



INSIDE LOOK AT 12 PROJECTS WINNING WITH BIM



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INTRODUCTION

Since its introduction almost 20 years ago, Building Information Modeling (BIM) has been giving architects, engineers, contractors, and owners the insight and tools to more efficiently plan, design, construct, and manage buildings and infrastructure.

According to the NBS National BIM Report 2019, 63% of those who have adopted BIM feel that they have done so successfully, and 55% of those yet to adopt it think they'll get left behind if they don't. Looking ahead, 63% anticipate that they'll need to use BIM on all projects.

To discover how our customers are using BIM and other technologies to achieve their business objectives today, we completed an analysis of more than 500 projects that were submitted to the [AEC Excellence Awards](#) over the past three years.

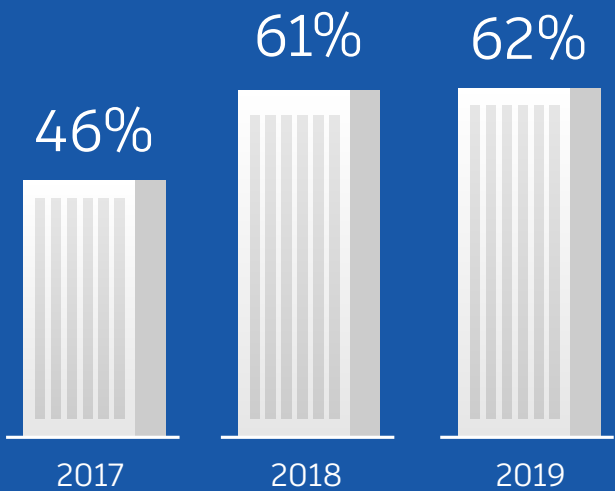
Here we will look at some stories behind successful projects using BIM workflows and other technologies to deliver better outcomes.



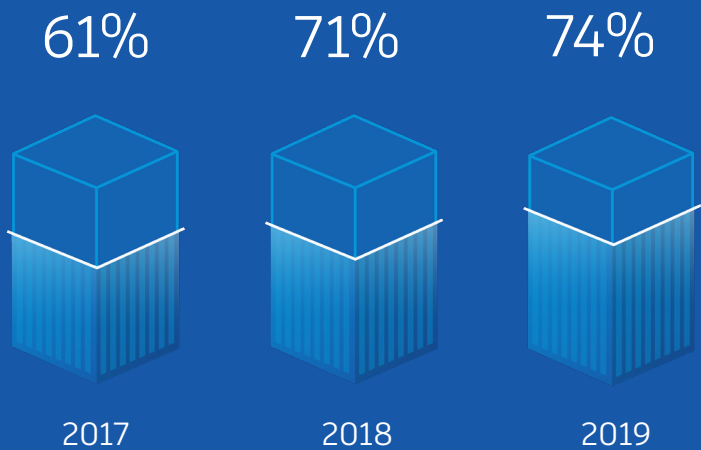
KEY FINDINGS

Year-over-year growth for projects citing BIM benefits

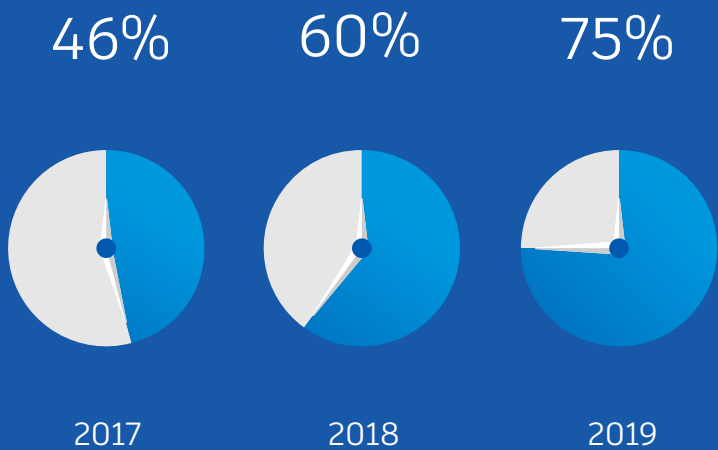
Model coordination



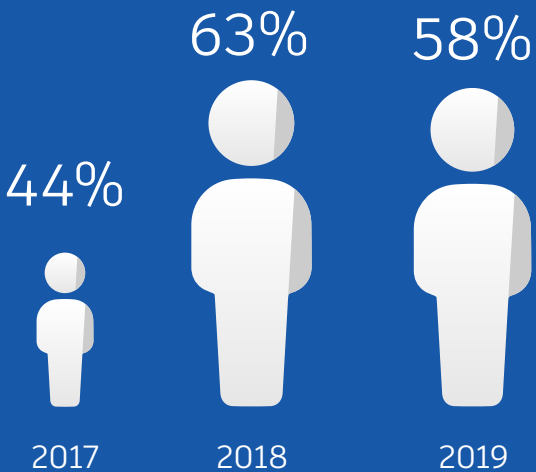
Simulation and analysis



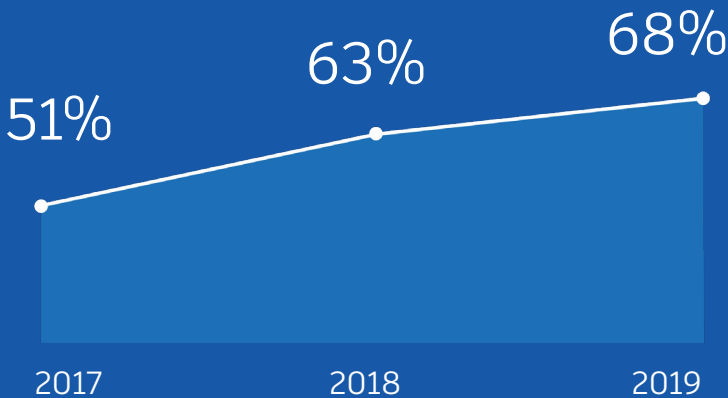
Scheduling



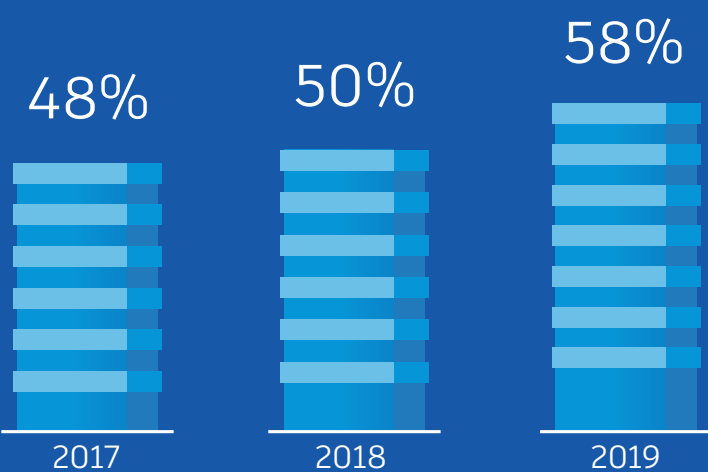
Collaboration



Communication



Visualization



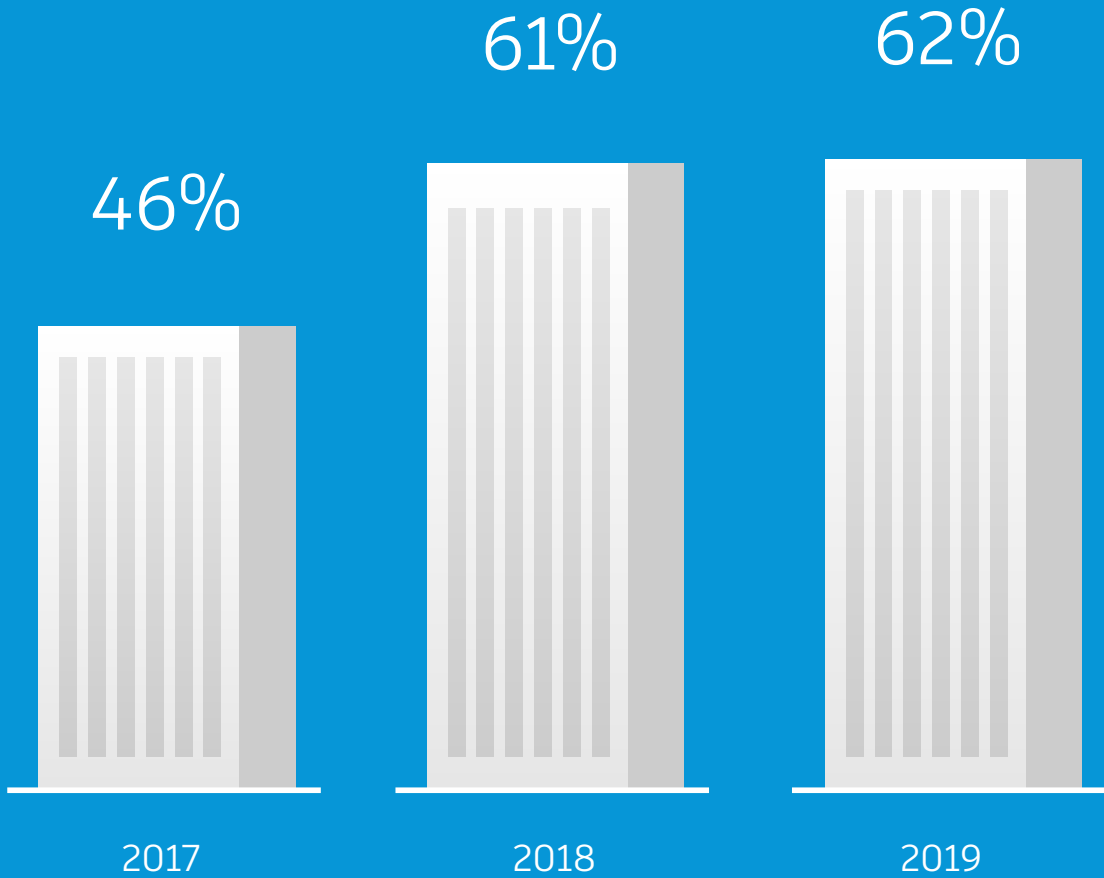
The 3 C's: COORDINATION, COMMUNICATION, AND COLLABORATION

The inherent capabilities and benefit cornerstones of BIM are coordination, communication, and collaboration. These “3 C's” are cited most regularly across all infrastructure, building design, and construction projects as key benefits to using BIM.

01 COORDINATION

Model coordination with BIM enables unparalleled visibility between disciplines. Everyone can work from the same model with the same data to quickly identify and resolve problems.

YoY growth for projects citing model coordination as a key benefit



SUCCESS SPOTLIGHT: COORDINATION

Project: Istanbul Metro, Turkey

Company: Yuksel Proje

Phase one of Istanbul Metropolitan Municipality's project involves the design of a 16km metro line, which will be comprised of 11 stations connecting to five existing metro lines when completed in 2023. The project will play a vital role in the Istanbul public transport system, presenting a unique logistical challenge for the design team involving many different AEC disciplines.

Twenty different models from various disciplines designed in Autodesk software—including Revit, Civil 3D, and InfraWorks—were combined into a single coordination model, which facilitated easier collaboration and reduced duration and cost.

With phase one of the project that will eventually cover 60km in total, the design team is using it as an example of how BIM software and modern construction technology can seamlessly integrate and coordinate diverse disciplines, including HVAC, plumbing, and electrical.



SUCCESS SPOTLIGHT: COORDINATION

Project: MIB – Micro-scale Urban Planning in Medellín, Colombia

Company: Empresa Desarrollo Urbano de
Medellín (EDU)

Colombia's second-largest city, Medellín, is located in the Andes Mountains roughly 1,500 meters above sea level, and much of the city's development extends up the sides of the area's many mountains. Some of that development took place with little or no planning, with neighborhoods forming as people built small dwellings.

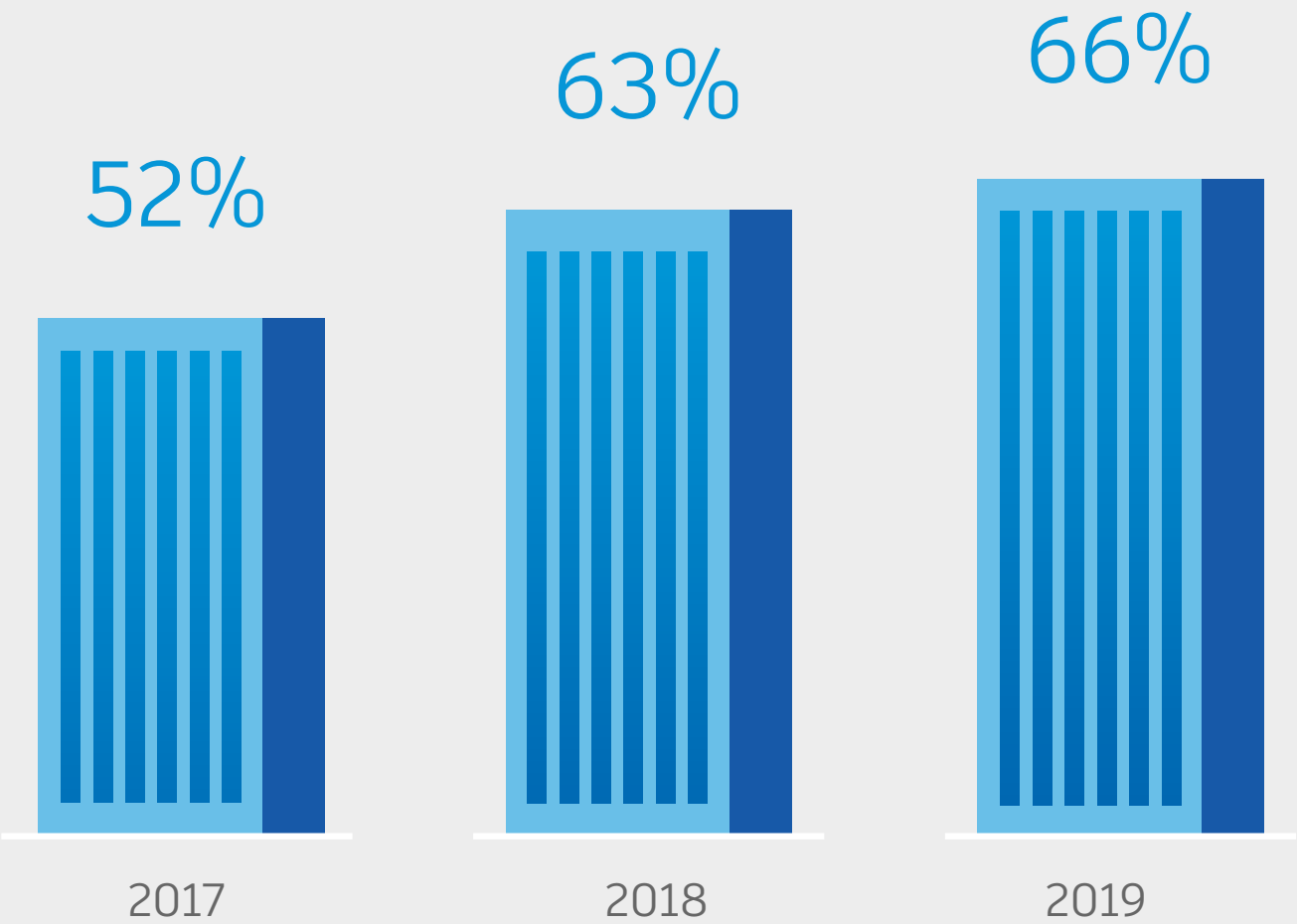
However, many of these vibrant communities are located on land at high risk of dangerous landslides. Empresa Desarrollo Urbano de Medellín (EDU) used BIM tools to plan safer communities for people living in these areas.

The team estimates that the planning process took 45% less time thanks to BIM and the Autodesk AEC Collection, including Civil 3D, InfraWorks, Revit, Navisworks, and Insight software. A model-based approach improved quality as well, with the team estimating that the new housing will be 28% more efficient and constructible.

COORDINATION AND CLASH DETECTION

Clash detection is also an important component of model coordination. Imagine finding that clash with a pipe or a wall before you step onto a construction site. That's what is possible with BIM.

YoY growth for projects citing coordination and clash detection as a key benefit

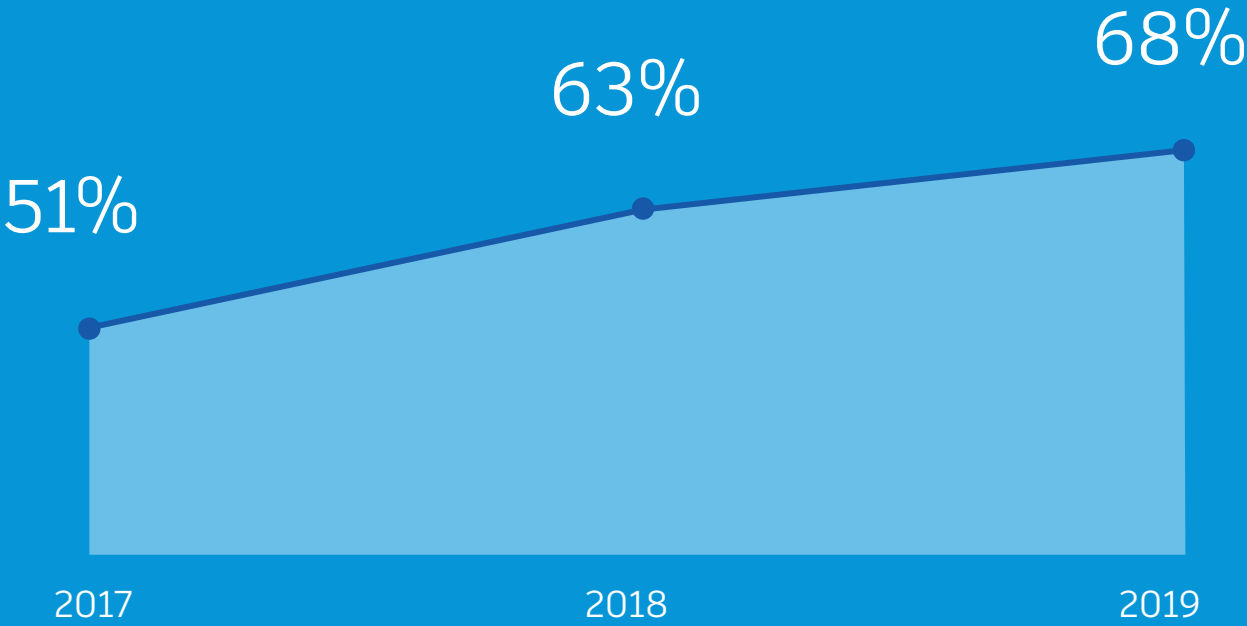


02

COMMUNICATION

BIM streamlines the flow of information between all disciplines and stakeholders, providing the opportunity for higher quality design and construction as well as greater insights for owners and project stakeholders.

YoY growth for projects citing communication as a key benefit



SUCCESS SPOTLIGHT: COMMUNICATION

Project: Chase Center, USA

Company: Mortenson | Clark, a Joint Venture

The new Chase Center in San Francisco, CA is a \$1.4 billion sports and entertainment complex. It includes an 18,000-seat arena, two 11-story office buildings, a gatehouse, more than 20 unique retail locations, 3.2 acres of publicly accessible plazas and open space, as well as a 925-space parking structure.

Chase Center's signature façade is inspired by the rich nautical history of the San Francisco Bay Area and the dynamic and flowing forms of the surrounding water. From the outset, integrating innovative technology was essential to Mortenson | Clark's workflow.

Using BIM allowed the project team to meet three key objectives regarding communication: drive stakeholder meetings and timely decision making; improve communication to meet project milestones; and enhance communication with the surrounding community through visualization of the project.



CHASE CENTER

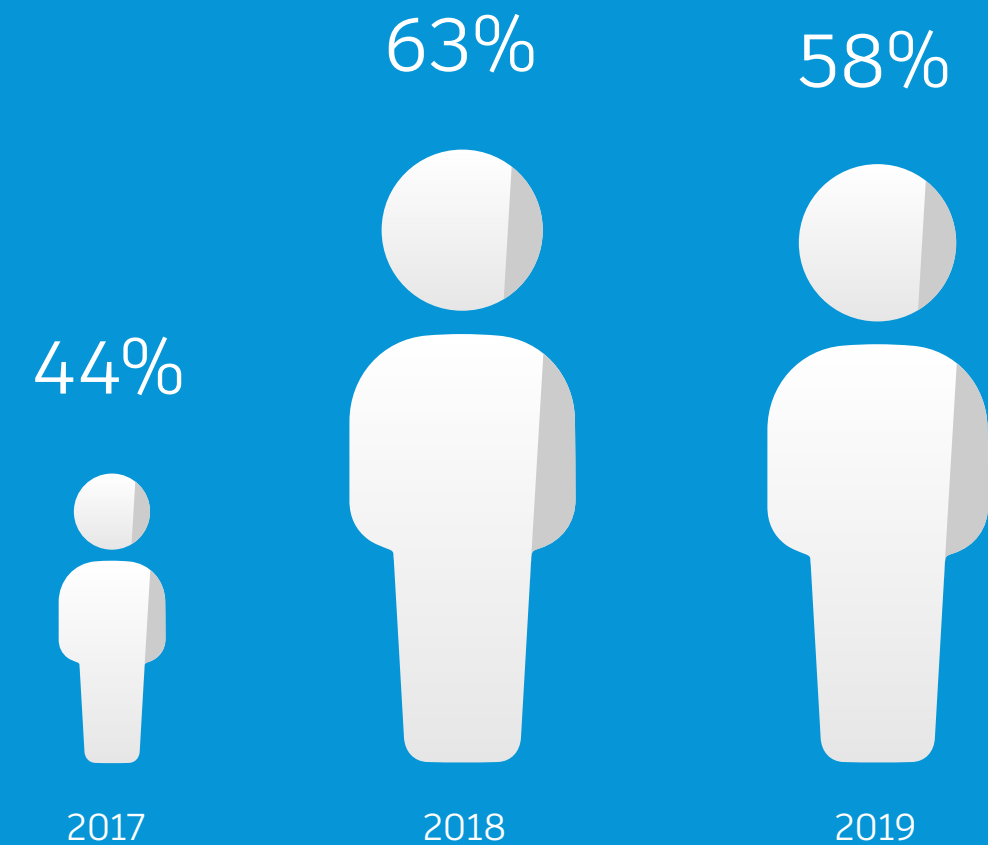
[AEC Excellence Awards winner in Construction](#)
Courtesy of Jason O'Rear/Chase Center

03

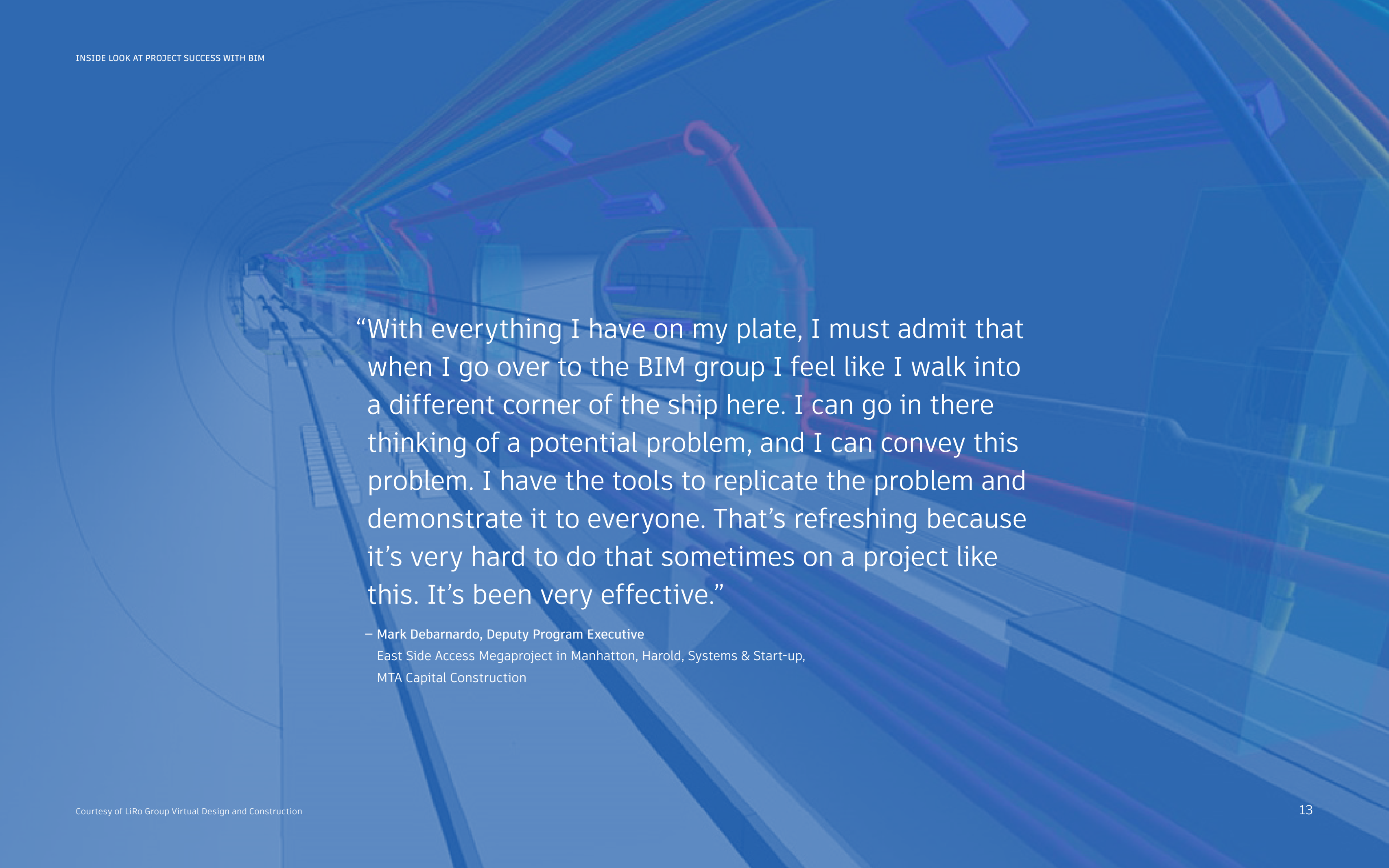
COLLABORATION

With all the parts and pieces that go into delivering a new building or infrastructure project, it's no surprise that collaboration is an important element for AEC projects. In fact, collaboration is cited every year as one of the leading benefits of BIM.

YoY growth for projects citing collaboration as a key benefit



According to the NBS National BIM Report 2019, 87% agreed that firms that can effectively collaborate will be the most successful.¹



“With everything I have on my plate, I must admit that when I go over to the BIM group I feel like I walk into a different corner of the ship here. I can go in there thinking of a potential problem, and I can convey this problem. I have the tools to replicate the problem and demonstrate it to everyone. That’s refreshing because it’s very hard to do that sometimes on a project like this. It’s been very effective.”

– Mark Debarnardo, Deputy Program Executive
East Side Access Megaproject in Manhattan, Harold, Systems & Start-up,
MTA Capital Construction

SUCCESS SPOTLIGHT: COLLABORATION

Project: European Spallation Source (ESS), Sweden

Company: ÅF Infrastructure, Sweco Architects, and Skanska Sverige AB, Sweden

With a budget of more than \$1.8 billion, the European Spallation Source is one of the largest building projects in Europe. Located in Sweden, it will be the world's most advanced neutron source and the leading sustainable research center.

Collaboration is key for this project. With stakeholders from ESS's 13 member countries, it is a constant challenge to keep this complex and technically demanding project moving. Using Autodesk technology, the team is able to collaborate better and achieve their key goal of having as much information as possible in each model.

The majority of designers work in Revit and use a master file that contains everything that the designers need to deliver, making changes easy and fast to manage. As a result, the team has enhanced and streamlined processes, which enabled them to optimize time in several areas of the project.

The construction of the buildings is set to be completed in 2022, and the team is continuing to reach construction and operation milestones on-time and on-budget.

CONNECTED BIM: BIM PLUS THE POWER OF THE CLOUD

Collaboration, coordination, and communication can be taken to the next level by taking advantage of the cloud. The increased use and value discovered by customers is evident, especially through the adoption of tools that enable connected BIM workflows.

“The biggest win with a connected BIM approach is communication. The clarity and intelligence of the process brings people together. It’s easier for people to see and discuss what needs to be done and improved. On the UVA project, we were able to fast-track key portions of the project with help from cloud-based BIM 360 tools.”

– John Calvin, Project Executive
Skanska USA

“With robust, cloud-based BIM, everyone could see behind the curtain and understand what everyone else was doing. The construction manager could better understand why the architects did what they did, the architects understood exactly what the MEP engineers were contributing, and so on. Everyone was on the same page, and there were no surprises.”

– Paul McGilly, Associate Principal/BIM Manager
BuroHappold Engineering

Cloud technology usage

2017–2018



77%+

AEC Excellence Awards
winners

2019



100%

AEC Excellence Awards
winners

2017–2019



50%+

AEC Excellence Awards
submissions

SUCCESS SPOTLIGHT: CONNECTED BIM

Project: Facebook's Clonee Data Centre, Ireland

Company: Mace

There's much to like about Facebook's new Clonee Data Centre in Clonee, Ireland. Supported by 100% wind energy, the Clonee Data Centre is a complex that includes a pair of 25,000-square-meter (approximately 269,000 square feet) data halls designed to bring Facebook apps and services to people around the world.

As many as 1,500 people per day contributed to the construction of these centers, with project general contractor Mace Technology Ireland leading the construction phase of the undertaking. To keep the project on track, Mace and the extended project team relied on the BIM 360 cloud-based platform for construction management.

As a result of using the cloud for construction management, Mace reports that managers saved more than 13 hours each week—helping them be 35% more productive overall.

Typical site users saved 12 hours each week on document control. Organizations that participated in the quality assurance and controls processes saved more than 14 hours each week. Mace also determined that employees on the construction site that were actively contributing information to BIM 360 were 21% more productive overall.

“You can have the best technology, but it doesn't really do much good unless you have backing from the whole team. We had that on the Clonee Data Centre project for Facebook. From the client to the trades, everyone on the project bought into the use of BIM and cloud technology. Now, it's hard to imagine doing a project like this any other way.”

— Paddy Ryan, BIM Lead
Mace

Managers

 **35%**
more productive

 **13hrs+**
saved each week

Typical site users

 **21%**
more productive

 **12hrs**
saved each week on
document control

 **14hrs+**
saved each week on
quality assurance and control

SUCCESS SPOTLIGHT: CONNECTED BIM

Project: Paper-free office expansion project, Switzerland

Company: Basler & Hofmann AG

While Basler & Hofmann AG began using BIM in limited circumstances several years ago, the company wanted to take full advantage of BIM's capabilities for a new office expansion project, implementing Revit building-design software, Navisworks project-review software, and BIM 360 cloud-based project management software.

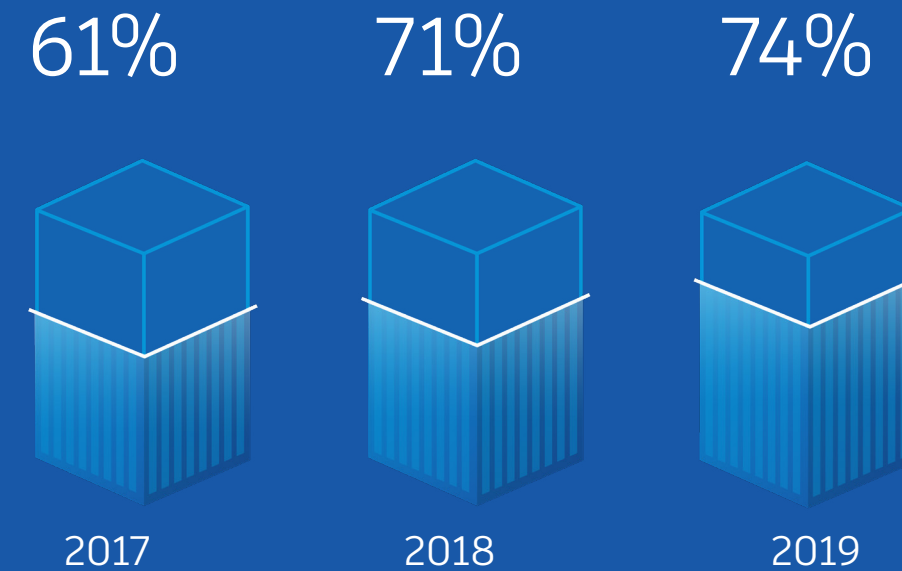
Instead of having the different stakeholders work from separate 2D plans, the firm sought to have everyone—including architects; structural and mechanical, electrical, and plumbing (MEP) engineers; and construction contractors—work from a single BIM model. And instead of using printed drawings, the firm preferred a paper-free project with no 2D drawings—even during construction.

Thanks to BIM 360, the team was able to bring the complete, live 3D model directly to the jobsite, where it can be consulted in real time using tablets. As a result, document version control was not an issue at any point in the project lifecycle. In addition, the firm was able to completely eliminate use of paper and disconnected data at the jobsite.

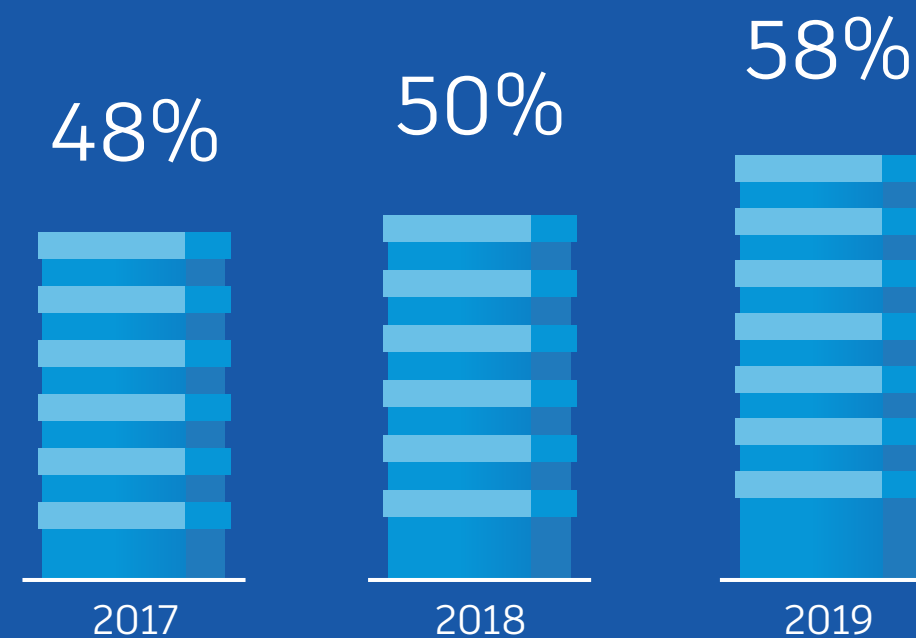
SIMULATION, ANALYSIS, AND VISUALIZATION

Simulation, analysis, and visualization contribute to even greater project success—from the site itself to structural engineering or MEP.

YoY growth for projects citing simulation and analysis as a key benefit



YoY growth for projects citing visualization as a key benefit



SUCCESS SPOTLIGHT: SIMULATION, ANALYSIS, AND VISUALIZATION

Project: Engineering of Luchuan Service Area of Yulin-Zhanjiang Expressway (Guangxi Section), China

Company: Tianjin Port Engineering Design & Consulting Company Ltd. of CCCC First Harbor Engineering Company Ltd.

The Yulin-Zhanjiang Expressway (Guangxi Section) project is 74.5km in length, and it comprises a two-way, four-lane expressway with seven toll stations, two service areas, and one parking area.

By simulating traffic routes, the project team was able to determine optimal road and parking layouts, while energy consumption analysis was employed to optimize air conditioning and thermal insulation.

The broad, multidisciplinary nature of the project made 3D visualization crucial in analyzing the spatial relationships of all the different parts as they are designed and built. Collaborating in one model via the cloud meant that communication between teams across different regions and disciplines was convenient and fast. With its opening in early 2020, the project has served as a successful pilot program for implementing BIM technology.



COST, QUALITY, AND SCHEDULE

With these new workflows and capabilities provided by BIM, the ultimate pay-off often happens during construction with increased cost saving, better quality, and improved schedules.



86%

of projects reported cost savings from labor, collaboration, and/or materials in 2019

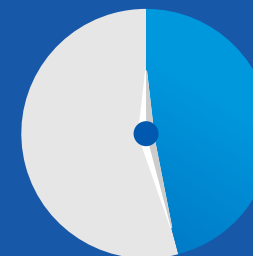


75%

of projects realized higher quality in the design and/or construction in 2019

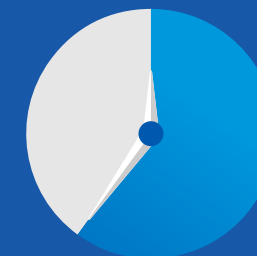
YoY growth for projects citing schedule as a key benefit

46%



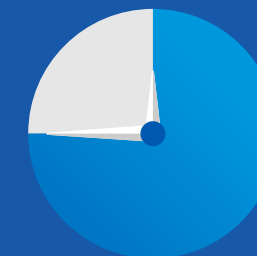
2017

60%



2018

75%



2019

“A mere 1% reduction in construction costs would save society about \$100 billion annually. In fact, the ambitions go far beyond that: the vision formulated by the UK government for 2025 is of a 33% reduction in the initial cost of construction and the whole-life-cycle costs of built assets.”

- World Economic Forum Shaping the Future of Construction:
A Breakthrough in Mindset and Technology²

SUCCESS SPOTLIGHT: COST, QUALITY, AND SCHEDULE

Project: Tianjin Chow Tai Fook Financial Center, China

Company: China Construction Eighth Engineering Division Corp. Ltd.

Tianjin Chow Tai Fook Financial Center is a striking new landmark in Beijing. It has a 390,000-square-meter total construction area, constituting a four-story basement, a five-story podium, and a 103-story tower and reaching a total height of 530 meters.

For China Construction Eighth Engineering Division Corp., Ltd., BIM was integral to success of this complex tower project. More than 100 members of the BIM team worked and collaborated on the design and construction.

By avoiding modification and rework ahead of time, the project saved 30 days and \$10 million RMB. With an output of nearly 4,000 drawings for the models of masonry panels, light partition walls, piping shafts, doors, and more, contractors could prepare their work precisely. This helped to cut the amount of materials needed for delivery, saving 60 days of construction work and material and labor costs of more than \$14 million RMB.

“Only by using BIM and the latest technologies throughout the entire construction process, we can finish a building 530 meters in height in five years. BIM has not only changed the way we work, but also clarifies how we think about and meet new challenges.”

— Yawu Su, Project Manager
China Construction Eighth Engineering Division Corp. Ltd.

[AEC Excellence Awards winner in Construction](#)

Courtesy of China Construction
Eighth Engineering Division Corp., Ltd.

ACCELERATING TRENDS & EMERGING TECHNOLOGIES

Of course, BIM isn't used in a silo. The advancement of new technology—including drones augmented reality, virtual reality, and generative design—are making even more impact on workflows and outcomes when used in conjunction with BIM.



20%

of projects used
drones in 2019



14%

of projects used
AR in 2019



X2

Use of Internet of
Things (IoT) doubled
from 2018 to 2019

ACCELERATING TREND & EMERGING TECHNOLOGY: PREFABRICATION

The [use of prefabrication](#)—especially for components—isn’t new, but it has grown exponentially as its value is increasingly discovered and unlocked. BIM is key for a strong prefab workflow, allowing for a detailed 3D visualization of components to ensure that the finished parts fit. BIM also provides the means to detail each component for precise manufacturing that may include wall-assembly templates and jigs, subassemblies that fit within wall frames, and automotive approaches such as robotic welding.



X3

Use of prefabrication has more than tripled in the past three years

SUCCESS SPOTLIGHT: PREFABRICATION

Project: Baptist Health MD Anderson Cancer Center, USA

Company: Miller Electric Company

Miller Electric uses off-site prefabrication to address the challenges with installation of electrical conduit. Often, electrical contractors work during later stages and are often expected to physically work around coordination issues and potential conflicts.

With BIM 360, the team can coordinate and eliminate conflicts with contractors and other trades. Then, off-site, Miller Electric fabricates large assemblies of electrical work from models and installs that work before the other trades do. This results in time saved, less waste, and packaging.

Models guide installation, too. Miller Electric uses models to determine installation points in Point Layout software. The firm exports this information into robotic survey instruments and marks exact locations for work with lasers. The traditional approach requires hours spent tape measuring and results in occasional disagreements with other trades about which measurements are correct.

For their [Baptist MD Anderson](#) project, the precision of the off-site fabrication proved to be perfect with 100% of the modules fitting as planned.

“We asked ourselves how we could get the most out of our workflow. It’s about creating a workflow that makes sense for us and all our trade partners. We were able to achieve a 100% success rate with our prefabrication and installation process. That’s because the information—the data—behind the process was so accurate.”

— Alan Creel, Vice President of Preconstruction Services
Miller Electric Company

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VIRTUAL REALITY

The popularity of virtual reality continues to grow as it provides an unrivalled way to view a project and—quite literally—experience it first-hand.



SUCCESS SPOTLIGHT: VIRTUAL REALITY

Project: Arna-Bergen, Ulriken Tunnel, Norway

Company: Norconsult

The Arna-Bergen, Ulriken Tunnel is the first use of a tunnel boring machine in Norway. When Bane NOR's new parallel tunnel is finished, double tracks will run between Arna and Bergen, providing more frequent departures between the cities and updated stations to accommodate the new trains. The route will be safer with the creation of 16 evacuation cross passages every 500 meters between the tunnel tubes. Ten technical rooms will also be built throughout the tunnel.

With this massive project, Norconsult AS took a decidedly different route. Design validation, maintainability, and training could be easily achieved through the innovative use of immersive technology and interactive virtual reality. The virtual environment also enabled the firm to execute signal and sign placement verification and simulations of emergency scenarios in a new way.

“Delivering an interactive virtual-reality experience with our BIM models truly disrupts the status quo in a traditionally conservative industry.

BIM improved coordination and phase planning by enabling us to visualize, and we found a significant reduction in the amount of time for approvals, stakeholder buy-in, and review cycles. Through an intuitive experience, the design was fully understandable for even non-professionals. In the end, we can help to deliver a better, safer tunnel and stations than ever before.”

– Thomas Angeltveit, BIM coordinator
Norconsult AS

[AEC Excellence Awards winner
in Infrastructure](#)

Courtesy of Bane NOR, Norconsult AS, Baezeni

SUCCESS SPOTLIGHT: MOBILE

Project: University of Virginia (UVA) Health | System University Hospital Expansion, USA

Company: Skanska USA and Perkins+Will

With one of the region's few trauma centers in the area, University of Virginia (UVA) Health System University Hospital receives as many as 20 patients via helicopter each day. The expansion brings much-needed capacity to in-patient and emergency services, but hospital operations must also continue as usual throughout construction.

The construction manager, Skanska USA, and design team, Perkins+Will, used 3D construction models linked to schedules to deliver the project safely and to keep the hospital's helipad—located just 30 feet from construction cranes—in normal operation for 22 months.

Using a connected-BIM approach to share 4D project schedules, Skanska USA took the insights gained during preconstruction onto the jobsite with BIM 360.

Many of the tradespeople working in the field accessed construction models with [mobile] on-site tablets. They could see the schedule, communicate issues, and visualize the next



1/3

of all projects cited the
integral use of mobile
in 2019

steps without having to go to a construction office. Using BIM 360 to analyze crane operations, the team was able to maximize crane picks, radius, weight, and sequencing for efficiency. The similar study helped sequence steel and concrete construction to eliminate more than \$1 million in bracing costs.

“Today, tradespeople are as likely to have a tablet on the jobsite as they are to have a hammer. It’s something you can take advantage of by using BIM 360 for coordination, scheduling, and more. They access the latest information in the cloud instead of accessing potentially outdated models. Tablets and BIM 360 connect people who spend most of their time in the field to BIM.”

– Cody Holder, Senior Project Engineer
Skanska USA



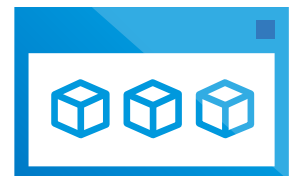


GENERATIVE DESIGN

Generative design is a definitive shift in how to conceptualize, design, and build. At its core, generative design is a strategy that augments human capabilities by using algorithms to automate your design logic. You still define the design parameters, but instead of modeling one thing at a time, generative design software helps you—the designer—create many solutions simultaneously and sometimes even find “happy accidents” or unanticipated and unique solutions that would be difficult to discover with traditional methods.

According to Dodge Data & Analytics’ Connecting Design Intent, 46% of respondents are aware and 37% of those currently use the generative design capability.³

90% of architects currently using generative design believe they will be using it on most projects within five years.



X2

Use of generative design doubled year-over-year from 2018 to 2019

SUCCESS SPOTLIGHT: GENERATIVE DESIGN

Project: Designing Entire Stores in Minutes With Generative Design

Company: Stamhuis

Netherlands-based Stamhuis specializes in retail shop construction and renovations, ranging from supermarkets to liquor and convenience stores. In the highly competitive and low-margin world of retail, cost-savings are critical across the board.

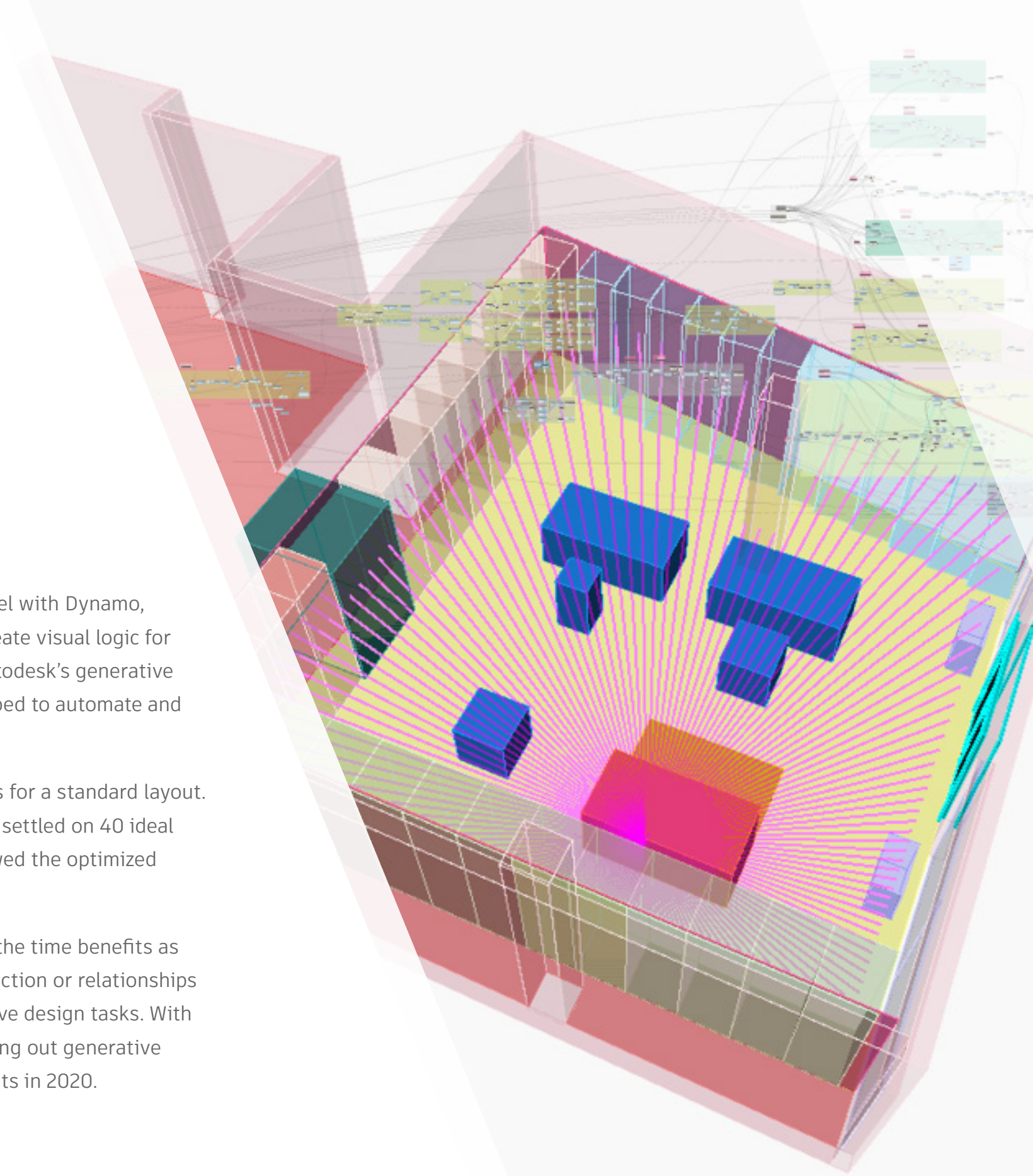
They wanted to focus on the design phase of their projects and see how generative design could help to optimize and see the outcomes for different key aspects of a successful liquor store retail design, including:

- Location and size of the cash register area
- Ratio between the shop and inventory storage
- Shelf spacing
- Aisle size
- Seller's field of vision

The team set up a computational model with Dynamo, which helps to automate tasks and create visual logic for exploration of parametric designs. Autodesk's generative design beta Project Refinery then helped to automate and optimize the design options.

It typically takes a designer four hours for a standard layout. With the script they created, the team settled on 40 ideal options for the liquor store and reviewed the optimized designs—all within 15 minutes.

The team and designers also realized the time benefits as they could now focus more on construction or relationships with the customers instead of repetitive design tasks. With more projects tested, Stamhuis is rolling out generative design for full commercial engagements in 2020.



<https://www.autodesk.com/solutions/generative-design/architecture-engineering-construction/stamhuis>

Courtesy of Stamhuis

EMERGING TECHNOLOGIES SPOTLIGHT

Amr Raafat, Windover Construction **2019 Innovator of the Year – AEC Excellence Awards**

Amr Raafat has an unparalleled passion for pushing the envelope of what is possible. He is renowned for creating groundbreaking virtual experiences that support the efficiency and execution of Windover Construction projects, all while mitigating risk and increasing client satisfaction.

For example, he recently combined drone mapping and virtual reality to create an innovative method to use immersive VR to support a real-life project lighting study. He performed a drone flyover of an athletic field and surrounding site to capture and map a detailed 3D model. The data collected included elevations and dimensional information.

By importing the site model into Autodesk 3ds Max, Amr was able to model the stadium light pole in Revit exactly as it was shown in the cut sheets from the manufacturer. Amr then added the exact light intensity and distance, creating the virtual reality environment base for the light study.

Windover's team was then able to explore several different and creative methods to reduce the light entering the adjacent building. Options included everything from planting evergreen trees to using different light shade fabrics. All options were modeled in Revit and exported to 3ds Max in the immersive virtual environment.

Ultimately, this process helped determine that light shades would serve as the best option to mitigate the light overflow. By using the elevation data captured by the drone and represented in the 3D model, they were able to identify precise fabric dimensions, color, and positioning. Combining drone mapping with the 3D model in this completely new and innovative manner helped the team provide a solution very efficiently and quickly, resulting in high client satisfaction.

Whether you're just starting out with BIM or growing your use of it, the far-reaching effects are evident. Better project coordination and collaboration with stakeholders, efficient workflows, 3D visualizations, and resulting improved project outcomes are just some of the benefits of using BIM processes.

THE PROJECTS MENTIONED WERE POWERED
BY THE AUTODESK AEC COLLECTION.
LEARN MORE ABOUT THE SOFTWARE TODAY.

Sources

- 1 NBS National BIM Report 2019:
<https://www.thenbs.com/knowledge/national-bim-report-2019>
- 2 World Economic Forum, Shaping the Future of Construction: A Breakthrough in Mindset and Technology:
http://www3.weforum.org/docs/WEF_Shaping_the_Future_of_Construction_full_report_.pdf
- 3 Dodge Data & Analytics' Connecting Design Intent:
<https://damassets.autodesk.net/content/dam/autodesk/www/campaigns/You-can-Subscription/aec-smart-market-brief-connecting-design-insight-en.pdf>

