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JULY/AUGUST 2022

2022 GIANTS 400 REPORT

Ranking the Nation's Most Prominent Design and Construction Firms

19

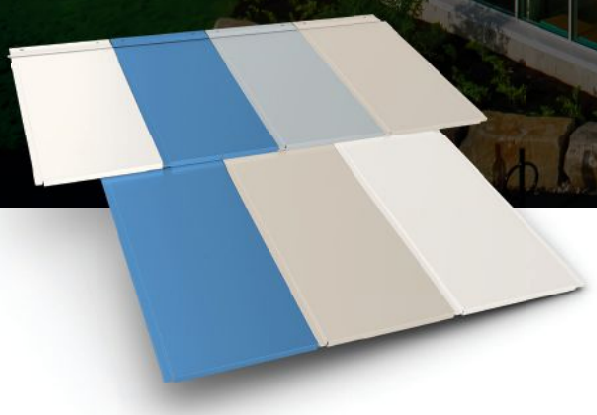
UBER HEADQUARTERS
SAN FRANCISCO, CALIF.

HORIZON

Playful Patterning

Photo: hortonphotoinc.com

The patterning of the Precision Series Tile hues from cream upward to mottled grays, with splashes of sea/sky blue creates a mosaic, described by the architect as inspired by rippling water and natural elements. Explore PAC-CLAD's palette and expand your creative process.



Children's Museum + Theatre of Maine, Portland, ME Installing contractor: Industrial Roofing and Siding
Architect: Bruner/Cott Architects Distributor: North Bridge Building Products GC: Zachau Construction

Precision Series TS Tile
Metal Roof and Wall System

Cityscape, Berkshire Blue,
Stone White, Granite

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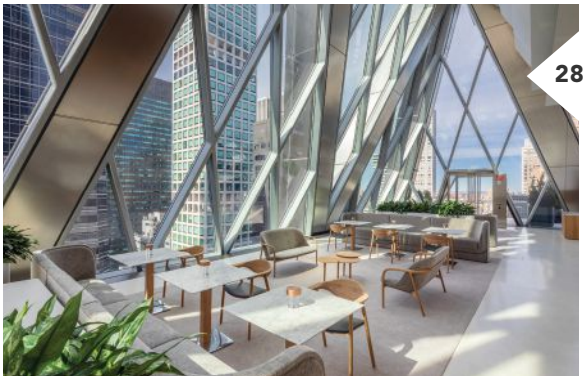

FEATURES

DEPARTMENTS

p.46

AIA CONTINUING EDUCATION

Solutions for cladding supply and performance

WINNER JESSE H. NEAL AWARDS Est. 1959

2014-2017, 2019-2020 JESSE H. NEAL AWARD WINNER

ON THE COVER: The new 450,000-sf, ground-up global headquarters campus for Uber consists of two glass-clad buildings (one seven stories, the other 12 stories), linked by a pair of skybridges. The exterior façades of the buildings feature a natural ventilation system comprised of glass, metal, and wood assemblies. The design architect was SHoP Architects; Truebeck Construction was the GC. **PHOTO: JASON O'REAR**

BUILDING DESIGN+CONSTRUCTION PRESENTS

Life of an Architect

a podcast by architects for architects

BD+C AND BOB BORSON, FAIA, have teamed up to bring you Life of an Architect, a twice-monthly podcast that delves into all things architecture and design.

CHECK OUT THE LATEST Life of an Architect episodes:

EPISODE 105

INTERIOR ARCHITECTURE

Architecture is a field with a wide variety of possible pathways and careers. Bob Borson, FAIA, and Andrew Hawkins, AIA, focus their attention on the closely related field of interior architecture.

EPISODE 104

ARCHITECTURE CONVENTIONS: THE BEST AND WORST OF TIMES

Bob and Andrew discuss the good, the bad, and the ugly of industry conventions.

EPISODE 103

THE ART OF BEING HAPPY

People—including architects—seem to be fairly unhappy at the moment. Bob and Andrew cover the art of being happy.

LISTEN TO ALL EPISODES AT:

BDCnetwork.com/lifeofanarchitect

REGISTRATION OPEN: 2022 WOMEN IN DESIGN+CONSTRUCTION CONFERENCE

We're excited to announce that the 2022 Women in Design+Construction Conference is back in-person. The 2022 WIDC event will take place September 26-28 at the Sofitel Chicago Magnificent Mile. Each year, WIDC brings together more than 150 leading AEC women for three days of professional development, leadership training, networking, and fun. Join us!

BDCnetworkwidc.com/2022

3 WAYS ARCHITECTS CAN RESPOND TO THE SUPREME COURT'S EPA RULING

The U.S. Supreme Court's ruling to limit the Environmental Protection Agency's power to regulate greenhouse gas (GHG) emissions from power plants dealt a significant blow to our ability to fight the climate crisis with federal policy. This decision will have immeasurable effects on the built environment, as AIA President Dan Hart outlined in his statement. But all is not lost. HOK's Director of Sustainable Design, Anica Landreneau, offers three ways architects can help.

BDCnetwork.com/HOK-EPA

REVERSE MENTORSHIP IN CONSTRUCTION

While the industry has made great strides to move beyond a stereotypical view of careers in construction, there is still work to be done to attract and retain workers. Younger generations aren't just interested in a job, they are seeking career opportunities. Reverse mentorship is one solution.

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4 EMERGING TRENDS FROM THE 2022 GIANTS

A record 519 architecture, engineering, and construction firms reported data for *BD+C*'s 2022 Giants 400 Report. The data offers a fascinating view of the overall health of the U.S. AEC industry, including revenue rankings across 25-plus building sectors, specialty categories, and industry disciplines (see the rankings starting on page 20).

Beyond the revenue numbers, the Giants survey asks firms to detail an innovation their team developed during the past year that has greatly impacted their firm's operations or projects. While only a little more than half of the participating firms responded to this request, the 278 innovation entries, when analyzed in aggregate, foretell emerging and expanding trends across the AEC industry. Here are four to note:

Firms are moving their teams, clients, and projects beyond the "do less harm" mentality of sustainability to a "restore the earth" mindset with regenerative design.

1. Firms address burnout and brain health. HKS and McMillan Pazdan Smith (MPS) are among the growing number of firms implementing formal cognitive health initiatives to help address staff burnout and improve employee health and well-being. MPS last year introduced 31 staff health initiatives, including incorporating "brain breaks" and meditation sessions into the workday, making healthy snacks freely available, and hosting virtual seminars on staying financially fit.

2. Regenerative design > sustainability. Four design firms—Cuningham, HDR, HOK, and Little—mentioned moving their teams, clients, and projects beyond the "do less harm" mentality of sustainability to a "restore the earth"mindset with regenerative design. Cuningham's regenerative strategies include in-house measures like monitoring carbon emissions to reduce or offset them, developing a climate action plan, and working on justice, equity, and diversity. Its project design strategies include reusing building infrastructure where possible and pursuing net-zero performance.

3. Finally! Some work-life balance. The COVID-19 pandemic forced AEC firms to get serious about work-life balance. Nearly a dozen firms mentioned shifting to a permanent hybrid schedule. Others are expanding their benefits package with work-life balance in mind. Pittsburg-based IKM Architecture introduced unlimited PTO last year. The firm also moved from a structured, eight-hour workday Monday-Friday, to a 40-hour work week Sunday-Saturday.

4. Robotics move beyond pilot testing. DPR Construction, HITT Contracting, Swinerton, and Turner Construction all report more formalized initiatives utilizing robotics on jobsites. HITT is using Boston Dynamics' Spot and Hilti's Jaibot for repetitive tasks such as drilling anchors. Swinerton last year became the first construction company with fully trained in-house operators for Dusty Robotics, and was an early adopter of that supplier's FieldPrinter on projects in California, Texas, and Virginia. Turner is using robotics for drywall finishing, perform layout, and overhead drilling.

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THE EV CHARGER STATION MARKET IS APPEALING TO INVESTORS AND DEVELOPERS, LARGE AND SMALL

There are just shy of 50,000 electric vehicle (EV) charging stations across the U.S., according to Department of Energy estimates. But with anywhere from 35 million to 44 million electric cars and trucks expected to be on the roads by 2030 (compared to around three million today), the U.S. will need 1.2 million public chargers and 28 million private chargers to keep pace with demand, according McKinsey & Company.

The federal infrastructure bill includes $7.5 billion for EV charging infrastructure, and President Biden has committed to adding 500,000 public chargers by 2030. There is also a slew of companies—including Tesla, ChargePoint, Electrify America, EVgo, and Volta—that's building networks of Level 3 fast-charging EV charging stations, to say nothing of the partnership between General Motors and Bechtel to build thousands of fast charging stations.

Amid this jockeying for position, the startup LL Development plans to begin construction this fall on The StackCharge, an EV charging station that aspires to enhance the user experience with a quick-service restaurant, 24/7 restrooms, WiFi, and an outdoor lounge area. LL Development is led by entrepreneur Lawrence Fung and real estate investor Lester Ciudad Real, who spoke with *BD+C* about their plans.

COURTESY STACKCHARGE

LL Development plans to open 10 StackCharge EV charging stations by the end of 2023. They will aspire to elevate the charging experience with food and beverage options and other amenities.

Fung said the notion for The StackCharge can be traced to his own experiences using existing stations to recharge the Tesla he purchased 18 months ago. He observed that EV chargers, in the main, seemed to be set up to serve the shopping malls whose parking lots they were located in, rather than motorists waiting for their cars to recharge.

How to fill that time was the question. "Maybe the answer," he recalled speculating, "was quick-service food and other amenities" that might elevate the charging experience.

At the time, there were some concepts for EV charging stations floating around, including one conjured by Gensler and BMW Designworks that suggested ways to convert conventional gas stations to EV charging meccas. But Fung said he wasn't convinced that most gas station operators were ready yet to change their business model, at least not until there was a lot more EVs in use.

The first StackCharge station, with 40 universal fast-charging ports, will be located on 1.29 acres in Baker, Calif., a pit stop between Las Vegas and Los Angeles. The nearly 2,500-sf retail pad on site—that once was a Starbucks—has a vacant existing drive-thru building that will be renovated and leased to a quick-service retail tenant. The chargers will be able to recharge vehicles within 30 minutes for up to 200 miles of driving distance.

Baker is already served by Tesla Supercharger, EVgo, and Electrify America, so StackCharge will be entering an already competitive market. Fung quipped that electric vehicles are "iPhones with wheels," and that his company plans to deploy digital marketing that targets drivers directly.

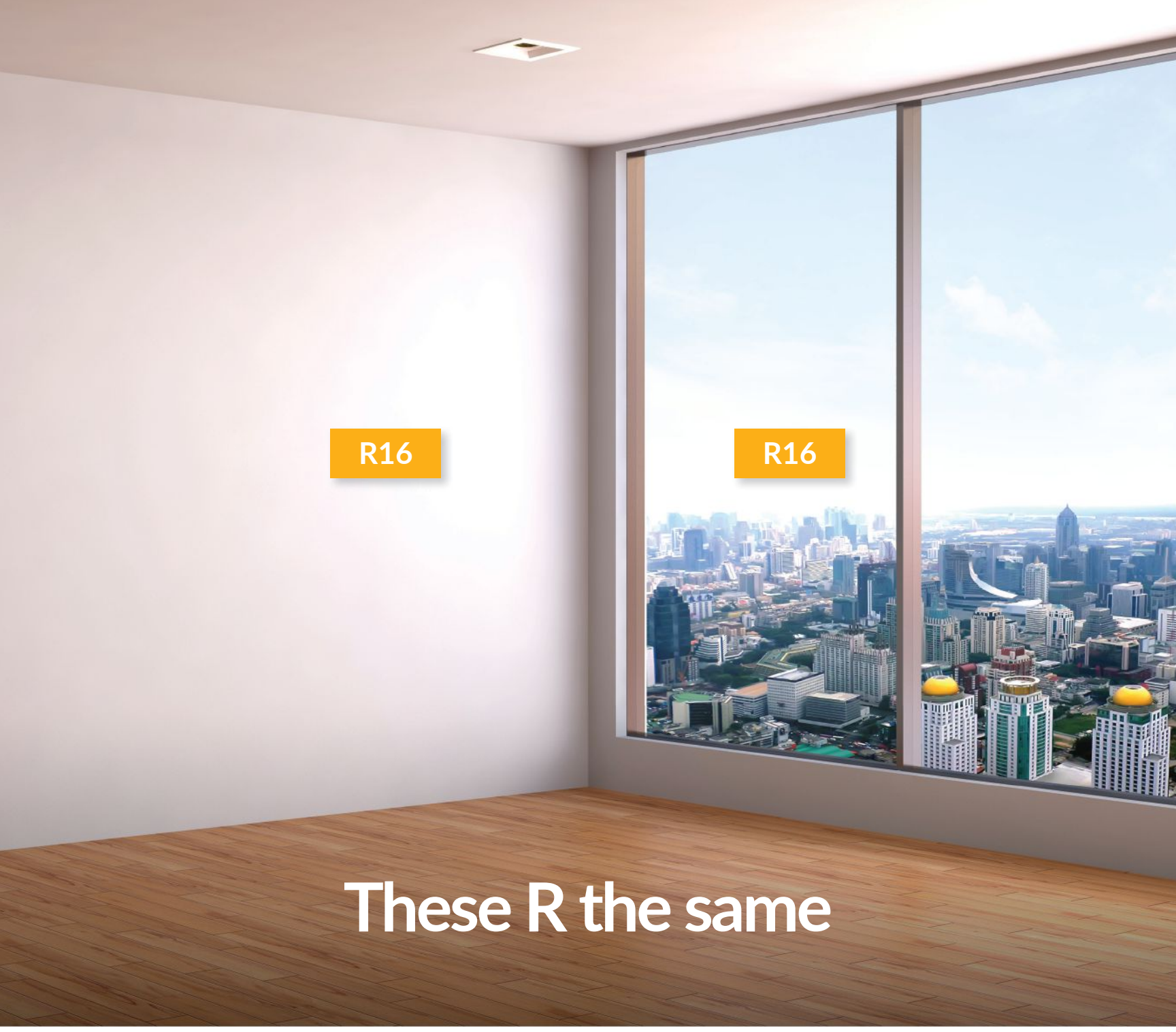
The first StackCharge is scheduled to open sometime next Spring. It will be the first of 10 stations in southern California.

29.1 MILLION

The amount (in square feet) of life sciences lab space currently under construction nationally that will be delivered within the following 12 to 24 months, according to CBRE. JLL research shows that venture capital investment in life sciences labs grew from $63 billion in 2019 to $103 billion through mid-2021. Lab space in New York City alone reached a record-high of 433,000 sf leased last year. The growing demand for lab space has made renovation and adaptive reuse of existing buildings more viable alternatives to new construction. The biggest benefits to renovating existing space versus building new are location, proximity to available talent, and speed to market.

$20 billion

The forecasted revenue for the U.S. telehealth sector by 2027, according to *Bloomberg Intelligence*. "Rising costs, value-based health care, more consumerization, and the pandemic are key catalysts creating demand for more digital solutions in the industry," says *Bloomberg*.



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FAA TO AWARD NEARLY $1 BILLION FOR 85 AIRPORT PROJECTS

The Federal Aviation Administration (FAA) will award nearly $1 billion to 85 airports of all sizes across the country to improve terminals. The grants will help expand capacity at the nation's airport terminals, increase energy efficiency, promote competition, and provide greater accessibility for individuals with disabilities. Two grants will also be awarded to build and improve new air traffic control towers.

Historically, the FAA has invested in runways, traffic-control towers, and back-of-house infrastructure. The recently enacted Bipartisan Infrastructure Law, though, dedicates funding to also support modernizing airport terminals.

Seventy grants contain an element that will expand terminal capacity. Forty-seven grants contain an element that will go to improving airport access to historically disadvantaged populations and rural airports. The law provides $1 billion annually for five years for airport terminal grants.

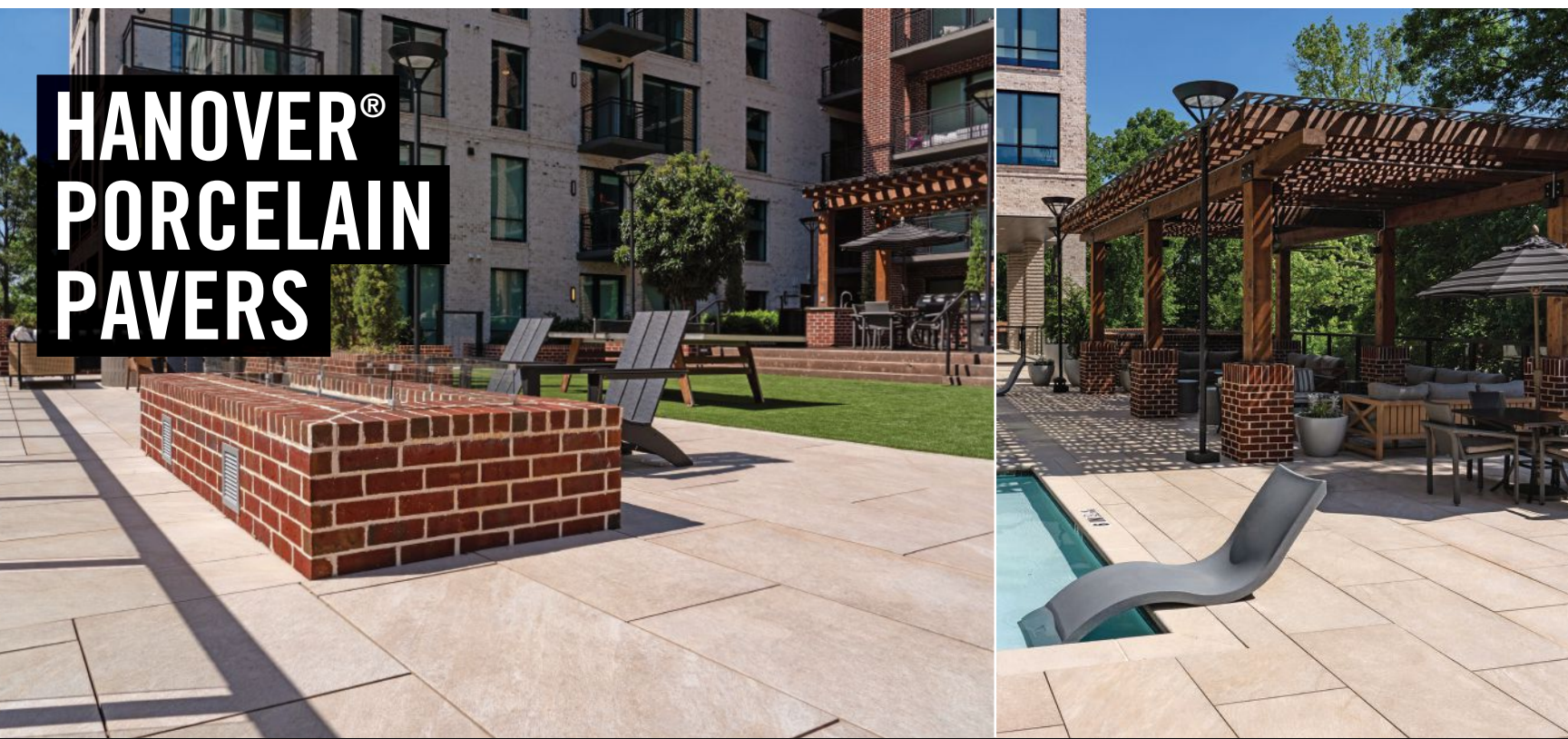
AISC LAUNCHES NEW DESIGN GUIDE FOR HYBRID STEEL-MASS TIMBER FRAMES

The American Institute of Steel Construction (AISC) has released the first-ever set of U.S. recommendations for hybrid steel frames with mass timber floors.

Design Guide 37: Hybrid Steel Frames with Wood Floors, written by Arup, encourages the use of mass timber floor systems in construction, "an underused yet important material to reduce the amount of carbon-intensive concrete in a structure," the release says. The guide provides a comprehensive context for this new building typology, detailing strategies from the perspective of multiple disciplines.

By facilitating this new generation of sustainable buildings, the guide will help accelerate the use of hybrid timber and steel in multistory residential and commercial construction. Mass timber is lightweight, and steel provides strength to structures and may better meet buildings' vibration and span requirements.

Hybrid steel-frame buildings with mass timber floor panels allow for longer beam spans and reduced column size than comparable mass-timber post and beam construction, making it an attractive option for market-driven spaces such as office buildings. Cross-laminated timber (CLT) flooring can take the place of carbon-intensive concrete slabs and may be left exposed in places, such as at soffits, eliminating the need for additional architectural finishes and allowing for the showcasing of the structural aesthetics of both steel and mass timber.



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CHECKING IN TO A BETTER GUEST EXPERIENCE: SF COSTS FOR HOTELS

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Clean and safe accommodations have always been a high priority to hoteliers, but in our post-COVID society this once mundane expectation is now a key selling point for travelers. Hotel facilities managers are looking to improve the guest experience and meet high cleanliness standards with HVAC system upgrades, the installation of no-touch technologies, contactless check-in and keyless entry systems, and the installation of anti-bacterial surfaces.

Hoteliers are also making improvements to meet green building expectations and anticipate guests' needs with a more personalized, homier experience. RSMeans data from Gordian can help estimate these costs. With localized, square foot costs on over 100 building models, including hotels, RSMeans data allows AEC professionals to quickly and accurately create conceptual estimates for future builds. The table above shows the most recent costs per square foot for 15-story hotels in select cities.

Visit rsmeans.com/bdandc for more information about RSMeans data from Gordian.

CITY	Q3 2021	Q4 2021	Q1 2022	Q2 2022	PERCENTAGE CHANGE
NEW YORK	$277.78	$287.72	$299.93	$295.76	6.47%
LAS VEGAS	$233.11	$244.12	$255.44	$252.74	8.42%
NEW ORLEANS	$197.89	$205.72	$219.02	$215.34	8.82%
LOS ANGELES	$251.03	$262.88	$275.53	$270.56	7.78%
SEATTLE	$240.67	$249.96	$262.37	$260.57	8.27%
PHOENIX	$200.32	$211.35	$226.31	$222.93	11.29%
CHICAGO	$255.67	$266.51	$279.23	$275.51	7.76%
MIAMI	$196.62	$208.36	$220.20	$218.52	11.14%
WASHINGTON, D.C.	$221.44	$228.93	$242.20	$237.95	7.46%
BOSTON	$246.21	$256.78	$271.16	$268.33	8.98%

Please note: Square foot models are used for planning and budgeting and are not meant for detailed estimates.

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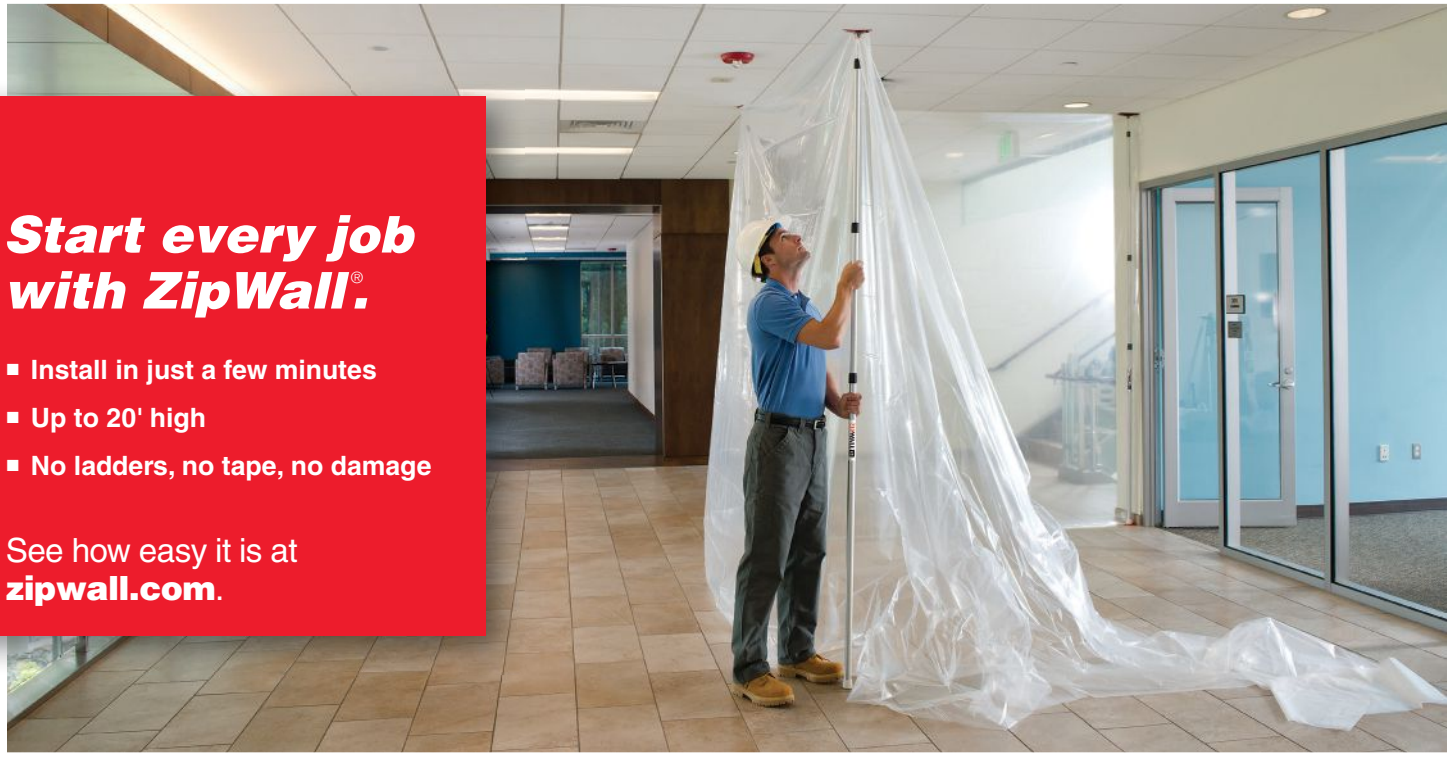

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SPACE SHUTTLE ENDEAVOUR GETS A NEW HOME AT THE CALIFORNIA SCIENCE CENTER

COURTESY ZGF

The California Science Center—a hands-on science museum in Los Angeles—recently broke ground on its Samuel Oschin Air and Space Center. At 200,000 sf and 20 stories high, the Air and Space Center will almost double the California Science Center's educational exhibit areas.

The new addition to the science center will contain 150 interactive, educational exhibits in three multilevel galleries. The hands-on exhibits will be designed to encourage visitors to investigate scientific and engineering principles of atmospheric flight and the exploration of the universe. The Air and Space Center's collection of aircraft and spacecraft will be selected to illustrate a key concept on each of its three multilevel galleries—air, space, and shuttle—across four floors and 100,000 sf of exhibit space.

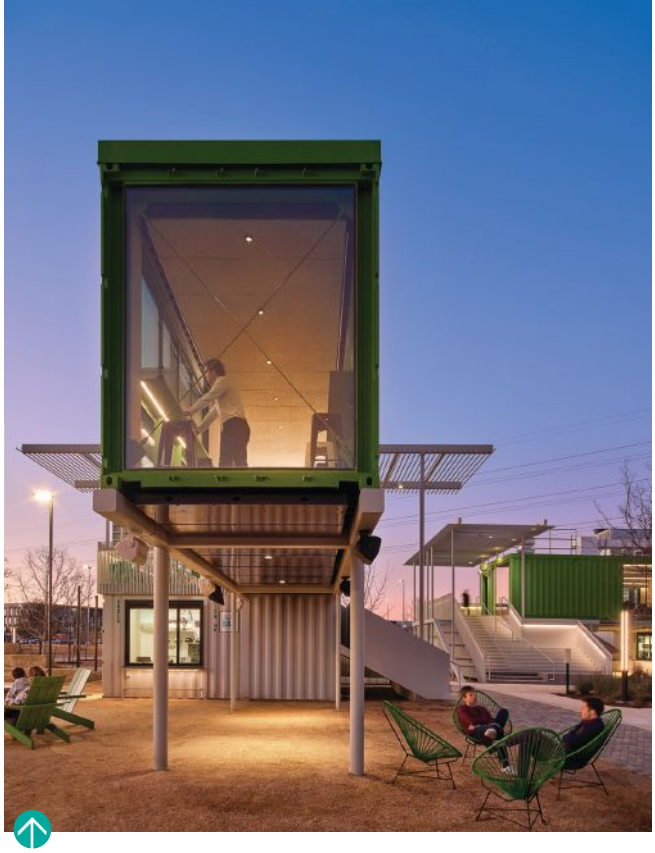
The center also will become the permanent home of Space Shuttle Endeavour, one of three remaining flown space shuttle orbiters. Endeavour will be presented in a "ready-to-launch" vertical configuration that will include solid rocket boosters and an external tank—the world's only display of an authentic space shuttle system, according to the project team. The June 1 groundbreaking event coincided with the 11th anniversary of Space Shuttle Endeavour's final touchdown.

The Samuel Oschin Air and Space Center marks the third phase of the California Science Center's three-phase, three-decade master plan to develop one of the world's leading science learning centers. Construction is expected to last three years. At about a year and a half into construction, Space Shuttle Endeavour will be positioned in the Air and Space Center.

Architectural design is by ZGF, construction by MATT Construction, and exhibit design by Evidence Design.

On the project team: owner and developer: California Science Center Foundation; design architect and architect of record: ZGF; MEP engineer and structural engineer: Arup; general contractor/construction manager: MATT Construction.

PHOTO: CASEY DUNN



AUSTIN'S NEWEST ENTERTAINMENT COMPLEX IS MADE FROM REPURPOSED SHIPPING CONTAINERS

A new entertainment and hospitality complex in Austin, Texas, The Pitch, has been made out of repurposed shipping containers. Designed by the Austin-based firm Mark Odom Studio, The Pitch consists of 23 shipping containers that serve as food and beverage outlets, as well as co-working spaces and viewing areas that look onto live entertainment and volleyball and pickleball courts. The Pitch is part of a large sports venue and entertainment complex for Austin FC soccer fans and the community.

The containers come in two standard modular sizes: 8x20 feet and 8x40 feet. The containers are stacked to create two stories, then grouped into five separate building pods of varying square footages. The ground-level containers serve as food and beverage outlets for local vendors. The second-level containers serve multiple functions: viewing decks, interior conditioned gathering spaces, private office space, private party rooms, and Austin FC game-watching parties.

In addition, three 40-foot-tall containers, placed on their ends, function as wayfinders from afar. They also include restroom facilities and electrical rooms on the ground level.

On the project team: developer: Karlin Real Estate; architect: Mark Odom Studio; landscape architect: TBG Partners; contractors: Austin Commercial and Citadel Development Services; fabricator: Makehaus Design and Fabrication Studio; MEP engineer: Bay & Associates; structural engineer: Leap!Structures; civil engineer: LandDev Consulting; container consultant: Falcon Structures.

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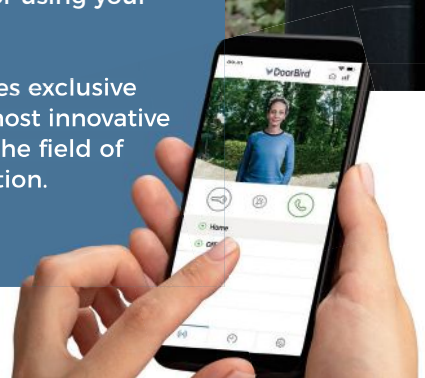

CIRCLE 757

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WENZHOU-KEAN UNIVERSITY OPENS CAMPUS BUILDING THAT BRIDGES CHINA'S PAST AND FUTURE

After pandemic-related stops and starts, Wenzhou-Kean University's Ge Hekai Hall has finally begun to see full occupancy. Located in Wenzhou, China, about five hours south of Shanghai, Ge Hekai Hall serves as the front door to the university's 175-acre campus. Designed by Moore Ruble Yudell, Ge Hekai Hall houses three schools, including architecture and design, for Wenzhou-Kean University, a joint venture between New Jersey's Kean University and China's Wenzhou University.

Ge Hekai Hall's gateway portico nods to both the surrounding mountain landscape and the high-rise residential towers across the street. The structure comprises eight buildings that contain classrooms, offices, shops, and a library. Evoking traditional Chinese alleyway neighborhoods, the alleys between the buildings provide light and air, multiple entries, and spaces for informal interaction. Accessible 24/7, the building's rooftops are connected by a network of bridges. Atop these linear buildings sit two high-bay studio loft buildings.

"The building design concept revolves around sets of dualities: China's past and future, building techniques old and new, and a set of orthogonal lower buildings supporting an active, angular upper building," said Christopher Chan, AIA, principal-in-charge of the project at Moore Ruble Yudell.

At the intersection of the lower and upper buildings, a civic-scaled atrium called the Forum serves as a community and social hub, an extension of the classrooms, and an 800-person event venue for the entire university.

Designed to LEED Gold and China Two-Star standards, the building integrates façade sunshades, a photovoltaic array, rainwater harvesting, thermal massing with a heat recovery system, and a passively cooled atrium. To enhance wellness, the design provides ample indirect sunlight and biophilic elements, such as more than 2,000 sm of solid wood. In addition, the building provides only the code minimum number of elevators, encouraging people to use the stairs in the Forum atrium.

On the building Team: owner: Wenzhou-Kean University; design architect, interior design, and landscape design: Moore Ruble Yudell; associate architect: Tongji University Architecture Design Research Institute; architect of record: Zhongtian Construction Architectural Design Institute; structural, civil, and MEP engineer: Zhongtian Construction Group; and general contractor: Zhongtian Construction Group.

MIXED-USED BUILDING TO RISE ABOVE FORT LAUDERDALE, FLA.

ODA has released renderings of Ombelle, a project that includes two residential towers in Fort Lauderdale, Fla. Developer Dependable Equities hired ODA to design the architecture, interiors, and landscaping for the mixed-use development. Project plans were submitted to the city in May, beginning the approval process.

With more than 1.5 million sf, Ombelle will include 1,100 rental units. The tapering forms of the two 43-story towers step away from each other as they rise, giving the units views of downtown Fort Lauderdale and the ocean. The façade comprises "a delicate exoskeleton," according ODA. The towers' outer shell features terraces and balconies that vary in depth, length, and density, which is meant to provide each unit a sense of individual identity.

The amenity package for the multifamilty residential development includes two pools: one with landscaping and a nearby work lounge, the other a larger infinity pool on the building's edge. Amenities also include an outdoor bar area and chef's kitchen, garden, gym, game room, library, private dining room, spin room, spa, dance studio, and yoga studio.

An urban plaza sits at the base of the building, connecting to a double-height colonnade around the perimeter. Also on its ground floor, Ombelle has more than 11,000 sf of commercial space for retail and restaurants.

RENDERINGS: VERO DIGITAL

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IMAGES: RASMUS HJORTSHØJ

DENMARK OPENS MUSEUM THAT TELLS THE STORIES OF REFUGEES WORLDWIDE

Located on the site of Denmark's largest World War II refugee camp, the new Refugee Museum of Denmark, FLUGT, tells the stories of refugees from the camp, as well as refugees worldwide. At 1,600 sm, the museum was designed by BIG-Bjarke Ingels Group and exhibition designers Tinker Imagineers. Together, they adapted and extended one of the camp's few remaining structures—a hospital—into the museum.

The former hospital comprises two long buildings. BIG connected the two structures by adding a soft curve-shaped volume, which serves as a welcoming structure and creates 500 sm of additional museum space. From the outside, the volume welcomes visitors into a seemingly closed entry hall. But inside, a floor-to-ceiling curved glass wall reveals a sheltered green courtyard and the forest, where the refugee camp used to be. From the entry hall, which functions as a lobby or a temporary exhibition space, guests continue to one of the museum wings.

The north wing's exhibition area contains gallery spaces organized according to the hospital's original flow. The south wing includes a flexible conference room, smaller exhibition spaces, cafe, and back-of-house functions.

DALLAS' FAIR PARK WILL PLACE A PARK ATOP A NEW PARKING GARAGE

A registered National Historic Landmark, Fair Park is the 227-acre home to the State Fair of Texas and various cultural institutions in Dallas. In 2020, Fair Park revised its master plan to include the 14-acre Community Park and a parking garage. Designed by Gensler, the Fair Park Fitzhugh Parking Structure recently won the AIA Dallas Chapter Unbuilt Design Award.

The garage will have 1,650 parking spaces over five stories. In an attempt to design a large concrete parking structure that's sensitive to its surrounding community, the team placed part of Community Park on top of the garage structure, making it an extension of the park.

To connect the park to the garage's top deck, the design uses both earth berms and structural berms. On the surface of the north berm, an immersive outdoor experience includes a prairie landscape, viewing deck, shading canopies, shading platform, and rooftop event deck. With concessions and restrooms, the rooftop deck can be used for public and private events. Beneath the north berm lies 80,000 sf of operational facilities for Fair Park and Community Park.

With a 47-foot ascent to the top of the garage, the project makes the structure's height an asset for the park, offering views of the adjacent neighborhood, Fair Park, and downtown. It also creates a new, distinctive public space for Dallas. The project's shape takes inspiration from the region's limestone ridges and the park's prairie-inspired landscape, blending and unifying the garage structure with its surroundings. The parking structure aims to incentivize wellness by encouraging people to walk rather than use the elevator.

On the project team: owner and developer: Fair Park First; design architect and architect of record: Gensler; associate architect: Moody Nolan; MEP engineer: DFW Consulting Group; structural engineer: Ponce-Fuess Engineering; general contractor/construction manager: VCC and Con-Real; parking consultant: WGI; civil engineer: Pacheco Koch.

COURTESY GENSLER

AFTER 10 YEARS, TAIWAN'S TAIPEI MUSIC CENTER REACHES THE FINISH LINE

RUR Architecture has finished the Taipei Music Center (TMC), turning a 22-acre site into a new urban arts district. The New York-based firm's design took over a decade of planning and construction, as it both reflected and helped shape the post-industrial revival of Taipei.

Conceived as a City of Pop Music, the TMC is a hybrid and multipurpose site dedicated to the performance, production, and celebration of Asian pop music. TMC has three main buildings: the Concert Hall, the Cultural Cube, and the Creative Hub. A new elevated public ground bridges the north and south sites, bringing the three buildings together. The building program also includes three live-houses that allow for simultaneous performances and support new talent with intimate concerts.

The project's centerpiece—the 756,000-sf Concert Hall—is designed for both indoor and outdoor performances. Inside, it can seat 6,000 people; outside in the public plaza, it can accommodate several hundred. A faceted double skin, made of an anodized aluminum cladding outer layer and a gypsum wall inner layer, wraps around and encloses the auditorium. The Performance Hall features state-of-the-art technology, from the acoustics and lighting to eco-friendly heating and cooling systems.

PHOTO: YANA ZHEZHELA & ALEK VATAGIN

The design has interwoven the buildings into the natural surroundings and the city fabric. The expansive geometric volumes are meant to mirror the nearby mountains, connecting the structure with its environment.

On the building team: design architect: RUR Architecture; architect of record: Fei and Cheng Associates; structural engineer (schematic design): Arup; structural engineer (detailed design): Supertek; façade consultant: Meinhardt Façade Technology; theater, acoustics consultants: Arup; landscape architect: The Environmental Arts Design Company; lighting consultant: RDG.

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TYPICAL APPLICATIONS

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- Hospitals
- Warehouses/Distribution Centers
- Retail/Convenience Store

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2022 Giants 400

HOW WE GET THE DATA

Data for our Giants 400 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 market-specific sections (Hotels, Retail, etc.) data labeled "Construction" includes all delivery methods.

PHOTO: SETH POWERS, COURTESY SOM

The SOM-designed Shenzhen Rural Commercial Bank Headquarters in China features a tightly-spaced diagrid exostructure that makes a striking architectural statement for the 33-story tower. The structural scheme also creates an entirely column-free floor plan and provides much needed solar shading for the tower, reducing its solar gain by roughly 34%, according to SOM.

WHAT'S NEW AT 173 DESIGN FIRMS

BY ROBERT CASSIDY, EXECUTIVE EDITOR

AE7 Released its Project Management Office service.
AECOM Launched Think and Act Globally strategy.
AG ARCHITECTURE Transitioned to ESOP ownership.
AHL Promoted Deirdre Stearns to Director of Sustainability.
ÁLVAREZ-DÍAZ & VILLALÓN Partnered with the UN on the SDG Ambition Accelerator.
ANDERSON MIKOS ARCHITECTS Adopted Lean design.
AO Partnering with developers on action-anchored resorts.
ARC/ARCHITECTURAL RESOURCES CAMBRIDGE New strategic branding effort.
ARCHITECTURE, INCORPORATED Tara McGrath, new Director of Interior Design.
AYERS SAINT GROSS Designing for operational and embodied carbon in all projects >50,000 sf.
BAILEY EDWARD DESIGN Established a DEI team.
BBS Created BBS University for staff development.
BKSK ARCHITECTS Moved to new location in NYC.
BKV GROUP Used wood-and-steel panelization on 67 multifamily projects.
BLAIR + MUI DOWD ARCHITECTS ASHE Vista Award for a children's hospital.
BRAY ASSOCIATES ARCHITECTS Designed the first net zero school in Wisconsin.
BSB DESIGN Acquired Withee Malcolm design firm.
BWBR Launched BWBR+ advisory service. New President/

ARCHITECTURE FIRMS | TOP 90

Rank	Company	2021 Architecture Revenue
1.	Gensler	$1,369,822,300
2.	Perkins and Will	$572,468,333
3.	HKS	$401,400,000
4.	Perkins Eastman	$274,700,000
5.	NBBJ	$256,000,000
6.	ZGF Architects	$240,150,062
7.	CallisonRTKL	$239,035,940
8.	Corgan	$204,531,586
9.	Populous	$186,389,441
10.	Kohn Pederesen Fox Associates	$169,267,600
11.	Interior Architects	$135,289,077
12.	PGAL	$114,472,000
13.	Nelson Worldwide	$100,714,013
14.	LS3P Associates	$97,491,794
15.	Elkus Manfredi Architects	$96,500,000
16.	KTGY	$94,733,804
17.	AO	$91,137,000
18.	DGA planning | architecture | interiors	$88,538,043
19.	HMC Architects	$83,713,498
20.	Hord Coplan Macht	$80,309,588
21.	Studios Architecture*	$76,200,000
22.	Cooper Carry	$74,389,205
23.	Solomon Cordwell Buenz	$72,387,077
24.	WRNS Studio*	$68,000,000
25.	McMillan Pazdan Smith	$65,138,212
26.	WATG	$64,101,572
27.	CO Architects	$63,976,513
28.	EUA	$63,973,000
29.	VLK Architects	$63,087,000
30.	Cuningham	$62,049,287
31.	NAC Architecture*	$60,800,000
32.	Moody Nolan	$60,234,048
33.	HNTB Corporation	$59,950,080
34.	Payette	$59,314,154
35.	Moseley Architects	$58,349,264
36.	Robert A.S. Stern Architects*	$58,300,000
37.	HLW*	$55,000,000
38.	Ayers Saint Gross	$52,638,118
39.	Quinn Evans	$48,961,972
40.	Davis Partnership Architects*	$47,500,000
41.	Shepley Bulfinch	$45,857,543
42.	CBT	$45,797,936
43.	Handel Architects	$45,474,326
44.	LMN Architects	$44,742,658
45.	Beck Architecture	$44,454,153
46.	Niles Bolton Associates	$44,181,372
47.	Steinberg Hart	$43,283,435
48.	FFKR Architects*	$42,500,000
49.	BWBR	$41,595,912
50.	Diamond Schmitt Architects	$40,714,000
51.	Kirksey Architecture	$40,422,324
52.	SGA*	$39,600,000
53.	TPG Architecture	$39,004,000
54.	Fentress Architects	$38,880,000
–	Zyscovich	$38,800,000
56.	Macgregor Associates Architects	$38,550,832
57.	Sheehan Nagle Hartray Architects	$38,384,100
58.	Mithun	$37,994,350
59.	JLG Architects*	$37,500,000
60.	JCJ Architecture	$36,630,232
61.	GFF	$36,604,273
62.	Vocon	$36,360,000
63.	Sasaki Associates	$36,058,724
64.	Kendall/Heaton Associates*	$35,500,000
65.	BHDP Architecture	$34,808,849
66.	MBH Architects	$33,929,000
67.	Powers Brown Architecture*	$32,900,000
68.	Ted Moudis Associates	$32,500,000
69.	RRMM Architects	$32,419,100
70.	GBBN	$31,800,000
71.	Array Architects*	$31,300,000
72.	Integrus Architecture*	$31,200,000
73.	STG Design*	$30,800,000
74.	Dattner Architects	$30,515,689
75.	FGM Architects	$30,497,429
76.	Hanbury	$28,949,057
77.	CSO Architects	$28,852,044
78.	ESG Architecture & Design*	$28,700,000
79.	LRK	$28,175,000
80.	Massa Multimedia Architecture	$28,086,394
81.	FXCollaborative Architects	$27,132,833
82.	CUBE 3*	$26,800,000
–	SB Architects*	$26,800,000
84.	AHL	$26,289,368
85.	Dahlin Group Architecture | Planning	$26,054,363
86.	Grace Hebert Curtis Architects	$25,513,146
87.	Quattrocchi Kwok Architects	$25,400,000
88.	VCBO Architecture*	$25,200,000
89.	WDG	$24,600,000
90.	Taylor Design	$24,520,657

SOURCE: *BD+C* 2022 GIANTS 400 REPORT *EDITORS' ESTIMATE

See the full
GIANTS 400
rankings and
bonus categories at:
BDCnetwork.com/
Giants2022

CEO: Stephanie McDaniel.

CARRIER JOHNSON + CULTURE Appointed Claudia Escala and Ray Varela as Co-Presidents.

CB DESIGN GROUP Developed new design for electronic health record upgrades.

CBT Earned JUST label. Grew its life science business.

CDM SMITH Developed digital-twin technology to generate real-time simulations.

CETRARUDDY ARCHITECTURE Instituted three-days-in-office/two-at-home work week.

CHOATE PARKING CONSULTANTS Certifying two ParkSmart projects.

CLARK & ENERSEN Completed its first LEED Platinum and WELL-certified projects.

CLARK NEXSEN Developed a project data dashboard to assess progress on AIA 2030 DDx and SE2050.

COLLIERS ENGINEERING & DESIGN Acquired engineering firm Bergmann and four others.

COOPER CARRY Named Kyle Reis President/CEO; Tim Bakos, COO. Hired JD Harper as Sustainability Leader.

CORE STATES GROUP OF COMPANIES Acquired by Harren Equity Partners.

CORGAN Stephen Lohr named Multifamily Studio Leader. Rolled out Unscripted, which evaluates workplaces based on spacing and occupancy.

COSCIAMOOS ARCHITECTURE Using Enscape and Oculus Quest 2 in its VR platform.

CRAWFORD ARCHITECTS Became a corporate partner of the Green Sports Alliance.

CROMWELL ARCHITECTS ENGINEERS Divided the firm into eight market segments.

CRTKL New COO: David Asfour. New Retail Design Principal: Robyn Oyler. Created Prognosis, a prototyping platform for next-gen spatial design.

CSARCH Incorporating Universal Design into projects.

CTA ARCHITECTS Hired Christian Rasnake as Sustainability Coordinator.

CUNINGHAM Adopting regenerative design.

CURTIS + GINSBERG ARCHITECTS Completed 20,000 new/renovated dwelling units in NYC in 2021-22.

CUSHING TERRELL New director hires: Randy Rhodes, Affordable Housing; Keith Walzak, Urban Planning.

DAHLIN GROUP ARCHITECTURE | PLANNING Its MOD HIVE tiny home in pilot project for homeless in California. Expanding into K-12.

DATTNER ARCHITECTS Three Passive House residential projects in the works.

DESIGN COLLABORATIVE Using Matterport 3D scanner to document as-built conditions. New market: industrial.

DGA Expanded its San Diego office.

DIAMOND SCHMITT ARCHITECTS Using customized data aggregator, CloudDesign, for project analytics.

DLR GROUP Launched an internal online learning platform. Formed Equity Forum to guide its racial equity work.

DLZ CORPORATION Acquired Carbon Engineering (Costa Rica). Secured a National PM Service Contract (USPS).

DYER BROWN & ASSOCIATES Updated its materials library to ensure building products are eco-friendly, healthy.

E4H ENVIRONMENTS FOR HEALTH ARCHITECTURE Acquired Dixon Associates.

ELEVATUS ARCHITECTURE Developed a prototype 213-240-bed county jail.

ELKUS MANFREDI ARCHITECTS Alicia Mills named VP of Talent and Culture.

EUA Acquired Performa Inc.

EYP MISSION CRITICAL FACILITIES Developing off-the-grid data centers.

FANNING HOWEY ASSOCIATES Providing visioning, professional development, and Cx services to school districts.

FENTRESS Designing Terminal C at Orlando International.

FGM ARCHITECTS Acquired LeMay Erickson Willcox Architects.

FIFTH DIMENSION ARCHITECTURE & INTERIORS Developed BIM process for faster design documentation, QA.

FINEGOLD ALEXANDER ARCHITECTS Launched FA Energy, to help clients meet carbon emissions goals.

FITZGERALD Moved to new studio in Chicago Loop.

FK ARCHITECTURE Moving into modular construction.

FLAD ARCHITECTS Integrating computational design into daily practice.

FOGARTY FINGER Adopted OpenAsset to organize its imagery library.

FXCOLLABORATIVE ARCHITECTS Moved office to Brooklyn, N.Y. Developed Automated BIM QC Process to speed up 3D models.

G70 Norman Hong named Chairman; Linda Miki, CEO.

GARMANN MILLER Using Matterport to create digital twin immersive spaces.

GBBN Using AR to deliver full-scale design models for clients. Expanded parental leave benefits.

GENSLER Issued gFloorz 2.0 computational product for use with all project types.

GREENBERGFARROW Acquired SGA|NW; broadens its multifamily reach in SE U.S.

GFF INC. Used digital modeling to design a placemaking shading structure.

GGLO Using GIS to create "heat maps." Signed NOMA NW Call to Action. Sixteen mass timber projects in design or under development.

GLENN|PARTNERS Fabricated a perforated metal panel sunshade for a high school.

GMB ARCHITECTURE + ENGINEERING Launched an Employee Development Plan.

GOODWYN MILLS CAWOOD Acquired Binkley Garcia Architecture and Florida Disaster Consulting.

GRACE HEBERT CURTIS ARCHITECTS Implemented firmwide PM training using Centerline PM software.

GRESHAM SMITH Appointments: Rodney Chester, CEO; Peter Oram, COO. Developing A-Eye computer vision program. Created a Sustainability and Resiliency Center.

GRIMM + PARKER Became a SWaM Certified Women-Owned and Small Business in Commonwealth of Virginia.

GUIDON Launched a Science + Technology practice.

GWWO ARCHITECTS Tested PointFuse and EdgeWise software. Using Revisto UI for BIM clash detection workflows, and Polycam and Mat-

terport for reality capture.

H. HENDY ASSOCIATES Added a healthcare studio. Developed new content management system.

H2M ARCHITECTS + ENGINEERS Acquired Dennis Noskin Architects.

HAFER Acquired hmb Architects. Using Enscape plug-in.

HANBURY Created grassroots councils to give emerging leaders a voice in firmwide strategy and leadership.

HANDEL ARCHITECTS Louis Koehl named Sustainable Design Director; Katie Donahue, Denver Office Director. Passive House projects under construction in Boston, New York, and Toronto.

HDR Developed a regenerative design tool.

HED Renewed its JUST label.

HFG ARCHITECTURE Designed a 300,000-sf cardiothoracic surgery center in Kenya for Engineering Ministries International.

HFMH ARCHITECTS Used Tally and Climate Studio to design a net-positive-energy school.

HGA Its new ENERGY.script tool performs a step-by-step energy analysis model during planning and SD.

HKS Conducting research on using neuroscience-informed design to slow cognitive decline in aging populations.

HMC ARCHITECTS Acquired Rainforth Grau Architects. New directors: Jennifer Wehling, sustainability; James Krueger, design.

HOEFER WELKER Using data visualization and role-specific dashboards for projects.

HOK Created a Regenerative Design Studio.

HOLLIS + MILLER ARCHITECTS Won the A4LE John Shaw Award for a middle school in Kansas City, Mo.

HORD COPLAN MACHT New leaders: Jennifer Cordes, Higher Education; Jim Albert, Healthcare; Monica Robertson, Housing/Mixed-use; Adele Willson, K-12.

HUCKABEE Acquired Rachlin Partners. Josh Brown named President. Developed generative design tool to explore numerous complex design solutions simultaneously.

HUITT-ZOLLARS Implemented Bluebeam Revu firmwide.

IA Joined the Science Based Target Initiative's Business Ambition for 1.5°C and the UN's Race to Zero. Acquired FYOOG design firm.

IKM ARCHITECTURE Moved to a 40-hour work week Sunday-Saturday with no PTO limits.

IPS Acquired management consulting firm Linesight.

JEFFREY BERMAN ARCHITECT Healthcare architect for a pediatric cancer center in Kenya (with David Adjaye).

JLL Acquired Skyline AI artificial intelligence company.

KAHLER SLATER Using hybrid videography and animation in construction. New CEOs: Al Krueger, Glenn Roby.

KGD ARCHITECTURE Designing global HQ campus for bioscience giant Novavax.

KIRKSEY ARCHITECTURE Named Catherine Callaway Director of Sustainability. Developed a tool to help clients calculate workspace square footage needs.

KITCHEN & ASSOCIATES Added Mac Studio, Matterport, and animations.

KPF Created (with Simscale) KPFlow; runs wind simulations in early 3D design.

KTGY Added interior design and branding services.

LABELLA ASSOCIATES Acquired Odell Associates and Stieglitz Snyder Architecture. Moving into multifamily and mixed-use markets.

LARSON DESIGN GROUP Acquired LWPB Inc.

ARCHITECTURE/ENGINEERING FIRMS | TOP 66

Rank	Company	2021 Arch/Eng Revenue
1.	Stantec	$703,911,672
2.	HDR	$597,200,000
3.	HOK	$430,000,000
4.	Skidmore, Owings & Merrill	$350,300,000
5.	SmithGroup	$301,588,780
6.	IBI Group*	$287,300,000
7.	DLR Group	$268,700,000
8.	CannonDesign	$265,000,000
9.	Page	$226,937,670
10.	Ware Malcomb	$203,218,655
11.	HGA	$172,108,972
12.	PBK*	$155,200,000
13.	NORR	$136,105,562
14.	Flad Architects	$132,800,000
15.	EYP	$126,503,602
16.	Leo A Daly	$102,808,685
17.	LPA	$100,745,245
18.	EwingCole	$100,000,000
19.	GPD Group	$91,381,000
20.	Haskell	$87,694,056
21.	HED	$85,485,110
22.	RS&H	$84,800,000
23.	Huckabee	$82,600,000
24.	Parkhill	$79,985,909
25.	RSP Architects	$78,194,000
26.	Clark Nexsen	$74,155,000
27.	Ballinger*	$73,000,000
28.	Core States Group	$72,084,351
29.	Michael Baker International	$71,827,114
30.	Cushing Terrell	$70,214,051
31.	SLAM Collaborative, The	$67,292,102
32.	Little Diversified Architectural Consulting	$62,980,503
33.	Wold Architects and Engineers	$60,957,000
34.	E4H Environments for Health Architecture	$60,108,000
35.	CESO	$57,510,000
36.	Goodwyn Mills Cawood	$56,801,006
37.	Humphreys & Partners*	$55,000,000
38.	Symmes Maini & McKee Associates (SMMA)	$51,658,000
39.	BSA LifeStructures	$45,130,076
40.	Colliers Engineering & Design	$44,894,462
41.	Progressive AE	$44,492,237
42.	WD Partners	$44,100,000
43.	RDG Planning & Design	$42,088,293
44.	GreenbergFarrow (GF)	$42,000,000
45.	Lionakis*	$41,900,000
46.	H2M architects + engineers	$40,882,007
47.	TreanorHL	$38,185,732
48.	CPL Architecture, Engineering, Planning	$37,345,357
49.	Ryan Companies US / Ryan A+E	$36,176,989
50.	Dekker/Perich/Sabatini*	$35,500,000
51.	Wiley | Wilson*	$34,854,000
52.	BSB Design	$34,753,403
53.	G70	$32,751,090
54.	AE7	$32,213,301
55.	Kahler Slater	$32,000,000
56.	TowerPinkster	$31,179,500
57.	Alliance	$31,037,920
58.	GMB Architecture + Engineering	$30,438,529
59.	Lawrence Group/Integrate Construction Partners	$29,445,611
60.	Whitman, Requardt & Associates	$29,228,755
61.	Schmidt Associates*	$29,200,000
62.	KZF Design	$29,000,000
–	BKV Group	$29,000,000
64.	Rule Joy Trammell Rubio	$28,578,500
65.	Hollis + Miller Architects	$28,069,237
66.	Hoefer Welker	$27,164,000

SOURCE: *BD+C* 2022 GIANTS 400 REPORT *EDITORS' ESTIMATE

LEGAT ARCHITECTS New sector: community centers. Barry DeSimone named President/CEO.

LEO A DALY Developed Fix-Activate-Calibrate-Tune workplace design framework. Hired Steven Plam to head Design Technology.

LITTLE Implementing regenerative visioning in projects.

LPA Cut fossil fuel use in its projects by >70%, surpassing AIA 2030 Challenge.

LRK Turning single-use office buildings into residential/mixed-use communities.

LS3P Two mergers: TFF Architects & Planners and PFA Architects. Donating 1% of staff time to pro bono work.

LUMINAUT INC. Acquired Rowland Design. Added a K-12 studio.

MA DESIGN Rebranded from M+A Architects.

MARGULIES PERUZZI Conducted mandatory diversity training across the firm.

MASSA MULTIMEDIA ARCHITECTURE Implemented DfMA (Design for Manufacture and Assembly) for Walmart health clinics.

MBH ARCHITECTS Conducted a VR tour of BioEnginuity Hub at UC Berkeley.

MCFARLANE ARCHITECTS Expanding into Arizona/Utah life sciences market.

MCMILLAN PAZDAN SMITH Acquired Watson Tate Savory. Earned WELL Health-Safety rating for its offices.

METHOD ARCHITECTURE Acquired GSC Architects.

MG2 Signed the AIA Materials Pledge.

MICHAEL GRAVES ARCHITECTURE Acquired Waldon Studio Architects.

MOSELEY Using Newforma Connector for Procore to eliminate duplicate data entry in CA workflow.

NBBJ Introduced ZeroGuide, a tool that estimates the carbon equivalent of a project's emissions.

NELSON WORLDWIDE Jennifer Acevedo named Director of Strategy & Insights.

NILES BOLTON ASSOCIATES Acquired Dye Aviation to enter private aviation sector.

NMDA Christina Straughan named Creative Director.

NORR George Sorich named VP Residential. Issued an e-book on carbon neutrality.

ONYX CREATIVE Merged with L2M Architects.

PAGE Acquired EYP.

PARKHILL Launched Work Together hybrid work policy.

PAYETTE Developed Kaleidoscope, which evaluates embodied carbon in façades and flooring assemblies.

PBK Invited by Uvalde CISD to advise on school safety design following the incident at the Texas school.

PERKINS EASTMAN Acquired BLT Architects and Kliment Halsband Architects.

PERKINS AND WILL New Managing Directors: Lindsey Peckinpaugh, Chicago; Yanel de Angel, Boston; Ernest Joyner, Denver.

PFLUGER ARCHITECTS Designed high-tech school with no classrooms. Terry Hoyle named CEO.

PRIME AE Acquired Penza Bailey Architects and Prosser Inc.

PROGRESSIVE AE Signed the AIA 2030 Commitment.

PULSE DESIGN GROUP Using VantagePoint to enhance workflow and recruiting.

QUINN EVANS Named Alyson Steele President/CEO; Thomas Jester, COO.

RDG PLANNING & DESIGN Developed an equitable employee benefits package.

RKTB ARCHITECTS Using mobile video cameras for remote site observation.

ROSEMANN & ASSOCIATES Moved Atlanta office to Circa 730 Building.

RSC ARCHITECTS Won the AIA-NJ Firm of the Year Service Award.

RYAN A+E Created tool that produces SD level of design from simple parametrics.

SASAKI ASSOCIATES Invented a free tool, the Carbon Conscience App.

SCB Converted Tribune Tower, Chicago, to condominiums.

SCHAEFER Pursuing the federal buildings market.

SCHRADERGROUP Running Instagantt, Asana, and Project Guru to keep projects on schedule.

SHEEHAN NAGLE HARTRAY ARCHITECTS Implementing DfMA. New Sustainability Director, Denis Blanc.

SHEPLEY BULFINCH Named Angela Watson President/CEO. Acquired PARC design lab.

SMITH SECKMAN REID New COO: Susan Osterberg; Chief Growth Officer: Mike Rogers.

SMITHGROUP Presented an analysis of mechanical systems in healthcare facilities at ASHRAE 2022.

SOM Created Equity Design Lab to embed DEI into its projects. Presented "Urban Sequoias" concept—buildings absorbing carbon—at UN COP26 conference.

STEINBERG HART Named new office directors: Douglas Moss, Austin, Texas; Vincent Mudd, San Diego.

TAYLOR DESIGN Joined the new I2SL LA/Orange County (Calif.) chapter.

TETER Implemented Vantagepoint for business and PM.

THENDESIGN ARCHITECTURE Named Christopher D. Smith President.

TOWERPINKSTER Acquired Kovert Hawkins Architects. Signed the AIA 2030 Commitment.

TPG ARCHITECTURE Promoted Ken Tracey to Managing Executive.

TREANORHL Hired visualization expert Joel Gray.

TVS Using Web-based tools to create experiential marketing materials.

URBAHN ARCHITECTS Leading gut renovation of two public hospitals for NYC's corrections department.

VLK ARCHITECTS Employed off-site manufacture of building components in a K-12 project.

WALKER CONSULTANTS Launched Perq customizable parking solution. New President/CEO: Dave Ryan.

WARE MALCOMB Enhanced its WM Future Lab.

WDG Adapting office buildings, hotels to residential.

WEBER THOMPSON Now a Woman-Owned Business.

WENDEL Named Joseph DeFazio President/CEO.

WOOLPERT Acquired Optimal GEO, AAM, and eTrac. Earned a LIDAR patent.

ZGF Reduced emissions in its portfolio by ~60%.+

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ENGINEERS CASH IN ON A VOLATILE, EXPANDING MARKET

New practices and markets drive growth. And engineers get serious about reducing projects' carbon footprint.

Last year, IMEG Corp. made six acquisitions that bumped up its office count to more than 60 locations with 1,600 employees. SSOE Group implemented a horizontal organization management structure that bases upward mobility on operational performance and is scaled for growth. **Specialized Engineering Solutions** added an office in Indianapolis, hired 22 new staffers, and firmwide completed more than 500 projects and worked with 25 new clients.

Last year and the early months of 2022 were periods of expansion and activity for many engineering giants, whose cohort continued to add new markets and practices through mergers, acquisitions, and organic growth. Engineers developed tools that improve designing, workflow management, and reducing the carbon footprint of buildings. And in the wake of COVID, a sizable number of engineering firms cite their health and safety protocols among their accomplishments last year.

Technology continued to change the game for expansion-minded engineering firms, be it **CDM Smith**'s embrace of digital twin for its utilities and private-sector clients, or **Henderson Engineers** (in collaboration with EvolveLAB) developing a ductwork automation tool that significantly reduces design time. **The RHM Group** started using LiDAR scans for more complex retrofits to cut down on field time, while **Kimley-Horn** honed its Advanced Air Mobility modeling capabilities for the aviation sector in anticipation of the coming wave of battery-powered vertical flight.

ENGINEERING FIRMS | TOP 56

Rank	Company	2021 Engineering Revenue	Rank	Company	2021 Engineering Revenue
1.	Kimley-Horn	$680,012,405	29.	HPE Data Center Technologies Services	$57,740,000
2.	Terracon Consultants*	$364,800,000	30.	DeSimone Consulting Engineering	$57,150,934
3.	Tetra Tech's High Performance Buildings Group	$350,000,000	31.	ME Engineers	$55,500,000
4.	Langan	$318,000,000	32.	RMF Engineering	$55,034,672
5.	NV5 Global	$266,148,279	33.	P2S	$54,762,037
6.	IMEG Corp.	$263,433,800	34.	Coffman Engineers*	$50,600,000
7.	Arup	$207,433,404	35.	Degenkolb Engineers*	$50,500,000
8.	KPFF Consulting Engineers	$198,565,507	36.	Smith Seckman Reid	$48,049,377
9.	Jensen Hughes	$186,297,125	37.	Magnusson Klemencic Associates	$47,665,293
10.	Fluor	$173,340,474	38.	Bala Consulting Engineers	$46,100,000
11.	Affiliated Engineers Inc	$165,576,000	39.	Jordan & Skala Engineers*	$46,000,000
12.	Henderson Engineers	$148,674,227	40.	I. C. Thomasson Associates	$45,238,335
13.	Parametrix	$134,695,704	41.	Martin/Martin	$39,334,656
14.	Black & Veatch Corp.*	$110,403,000	42.	Mazzetti	$38,488,181
15.	Syska Hennessy Group	$110,148,902	43.	Osborn Engineering	$37,200,000
16.	Simpson Gumpertz & Heger*	$105,980,000	44.	Newcomb & Boyd	$36,540,021
17.	Pennoni*	$105,976,000	45.	Wallace Design Collective	$33,800,000
18.	M.C. Dean	$104,991,797	46.	MG Engineering (MGE)*	$33,100,000
19.	Walter P Moore	$101,715,081	47.	Dunham Associates	$31,270,000
20.	CMTA	$99,244,345	48.	Stewart*	$30,100,000
21.	Olsson	$97,040,000	49.	Arora Engineers	$28,419,328
22.	Vanderweil Engineers	$95,981,900	50.	RTM Engineering Consultants*	$26,746,000
23.	BKF Engineers	$88,282,748	51.	M/E Engineering	$26,571,000
24.	Integral Group*	$83,125,000	52.	H.F. Lenz	$26,413,500
25.	TLC Engineering Solutions	$70,403,634	53.	TEECOM	$26,188,095
26.	ESD	$68,219,448	54.	ThermalTech Engineering	$25,477,000
27.	Jaros, Baum & Bolles	$64,357,800	55.	Loring Consulting Engineers*	$23,162,000
28.	AKF	$60,000,000	56.	Specialized Engineering Solutions	$22,270,000

SOURCE: *BD+C* 2022 GIANTS 400 REPORT * EDITORS' ESTIMATE

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Burns & McDonnell has been deploying solar pile drivers that transmit engineering plan data through GPS technology to align a pile on a precise spot and drive it to the exact depth needed. **WSP** last year began integrating Web-based technologies into its engineering workflows. "This opens another avenue into the model database for analysis, compliance checking, etc.," stated the firm, which claims to have more than 30 tools in the works.

KLH Engineers, through a licensing deal with Trimble MEP, started marketing its own proprietary software for engineering building design. The product is called SysQue Model Manager. And **Paradigm Structural Engineers** has been assisting clients to incorporate passive energy dissipation devices into new buildings to mitigate business interruptions for pharmaceutical manufacturing and data centers.

Technology in the form of prefabrication and modular design also found more engineering advocates. Working with the GC Swinerton, **Walker Consultants** launched Perq, a predesigned, pre-engineered, customizable parking solution that customers can buy as a product. Starting in 2022, **NORR** has engaged in design projects to support rapid deployment facilities with modular construction that abets aggressive scheduling, increases quality, and reduces cost.

GROWTH BY ADDITION

Several engineering giants entered new practices last year. **SSOE**, for one, started aggressively pursuing manufacturing projects, especially those related to electric vehicles; it is currently engaged in more than 20 EV projects in the U.S. and Mexico. **KCI Technologies**, which acquired three companies in Texas, Florida, and the East Coast, also expanded its internal structure to include a technology- and innovation-focused market, as well as a vertical construction management practice. And **PBS Engineers** expanded into technology design and commissioning services.

Some expansion took the form of investment: **Affiliated Engineers** has been investing strategically in a comprehensive resilience planning consultation program that engages owners and is supported by integrated design. Affiliated also invested in a process engineering design studio to support new and upgraded manufacturing facilities, and grew its industrial test market that supports design of complex battery research and production.

Syska Hennessy Group launched Syska Innovations, a subsidiary that invests in seed-stage companies, pilots their software and products, and nurtures their development within the firm.

Engineering firms typically expand with an eye toward cracking into new markets or practices. Last year was no different, as many firms plowed new fields, both organically and through acquisition. For example, **Tower/Pinkster** said it "drastically expanded" the reach of its offices in Indiana and Kentucky by acquiring Kovert Hawkins Architects. With its acquisition of South Carolina-based SGA/NW, the AE firm **Greenberg/Farrow** hoped to broaden the combined company's multifamily presence in the Southeast.

When the CE firm **Integrated Project Services** acquired Linesight, it tapped into a Dublin-based multinational with 900 employees in 24 offices that provide project controls to data center providers, life sciences companies, commercial real estate, healthcare, hospitality, retail, and residential sectors. This acquisition doubled IPS to nearly 2,800 employees and 45 offices.

Dewberry—which shifted many of its commercial projects into a model that maximizes design, material selection, construction, and occupancy efficiencies—acquired Edmonds Engineering, a 75-person MEP specialist with five offices in the Southeast. Dewberry also opened a new office in Philadelphia, and grew its architecture practice in California.

Goodwyn Mills Cawood, an AE firm, doubled the

ENGINEERING/ARCHITECTURE FIRMS | TOP 40

Rank	Company	2021 Eng/Arch Revenue	Rank	Company	2021 Eng/Arch Revenue
1.	Jacobs	$3,318,550,000	21.	Farnsworth Group	$69,086,930
2.	AECOM	$1,305,400,000	22.	BRPH Companies	$65,900,000
3.	WSP	$678,055,173	23.	Prime AE Group	$62,517,523
4.	Burns & McDonnell	$558,297,341	24.	Ross & Baruzzini	$62,381,311
5.	Alfa Tech Consulting Engineers	$557,430,000	25.	Walker Consultants	$58,549,780
6.	EXP	$380,560,118	26.	Merrick and Company*	$54,343,000
7.	Thornton Tomasetti	$290,000,000	27.	CDM Smith	$53,925,406
8.	CRB	$249,546,165	28.	Shive-Hattery	$51,154,083
9.	Gresham Smith	$236,589,629	29.	LaBella Associates	$44,100,000
10.	Salas O'Brien	$231,067,681	30.	Woolpert	$42,490,189
11.	IPS-Integrated Project Services	$218,933,969	31.	Stanley Consultants	$41,043,487
12.	Barry-Wehmiller Design Group	$213,222,217	32.	FSB Architects + Engineers	$36,773,773
13.	SSOE Group	$151,848,023	33.	Highland Associates	$34,600,000
14.	Dewberry	$140,048,945	34.	Halff Associates	$34,049,000
15.	Wiss, Janney, Elstner Associates	$124,150,000	35.	Heapy	$32,877,731
16.	CHA Consulting*	$118,400,000	36.	PVE, LLC*	$30,000,000
17.	STV	$110,366,354	37.	GRAEF	$27,128,995
18.	Ghafari Associates	$94,600,000	38.	Hixson Architecture, Engineering, Interiors	$22,000,000
19.	Morrison Hershfield	$94,361,171	39.	DLZ Corporation	$21,962,232
20.	BL Companies*	$89,397,000	40.	Becker Morgan Group	$19,319,839

SOURCE: *BD+C* 2022 GIANTS 400 REPORT * EDITORS' ESTIMATE

size of its Aviation team by adding Franklin, Tenn.-based PDC Consultants. Last January, the firm acquired Nashville-based Binkley Garcia Architecture, which specializes in educational, commercial, and church architecture. And last April, GMC bought Florida Disaster Consulting, which expanded its regional disaster recovery services and capabilities.

With the help of the U.S. Commercial Service and the U.S.-Saudi Business Council, the engineering firm **P2S** brought its commissioning management services to Saudi Arabia via a Memorandum of Understanding agreement with Saudi Engineering Group. This pact allows P2S's commissioning agents to review design documents and create checklists remotely from the firm's West Coast offices. (P2S is based in Long Beach, Calif.)

ENVIRONMENTAL STEWARDSHIP

Last year, more engineering giants started paying closer attention to the sustainability and carbon footprint of their buildings. Notable was **Arup**'s "Changing the Game" program, an R&D investment that challenges its teams to develop tools, services, and products that "prepare us for a net-zero future."

When Burns & McDonnell's teams are working on solar project sites, they conduct geospatial surveys of the topography, the data from which is loaded into AutoCAD to build a detailed layout with precise locations of each pile.

Over the past year, more than 70 projects have received $1 million in funding under this program.

To help its clients comply with Boston's Building Energy and Reporting Ordinance 2.0, **AFK** developed a Web-based tool that allows the user to input annual utility information and building characteristics to generate emissions thresholds and resulting estimated penalties. Another firm, **Mazzetti**, beta tested an app called M+Carbon that empowers the client with data visualization of carbon emissions—the sources, degrees of severity, and opportunities for improvement.

CHOLLA WATER TREATMENT PLANT AND BOOSTER PUMP STATION
Glendale, Arizona

Morrison Hershfield contributed to the launch of the Embodied Carbon Pathfinder, a free app for quickly estimating cradle-to-grave whole building life cycle assessment results for multifamily buildings. That firm also launched its Climate Change Initiative, whose goals include identifying climate change vulnerability and risk, and reducing embodied and operational carbon from building and infrastructure projects. **Thornton Tomasetti**—which was the structural engineer on Ascent in Milwaukee, the tallest mass timber building in the world—developed a new cross-laminated timber floor that seeks to reduce embodied carbon where it's most prevalent in buildings.

Expertise and reputation are the name of the game here. **STV** has positioned itself as a leader in zero-emissions bus planning through the development of its Performance Evaluation of Electric bus Routes (PEER) modeling tool. The AE firm **NORR** even produced a blog series and eBook titled, "Our Journey to Carbon Neutrality." And **EYP Mission Critical Facilities** has been working with its data center clients to come up with renewable design alternatives that lead to better energy efficiency.

IT'S STILL ALL ABOUT TALENT

As they have expanded, reorganized, or shifted gears, quite a few giants made important personnel changes and additions that sometimes reflect a new mindset, like **Henderson Engineers**—which last year became 100% employee-owned—hiring its first sustainability director. In an industry cohort where males dominate the C-suite, it's still news when **SSOE** hired its first female president Catherine Myers; **SSR** announced Susan Osterberg as its new COO; and **Bala Consulting Engineers** promoted CFO Kim Burkert to CEO, the first woman to assume that post in the company's 40-year history.

Several firms have been hiring and promoting aggressively. **Highland Associates** added five principals in support of its succession plan. **Karpinksi Engineering** hired 22 employees last year and planned to add another dozen this summer. **H.F. Lenz**, which celebrated its 75th anniversary last year, had 19 new hires. **CMTA** expanded its engineering capabilities with acquisitions in the Upper Midwest and Texas that added 135 people.+

—John Caulfield, Senior Editor

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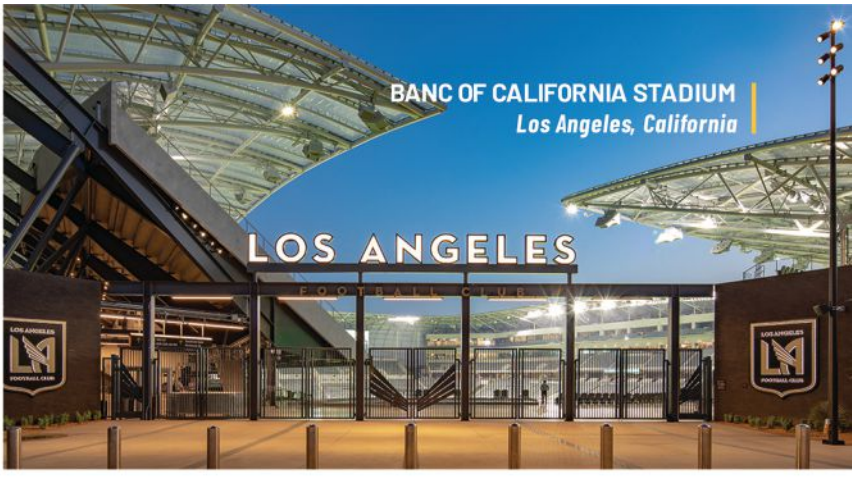

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CONTRACTORS LEAN ON TECHNOLOGY TO MANAGE GROWTH AND WEATHER A PANDEMIC

Greater attention is also being paid to workplace diversity, equity, and inclusion.

In 2021, Gilbane Building Company and Nextera Robotics partnered in a joint venture to develop an artificial intelligence platform utilizing a fleet of autonomous mobile robots. The platform, dubbed Didge, is designed to automate construction management, maximize reliability and safety, and minimize operational costs.

This was just one of myriad examples over the past 18 months of contractor giants turning to construction technology (ConTech) to gather jobsite data, manage workers and equipment, and smooth the construction process.

Drones in particular have become standard tools for large and small contractors alike. These include Charleston, S.C.-based **Brownstone**, which increased its use of drones for site evaluations and inspections, and for quality control. **Juneau Construction** partnered with DroneDeploy to test and develop a 360 camera-based walkthrough platform for geolocated photo documentation of projects by any user.

Robotics took center stage at **Swinerton**, which last year became the first construction company with fully trained in-house operators for Dusty Robotics, and was an early adopter of that supplier's Field-Printer on projects in California, Texas, and Virginia. **Turner Construction** also has been using robotics for drywall finishing, perform layout, and overhead drilling. Turner recently tested Boston Dynamics' Spot robot during an extensive multiyear pilot.

The growing impact of ConTech would be hard to overstate, with many contractors playing catch-up to level the playing field. **Arc Building Partners** expanded its use of tools like VDC and BIM, and hired its first VDC manager. Earlier this year, **Truebeck**

Shawmut Design and Construction provided GC services for Diagrid Club, an HDR-designed amenities retreat within 425 Park Avenue in New York City, the first full block office tower redevelopment on Park Avenue in more than 50 years. The 47-story tower is expected to open next year.

Construction started using SLAM (for simulated localization and mapping) scanning, specifically NavVis VLX. **Clark Contractors**, in Little Rock, Ark., expanded its drone program (it now has five pilots), ventured into 3D scanning, and is now providing more digital documentation of construction drawings. **DPR Construction** partnered with a startup to refine a robot that handles layout for self-perform drywall crews, and sold the patent for that tool to Dusty Robotics. **HITT Contracting** invested in robotics by partnering with Clearpath Robotics to develop a semi-autonomous rover machine that provides an extra set of eyes and ears for superintendents on horizontal job sites. HITT also started using Boston Dynamics' Spot and Hilti's Jaibot for repetitive tasks such as drilling anchors.

Software is playing a much bigger role in contractors' project management, too. **Huitt-Zollars** has implemented a companywide use of Bluebeam Revu for quality control on projects. **Lendlease** now makes extensive use of its Podium digital platform that offers a digital twin feature, can perform generative design, and includes Podium MX Studio, an automation and fabrication space for testing, prototyping, and assembling physical and digital components. Within the past year, **Manhattan Construction** has integrated Vista and ProjectSight software into its budgeting and cost data entry, Smart PM for scheduling analytics, and HammerTech for safety training.

CMR Partners teamed with Kahua, a project management information systems leader, to create an internal platform for CMR's team to manage multi-jobsite programs and bring clients real-time data. As a result, CMR increased the efficiency of its document controls by 25%.

PCL Construction Enterprises internally developed a trademarked project management platform, called PM4+, as well as Job Site Insights, which uses sensors to monitor jobsite conditions like water intrusion or temperature. That real-time data, paired with artificial intelligence, has helped PCL become more predictive in its jobsite management and safety. **Pepper Construction** is

CONTRACTORS | TOP 90

Rank	Company	2021 GC Revenue
1.	Turner Construction	$14,283,050,089
2.	STO Building Group	$9,510,000,000
3.	Whiting-Turner Contracting Co., The	$8,213,682,247
4.	DPR Construction	$7,491,679,000
5.	Gilbane Building Company	$6,078,889,000
6.	AECOM	$5,972,900,000
7.	Clark Group	$5,736,756,035
8.	Hensel Phelps	$5,509,959,574
9.	Clayco	$4,984,000,000
10.	Holder Construction	$4,906,000,000
11.	JE Dunn Construction	$4,826,437,847
12.	Swinerton	$4,527,589,383
13.	PCL Construction Enterprises	$4,369,225,595
14.	Suffolk Construction	$4,199,702,000
15.	Skanska USA	$4,147,629,664
16.	Brasfield & Gorrie	$3,981,722,806
17.	Ryan Companies US / Ryan A+E	$3,973,561,286
18.	Arco Construction	$3,743,376,826
19.	Balfour Beatty US	$3,666,142,905
20.	HITT Contracting	$3,345,642,511
21.	Barton Malow Holdings	$3,242,739,783
22.	McCarthy Holdings	$3,142,842,675
23.	Mortenson	$3,030,653,275
24.	Walsh Group, The	$2,935,085,088
25.	Tutor Perini Corp.*	$2,791,189,000
26.	Gray Construction	$2,716,739,916
27.	Consigli Construction*	$2,215,000,000
28.	Alberici-Flintco	$2,209,854,246
29.	Yates Companies, The	$2,162,399,000
30.	Walbridge	$2,104,370,255
31.	Alston Construction	$2,044,038,000
32.	Conlan Company, The*	$1,915,400,000
33.	Devon Construction*	$1,850,000,000
34.	Lendlease	$1,807,469,000
35.	Austin Industries	$1,676,968,442
36.	Fortis Construction	$1,606,537,612
37.	Hathaway Dinwiddie Construction*	$1,565,600,000
38.	Fluor	$1,550,308,151
39.	Okland Construction*	$1,529,690,000
40.	Big-D Construction*	$1,486,680,000
41.	Harvey / Harvey-Cleary*	$1,440,000,000
42.	J.T. Magen & Company	$1,374,282,017
43.	Core Construction Group	$1,362,330,975
44.	FCL Builders*	$1,350,000,000
45.	Messer Construction	$1,348,985,437
46.	Robins & Morton	$1,341,848,275
47.	Pepper Construction	$1,323,236,722
48.	Miron Construction	$1,318,195,000
49.	Clune Construction	$1,313,668,936
50.	Haskell	$1,269,599,469
51.	Power Construction	$1,254,000,000
52.	Shawmut Design and Construction	$1,236,747,718
53.	Adolfson & Peterson Construction	$1,210,352,175
54.	M.C. Dean	$1,204,996,312
55.	BL Harbert International	$1,202,203,468
56.	Choate Construction	$1,185,728,082
57.	E.E. Reed Construction *	$1,157,000,000
58.	Crossland Construction*	$1,138,640,000
59.	Weitz Company & Affiliates, The	$1,116,248,800
60.	McShane Companies, The	$1,107,872,644
61.	BNBBuilders*	$1,075,000,000
62.	Christman Company, The	$1,059,900,000
63.	Hoar Construction	$1,056,833,000
64.	Hunter Roberts Construction Group*	$1,040,000,000
65.	Webcor	$1,025,744,450
66.	Burns & McDonnell	$1,024,735,026
67.	Boldt Company, The	$1,008,400,000
68.	Manhattan Construction	$995,140,715
69.	Nabholz Construction	$970,498,826
70.	J.H. Findorff & Son	$935,296,391
71.	Level 10 Construction	$925,203,192
72.	Plaza Construction*	$887,900,000
73.	Caddell Construction*	$869,088,000
74.	Graycor	$852,985,220
75.	KPRS Construction*	$850,000,000
76.	Catamount Constructors*	$843,900,000
77.	W.E. O'Neil Construction	$833,310,304
78.	Beck Group, The	$828,042,657
79.	Brinkman Constructors*	$822,300,000
80.	James G. Davis Construction	$815,847,775
81.	Summit Contracting Group	$807,890,876
82.	Sundt Construction	$762,415,165
83.	Joeris General Contractors	$760,793,788
84.	JRM Construction Management	$750,000,000
85.	McCownGordon Construction	$737,300,151
86.	LeChase Construction Services	$735,216,914
87.	Andersen Construction	$734,157,000
88.	Wilhelm Construction*	$729,560,000
89.	Coastal Construction Group*	$728,700,000
90.	CRB	$727,800,245

SOURCE: *BD+C* 2022 GIANTS 400 REPORT *EDITORS' ESTIMATE

using technology like SmartTagit and MindForge to improve communications with its tradespeople.

Pennsylvania-based **W.S. Cumby**'s implementation of tech and systems enhancements now includes TimberScan, which its project managers use to paperlessly approve general conditions charges; and portals in Procore through which subcontractors can submit digital invoices.

COPING WITH COVID

ConTech provided contractors with solutions to manpower shortages and social-distancing restrictions during the COVID-19 pandemic. For its work on the expansion of New York's John F. Kennedy International Airport's Terminal 8, **Holt Construction** created "Get Ready to Work on Terminal 8," a virtual program developed to identify, engage, and hire certified and local firms interested in workforce opportunities. Holt also developed "Opportunity Fridays," a virtual program designed to host one-on-one meetings with the JFK T8 team. "We anticipate that this program will span all of our business units," Holt stated. During COVID, **JRM Construction**'s jobsite management has included 360-degree virtual site walkthroughs for clients and a digital jobsite safety application for all workers, with touchless single-scan site check-ins.

Quite a few contractor giants cite jobsite safety among their recent accomplishments. In early 2021, **Hill International** developed a digital Job Hazard Analysis process tool that enables field employees to digitally access, complete, and submit forms to identify jobsite hazards before they occur. **McCarthy Holdings**' Bright Idea platform, through which employees can share solutions for jobsite safety, in the past year impacted more than 125 projects across the country. McCarthy was also a founding member of the NEXT Coalition of industry peers that created a COVID Safety Challenge, and the firm adopted GoContractor, a digital onboarding and subcontractor management platform designed to reduce compliance risk and improve safety.

Robins & Morton has developed a virtual reality safety training app, which it released across the country last January. The firm's safety team conducted training for 345 craft workers on 64 jobsites in 2021. **Rogers O'Brien Construction**'s Operational Excellence Program, launched in 2021, is "built on the foundation of safety," said the firm, which also rolled out its Life Saving Commitments Program with the goal of eliminating serious injuries and fatalities through education, data review, and the firmwide integration of current safety practices.

To reduce falls that are the causes of so many construction-related injuries and deaths, **Choate Construction** created pedestal-mounted guardrail stanchions that can withstand more than 200 lbs. of weight and are designed to be reused from project to project. (AGC awarded Choate its Grand Award for its Willis Tower Watson 2022 National Construction Safety Excellence Awards.)

MANAGING VOLATILITY

The recent supply chain disarray that has created worldwide product shortages, coupled with developer demands for quicker project completions, compelled more construction firms to explore different procurement and delivery methods. **Fortis Construction**, which specializes in mission-critical facilities, and **W.M. Jordan Company** refocused on prefabrication of building systems. **Volumetric Building Companies (VBC)** launched a proprietary modular solution called Volumetrix, a 10-step process for project delivery that encompasses design, logistics, production, and construction. In line with that launch, and to keep up with its "significant

CM AGENT + PM FIRMS | TOP 36

Rank	Company	2021 CM+PM Revenue	Rank	Company	2021 CM+PM Revenue	Rank	Company	2021 CM+PM Revenue
1.	CBRE	$2,491,707,424	13.	CDM Smith	$155,000,000	25.	SSOE Group	$47,511,291
2.	Alfa Tech Consulting Engineers	$760,000,000	14.	STV	$131,450,438	26.	Henderson Engineers	$37,796,655
3.	Jacobs	$541,593,682	15.	Gilbane Building Company	$121,111,000	27.	HPM	$35,867,000
4.	Hill International	$377,437,789	16.	Michael Baker International	$103,095,803	28.	Clune Construction	$31,852,062
5.	McKinstry	$350,000,000	17.	CRB	$102,084,115	29.	Russell Group	$26,000,000
6.	AECOM	$286,700,000	18.	JE Dunn Construction	$91,480,198	30.	Robins & Morton	$25,072,164
7.	JLL	$241,928,928	19.	W.E. O'Neil Construction	$81,164,339	31.	WSP	$24,374,087
8.	Construction Management & Builders	$190,812,499	20.	Skanska USA	$73,579,393	32.	Wesbuilt Construction Managers	$21,062,000
9.	CM&B	$190,812,499	21.	Kitchell Corporation	$68,022,838	33.	MG2	$19,855,970
10.	Turner & Townsend	$164,331,000	22.	Kraus-Anderson	$55,000,000	34.	Christman Company, The	$18,400,000
11.	Turner Construction	$162,848,491	23.	McDonough Bolyard Peck	$53,541,813	35.	LeChase Construction Services	$18,397,214
12.	Walbridge	$156,109,745	24.	PMA Consultants	$53,010,507	36.	AFG Group	$17,447,797

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

PHOTO: C&N PHOTOGRAPHY

The Deforest (Wis.) Area School District hired Findorff in 2018 to provide precon and CM services for a 2019 referendum. One of the projects funded was the new Harvest Intermediate School, which opened officially in August 2021.

growth" over the past year, VBC expanded into components manufacturing via its August 2021 acquisition of a 577,000-sf factory in Tracy, Calif., that had previously been owned by Katerra.

To meet its construction workload, **Hoar Construction** needed a better way to stay on top of market volatility. It devised a Market Trends Dashboard for its internal teams to use via its intranet. The Dashboard provided monthly recaps, hard data, and insights that could be used for planning purposes. Similarly, **Walbridge**'s monthly Material Lead Time and Pricing Feedback Survey of its vendors and subcontractors provided Walbridge with reconnaissance for managing its supply chain and effectively measuring COVID's impact.

Level 10 Construction deployed SpeedCore, a concrete-filled composite plate shear-wall system for core erection, on a project in San Jose, Calif., and reduced that project's schedule by three months.

Like many other giants, Level 10 has been thriving: over the past decade, it has constructed 30 million sf of buildings and structures, and improved an additional 10 million sf of tenant space. That portfolio's value is $9 billion.

The last few years have been robust for other firms, too. **Findorff** expanded more in 2021 than it had in its 132-year history. Last year, HITT Contracting delivered more than 1,400 projects in the U.S., and saw its revenue increase by 34%. **Schimenti Construction** added 100 core personnel and increased its employee count by 38 percent. **Ryan Companies**, which was active in every state last year, delivered an estimated 146 projects totaling more than 28 million sf.

Some of the contractors' growth came from opening offices in new markets and adding new practices. Ann Arbor, Mich.-based **PMA Consultants** expanded into Canada by establishing operations in Toronto and Montreal. **Fite Building Company** invested in self-performing site work and developed a construction management services division within the company.

The aviation specialist **VHR Construction** developed its scanning services as a communications and collaboration tool. W.S. Cumby expanded its Philadelphia office to pursue religious building. PCL Construction's solar practice grew its revenue by 40% in 2021, and increased its team to 214 people from 119. **DeAngelis Diamond** created a special projects division within its Naples, Fla., office, concentrating on interior renovations, additions, tenant improvements, and buildouts for commercial, faith-based, and nonprofit projects. In 2021, this division completed over 20 projects.

STRIVING FOR A FAIRER WORKPLACE

As contractors grew, they devoted more attention to workplace diversity, equity, and inclusion (DEI). Last year, **Skanska**'s leadership worked in partnership with the firm's USA D&I Working Group to refine methods and metrics for recruitment, talent management, and education. The firm could also point to organic progress, such as the all-woman leadership team at its 9000 Wilshire office development in Los Angeles.

Shawmut Design and Construction launched a supplier diversity initiative, first regionally then nationally, to support Underrepresented Business Enterprises with topics such as insurance, bonding, and contract requirements. This task force focuses on increasing UBE partner outreach and participation, and setting diversity goals outside of client requirements.

In 2021, Robins & Morton introduced The Family Table, which celebrates diversity and inclusion and serving as a platform for team members to share individual perspectives. This year, Family Table is focusing on recruitment, training, career development, and information resources. Over the past year, **STO Building Group** has developed more robust Minority, Women, and Disadvantaged Business programs for subcontractors, achieved 40% supplier diversity on one of its projects, added more chapters to its STOBG Women in Construction network, and hired a DEI manager.+

—John Caulfield, Senior Editor

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HIGHER EDUCATION, STRIVING FOR 'NORMAL' AGAIN, PUTS STUDENT NEEDS AT THE CENTER OF PROJECT PLANNING

Demand, while strong, is still inconsistent, say AEC firms.

Sustainability is a high priority for Des Moines University's new 88-acre campus for health sciences education in West Des Moines, Iowa, which will include 350,000 sf of spaces for classrooms, labs, a fitness center, admin offices, and parking.

IMEG Corp. is providing engineering designs and services for this $105 million project, which is scheduled for completion next year. (RDG Planning & Design and Turner Construction are on the building team.) The designs for the campus include a 700-well geothermal system for heating and cooling. The campus's central utility plant will include a 1.0 mW generator with an option to add a second plant. Water-to-water heat pumps connected to the geothermal well field will provide 1,300 tons of cooling and 10,300 MBH (1,000 Btu/h) of heating.

Sustainability and design flexibility are what higher education clients are seeking consistently, according to the dozen AEC Giants contacted for this article. "University campuses across North America are commissioning new construction projects designed to make existing buildings and energy

RENDERINGS: PLOMP; COURTESY KPF

systems more sustainable, and are building new flexible learning space that bridge the gap between remote and in-person learning," say Patrick McCafferty, Arup's Education Business Leader–Americas East region, and Matt Humphries, Education Business Leader in Canada region.

Humphries points specifically to the University of Toronto at Mississauga's Centre for Medicinal Chemistry, which will be the most energy efficient lab ever constructed in ASHRAE Climate Zone 5. The university expects the building to achieve a 60% reduction in energy use compared to ASHRAE 90.1.

McCafferty singles out three recent projects—the University of Virginia's Data Science Center, Northeastern University's Interdisciplinary Science and Engineering Complex, and Harvard's Treehouse Conference and Convening space—as examples that meet demand for flexible yet complex spaces. He adds, too, that every higher ed project now "aims to reduce the overall carbon footprint of campuses."

Both Buro Happold and RMF Engineering had a hand in Harvard University's latest campus in Allston, Mass. RMF was involved in the installation of a 54,000-sf district energy facility that provides chilled water, low-temperature hot water, and electrical power to the campus's buildings. The facility includes a heat-recovery chiller and a 1.34-million-gallon thermal energy storage tank. Buro Happold provided integrated structural and geotechnical engineering services for the campus's 544,000-sf, eight-story LEED-Platinum certified Science and Engineering complex that offers an adaptable, innovative environment "while showcasing sustainability," says Susan Sachs, a Partner with Buro Happold.

That firm's higher ed consultancy, brightspot, was the planner for Smith College's Neilson Library in Northampton, Mass., which the college touts as "one of the most sustainable libraries in the U.S." It includes a central oculus for daylighting, a window-to-wall ratio optimized for high performance, sun louvers, and double-pane glass. It uses recycled materials, and its interior is red-list chemical free.

Libraries accounted for 12 of brightspot's 32 higher ed sector projects in the 12 months ending June 2022. "A lot of libraries are planning for their post-pandemic futures," says Buro Happold Marketing Manager Sinead O'Connor.

PLANNING SETS STAGE FOR ROBUST ACTIVITY

In collaboration with the Society for College and University Planning (SCUP), brightspot recently released a Campus Facilities Inventory Report, which found that 84% of institutions planned to update or adapt existing facilities over the next year, 80% planned to make major updates to campus infrastructure, and 88% intended to update meeting room technologies for more virtual learning engagements.

Project demand appears to be cutting across building types and learning disciplines. And for most of the AEC firms contacted for this article, science, engineering, and health sciences comprise the bulk of their higher ed new construction or renovation.

When it opens, the Detroit Center for Innovation, a four-acre expansion of the University of Michigan's campus, will feature a 200,000-sf research and graduate education building for UM students, and provide Michigan businesses with a pipeline for talent.

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The SmithGroup-designed, 175,210-sf Anne Arundel Community College Health and Life Science Building now provides a shared home for the school's life sciences and biology programs. Its features include Sim-City, medical simulation rooms with operable partitions to allow group events; a white-box theatre with projection and whiteboards that can function as a classroom; a 360-degree simulation theater; and a biology super lab with motorized partitions. The LEED Gold building also has a 160-seat lecture hall, a greenhouse, classrooms and computer labs, study and meeting rooms, and offices.

"Resilience, flexibility, and adaptability are fundamental guiding principles" for designing academic spaces, says Chris Purdy, AIA, LEED AP, SmithGroup's Vice President–Higher Ed Practice Director. The firm has been seeing more demand for projects with health science programming that addresses regional needs for increased care providers and community health, such as physical therapy.

In May, Colorado State University opened the 80,000-sf Nutrien Agricultural Sciences building that centers the school's College of Agricultural Sciences at the heart of its campus. Designed by CannonDesign, the Nutrien building features labs and studios on its upper floors, a 180-seat in-the-round auditorium, a student-focused mall that creates storefronts for the building's programming, and an Innovation Gym for collaboration.

PHOTO: NIC LEHOUX ARCHITECTURAL PHOTOGRAPHY

Neilson Library on the campus of Smith College in Northampton, Mass, is highly sustainable. It features a central oculus for daylighting, an optimized window-to-wall ratio, and recycled materials.

BUILDING FOR A RETURN TO NORMAL

DPR Construction has seen a steady increase in capital planning activities for renovations, modernizations, and new construction, says Greg Fraikor, the firm's Higher Education Core Market Leader. "The continued demand for general classrooms, sports facilities, and student housing is being driven by the momentum of students likely returning to a more 'normal' on-campus community lifestyle," he explains. One recent example is the 160,000-sf addition to and renovation of the University of Georgia's Butts-Mehre Heritage Hall, which Fraikor claims enhances the student-athlete experience as one of the largest sports medicine and strength and conditioning facilities in the country for a Division 1 team.

Athletics and kinesiology, along with STEM, housing, and renovations are the kinds of higher ed projects that HMC Architects has been engaging lately. "Academic buildings and affordable housing are the priorities in California," says Sean R. Rosebrugh, AIA, LEED BD+C, HMC's Principal in Charge–Higher Education. At California State University, Fullerton, one such project is expanding that campus's housing options by demolishing older buildings, eliminating a parking lot, and extending the campus footprint. The new $120 million, six-story building with 600 beds, which HMC designed and Sundt is constructing, is organized so that its three wings, while connected as a cohesive "community," can also operate autonomously, depending on resident or conference needs. The building is scheduled for completion in August.

The trend toward student "normalcy" might also explain the demand on some campuses for new performing arts centers. At Brown University in Rhode Island, Shawmut Design and Construction has been completing the 94,000-sf Lindemann Performing Arts Center, which is set to open next year and will anchor a future campus arts district, says Ron Simoneau, Shawmut's Executive Vice President of Education.

SmithGroup is also seeing demand from universities and colleges for multicultural projects that address inclusion, says Purdy. These include a Multicultural Center at Michigan State University, and

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PHOTO: CHRISTY RADECIC

DPR Construction worked creatively with the design team on the expansion of Butts-Mehre Heritage Hall for the University of Georgia Athletic Association. The 160,000-sf renovation and addition enhanced the student-athlete experience and contributed to the college's post-COVID return to normal.

the College of DuPage's Student Success Center encompassing a multicultural space.

DEMAND STILL AMBIVALENT

SmithGroup's higher ed practice enjoyed an increase in business last year, "with students at the core of institutions' decision-making more than ever before," says Purdy.

"Coming out of the pandemic, campuses are in a period of reflection, to be prepared for the future," observes John Holbert, IMEG Corp.'s National Director of Education. Consequently, his firm has been receiving "a tremendous number of proposals" from institutions across the U.S., with focuses on academic health and industrial technology. "Right now, the balance is getting the supply chain and budget to align with designs," says Holbert.

For some AEC firms, though, demand from the university sector has been mixed. Over the past year, HMC Architects saw a decrease in demand, possibly due to reduced enrollments and lack of reliable funding from California, suggests Ken Salyer, AIA, HMC's Principal and Higher Ed Practice Leader. LF Driscoll, the construction management firm, also has experienced a slowdown in RFPs across the higher ed sector, and some projects put on hold "indefinitely," says Trish Mitchell, the firm's Director of Business Development.

Conversely, Buro Happold saw "a welcomed increase" in demand, says Sachs. And brightspot had around 10 more university projects between June 2021 and June 2022, compared to the previous 12-month period, says O'Connor.

During the past year, architecture firm Kohn Pedersen Fox saw a slight uptick in higher ed project demand, with a "continued focus" on research and innovation districts, says Jill Lerner, FAIA, Principal.

One of her firm's latest endeavors is the Detroit Center for Innovation, to be located on four acres in The District Detroit, a mixed-use sports and entertainment district between the Motor City's downtown and midtown. With groundbreaking scheduled for 2023, this $250 million innovation project—whose clients include the University of Michigan and the developers Related Companies and Bedrock Detroit—will feature 200,000 sf of research and graduate education space for UM students in mobility, AI, data science, entrepreneurship, cybersecurity, and financial technology. The initial phase will also include incubator and startup services, residential units, a hotel/conference center, and event space.+

—John Caulfield, Senior Editor

UNIVERSITY SECTOR ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2021 Higher Education Revenue
1.	Gensler	$67,705,309
2.	CannonDesign	$55,000,000
3.	SmithGroup	$54,956,712
4.	Perkins and Will	$46,864,376
5.	Ayers Saint Gross	$29,124,106
6.	Skidmore, Owings & Merrill	$24,294,000
7.	Kohn Pederesen Fox Associates	$23,832,049
8.	Perkins Eastman	$23,314,200
9.	DLR Group	$21,750,000
10.	Shepley Bulfinch	$21,508,030

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

UNIVERSITY SECTOR ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2021 Higher Education Revenue
1.	AECOM	$89,300,000
2.	Jacobs	$43,950,000
3.	Salas O'Brien	$29,338,167
4.	IMEG Corp.	$27,464,000
5.	NV5 Global	$25,297,770
6.	WSP	$22,105,278
7.	P2S	$20,279,758
8.	Affiliated Engineers Inc	$17,303,915
9.	Arup	$15,589,756
10.	RMF Engineering	$15,000,000

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

UNIVERSITY SECTOR CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2021 Higher Education Revenue
1.	Turner Construction	$1,198,545,450
2.	Whiting-Turner Contracting Co., The	$479,633,587
3.	PCL Construction Enterprises	$413,505,527
4.	DPR Construction	$404,808,000
5.	STO Building Group	$392,000,000
6.	Gilbane Building Company	$312,935,000
7.	Suffolk Construction	$294,332,000
8.	Shawmut Design and Construction	$285,292,607
9.	McCarthy Holdings	$236,095,930
10.	Messer Construction	$222,441,771

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

LAB SPACE SCARCITY PROPELS CONSTRUCTION DEMAND IN LIFE SCIENCES SECTOR

Speed to market and design flexibility define many projects.

In its 2021 Life Sciences Real Estate Outlook, JLL predicted that access to talent would be a primary concern for an industry sector that had been growing by leaps and bounds. A year later, talent still guides real estate decisions. But market conditions of a different sort were cooling the biotech field: namely, investors that have soured on startups which underperformed after going public.

What this means for new construction and renovation going forward is unpredictable, as the drivers behind life sciences' surge—demand for new medicines and vaccines at a time when lab space has been scarce—are still palpable. What also hasn't changed are client expectations for labs, innovation hubs, and science- and research-related projects: design flexibility, amenities that promote collegiality and exposure to the outdoors, and locations with ample access to highly skilled workforces.

AEC firms reiterate variations of these "must haves" when asked about trends in science and technology design and construction. Nancy Escano, AIA, Co-founder and Managing Principal for the architecture design firm DGA, cites "Science on Display" that connects offices and labs, collaboration and adaptability, quiet zones, branding, and amenities that improve tenant satisfaction. Jose Jimenez, Gilbane Building Company's Vice President–Life Sciences, says his firm's clients want speed to market, budget certainty, and flexibility within the context of increased demand for manufacturing and research spaces, greater adoption of prefabrication and modular systems, commitment to environmental sustainability, and a focus on intensification and digitization.

Developers "want to come up with a recipe that allows them to market a building as 'lab ready,' but also to be able to accommodate a full office tenant if that is where the demand is," observes Scott Strom, DPR Construction's Life Science Core Market Leader.

"Flexibility in design allows for spatial enhancements that adapt to future changes," wrote three execs from the design firm HKS in a blog posted earlier this year that identified five trends shaping life science labs. The authors—Vice President Nancy Constandse, Senior Lab Planner Tom Guiggio, and Regional Practice Director Darcy Royalty—noted that renovations were on the rise, as was demand for innovation hubs that "are becoming more prevalent [in this sector] as people realize how important and influential shared data and findings can be."

AN OPEN RUNWAY

All nine AEC Giants contacted for this article report that their science and tech practices grew during the previous 12 months. "We've seen a significant rise in activity," says Rishi Nandi,

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HAIKEN MASON PHOTOGRAPHY

The mixture of lab and office space distinguishes the buildout of Regenxbio's corporate headquarters in Rockville, Md., which was completed in May by DPR Construction.

AIA, LEED AP, RELi AP, Senior Associate and Senior Project Architect for NBBJ. Nandi adds that his firm has witnessed both considerable speculative demand for new construction, as well as more calls for converting offices, warehouses, and other building types to labs.

Despite signs that demand might be peaking, Strom of DPR says the sector remains robust. Demand for cGMP manufacturing space has been "at an all-time high," and is being met by sizable investment from contract manufacturing organizations (CMOs) and big pharma companies. On the vaccine front, there are increased facility needs for emerging RNA-based applications and lipid nanoparticle formulation technologies.

Demand for life sciences labs has been expanding beyond the traditional tech corridors into new markets. Over the past year, Skanska saw "notable" expansion of projects into new geographies like Ohio and Texas, says Bryan Northrop, the firm's Executive Vice President–New England Building Operations. Such demand is due, in part, to supply-chain issues and the desire to return manufacturing to the U.S., he explains. "We are starting to see the planning and construction of large-scale manufacturing facilities with 15,000- to 20,000-liter bioreactors, and companies like Amgen and Johnson & Johnson exploring locations to construct new facilities."

SCIENCE+TECHNOLOGY ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2021 S+T Facilities Revenue
1.	HDR	$104,448,517
2.	Flad Architects	$92,960,000
3.	Gensler	$91,887,410
4.	DGA planning | architecture | interiors	$78,875,316
5.	HOK	$65,636,169
6.	Perkins and Will	$58,880,033
7.	EwingCole	$52,000,000
8.	Payette	$43,902,701
9.	Elkus Manfredi Architects	$37,553,350
10.	ZGF Architects	$35,764,669

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

SCIENCE+TECHNOLOGY ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2021 S+T Facilities Revenue
1.	Jacobs	$406,875,000
2.	CRB	$222,958,353
3.	Fluor	$145,334,807
4.	Affiliated Engineers Inc	$63,614,626
5.	Barry-Wehmiller Design Group	$60,759,780
6.	Burns & McDonnell	$52,311,608
7.	WSP	$30,820,598
8.	Vanderweil Engineers	$22,030,700
9.	Alfa Tech Consulting Engineers	$21,000,000
10.	Salas O'Brien	$17,093,865

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

SCIENCE+TECHNOLOGY CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2021 S+T Facilities Revenue
1.	Whiting-Turner Contracting Co., The	$933,529,411
2.	Hensel Phelps	$886,806,572
3.	DPR Construction	$848,745,000
4.	Skanska USA	$728,750,484
5.	Turner Construction	$610,760,618
6.	CRB	$581,267,994
7.	McCarthy Holdings	$437,654,661
8.	STO Building Group	$400,000,000
9.	Truebeck Construction	$303,233,504
10.	Gilbane Building Company	$291,935,000

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BD+C University

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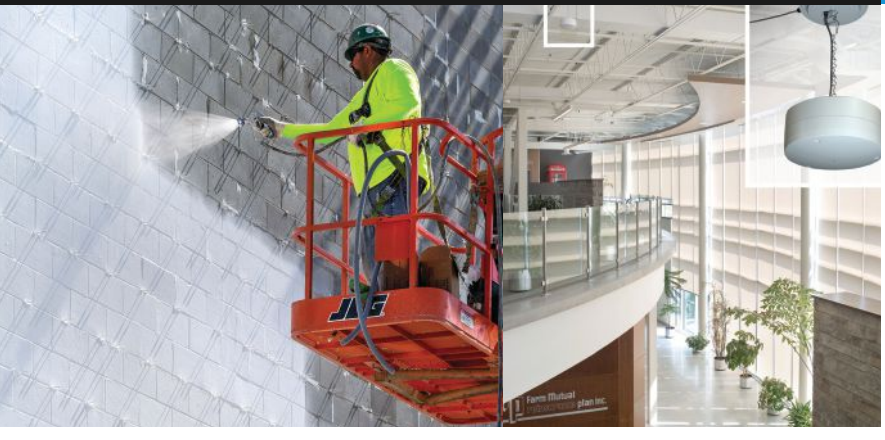

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BUILDING FASTER

More than three-fifths—62%—of Skanska's recent life sciences/S+T projects were renovations and additions. Northrop and other AEC sources point out that renovations are often preferable to new construction because the latter takes much longer to get started.

"Speed to market is the primary driver in this sector. Renovation may offer the ability to expedite the construction schedule," says Gregory T. Smith, Turner Construction's Vice President of Preconstruction. (That schedule benefit diminishes, he cautions, when projects are phased.)

Adaptive reuse has become a viable alternative to new construction, although Smith notes that many existing buildings aren't suitable for life science programs without substantial and costly modifications to address vibration mitigation, floor-to-floor heights, and adaptable building cores.

DGA's Escano agrees. "On a few occasions, we have been approached to look at the repositioning of other types of buildings into life sciences facilities, such as big boxes and even an ice-skating rink. These projects are extremely challenging, and there is uncertainty about how desirable the completed facilities will be."

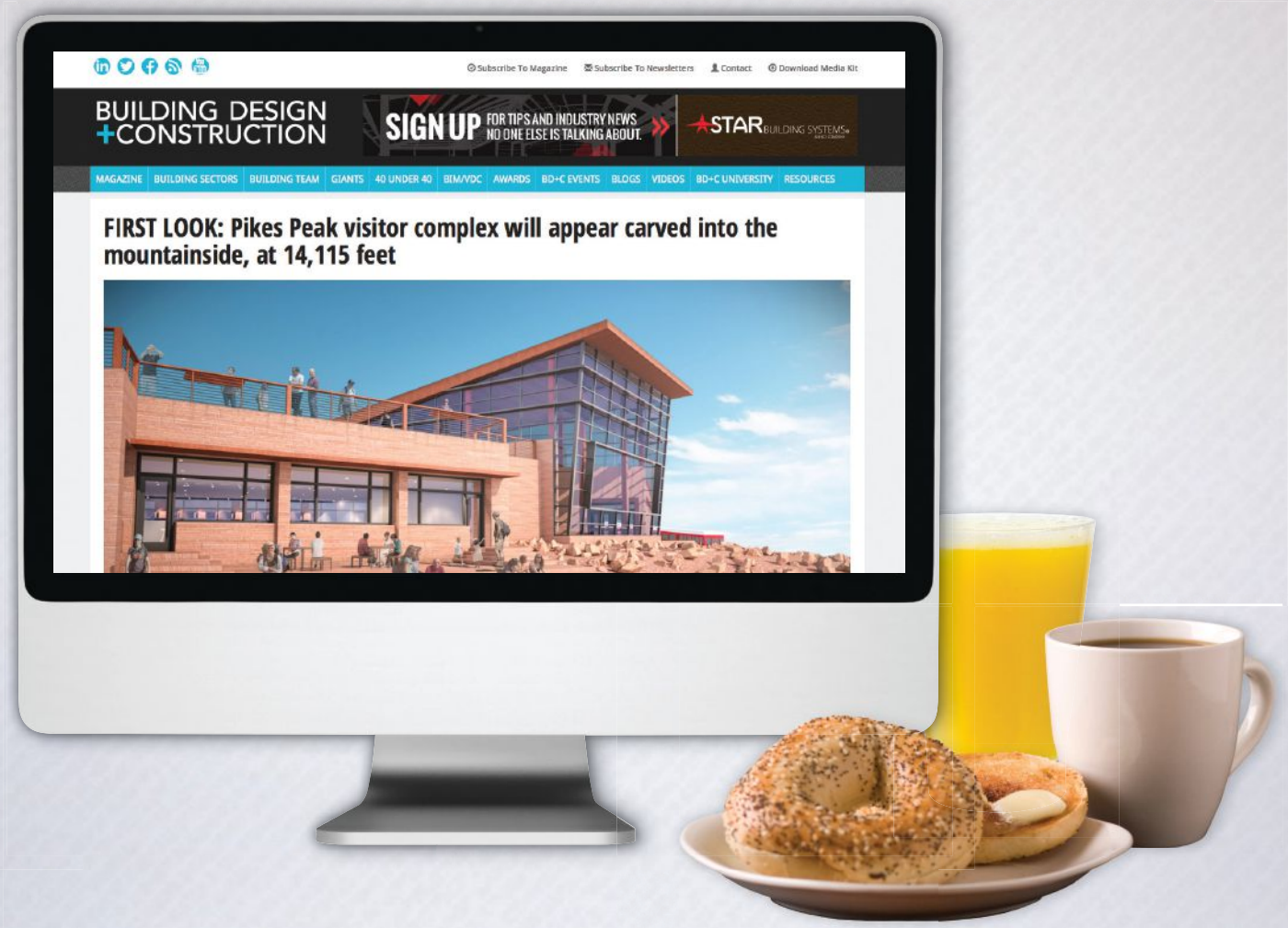
That being said, "It's definitely a trend," says NBBJ's Nandi about adaptive reuse. His firm is in the process of converting a ballroom into lab space. Another project, in the U.K., called The Works, was a former auto body shop that NBBJ transformed into a flexible R&D work environment.

In Grove City, Ohio, Skanska is transforming a book storage facility into a 126,000-sf research and biomanufacturing facility that's part of a multi-phased master plan for Forge Biologics. Scheduled for completion next March, the build-out, designed by BHDP Architecture, is adding 18 new ISO 7 clean rooms, three culture labs, a quality control lab, two 5,000-liter bioreactors, and a new HVAC system. As part of this $76 million project, Skanska is building a two-story structure with 50,000 sf of office space.

"We've seen more developers re-evaluating their portfolios and reusing them for life science laboratories and processing facilities," says John Westphal, an Oakland, Calif.-based Managing Director with Salas O'Brien, the engineering and facilities planning firm. For example, he's watched suburban developers rebrand one-story warehouses, vacant

Renovations are a big part of the life sciences movement. Two of DGA's recent S+T designs include tenant improvements for 150,000 sf of the startup Element Biosciences' headquarters and R&D facility in San Diego, Calif. (top); and adapting an existing 59,000-sf two-story building in Alameda, Calif., for the new Drug Discovery Building for the oncology biotech company Exelixis (above).

ALL THE ESSENTIAL NUTRIENTS



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retail malls, and underperforming commercial assets to tech and research labs.

Michelle Gangel, R&D Segment Leader for the AEC firm CRB, believes that adaptive reuse will become "increasingly necessary" to address supply chain and sustainability issues in this sector. CRB provided lab planning and MEP engineering services for Fulton Labs, a former office building in Chicago's popular Fulton Market neighborhood that's now a 14-story, 301,260-sf facility with 11 floors dedicated to leasable lab and office space, and amenities that include a rooftop lounge and beer garden. Modular design and flexible plug-and-play infrastructure allows the lab space to be reconfigured as needed. (CRB completed this project in late 2021 for developer Trammel Crow.)

One of Turner's recent adaptive reuse projects is The Assembly, a former Ford Motor Company assembly plant in Pittsburgh that a building team led by Wexford Science & Technology and the University of Pittsburgh transformed into a research, innovation, and entrepreneurship hub that added 108,000 sf of new leasable space to the building's original 250,000 sf. This $330 million project houses labs, offices, a 250-seat auditorium, restaurant and café, and event and conference spaces.

BUILDING SMARTER

Moving forward, the life science/S+T sector is likely to expand through a mixture of new builds and renovations. DGA has been particularly active in this sector, and its recent projects include the design of Cytokinetics' seven-story, 235,000-sf headquarters and R&D facility in San Francisco that is opening in phases through next January; tenant improvements to 150,000 sf of Element Biosciences' headquarters and R&D facility in San Diego, which will be completed in December 2023; and a new campus for Neurocrine Biosciences in Del Mar, Calif., that includes ground-up lab buildings totaling 280,000 sf, tenant improvements on 553,000 sf of existing office space, a new fitness center and interconnected courtyards and outdoor spaces.

Among DPR Construction's recent work was the fitout of 26,000 sf in an existing warehouse in Arcadia, Calif., for clean rooms and support labs for cell and gene therapy. Its client was Theragent, and the project, designed by Lionakis, was completed last March. For Regenxbio, DPR built out a new 140,000-sf office-and-lab headquarters in a recently completed but unoccupied building in Rockville, Md.

COURTESY SGA

Gilbane is providing CM-at-risk services for the 205,000-sf mixed-use Union Square life sciences building in Somerville, Mass. This is the first phase of a 2.7 million-sf urban redevelopment that will revitalize Union Square into an urban employment district and provide new accessibility by way of a new MBTA train station, bike lanes, and pedestrian paths.

DPR completed this $71 million project, designed by Ewing Cole, on a fast-track schedule. Strom has noticed that clients are showing increased interest in evaluating project delivery and procurement methods "to help them lockup trade contractor capacity and deal with supply-chain and price escalation. Selecting the appropriate delivery method is crucial for increasing the speed to market."

With speed to market the abiding directive, delivery methods more often include prefab and modular options. "Maximizing offsite prefabrication of specific building systems is another key strategy," says Gilbane's Jimenez. His company is the construction manager for the Spagnola/Gisness & Associates-designed Union Square Life Sciences development in Somerville, Mass. Its first phase, which is scheduled for completion next May, is a seven-story, 205,000-sf building whose MEP systems for entire floors are prefabricated, including nearly all the mechanical piping in the penthouse.

To ensure flexibility, one of Skanska's current S+T projects has a prefabricated panelized ceiling system with stick-built walls, instead of a more conventional panelized system or pre-manufactured pods. Northrop explains that this method will fully support the ceiling system with non-load bearing walls while allowing the client "to easily change the layout of their manufacturing facility, if necessary."+

—John Caulfield, Senior Editor

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AEC GIANTS INNOVATE MULTIFAMILY HOUSING

Co-living spaces, wellness-minded designs, and tiny home developments highlight the AEC firm innovations in the multifamily sector.

PHOTOS COURTESY CLAYCO

The booming multifamily sector shows no signs of a significant slowdown heading into 2023. Here is a round up of Giants 400 firms that are driving innovation in this sector:

Clayco and **Fitzgerald and Associates** completed the 20-story, 330-unit X Phoenix development, a mixed-use residential high-rise in downtown Phoenix that contains, among other rental units, dedicated space for co-living. This shared apartment model is designed to cater to working professionals seeking convenience, community, and modern shared amenity space at more attainable prices in expensive rental markets. The development also includes an indoor bike mezzanine, 105,500-gallon pool, five-story parking garage, and 50,000 sf of shell space that will include a commercial restaurant.

Dahlin Group developed a tiny home prototype, Mod Hive, to help address the affordable housing shortage in Salt Lake City. The prototype works as a small cluster on one lot or a small, planned development consisting of multiple lots. The concept involves an inward-looking site plan that creates a tiny village with space for a community garden, outdoor gathering space, and barbecue/firepit. It replicates the feel of a traditional neighborhood of two-story, single-family detached homes by employing a lower-density configuration at the front of the lot, with higher densities at the rear.

For another tiny house project, Dahlin collaborated with HomeAid Northern California and Firm Foundation Community Housing to design cost-effective tiny home villages sited on church properties, targeted at individuals facing homelessness. This partnership completed its pilot project in February 2020 with additional projects under development in 2021. In the San Francisco Bay Area, affordable multifamily developers expect to spend $700,000 to $1 million per single one-bedroom unit; the pilot village came in at $150,000-$170,000 per unit, with an entitlement process of just 12-18 months.

Dattner Architects had four Passive House projects progress through construction stages in 2021, with Santaella Gardens completed in late 2021 and receiving Passive House Certification in early 2022. These projects provide replicable models for Passive House applications to multifamily affordable housing. Santaella Gardens provides much needed workforce and affordable housing in the Bronx. Its super-insulated, airtight building envelope includes thermally

Clayco and Fitzgerald and Associates recently completed the 20-story, 330-unit X Phoenix development, a mixed-use residential high-rise in downtown Phoenix that contains, among other rental units, dedicated space for co-living.

See the full **GIANTS 400** rankings and bonus categories at: BDCnetwork.com/Giants2022

broken, high-performance windows and advanced air sealing details to eliminate condensation and air exfiltration. Rooftop solar photovoltaic panels generate onsite renewable energy, with a capacity of 162.7 kW. The building has a projected energy use intensity of 20.40 kBTU/sqft/yr.

The Hall Arts Residences in the Dallas Arts District joins **HKS**'s growing portfolio of projects focused on creating superior spaces for the health and well-being of building occupants. The project is the first residential project in Texas to register for WELL Multifamily Certification.

Morrison Hershfield contributed to the launch of the Embodied Carbon Pathfinder, a free app for quickly estimating cradle-to-grave whole-building life cycle assessment results for multifamily buildings. The tool uses thousands of data points that allow users to find "pathways" through design choices to land on a target embodied carbon result. The project is a collaboration with OPEN Technologies and the Athena Institute.+

— Compiled by BD+C Staff

APARTMENT + CONDOMINIUM ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2021 Apart/Condo Revenue
1.	Solomon Cordwell Buenz	$49,528,762
2.	KTGY	$49,087,992
3.	Gensler	$40,673,109
4.	AO	$39,650,000
5.	Humphreys & Partners*	$35,200,000
6.	Handel Architects	$34,193,203
7.	HKS	$30,000,000
8.	Stantec	$28,028,258
9.	Niles Bolton Associates	$22,400,252
10.	GGLO	$21,451,990

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

APARTMENT + CONDOMINIUM ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2021 Apart/Condo Revenue
1.	Kimley-Horn	$173,879,680
2.	Langan	$43,000,000
3.	Thornton Tomasetti	$38,938,827
4.	WSP	$36,373,844
5.	DeSimone Consulting Engineering	$35,875,046
6.	Olsson	$31,690,829
7.	Wiss, Janney, Elstner Associates	$22,740,000
8.	BKF Engineers	$22,364,878
9.	AECOM	$18,200,000
10.	Morrison Hershfield	$16,395,415

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

APARTMENT + CONDOMINIUM CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2021 Apart/Condo Revenue
1.	Clark Group	$1,520,704,261
2.	Suffolk Construction	$1,450,051,000
3.	AECOM	$1,159,200,000
4.	Lendlease	$879,389,000
5.	Summit Contracting Group	$777,448,575
6.	Whiting-Turner Contracting Co., The	$662,057,419
7.	Gilbane Building Company	$601,943,000
8.	Balfour Beatty US	$576,262,875
9.	McShane Companies, The	$517,088,014
10.	Bozzuto Construction	$501,159,825

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

STUDENT HOUSING ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2021 Student Housing Revenue
1.	Niles Bolton Associates	$13,835,722
2.	Humphreys & Partners*	$11,000,000
3.	Mithun	$8,401,130
4.	Gensler	$7,179,986
5.	Perkins and Will	$7,003,039
6.	Elkus Manfredi Architects	$6,035,185
7.	Ayers Saint Gross	$5,517,832
8.	Solomon Cordwell Buenz	$5,434,997
9.	Clark Nexsen	$4,140,500
10.	BKV Group	$3,500,000

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

STUDENT HOUSING ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2021 Student Housing Revenue
1.	Kimley-Horn	$7,244,987
2.	Wiss, Janney, Elstner Associates	$6,500,000
3.	KPFF Consulting Engineers	$6,052,778
4.	Jacobs	$5,840,000
5.	Langan	$5,000,000
6.	Bala Consulting Engineers	$4,400,000
7.	BKF Engineers	$3,490,661
8.	IMEG Corp.	$2,658,000
9.	Salas O'Brien	$1,084,394
10.	Tighe & Bond	$1,000,000

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

STUDENT HOUSING CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2021 Student Housing Revenue
1.	J.H. Findorff & Son	$185,162,149
2.	PCL Construction Enterprises	$135,734,297
3.	Juneau Construction	$93,213,210
4.	Sundt Construction	$92,955,309
5.	JE Dunn Construction	$82,556,195
6.	McCarthy Holdings	$76,855,853
7.	Weitz Company & Affiliates, The	$75,704,537
8.	Holder Construction	$71,000,000
9.	Gilbane Building Company	$68,712,000
10.	Clark Group	$64,507,662

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

SENIOR LIVING ARCHITECTURE + AE FIRMS | TOP 10

Rank	Company	2021 Senior Living Revenue
1.	Perkins Eastman	$43,300,000
2.	Hord Coplan Macht	$14,535,223
3.	Ryan Companies US / Ryan A+E	$12,206,336
4.	Stantec	$8,584,846
5.	Moseley Architects	$6,957,541
6.	Lawson Group Architects	$6,500,000
7.	AG Architecture	$6,012,662
8.	CallisonRTKL	$5,412,338
9.	RDG Planning & Design	$4,506,037
10.	Gensler	$4,282,894

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

SENIOR LIVING ENGINEERING + EA FIRMS | TOP 10

Rank	Company	2021 Senior Living Revenue
1.	WSP	$16,706,938
2.	Olsson	$11,102,000
3.	Kimley-Horn	$10,061,381
4.	KPFF Consulting Engineers	$6,052,778
5.	Langan	$5,000,000
6.	IMEG Corp.	$3,379,800
7.	Wiss, Janney, Elstner Associates	$3,250,000
8.	BKF Engineers	$2,591,479
9.	EXP	$1,916,733
10.	Dewberry	$924,453

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

SENIOR LIVING CONSTRUCTION + CM FIRMS | TOP 10

Rank	Company	2021 Senior Living Revenue
1.	Whiting-Turner Contracting Co., The	$405,239,474
2.	Ryan Companies US / Ryan A+E	$318,177,097
3.	W.E. O'Neil Construction	$168,715,324
4.	KBE Building Corporation	$164,841,093
5.	Suffolk Construction	$160,362,000
6.	McShane Companies, The	$133,256,564
7.	Weis Builders	$101,179,279
8.	Arco Construction	$95,929,371
9.	W. M. Jordan Company	$91,875,096
10.	Gilbane Building Company	$90,161,000

SOURCE: *BD+C* 2022 GIANTS 400 REPORT

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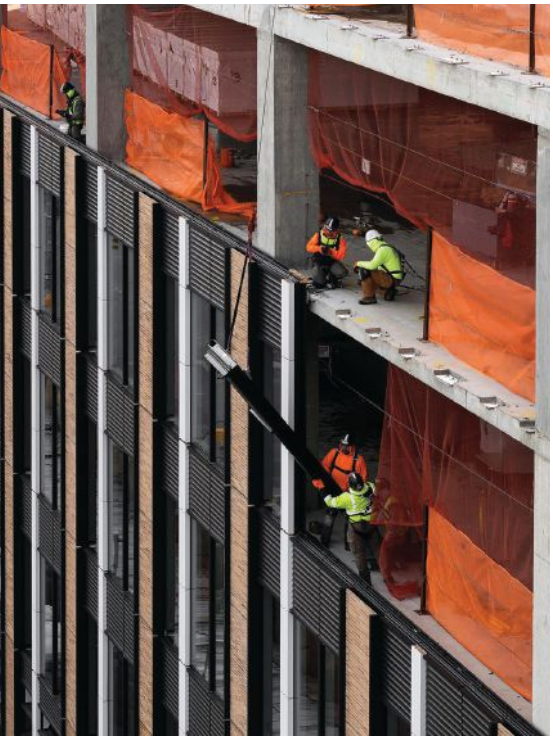
SOLUTIONS FOR CLADDING SUPPLY AND PERFORMANCE



Contextually inspired material mixing for One Essex Crossing's curtain wall façades weave together panels of warm brick and Italian terra cotta.

PHOTOS COURTESY CETRARUDDY

LEARNING OBJECTIVES

After reading this article, you should be able to:

- **DISCUSS supply challenges related to cladding materials and potential solutions building teams are employing**
- **LIST four or more cladding material choices and their relative benefits and limitations for cladding assemblies**
- **DESCRIBE building design and construction methods that have been used for cladding solutions, including rainscreens**
- **EXPLAIN how project team experiences in high-performing building design have affected the choice of cladding solutions or delivery methods, such as enclosure commissioning**

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From a distance, today's building innovations in cladding performance, aesthetics, and construction appear unconstrained and quite varied. Material mixing is creating newly expressive façades, and performance standards for solar heating, air infiltration, and moisture management are more effective than ever before. Increased use of rainscreens and new fabrication innovations, including engineered precast systems, contribute to surprising new enclosure designs backed by better solutions to ensure continuous insulation (CI) and properly installed and structurally supported air barriers.

Technically, today's building teams are producing passive designs and sustainable solutions that are more effective than ever, often with renewable materials that better withstand climate stressors while committing less embodied carbon.

It sounds good. Yet, just as this is happening, building teams are facing unprecedented price pressures and supply chain issues that necessitate rapid, creative solutions.

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CIRCLE 763

The Future is Fiberon

Where value engineering has been a dominant solution path of last resort in past decades, post-pandemic cladding selection is all about making do with less, anticipating shortages, and collaborating on clever downstream substitutions.

First, managing project costs is a dynamic, ongoing battle. Construction materials jumped over 20% on average from 2021 to 2022, according to Associated General Contractors (AGC) of America, which reported that "multiple increases have taken effect for metals, fuel, and trucking, while supply chains have become even more snarled." Examples of base products commonly used in cladding systems include copper (24.4% YOY cost increase), architectural coatings (20.3%), insulation materials (17.8%), and plywood sheathing and exterior siding products more generally, both at 22.5%. Behind the double-digit price increases are challenges for many material suppliers, including reduced availability and price hikes for energy and fuels, constituent materials, and freight itself. "At some point, projects no longer pencil out as contractors have to raise bid prices to keep pace with the rapid inflation in materials costs," said Stephen E. Sandherr, CEO of AGC.

Commissioning + Cladding = Confidence

To make cladding choices that promise longevity, sustainability, and optimized return on investment, more building teams are incorporating a commissioning process.

"Commissioning has been key tool for public projects to insert accountability in meeting design criteria," says Zack Aders, AIA, LEED AP, with the nonprofit project leader New York City Economic Development Corporation. "Envelope commissioning in particular is critical to ensure that weather-resistive barriers are applied correctly and continuously and that air sealing details perform as designed."

According to engineering firm Simpson Gumpertz & Heger, enclosure commissioning is outlined in both LEED and ASTM E2813 to orient building teams. "To be truly effective, building enclosure commissioning should begin in the predesign phase and continue through the design, preconstruction, and construction phases of the project," says the firm, which holds a specialty in façade engineering. ASTM E2813, for example, requires commissioning to begin during design development at minimum, and for better, enhanced commissioning, it should start in schematics.

Beginning-to-end is the mantra for enclosure excellence: A key part of the process for enhanced commissioning, for example, is to plan for oversight during construction. This vastly improves the resolution of such challenges as constructability, material compatibility, and full continuity of insulation, or CI, and weather-resistive barriers, or WRBs.

"Verifying these details as the building is being constructed allows us to address any gaps before the walls are closed up, helping the team avoid costly rework," says Aders.

SUPPLY CHAIN SOLUTIONS

The initial response has been chaos for cladding specifiers and subcontractors alike. Owners and developers have postponed project starts to match exterior system delivery timeframes. Construction management (CM) firms have devised inventive project staging and sequencing to realign preconstruction activities or speed up certain trades while cladding deliveries catch up, according to global developer McLaren. Other project teams report using a stop-start approach on multiple project sites, both priming the project pipeline while also staging strategically for pending cladding product deliveries.

During the pandemic, owner-operators with ambitious building programs like hotel company citizenM have stocked up on modular construction systems with integrated façade assemblies, completing new hotels in Los Angeles and Seattle recently, among others. Using a centralized business model, the global company created a backlog of the interchangeable and deployable, stackable units within structural steel cages. According to the CM Mortenson, which has built several of the hotels with architects Concrete, Baskervill, and Gensler, as well as engineers like Arup, integrating the "modern and luxurious modular room pods" into the building designs also slashes construction waste by up to 60% says Mortenson's Director Of Project Development, Nathan Jenkins. He says the approach cuts construction duration by three to four months, compared to traditional onsite methods.

On the supply end, some façade system manufacturers resist bidding on projects unless they've received iron-clad purchase orders. Others, according to Capstone, a financing company active in the construction sector, use price collars or put "expiration dates" on bids so they "have the opportunity to rebid if the bid validity date passes to account for the higher cost of goods." Another option that has been rare in the past, stipulating inflation terms in contract language, can benefit general contractors and at-risk CMs, as well as the suppliers involved. "Construction cost inflation has not exceeded 5% for over three decades, so many contractors do not have experience in an inflationary environment," according to Capstone. "Adding a few percentage points to bids for inflation won't protect you sufficiently in this type of environment either."

STOCKPILING AND SPEEDING ENVELOPES

Building teams with multiple projects or major capital programs are stockpiling materials they use frequently or are making "ghost orders" not necessarily

PHOTOS: HOWARD HUGHES CORP.

An innovative, light-colored cladding of preglazed, preinsulated GFRC panels clads 1700 Pavilion in Summerlin, Nev., accelerating construction for the lifestyle-driven commercial building.

related to a particular project. Suffolk Construction has successfully warehoused materials recently to keep projects on schedule, while other contractors are reporting related shortages of storage facilities, leading the teams to erect temporary laydown facilities. Taking a proactive posture has helped contractor XL Construction, which self-performs some of its work, to deal with reported lead times of up to a year for curtain wall systems and precast wall cladding.

Building design teams are regrouping and looking for more readily available materials. While fiberglass resin shortages slowed swimming pool construction last year, sales of glass-fiber-reinforced concrete (GFRC) grew, boosting architectural precast suppliers like Willis Construction. Projects under way include 1700 Pavilion in downtown Summerlin, Nev., a Howard Hughes Corp. office building to open this fall. Designed by architect Hart Howerton and being built by GC Whiting Turner, the building features an innovative, light-colored cladding of preglazed and preinsulated GFRC panels.

The lightweight cladding panels minimize structural loads, which can hasten framing and connection deliveries, and they can be "prefabricated in advance while the foundation and structure are being built," according to another GFRC maker, Stromberg Architectural. "Cladding with GFRC panels can often eliminate the need for scaffolding because the panels are lifted by crane and then attached from inside the building," regardless of weather, adds the Texas-based supplier.

Craned applications hold wide appeal in this tight market, according to owner-developers like nonprofit senior community Harbor's Edge in Norfolk, Va. Their project team—including contractor W.M. Jordan and architecture firms three and Clark Nexen—responded to developer and CEO Neil Volder's conception of a 24-story high-rise expansion, River Tower, with an exterior façade system melding brick, masonry, and glass that could be erected quickly and with a crane, rather than system scaffolding. Local precast manufacturer Smith-Midland produced the SlenderWall composite cladding panels offsite in two-story sections with windows preinstalled, says Carl S. Ede, AIA, LEED AP, Principal and Senior Designer with three, the Dallas-based firm. About 66% lighter than traditional 6-inch-thick precast and with better thermal performance, the opaque wall sections integrate a two-inch-thick concrete panel on a frame of galvanized steel studs backed with closed-cell foam insulation. Less concrete means lower embodied carbon, too, say suppliers.

Attached to the building frame with all-concrete floor slabs—a better choice acoustically between floors to mask footfall and other noise, says three's Ede—the mixed-material system with brick, masonry, and glass allows for articulated transitions such as banding across glass areas that echoes Norfolk's portside context, yet can be hoisted into place quickly in two-floor sections. The only tradeoff is crane access and operations, he adds, which building teams must consider in site staging and construction decisions.

CREEPERS AND SCREENS

For another high-rise, a new 35-story glass tower in Boston for Raffles set to open this year, the use of small, portable crawler or creeper cranes allows smooth construction progress in spite of a constrained urban site. Built with a carefully tuned, unitized glass curtain wall system specifically to allow this fast, effective assembly process with the moveable cranes hanging off the structure, the Back Bay-area project for Raffles Hotels & Resorts, part

Example Rainscreen Wall Assemblies

Rainscreen over wood-frame wall	Rainscreen over steel-frame wall with exterior insulation	Rainscreen over concrete/CMU wall with exterior insulation	Rainscreen over insulating concrete form (ICF)
1. *Outer Layer*: Cladding 2. *Cavity*: Created by vertical treated wood furring straps 3. *Inner Layer*: WRB attached to backup wall sheathing	1. *Outer Layer*: Cladding 2. *Cavity*: Created by vertical galvanized steel furring outboard of the insulation 3. *Inner Layer*: WRB adhered to backup wall sheathing	1. *Outer Layer*: Cladding 2. *Cavity*: Created by vertical galvanized steel furring outboard of the insulation 3. *Inner Layer*: WRB applied to concrete surface	1. *Outer Layer*: Cladding 2. *Cavity*: Created by vertical treated wood furring straps outboard of the WRB 3. *Inner Layer*: WRB attached to surface of ICF

of AccorHotels, brings together Saunders Hotel Group and developer The Noannet Group for the U.S. debut of the brand's hotel and residential concept. The building team of Suffolk Construction and The Architectural Team, along with structural engineers McNamara Salvia, resolved the tower's cantilever structure atop a dense field of six-foot-wide caissons tied by steel plate girders, all supporting the tower with 147 guestrooms and 146 residences serviced by a program of extensive amenities.

The new Boston tower, adjacent to the city's most iconic tall structures, melds varied glass specifications in response to its multiple uses and performance goals for a unique expression. Other project cladding approaches, by contrast, mix materials and construction types for not only aesthetics but also to help deal with cost inflation, supply issues, and construction scheduling.

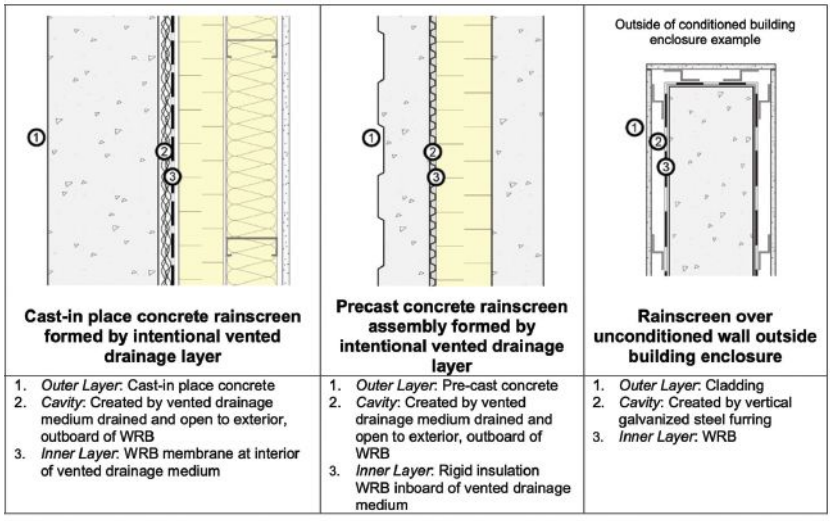
Among the most prevalent trends is an expanding use of rainscreens, says the Rainscreen Association in North America, founded in 2020. "Over the last two decades, the building science community has pushed exterior wall assembly performance to the front of the conversation regarding overall building performance," according to the trade group and technical resource, which defines a rainscreen as "an assembly applied to an exterior wall that consists of, at minimum, an outer/inner layer and a cavity between them sufficient for the passive removal of liquid water and water vapor." Rainscreen systems also incorporate insulation, continuous air barriers for air-tightness control, and vapor barriers or retarders for diffusion control, "a balance of wetting versus drying for the whole assembly."

With constrained supplies for some components, building teams are turning to rainscreen outer layers made with readily available composites of stone, wood fiber, or plastics—many of them drawing from waste streams. Examples include composite panels such as Fiberon, a substitute for thermally modified timbers or other wood panels that might be harder to source in some areas. The composite is made from locally sourced recycled plastic and captured waste wood fiber, specifying approximately 94% pre- and post-consumer recycled content. In 2021, makers of building products had been facing material shortages for certain plastics and resins, though raw material makers pushed to increase production, according to plastics industry sources.

Similarly, other rainscreen cladding products such as stone composites have been in good supply. These engineered materials include panels made from fiberglass-reinforced polymer composites with a crushed limestone core, for example, and some are treated with electron-beam or EB technology and acrylic resins to produce a range of smooth, water-impermeable finishes that stand up to ultraviolet and corrosive environments.

PHOTOS COURTESY COOKFOX

A modular terra-cotta façade system serves as habitat for birds, bees, and plantings, made with a base module designed to resist freeze-thaw cycles.



COURTESY RAINSCREEN ASSOCIATION IN NORTH AMERICA

One Norwegian manufacturer, Steni, produces a line of stone composite panels with a surface of aggregated natural stones. Produced in different grades of coarseness, carefully calibrated composites of this type have a relatively low carbon footprint and are highly stable, resisting impact and water and vapor diffusion—basically, moisture-proof. Also of interest to designers, stone-based façade panels are flexible and so can be curved and radiused for organic building shapes.

Strength and resiliency is a benefit of the wood-look plastic composites as well, offering "high flexural strength, which translates to maximum protection in severe weather conditions," according to Peter Kotiadis, VP of Product Development at Fiberon. The material class is considered effective for open-joint rainscreens, which require not only highly durable materials, but also carefully detailed envelope installation.

+ EDITOR'S NOTE

Additional reading is required for this course. To earn 1.0 AIA HSW learning units, please review this course and take the exam posted at **BDCnetwork.com/Cladding2022.**

FIBERON WILDWOOD CLADDING ADDS MODERN DESIGN TO NEW STARBUCKS

Worried that wood wouldn't be able to maintain its appearance or performance after prolonged wind and UV exposure, and concerned that wood cladding might also encounter problems with moisture, the project team for a new Starbucks in Pell City, Alabama found Fiberon Wildwood composite cladding to be an ideal alternative. Wildwood's nature-inspired embossing and multi-tonal colors delivered an eye-catching modern aesthetic without sacrificing anything in terms of durability and performance.

"Not using a real wood product was appealing to us because no matter how well you install it, if the product is failing in a year or two, that makes us look bad," said Jonathon Seay, president of Seay Construction, Inc., the project's general contractor. "With Wildwood, once you properly install it, the owner never has to worry about it again."

The project was so successful that Starbucks added Fiberon Wildwood to its list of preferred products for future builds.

"The Wildwood cladding sets the building apart," Seay added. "When the lighting shines on it at night, it really takes the spotlight. I know Starbucks was bragging on it, too."

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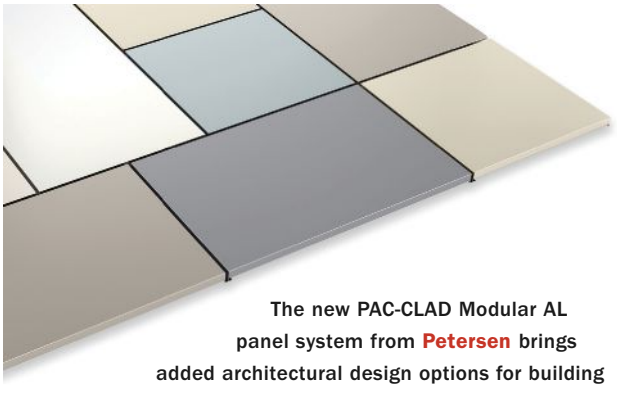
For more information visit fiberoncladding.com/future

CIRCLE 764

To help keep high-traffic commercial restrooms clean and sanitary, **Bobrick Washroom Equipment** launched its Pure Hygiene Solutions collection—PureDri Sanitizing Hand Dryer (pictured) and PureSphere Air Sanitizer—both of which are proven to eliminate 99% of bacteria, viruses, mold, and fungi in less than 10 minutes, says the maker. The systems work by destroying existing microorganisms in the air and on surfaces through continuous sanitization using a three-step process: first, eliminate viruses and bacteria via a germicidal UV lamp that inactivates all microorganisms; then neutralize viral particles through strong oxidizing agents as air passes through the chamber; and finally employ superoxide ions to neutralize airborne particles, causing them to drop to surfaces below. The systems offer 100% air disinfection and elimination of E. coli, staphylococcus aureus, and aspergillus fumigatus after one hour.

CIRCLE NO. 800



The new PAC-CLAD Modular AL panel system from **Petersen** brings added architectural design options for building exterior applications. Architects and designers can create virtually one-of-a-kind façade designs using cassette-style metal cladding of varying sizes, depths, and colors. Vertical or horizontal panels can be combined in the same layout. Panels can be finished in any combination of the 46 standard PAC-CLAD colors or custom colors. Panels can be perforated, including in specific patterns that spell words or form logos. Installation of Modular AL panels can be performed on a variety of substrates including, plywood, insulation, purlins, or any combination of these.

CIRCLE NO. 802

Construction Specialties has expanded its lineup of louvers with two new shallow design options. The RS-3700 Extreme Weather Louver features a depth of just three inches, making it the shallowest model that meets AMCA 550 standards for extreme weather, including hurricane-prone regions, according to the maker. The RS-5900 Storm Resistant Louver offers a sleek vertical blade orientation to help meet high performance standards under harsh conditions. Both products are designed to fully integrate with curtain wall systems and feature a glazing frame option.

CIRCLE NO. 803

The StrataClean IQ Air Filtration System from **Armstrong Ceiling & Wall Solutions** is an in-ceiling system that captures and eliminates airborne bacteria, viruses, mold, and other particulates using proven MERV 13 filtration. The system uses an internal fan to draw air through one side of the grille. The air then moves through a two-inch MERV 13 filter and discharges back into the space through the opposite side of the grille. With the fan continually running, the air in the occupied space is constantly filtered to provide clean, purified air. The system has proven efficient at removing 90% of airborne viruses, bacteria, VOCs, odor, and other particles down to 0.3 microns. One unit can filter the air in a 1,000 sf space every hour.

CIRCLE NO. 807

Metl-Span has expanded its line of clips for concealed fasteners for insulated metal panel (IMP) applications with the patent-pending V6 X-Span Clip. The clip provides an alternative to backfastening, allowing crews to install longer spans without the need to access the interior of the panel for a more efficient installation and stronger panel. The V-shaped fastener is designed to fit the joinery of Metl-Span CF insulated metal panels to increase the stiffness of the panel and better distribute the shear load at fastening locations. This distribution helps to delay panel disengagement under negative loads, a failure point of thicker panels at longer spans.

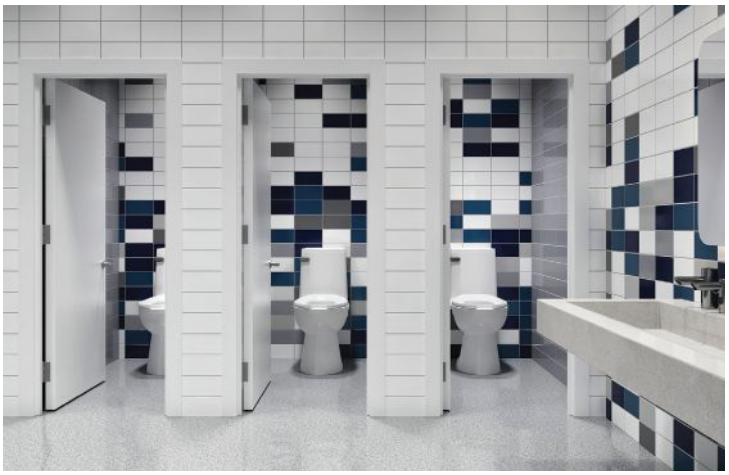
CIRCLE NO. 806

C.R. Laurence (CRL) has introduced the Palisades S90 bi-folding glass door and wall system with a slimline profile, concealed hinges, and 12-foot maximum frame height. Designed for residential and commercial applications, the system features slim 4¾-inch panel posts and low-profile rails to maximize daylight and views. Concealed hinges create a sleek, monolithic aesthetic. The Palisades S90 is a thermally broken structure with one-inch insulating glass. According to the maker, it is the only system in the industry that has a CW40 Performance Grade rating, for superior thermal and structural performance, making it ideal for exterior applications in demanding environments.

CIRCLE NO. 808

Sloan's new Gravity Toilet features a sleek one-piece look in a two-piece design for ease of installation. Its tank has a slightly inverted taper design for a modern aesthetic, and a raised deck that eliminates rocking. The lid fits perfectly on the tank with no overhang, creating a monolithic appearance, according to the maker. Its Centriflo dual-delivery bowl technology helps prevent bacteria and germs from collecting in the bowl, making the toilet easier to clean. Designed for commercial applications such as hotels, commercial buildings, schools, hospitals, and multifamily housing facilities.

CIRCLE NO. 805



pinta acoustic's Contour Ceiling Tiles are available in three new patterns: Labyrinth, Taper, and Whisperwave. Suitable for both small- and large-scale indoor spaces, such as offices, lobbies, retail spaces, and restaurants, the tiles offer a noise reduction coefficient (NRC) up to 1.20, and are made with open-cell, mold-resistant WillTec foam. Standard direct-apply, glue-up tiles are 24x24 inches. Suspended ceiling grid tiles fit in standard 15/16-inch grid systems and have a backerboard that blocks sound from traveling into adjacent rooms with a ceiling attenuation class (CAC) of 34. Ceiling grid tiles are 23 inches square.

CIRCLE NO. 812

The newly constructed Pikes Peak Summit House visitor center in Cascade, Colo., was designed to provide a seamless, immersive visitor experience. Upon arrival at the 14,000-foot summit, visitors are able to focus on and be enveloped by the natural forms of the mountain. To maximize views while enhancing the building's energy efficiency, RTA Architects selected Solarban 70 glass by **Vitro Architectural Glass**. The glass strikes the right balance between form and function with a transparent, color-neutral aesthetic and good solar control and visible light transmittance (VLT). When coupled with conventional clear glass in a one-inch insulating glass unit, Solarban 70 glass offers a solar heat gain coefficient of 0.27 and a VLT of 64%.

CIRCLE NO. 801

To help meet growing demand for tested structural solutions for mass timber buildings, **Simpson Strong-Tie** developed the E20/3 angle bracket. The versatile, off-the-shelf, pre-engineered bracket is a tested option for base-of-wall connections in mass timber applications where a gap is desired between the wall and slab to accommodate a sill plate or grout pad. It eliminates the need for custom fabrication of steel connectors on the jobsite. The E20/3 is load rated for in-plane, out-of-plane, and uplift loads in designs with gaps up to two inches between the wall and the slab.

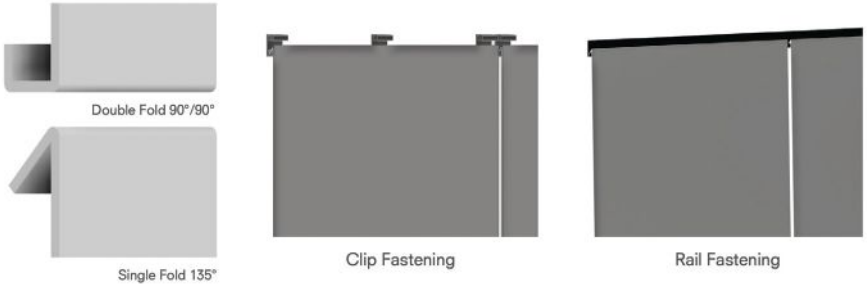
CIRCLE NO. 811

Copper Armor paint from **PPG** is an EPA-registered anti-viral and anti-bacterial paint containing Corning Guardiant technology that is proven to kill 99.9% of bacteria and viruses, including SARS-CoV-2, on the painted surface in two hours. The product's efficacy was measured using tests that simulate real-world contamination as mandated by the EPA for products making claims against harmful pathogens, according to the maker. The paint and primer offers the application properties of a premium paint, including good durability and hiding performance.

CIRCLE NO. 810

Alucobond has developed a new attachment method for its aluminum composite material (ACM) panels that combines ease of installation and architectural aesthetics. Alucobond EasyFix features two types of folds, which allows installers to quickly and accurately insert the ACM panels with short clips or with a continuous rail. The final product is an attractive, finished look similar to traditional ACM systems, according to the maker. The attachment system is designed for use with Alucobond Plus 4mm panels.

CIRCLE NO. 809



Sto Corp. has launched Stolit HDP, an acrylic-based textured wall finish with enhanced hydrophobic properties. The solution makes walls less susceptible to dirt accumulation and microbial growth, and more resistant to freeze-thaw cycles and mildew, according to the maker. Available in four texture options, Stolit HDP can be applied using any StoSignature application techniques.

CIRCLE NO. 804

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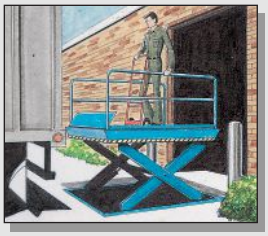

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DEVELOPMENT USES SKANSKA'S 'GREEN CONCRETE' MADE FROM LEFTOVER MASONRY, CONCRETE

On the site of a former sugar factory, the development outside Prague is the largest project to use Skanska's Rebetong—and the first to use the recycled material for its façade.

OUTSIDE PRAGUE, THE SUGAR FACTORY, a mixed-use residential development with public space, marks the largest project to use the sustainable material Rebetong. Invented by Skanska, Rebetong comprises completely recycled concrete or masonry, instead of natural aggregates. With Rebetong, buildings can be constructed from other buildings at the end of their lives, forming a circular economy. The Sugar Factory is also the first project to use Rebetong for its façade.

The architecture and urban design practice Chybik + Krisof, in collaboration with Skanska, recently unveiled the Sugar Factory, located on a former sugar factory site. At 58,000 sm (about 625,000 sf), the project includes seven blocks with 790 apartments. It also features more than 6,600 sm of public space, including a multifunctional hall, brewery, coffee house, kindergarten, and boat club. The project is scheduled for completion in 2030.

Following intensive research and experimentation with different sizes, shapes, and densities, the Rebetong material used for this project has been made from leftover bricks, reflecting the site's industrial character. So that Rebetong can serve as a fully visual reminder of the area's history, CHK proposed using the material not only for structural purposes, but also as an exposed façade. The project also preserves the sugar factory chimney, built in 1927, so it can serve as a historic landmark and symbol for the area.

RENDERINGS COURTESY VIVID VISION. PHOTOS: SKANSKA

Rebetong comprises completely recycled concrete or masonry, instead of natural aggregates. With this concrete mix, buildings can be constructed from other buildings at the end of their lives.

The benefits from using Rebetong include less demolition waste sent to landfills; roughly 12% less carbon emissions compared to regular concrete; and overall reduced costs, according to Skanska. The construction giant also claims that the concrete mix—especially when made using recycled masonry—has better insulating properties than traditional concrete, which can help to lower energy consumption throughout the building lifecycle.

"Appreciated for its historic significance and ability to fit into the existing landscape, Rebetong acts as a functional and emotional connection to the collective memory of the area, adding value to the local culture and community, while being a sustainably elegant solution," said the Chybik + Krisof team workiong on the Sugar Factory project.

More on Rebetong concrete at: BDCnetwork.com/Skanska-Rebetong.


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3. Which category best describes your job title?
(Check one box only.)
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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.)
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99 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.)
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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

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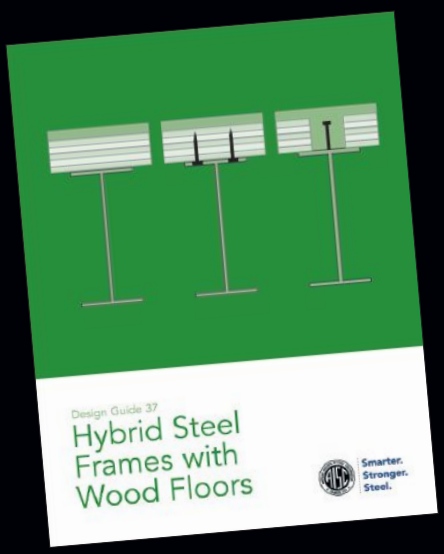

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