF social events feature extensive raffles and door prizes, with 100% of the proceeds donated to a myriad local charities, including the ACE Mentor Program and Leukemia & Lymphoma Society (LLS). The centerpiece of CASF's Annual Holiday Party is a massive toy drive to benefit ChildNet.

PHOTOS: COURTESY OF CASF

In April of this year, CASF recognized top safety professionals (from left) Eric Bell, David Weingarten, Brian Cardona, Manual Rodriguez, Rickey Rivera, Cindy Sikora, Chris Diaz, Brian Trusky and Paul Loughran.

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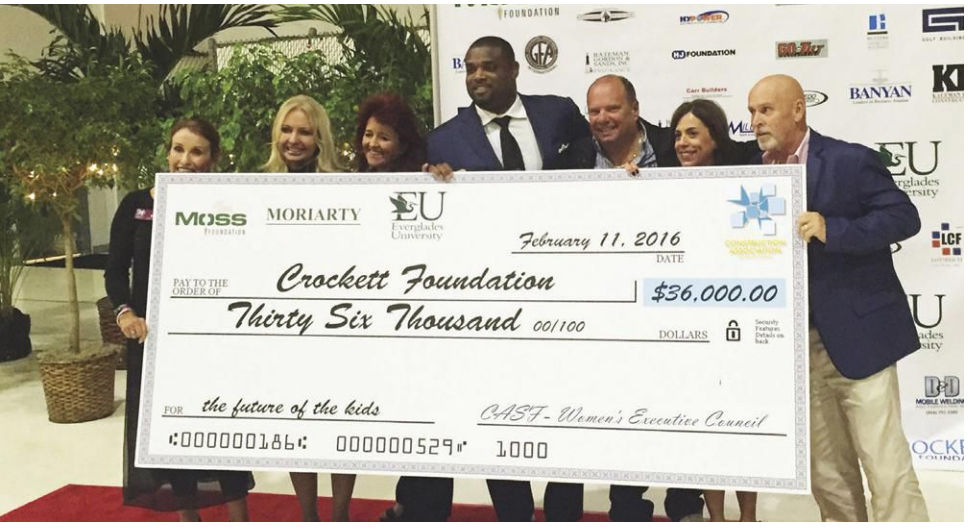
CASF also hosts three long-standing annual events devoted entirely to charitable causes.

The two X-treme Go-Cart Driving Challenges (one in Broward and one in Dade counties) generate funds for college scholarships. The CASF Golf Tournament annually raises more than $100,000 for Children's Aid Club and other local charities. The Tom Tucker Fishing Tournament donates its proceeds to the LLS in memory of Tucker, a former member who succumbed to leukemia.

In addition, the CASF Women's Council holds an annual fundraising gala. The council's next event is slated for March to help ARC Broward build a $4-million professional-grade kitchen. When finished, the facility will enable developmentally challenged adults to earn culinary certifications leading to placement in local restaurants.

Providing individuals and companies with tools to succeed is the CASF way. The organization has been delivering those tools to South Florida's construction community for nearly 70 years. And with a bold vision for its future, CASF will only build on the services it offers to promote growth for its members and the construction community. ◆



CASF presents the proceeds of its Women's Council Gala to the Crockett Foundation (CF). Pictured (from left) are CASF Women's Council Co-Chair Vicki Schuerger, unidentified participant, CASF Women's Council Co-Chair Laura Frione, CF Founder and President Henri Crockett, then-CASF President Frank Frione, CF Executive Director Eileen Lamarca and CASF Director Rick Schuerger.

PHOTO: COURTESY OF CASF

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A Tradition of Promoting Career Opportunities

High school students learn about career paths in the construction industry at the Build Your Future storefront at the 60,000-sq-ft JA Center on the Broward College campus.

Finding qualified workers has become the industry's most pressing challenge. But long before the dictates of the current labor market, CASF was at the forefront of promoting career opportunities in the skilled trades.

Two decades ago, CASF members were going into high schools throughout South Florida to promote job and career opportunities in the construction industry. Those were simpler times, when heavy equipment could be brought on campuses to be demonstrated and explained. CASF evolved a formal program, gave out interactive DVDs and acted as a conduit to real-world, entry-level positions.

In the new millennium, school districts began reacting to increased security concerns and a growing emphasis on college-focused curriculums. CASF responded to these changes by finding a new way to reach even more students.

On Monday, Sept., 21, 2009, the doors opened to the 60,000-sq-ft Junior Achievement World on the campus of Broward College. The JA center featured large 'storefronts'—room-size buildouts representing South Florida's major employers and industries. CASF was an inaugural member. Through its JA curriculum, CASF exposed students to viable career options in 13 construction trades. In that first year, tens of thousands of students attended day-long sessions at the JA center to learn about career paths, compensation rates and opportunities in the skilled trades.

"The Junior Achievement project allowed us to get our message to a larger audience of young people," says Stiles Construction Vice President of Preconstruction Doug Wallace, who in 2009 served on the CASF Youth Education Committee. "The school district mandated every student attend a whole-day program at the JA. That type of access is unparalleled. And JA's interactive 'theme park' design is so unique and well done, it really gets the kids' attention when they walk through the front door."

A number of CASF members originally pitched in to build out the storefront, most notably Stiles Construction, Cayman National Manufacturing, James A. Cummings, Expressive Designs, Central Florida Equipment, Elcon Electric and Lotspeich Co. of Florida CASF's $45,000 annual investment paid dividends. The CASF storefront quickly became a favorite among the 50,000 students from Broward and south Palm Beach counties who visited the JA center each year.

As an original partner, CASF has helped Junior Achievement of South Florida make a tremendous impact, advancing its mission of inspiring and preparing young people to succeed in a competitive, global economy. The JA center, in turn, has enabled CASF to promote skilled trades as a viable career path to a large population of young people who need to hear the message most.

"Talk to high school kids today, and you hear the word 'entrepreneur' a lot," says Justin Lord, Central Broward Construction owner and CEO. "What industry offers a clearer and more realistic path to that than construction? As an alternate industry path, you still have long-term prospects for advancement in construction."

To broaden and refine this message through its storefront, CASF in 2017 entered into an equal partnership with the Construction Executives Association (CEA) and Associated Builders and Contractors (ABC) Florida East Coast Chapter. As its first order of business, the three organizations undertook a

The new BYF initiative features ads targeted at parents to help them make informed career decisions with their children.

IMAGES: COURTESY OF CASF

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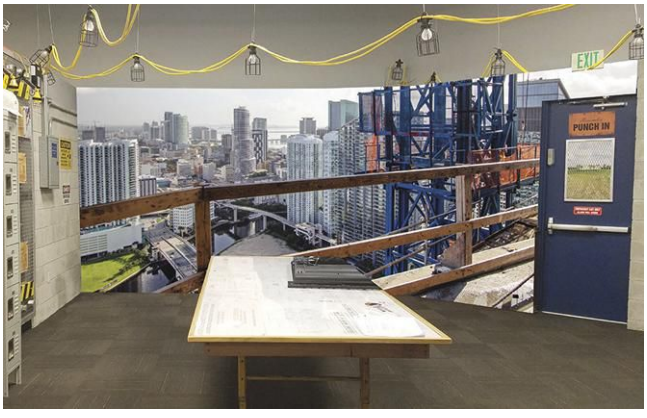
We don't just meet the schedule, we drive it. We don't just talk about safety, we live it. We don't just tell the client about a problem, we solve it. That's why we do the job better than anyone else.

renovation of the storefront. Lotspeich Co. of Florida again stepped up to spearhead the project.

The new partnership also revamped the JA construction curriculum, which is presented to students both at the storefront and through outreach programs in public-school classrooms. A marketing campaign was devised to target not just students but also their parents. In addition, the storefront was renamed to point toward Build Your Future (BYF), a high-profile national program that seeks to recruit the next generation of craft professionals. The storefront name was recently changed to Build Your Future, and it features BYF's recognizable wordmark and hardhat logo.

"It's very important to help young people understand the variety of career pathways open to them," says Debbie Fairholm, vice president of education at JA of South Florida. "Broward County Schools have asked for our help to ensure that students not seeking a four-year college degree have the opportunity to consider other options. We're excited to share the many pathways the new Build Your Future storefront will open for them." ◆



The back wall of the newly renamed BYF Construction Storefront before and after the remodel.

PHOTOS: COURTESY OF CASF

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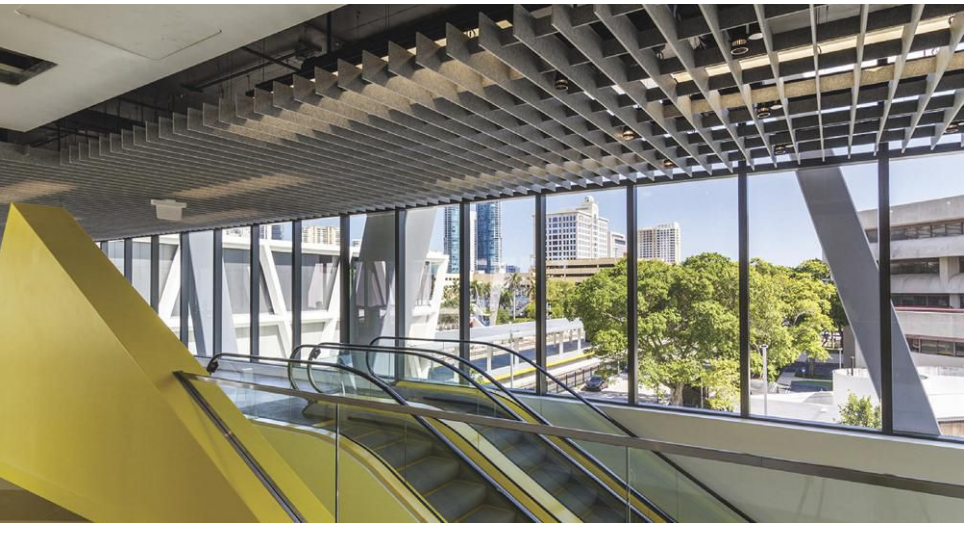
CASF Honors South Florida Craftsmen

Since 1958, CASF has publicly recognized South Florida's most skilled artisans at its annual Craftsmanship Awards. CASF honors as many as 50–60 craftsmen in dozens of categories each year. These range from mechanical piping and decorative concrete to glazed-block masonry and architectural woodwork. Whether demonstrating the intricacies of an age-old craft or the creative application of a modern innovation, all Craftsmanship Award winners share a proud devotion to old-world artistry.

"The Craftsmanship Award is our highest honor," says Mike Fee, CASF director and president of Lotspeich Co. of Florida. "Projects, companies and executives tend to get the lion's share of press in our industry. The intent of our Craftsmanship Awards has always been to put the spotlight on jobsite craftsmen whose skill and dedication make those projects possible."



Craftsman: Steve Bacalucus
Company: Advanced Woodworking Industries
GC: Moss & Associates
Project: Brightline All Aboard Florida Fort Lauderdale

PHOTO: COURTESY OF CASF

Craftsman: Carl Bell
Company: Central Broward Construction
GC: Moss & Associates
Project: Riva Condominium

In keeping with the high standards it celebrates, the CASF Craftsmanship Awards are marked by a rigorous nomination and judging process. Following extensive application and vetting processes, every project is visited by one of six judges' panels, each composed of three industry experts. Once the visits are completed, all of the judges meet to review each project by category and vote on a winner. If no project achieves the criteria for excellence in a particular category, no winner is announced that year.

Each winning craftsman in 2017 will be recognized on stage and presented with a customized award at the 59th annual CASF Craftsmanship Awards,

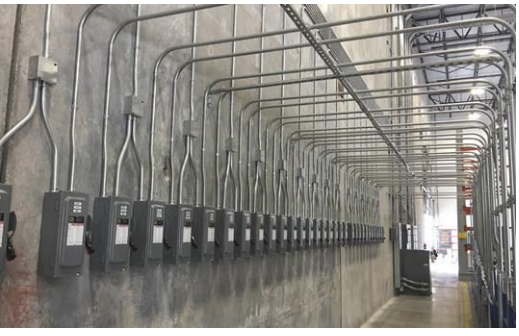
PHOTOS: COURTESY OF CASF

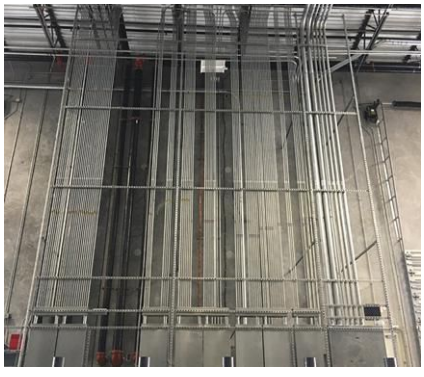
Craftsmen: Glenn Savell
Company: Premier Stoneworks
GC: Facchina Construction
Project: Grove at Grand Bay

Craftsman: Mark Horch
Company: Commercial Builders
GC: Constrology
Project: Pembroke Centre Retail Buildings A & B

held Thursday, Nov. 9 in Fort Lauderdale, Fla. In addition, the craftsman's employer and the project's general contractor will receive commemorative plaques.

This year's awards will also recognize the long-standing contributions of John E. Custer to the Craftsmanship Awards, CASF and the construction industry.





Craftsman: Jason Fromer
Company: Miller Electric Co.
GC: Stiles Construction
Project: Graybar Service Center

Craftsman: Jerry Metcalf
Company: D & D Mobile Welding and Fabrication
GC: Miller Construction Co.
Project: Fort Lauderdale BMW East Showroom

PHOTOS: COURTESY OF CASF

"John always believed in doing things the right way," says Tony Martin, owner and president of Structural Roof Systems. "You saw that every day in the way he treated and mentored people, made deals and worked on projects."

Former CASF President and Miller Construction Company President Harley Miller adds, "John's passion for quality work and his devotion to guys in the field doing that work was unsurpassed. He must have volunteered hundreds of hours over the years to work with (former Executive Director) John Siegle on these awards. In fact, he was so integral to the process, it's hard to imagine the Craftsmanship Awards without thinking of John Custer."

PHOTOS: COURTESY OF CASF

Craftsman: Mickey Vinski / **Company:** Robert Allard Pools
GC: Kaufman Lynn Construction / **Project:** Residences of Broken Sound

Craftsman: Tom Sinkle
Company: Structural Roof Systems
GC: Coastal Construction
Project: The Surf Club

Craftsman: Joe Walker
Company: Commercial Builders
GC: OHI Building
Project: Pompano Beach Cultural Center

Craftsman: Drew Wilson
Company: Lotspeich Co. of Florida
GC: The Weitz Co.
Project: Seafood Restaurant at the Breakers

Craftsman: Tim Whipps / **Company:** Hoover Architectural
GC: Coastal Construction / **Project:** Saxony Hotel Veranda

PHOTOS: COURTESY OF CASF

In recognition of this contribution, CASF will formally rename its physical award in Custer's honor at this year's ceremony. Henceforth, winners will be presented the John E. Custer Craftsmanship Award, or The Custer.

"John embodied what the Craftsmanship Awards stand for: attention to detail, highly developed skills, creativity and a passion for getting it right," says Jeff Slade, CASF craftsmanship committee chair and Miller Construction Company vice president operations. "No matter how amazing a project's conception, it only becomes a reality if tradesmen execute onsite at the highest levels. Those are the individuals and ideals CASF celebrates each year through its Craftsmanship Awards." ◆

2017 CASF Craftsman Award Winners

CRAFTSMAN	PROJECT	SUB/EMP	GC
Russell Adams	Boca West Country Club Chiller Plant & Ice Storage	Southeast Mechanical Contractors	N/A
Israel Aguirre	Gulfstream Properties – 3410 N. Ocean Blvd.	Gulfstream Roofing	Seaside Builders
Steve Backalukas	Brightline Fort Lauderdale – AAF	Advanced Woodworking Ind.	Moss & Associates
Carl Bell	Riva Condominium	Central Broward Construction	Moss & Associates
Gino Bertoloti	Pembroke Pines Civic Center	Physical Security	Stiles Construction Co.
Rollin Blanshine Jr.	Fort Lauderdale BMW East Showroom	American Engineering	Miller Construction Company
James Clemence	Palm Beach State College	Lotspeich Co. of Florida	Balfour Beatty
Luis Compres	Memorial Regional Hospital – Parking Garage	Coreslab Structures (Miami)	Stiles Thornton Joint Venture
Louis Damiano	Brightline West Palm Beach – AAF	Coast to Coast Forming	Moss & Associates
Mark Edie	The Surf Club Cabanas	Structural Roof Systems	Coastal Construction
Rick Emmerson	Brightline West Palm Beach – AAF	Acousti Engineering Co. of Florida	Moss & Associates
Jason Fromer	Graybar Service Center	Miller Electric Co.	Stiles Construction Co.
Sam Godbey	Artistic Surfaces Showroom	Artistic Surfaces	N/A
Gilbert Gonzales	Norton Museum of Art – Expansion	Steel Fabricators	Gilbane Building Company
Jose Grau	Thornton Tomasetti Fort Lauderdale Tenant Impr.	Charland Rurey Construction	Charland Rurey Construction
Daniel Hall	Pembroke Pines Civic Center	Advanced Woodworking Ind.	Stiles Construction Co.
Brian Hecker	Sweetbird South Residences	Reinforced Structures	GT McDonald
Mark Horsch	Pembroke Centre – Retail Buildings A & B	Commercial Builders	Constrology
Justin Kendall	Riva a Condominium	Otis Elevator	Moss & Associates
David Klein	Residences of Broken Sound	ET Flooring	Kaufman Lynn Construction
Doug Littriello	Residences of Broken Sound	Crossroads Paving Solutions	Kaufman Lynn Construction
Juan Lopez	Nicklaus Children's Hospital Exterior Plaza	Meisner Electric	Robins and Morton
Jerry Metcalf	Fort Lauderdale BMW East Showroom	D & D Welding & Fabrications	Miller Construction Company
Delmer Molina	Altis at Boca Raton	Artistic Surfaces	Altman Glenewinkel Construction
Ramon Ramirez	Pembroke Pines Civic Center	J & S Contractors	Stiles Construction Co.
Ray Rammacher	Royal Palm Yacht Club	Moraca Builders	Mouw Associates
Chris Rouleau	Seafood Restaurant – The Breakers	Palm Beach Trim	The Weitz Co.
Glenn Savell	Grove at Grand Bay	Premier Stonework's	Facchina Construction
Gerry Sawyer	Brightline West Palm Beach – AAF	Canopy by Design	Moss & Associates
Tom Sinkle	The Surf Club	Structural Roof Systems	Coastal Construction
Corey Tharpe	Brightline West Palm Beach – AAF	Advanced Woodworking Ind.	Moss & Associates
Felix Torres	Fort Lauderdale International Airport Term 1	Steel Fabricators	Hunt/Moss Joint Venture
Michael Vargo	Brightline Ft. Lauderdale – AAF	Coast to Coast Forming	Moss & Associates
Mickey Vinski	Residences at Broken Sound	Robert Allard Pools	Kaufman Lynn Construction
Danue Walker	Norton Museum of Art – Expansion	Meisner Electric	Gilbane Building Company
Joe Walker	Pompano Beach Cultural Center	Commercial Builders	OHL Building
Jim Walters	Coral Springs Municipal Complex	Moraca Builders	Kaufman Lynn Construction
Tim Whipps	Saxony Hotel – Veranda	Hoover Architectural	Coastal Construction
Drew Wilson	Seafood Bar – The Breakers	Lotspeich Co. of FLorida	The Weitz Co.

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Fort Lauderdale, Fla.-based Moss has promoted **John Bowden** to senior vice president. Bowden, with four decades of construction management experience, was previously vice president. He will be responsible for planning, business development and project development as well as management of both the Tampa and Orlando offices.

Pond announced that it has hired **Kristopher Erwin** as senior project manager for its aerospace division. Located at the firm's Atlanta's headquarters, Erwin has 15 years of experience with engineering, programming and management of aerospace projects. A graduate of the Georgia Institute of Technology, Erwin previously worked as part of Hartsfield-Jackson Atlanta International Airport's Consolidated Rental Agency Complex project.

The firm also added **Brad Jones** to its Atlanta office, hiring him as senior project manager for its transportation and community development division. Jones has more than 20 years of experience as a landscape architect and project manager with a focus on parks, urban plazas, streetscapes and greenway trails.

In addition, **Doug Swift** has joined Pond's Atlanta office as quality control director for its construction division. Swift previously held a senior leadership role with the U.S. Air Force, where he has more than 25 years of experience in the planning, engineering and construction of military installations in the U.S. as well as numerous construction projects throughout the Middle

East. For the last two years, he served as inspector general and director of compliance of the Air Force Installation and Mission Support Center.

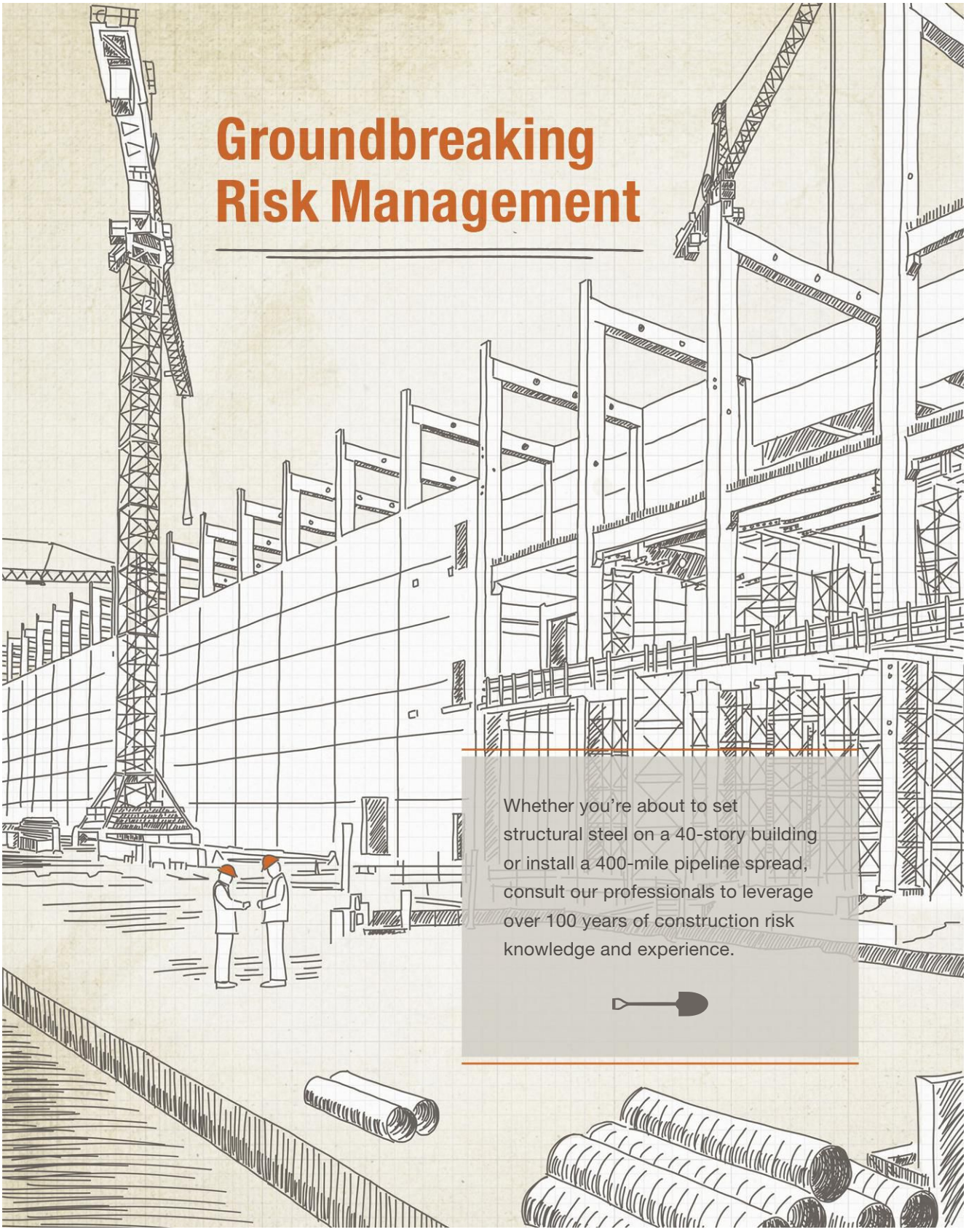
David Kosterno was named a vice president in the Miami office of WSP USA, formerly WSP | Parsons Brinckerhoff. Kosterno will head the Miami office's mechanical department. He has more than 30 years of experience in the building services industry. He was operations manager for the MEP/sustainability group at SOM. "David brings a diverse background that includes design of multiple building types in a host of international locations," says Jeff Black, senior vice president.

Dewberry hired **John Adams** as a vice president and transportation department manager in its Raleigh office. His responsibilities include client communications and technical services oversight. Adams' 24-year career as a transportation engineer includes experience with transportation planning, freeway facility systems planning, corridor studies, roadway design and traffic operations.

Tony Dembickie has been promoted to director of project management for Woodstock, Ga.-based contractor Primus. Dembickie's leadership on recent complex projects, such as PFG and Nestle, helped earn him recognition as the firm's Premiere Project Manager.

The firm also announced the hiring of **Theresa Ciatto** as director of safety. Ciatto's previous experience includes developing and implementing OSHA compliance programs for contractors and manufacturers.

Cardno Inc. has hired **Jeremy VanWyk** as a civil engineer in its Charlotte office. VanWyk will assist in the design and development of construction documents, engineering calculations and permitting packages. The firm also hired **Ed Call** as a senior project scientist in its Tampa office. He has more than 15 years of experience in environmental permitting.



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Thank you,

Scott J. Seltz,
Publisher
ENR
Engineering News-Record

Miami/South Florida Report

After Irma

Picking up the pieces and moving forward

By Eda Galeno

WHAT'S INSIDE

Irma's Impact on the Florida Construction Industry

When Hurricane Irma swept through Florida, she left destruction in her path. Few escaped the high winds, rains and water surge, but building codes put in place after Hurricane Andrew in 1992 kept many structures safe. So, what does the future look like for the state's construction industry? Here, several professionals share their thoughts on moving forward after Irma.

How has Hurricane Irma impacted the South Florida insurance/surety market?

Charles Nielson, Chairman of the Board, CEO, Nielson, Hoover & Co.: The price tag will be high on two levels: 1) The cost to the insurance in our marketplace, Federal Flood Program (tax payers), and the cost of rebuilding to the uninsured home and business owners is likely to be staggering; and 2) The cost and availability of coverage is likely to increase so we will be paying the price for Irma for many years to come.

As far as the surety marketplace is concerned, the impact is relatively minimal. Projects will be delayed, and there will obviously be some rebuilding, but in the Miami area, there was not significant structural damage. Most of the contractors that will be involved in restoring the area will be picking up debris.

In the Keys, most of the damage is residential, and most residential projects of that type build are not bonded. So, from a surety perspective, I don't see that there will be a significant amount of bonds written for the rebuilding of the Keys or for any other storm-related damages in South Florida.

"Even with advancements in technology, conditions on the ground can change rapidly, so the earlier you begin to prepare, the better off you will be in the long run."

—Brad Meltzer

Will Griffin, Vice President, American Global of Florida: According to data from the Florida Office of Insurance Regulation, property insurance claims from Hurricane Irma have reached $4.2 billion in estimated losses. Insurance underwriters and professionals are anticipating a "gradual" increase in property insurance rates, which was likely to happen after a large hurricane, given how soft the market was before Hurricane Irma.

The reinsurance property markets will likely feel the effect first, and then the direct property markets. Casualty lines should not see much of an impact, but carriers may use the storm as a catalyst to increase profits.

What is the state of construction in South Florida post Hurricane Irma?

Peter Dyga, CAE, President and CEO, Associated Builders and Contractors (ABC) Florida East Coast Chapter: Florida's Gov. Rick Scott immediately reached out to ABC to seek input on what rules, regulations and fees could be suspended or modified to enable the most prompt, efficient restoration and recovery effort. The governor subsequently ordered regulatory agencies to suspend or relax certain permitting, inspection and fee requirements, one of which allows commercial contractors and GCs to step in and help with residential roofing repairs, which is one of the most pressing and important needs to help prevent further destruction and damage from water intrusion.

Do you foresee regulation changes in hurricane-prone areas?

Remy Mackowski, Executive Director, Construction Association of South Florida (CASF): What is evident in the wake of Hurricane Irma is that the regulations currently on the books work. South Florida experienced sustained winds of 60–80 mph for more than 10 hours, and projects throughout the tri-county area withstood the battering. There were some tornados and isolated incidents, but that is unavoidable with a storm of this magnitude.

South Florida already carries some of the strictest regulations in the industry, and overall, it is clear that those regulations are doing their job.

Has Hurricane Irma affected construction and construction employment in Florida?

Mackowski: In the short term, Irma is impacting South Florida's already fragile labor market. As is true nationwide, labor demand here has been outstripping supply. Now, we can add to that the fact that some of our members

are reporting as much as a 30% decrease in day-to-day labor.

Irma brought down a lot of old fences, tree limbs, screened enclosures and the like. As a result, laborers on major projects are taking days off here and there to make a quick buck on small jobs, debris removal, etc. It's not a permanent loss of labor, but the cumulative effect of these absences is being felt throughout the region.

And although the effect will pass, this feature of the market will continue. As long as the labor market remains thin, we can anticipate short-term tightening in the immediate aftermath of hurricanes and similar incidents.

Rick Schuerger, Vice President, Moriarty: Our projects are up and running. The impacts vary from a couple of weeks to several months depending on water damage and where the projects are located. We are not feeling the effects as of now, but labor is spread a little thin as recovery/renovation efforts are now happening in tandem with new construction.

There is also a shortfall of landscaping material as a result of tree farms that were damaged by the storm. Expectations on some projects may have to be modified to work with landscaping that is available.

What was learned from this experience that can be applied to future construction projects?

Brad Meltzer, President, Southeast Region, Plaza Construction: Hurricane Irma served as a reminder of the power of Mother Nature, as well as how difficult it is to predict the path and strength of these storms. Even with advancements in technology, conditions on the ground can change rapidly, so the earlier you begin to prepare, the better off you will be in the long run. We learned that our practices for preparation are extremely prudent and strong, and we need to continue to heed the warning signs and always take them seriously.

Mindy Szarowicz, LEED AP, Director of Business Development, Baker Concrete Construction, and President, Construction Association of South Florida (CASF): From what Baker has seen, it appears that the buildings that have been designed and built since Hurricane Andrew survived Irma relatively unscathed. It points out that buildings can be constructed to survive hurricanes if the proper materials and methods are used. At Baker, we use each natural disaster as a learning event. We do a postmortem to see what we could have done differently to prepare or recover from the storm. One of the biggest things we do is to try and work the necessary overtime to get concrete placed on whatever deck forms are in place to eliminate the hazard of them coming off of the building. We also work together to make sure that the homes of coworkers who are working out of town are properly prepared and protected, and we stay in touch with them after the storm.

Schuerger: Closely monitoring the tracking of the storm is paramount. We saw our industry all coming together and talking and assisting on projects at all different levels. The attitude was terrific, and the recovery was also fast and swift as could be, considering the circumstances.

What did you learn that will help in preparation for a similar event?

Szarowicz: There is no substitute for proper planning before a hurricane. We have seen a direct correlation between planning and proper preparation before an event and the ability to get back to work afterward. Equipment must be moved to higher elevations, materials must be properly tied down, pictures must be taken to properly document the condition of the building and the preparations taken before the storm, and cranes must be properly prepared.

> *"Hurricane Irma revealed some weaknesses that Miami still has, specifically regarding sea level rise, but it has also presented Miami with the opportunity to encourage development in its urban core."*
>
> —Berta Abedi

Meltzer: Our team has already done a lessons-learned analysis ranging from project-related storm prep to the employee telephone tree we implemented to confirm that all were safe and accounted for. In preparing for Irma, our firm purchased 15 satellite telephones for key individuals in the event that cellphone service was not available for an extended period of time. This was found to be a worthwhile investment, as cellphone service was unavailable at times.

What insights can the industry take away from the Irma experience?

Nielson: To a great extent, our ability to minimize cost and damages lies in our hands. The building codes in Miami-Dade County are the toughest in the nation. Those buildings built after Hurricane Andrew will withstand a Category 4 or possibly 5 hurricane. Those built before 1992 would likely see some damage, and in some cases, extensive damage. So, from a building codes perspective, South Florida has done what it needs to do.

Aside from electrical grid issues, Irma proved to be a very messy and expensive landscaping event. We have ourselves to blame. People move to South Florida, and they want to have leaf-bearing trees in their yards like they had in Northern locations. Because of our geological coral base, the roots of these trees spread laterally, and when we get any type of tropical storm or hurricane, the limbs break or the entire tree falls over, exposing a root system that grew horizontally rather than vertically. That is what we are trying to clean up now in South Florida, and we will be doing so for the next four to six months.

Palm trees and other native vegetation is seldom uprooted by tropical storms or hurricanes. Public entities plant Northern trees on the public right-of-ways, and homeowners plant them in their yards. This is what causes the tremendous amount of debris that we are experiencing. Public entities should be required to plant only native vegetation in the public right-of-ways, and homeowners should be charged for debris pickup after a tropical storm or hurricane. If that were the case, we would use a lot more common sense in what we plant.

Berta Abedi, Account Executive, American Global of Florida: Hurricane Irma revealed some weaknesses that Miami still has, specifically regarding sea level rise, but it has also presented Miami with the opportunity to encourage development in its urban core. Due to Florida building codes, many of which were put in place after Hurricane Andrew back in 1992, many of the new mixed-use buildings fared well and saw little to no power loss as FPL lines were buried.

Hurricane Andrew stimulated a response of growth in building and construction for much of South Florida, and Irma will most likely show South Florida's amazing ability to bounce back quickly as well.

"According to data from the Florida Office of Insurance Regulation, property insurance claims from Hurricane Irma have reached $4.2 billion in estimated losses."

—Will Griffin

Finding Help

The ABC Cares Foundation (www.abccaresfoundation.com) has established a restricted fund whereby 100% of the proceeds donated will aid construction professionals who suffered a loss from the storm. ◆

Fourth-Generation Family-Owned Business Expands in South Florida

With a recently opened, state-of-the-art ready-mix facility in Miami, Ozinga demonstrates confidence in the recovering economy, steady growth in the construction industry and a strong testament to a skilled workforce. To help continue building South Florida communities, the company acquired the assets of two ready-mix plants in Davie and Hollywood, Fla., expanding its service area from Miami-Dade County north into Broward County.

Ozinga supplies concrete for a residential project in Miami.

PHOTO: COURTESY OF OZINGA

A fourth-generation, family-owned American business, Ozinga knows what it means to be fully committed to an idea. When it was established in 1928, that idea was simple: serve the local communities and bring value to something bigger. By providing customers with the best concrete at a fair price and underwriting it with a strong set of values and principles, the company has grown to become a trusted ready-mix concrete provider.

The Ozinga family has a passion for more than turning a profit. The company's move is about building relationships with new coworkers and customers in South Florida, adding value to local economies, and building the communities where it lives, works and plays. ◆

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The team of now more than 210 members has decided to go west. Our client base of contractors and developers has asked that we push into the Gulf Coast market so we will follow the road map that made us successful some 30 years ago: hard work and humility. It is imperative that our successes on the East Coast transition west, bringing years of experience in leadership to a growing market, and offering design-build delivery methods and knowledge of systems to an area that will soon require multiple zone pumps in its quest for taller structures. Sprinklermatic's team will be an obvious answer for the coming challenges.

The team, led by Robin Collier in estimating and sales and Timothy O'Brien in operations looks forward to bringing solutions to a new marketplace. We offer training and education on estimating of fire protection as it relates to the most current standards and state requirements, along with best practices in closeout of projects that minimize stretched dates on certificate of occupancy. Sprinklermatic's goal is to not only deliver our discipline on time but to assist the team in bringing all of the life-safety systems across the finish line in a well-sequenced, collaborative manner. In addition, we maintain a high bonding capacity ($20 million single and $50 million aggregate) with Liberty Mutual and an A+XV A M Rating, with additional job references available upon request.

The obvious concern for all parties pushing west is manpower. Our solution is simple: We will only sign up for what we can do. Our success in South Florida has simply been following through with our word. Sprinklermatic's goal is to personally come and meet with your team, introduce our highly qualified West Coast team, and determine how we can partner with you in making your next project a success with the same humble, hardworking approach that has given us the opportunity to do so.

For more information, please feel free to reach us at 813 508-2776, robin@sprinklermatic.net or tim@sprinklermatic.net.

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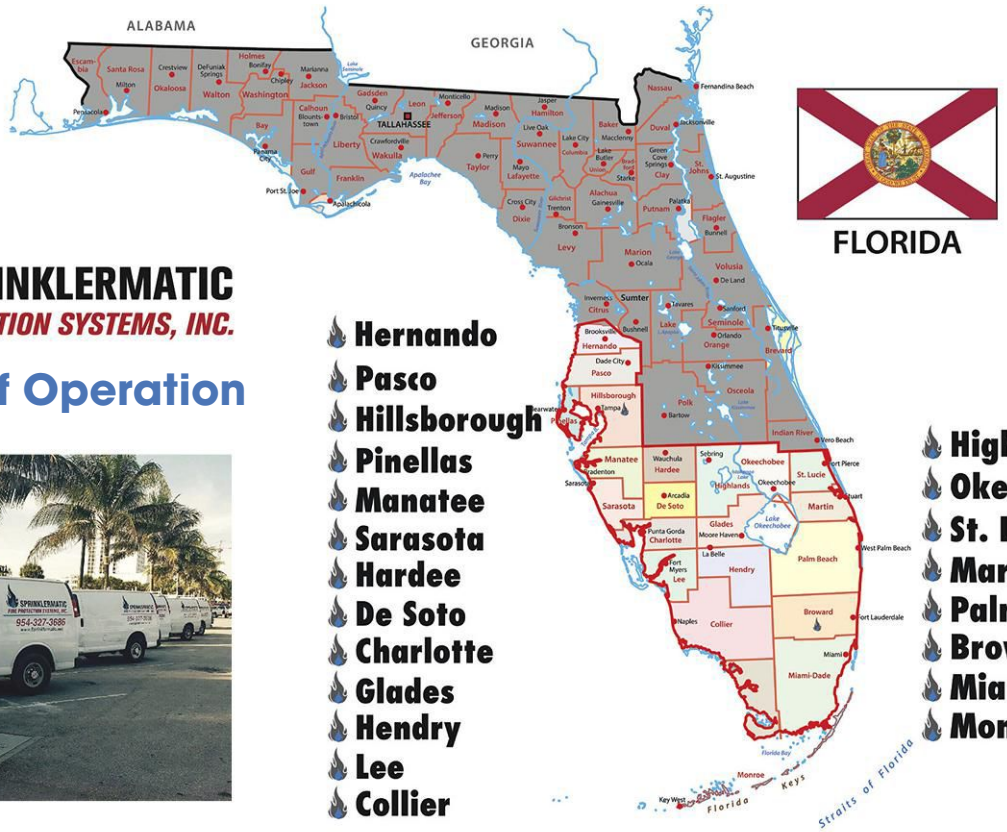

FLORIDA

IMAGES: SPRINKLERMATIC

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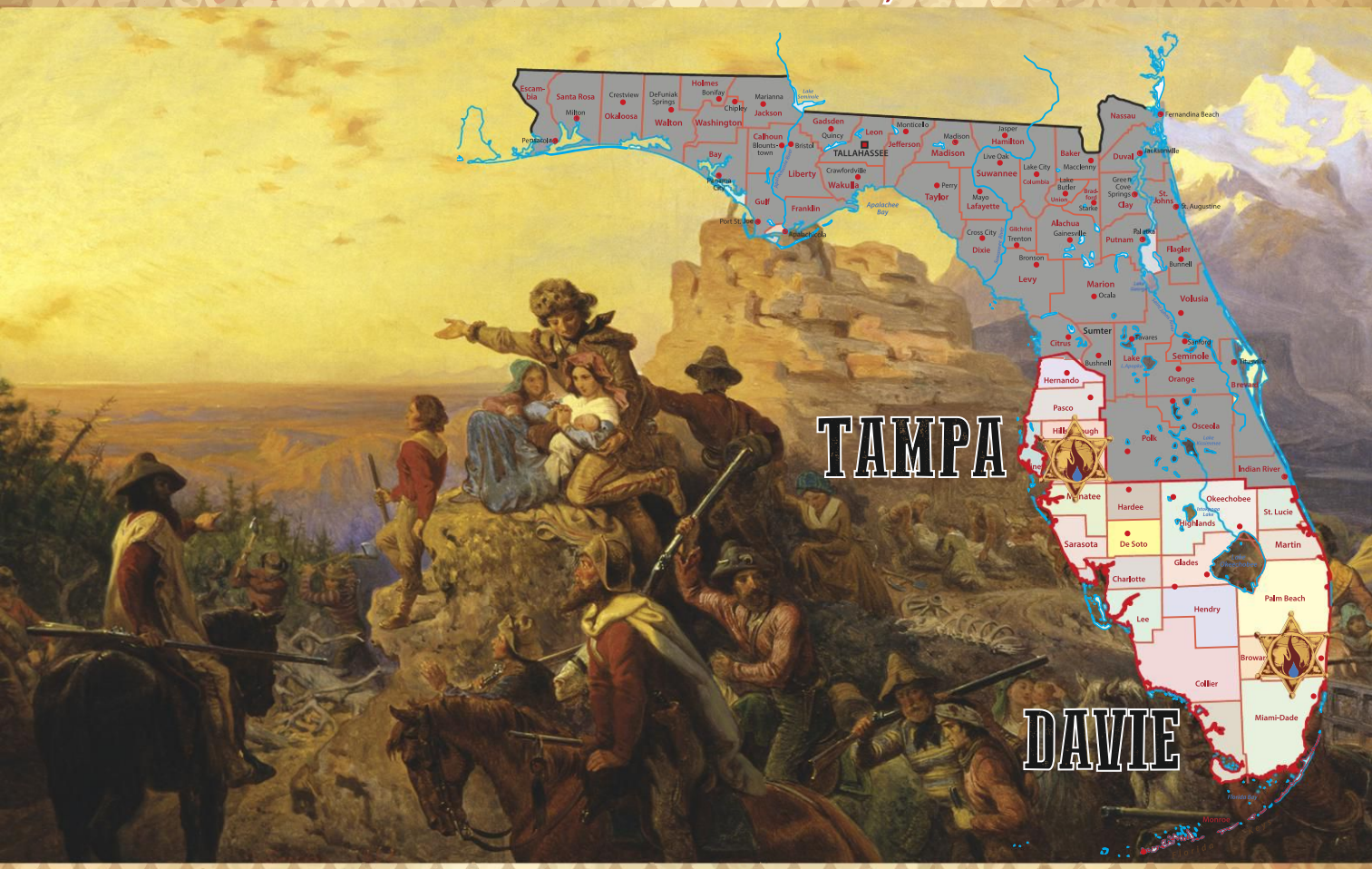

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The line of walk-in coolers and freezers from Polar King has successfully passed the rigorous testing required to gain Miami-Dade County Product Control Approval. This means that all Polar King products are designed to comply with the high-velocity hurricane zone of the Florida Building Code. The Miami-Dade Product Approval System, which is viewed by many as the benchmark for code-related building product approvals, is directly related to the structural wind resistance of buildings and building components. Miami-Dade County, with its location in one of Florida's high-velocity hurricane zones, has the most stringent code requirements of the Florida Building Code. This approval further demonstrates the quality of the seamless construction methods used to manufacture Polar King walk-in units.

A Polar King Fiberglass Outdoor Walk-In Cooler Unit is used at a Subway in Fort Wayne, Ind.

Since 1982, Polar King has been manufacturing outdoor walk-in cooler and freezer units as well as refrigerated trailers. All Polar King units feature a seamless fiberglass design and are constructed and designed specifically for outdoor usage. Each unit incorporates foam insulation completely encased in fiberglass, both inside and out. This construction method provides superior structural strength since it forms a one-piece unit. With one of the most comprehensive manufacturer warranties in the industry, the Polar King limited warranty provides 25-year coverage for the internal foam insulation as well as 12-year coverage for the walk-in structure. Whether you need a cooler, freezer, combination unit or refrigerated trailer, Polar King offers the flexibility required in any industry.

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PHOTO: COURTESY OF POLAR KING

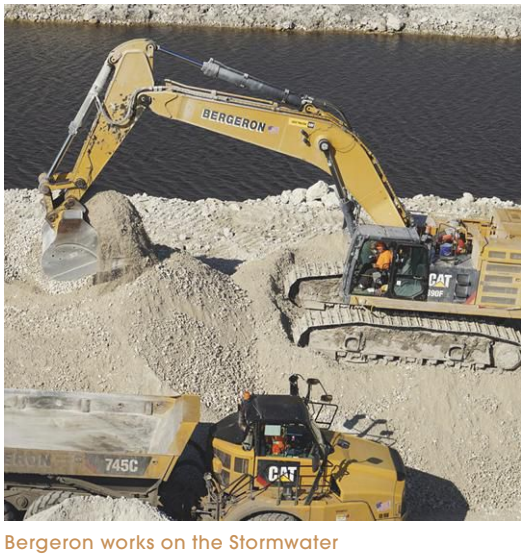
Shaping Florida's Landscape

Since 1965, few businesses have shaped the landscape of Florida and the lives of its residents more than Bergeron Land Development. As one of the most highly respected and largest site development and roadway construction contractors in Florida, Bergeron has grown communities, expanded commerce and improved commutes—all while protecting Florida's environmentally sensitive ecosystem.

Bergeron's high-profile projects include the construction of the I-95/I-595/SR84 Interchange and the I-595 Expressway, both the costliest road and bridge construction projects at the time of their construction; the I-75/I-595/Sawgrass Expressway Interchange, the largest interchange in Florida at that time; and the award-winning Miami Beach pump stations project commissioned to fight rising sea levels in Miami Beach.

Bergeron is currently constructing the SunTrax Test Facility in Polk County, Fla. The result of a partnership between FDOT and Florida Polytechnic University, the transportation technology testing facility will establish Florida as a transportation technology leader and create a high-tech hub for the research, development and testing of emerging transportation technologies related to tolling, intelligent transportation systems (ITS), and automated and connected vehicles.

Bergeron is also working with the South Florida Water Management District on restoring the Everglades—the biggest restoration project in the world. It is expanding the stormwater treatment area, which consists of constructed wetlands that get rid of excess nutrients. Eventually, the stormwater will enter the Everglades to improve the quality of water and recreate nature as it used to be.



Bergeron works on the Stormwater Treatment Area project.

In 2016, Bergeron's work and safety record were recognized by *ENR Southeast*, Cuban-America Association of Civil Engineers, U.S. Builders Review, Florida Transportation Builders Association and I Build America. For more information, visit www.bergeronlanddev.com. ◆

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Becoming a One-Stop Shop for Commercial Specialties

General contractors in the commercial construction industry are under intense pressure to deliver—so whenever they can streamline the process with their subcontractors, it's a relief. In an effort to provide that relief, Window Interiors has been diligently adding to its service offerings to become a one-stop shop for commercial specialties throughout the state of Florida.

Earlier this year, the firm acquired Division Ten Specialties Inc. (www.division-ten.com), which provides and installs construction specialty items ranging from bathroom partitions and accessories to lockers, fire extinguishers, and wall and door protection.

Dave Riley, the president of Window Interiors, says this means that the company can now handle an increased scope of work under a single contract. "The acquisition of Division Ten Specialties means less paperwork and one point of contact but the same commitment to excellence that our reputation is built on," he explains.

That reputation comes from nearly three decades in the industry—and numerous accolades.

The company has earned a spot on *ENR Southeast*'s Top 100 Specialty Subcontractor lists as far back as 2005. It also took home the coveted Associated Builders and Contractors Subcontractor Award of Excellence in 2016.

"Our customers have come to expect consistently excellent service from Window Interiors," says Executive Vice President Bob Robinson. "They can expect the same from Division Ten Specialties."

Both Window Interiors and Division Ten work heavily in the health care, retail, hospitality, education, multifamily and municipal industries. Learn how Window Interiors and Division Ten Specialties can assist on your next project by calling 407-539-1303, or visiting www.windowinteriors.com or www.division-ten.com. ◆

PHOTO: COURTESY OF WINDOW INTERIORS

Executive Vice President Bob Robinson (left) and President Dave Riley own Window Interiors and recently acquired Division Ten Specialties to provide Division 10 services throughout Florida.

Client Focus and Employee Ownership Keys to Success

An integrated engineering, architecture, construction, environmental and consulting firm, Burns & McDonnell has a multidisciplinary staff of more than 5,700 professionals worldwide. With annual revenues of $2.8 billion, it offers large-firm resources combined with small-firm responsiveness.

The company demonstrates an ongoing commitment to client partnerships that have inspired a 90% repeat-business rate and decades-long relationships. This success is built on 100% employee ownership, a model that promotes integrated teamwork and contributes to consistent high rankings among *Fortune*'s 100 Best Companies to Work For.

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Burns & McDonnell regards safety as a cornerstone value for every employee-owner. This commitment is built into the company's plans, designs, construction and operations for each client on every project.

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Aviation: The company's aviation experience includes every facility type and service that touches commercial and private operation.

Manufacturing: Burns & McDonnell provides its clients with better ways to control costs, optimize systems and processes, and deliver results.

Water: The company develops water treatment, supply and systems solutions that evolve with the needs of communities and industries.

Commercial, retail and institutional: Burns & McDonnell provides seamless planning, design and construction on a design-build basis.

Environmental: The company's permitting and compliance staff stays on top of regulations and project needs to determine effective solutions.

Oil and gas: Burns & McDonnell supports complex process facilities to handle changing markets, regulations and infrastructure needs.

Transportation: The company's planning, design and construction experience keeps traffic flowing while saving time and money.

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Burns & McDonnell is one of the AEC industry's foremost practitioners of integrated design-build delivery of large-scale complex projects. No other delivery method is as certain to ensure accountability, trust and value on mega-scale projects. ◆

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Award of Merit in Higher Education/Research
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Project of the Year in Highways/Bridges
Choctawhatchee Bay Bridge, Pensacola, FL

Project of the Year in Healthcare
University of North Carolina Rex Healthcare, Heart and Vascular Hospital, Raleigh, NC

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Helping Engineering Contractors Move Forward With Florida's Ever-Expanding Highway Infrastructure

With roots that go back to the mid-60s, Nielson, Hoover & Co. (NHC) Chairman Chuck Nielson began providing surety credit and building long-term relationships with key engineering contractors/road construction companies that were integral in the expansion of the highway infrastructure throughout the Southeast. Fast forward 50 years, and like the rest of the world, the engineering/road construction industry has evolved substantially, and so has NHC. With all the advances in technology, construction methods have changed substantially from those being used half a century ago. Today, contractors working on Florida's ever-expanding infrastructure are involved in areas of specialized construction that had not been conceived back when the era's biggest innovation was four lads from Liverpool.

With today's complicated highway systems including HOV toll lanes and complex ramp systems, the need for a way to keep it all running smoothly was obvious: introducing the new intelligent transportation systems, or ITS. This system requires very specialized knowledge in wireless, routing, and switching and security systems and the construction, operation and maintenance of the networks that operate it. So, engineering contractors have had to evolve to meet the technical demands of their ever-changing industry, and so has NHC. As a leading surety broker in the Southeast, NHC has advanced in both knowledge and the comprehensive understanding of the highway engineering sector in order to effectively service its clients' constantly changing surety demands.

To learn about how NHC can provide better service, more negotiating power and better terms, call 305-722-2673 or visit www.nielsonbonds.com. ◆

Intelligent transportation systems: keeping Florida's complicated highway infrastructure running smoothly.

IMAGE: COURTESY OF NIELSON, HOOVER & CO.

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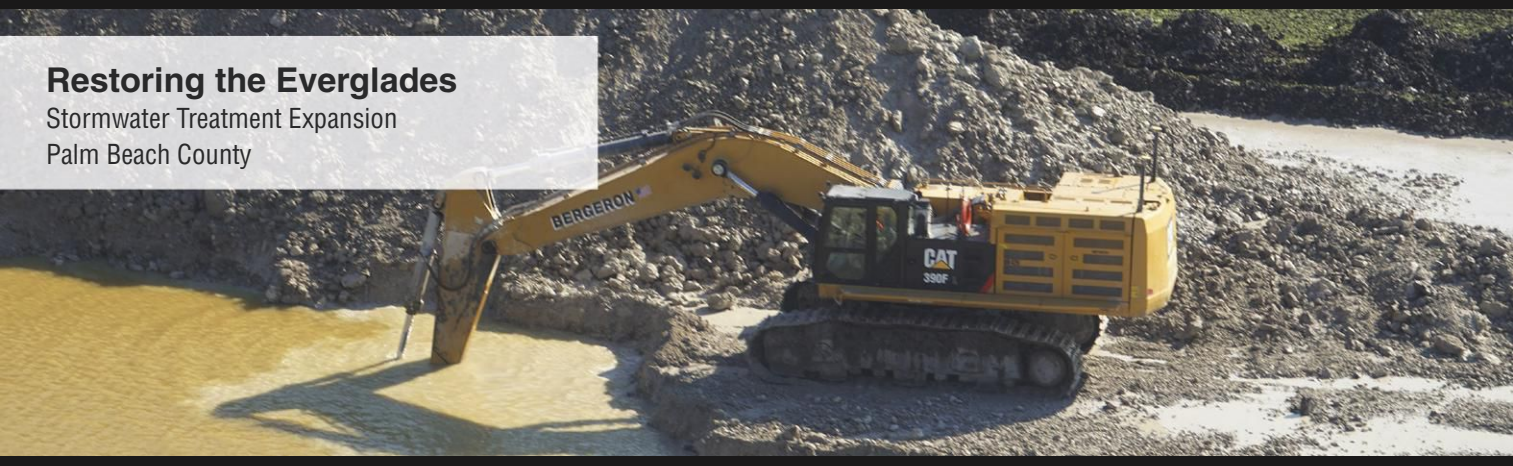

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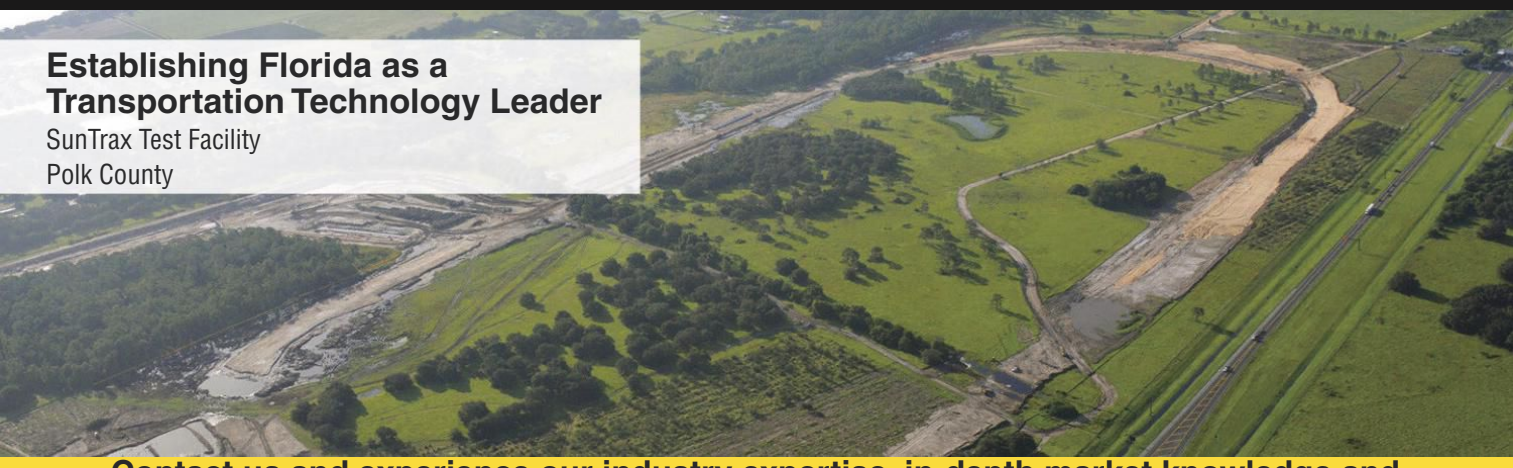

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A Driving Force in the South Florida Construction Market

One of the nation's foremost construction management and general contracting firms, Plaza Construction has a multifaceted, national presence in the industry. The company strives to make a positive difference in the communities where it works, and above all, provide outstanding service through teamwork, experience, accountability and innovation.

Founded in 1986, with headquarters in New York and regional offices in Miami and Washington, D.C., both the public and private sectors have turned to Plaza for the most specialized and highly complex projects, from the new Fulton Street Transit Station in New York City to Zaha Hadid's One Thousand Museum—one of Miami's tallest and most unique residential towers.

A driving force in the South Florida market, Plaza has been tapped to lead the ongoing modernization and expansion of the Aventura Mall, as well as the transformation of a 9-acre site in Miami Beach into the new Ritz Carlton Residences, slated to open this winter. Past projects include the Dadeland Mall Expansion in Kendall, 1 Hotel & Residences South Beach and Millecento Residences, to name a few.

Plaza Construction's three-level Aventura Mall expansion and modernization will make its debut later this winter.

IMAGE: COURTESY OF PLAZA CONSTRUCTION

One of the company's core values is to build projects of lasting value that not only enhance surroundings but also respect the planet. As a longtime leader in the green building movement, Plaza has completed more than $4 billion in sustainable projects representing every LEED level of achievement (certified, Silver, Gold and Platinum) and stands ready to assist clients in finding the right balance between project costs and protecting the environment. ◆

Constructing One of the World's Most Unique Museums

One of the largest and most complex structures in Miami, the Phillip and Patricia Frost Museum of Science was recently completed by Skanska USA. The state-of-the-art museum serves as an economic engine and cultural anchor for downtown Miami's growing urban core. Touted as a "masterpiece of living science," Frost Science is projected to attract 750,000 visitors each year.

The 500,000-gallon saltwater aquarium is one of the Frost Museum of Science's most unique features.

PHOTO: RA-HAUS

Skanska's extensive experience building highly complex, sophisticated projects was the primary reason the firm was selected to deliver this monumental project totaling 258,000 sq ft.

With its completion, the waterfront museum became one of the nation's top science museums, and its anchor piece, the three-level saltwater aquarium, opened as the only aquarium in the world where visitors can experience an aquatic ecosystem from above the water, next to the aquarium and underneath it as guests walk below the tank above.

For the planetarium, Skanska assembled 32 concave orange-peel-like panels weighing 50,000 lbs each to form the new planetarium's impressive span. This design required construction running day and night for 2.5 weeks. To build the 500,000-gallon aquarium, Skanska executed a 25-hour, 1,200-cu-yd concrete pour. Complex in its conical shape, inclination and suspension, the shape is ideal for sharks as there are no sharp corners, maximizing the cruising surface while reducing the amount of water.

Designed by Grimshaw Architects, the museum's subtle architecture reminds visitors of the natural and scientific worlds people engage in their daily lives, serving as a reminder that nature and discovery are present everywhere. ◆

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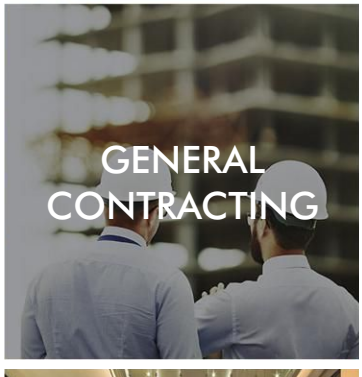

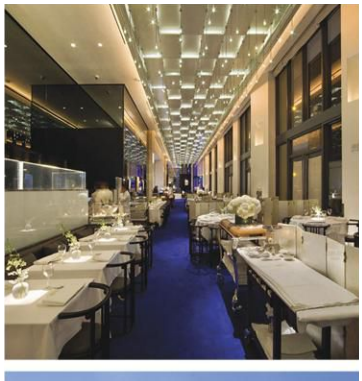

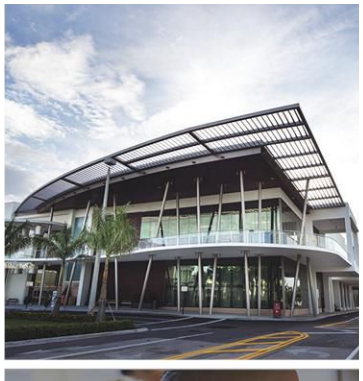

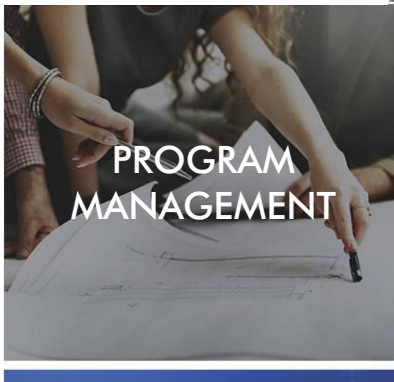

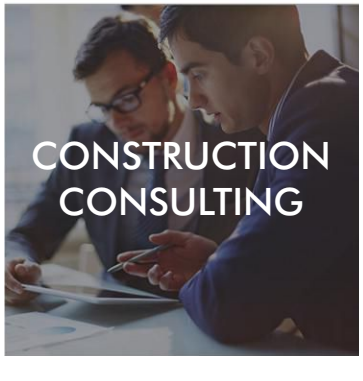

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Planning

FLORIDA

Walt Disney Parks & Resorts U.S. is planning to build the Disney Coronado Springs resort hotel in Kissimmee. The 15-story, 400,000-sq-ft building will contain 500 rooms. It is being designed by Walt Disney Imagineering and will be located at 1000 Buena Vista Drive. Construction build-out is anticipated in 2019. The project is valued at $100 million. **Walt Disney Parks & Resorts U.S., Attn: Jacquee Polak, P.O. Box 10321, Lake Buena Vista, 32830. DR#17-00568564.**

GEORGIA

Dockery Group LLC is planning to construct Founders Movie Studios in Tyrone. The first phase involves erecting two 250,000-sq-ft buildings for sound stages and 45,000 sq ft of office space. Valued at between $25 million and $50 million, the complex is being designed by Foley Design Associates Architects Inc. **Dockery Group LLC, Attn: Nathan Dockery, 501 N. Highway 74, Peachtree City, 30269. DR#17-00732112.**

TENNESSEE

JTEKT Automotive is planning to expand its automotive components plant in Vonore. The project is valued at $218.5 million. **JTEKT Automotive, Attn: Mike Davidson, COO, 55 Excellence Way, Vonore, 37885. DR#16-0430482.**

TENNESSEE

TPA Group is planning to develop Germantown Union, a mixed-use project in Nashville. The project will include two office buildings, parking garages, a boutique hotel and restaurant. It is being designed by Hastings Architecture Associates. The project is valued at between $25 million and $50 million. **TPA Group, Attn: J. Brad Smith, Managing Principal, 3350 Riverwood Parkway, Atlanta, 30339. DR#17-00523881.**

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