DATA’S COMING OUT PARTY

AEC firms are finally putting to use project information they’ve been storing in their computers for years.

BY JOHN CAULFIELD, SENIOR EDITOR

This summer, Gensler launched its newest practice, Intelligent Places, which was in development for a year and whose focus is the application of data and visual services to support design and business results.

HMC Architects is building a data warehouse as part of a network to distribute content throughout the firm. So far, HMC has finalized the selection of servers. In phase two, the firm will add all of its practices onto the network. An R&D component will be added in phase three. In line with its repositioning around innovation and digital transformation, Lendlease last January hired Bill Ruh, General Electric’s Chief Digital Officer, as its CIO, Digital. At the time of the hire, Lendlease’s Managing Director Steve McCormack proclaimed his company’s “leadership position in the digital space in our sector.”

These and many other AEC firms are all asking themselves the same question: How can we exploit the data that has been languishing in our computer servers for years, and sometimes decades, to produce better work and, perhaps, new revenue streams?

“Too many firms have been collecting data as a benchmarking exercise. But we’re not just using data for the sake of using data,” says Jit Koo Chin, whom Suffolk Construction hired two years ago as its Chief Data Officer. “We are constantly reacting, correcting, and improving.”

Chin notes that what resonates with investors and insurers these days is risk mitigation, “because construction is a risky business.” So Suffolk has been gathering inspection-based data on jobsites to drive actions and behaviors. In March 2018, it assembled Risk X, a mobile, cloud-based safety-management tool that accommodates different data types, from human input to metadata. By using this data to identify risk, Suffolk, over a 12-month period, reduced its recordable and long-term incident rates by 47%.

‘Data goes beyond the rule of thumb. We are now able to answer questions that we previously only had feelings about, to clients and to ourselves.’

— JAMES CARPENTIER, B2 ARCHITECTS

Opposite page: HP S created a VR model with all the sensor data displayed in real-time information that’s visible through VR goggles. At left: The actual data displayed of space occupancy over energy consumption.
term incident rates by 40%. The firm has also used jobsite data to rewrite training manuals for clearer communication with its workers.

**ANALYTICS TOOLS PAVE THE WAY**

Suffolk Construction is one of 17 AEC firms that *BD+C* interviewed in late July and early August about their practical applications of data. Those conversations inevitably came around to the question, “Why now?”

In its proposal for a presentation titled “Analytics for Operations: Pushing Your Firm’s Data to Work,” that would be delivered at the recent AIA conference, Leo A. Daly noted that “virtually every large design firm is sitting on a mountain of practical data.” 90% of it is based on servers and never looked at again.

That’s no exaggeration, say other firms, and it’s hardly a surprise when one of the biggest obstacles for AEC firms continues to be file sharing among project teams, according to recent Newforma research based on 1,154 industry respondents.

What’s changing over the past few years, however, is the proliferation of data analytics technologies “that is getting people excited,” says Zamir Khawaja, PE, Associate Structural Engineer with Arup in New York.

These analytical tools are helping Building Teams and their clients spot problems and make decisions earlier.

“It isn’t a quick fix,” says Judy Baldino, Manager, Mid-Atlantic division of Enviroview, a subsidiary of Southpaw Industries that provides open-platform building management solutions.

Next up, he predicts, are better communication systems and algorithms for machine learning.

Kelly Benedict, Landeskes’s Senior Vice President of Innovation and Customer Focus America, thinks the fact that more AEC firms are putting their data to work is “realization that if we don’t do this, someone else will, and maybe someone outside of the business.”

**PROOF BEYOND THE RULE OF THUMB**

Kevin Vos, Director of Venture’s Intelligent Places practice, says his firm uses data “to create better outcomes, driven by feedback.” Jacobs relies on data to add “context” to a project’s design process, says Sharon McElwain, the firm’s Global Director of Gooddesign-ArchiPlan Planning Group.

It doesn’t hurt, either, say AEC firms, to have good data in your back pocket to substantiate a project’s design ideas, costs, or programming, both internally or when speaking with clients, vendors, or building partners. “Data goes beyond the rule of thumb,” says Andrew Carruthers, Project Manager with ZGF Architects at Seattle.

“We are now able to answer questions that we previously only had feelings about, to clients and to ourselves.”

Arup has installed accelerometers in seven buildings in New York City and London, whose output gets piped into data sets that can be merged with weather data to determine, for example, whether the firm’s assumptions about a building’s stiffness are correct.

Lori Coppenski, Principal and Planner in DLR Group’s Justice & Public Practice in Seattle, says her firm has found pre- and post-occupancy data to be motivating factors when pitching criminal justice projects to government officials, especially those in “small counties in the middle of nowhere that don’t want to do anything.” In turn, those
Amp has been developing an AI framework for its Mass Motion program that uses computer vision to gain insight into the way people move through spaces.

Some municipalities could use the data to justify the expense of projects to taxpayers.

AEC firms must also demonstrate the value of data to get clients to pay for it, says Herbert Els, Senior Vice President, Building Technology Systems with WSP USA in Boulder, Colo. That value is still sometimes a harder sell because of data's “soft ROI,” says Emilex Baldwin.

'We now have the ability to know where people are in a space, and to predict where they'll be. This opens our understanding of how spaces are being used and how systems are deployed.' — DON WESNICH, FAIA, LEED AP, ENVIRONMENTAL ARCHITECTS

who observes that data, at the moment, seems more relevant to developers and property managers of existing buildings than for new construction, “where we need it to be.”

SEPATING WHEAT FROM CHAFF

Faced with a firehose of data from myriad sources at their disposal, AEC firms and their clients have become far more discerning about what they collect, use, and disseminate. Firms say they're trying to avoid falling down a “rabbit hole” that either buries them in information overload or sends them off on wild goose chases. A good anchoring point, says Amp's Keatson and Gambier's Tyler, is to identify the

WSP is focused on analyzing building systems against each other to gauge performance, says Els. The firm has also installed IoT devices in its Boulder office, turning it into a “living lab” that, says Els, influences future design.

McCownGordon Construction in Kansas City, Mo., has been leveraging cloud-based platforms to collect data, and supplementing APIs with what Dustin Burns, the firm's IT Director, calls "robotic process automation" software that extracts information to generate reports in the form of Excel files to which new information can be merged.

The practical application of data is in spotting leading indicators that could lead to

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change,” says Burns. Data analysis revealed that RFIs were typically being generated 40% to 60% into a project’s completion cycle. “We’re trying to push that back earlier” and get subcontractors involved before they’re on the job, says Burns. “This is more of an inclusive decision-making process.”

SmithGroup, whose staff includes a data scientist and sociologist, uses a Rent data collector that takes into account 50 to 60 variables for each model. The data signifies how a model’s personality compares to the firm’s past practices for metal integrity, explains Derek White, SmithGroup’s CIO. (An example of an “angry” model is one that might take much longer to open.)

DUR Group has formalized its platform for post-occupancy evaluation in order to “close the loop” between design, construction, and operations, says Russi Bernwell, Principal and Energy Services Leader. The service generates $2 million in annual revenue, and DUR Group’s ultimate goal is to create an evidence-based library for this practice that enables the firm to hit its carbon-neutral targets for 2030.

WHERE DATA PROVIDED REAL-WORLD INSIGHTS

Among the AEC firms interviewed, their use of data broke down into four buckets:

- Operations. Baldwin says that Southland has developed an analytical platform that helps the data being generated from the HVAC system within an embassy in Washington, D.C. “We’ve learned something about temperature, comfort, and energy” that can be applied to “figuring out problems we know we had.” Southland is also in the midst of building a military-museum with 140 sensors installed which will predetermine data that, says Baldwin, could be used for future wayfinding and crowd control.

- Data analysis has helped DUR Group spot where building systems, economics weren’t set properly, and where the on-off scheduling of systems running a building in Chicago weren’t working “and that’s been set right from the get-go,” says Bernwell. ZGF last year launched an urban daylighting tool whose development began with a questionnaire designed to qualitatively analyze the human impact of natural light on 25 existing outdoor facilities.

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INFORMATION IS POWER, BUT ARE CONTRACTORS COLLECTING WHAT THEY NEED TO MAKE BETTER DECISIONS?

A recent survey conducted by Viewpoint and Dodge Data & Analytics has revealed that contractors are not collecting data that could potentially improve their business. According to the survey, only 40% of contractors consider data to be a valuable asset, and only 25% of them have a data-driven decision-making approach. This indicates that there is a significant gap between the potential benefits of data and its actual utilization in the construction industry.

The survey also highlights the importance of data in managing projects, improving productivity, and reducing costs. However, the lack of data collection and analysis can lead to poor decision-making, which can result in project delays, increased costs, and reduced profits.

To address this issue, contractors need to implement a data-driven approach that includes collecting, analyzing, and utilizing data to make informed decisions. This can be achieved by investing in data management software, training employees in data analytics, and establishing a culture of data-driven decision-making.

In conclusion, data is a valuable asset for contractors, and its effective utilization can lead to significant improvements in project management, productivity, and profitability. Therefore, contractors need to prioritize data collection and analysis to make better decisions and improve their overall performance.
For the design of the Phil and Penny Knight Campus for Accelerating Scientific Impact at the University of Oregon, Ennead Architects deployed an analytical tool created by the engineer- ing firm Buro Happold to create virtual models with avatars included to simulate trails of movement, with the intention of predicting where casual interactions within the building might occur.

WSP is working with a large technology firm that has buildings all over the world to develop smart space utilization that can accommodate the company’s aggressive hiring. “It is asking now, if it hired 1,000 people, it could move people around,” explains Et. WSP designed a multisensory system on a high-resolution grid that Emerson says “pushes” data into an analytical environment. The client is now sharing this information with its real estate team.

Ennead, with Buro Happold, designed the University of Oregon’s Phil and Penny Knight Campus for Accelerating Scientific Impact, which is under construction. Weimer says that one of the goals of this campus is to bring together academia and business. So Ennead deployed a tool developed by Buro Happold that creates a virtual model of the space, and populates the model with avatars that behave according to certain rules and patterns to simulate trails of movement and to identify where casual interactions might happen. Ennead is now beta testing a more advanced tool that incorporates machine learning and sensors.

Workplace. Seattle Children’s Hospital has been relocating its administrative staff to three floors of a downtown high rise, about five miles from the hospital’s main campus. As a prelude, Seattle Children’s partnered with 2GF to assess
Before starting most projects, Clark Construction collects data on the location’s underground utilities. This investigation sometimes includes historical information, such as previous surveys, that is not always reliable or correct, which makes it challenging to accurately estimate the size of a job site. The image shown is from a laser scanner used to gather detailed data on the site’s terrain and obstacles.

how each of its departments uses space, and to project future capacity needs. ZGF surveyed the workers who would be moving to gauge more precisely how they worked individually and with each other. Sara Hewell and Amy Triscott, ZGF’s Project Architect and Associate Urban Designer, say the surveys revealed, for instance, that two-to-three-person meeting rooms were in greater demand than expected. “One of our goals was to right-size the ratio of different spaces,” says Triscott.

SmithGroup’s Chicago office, with about 100 people on one floor, was its first to go completely agile. As the firm was fitting out the first three-quarters of that space, it tagged employees and used a Bluetooth beacon to monitor their movements. While says this data informed how the last quarter of the floor was fitted out, and showed a need for smaller conference rooms. (They also showed that people don’t move around that much.) SmithGroup has also created a Deloitte Connect, which uses access points, like smartphones, to locate people in offices. This was first tested at the firm’s Ann Arbor, Mich., office and is being rolled out to San Francisco (170 employees on seven floors) and Detroit (300 people on four floors).

IS DATA A RELIABLE CRYSTAL BALL? The dream of many AEC firms is that data will be their ticket to predicting outcomes, which could, among other things, mitigate job site risk, improve occupant comfort and, on a broader scale, facilitate smarter cities.

to that end, Suffolk Construction is one of nine construction firms that are members of the Predictive Analytics Strategic Council, whose goal, says Chin, is to share and aggregate data for the purpose of developing predictive software that can be marketed to the industry. The impetus behind the council’s formation was a 12-month collaboration between Suffolk and Smartvid.io. Suffolk contributed a decade’s worth of photo and project data, which Smartvid.io (the council’s technical advisor) analyzed and then fed additional project data into a multiphased machine learning model to see if job site incidents could be forecasted.

Chin and other AEC sources are convinced that, with enough data, reliable predictions are possible. “It’s a feasible aspiration,” says Clark Construction’s Hsu. But, he cautions, the uncertain nature of construction will always need to be built into any model. That’s why he prefers prescriptive algorithms that leave wriggle room for improvisation when it comes to constructability, coding, and interoperability.

Nancy Reyes, AMC Architects’ Associate Principal and Corporate BIM Director, says her firm is actually less interested in predicting behaviors than in leveraging data “that will give us more options” to select from.

“I’m heartened that other firms aren’t being deterministic,” says Gerster’s Tysen. Building the environment, he points out, remains “highly dynamic,” so what data provides is “an opportunity to learn and have information in real, or almost real, time.”

FROM RESPONSE TO REVENUE Right now, construction data analysis and application are part of what Jacob McElwee and other AEC experts view as a “convergence of technology” that is also spurring the rise of digital twin, machine learning, and AI.

But just how robustly can data be monetized, which some sources suggest is the industry’s logical next step, and what the Predictive Analytics Strategic Council is trying to achieve?

Arup’s Kostow sees opportunities in data for creating new services. He cites a large mixed-use project in the U.S., where Arup refined the building’s communication data through a converged network in the cloud. He explains that putting data in a single space allows for the correlation of data sets, which is the basis for machine learning. Creating a serverless environment, he adds, “encourages building the organization.”

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