Top 2021 Trends: Architecture, Engineering and Construction

15 industry experts share trends they think will shape the AEC industry in 2021
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The architecture, engineering and construction (AEC) industry has historically been slow to change. For instance, productivity in construction has only grown one percent annually over the past two decades, according to McKinsey & Company.¹ This was before 2020 – the impact of COVID-19 on the AEC industry was immediate and will continue to be felt in the future.

Companies must adapt to the new normal, one that changed all parts of the building lifecycle. Remote work has forced companies to find new ways to communicate, collaborate and create. The coronavirus changed the way that buildings and especially offices will be designed for a post-pandemic world.²

As 2020 comes to a close, 2021 is poised to bring even more change. Here are some of the top trends that will shape the AEC industry in 2021 and beyond.

— **Mixed reality (XR) will extend the usability of existing AEC digital assets** and make high-quality modeling a more cost-effective option.³ The industry will invest in technologies that bring the “true capabilities for XR to the broader economy”⁴ and provide “shared and clear understanding amongst all stakeholders.”⁵

— **Digital twins will continue gaining momentum** in the AEC world as part of a movement toward standardization.⁶ The continued evolution of digital twin technology will “support the democratization of digital twins, enabling a new wave of users to be able to make digital twins”⁷ and “improve productivity, safety and quality.”⁸

— **Real-time 3D, building information modeling (BIM), and virtual design and construction (VDC)** will enable the AEC industry to utilize interactive digital environments to make their work more accessible, more engaging, and add increased value for stakeholders.⁹ It will be the year that the “cost savings that those with the vision for the use of real-time in AEC have been anticipating all along.”¹⁰

Read on for more insights from 15 AEC experts on the trends they expect to define 2021.

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¹ “The next normal in construction: How disruption is reshaping the world’s largest ecosystem,” McKinsey & Company.
² “How Should Office Buildings Change in a Post-Pandemic World?,” Gensler.
³ YuanPo Li, Immersive Lab Lead, AECOM.
⁴ Karen Sanders, General Manager and Commercial Director, Real Serious Games.
⁵ Matthias Krampe, Managing Director, Auggd.
⁶ Niko Moreira, Digital Twins Specialist, Sitewise.
⁷ Sandra Marshall, Chief Technologist, Booz Allen Hamilton.
⁸ Rowan Braham, Lead of Data, Laing O’Rourke.
¹⁰ Murray Walker, Expertise Leader: Interactive Visualisation, Zutari.
Mixed reality
The design process of the AEC industry has evolved from traditional hand sketching to 3D generative modeling during the past decades. Although our design drawing has been massively digitized, it is hard to believe how limited it is in the contemporary workflow. The statistics show that, in recent years, digital models, including BIM, are used merely in the planning and design phases and rarely be transferred to the construction and operation stages that account for a larger proportion in a building lifecycle.

In 2021, with increasing 5G deployment and XR performance, it becomes possible to bring the sophisticated 3D model outside of the office by empowering mobile devices with cloud access. In conjunction with augmented reality (AR), we can bring the 3D model “alive” in real coordinates to improve the efficiency and accuracy for many onsite tasks relying on traditional paper-based workflows such as QAQC, public engagement and facility maintenance.

The combination of two technologies can extend the usability of existing AEC digital assets and makes high-quality modeling a more cost-effective option. With proper UX design, this could also achieve an effective remote working model between the office and onsite groups. We should acknowledge that XR has the potential to lead the dominant narrative for the next generation of the human interface under the ongoing global trend of the remote working model.
The headline above is a claim that has been made many times over the years. We truly believe that it will be different in 2021 because 2020 was a serious financial shock for the industry. Therefore, the barebones business issue of cutting costs will be the unsexy trend and drive AR adoption in 2021.

One major area the construction sector will focus on is rework, which, according to an FMI report and the Get it Right Initiative, makes up to 20% of all construction-related costs. Most of it is attributable to poor project communication.

Across the board, AR, by visualizing design intent at 1:1 scale throughout the project lifecycle, provides shared and clear understanding among all stakeholders.

Specifically, AR pushes the identification of issues upstream, i.e., during the design phase, thereby reducing the cost-prohibitive rework that currently happens in the latter phases of a project.
Due to the global pandemic, companies enter 2021 with a paradigm shift on staff remote working. This has escalated the urgency for providing quality training experiences for dispersed workforces.

For many of our customers, the business case for virtual reality (VR) training stacks up and has become reality. This is especially true if the equipment or environments operated in are expensive or dangerous to access.

2021 will see continued growing demand for scalable process-driven VR training for enterprises. That means having solutions for some challenges:

— The isolated in-field engineer can receive remote training facilitation.

— Geographically dispersed trainees can engage in multiuser training environments via mobile VR units.

— Elementary user data to provide progress metrics for the remote training facilitator (e.g., completing an activity).

— The integration of data across platforms will be essential for organizational intelligence (e.g., reporting to a learning management system).
The pandemic has changed how we innovate, and the limelight is on platforms that offer freedom and flexibility for remote collaboration and education. Clients want customized XR environments that are tailored to their specific needs and supported on a range of devices.

In 2021, we expect to see infrastructure industries, especially engineering, construction and mining, invest in XR technologies that will bring the true capabilities of XR to the broader economy. The year should also see a rise in the hardware as a service (HaaS) business model to make these technologies accessible for individuals and smaller companies.

Real Serious Games is on point to meet the challenges of the global pandemic and continues to develop XR applications that offer remote learning, remote guidance, and multiplayer capabilities. Two large mining corporations have already adopted the platforms to pioneer their way to a safer, more collaborative future.
Mixed reality engaging early critical thinking

3D visuals for construction have opened the door for more in-depth conversations on design and construction approaches for quite a while. Now, XR systems are reaching a point where they can be deployed at scale. This will place the model's power in many hands across a construction project lifecycle, from design to construction and beyond.

Tablet-based AR makes it familiar and deployable to large teams while remaining affordable. Customizing our app functionality and experience, we can tailor use and provide the greatest engagement and impact.

Utilizing XR for construction allows our teams and partners to collaborate, review and engage in critical conversations earlier and often. Ultimately, it's about shifting these discussions to a timeline that allows for changes and corrections to be found, analyzed and resolved before an issue negatively impacts the project's success.
Digital twin
Increased accessibility of digital twins and data

Digital twins consume historical context and performance data to understand the past, use direct and indirect data to analyze present conditions, and apply machine learning and knowledge to predict and act on the future. When digital twins are leveraged across the lifecycle, they create a digital thread of data, performance and decisions that bring transparency and enhanced communication to stakeholders across an enterprise.

Future trends will be:

— The continued evolution of technology will support the democratization of digital twins, enabling a new wave of users to make them.

— The cost of AR/VR equipment makes the technology more accessible, so more users can adopt it and therefore see and interact with their digital twins in new ways, fostering fresh insights and understanding.

There is going to be a move towards platforms that enable users to develop digital twins – bringing together data from disparate systems into a single interactive visualization that can be modified for users across the lifecycle and a wide variety of platforms to enable new insights.
A seamless union of the digital and physical worlds

Through 2021 and beyond, we will see the completion of the information ecosystem, allowing knowledge to flow seamlessly between the digital and physical worlds.

Previous years have seen a huge increase in the utilization of visualization technologies such as augmented and virtual reality. These technologies allow us to insert the digital world into the physical world, and, by doing so, massively increase the contextual relevance of that information. This can be transformative for everyone involved in the delivery of major construction projects; the delivery teams, the clients and the ultimate end user. Complex information that was once abstract can become tangible and “real.”

We will see a closing of this circle with the development and introduction of methods that will allow information to flow in the other direction – bringing the physical world into the digital world. Sometimes referred to as digital twins, these digital representations of the world are updated in real-time with rich information from a variety of sources. A large number of technologies need to interact to enable this vision, such as sensors, scanners, robotics and artificial intelligence (AI), along with the platforms and data architectures required to manage and distribute this information.

The introduction of these digital twins, and their supporting technologies, will create interactive data ecosystems in AEC projects. This will fundamentally improve productivity, safety and quality, which will lead to a more satisfying built environment that we all share.
2021 will see the democratization of spatial data capture capability on mobile devices.

These acquisition methods will act as a force multiplier to data-driven applications like digital twins, smart cities, and more efficient design practices.

From a design perspective, it is valuable to have an intimate understanding of how a system or piece of infrastructure behaves over time, whereby data can be rapidly captured on low-cost devices and shared on a daily basis.

Spatial computing (XR, AR, VR) is set to gain greater traction as a tool to provide kinesthetic training and visualization of assets, designs and concepts pertaining to AEC-related workflows.

This allows for the reduction of abstraction and greater retention of learned concepts and transferable knowledge.

The diffusion of innovation on related technologies is now transitioning beyond early adopters, and this is driven by advancement in hardware and creation tools like the Unity platform.
2021 will see increased adoption of several key technologies that help bring better communication and efficiency throughout the project lifecycle.

The shift to BIM across the industry will continue, not only for the architect, but for all consultant trades. These more consistent and complete digital twins – in combination with improved embedded metadata – will allow BIM to prove greater impact outside of 2D document creation.

There will be an increase in modular and off-site construction efforts as housing needs continue to grow. Modular will increase efficiency and decrease the time it takes to build.

Laser scanning and the accessibility of LiDAR are set to make waves in the industry. It is becoming increasingly easy to quickly and accurately digitize a physical space and distribute that 3D asset to larger teams.

Improvements in mobile AR and wireless VR headsets are setting the stage for increased adoption. With growing integration into widely used out-of-the-box tools, immersive media will continue to allow stakeholders to make more informed decisions, faster.
The year of digital twins

1. Digital twins will continue gaining momentum in the AEC world, as there is a movement towards standardization. City infrastructure, 3D city modeling, and building automation engineering are increasing traction for digital twins.

2. Smart cities will become more important in 2021. The United Nations projects that 11 billion people will be living in urban environments by the end of the century, creating a dire need for efficient digital city infrastructure. 5G and IoT technologies are gaining more of a foothold in modern infrastructure, which will help digital twin applications proliferate.

3. Real-time 3D visualization started raising eyebrows in 2019, with major players taking more serious steps towards the AEC industry, and many plug-ins and solutions for industry tools came about as a result. This trend is expected to continue growing in 2021.

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Real-time design
In 2021, we will start to see the role of virtual design and construction (VDC) in the AEC industry evolve, utilizing interactive digital environments to become more accessible, more engaging, and add increased value for stakeholders.

There will be greater integration with existing BIM platforms, external data sources, and scheduling engines to provide project stakeholders with an intuitive and accessible way to experience, navigate, interrogate, control and interact with data-rich models in real-time, from any angle and at any stage of construction.

Coupled with a rise in vertically integrated industrialized design and construction, interactive VDC will inform better decision-making and help architects and engineers to better understand and mitigate coordination and logistics issues before construction begins.

We will also see opportunities grow for improved training of contractors’ site staff, as they can review and rehearse project tasks in a virtual environment, allowing them to have a greater awareness of site activities while increasing site safety.
BIM and VDC are the most significant changes to the architecture, engineering and construction market segment since the industrial revolution. This digital transformation changes the way contracts are executed and how projects are delivered. Virtual and mixed reality are an extension of that digital transformation.

These factors increase stakeholder engagement throughout the project lifecycle. It allows owners, designers, engineers and builders to effectively collaborate to deliver a project that can be utilized by all. Healthcare, aviation, mixed-use, educational, government or commercial projects will realize the benefits of this digital transformation if it is appropriately planned and executed.
BIM has become one of the most powerful tools to enhance collaboration, design and data management in the booming construction industry today. However, with the industry's environmental impact and energy consumption concerns in mind, BIM still fails to provide a comprehensive solution for these issues. That's where building energy modeling (BEM) thrives. BEM is a multipurpose tool for energy analysis and management that is used for green certification, building and retrofit design, simulation and real-time building control.

Combining the uses of BIM and BEM can be the answer to achieving a more sustainable future, but it comes with its challenges in terms of integration and translation between the different tools. The research into integrating these solutions is growing substantially where AEC companies are working hard to implement sustainable practices – and where BIM meets BEM, this can help to prevent further damage to our environment.
The recent pandemic has been highly impactful on design, forcing everyone to rethink their needs, especially when it comes to their homes. Humans are social beings that thrive on connections with others, and urban environments provide the infrastructure for the sense of community that we yearn for. Yet with so much time spent at home, many have found that quality connections to the outdoors are lacking, especially in dense urban neighborhoods where access to parks is limited.

In the coming years, housing is going to adapt to this demand with innovative solutions that weave more private and shared outdoor space into multifamily dwellings. Residents already choose their housing based on proximity to open space, and in neighborhoods where it isn’t available, there will be high demand for architecture that integrates biophilia, access to natural daylight, and even views to nature.
The commodification of real-time AEC tools

After years of testing to figure out what works and what doesn't, and with purpose-built real-time 3D tools for game engines, it's now possible to commodify offerings to our customers and make real-time tools in AEC “business as usual.” This will in turn produce substantial time and cost savings that those who have had the vision to use real-time in AEC have been anticipating all along.

In addition, we're seeing the maturation of hardware, especially in VR, that will improve accessibility and lower the barrier to entry for the use of real-time tools. Now it's feasible for a designer to have a headset on their desk, while the connection between design tool and real-time engine is just one click away.
Create real-time 3D experiences

Real-time 3D extends far beyond just gaming – it’s transforming the building lifecycle across every industry and changing how the AEC industry designs, creates and operates buildings. Today, 19% of AEC and manufacturing companies have adopted real-time 3D, according to a commissioned study conducted by Forrester Consulting on behalf of Unity.

Harness the power of Unity’s development platform to start creating immersive, interactive, real-time 3D experiences.

Unity Reflect
Transfer Autodesk Revit, Navisworks, Rhino, and SketchUp models into real-time 3D experiences, including in AR and VR, to better coordinate design and engineering reviews.

Unity Pro
Create and deploy enterprise applications and immersive experiences with our complete software solution for professionals across industries.

Furioos
Stream real-time 3D experiences from Unity in any web browser and embed them onto any website.
Get started with Unity Reflect

In this three-hour course, you will gain a full understanding of Reflect as a product, and learn how it can be used to improve production pipelines in your day-to-day work.

Picking up where Getting Started with Reflect left off, Basic Reflect Customization is a course designed for Unity developers who are ready to integrate Reflect into their development pipelines.

Out of the box, the Unity Reflect Viewer allows for quick and easy design reviews on desktop, AR and VR. In this tutorial, we’ll learn how to navigate in VR and interact with the mesh data.

Want to start making real-time 3D experiences? Get your free 30-day trial of Unity Reflect today.