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JULY 2019

2019
GIANTS ~~300~~
REPORT 486

Innovations and Trends From
the Nation's Largest AEC Firms

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The Park at OWA, Foley, AL
Installing contractor: Reelentless Construction
Architect: STOA Architects
Distributor: Roofers Mart Southeast
Photographer: hortonphotoinc.com
Profiles: Snap-Clad w/striations, PAC-850 soffit, 7/8" corrugated
Colors: Hemlock Green, Cityscape, Terra Cotta, Sierra Tan



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"This park is in a high-wind district, and metal roofing just tends to hold up better than anything else. And with metal, you get the look – it's more and more popular every day. "

-Billy Landry, project manager, estimator, Reelentless Construction



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GIANTS 300 REPORT

Ranking the nation's largest AEC firms across 12 building sectors and industry disciplines:

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For full Giants 300 rankings and bonus categories, visit:
BDCnetwork.com/Giants2019.

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ON THE COVER: Designed by Elkus Manfredi Architects, the 75,000-sf Joan & Edgar Booth Theatre at Boston University can be configured for a variety of performances: theater in the round, runway, and end stage. The 250-seat theater features production and costume shops, design labs, classrooms, faculty offices, and a landscaped plaza. PHOTO: ERIC LAIGNEL, COURTESY ELKUS MANFREDI ARCHITECTS

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Among the services and amenities at the Carillon at Belleview Station, a 163-unit senior living complex in Denver, is a hair salon that is open to—and popular with—the public. The project is featured in the report, “11 trends in senior living” (see below).

11 TRENDS IN SENIOR LIVING

Eclectic design styles, open floor plans, and outdoor amenity “destinations” are among the top emerging trends in senior living communities. This exclusive report from *BD+C*'s sister publication *Multifamily Design+Construction* examines one project, the Carillon at Belleview Station in Denver, that pushes the envelope of senior living design.

BDCnetwork.com/SeniorLivingTrends

ESD SPINOFF DEVELOPS IOT-BASED APPS TO POWER INTELLIGENT BUILDINGS.

What started out as a consulting assignment ended with the installation of a new intelligent building platform, incubated by a leading engineering design firm, into two high-rise office buildings in Chicago. The IoT-enabled platform,

which unites a building's various workflows, is from Cohesion, a company launched in August 2018 after being spun out from Environmental Systems Design (ESD). The two buildings in which Cohesion's app is now live are owned by The John Buck Company.

BDCnetwork.com/Cohesion

CALL FOR ENTRIES: *BD+C*'S 101 TOP PRODUCTS FOR 2019

Attention building product manufacturers! The *BD+C* editorial team is looking for your best new and upgraded products for our annual 101 Top Products awards program. Do you have a new product that solves a thorny issue, speeds installation, or delivers a first-of-its-kind solution for the AEC market? The *BD+C* editors are accepting submissions through August 2.

BDCnetwork.com/Enter101TopProducts

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3 'GIANT' TRENDS FOR 2019-2020

Every spring, as the *BD+C* editors connect with hundreds of architecture, engineering, and construction firms for our annual *Giants 300* report (see page 17), we get a compelling snapshot of the business and project innovations—and obstacles—at the nation's largest AEC firms.

A record number of firms (483) participated in our 43rd annual *Giants* survey. Collectively, this group represents well more than half of all nonresidential and multifamily building sector design and construction work completed in the U.S. in a given year. Starting on page 18, we report on the latest business happenings and innovations at many of these firms.

Based on feedback from the 2019 *Giant* firms, we pinpointed three emerging trends and themes for 2019-2020:

1. Firms aim to incubate innovation. From innovation competitions to grant programs to seed funding for startups, a growing number of firms are encouraging their employees to invent or reinvent AEC tools, services, processes, and business models. An April 2019 survey of 106 AEC *Giant* firms by *BD+C* showed that nearly half of responding firms (49%) have either implemented or are planning to implement an innovation grant/seed money program.

Last year, Burns & McDonnell (page 22) launched a “Shark Tank”-style innovation incubator, called *Ignite*. Just a few months in and the firm already has funding earmarked for projects related to AI, machine learning, advanced analytics, business intelligence, and robotics.

2. Data wealth spurs research initiatives. The AEC industry isn't exactly known for its research prowess—big or little r—especially concerning occupant performance and preferences in the built environment. But

we're starting to see a shift toward research, thanks in part to the influx of data, data tools, and analytics expertise in the market.

Clayco, HOK, Magnusson Klemencic Associates, Perkins Eastman, and SOM are among the firms to partner with university teams to conduct custom research—in some cases, peer-reviewed initiatives—in recent years. As firms continue to gather and explore data on their projects and business operations, we expect to see a research rush among the AEC *Giants*.

3. Lean moves beyond construction.

Twenty-two years ago, the Lean Construction Institute ushered the concepts of Lean manufacturing—last planner system, 5S, 3P, TPM—into the U.S. construction market. Today, you'd be hard pressed to find a large GC or CM that isn't using some form of Lean planning on projects.

We're starting to see a shift toward research, thanks in part to the influx of data, data tools, and analytics expertise in the market.

In recent years, we've seen traditional architectural and engineering design firms and owners/developers adopt Lean—whether for efficiencies in internal/external project teaming or for space/operations planning for clients.

Barge Design Solutions, Harvard Jolly, Integrated Project Services, and Trinity all implemented or expanded internal Lean programs last year. Trinity conducts two-day Lean 3P sessions with clients, while Barge Design is using a pull vs. push schedule method to streamline internal scheduling, reduce rework, and provide clear deadlines and impacts to the team's efforts.

For the full *Giants 300* rankings and bonus categories, including complete rankings for 22 building sectors, visit BDCnetwork.com/Giants2019 (short registration required).



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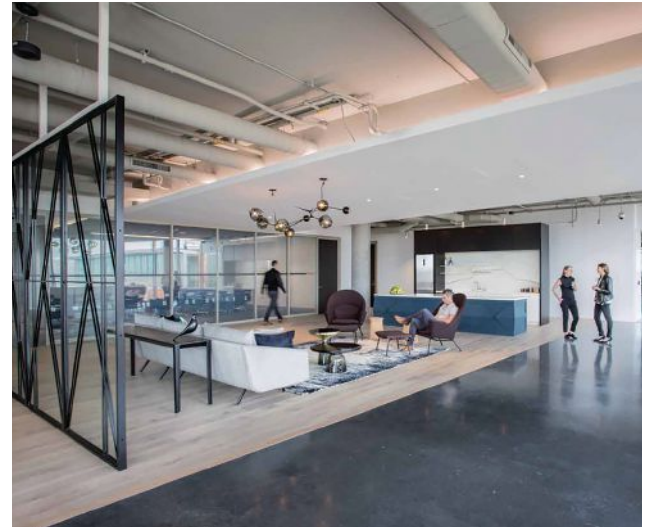
HOK TECH WORKPLACE STUDY: AMENITIES, OCCUPANT HEALTH TOP RECRUITMENT STRATEGIES

➔ **How are leading tech firms** responding to their workplace challenges? That's a question that HOK examines in "HOK Forward: Tech Workplace Takes Center Stage," an 83-page report based on input from the firm's Workplace leadership and global delivery network partners.

One of the report's observations is that tech is now all-pervasive in the workplace. "We are quickly evolving toward an era in which tech is not just a discrete sector but a foundational element of all businesses," the report states. "More and more companies are considering themselves 'tech' companies regardless of the sector they are in."

The report notes that as tech companies expand into traditional industries, they often have a competitive advantage because they fall outside the purview of state and federal regulations. However, that regulatory climate is changing.

There is also the question of whether technology is, inadvertently, accelerating the expected obsolescence of businesses. Globally, the average life expectancy of a company is less than 20 years. Up to 80% of today's businesses may not exist in 10



Open Text's 160,000-sf office in San Mateo, Calif., is showcased as an example of the type of office space that is designed to promote employee well being and facilitate social interactions "and a fusion of ideas."

years, states the report.

In this high-growth sector, HOK's survey portrays an industry whose companies tend to lease in urban environments. These companies continue to increase their headcounts, but envision accommodating more people within their existing footprint before deciding to expand. More than two-fifths (43%) of companies polled prefer to have employees on-site, and are designing their environments to encourage synergy, ideation, and speed to market.

The cost of real estate—the cost per sf for tech office space ranges from \$80 to \$300, and averages around \$190—and time spent at the office continue

to be the most important factors influencing workspace allocation. These companies' top priorities include enhancing the employee experience and creating flexible spaces.

Amenities are evolving: Companies looking to attract and retain top talent now offer everything from nap pods and wellness rooms to medical clinics and maker spaces. "Smart" workspaces, tracked by networks of sensors, are increasing, too, as designers and clients continue to learn how to leverage data in order to optimize and right-size space that reflects the company's culture, work style, and business goals.

BDCnetwork.com/HOKtechSurvey

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LEAD LODGING: SQUARE FOOT PRICES FOR HOTELS

By Gordian

When visiting any new city, travelers often research the essentials: where to eat, what to see, and where to sleep. Hotels are looking to the future of travel with trendy perks and sleek renovations, as well as completely new locations built with evolving guest expectations in mind. As energy conservation and the latest technologies and amenities become more important in hotel construction, the cost of construction will be affected.

RSMMeans data from Gordian features more than 100 building models, including

CITY	Q2, 2019	Q2, 2020	Q2, 2021	Q2, 2022
BIRMINGHAM, ALA.	\$175.87	\$177.40	\$182.02	\$187.90
HUNTINGTON, N.Y.	\$254.08	\$259.25	\$264.53	\$270.24
NORFOLK, VA.	\$174.62	\$176.59	\$182.31	\$188.11
PHOENIX, ARIZ.	\$181.99	\$185.35	\$192.19	\$198.26
PHILADELPHIA, PA.	\$237.85	\$242.45	\$248.74	\$255.88
OMAHA, NEB.	\$186.84	\$188.93	\$194.54	\$199.30
SEATTLE, WASH.	\$221.27	\$225.98	\$233.35	\$240.12
MEMPHIS, TENN.	\$172.87	\$174.93	\$178.81	\$183.31
HONOLULU, HAWAII	\$243.33	\$243.99	\$250.15	\$255.58
KANSAS CITY, MO.	\$203.91	\$206.33	\$210.92	\$215.27

Note: square foot models are used for planning and budgeting and are not meant for detailed estimates.

models for various sizes of hotels. These localized models allow architects, engineers, and contractors to

quickly and accurately create conceptual estimates for future builds.

This table shows the cost

per square foot of hotels (4-7 stories) in 10 cities.

Visit [rsmmeans.com/bdandc](https://www.rsmmeans.com/bdandc) for more information about RSMMeans data.



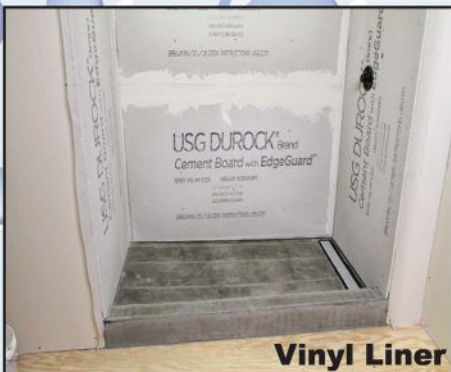
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TRENDSSETTING PROJECTS

By David Malone, Associate Editor, and Jonathan Barnes, Contributing Editor

FOSTER + PARTNERS CONVERTS HISTORIC D.C. LIBRARY FOR APPLE



COURTESY APPLE

The Carnegie Library, originally funded by Andrew Carnegie and first opened in 1903, was Washington, D.C.'s first public library and the city's first desegregated public building. It remained in service until 1970. Soon after, the Beaux Arts-style building fell into a period of neglect until Apple decided to restore the building to its previous luster.

The project team, led by Foster + Partners, worked with conservation experts to preserve the historic façade, return the interior spaces to their original footprints, and restore distinctive early 20th century detailing. An urban route through the building was created with entrances on both sides of the north-south axis. The original southern entrance to the building is fronted by a grand public plaza that will host

public concerts and events.

Inside, the building's heart has been transformed into a double-height space that is capped with a new skylight to bring light deep into the interior spaces. This is where the Forum forms the creative hub of the building—a place where experts from various fields will host free talks, performances, and workshops for the public, viewable from two levels.

A grand staircase leads up to the DC History Center on the second floor, and down to the Carnegie Gallery, which displays historic photographs and documents about the origins and history of the building, in the basement. The upper levels of the building will continue to be occupied by the Historical Society of Washington, D.C.

Apple Carnegie Library opened on May 11.

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MULVA CULTURAL CENTER BUILDS UPON DE PERE, WIS.'S ARTS LEGACY

The city of De Pere, Wis., located in the greater Green Bay area, began in the 17th century as a fishing village with a monastery. It grew to be an incorporated city by the 1860s, and has a National Register of Historic Places historic district with dozens of homes in a variety of styles.

That architectural legacy is only part of what makes the small city attractive to some. Now, thanks to the generosity of James and Miriam Mulva, who have in recent years donated tens of millions of dollars to various groups, a new artistic focal point will draw visitors and enliven the historic town.



The wife and husband philanthropists recently announced designs for the Mulva Cultural Center in De Pere. The building will have an exterior made of transparent glass and will be a setting of arts activities and a focal point of the city's arts community.

Designed by Skidmore, Owings &

Merrill, the center will be situated along the Fox River. The 60,000-sf center will have an open-air atrium spanning the building's three stories and a large auditorium. The center will have a mix of permanent and temporary exhibition spaces, event space, classrooms, a café, and an outdoor terrace.

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EYE-CATCHING TRANSPORTATION FACILITY RETURNS TRAIN ACCESS TO CHICAGO NEIGHBORHOOD

A public art piece created by artist Folayemi Wilson will be just one of the eye-catching features of the new Damen Green Line Station in Chicago.

For the first time since 1948, part of the Near West Side of Chicago will have train access. Plans for the Damen Green Line Station, a new glass-walled transportation center to be located at Damen

Avenue and Lake Street, recently were unveiled.

With glass walls, open sightlines meant to give broad views of Chicago, and a landmark green truss mimicking both the city's bridges and the Green Line itself, the planned transit center will serve as a connection point for train-to-bus riders, at nearly every hour of the day and night. Designed by Perkins+Will, the open-concept structure will be brightly illuminated to provide a safe atmosphere.



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2019 Giants 300 REPORT

GARETH GARDNER, COURTESY GENSLER

HOW WE GET THE DATA

Data for our Giants 300 charts is based on information supplied by the respective firms. Firms are asked to verify the accuracy of their data.

The Construction section includes two types of statistics. The Contractors chart reflects revenues for general contracting, design-build, CM at risk, and IPD—projects where all revenues flow through the contractor. The CM Agent + PM chart lists firms that derive their revenues through fees. In the subsequent market-specific sections (Healthcare, Data Centers, etc.) data labeled “Construction” includes all delivery methods combined (GC, DB, CM at risk, IPD, CM agent, PM).

For more Giants rankings: BDCnetwork/Giants2019.

Gensler collaborated with KD Architects to design a new 330,000-sf headquarters in London for Microsoft. The campus consolidates more than 2,000 employees with a wide mix of workstyles and cultural preferences (72 nationalities are represented in the office). Pictured is one of the building’s focus rooms, called the “caves.”

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THE YEAR THAT WAS AT 94 DESIGN FIRMS

BY ROBERT CASSIDY, EXECUTIVE EDITOR

News from North America's Architecture Giants:

- **AE7** Using Revit to connect teams around the world.
- **AHL** Trained staff on use of point cloud laser scanning.
- **ALLIANCE** Implementing VR,

AR, and 3D modeling.

- **api(+)** Intensifying focus on food retail service concepts.
- **ATA BEILHARZ** Opened new office in Dayton, Ohio.
- **AYERS SAINT GROSS** Developed common detail libraries across three offices.
- **BALLINGER** New Research +

Strategy group aids in design of evidence-based environments.

- **BARKER RINKER SEACAT ARCHITECTURE** Developed "Consider. Confirm. Commit." and Owner Decision Matrix.
- **BBS** Added five partners.
- **BCA** New enterprise-wide BIM conversion and virtual

server environment.

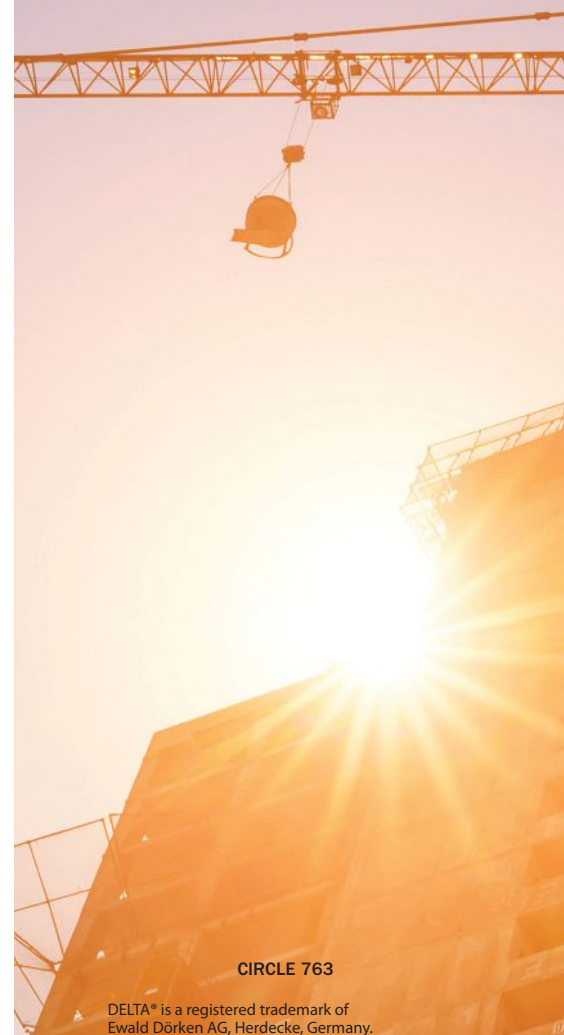
- **BOSTWICK DESIGN PARTNERSHIP** Engaging in intentional design process.
- **CALDWELL ASSOCIATES ARCHITECTS** Developed proprietary PM website.
- **CANNONDESIGN** Acquired Blue Cottage Consulting.

ARCHITECTURE FIRMS | TOP 90

Rank	Company	2018 Architecture Revenue	Rank	Company	2018 Architecture Revenue	Rank	Company	2018 Architecture Revenue
1.	Gensler	\$1,355,625,836	31.	Arquitectonica*	\$56,900,000	61.	Boulder Associates*	\$34,200,000
2.	Perkins+Will	\$607,958,770	32.	Beyer Blinder Belle*	\$53,492,000	62.	Davis Brody Bond	\$33,980,731
3.	HKS	\$396,060,463	33.	Quinn Evans Architects	\$50,688,349	63.	Array Architects	\$32,450,000
4.	Perkins Eastman	\$261,631,130	34.	CBT	\$49,209,472	64.	GBBN	\$31,600,000
5.	IBI Group*	\$246,400,000	35.	HLW International*	\$47,600,000	65.	CO Architects	\$30,848,741
6.	NELSON Worldwide	\$222,608,600	36.	Beck Group, The*	\$46,500,000	66.	WDG Architecture	\$30,700,000
7.	Corgan	\$191,585,851	37.	VLK Architects	\$46,167,000	67.	OZ Architecture	\$30,592,381
8.	ZGF Architects	\$189,555,601	38.	LMN Architects	\$45,920,000	68.	HuntonBrady Architects	\$30,311,271
9.	NBBJ	\$182,000,000	39.	TreanorHL	\$45,772,132	69.	Grimm + Parker Architects	\$30,290,304
10.	Kohn Pedersen Fox*	\$152,139,000	40.	DGA	\$45,435,401	70.	Rule Joy Trammell + Rubio	\$30,078,271
11.	Interior Architects	\$144,344,671	41.	Ayers Saint Gross	\$45,381,884	71.	Vocon	\$30,000,000
12.	HMC Architects	\$100,304,750	42.	Diamond Schmitt Architects	\$45,314,700	72.	Looney Ricks Kiss*	\$29,500,000
13.	Elkus Manfredi Architects	\$92,000,000	43.	NAC Architecture	\$44,785,688	73.	Miller Hull Partnership*	\$29,068,000
14.	KTGY Architecture + Planning	\$90,964,254	44.	Shepley Bulfinch	\$44,724,277	74.	HBG Design	\$29,061,000
15.	Cooper Carry	\$89,059,502	45.	Fentress Architects	\$44,700,000	75.	GFF	\$28,716,857
16.	Studios Architecture*	\$86,300,000	46.	Kirksey Architects	\$44,366,258	76.	Quattrocchi Kwok Architects	\$28,700,000
17.	WATG	\$81,895,000	47.	Mithun	\$43,323,885	77.	SLCE Architects	\$28,000,000
18.	LS3P	\$81,088,595	48.	DAVIS*	\$41,900,000	78.	Macgregor Associates Architects	\$27,398,715
19.	Architects Orange*	\$79,600,000	49.	BWBR	\$41,638,000	79.	Steelman Partners	\$27,200,000
20.	Solomon Cordwell Buenz	\$78,962,762	50.	BHDP Architecture	\$41,300,244	80.	Schenkel + Shultz	\$25,817,044
21.	Hord Coplan Macht	\$78,640,600	51.	Wilson Associates	\$41,000,000	81.	CambridgeSeven	\$25,447,000
22.	PGAL	\$76,600,000	52.	MBH Architects	\$39,750,000	82.	orcutt winslow	\$24,451,769
23.	Cunningham Group Architecture	\$76,306,401	53.	JCJ Architecture	\$39,707,537	83.	Carrier Johnson + Culture	\$24,447,000
24.	Moseley Architects	\$69,921,462	54.	RATIO	\$39,196,000	84.	Smallwood, Reynolds, Stewart, Stewart & Assoc.	\$24,423,646
25.	tvdesign*	\$69,000,000	55.	Steinberg Hart	\$38,750,000	85.	AHL	\$24,114,750
26.	Robert A.M. Stern Architects*	\$68,200,000	56.	Adrian Smith + Gordon Gill Architecture	\$37,690,577	86.	Harvard Jolly	\$23,653,607
27.	Moody Nolan	\$66,000,000	57.	Niles Bolton Associates	\$37,686,191	87.	Dattner Architects	\$23,108,959
28.	MG2	\$65,587,835	58.	FXCollaborative	\$37,562,449	88.	Ziegler Cooper Architects	\$22,637,283
29.	Payette	\$59,315,592	59.	Ted Moudis Associates	\$36,000,000	89.	FGM Architects	\$22,133,408
30.	Ennead Architects	\$57,491,982	60.	JLG Architects	\$35,530,960	90.	Taylor Design	\$21,891,341

SOURCE: ENR'S 2019 GIANTS 300 REPORT • EDITORS' ESTIMATE

YOUR CONSTRUCTION CREWS AREN'T THE ONLY ONES BAKING UNDER THE SUN.



CIRCLE 763

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- **CARRIER JOHNSON + CULTURE** Forming “Strategic Alliance Partnerships” in university P3 projects.
- **CLARK ENERSEN PARTNERS** Completed strategic plan through 2025.
- **CLARK NEXSEN** New Building Science Group formed.
- **CORGAN** New in-house incubator, HUGO, to facilitate innovation by staff.
- **CORTLAND** Pivoted to real-time information access.
- **CTA ARCHITECTS** Completed the first Passive House pre-K school in the U.S.
- **CUNINGHAM GROUP ARCHITECTURE** Registering patent for a room fitness monitor. Researching an all-inclusive restroom.
- **CURTIS + GINSBERG ARCHITECTS** Integrating Passive House into projects.
- **DATTNER ARCHITECTS** Created exclusive Project Management Manual and Visual Standards Manual.
- **DIGROUPARCHITECTURE** Implemented Revit for process-driven design.
- **DLR GROUP** Hired Brooke Grammier as CIO. K-12 Studio created Student Engagement Index.
- **DLZ CORP.** Using panoramic and flythrough renderings for client visualization.
- **E4H ENVIRONMENTS FOR HEALTH ARCHITECTURE** Using tethered VR and Lean processes—3P, Choosing by Advantages, pull planning.
- **ELKUS MANFREDI ARCHITECTS** Two-year state-

- funded workforce training initiative to enhance green credentials, productivity, and high-performance design.
- **EYP MISSION CRITICAL FACILITIES** Broke off from Hewlett Packard Enterprise.
- **FLAD ARCHITECTS** Formalizing its post-occupancy evaluation (POE) process.
- **FOGARTY FINGER ARCHITECTURE** Won its first hotel project.
- **FSB** VR for visual coordination and client experience.
- **FXCOLLABORATIVE** Hired Robin Elmslie Osler, AIA, as Interiors Studio Director.
- **GENSLER** Using sensing, technology, and data spatialization in designs.
- **GGLO DESIGN** Awards innovation grants to staff to investigate new technology.
- **GLAVE & HOLMES ARCHITECTURE** Doubled revenue under new strategy plan.
- **GMB ARCHITECTURE + ENGINEERING** Staff meet in multidisciplinary “Team of Teams” pods for 15 minutes a day to discuss corporate goals.
- **GREENBERG FARROW** Added COO, CFO, and BizDev Managing Principal.
- **GRESHAM SMITH** New tag: “Genuine ingenuity.” Opened new Chicago office.
- **GRIMM + PARKER ARCHITECTS** Two net-zero buildings under construction.
- **GWVO ARCHITECTS** New tool collects data from firm’s Revit models for monitoring by BIM manager.
- **H2M ARCHITECTS + ENGINEERS** Educated residents near a New York state park on importance of resiliency.

- **HARVARD JOLLY** Implementing 3D visualization, integrated project approach, Lean design, 21st-century learning in schools.
- **HASTINGS + CHIVETTA ARCHITECTS** Moved HQ to new office in St. Louis.
- **HDR** Acquired planning firm Calthorpe Associates. Employed predictive analytics to determine how Car-T cell therapies impacted a client’s patient bed capacity.
- **HGA** Design Insights Group has moved into services for arts, community, higher ed, public, corporate, and infrastructure clients.
- **H. HENDY ASSOCIATES** Developed a proprietary evidence-based program that analyzes workplace activities, amenities, and migration patterns.
- **HMC ARCHITECTS** Contributing to employees’ student loan payments.
- **HOLST ARCHITECTURE** Earned ILFI JUST Program label.
- **HUCKABEE** Completed four pilot studies on K-8 education.
- **HUMPHREYS & PARTNERS ARCHITECTS** Megan Dimmer named CEO.
- **HUNTON BRADY ARCHITECTS** Current focus: community-centered outpatient facilities.
- **HUNTSMAN ARCHITECTURAL GROUP** Implementing VR.
- **INTERIOR ARCHITECTS** Using Experiential Graphic Design to enhance workplace experience.
- **JCJ ARCHITECTURE** Applying Deltek database platform.

See full
GIANTS 300
rankings and bonus
categories at:
[BDCnetwork.com/
Giants2019](http://BDCnetwork.com/Giants2019)

آموزشگاه انعکاس منبع جدیدترین اطلاعات، مقالات و دوره‌های آموزشی دکوراسیون داخلی





- **KIRKSEY ARCHITECTS** Opened office in Austin, Texas. Became carbon-positive as a company.
- **KTGY ARCHITECTURE + PLANNING** Established a construction innovation committee.
- **LARSON DESIGN GROUP** Implemented real-time 3D rendering for visualization.
- **LEGAT ARCHITECTS** New R&D group encourages employees to apply for research grants.
- **LEO A DALY** Using its software to develop greenfield sites.
- **MARGULIES PERRUZZI** Using 3D design, AR/VR, and visioning for presentations.
- **MBH ARCHITECTS** Created an in-house job captain school.
- **MCKEE & ASSOCIATES ARCHITECTURE + INTERIOR DESIGN** Flying drones for roof projects.
- **METHOD ARCHITECTURE** Using VR to save costs on projects with very tight budgets.

- **MILLER DUNWIDDIE** Implemented a time projection tool to optimize staffing allocations.
- **MITHUN** Researching model resilience zoning code.
- **NILES BOLTON ASSOCIATES** Developed prototype for mass timber in multifamily projects.
- **OMNIPLAN** Expanded into the multifamily market.
- **PAGE** New Mexico City office.
- **PAYETTE** Won the 2019 AIA Architecture Firm Award.
- **PERKINS EASTMAN** Won AIA Latrobe prize with Drexel U. Appointed Rebecca Milne to Director of Design Strategy.
- **PRELLWITZ CHILINSKI ASSOCIATES** Appointed Ruth Parr, AIA, to Chief BIM Strategist.
- **QUATTROCCHI KWOK ARCHITECTS** Rebuilding schools devastated by California wildfires.
- **QUINN EVANS ARCHITECTS** Acquired 34-person BCWH.
- **RATLIFF GROUP** Expanded

- into country clubs, hotels, and light manufacturing facilities.
- **RBB ARCHITECTS** Developed proprietary BIM guidelines for hospital renovations.
- **RDG PLANNING & DESIGN** Using VR, rapid 3D prototyping.
- **ROSS & BARUZZINI** Aligning transportation, education, infrastructure, and healthcare services.
- **SCHRADERGROUP** Using BIM 360 in project partnerships.
- **SHEPLEY BULFINCH** Janette S. Blackburn made AIA Fellow.
- **S/L/A/M COLLABORATIVE** Merged with Frank Webb Architects, Los Angeles.
- **SMITHGROUP** Using its Sensor Lab to enhance POE studies.
- **STEVENS & WILKINSON** Using VR to create 3D models.
- **TEG ARCHITECTS** Employing Oculus Go headsets for project interviews and initial design.
- **THEDESIGN ARCHITECTURE** Developed educational

- visioning conceptual design process.
- **TINKER MA** Implemented BQE Core PM software.
- **TREANORHL** Started new TreanorHL Academy for staff education and development.
- **TRIA** Made new hires for S&T interior design team.
- **TRINITY** Holding two-day Lean 3P sessions with clients.
- **URBAHN ARCHITECTS** Increased staff training in Passive House design.
- **VMDO ARCHITECTS** Piloting WELL certification for projects at the UMiami and UVA.
- **VOCON** New LA office.
- **WARE MALCOMB** Educating clients on futureproofing.
- **WATG** Adopted VR and parametric modeling.
- **ZGF ARCHITECTS** Partnering with UWisconsin on smart flooring sensors.

ARCHITECTURE/ENGINEERING FIRMS TOP 66					
Rank	Company	2018 Arch/Eng Revenue	2018 Arch/Eng Revenue		
1.	Stantec	\$693,600,047	23. Huckabee	\$82,500,000	
2.	HDR	\$488,900,000	24. RSP Architects	\$79,609,000	
3.	HOK	\$454,635,000	25. EwingCole	\$74,529,929	
4.	Skidmore, Owings & Merrill	\$365,990,665	26. Clark Nexsen	\$73,610,000	
5.	CallisonRTKL	\$361,124,000	27. Humphreys & Partners Architects	\$71,667,500	
6.	SmithGroup	\$272,151,438	28. RS&H	\$66,700,000	
7.	DLR Group	\$262,400,000	29. Little	\$62,862,500	
8.	CannonDesign	\$222,000,000	30. GreenbergFarrow	\$54,000,000	
9.	Populous	\$208,731,025	31. BSA LifeStructures	\$52,382,846	
10.	HGA	\$154,043,981	32. Eppstein Uhen Architects	\$50,430,000	
11.	Page	\$144,000,000	33. CBRE	\$50,130,000	
12.	Leo A Daly	\$133,272,000	34. S/L/A/M Collaborative, The	\$48,703,000	
13.	EYP	\$128,610,268	35. Wold Architects	\$48,475,000	
14.	Gresham Smith	\$125,660,000	36. Ballinger	\$46,714,496	
15.	NORR	\$125,098,414	37. AE7	\$45,693,289	
16.	HNTB Corporation	\$113,191,355	38. E4H Environments for Health Architecture	\$44,000,000	
17.	LPA*	\$107,600,000	39. WD Partners	\$43,500,000	
18.	Ware Malcomb	\$103,703,978	40. Goodwyn, Mills and Cawood	\$43,362,818	
19.	Harley Ellis Devereaux	\$101,765,959	41. RDG Planning & Design	\$35,210,000	
20.	Michael Baker Intl.*	\$101,555,000	42. G70	\$34,400,000	
21.	Flad Architects	\$97,000,000	43. Wendel	\$34,347,964	
22.	PBK	\$95,600,000	44. Bermello Ajamil & Partners	\$34,250,000	
45.	Cuhaci & Peterson	\$33,116,815	45.	Cuhaci & Peterson	\$33,116,815
46.	Clark Patterson Lee (CPL)	\$32,767,231	46.	Clark Patterson Lee (CPL)	\$32,767,231
47.	Wight & Company*	\$32,702,000	47.	Wight & Company*	\$32,702,000
48.	H2M Architects + Engineers	\$32,304,124	48.	H2M Architects + Engineers	\$32,304,124
49.	Progressive AE	\$31,935,365	49.	Progressive AE	\$31,935,365
50.	Sasaki	\$31,789,000	50.	Sasaki	\$31,789,000
51.	Parkhill, Smith & Cooper	\$31,758,317	51.	Parkhill, Smith & Cooper	\$31,758,317
52.	FSB Architects & Engineers	\$31,485,977	52.	FSB Architects & Engineers	\$31,485,977
53.	Goettsch Partners	\$31,420,000	53.	Goettsch Partners	\$31,420,000
54.	Retail Design Collaborative/Studio One Eleven	\$30,717,321	54.	Retail Design Collaborative/Studio One Eleven	\$30,717,321
55.	LaBella Associates	\$30,160,440	55.	LaBella Associates	\$30,160,440
56.	Hoefler Wysocki Architects	\$29,550,000	56.	Hoefler Wysocki Architects	\$29,550,000
57.	BKV Group	\$27,378,501	57.	BKV Group	\$27,378,501
58.	Highland Associates	\$26,500,000	58.	Highland Associates	\$26,500,000
-	Sargenti	\$26,500,000	-	Sargenti	\$26,500,000
60.	Bergmann	\$26,070,000	60.	Bergmann	\$26,070,000
61.	Lawrence Group	\$25,954,000	61.	Lawrence Group	\$25,954,000
62.	PS&S	\$25,728,200	62.	PS&S	\$25,728,200
63.	Stevens & Wilkinson	\$25,122,717	63.	Stevens & Wilkinson	\$25,122,717
64.	Alliance	\$24,957,753	64.	Alliance	\$24,957,753
65.	Kahler Slater	\$22,902,000	65.	Kahler Slater	\$22,902,000
66.	DLZ	\$20,740,000	66.	DLZ	\$20,740,000

SOURCE: BDC 2019 GIANTS 300 REPORT *EDITORS' ESTIMATE



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Davis, Bowen & Friedel is among the engineering and EA giants to add or expand drone services in 2018. The firm formed an in-house drone services group to offer cost-effective aerial data collection.

ABOBE/STOCKMARTAN

RAPID EXPANSION: FIRMS ADD IN-DEMAND SERVICES

BY DAVID BARISTA, EDITORIAL DIRECTOR

Each year, as part of the Giants 300 survey, we ask the nation's largest engineering and engineering/architecture firms to pinpoint their most significant business moves within the past 12-18 months.

Cited most often this year: "added a new service" and "tech innovations." Here's a recap of the top business innovations from the 2019 Engineer Giants:

- **AE Works** added Security Risk Management services to help clients balance operational needs and organizational culture with security solutions. Services include security compliance audits, building design review, security system design, and facility/campus security assessments.
- **Burns & McDonnell** launched an innovation incubator, Ignite, focused on researching and developing ideas for business lines or new approaches to serving clients. Similar to "Shark Tank," teams of Burns & McDonnell professionals develop and pitch ideas that can receive funding for further development. The current round is focused on artificial intelligence, machine learning, advanced analytics, business intelligence, and robotics.

- **Core States Group** expanded its service offerings to meet client demand, including in-house production of custom electrical interconnection points (known as bus connections) for battery storage, fuel cell, and solar array applications; and signage design and fabrication and brand management services.
- **Davis, Bowen & Friedel** added in-house drone services to provide more efficient, safer, and cost-effective drone-based aerial data collection.





• **dbHMS** has expanded its Building Envelope Commissioning practice to meet growing demand for these services. The firm also integrated its High-Performance Simulation Practice with its MEP Design Practice to help improve the actual performance of buildings over the modeled performance, and to reduce the duration for commissioning for efficiency and thermal comfort.

• **Epstein** is employing advanced modular construction techniques for a 25-story hotel in Manhattan. The modules are being mass-produced, staged for convenient access, and then will be constructed to a higher standard before delivery to the jobsite.

• **EYP Mission Critical Facilities**, formerly a wholly owned subsidiary of a global public

IT company, is now an independent firm and has expanded its range of services for its data center and mission critical facility clients, from consulting, to engineering, to commissioning and operations.

• **Fluor** partnered with IBM to develop artificial intelligence-based tools to predict, monitor, and measure the status of engineering, procurement, fabrication, and construction of its mega-projects. The firm's new EPC Project Health Diagnostics (EPHDsm) and Market Dynamics/Spend Analytics (MD/SASm) tools are powered by IBM Watson, and help identify dependencies and provide actionable insights by

ENGINEERING FIRMS | TOP 56

Rank	Company	2018 Engineering Revenue	Rank	Company	2018 Engineering Revenue
1.	WSP USA	\$441,340,147	29.	Magnusson Klemencic Associates*	\$50,819,000
2.	Kimley-Horn	\$401,619,010	30.	DeSimone Consulting Engineers	\$48,414,197
3.	Terracon Consultants*	\$288,002,000	31.	CMTA	\$42,314,993
4.	Arup	\$224,104,754	32.	I.C. Thomasson Associates	\$42,130,000
5.	Jensen Hughes	\$211,807,000	33.	Jordan & Skala Engineers	\$40,479,647
6.	Tetra Tech High Performance Buildings Group	\$200,000,000	34.	P2S	\$39,240,000
7.	Fluor Corp	\$198,700,000	35.	HEAPY	\$37,195,822
8.	KPFF Consulting Engineers	\$165,485,945	36.	Bala Consulting Engineers	\$37,100,000
9.	IMEG Corp	\$149,455,125	37.	Mazzetti	\$35,134,298
10.	Henderson Engineers	\$139,000,000	38.	Degenkolb Engineers*	\$33,840,000
11.	Affiliated Engineers	\$137,477,000	39.	Martin/Martin Consulting Engineers	\$30,258,833
12.	Vanderweil Engineers	\$113,571,500	40.	kW Mission Critical Engineering	\$30,100,000
13.	Olsson Inc.*	\$104,222,000	41.	CJL Engineering	\$30,049,488
14.	Simpson Gumpertz & Heger*	\$99,680,000	42.	M/E Engineering	\$28,869,374
15.	Walter P Moore	\$94,740,866	43.	Newcomb & Boyd	\$26,941,571
16.	Syska Hennessy Group	\$93,975,865	44.	Arora Engineers	\$26,518,324
17.	Timmons Group*	\$76,807,000	45.	KCI Technologies	\$23,800,000
18.	ESD	\$71,999,940	46.	Dunham Associates	\$23,000,000
19.	Integral Group	\$70,500,000	47.	Loring Consulting Engineers*	\$22,718,000
20.	AKF Group	\$70,000,000	48.	RTM Engineering Consultants	\$22,445,000
21.	Jaros, Baum & Bolles	\$66,177,150	49.	Teecom	\$22,135,128
22.	TLC Engineering Solutions	\$66,047,674	50.	Wallace Engineering	\$19,200,000
23.	BR+A*	\$65,000,000	51.	Korda/Nemeth Engineering	\$18,200,000
24.	Smith Seckman Reid	\$62,864,094	52.	Karpinski Engineering	\$17,676,005
25.	RMF Engineering	\$61,000,000	53.	GHT Limited	\$17,432,000
26.	ME Engineers	\$56,500,000	54.	Peter Basso Associates	\$17,250,000
27.	Coffman Engineers	\$53,426,605	55.	Bridgers & Paxton Consulting Engineers, Inc.	\$16,984,151
28.	Interface Engineering	\$53,146,274	56.	French & Parrello Associates	\$16,715,627

SOURCE: BDC 2019 GIANTS 300 REPORT * EDITORS' ESTIMATE



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CIRCLE 765





fusing thousands of data points across the entire life cycle of capital projects.

- **Half Associates** developed a high dynamic deep locating (HDDL) system that allows the firm's sub-surface utility engineers to designate a utility more than 40 feet underground. Standard locating equipment is typically only effective for depths of 10 to 15 feet.
- **Integral Group** launched "Fresh Voices," a retreat for employees from across the company to provide a diverse conversation both from local experience and global context. Participants produced a report that was shared firm wide to maximize the impact of the workshop.
- **Jaros, Baum & Bolles** expanded its adoption of direct outside air system (DOAS) technology for commercial office retrofit and repurposing projects in the New York City market. The installations utilize overhead chilled-water, fan-powered terminal units.
- **kW Mission Critical Engineering** added telecommunications design, based on demand from its data center clients. Its RCDD-certified telecom engineers work with kW's in-house MEP/FP engineers and external consultants to coordinate telecom design with power distribution, hot/cold aisle containment, and liquid cooled piping to reduce delivery times and lower design and construction costs.

- **KLH Engineers** is using Python, a multi-paradigm programming language, to create machine learning models to more efficiently bridge the gap between AutoCAD and Revit. The firm is exploring other machine learning applications, as well, including mapping building types with corresponding HVAC system types.
- **Magnusson Klemencic Associates'** nonprofit research arm, MKA Foundation, has signed on with the Charles Pankow Foundation as a funding partner on several of CPF's research initiatives. MKA Chairman and CEO Ron Klemencic, PE, SE, is a long-running member of the CPF Board of Directors.
- **Martin/Martin Consulting Engineers** expanded its specialty engineering services through its Construction Engineering Services (CES) group. The CES team assists contractors—particularly on design-build and integrated project delivery projects—with their on-site engineering needs, including enhanced fabrication drawings.
- **Thornton Tomasetti's** innovation investment arm, TTWiiN Investment Partners, invested in XtreeE, a Paris-based technology company focusing on large-scale 3D printing solutions for the AEC industry. XtreeE was founded in 2015 and is at the forefront of large-scale additive manufacturing, primarily in concrete.
- **Woolpert** combines the use of aerial thermal imagery of buildings with property and utility data to create a "heat score map," a visual depiction of the thermal losses of structures. The firm hosts its heat score maps on a custom-designed Web portal, SmartView Connect, which can present a side-by-side comparison of buildings and homes across a community or neighborhood.
- **WSP USA** aims to become carbon neutral across its U.S. operations in 2019. The initiative pertains to all U.S. offices and employee business travel. WSP will manage and reduce its own greenhouse gas impacts through energy efficiency, transportation, and travel efficiency. It will also source renewable energy and pursue high-impact carbon offsets. The firm's sustainability actions include waste and water management, procurement, the health and wellness of its staff, and community engagement.

For full **Giants 300 rankings and bonus categories**, visit: BDCnetwork.com/Giants2019.

ENGINEERING/ARCHITECTURE FIRMS			TOP 39		
Rank	Company	2018 Eng/Arch Revenue	Rank	Company	2018 Eng/Arch Revenue
1.	AECOM	\$1,038,600,000	21.	Mason & Hanger	\$49,593,409
2.	Jacobs	\$605,479,500	22.	Merrick & Company*	\$46,176,000
3.	Burns & McDonnell	\$293,575,993	23.	Shive-Hattery	\$43,604,008
4.	Thornton Tomasetti	\$256,286,911	24.	Woolpert	\$39,947,548
5.	NV5 Global	\$186,463,366	25.	Farnsworth Group*	\$34,740,000
6.	EXP	\$174,492,200	26.	Fishbeck, Thompson, Carr & Huber	\$34,010,462
7.	CRB	\$145,425,417	27.	McKinstry	\$28,220,000
8.	IPS-Integrated Project Services	\$135,100,000	28.	H.F. Lenz Co.	\$24,997,999
9.	SSOE Group	\$133,240,000	29.	Epstein	\$24,670,000
10.	STV	\$101,770,723	30.	GRAEF	\$24,134,005
11.	Wiss, Janney, Elstner*	\$98,280,000	31.	CESO	\$22,870,000
12.	Dewberry	\$95,701,470	32.	Guernsey	\$22,401,040
13.	Salas O'Brien	\$83,851,549	33.	Stanley Consultants	\$22,115,270
14.	Ghafari Associates	\$83,700,000	34.	Hixson Architecture, Engineering, Interiors	\$21,500,000
15.	Morrison Hershfield	\$77,194,937	35.	Galloway & Company	\$21,257,445
16.	BRPH	\$67,324,956	36.	Half Associates	\$20,130,000
17.	CTA Architects Engineers	\$67,121,462	37.	VMDO Architects	\$19,737,574
18.	Walker Consultants	\$65,935,449	38.	Barge Design Solutions	\$16,799,378
19.	Ross & Baruzzi	\$60,140,000	39.	EAPC Architects Engineers	\$16,750,023
20.	Core States Group	\$55,591,912			

SOURCE: BDC 2019 GIANTS 300 REPORT * EDITORS' ESTIMATE



THE HEART OF SYDNEY'S NEW FINANCIAL HUB

Containing thousands of copper pipe fittings that will ensure sustained drinking water hygiene for the future

Barangaroo, the new business district adjacent to the Sydney Harbor, is home to the new economic center for the Asia-Pacific region: the International Towers Sydney. Viega ProPress Copper fittings are used throughout to provide the 131 floors of the three towers with a reliable supply of drinking water. Not only does the system impress with its excellent hygienic properties, it is also quick and easy to install – a significant advantage for a major project on a tight schedule, such as this one. **Viega. Connected in quality.**

International Towers Sydney, Sydney, Australia

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GCS PURSUE LEAN, PREFAB, SAFETY, DATA

BY DAVID BARISTA, EDITORIAL DIRECTOR

The nation's largest general contractors and construction managers continue to adapt and innovate to thrive in the highly competitive U.S. construction market. Here are the latest developments from our 2019 Contractor Giants:

- On a mission to create the “hard hat of the future,” **Clayco** teamed with 14 students and two faculty members from the Savannah (Ga.) College of Arts and Design (SCAD) on a yearlong research project. The initiative involved conducting interviews with construction professionals, jobsite visits, an online survey of 188 industry professionals, and a comparative study of safety helmet technology. It led to the development of two prototypes, Pollux and Captain (BDCnetwork/ClaycoHardhat).

- **DPR Construction** is beginning to widely implement multi-trade, digitally-produced, prefabricated elements, including load-bearing components, on its projects. DPR says its prefab strategy is advantageous for

its core markets—data centers, healthcare, industrial, office, S+T, university—and has proven to reduce project schedule and increase on-site safety.

- **Gilbane** launched the Gilbane Drone Program, in part, to shift the risk of utilizing drone technology to an external party. The internal portion of the program is focused on gathering “low risk” data to support project pursuits, progress documentation, and 2D deliverables. The “high risk” engineered design data gathering is outsourced to mitigate risk and high costs.

Other contractors that are expanding drone usage:

- **Absher Construction**, for aerial surveying of sites to assess cut/fill and building siting. Says the firm: “It allowed us to be accurate within a quarter of an inch, minimizing earthwork requirements and saving the client several million dollars.”

- **Austin Commercial**, primarily for façade scanning and QA/QC for pre/post concrete pours.

- **Walbridge**, for inspecting elevated work (interior and exterior), which reduces

the need for inspectors in personal lifts and engineers from even traveling to the jobsite.

- **Haselden Construction** created a “business integration team” to ensure all departments work together as seamlessly as possible and are equipped with the proper tech tools. Big wins so far: implementation of a mobile device management tool for all Haselden-issued iOS devices, and a shift to private cloud-based servers.

- **James G. Davis Construction** and **W.M. Jordan Company** report having success implementing the last planner system (LPS) on projects. The goal of LPS—which involves utilizing Lean scheduling and programming tools such as pull planning—is to create and maintain buy-in at all levels at every stage in the construction process.

- **Kaufman Lynn Construction** launched a social-media-styled communication channel, called KLiX, to help increase employee engagement and education. The portal provides its 200+ staff members across three states with everything from

industry news to OSHA training presentations to job-related data.

- **Manhattan Construction's** professional development program, Manhattan Builder's Academy, includes a mix of in-person and online educational programs. Educational assignments are tied to employees' yearly performance goals.

- **Mortenson Construction** in June entered into a strategic partnership with Built Robotics, a developer of autonomous robotic equipment technology. The two companies will work in tandem to develop Built Robotics' equipment upgrade kits specifically for heavy civil earthmoving on renewable energy projects.

- **Pepper Construction's** new Building Performance Tool demonstrates to clients the real-time financial impact of design decisions and systems on their projects. (Pepper's Susan Heinking, AIA, LEED Fellow, demonstrated the tool at BD+C's 2019 Accelerate AEC Conference, BDCnetwork.com/Accelerate19Talks.)

- **Robins & Morton's** Building Forward program encourages



CONTRACTORS | TOP 90

Rank	Company	2018 GC Revenue	Rank	Company	2018 GC Revenue
1.	Turner Construction	\$13,187,985,876	46.	CORE Construction Group	\$1,150,572,565
2.	Jacobs	\$10,667,520,000	47.	Fortis Construction	\$1,144,428,000
3.	Whiting-Turner Contracting Co., The	\$8,563,454,474	48.	Robins & Morton	\$1,103,925,321
4.	AECOM	\$7,867,330,000	49.	Choate Construction	\$1,092,554,646
5.	DPR Construction	\$5,879,591,000	50.	Gray Construction	\$1,090,902,644
6.	Gilbane	\$5,661,765,000	51.	McShane Companies, The	\$1,058,545,587
7.	PCL Construction Enterprises	\$5,526,306,776	52.	Messer Construction	\$1,057,000,000
8.	Skanska USA	\$5,252,229,872	53.	Plaza Construction	\$1,054,000,000
9.	STO Building Group (formerly Structure Tone)	\$4,904,900,000	54.	Boldt Company, The	\$1,036,913,000
10.	Hensel Phelps	\$4,716,377,576	55.	Power Construction	\$1,019,000,000
11.	Clark Group	\$4,694,402,313	56.	BL Harbert	\$998,206,782
12.	Lendlease	\$3,886,760,660	57.	Hunter Roberts Construction Group	\$970,000,000
13.	Balfour Beatty US	\$3,792,896,504	58.	Beck Group, The*	\$944,880,000
14.	Suffolk	\$3,447,203,194	59.	Weitz Company, The	\$934,486,000
15.	McCarthy	\$3,433,115,464	60.	Christman Company, The*	\$922,735,000
16.	JE Dunn Construction	\$3,389,711,433	61.	Okland Construction*	\$916,944,000
17.	Swinerton	\$3,339,850,000	62.	Alston Construction*	\$910,000,000
18.	Holder Construction	\$3,280,000,000	63.	VCC	\$894,964,331
19.	Mortenson Construction	\$3,254,890,000	64.	Adolfson & Peterson Construction*	\$884,070,000
20.	Brasfield & Gorrie	\$3,184,043,829	65.	LeChase Construction Services	\$882,191,837
21.	Fluor Corp	\$3,001,300,000	66.	Hoar Construction	\$866,478,000
22.	Tutor Perini Corp.*	\$2,796,942,000	67.	Clune Construction	\$844,362,752
23.	Clayco	\$2,680,000,000	68.	Haskell	\$838,344,823
24.	Webcor	\$2,223,000,000	69.	Sundt Construction	\$815,792,865
25.	HITT Contracting	\$1,968,872,311	70.	James G. Davis Construction	\$793,300,670
26.	Walsh Group, The	\$1,896,205,691	71.	Lease Crutcher Lewis*	\$774,720,000
27.	Layton Construction	\$1,801,920,511	72.	Nabholz	\$747,900,000
28.	Yates Companies, The	\$1,771,515,000	73.	Andersen Construction	\$745,000,000
29.	Barton Malow Company	\$1,766,276,573	74.	Big-D Construction*	\$726,400,000
30.	Austin Commercial	\$1,724,576,898	75.	Kitchell	\$713,475,122
31.	ARCO Construction	\$1,669,026,685	76.	McGough Construction	\$704,000,000
32.	Ryan Companies*	\$1,554,280,000	77.	Rogers-O'Brien Construction	\$682,506,994
33.	Devcon Construction*	\$1,537,000,000	78.	Kraus-Anderson Construction Company	\$679,000,000
34.	Shawmut Design and Construction	\$1,443,600,000	79.	C.W. Driver Companies	\$676,914,714
35.	Hathaway Dinwiddie Construction	\$1,417,000,000	80.	Sellen Construction*	\$656,000,000
36.	Consigli Building Group	\$1,340,186,249	81.	Miron Construction*	\$637,626,000
37.	Level 10 Construction	\$1,333,877,462	82.	McKinstry	\$635,447,400
38.	Hoffman Construction	\$1,308,067,994	83.	BNB Builders*	\$620,000,000
39.	Walbridge	\$1,270,629,311	84.	James McHugh Construction	\$556,838,628
40.	Pepper Construction Group	\$1,254,640,000	85.	IMC Construction*	\$539,000,000
41.	W.E. O'Neil Construction	\$1,253,990,621	86.	Bernards	\$530,280,000
42.	Crossland Construction	\$1,225,935,363	87.	Summit Contracting Group	\$511,216,670
43.	J.T. Magen & Company	\$1,220,322,016	88.	Paric	\$504,509,366
44.	Manhattan Construction Group	\$1,192,691,942	89.	Holt Construction	\$482,860,100
45.	Alberici/Flintco*	\$1,161,548,000	90.	McCownGordon Construction	\$479,721,533

SOURCE: BDC 2019 GIANTS 300 REPORT *EDITORS' ESTIMATE



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entrepreneurial thinking and creativity in the workplace. Early results: BuildFore, a startup launched by three R&M schedulers focused on developing collaboration and efficiency tools, like the Lean app SlatPlanner (slatplanner.com).

- **Suffolk Construction's Risk X: Safety Management Tool** uses predictive analytics to inform its project leaders of potential and actual jobsite safety risks, in real time. Results from year one (2017-2018): 28% drop in total incident rates and 39% drop in lost time due to safety incidents.

Safety initiatives at other construction firms include:

- **Balfour Beatty US** is

using gaming-based VR tools to develop interactive simulations that train workers to make smart choices when performing one of the most hazardous tasks in the industry: working at height.

- **Hoar Construction** launched its "leading indicator safety initiative," which utilizes data from jobsite safety inspections, pre-task safety analysis surveys, and safety meeting surveys to identify problem areas.

- **KBE Building Corp.** is implementing Triax Technologies' Spot-r monitoring system on its jobsites. The wearable GPS device tracks the exact time, location, and distance of a fall with a change in elevation of two+ feet.

- **Skanska USA** continues to innovate using BIM/VDC-based safety coordination.

For instance, the firm has optimized projects to reduce the need for ladders—a major source of construction injuries—on the jobsite during construction.

- **Skender's** 105,000-sf modular factory on Chicago's southwest side is fully operational. The firm is among a handful of traditional GC firms to build permanent offsite construction factories in recent years (the others: **DPR** and **PCL**).

- As part of its newly launched Redefining Green initiative, **Turner Construction** will aim to reduce water and energy consumption by at least 50% on a select number of jobsites. The firm already diverts, on average, 75% of jobsite waste from landfills. Turner's sights are set on resource consumption during

construction. It has selected 30 projects, across different building typologies, to participate in a pilot program that, over the next 18 months, will meter those projects on all forms of CO₂ emissions and water use, including onsite fuel use (BDCnetwork/Turner-RedefinesGreen).

- **Webcor's** Culture Conversations initiative aims to assess and support the workplace and career satisfaction of its 759 employees. The program uses open dialog sessions, discussions, and surveys to learn what Webcor staffers want to feel, see, and experience while working at the firm.

For full Giants 300 rankings and bonus categories, visit: BDCnetwork.com/Giants2019.

CM AGENT + PM FIRMS | TOP 66

Rank	Company	2018 CM/PM Revenue	Rank	Company	2018 CM/PM Revenue	Rank	Company	2018 CM/PM Revenue
1.	Jacobs	\$2,189,670,000	23.	Lendlease	\$20,930,057	45.	Barton Malow Company	\$3,770,544
2.	CBRE	\$588,400,000	24.	Skanska USA	\$20,576,346	46.	S. M. Wilson	\$3,546,117
3.	JLL	\$555,868,279	25.	EXP	\$20,131,500	47.	Haskell	\$3,509,648
4.	Hill International	\$429,820,000	26.	Salas O'Brien	\$16,674,914	48.	WD Partners	\$3,500,000
5.	Whiting-Turner Contracting Co., The	\$224,144,199	27.	IPS-Integrated Project Services	\$15,950,000	49.	Stalco Construction	\$3,400,000
6.	Clune Construction	\$207,712,096	28.	Paric	\$14,455,954	50.	Jonathan Nehmer + Associates	\$3,205,968
7.	JE Dunn Construction	\$187,765,673	29.	CRB	\$12,801,946	51.	Guernsey	\$3,033,070
8.	Cumming	\$137,977,478	30.	Campus Construction Management Group	\$12,400,000	52.	BL Harbert	\$3,029,720
9.	Turner Construction	\$127,512,663	31.	W. M. Jordan Company	\$12,103,035	53.	Kaufman Lynn Construction	\$2,867,681
10.	Hunter Roberts Construction Group	\$89,000,000	32.	Robins & Morton	\$11,543,738	54.	Arup	\$2,823,128
11.	Walbridge	\$67,640,689	33.	Plaza Construction	\$11,000,000	55.	Ghafari Associates	\$2,700,000
12.	Gilbane	\$66,235,000	34.	Fortis Construction	\$10,141,000	56.	Sundt Construction	\$2,573,020
13.	T.G. Nickel & Associates	\$62,368,125	35.	Bernards	\$8,980,000	57.	P2S	\$2,520,000
14.	Kitchell	\$60,609,539	36.	Holt Construction	\$8,920,000	58.	McCownGordon Construction	\$2,267,746
15.	STV	\$60,528,422	37.	Progressive AE	\$8,137,484	59.	HITT Contracting	\$2,251,872
16.	LeChase Construction Services	\$58,329,711	38.	Mortenson Construction	\$8,062,000	60.	Layton Construction	\$2,014,939
17.	Kraus-Anderson Construction	\$50,000,000	39.	SSOE Group	\$5,726,000	61.	Hagerman Group, The	\$2,000,000
18.	Burns & McDonnell	\$46,646,398	40.	Yates Companies, The	\$5,664,000	-	CSI Construction	\$2,000,000
19.	AECOM	\$44,020,000	41.	Pepper Construction Group	\$5,370,000	63.	Manhattan Construction Group	\$1,980,274
20.	Broadway Construction Group	\$26,964,053	42.	Swinerton	\$5,250,000	64.	CORE Construction Group	\$1,836,124
21.	McKinstry	\$21,332,600	43.	Brownstone	\$4,979,820	65.	McCarthy	\$1,766,881
22.	Balfour Beatty US	\$21,098,538	44.	KCI Technologies	\$4,000,000	66.	Brasfield & Gorrie	\$1,392,783

SOURCE: BDC 2019 GIANTS 300 REPORT



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The new 312,000-sf Biological Science Building at the University of Michigan, by Ennead Architects (design architect) and SmithGroup (AOR), unites two science departments and three museums under one roof. Barton Malow was the general contractor.

PHOTOS BY BARTON MALOW

FLEX to the FUTURE

Campuses are streamlining operations while addressing student health, wellness.

mirknig.su

BY MIKE PLOTNICK, CONTRIBUTING EDITOR

Escalating costs, demographic shifts, and growing competitive pressures are pushing colleges and universities to streamline—and transform—their operations.

State funding of U.S. public higher-education institutions declined by 16% from 2008 to 2017, even as tuition rose an average 35%. Campuses are adapting their facilities to underscore the ROI of earning a degree to a more discerning student population.

Many institutions are emphasizing interdisciplinary research. The University of Michigan's new

Biological Sciences Building brings together the Department of Molecular, Cellular, and Developmental Biology and the Department of Ecology and Evolutionary Biology, as well as the museums of Natural History, Paleontology, and Zoology. Designed by Ennead Architects and SmithGroup, the facility houses large, open classrooms and a flexible active-learning hall for group work.

A 100,000-sf classroom addition to the historic Alexander G. Ruthven Museums Building at the University of Michigan features learning spaces that can quickly transition from lectures to small work teams to larger group discussions. "Higher education clients are focusing on creating spaces that can accommodate large, modern, team-based, and



active-learning classrooms that also keep an eye on flexibility to accommodate future programmatic changes,” says Rob Rankin, LEED AP BD+C, Project Director, Barton Malow.

Some universities are creating “innovation districts” to historically separate programs. “These districts create holistic living and learning environments, offer a sense of community, and help connect and immerse higher-ed institutions with surrounding communities and professional organizations,” says Patricia Bou, AIA, LEED AP, Principal, CannonDesign.

Rather than committing to an entire new

‘Over the past year, we’ve seen an increase in the number of projects related to specific careers,’ such as automation and welding.

JEFF OKE, IMEG CORP.

building to house its new engineering program, Loyola University Chicago opted to renovate a storefront adjacent to several off-campus properties. The 9,255-sf Flex Lab is large enough to accommodate the program’s gradual growth while encouraging the exploration of different engineering sciences.

“The highly flexible, reconfigurable space supports entrepreneurial partnerships with students in the community and the university’s social justice mission,” says Chris Purdy, Vice President and Higher Education Practice Director at SmithGroup.

A new 790-space underground parking structure at Washington University in St. Louis is designed with built-in flexibility so it can potentially be repurposed into academic research or teaching space in the future. McCarthy Building Companies laser scanned all the post-tensioning cable, rebar, and embedded MEP systems before

concrete was poured on the deck so the university will have access to precise 3D data in the event of future renovation or repurposing.

Colleges and universities are also doubling down on academic programs that equip students with hand-on skills for in-demand careers. “Over the last year, we’ve seen an increase in the number of projects related to specific careers,” such as nursing, welding, automotive, automation, and electronics, says Jeff Oke, PE, Principal and Client Executive, IMEG Corp.

Wake Tech Community College opened the first building on a new 94-acre campus in Research Triangle Park, N.C., to help meet rising demand for technology workers in the region’s knowledge-based economy. Co-located with technology, life science, and R&D partner companies, the campus is a collaborative venture built with curriculum guidance and financial support from Cisco, Red Hat, and Lenovo. “This adaptable building helps fulfill Wake Tech’s vision to be a vital hub between the academic and corporate worlds,” said Kenneth Luker, AIA, LEED AP, Design Principal, Perkins+Will.

FOCUS ON PHYSICAL, EMOTIONAL HEALTH OF STUDENTS AT RISK

Health and wellness are taking center stage on many college and university campuses to address student anxiety, depression, and substance abuse.

Recent research from the American College Health Association reveals that three out of five college students experienced overwhelming anxiety in the last year; two out of five were too depressed to function. Only 10-15% of students who need help typically seek such services at campus counseling centers.

“Academic institutions are creating wellness centers to provide students more mental health resources than ever before,” says John Baxter, AIA, LEED AP, Higher Education Sector Leader at EYP.



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DAVE BURK



Rather than committing to a new building to house its new engineering program, Loyola University Chicago opted to renovate a storefront adjacent to several off-campus properties. The 9,255-sf Flex Lab was designed by SmithGroup.

The McLeod Tyler Wellness Center at the College of William and Mary, Williamsburg, Va., which opened last fall, integrates counseling, medical, and healthy living spaces in a highly visible and accessible campus building.

There's also an emphasis on designing for inclusivity, as universities strive to offer customized experiences matched to each student's unique academic journey. "Universities are engaged in a conscious drive toward multicultural human experience as they recognize evolving campus cultures," says Charles Smith, AIA, LEED AP, Principal, CannonDesign. "Student unions, dining experiences, and residence halls are being programmed and designed to create more open, collaborative, and

supportive environment for all students."

This fall, Pratt Institute will open Emerson Place, a new 10-story residence hall in Brooklyn designed to address the complex needs of first-year students. Compartmentalized toilet and bathing facilities located outside of traditional doubles sleeping rooms will give students privacy while addressing gender politics, identity, and religious diversity.

"Our clients understand the importance of providing spaces and resources that allow students to decompress or regroup," says Lynne Deninger, AIA, LEED AP, CannonDesign Principal and Boston Practice Leader.

For full Giants 300 rankings and bonus categories, visit: BDCnetwork.com/Giants2019.



UNIVERSITY SECTOR ARCHITECTURE + AE FIRMS TOP 10		
Rank	Company	2018 University Revenue
1.	Gensler	\$91,844,382
2.	AECOM	\$75,800,000
3.	Perkins+Will	\$62,253,540
4.	CannonDesign	\$62,000,000
5.	SmithGroup	\$44,132,816
6.	Stantec	\$43,193,420
7.	EYP	\$34,474,003
8.	Ayers Saint Gross	\$32,902,680
9.	Perkins Eastman	\$22,680,064
10.	ZGF Architects	\$22,499,761

SOURCE: BD+C 2019 GIANTS 300 REPORT

UNIVERSITY SECTOR ENGINEERING + EA FIRMS TOP 10		
Rank	Company	2018 University Revenue
1.	Jacobs	\$32,668,000
2.	IMEG Corp	\$25,572,181
3.	Affiliated Engineers	\$24,956,281
4.	Vanderweil Engineers	\$24,201,000
5.	Dewberry	\$21,509,918
6.	Arup	\$19,659,180
7.	WSP USA	\$17,870,435
8.	P2S	\$17,591,923
9.	RMF Engineering	\$15,250,000
10.	Fishbeck, Thompson, Carr & Huber	\$15,200,000

SOURCE: BD+C 2019 GIANTS 300 REPORT

UNIVERSITY SECTOR CONSTRUCTION + CM FIRMS TOP 10		
Rank	Company	2018 University Revenue
1.	Turner Construction	\$1,247,456,881
2.	Whiting-Turner Contracting Co., The	\$1,124,835,253
3.	Skanska USA	\$705,555,712
4.	Gilbane	\$627,251,000
5.	McCarthy	\$499,710,236
6.	Hensel Phelps	\$494,033,670
7.	Webcor	\$480,000,000
8.	Shawmut Design and Construction	\$466,400,000
9.	PCL Construction Enterprises	\$354,301,382
10.	Consigli Building Group	\$327,074,936

SOURCE: BD+C 2019 GIANTS 300 REPORT



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KEEPING UP

Space consolidation and workplace upgrades will keep project teams busy.

Rooftop deck of the 13-story, LEED Gold Pier 4 office building in Boston's Seaport district, designed by Elkus Manfredi Architects, SHoP Architects, and CBT Architects. McNamara Salvia was the SE; Turner Construction was the general contractor.

BY PETER FABRIS, CONTRIBUTING EDITOR

Corporate space consolidation and the need to upgrade the employee experience will keep the office market fairly strong for the next 18 months before the sector taps the brakes. “I don’t think it will be anything dramatic, but I think there will be a leveling,” says Dennis Cornick, EVP, Gilbane Building Company. Construction costs and a slackening demand for space built on spec will dampen the market, he says.

In the last year, open office design has come under attack by Harvard Business School. Recent HBS studies found that when employees moved from a traditional office setting to an open office, collaboration actually declined. Many workers plugged wireless devices in their ears to tune out office noise—and their co-workers. The studies have prompted designers and real estate decision makers to rethink the open-office trend.

“I’ve heard different opinions from different clients,”

says Cornick. Some open office projects have been successful, he says; others have not fostered the expected level of collaboration. Nonetheless, he says, “The drive for more collaboration and teamwork is almost a universal desire.”

With no universally accepted formula for office design, major redesigns should be preceded by “a robust process to understand the use of space” and employee habits, says Lise Newman, AIA, Vice President, National Workplace Director, SmithGroup.

SmithGroup looks for a blend of settings for three work modes: “focus, collaborate, and create.” Small rooms are for taking calls or writing reports. Larger rooms are for team activities—meetings and presentations. Open space may be appropriate for most other activities. The number and size of quiet rooms and of collaboration space vary from client to client.

The “WeWork factor” is also figuring prominently in office projects, says Gilbane Vice President Ryan Hutchins. WeWork is outfitting space with a rich menu of amenities for such clients as Citi, Microsoft, and BlackRock. WeWork’s mix of private, open, and event



space is replete with sofas, café counters, and a hip vibe. Other developers and owners are being forced to up their game to compete for the most desirable tenants.

In the war for top talent, particularly technology talent, the working environment is increasingly part of the competitive landscape. "To be innovative, you have to get the best people," Newman says. "Even traditional businesses like banking compete with Silicon Valley for talent." When a company like Google creates a new outdoor amphitheater for movie screenings, as it did at its Ann Arbor, Mich., location, it raises the bar. For some talented prospects, a cool, Google-like workspace can tip the scales when evaluating offers from multiple employers.

Developers are creating shared amenities to address this trend at multi-tenant sites. Shared work cafés offer the sense that "you are not stuck in an open office," Newman says. With increased use of mobile technology, many workers want a choice of indoor and outdoor work spaces. Commercial-grade kitchens and feature-rich fitness centers that might include basketball courts and squash courts are on the amenity wish list for some clients, Newman adds. "The convergence of

'Redesigns need a process to understand use of space and employee habits.'

LISE NEWMAN, AIA, SMITHGROUP

pleasure with work is here to stay," she says.

Employers and designers are looking to technology to improve work efficiency, space usage, occupant comfort, and security. Analytics can help companies understand workspace demand, says Val Loh, Principal, Syska Hennessy Group. If an organization learns that 10% of employees work outside the office every day, it can cut office space by 10% and slash real estate costs. "In

a major metro area, that's a substantial amount," Loh says.

Continued improvement in the performance of wireless technology has prompted some clients to raise the possibility of a totally wireless data environment. Loh warns that the technology is not yet reliable enough for that. "We still recommend at least one wire per workstation," he says, even for non-mission-critical systems.

Loh recalls one pharmaceutical client that wanted to go 100% wireless. Syska Hennessy convinced the client to stick with the one-wire-per-desk protocol. It turned out that many of the company's laptops were not compatible with the latest wireless networking. The wired option saved the company from paying for an immediate wholesale replacement of older laptops.

Mobile technology can enhance the work environment by allowing employees to reserve workspaces, change light settings, adjust heating and cooling at their workstations, arrange valet parking, dry cleaning, and provide mass transit updates.

Technology also offers new security tools. Cameras with video analytics can warn security personnel about unattended bags and packages, unauthorized people loitering around secure facilities, and suspicious vehicles.

Cameras, perhaps combined with palm or fingerprint recognition systems, might some day replace keycards and fobs for access control, says Loh. Workers at many high-rise office buildings have to carry two cards—one to enter the main lobby, another to get into their offices. In the future, video analytics and handprint systems could eliminate the need for any keycards.

HIGH-RISE MASS TIMBER CATCHING ON

The Class A office sector has become an early adopter of high-rise mass timber as the critical structural component. "Many of the first mass timber projects in the U.S. are offices because the 2015 IBC code already has a path for them," says Chris Evans,



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The lobby of the National Science Foundation headquarters, Alexandria, Va., links two towers, one 19 stories tall, the other 14. WDG Interiors designed the interiors for the LEED Silver project.

See full **GIANTS 300** rankings and bonus categories at: BDNetwork.com/Giants2019

Director, Swinerton Mass Timber, a spinoff of construction giant Swinerton. Most U.S. mass timber projects to date have been on the West Coast, close to cross-laminated timber suppliers, but a new CLT facility is coming online in a converted 227,000-sf General Electric facility in Dothan, Ala.

Mass timber structures offer the potential to save about 15% on the construction schedule and have a lighter superstructure than concrete. "Once you have the floor installed, trades can start working below," says Evans. "There is no shoring system needed. You

can start four to six weeks earlier compared to a post-tensioned system."

Being lighter than concrete means reduced earthwork and foundation work, he adds. Some sites that may not have the bearing for concrete structures without extraordinary engineering measures may be able to support a mass timber structure. Exposed wood beams add a biophilic aesthetic to interior spaces. "Design firms love it," Evans says.

Mass timber visionaries keep looking to build higher. A developer in Vancouver recently proposed a

35-40-story tower with a mass timber frame and concrete core. For now, the sweet spot is up to six stories, says Evans. "We see a lot of 120,000 to 300,000 sf projects that are five or six stories high," he says.

Evans is convinced that mass timber will continue to attract converts, especially in the office market. "We believe that it will not be a niche market," he says. "In the future, this is how many projects will be built, whether beams are exposed or not."

For full **Giants 300** rankings and bonus categories, visit: BDNetwork.com/Giants2019.

OFFICE SECTOR ARCHITECTURE + AE FIRMS TOP 10			OFFICE SECTOR ENGINEERING + EA FIRMS TOP 10			OFFICE SECTOR CONSTRUCTION + CM FIRMS TOP 10		
Rank	Company	2018 Office Revenue	Rank	Company	2018 Office Revenue	Rank	Company	2018 Office Revenue
1.	Gensler	\$719,907,266	1.	Jacobs	\$489,150,000	1.	Turner Construction	\$2,828,021,069
2.	AECOM	\$292,100,000	2.	Burns & McDonnell	\$98,242,999	2.	STO Building Group (formerly Structure Tone)	\$2,737,400,000
3.	Perkins+Will	\$183,950,450	3.	WSP USA	\$95,462,696	3.	AECOM	\$2,271,400,000
4.	Stantec	\$163,825,041	4.	Thornton Tomasetti	\$86,897,907	4.	Clayco	\$1,489,000,000
5.	HOK	\$159,795,000	5.	Arup	\$77,487,618	5.	Clark Group	\$1,381,490,453
6.	NELSON Worldwide	\$97,984,158	6.	Syska Hennessy Group	\$38,290,774	6.	Gilbane	\$1,339,757,000
7.	Interior Architects	\$71,677,254	7.	Dewberry	\$36,977,162	7.	DPR Construction	\$1,338,888,000
8.	Skidmore, Owings & Merrill	\$58,905,205	8.	EXP	\$34,959,800	8.	Holder Construction	\$1,303,000,000
9.	ZGF Architects	\$58,599,967	9.	NV5 Global	\$31,728,245	9.	Balfour Beatty US	\$1,300,660,404
10.	SmithGroup	\$55,898,891	10.	AKF Group	\$24,101,098	10.	Whiting-Turner Contracting Co., The	\$1,092,271,753

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RENTAL RESURGENCE

Apartment construction keeps moving along, but affordable housing lags behind.



Residents exercise at the Francis Goldin Apartments, a 100-unit senior housing tower designed by Dattner Architects for developer Delancey Street Associates. The 15-story structure is part of the planned Essex Crossing community in New York City's Lower East Side.

For full
GIANTS 300
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categories go to:
[BDCnetwork.com/
Giants2019](http://BDCnetwork.com/Giants2019)

BY PETER FABRIS, CONTRIBUTING EDITOR

Despite higher construction costs and the paucity of premium sites in urban cores, the multifamily market—notably the market-rate and luxury rental sectors—remains strong. More than 318,000 units are likely to be delivered nationally this year, says market analyst firm Newmark Knight Frank.

“There is no loss of demand,” says James Gray, Senior Principal, Stantec. “The country is under-housed,” adds Megan Dimmer, CEO, Humphreys & Partners Architects. In 2019, the occupancy rate of U.S. apartments stands at 95%, with rents rising 3.5% YOY, she says.

Limited availability of good sites where demand is greatest could slow the market a bit in 2020. “A lot of product in this cycle has been infill,” Gray says.

There are only so many of those sites to be had, and “it is starting to get to the point where projects are hard to pencil in the urban core,” he says.

“As deals get harder to fund in first-tier cities, development is going to second-tier areas,” says Luis Arambula, Principal, Vice President of Architecture, MVE + Partners. Good sites in Los Angeles are limited, so investment has shifted to neighboring Orange County. Salt Lake City is an emerging market that bears watching, he adds.

In California, the 2016 building code now allows developers to build up to three concrete levels above grade—up from one level previously. Now, eight stories—five levels of wood frame above a three-story concrete pedestal—has become the most popular multifamily form, Arambula says, as building higher with wood becomes more economical.



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BRIDGING THE AFFORDABILITY GAP

Los Angeles is the latest big city to mandate requirements for affordable housing in new large multifamily projects. “Affordable housing is now becoming part of every project if you have to deviate at all from zoning,” Arambula says. “You are allowed increased density in exchange for affordable units. But when you add affordable units, you have to subsidize them, so rents in other units go up.”

Broadly speaking, one-bedroom apartments in the urban core have shrunk from about 700 sf to 550–600 sf over the past 10 years, Gray says. “One bedrooms and studios probably can’t get much smaller,” he says. Some developers are embracing three- and four-bedroom units intended not for families but for singles with roommates, he says. Cities with acute housing shortages like Seattle, New York, and Boston are allowing micro-apartments.

IS PREBAB THE NEXT BIG THING?

New techniques, such as prefabrication—or what has become known as “industrial construction” (BDCnetwork.com/IndustrialConstruction)—and modular building could help cities meet at least some of their affordable housing needs, says Arambula.

Daniel Gehman, AIA, NCARB, Principal in Charge with Humphreys & Partners Architects, says clients have been looking hard at prefab options in recent months. “Until recently, you could offer a study, but it wouldn’t engage. Then about 18 months ago, there was a tectonic shift,” says Gehman.

More prefab vendors have displays at trade shows, and developers have taken notice. Gehman says modular will be “a key to our critical mission to house more people in America.”

Humphreys & Partners has devised a signature design line, which it calls “e-Urban,” that increases

rentable density to a new level (BDCnetwork.com/Humphreys2019). Previously, the firm’s densest design prototype offered 85–86% efficiency, partly by eliminating long corridors in high-rises, says Chief Innovation Officer Walter Hughes, AIA. The firm’s latest design raises efficiency to 92–94%, Hughes says. The design can accommodate modular components and still provide an amenity-rich environment—roof terraces, dog spas, social areas, etc.—to be competitive.

Providing amenities in new high-end developments continues to vex developers. “Renters see these properties as not just a place to live, but part of their lifestyle,” says Gray. A mixed-use approach that includes a restaurant or café tenant, or a feature-rich fitness center operated by a third party, adds amenity space that also generates income for the owner.

Lobbies are being reworked into multiuse spaces with third-party food and beverage vendors. Peter Chmielewski, City President—Chicago, Lennar Multifamily Communities, told a recent Marcus & Millichap conference that “free coffee” can cost a developer \$40,000 a year.

Gehman says lobby cafés can provide an appealing ambience for prospective tenants to meet with leasing agents. As developers rely more and more on virtual property tours to engage new renters, they may be able to repurpose some of their lobby space previously dedicated to leasing purposes.

The explosive growth of package deliveries continues to be a concern for developers. A concept undergoing beta testing at a major developer’s headquarters would have robots delivering packages to valet closets close to the unit’s front door, Gehman says. Valet closets could also store laundry for dry cleaning and trash for robotic pickup. He says developers are eager for any new strategy that frees up space now occupied by lobby storage areas.

For full Giants 300 rankings and bonus categories: BDCnetwork.com/Giants2019.



MULTIFAMILY SECTOR ARCHITECTURE + AE FIRMS TOP 10			MULTIFAMILY SECTOR ENGINEERING + EA FIRMS TOP 10			MULTIFAMILY SECTOR CONSTRUCTION + CM FIRMS TOP 10		
Rank	Company	2018 Multifamily Revenue	Rank	Company	2018 Multifamily Revenue	Rank	Company	2018 Multifamily Revenue
1.	Humphreys & Partners Architects	\$71,667,500	1.	Kimley-Horn	\$115,529,696	1.	Lendlease	\$2,505,211,046
2.	KTGY Architecture + Planning	\$58,418,579	2.	WSP USA	\$44,651,496	2.	AECOM	\$1,558,500,000
3.	Solomon Cordwell Buenz	\$51,202,613	3.	Thornton Tomasetti	\$36,288,000	3.	Suffolk	\$1,547,306,451
4.	CallisonRTKL	\$44,462,000	4.	Jordan & Skala Engineers	\$25,523,036	4.	Clark Group	\$1,360,345,538
5.	Perkins Eastman	\$37,368,315	5.	DeSimone Consulting Engineers	\$25,330,308	5.	Gilbane	\$1,137,687,000
6.	Stantec	\$31,730,617	6.	AECOM	\$22,300,000	6.	Whiting-Turner Contracting Co., The	\$911,173,512
7.	Skidmore, Owings & Merrill	\$31,399,682	7.	Simpson Gumpertz & Heger*	\$18,929,131	7.	Plaza Construction	\$735,000,000
8.	Niles Bolton Associates	\$30,300,882	8.	Jensen Hughes	\$15,430,000	8.	Balfour Beatty US	\$701,583,184
9.	SLCE Architects	\$28,000,000	9.	Morrison Hershfield	\$13,509,268	9.	PCL Construction Enterprises	\$644,721,077
10.	Hord Coplan Macht	\$26,989,894	10.	KPFF Consulting Engineers	\$11,890,995	10.	Swinerton	\$561,700,000

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The Beverly Knight Olson Children's Hospital, built by Robins & Morton for Navicent Health. The five-story addition to The Medical Center of Macon, Ga., includes a new emergency center, imaging suites, a new pediatric unit, and a new 66-bed NICU and CCU.

TOM HARRIS

'SMART HOSPITAL' ON THE HORIZON

These buildings perform functions like a medical practitioner.

BY PETER FABRIS, CONTRIBUTING EDITOR

Upgrades to medical equipment and systems and improvements to building systems are the current focus in the healthcare market.

Healthcare consolidation contributes to this trend. After larger health systems acquire smaller, rural facilities, there's typically a push to renovate them and upgrade technology, says Robin Savage, President/COO, Robins & Morton. "A lot of this work is centered on diagnostic and imaging and service areas like women's services," says Savage.

The next big advancement: the so-called "smart hospital." With multiple systems able to communicate with each other, such a building perform functions like another medical practitioner.

At the \$1.6 billion Mackenzie Vaughan Hospital, now under construction in Toronto, building systems and medical technology will be linked. When a patient's monitor detects a heart attack, it will send a silent alert to critical care response team members equipped with wearable location services badges. The badges will automatically override elevator controls, giving team members express service to the patient's floor.

Engineering giant WSP is examining ways to deploy Amazon Echo to aid HIPAA compliance and patient safety, says WSP's Gary Hamilton, Senior Vice President and Eastern Healthcare Lead. Alerts could be sent to surgical recovery nurses every four hours to ensure that patients receive pain medication on time.

Smart hospitals will also boost energy efficiency. Artificial intelligence would analyze data from building management

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**HEALTHCARE SECTOR
ARCHITECTURE + AE FIRMS | TOP 10**

Rank	Company	2018 Healthcare Revenue
1.	HDR	\$258,472,700
2.	HKS	\$158,618,636
3.	Stantec	\$154,477,562
4.	Perkins+Will	\$148,290,570
5.	CannonDesign	\$115,000,000
6.	SmithGroup	\$93,922,069
7.	Perkins Eastman	\$82,771,685
8.	NBBJ	\$82,700,000
9.	HGA	\$79,017,130
10.	HOK	\$78,810,000

SOURCE: BD+C 2019 GIANTS 300 REPORT

**HEALTHCARE SECTOR
ENGINEERING + EA FIRMS | TOP 10**

Rank	Company	2018 Healthcare Revenue
1.	Jacobs	\$265,030,000
2.	WSP USA	\$75,071,145
3.	IMEG Corp	\$59,612,291
4.	KPFF Consulting Engineers	\$39,636,649
5.	Affiliated Engineers	\$38,214,744
6.	Smith Seckman Reid	\$35,072,434
7.	Henderson Engineers	\$35,000,000
8.	Mazzetti	\$26,376,933
9.	TLC Engineering Solutions	\$26,297,493
10.	AKF Group	\$25,118,225

SOURCE: BD+C 2019 GIANTS 300 REPORT

**HEALTHCARE SECTOR
CONSTRUCTION + CM FIRMS | TOP 10**

Rank	Company	2018 Healthcare Revenue
1.	Turner Construction	\$2,536,806,484
2.	Brasfield & Gorrie	\$1,443,044,863
3.	McCarthy	\$1,335,212,642
4.	Robins & Morton	\$1,020,435,711
5.	Skanska USA	\$1,011,717,569
6.	DPR Construction	\$823,914,000
7.	JE Dunn Construction	\$788,790,127
8.	Whiting-Turner Contracting Co.,The	\$784,265,774
9.	Layton Construction	\$593,636,897
10.	Walsh Group,The	\$548,874,080

SOURCE: BD+C 2019 GIANTS 300 REPORT



systems and scheduling software to determine how best to use space. Knowing that a patient was just discharged, smart building technology could turn down the HVAC in the empty room and punch it back up when the room is scheduled to be reoccupied.

Using fiber optic systems throughout the building, MEP systems can be integrated with low-voltage systems such as AV and alarm systems. Once linked, these systems can enable smart hospital features. “In five years, the occupant-aware building is going to be commonplace in healthcare,” says Hamilton.

BIM and virtual reality are being used to analyze how healthcare medical professionals use space. “As we design key clinical spaces, we are mapping travel distances,” says Kate Renner, AIA, LEED AP BD+C, Design Researcher and Architect, HKS Inc. The data populates detailed behavior maps, which inform the creation of digital renderings that can be experienced in VR.

HKS also creates full-scale cardboard mockups of key spaces such as inpatient rooms and surgical suites that provide valuable feedback from medical personnel on the positioning of equipment, cabinetry, and sinks.

Coping with natural disasters also figures into the early stages of programming and design. A sudden influx of patients from a hurricane, tornado, or earthquake could be accommodated if emergency rooms were equipped with double medical gas outlets in headwalls so that trauma victims could be doubled up in each room. Post-anesthesia care units outfitted with extra medical gas and headwall capacity could also function as emergency care units following a disaster, says Renner.

Structural dampeners and reinforced stabilizers for overhead MEP systems are being required in earthquake-prone areas. After Mercy Hospital, Joplin, Mo., was destroyed by a tornado in 2011, collapsed MEP

assemblies were found to be the major source of damage, says Renner. To make the replacement structure more resilient, the design also included reinforced stabilizers for the MEP systems, laminated safety glass, reinforced stairwells, battery-powered lights, and wall hooks that can be used to ease patients down stairs with sleds and ropes.

Owners of critical facilities have increased their supply of water storage and generator fuel, Hamilton says. The Veteran’s Administration now requires a two-week supply of water, not the previous one-week standard.

PREFAB ON THE UPSWING

Prefab construction of mechanical systems continues to grow. “At least one headwall manufacturer is now including ductwork and insulation,” says Hamilton. “At most trade shows, we’re seeing four or five prefab bathroom manufacturers.”

Prefab exterior wall systems are an increasingly compelling option, says Tim Johnson, Vice President/ Division Manager, Brasfield & Gorrie. Evaluating prefab options is a task owners now count on their project teams to assess.

Lean construction is also in demand. “At least three out of four RFPs that we see address Lean management and Lean construction,” Savage says. Contractors must be involved earlier than ever to provide cost and constructability analysis. “Architects and GCs are now being selected at about the same time,” says Johnson.

“During pre-construction, owners require you to commit expensive and knowledgeable resources at the beginning—as much as 12 months before breaking ground,” says Savage. The extra effort does make for an improved architect-contractor relationship, says Hannah Wickham, Vice President, Business Development, Brasfield & Gorrie.

For full Giants 300 rankings and bonus categories, visit: BDCnetwork.com/Giants2019.



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Last year, Aligned Energy began expanding its data center campus in Phoenix (itself a repurposing of an old Honeywell facility) by 200,000 sf, which would bring its total to 550,000 sf at buildout sometime next year. The campus' critical capacity will be 120 MW, with an industry-leading 1.15 PUE. Aligned Energy offers an efficient, sustainable platform, reducing water usage by up to 85%. Multiple top-tier customers are currently being served at this facility. HKS was the AOR on this project.

FEEDING THE BEAST

AEC firms are stretching to keep up with data center demand.

BY JOHN CAULFIELD, SENIOR EDITOR

In 2018, Holder Construction did \$1.38 billion in data center construction. As of May 2019, it had 28 data center projects in the works, and the firm expects construction this year to approach \$3 billion. One such project—in Phoenix, for a large REIT—opens in July with 6 MW of processing capacity, and will reach 48 MW when it's eventually built out to around 500,000 sf.

To keep pace with this sector's expansion, Holder is increasing its headcount by 25%. "The AEC industry is very close to being overwhelmed by data center demand, especially for electricians," says Tony TeVault, Vice President with Holder's office in Atlanta. "Every market is at full capacity and equipment vendors are super-stretched."

Data center sector growth is creating opportunities for AEC firms, as owners scramble to build facilities as fast as they can. "Speed to market" is this sector's abiding objective, in part to accommodate looming 5G technology.

"As soon as a client receives a positive capacity demand signal in a region, the race is on to design and build a data center at rapid pace," says James Coe, PE, Senior Principal with Syska Hennessy, whom *BD+C* interviewed with Joshua Fluecke, PE, LEED AP, Associate Principal. They note that engineering design teams are under pressure to adapt a provider's prescriptive design within an eight- to 12-week window, and to offer construction

administration support for an accelerated build schedule that typically falls between seven and nine months.

"Contractors need to use every tool at their disposal to ensure just-in-time delivery of materials and methods like prefabrication to shorten schedules," says John Arcello, Advanced Tech Core Market Co-Leader with DPR Construction. "The magic will happen in the planning stages: pre-construction and VDC services have the tools to drive the process," especially in design-build collaborations that he says are more common within this sector.

Another "tool" some AEC firms have availed themselves of is the acquisition of talent and market share to serve a consolidating sector with fewer and bigger players. Last December, the engineering firm Morrison Hershfield merged with CCG Facilities, a mission-critical engineering firm. And last March, HED joined forces with the data-center specialty firm IDG.

HYPERSCALE AND EDGE FACILITIES PREVAIL

The sector is polarized between two dominant building types: massive hyperscale facilities and much smaller data centers for edge computing, which are usually located near population centers to ensure smooth content delivery.

Hyperscale data centers are simply getting bigger. Robert Sty, PE, LEED AP, Director of the Tech Sector for HDR, says that it wasn't too long ago when data centers with

DATA CENTER SECTOR ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2018 Data Center Revenue
1.	Corgan	\$66,573,221
2.	HDR	\$31,099,695
3.	Gensler	\$26,179,857
4.	AECOM	\$23,700,000
5.	Page	\$15,000,000
6.	Harley Ellis Devereaux	\$13,165,959
7.	Highland Associates	\$8,900,000
8.	DLR Group	\$7,300,000
9.	KZF Design	\$6,413,029
10.	Stantec	\$6,088,906

SOURCE: BD+C 2019 GIANTS 300 REPORT

DATA CENTER SECTOR ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2018 Data Center Revenue
1.	Vanderweil Engineers	\$49,734,800
2.	ESD	\$41,286,002
3.	KW Mission Critical Engineering	\$30,100,000
4.	Jacobs	\$28,610,000
5.	EXP	\$28,434,000
6.	Morrison Hershfield	\$23,493,542
7.	WSP USA	\$21,178,596
8.	Syska Hennessy Group	\$18,781,392
9.	Salas O'Brien	\$17,845,268
10.	Dewberry	\$14,130,694

SOURCE: BD+C 2019 GIANTS 300 REPORT

DATA CENTER SECTOR CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2018 Data Center Revenue
1.	Whiting-Turner Contracting Co., The	\$2,139,472,765
2.	Turner Construction	\$1,681,639,824
3.	Holder Construction	\$1,509,000,000
4.	DPR Construction	\$1,400,411,000
5.	Fortis Construction	\$894,313,000
6.	HITT Contracting	\$680,436,372
7.	STO Building Group (formerly Structure Tone)	\$501,400,000
8.	JE Dunn Construction	\$457,636,009
9.	Hensel Phelps	\$370,755,980
10.	AECOM	\$249,300,000

SOURCE: BD+C 2019 GIANTS 300 REPORT

20 MW of capacity were considered large. Now, hyperscale campuses are being planned for 200 to 300 MW of power and millions of square feet.

Gary Murphy, a Principal with HED, says data centers are being designed for 500+ MW. "Data centers are becoming more industrialized: as demand grows, so does their scale and performance."

Water cooling for cabinets is becoming more prevalent, as owners push the envelope on higher allowable temperatures to lower their operational costs. Terence

Denery, Vice President of Structure Tone's Mission Critical division, has seen some users locate IT racks in parking lots to test equipment tolerances and take advantage of free air cooling. Matt Lamont, HKS's Vice President and Mission Critical Team Leader—America West Region, adds that a key discussion among clients revolves around driving the power usage effectiveness (PUE) ratio—the power entering the data center over the power used—to sub 1.15 levels.

These hyperscale facilities put pressure on local utilities to provide the power, water, and industrial wastewater required for their operations, says Ken Gilmartin, Jacobs' Senior Vice President and GM—Advanced Facilities and Federal Solutions.

For one client, construction engineer McKinstry led the testing of four different power generation solutions within a live data center to determine the best solution for a rollout across multiple locations. (The client chose natural gas.) Dan Ronco, McKinstry's Director of Electrical Construction, adds that more clients are considering renewable energy sources. He cautions, however, that "the hard part is making intermittent renewables work in critical, always-on environments."

Edge computing facilities support the market's time-critical functions (e.g., streaming). Coe of Syska Hennessy has seen micro data centers as small as one cabinet within a facility to 150 kW self-contained modular

buildings. HKS's Lamont says that the "maximum load" of edge centers his firm has worked on has been 1,000 kW, and they often run without human personnel.

"These types of facilities must be approached as a product design, and not as a custom solution for each location," says Bruce Edwards, RA, a Principal with Morrison Hershfield. He elaborates that because edge data centers are pretty similar, their standardized design and construction lend themselves to prefabrication or modular options.

"Prefabrication and modular construction for data centers is becoming more consistent and reliable," says Annette Allen, Fluor's Vice President, Business Development—Life Sciences and Advanced Manufacturing. "They can reduce the amount of engineering required, and drive capital efficiencies, meaning cost and scheduling certainty."

This 245,000-sf data center, which opened last year, anchors Raging Wire's 78-acre campus that will eventually have seven buildings. HED provided architecture and MEP services to design the facility for retail and wholesale customers. It has six data halls, 33 MW of backup generator power, waterless cooling using pumped refrigerant economizers and condensers, and 16 MW of critical IT load. The building also has 52,000 sf of support and amenities spaces including lounges, kitchens, meeting rooms, and a shipping/receiving dock.



COURTESY HED



360-DEGREE LEARNING

K-12 schools are emphasizing practical, hands-on experience and personalized learning.



An outdoor classroom at Coolidge Corner School, a preK-12 in Brookline, Mass., which John F. Kennedy once attended. HMFH Architects was the design firm. CRJA-IBI Group was the landscape architect. Shawmut Design and Construction was the CM.

BY MIKE PLOTNICK, CONTRIBUTING EDITOR

The nation's school districts are focused on providing well-rounded learning experiences that plant seeds for future vocations in science, technology, business, or skilled trades.

In New Hampshire, the new Dover High School and Regional Career Technical Center brings together 1,500 students in a combined 302,000-sf facility.

"Parents and educators recognized the importance of making sure the career technical students were exposed to the highest academic standards possible, and that the traditional students had more involvement in hands-on programs and activities," says Laura Wernick, FAIA, REFP, LEED AP, Senior Principal, HMFH Architects, Cambridge, Mass. "The high-bay spaces are integrated with traditional academic spaces, so a science classroom might be next to an automotive lab."

School districts are continuing to shift their focus toward STEM and STEAM learning. NeoCity Academy, a new 500-student public STEM magnet high school in

Kissimmee, Fla., will open in August. Located in a 500-acre technology district, the net-zero energy facility will expose students to an engineering, biomedical, and cyber security curriculum in immersive, flexible learning environments. Many of the school's instructors will come from the University of Central Florida and the Florida Advanced Manufacturing Research Center.

Gould Evans and DLR Group collaborated on the design of the Missouri Innovation Campus in Lee's Summit, Mo. The STEM-focused facility unites 600 high schoolers and 1,200 University of Central Missouri students in a shared campus that enables high school graduates to earn associate and bachelor degrees.

Elementary schools are also embracing new learning environments. At Centerview Elementary School, a new K-4 school in Spring Lake Park, Minn., flexible learning studios include spaces for group learning, active learning, STEM, and specialized learning.

Outdoor classrooms, a rain garden, school gardens, and natural play elements are integral learning elements at Coolidge Corner School, an urban pre-K-12 school in Brookline, Mass. "Varied outdoor environments can play an

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important role in a student's social and emotional development," says Pip Lewis, Principal, HMFH Architects.

OVERCOMING FUNDING LIMITATIONS

Some school districts are circumventing funding obstacles through creative renovation projects, says Steven Herr, AIA, Director of Design, Fanning Howey, Indianapolis. "An old elementary school can become an innovation campus. A spirit shop can become a business incubator lab," he says. Schools are becoming more diligent in identifying and repurposing underused space for a modern use.

In Hilliard, Ohio, a suburb of Columbus, Fanning Howey oversaw the transformation of a traditional K-6 into a new innovation campus, all without moving a single wall. The Hilliard Innovative Learning Hub, which serves grades 6-12, provides experiences not available elsewhere in the district, such as a new Design Thinking course that incorporates language arts, science, and public speaking.

Public referendums are no longer the obvious go-to strategy for funding K-12 construction. "More states are going to need to pursue alternative methods to fund projects that won't require voter approval," such as private partnerships offered as tax credits and tax-direct incentives to districts, says Vaughn Dierks, AIA, LEED AP, Partner, Wold Architects and Engineers, Saint Paul, Minn.

Many rural and smaller communities can't afford to make even basic investments in maintenance and infrastructure. In Colorado, the BEST (Building Excellent Schools Today) grant program allocates a portion of state revenue to fund school facilities in need, particularly in small districts. "This is one way states are making safe, modern, effective teaching environments accessible to all students," says Dierks.

The Texas legislature is considering a \$9 billion plan, including property tax reform, to fund the state's public schools. "This is a heated topic," says Angela Cardwell, Chief Marketing Officer, Joeris General Contractors, San Antonio. "While funding for construction comes from bonds and not from the same pool of money as allocated by the state legislature, any reform will impact the overall state of



school spending."

Wold's Dierks says school districts can use maintenance projects as a means to achieve broader goals. Edina, Minn., is studying how to use roof replacements as an opportunity to partner with third-party solar panel providers to maximize life cycle benefits and minimize costs, he says. The Minneapolis Public Schools system is using the renovation of outdated restrooms and locker rooms as an opening to set new practices for personal comfort and safety amid questions of gender identity, equity, and privacy.

Some K-12 schools are expanding their core educational mission to provide broader social and human service functions for students and communities. Last March, Mayo Clinic opened a health clinic at the Alternative Learning Center, a nontraditional school in Rochester, Minn., where about two-thirds of students qualify for free or reduced-price lunches. The new clinic provides acute and chronic medical care to students and their dependents; payment is adjusted according to ability to pay. Other onsite conveniences provide homeless students with daycare, showers, laundry facilities, and clothing and food shelves.

For full Giants 300 rankings and bonus categories, visit: BDCnetwork.com/Giants2019.

Fanning Howey reimaged a traditional K-6 school and turned it into the Hilliard (Ohio) Innovation Hub, which now serves grades 6-12.

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Giants2019**

K-12 SECTOR ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2018 K-12 School Revenue
1.	DLR Group	\$90,100,000
2.	PBK	\$85,100,000
3.	Huckabee	\$81,479,500
4.	Stantec	\$64,906,046
5.	VLK Architects	\$44,589,875
6.	Perkins+Will	\$39,658,940
7.	Wold Architects	\$34,000,000
8.	Perkins Eastman	\$30,971,130
9.	NAC Architecture	\$29,908,497
10.	HMC Architects	\$29,594,748

SOURCE: BD+C 2019 GIANTS 300 REPORT

K-12 SECTOR ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2018 K-12 School Revenue
1.	AECOM	\$58,300,000
2.	Jacobs	\$49,002,000
3.	IMEG Corp.	\$17,912,991
4.	KPFF Consulting Engineers	\$17,837,059
5.	WSP USA	\$16,936,215
6.	CMTA	\$14,170,159
7.	NV5 Global	\$13,505,827
8.	Interface Engineering	\$11,087,159
9.	Dewberry	\$9,131,117
10.	STV	\$7,692,704

SOURCE: BD+C 2019 GIANTS 300 REPORT

K-12 SECTOR CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2018 K-12 School Revenue
1.	Gilbane	\$673,890,000
2.	Balfour Beatty US	\$560,725,760
3.	Turner Construction	\$478,061,391
4.	CORE Construction Group	\$444,559,723
5.	Skanska USA	\$334,307,218
6.	McShane Companies, The	\$272,813,949
7.	JE Dunn Construction	\$264,794,288
8.	Kraus-Anderson Construction Company	\$261,000,000
9.	Nabholz	\$241,403,058
10.	McCarthy	\$232,319,265

SOURCE: BD+C 2019 GIANTS 300 REPORT

HOTELS ARE RUNNING HOT AND COOL

Hotel construction is at its highest since the start of the Great Recession.

The 278-key InterContinental Hotel at The Wharf, Washington, D.C., designed by BBGM for developer Hoffman-Madison, achieved LEED Gold certification.

BY PETER FABRIS, CONTRIBUTING EDITOR

Hospitality is hot—and, as we shall see, it's also cool. Very cool.

The global hotel construction pipeline hit a 10-year high in 2018, according to Lodging Econometrics. In the U.S., nearly 670,000 rooms were in development or under construction last year—116,000 rooms shy of the 2008 peak. New York, Los Angeles, Nashville, Dallas, and Houston are particularly robust.

Upgrading the guest experience is a major focus of the sector. "Amenities are getting designed early," says Ed Cettina, CEO, Global Building Construction, AECOM. In some cases, the property is conceived around amenities, particularly dining and wellness spaces. A growing number of hotels and resorts have partnered with third-party restaurateurs to create multiple dining options under the same roof. "Large resorts might have seven to fifteen food and beverage venues," says Eddie Abeyta, AIA, LEED AP,

Principal, Chief Design Officer, HKS.

Lush spas are a must for new four- and five-star properties. In the casino/resort submarket, "there is a trend to capture more overnight stays by offering well-appointed spas for spouses," says Brent Hughes, Vice President of Operations, C.W. Driver Companies.

Fitness and wellness are strong themes in many new developments. The recently opened Equinox Hotel at New York's Hudson Yards boasts "the world's most advanced fitness experiences, 24 hours a day." Equinox owns hundreds of upscale gyms nationwide, but Hudson Yards is its first in the hospitality realm—and, at 60,000 sf, its largest.

Some properties are offering medical treatment, even surgical facilities, on site, says Ben Martin, HKS's Principal and Director of Consulting. Hair transplants, Botox, liposuction, and nips and tucks can be had in private resort settings offering luxurious recovery rooms.

A new resort will offer guests an agritourism experience. The project, being developed by a well-known brand, addresses two strong industry trends: wellness and regional

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authenticity, says Melissa Voelker, AIA, NCARB, LEED AP, HKS's Senior Vice President, Hospitality Group. Located in a pastoral setting about two hours from Philadelphia, the resort will offer rest, relaxation, spa pampering, and excursions to local farms to harvest fruits and vegetables. Participants will then trek to a resort restaurant for a lesson from the chef in preparing the harvest for that night's dinner. "Tourism is changing," Voelker says. "Travelers are looking for destinations where they can touch the community and the lifestyle."

Tourists are also demanding venues in far-flung outposts, even in the Arctic Circle and Antarctica. "Cold is the new hot," says Martin. Norway's Svart Hotel is billed as "the world's first energy-positive hotel concept by the Arctic Circle." Set to open in 2021, the generously fenestrated donut-shaped structure will offer panoramic views of a glacier, arctic landscape, and the Northern Lights. At the other end of the earth, the White Desert Resort in Antarctica serves those who want "a carbon-neutral experience that is as luxurious as it is adventurous." Travelers can check out the local Emperor penguins.

At a more mundane level, hotels are delivering a home away from home experience with large-screen TVs and digital entertainment options, says Hughes. Guests want to binge watch their favorite Netflix shows and view YouTube clips on the road, just like at home. "Wi-Fi is incredibly important," Hughes says. "Bad Wi-Fi will definitely get mentioned on Yelp."

Technology is also having a big impact behind the scenes, particularly on project programming and preliminary design. Leo A Daly designers use tools powered by artificial intelligence to compare thousands of possible building forms and parameters—site topography, zoning requirements, the structure's footprint, orientation, guest room sizes, and corridor widths. AI tools can crunch hundreds of thousands of factors, taking into account the clients' financial models and looking at the ramifications of different design parameters, and produce a dozen basic

building models. From there, designers can evaluate the options for presentation to the clients.

The technology reduces the time needed to develop the basic outline of a design, leaving more time to explore the finer aspects, says Ryan D. Martin, AIA, NCARB, Vice President, Director of Hospitality Architecture, Leo A Daly. AI-driven tools are good at repetitious, rule-of-thumb processes. "We're trying to let AI do that, so we can spend more time on the fun stuff," he says.

AI-aided models can incorporate empirical business data, such as projected revenue per room, to guide designers' decisions on the guest experience, functional flow, and spatial adjacencies within the financial context of the project. "AI lends credibility to the decisions we make," says Martin.

AI tools are not right for every project, says Martin. "Some are too small; some do not have enough variation in them. But they are increasingly a part of our process."

LODGING SECTOR TAKING IN MODULAR

Hospitality project innovation is extending to construction techniques. Marriott International said in April that it will build the world's tallest modular hotel in New York City. The \$65 million, 360-foot-tall AC Hotel New York NoMad is scheduled for final on-site assembly in late fall, with a late 2020 planned opening. The property's 168 prefabricated fully furnished guest rooms will be stacked on top of a traditionally built podium.

Since 2017, Marriott's development partners in North America have opened 31 low-rise structures that incorporate prefabricated guestrooms or bathrooms. The hospitality giants' goals for modular include reducing construction costs for its franchisees, speeding up scheduling, and coping with the U.S. construction labor shortage.

Innovation in programming, design, and construction is making the hospitality segment a highly engaging market for AEC firms.

For full Giants 300 rankings and bonus categories, visit: BDCnetwork.com/Giants2019.



HOTEL SECTOR ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2018 Hotel Revenue
1.	Gensler	\$83,636,305
2.	WATG	\$77,798,000
3.	HKS	\$70,967,821
4.	HBG Design	\$27,481,000
5.	Steelman Partners	\$27,200,000
6.	Cooper Carry	\$26,362,007
7.	Wilson Associates	\$25,830,000
8.	Perkins Eastman	\$24,440,000
9.	Perkins+Will	\$23,261,120
10.	CambridgeSeven	\$18,980,000

SOURCE: BD+C 2019 GIANTS 300 REPORT

HOTEL SECTOR ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2018 Hotel Revenue
1.	NV5 Global	\$29,582,316
2.	EXP	\$25,700,900
3.	Jensen Hughes	\$16,246,000
4.	KPFF Consulting Engineers	\$13,873,394
5.	Thornton Tomasetti	\$10,368,834
6.	WSP USA	\$9,816,619
7.	FEA Consulting Engineers	\$8,475,000
8.	Kimley-Horn	\$8,233,929
9.	DeSimone Consulting Engineers	\$7,494,518
10.	Arup	\$6,081,109

SOURCE: BD+C 2019 GIANTS 300 REPORT

HOTEL SECTOR CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2018 Hotel Revenue
1.	Suffolk	\$1,050,773,573
2.	Yates Companies, The	\$551,173,000
3.	AECOM	\$505,500,000
4.	Swinerton	\$397,300,000
5.	Turner Construction	\$391,546,128
6.	PCL Construction Enterprises	\$390,488,970
7.	Mortenson Construction	\$368,970,000
8.	DPR Construction	\$326,183,000
9.	Webcor	\$288,200,000
10.	dck worldwide	\$265,580,000

SOURCE: BD+C 2019 GIANTS 300 REPORT

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MANAGING THE LAST MILE

Online sales fulfillment is redefining the industrial buildings sector.

Automation, including vertical lift modules, carousel systems, and automated storage and retrieval, is widely used by retailers such as Dollar General, whose facility in Janesville, Wis., is shown here.

BY JOHN CAULFIELD, SENIOR EDITOR

The demand created by the unstoppable growth of ecommerce continues to have a major impact on the industrial building sector's design and construction of factories, warehouses, distribution centers, and fulfillment centers.

Walmart Mexico is in the midst of a five-year program to build 15 distribution centers across that country. SSOE Group has engaged in the design and construction management of three of these so far: a 376,000-sf building in Chihuahua, a 645,000-sf distribution center in Tabasco, and a 400,000-sf facility in Chalco, according to Erick Kuri, SSOE's Mexico Division Manager.

Stantec is experiencing greater demand for distribution centers (DCs) in all geographies, says George Halkias, a Senior Principal with the firm. He says the location of warehouse, distribution, and fulfillment centers is often deter-

mined by how quickly that building can be operational.

Michael Schmidt, Leo A Daly's Market Sector Leader for Food, Distribution, and Manufacturing, sees clients shifting from large, remote distribution facilities to fulfillment centers closer to metros. One retail client, Target, commissioned his firm to transform one quarter of the square footage in five of Target's million-sf DCs to accommodate fulfillment functions.

Ware Malcomb, which designs about 70 million sf of industrial space annually, is designing fulfillment centers that range from 40,000 sf to more than a million sf. Jim Terry, a Principal with the firm, notes that ceiling heights in some specialized ecommerce centers reach as high as 100 feet. Developers are considering cubic volume (abetted by technology) to accommodate more goods, and are asking for buildings with up to 40 feet of clear ceiling height.

Eric Buer, Burns & McDonnell's Real Estate Development Director, says there's a "huge need" for various types of warehousing and logistics capacity in response to the

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online sales boom. But at the current pace of development, only about half of the needed space over the next five years will be available.

The industry is definitely homing in on strategies to enhance and improve last-touch distribution capabilities. “The costs associated with multiple deliveries are the single largest target margin left in this cycle,” says Brian Chatham, a Project Manager with Burns & McDonnell. Chatham anticipates that freight consolidation by seller or delivery point will be an ongoing effort among operators.

Automated storage and retrieval systems and robotics in general are becoming more common in industrial facilities, too, so Stantec has been working with clients to determine automation’s real impact on their ROI. Stantec uses such tools as discrete-event simulation and mathematical optimization to model, test, improve, and evaluate systems performance in a virtual environment against stated project objectives.

Kuri of SSOE adds that automation integration is driving mechanical and electrical support systems to accommodate fewer employees, “or essentially be able to go dark with lighting systems only for maintenance.”

Tech is pervasive in this sector. Todd Schell, Senior Vice President—Industrial Sector for Ryan Companies, spots a “renaissance” in concrete technology that, for DCs, helps to minimize the need for sawcut or other joints that are hard on equipment. Prefabrication is also a growing trend, which Schell says is being utilized mostly for MEP construction.

Ryan Companies uses BIM and VDC frequently during the design phase of industrial projects to eliminate conflicts. Clayco, which started or completed 41.2 million sf of industrial projects in 2018, designs all projects for this sector in 3D and in ways that the facility can be built in modularized sections offsite, says Anthony J. Johnson, Clayco’s Executive Vice President and Industrial Business Unit Leader.

As industrial buildings move nearer to urban areas,

their designs are taking into account the surrounding aesthetic. “Our design approach is to look at warehouses as workplaces worthy of design excellence as a Class A office building,” says Schmidt of Leo A Daly.

The primary goal of any big change in this sector is, inevitably, faster delivery. “That requires finding land closer to customers, efficiency in scaling, and shortening delivery timeframes,” observes Clayco’s Johnson.

Buer says his firm is working on design ideas “for same-day, same-hour delivery options.” Like other AEC firms in this sector, Burns & McDonnell is keeping a close eye on the demand for and efficacy of multistory warehouse and distribution centers that last year started popping up in a few U.S. cities.

“The exciting new trend is for freestanding, multistory warehouses within metro areas,” says Borys Hayda, Partner and Managing Principal with DeSimone Consulting Engineers, which is designing five such projects to be located in the New York boroughs of Queens, Brooklyn, and The Bronx.

Ware Malcomb is working on five multistory distribution projects that are in various stages of development. The firm has master-planned over 50 sites to accommodate these facilities in major North American markets, says Michael Bennett, a Principal with the firm.

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Order fulfillment, spurred by ecommerce, is transforming warehouses and distribution centers. Target recently commissioned Leo A Daly to convert one quarter of the space in five of its larger distribution centers—including this 470,000-sf food distribution center in Lake City, Fla.—to accommodate fulfillment functions.



INDUSTRIAL BUILDING SECTOR ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2018 Industrial Building Revenue
1.	AECOM	\$184,800,000
2.	Stantec	\$60,273,273
3.	Ware Malcomb	\$45,714,169
4.	FSB Architects & Engineers	\$18,387,831
5.	Macgregor Associates Architects	\$15,393,532
6.	Gresham Smith	\$14,540,000
7.	NELSON Worldwide	\$13,279,135
8.	RS&H	\$9,300,000
9.	Gensler	\$6,444,747
10.	Leo A Daly	\$5,630,000

SOURCE: BD+C 2019 GIANTS 300 REPORT

INDUSTRIAL BUILDING SECTOR ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2018 Industrial Building Revenue
1.	Jacobs	\$1,880,390,000
2.	Fluor Corp	\$198,300,000
3.	IPS-Integrated Project Services	\$135,100,000
4.	CRB	\$128,592,432
5.	SSOE Group	\$117,569,000
6.	Jensen Hughes	\$86,803,000
7.	Burns & McDonnell	\$84,863,837
8.	Ghafari Associates	\$34,600,000
9.	BRPH	\$26,460,000
10.	Salas O'Brien	\$21,037,970

SOURCE: BD+C 2019 GIANTS 300 REPORT

INDUSTRIAL BUILDING SECTOR CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2018 Industrial Building Revenue
1.	Fluor Corp	\$1,664,300,000
2.	Clayco	\$1,191,000,000
3.	Jacobs	\$1,171,880,000
4.	ARCO Construction	\$1,024,031,298
5.	Gray Construction	\$955,449,982
6.	Walbridge	\$941,811,543
7.	Hensel Phelps	\$844,223,201
8.	Turner Construction	\$741,436,752
9.	Haskell	\$676,321,248
10.	DPR Construction	\$634,503,000

SOURCE: BD+C 2019 GIANTS 300 REPORT

FLYIN' HIGH

Multibillion-dollar expansions are helping air hubs meet explosive passenger demand.

At Seattle-Tacoma International Airport, the new 32,400-sf Concourse D Annex opened less than a year after ground was broken. The project's integrated design-build team included The Walsh Group and HOK, working with the Port of Seattle.

BY MIKE PLOTNICK, CONTRIBUTING EDITOR

Aging facilities, rising passenger and cargo volume, and surging technology demands are fueling a period of unprecedented redevelopment at airports across North America.

"The aviation market is busier than I've seen it in my 25 years in the industry," says Dwight Pullen, Senior Vice President and National Director of Skanska's Aviation Center of Excellence. "The U.S. is one of the most mature aviation markets in the world. The average age of major hub airport terminals is 40 to 45 years old."

What's most remarkable is not just the raw number of projects, but also the sheer scale of them. Numerous U.S. airports are undergoing modernization programs with construction values exceeding \$1 billion.

"We used to see these megajobs every three to five years, but now we're seeing several come out each year, at airports of all sizes," says Pullen.

The new Eastern Concourse that opened at New York's LaGuardia Airport late last year was the first component of a \$4 billion phased redevelopment of Terminal B. A broader \$8 billion blueprint to redevelop the entire airport will unify all terminals under one roof.

Other multibillion-dollar terminal redevelopment projects currently under construction: a new terminal complex and infrastructure at Salt Lake City International Airport; an expansion of Terminal 1 at San Diego International Airport; redevelopment of Terminal 1 at San Francisco International Airport; a new Central Passenger Terminal Complex at Atlanta's Hartsfield-Jackson International Airport; a new South Terminal Complex at Orlando International Airport; and a new Midfield Satellite Concourse at Los Angeles International Airport.

Even with the crowds and the disruption surrounding major construction projects, North American airports achieved record high passenger satisfaction scores in the J.D. Power 2018 North America Airport Satisfaction Study.

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A planned expansion of Chicago's O'Hare Airport attracted a who's-who of architects eager to design the new 2.25 million-sf global terminal, a signature element of O'Hare's broader \$8.5 billion expansion. Chicago-based Studio Gang earned the assignment, together with design collaborators STL Architects, Solomon Cordwell Buenz, Corgan, and Milhouse Engineering & Construction.

To fund projects, airports are embracing alternative procurement schemes such as public-private partnerships. The airlines themselves are often taking lead positions as investment partners in these capital projects.

At Seattle-Tacoma International Airport, the new 32,400-sf Concourse D Annex opened less than a year after ground was broken. The project's integrated design-build team included The Walsh Group and HOK, working with the Port of Seattle. "Our clients have been very interested in evaluating accelerated delivery options," says Thomas Haag, Walsh's Vice President and National Director of Aviation.

Airport expansions provide opportunities for capturing non-aeronautical revenue through expanded retail and food-and-beverage concessions.

"Everyone is focused on providing reasons for someone to get to the airport early and spend more time—and money—while they're waiting for a flight," says Skanska's Pullen. Parking is another top revenue source. "With Uber and Lyft, you'd think it would be declining, but we're still seeing airports building new parking structures to extend their parking revenue," he says.

Terminal redevelopments represent a high-stakes gamble to boost economic development and tourism. "The recent efforts by cities to land Amazon HQ2 prove how critical airports are to a city's economic health, quality of life, and ability to compete with other cities and regions," says Pat Askew AIA, LEED AP, Principal and Director of Aviation at HKS.

Airports are also serving as a home base for broader redevelopment initiatives. The former headquarters of

Braniff International Airways, a landmark building that has been vacant for more than a decade, is getting new life as an aviation hub that anchors a mixed-use development along the east side of Dallas Love Field. Scheduled to open this summer, the 26-acre Braniff Centre, designed by Burns & McDonnell and The Gravity Company, will have more than 180,000-sf of hangar space, aviation support facilities, and retail and entertainment components.

Eastern Concourse at New York's LaGuardia Airport opened last December, serving Air Canada, American, Southwest, and United Airlines. HOK was the designer.

BIOMETRICS IMPROVE SECURITY AND BOARDING EFFICIENCY

Facial recognition technology and other AI-derived biometrics are already in place at many airports, primarily to enhance security for passengers leaving U.S. terminals on international flights. The technology can take nine minutes off the boarding time for a wide-body aircraft.

"It's both a security enhancement and a means of enhancing self-service and facility throughput, which is a benefit for travelers," says David Yeaman, President of the Aviation and Federal Group at Burns & McDonnell.

Late last year, Atlanta's Hartsfield-Jackson International Airport and Delta Air Lines opened the nation's first curb-to-gate biometric terminal. U.S. Customs and Border Protection is working toward implementing biometric exit technology to cover more than 97% of departing commercial air travelers within the next four years.

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AIRPORT FACILITIES SECTOR ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2018 Airport Revenue
1.	AECOM	\$201,600,000
2.	Gensler	\$71,102,226
3.	HNTB Corporation	\$65,915,831
4.	Corgan	\$54,081,775
5.	HOK	\$50,512,000
6.	Stantec	\$27,066,452
7.	RS&H	\$26,700,000
8.	PGAL	\$25,500,000
9.	Skidmore, Owings & Merrill	\$24,453,345
10.	Gresham Smith	\$24,230,000

SOURCE: BDC 2019 GIANTS 300 REPORT

AIRPORT FACILITIES SECTOR ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2018 Airport Revenue
1.	Jacobs	\$265,350,000
2.	Arup	\$97,149,637
3.	Burns & McDonnell	\$85,626,735
4.	Ghafari Associates	\$30,100,000
5.	Kimley-Horn	\$22,330,490
6.	Arora Engineers	\$17,236,911
7.	Ross & Baruzzini	\$15,353,000
8.	STV	\$14,147,655
9.	Stanley Consultants	\$12,694,641
10.	EXP	\$10,434,000

SOURCE: BDC 2019 GIANTS 300 REPORT

AIRPORT FACILITIES SECTOR CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2018 Airport Revenue
1.	Hensel Phelps	\$1,362,338,425
2.	AECOM	\$735,800,000
3.	Turner Construction	\$712,485,972
4.	Skanska USA	\$629,798,736
5.	PCL Construction Enterprises	\$496,261,802
6.	Austin Commercial	\$487,921,829
7.	Walsh Group, The	\$467,701,402
8.	Swinerton	\$292,800,000
9.	Holder Construction	\$280,000,000
10.	Clark Group	\$245,016,896

SOURCE: BDC 2019 GIANTS 300 REPORT

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- 10 Owner/Developer/Manager
 11 College/University
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OTHERS ALLIED TO THE FIELD

- 90 Other (please specify) _____

3. Which category best describes your job title?

(Check one box only.)

- 10 Architect/Designer/CAD-BIM Specialist
 20 Building Owner/Property Developer

- 30 Construction Professional
 40 Engineer/Engineering Manager
 50 Facility, Building, Property or Asset Manager
 60 Specifications Writer
 70 Other Company or Firm Management
 90 Other (please specify): _____

4. Which of the following building types does your firm own, manage, design or build? (Check ALL that apply.)

- A Airport/Transportation
 B College/University
 C Correctional Facilities/Courthouses
 D Cultural Facilities
 E Data Centers/Mission-critical
 F Government/Military
 G Hospitals/Healthcare
 H Hotels/Resorts/Casinos/Restaurants
 I Industrial/Warehouses
 J K-12 Schools
 K Multifamily Housing
 L Office Buildings
 M Religious/Places of Worship
 N Retail Shopping/Malls/Big Box
 O Senior Housing/Assisted Living
 P Sports/Recreation/Stadiums
 Z None of the above

5a. Do you buy, specify, approve or recommend the following building systems, products, services or equipment for your projects?

Yes No

5b. Which building products, systems, services or equipment do you buy, specify, approve or recommend? (Check ALL that apply.)

- 01 Structural Systems - Concrete, Steel, Wood, Brick + Masonry
 02 Building Envelope Systems - Cladding, Glass, Insulation, Windows and Doors, Moisture Control, Architectural Metals
 03 Interior Systems - Ceilings, Flooring, Gypsum, Kitchen + Bath, Paints + Coatings, Hardware, Daylighting, Wall Coverings, Furniture, Furnishings, Shades
 04 Building Systems - Building Automation, Lighting, Electrical, HVAC, Plumbing, Security, Life Safety, Fire Protection, Sun Control, Elevators + Escalators, Solar + Wind
 05 Computer Systems - Laptops, Tablets, Software, BIM, CAD, Printers

6. Current Projects (Check ALL that apply.)

- A Is your firm directly involved in any phase of renovation or reconstruction projects? Yes No
 B Is your firm directly involved in green building or sustainability projects? Yes No
 C Is your firm using BIM (building information modeling) in projects? Yes No
 D Does your firm engage in projects under design-build delivery? Yes No

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SMART SENSOR MAINTAINS PRIVACY, ENHANCES SAFETY IN SENSITIVE SPACES

The HALO IOT sensor is designed for use in places where cameras are not welcome.

PRIVACY CONCERNS HAVE BECOME an everyday part of life for most people, especially in big cities and heavily populated areas. It seems like the moment someone ventures out of their home or workplace, they become the star of their very own “Truman Show,” thanks to the abundance of security cameras and sensors monitoring every move they make.

While some argue these cameras are an invasion of privacy, they have also proven to be invaluable in catching crimes where the culprit would otherwise get off scot-free.

But even in today’s world, there are still some places where cameras are not welcome: bathrooms, locker rooms, hotel rooms, patient rooms, senior housing units, and residential units. In the delicate balance between safety and privacy, spaces like these have always leaned more toward remaining private at the risk of extra security. But a new smart sensor from IPVideo Corporation looks to maintain privacy while also increasing the safety of these personal spaces.

The HALO IOT Smart Sensor has multiple sensors to monitor audio analytics, air quality, chemicals, light, and environmental factors without

the use of a camera.

The audio analytics include gunshot detection, glass breakage, shouting, excessive banging, and bullying. Air quality sensors can detect vape, THC, smoke, formaldehyde, benzene, and VOCs. The HALO’s chemical sensors can detect ammonia, oxidizers, methane, propane, natural gas, carbon monoxide, carbon dioxide, and glues,

HALO has 11 built-in sensors to monitor audio analytics (e.g., shouting, bullying), air quality (vape, smoke), chemicals (oxidizers, methane), light, and environmental factors (occupancy, humidity).

while the light and environmental sensors track things like occupancy, temperature, humidity, and pressure.

“When we designed HALO it was intended for limited applications doing vape detection and audio analytics for school construction projects,” says Jack Plunkett, Chief Technology Officer, IPVideo. “It has now evolved into an unlimited number of construction use cases.”

HALO has 11 built-in sensors that utilize advanced



IPVIDEO CORP.



analytics to adjust and maximize the settings for the specific room. For example, a HALO sensor in a locker room can be adjusted for that space to get fewer false alarms from body sprays and disinfectant sprays. It connects directly to a security monitor and VMS and, because it is a security product and not a Web app, there are no annual

cloud fees. When a sensor detects something out of the ordinary, an alert is sent via email or text message and digital alerts are sent via video management.

The sensor has an operating temperature between 32 F and 122 F and zero to 90% relative humidity. It is 3.1x5.8 inches. Mounting options: ceiling flush or surface mount.

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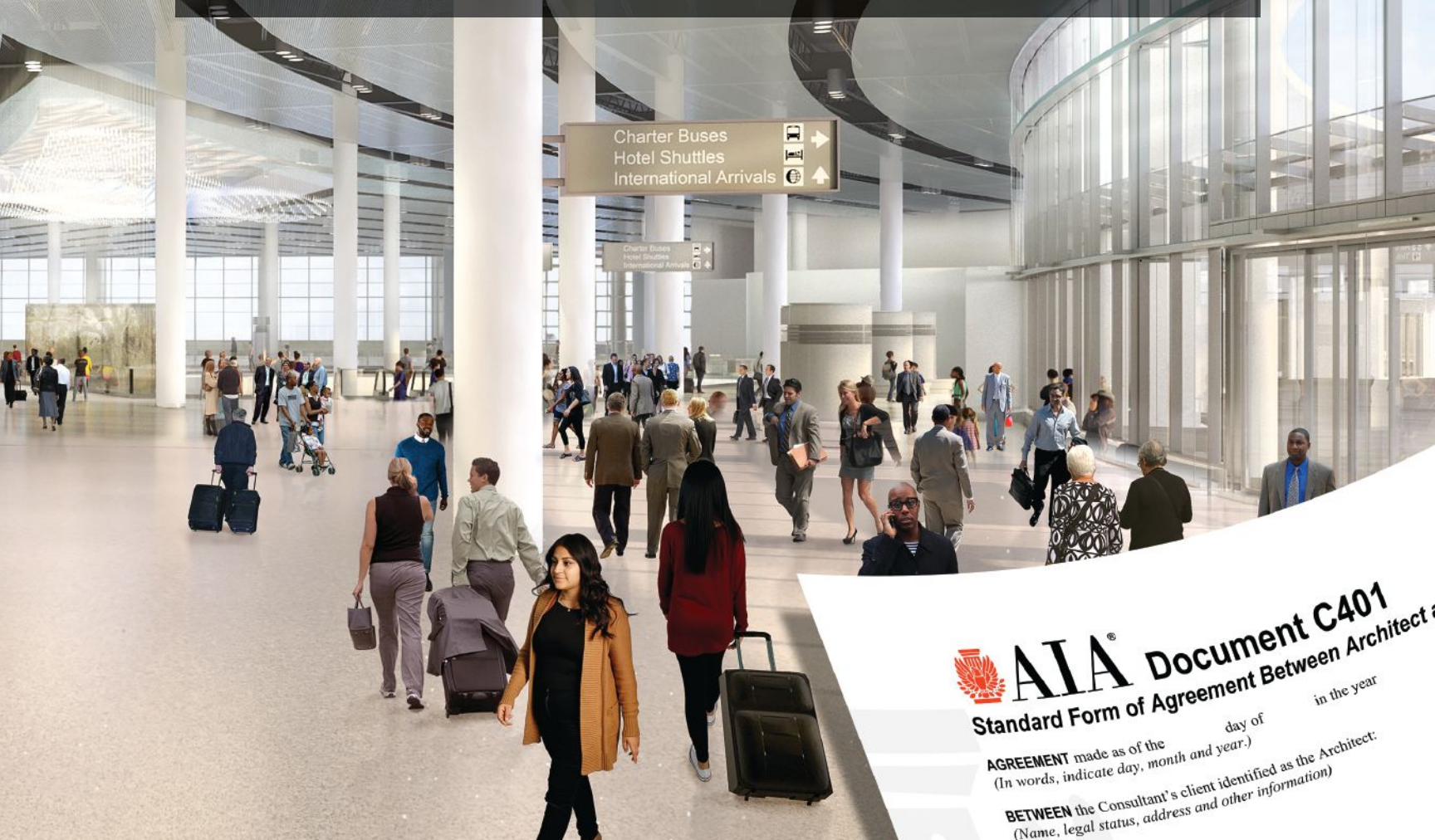
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AIA Contract Documents used: C401-Architect/Consultant Agreement.

Learn more about the project at aiacontracts.org/bdc-nola-airport



 **AIA** Document C401
Standard Form of Agreement Between Architect & Consultant
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