2025 TECH TRENDS REPORT • 18TH EDITION

BUILT ENVIRONMENT

FTSG

Future Today Strategy Group's 2025 Tech Trend Report

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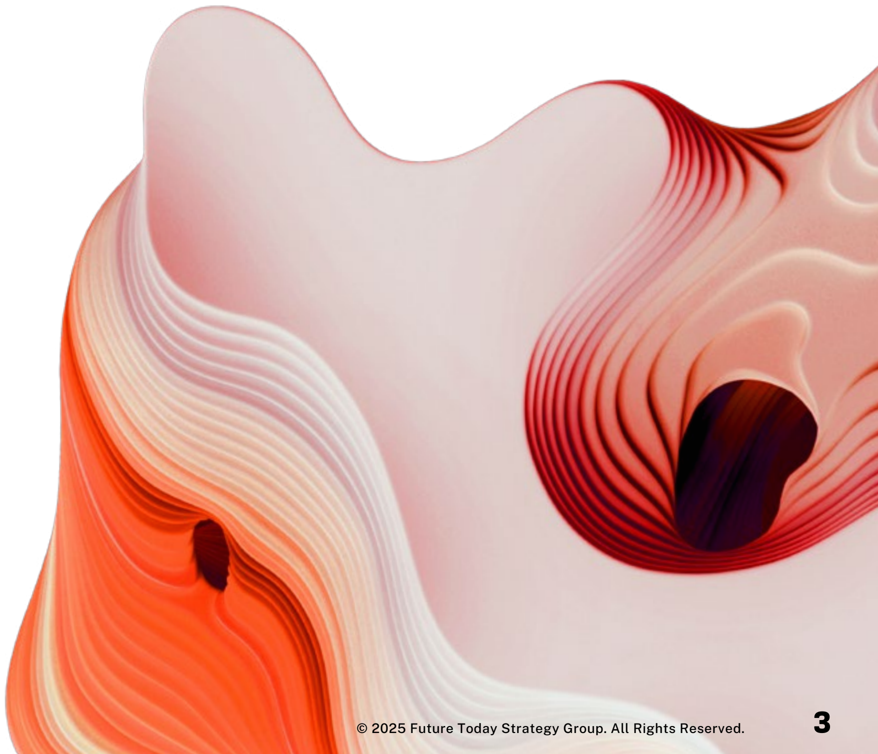


Mark Bryan
Built Environment Lead

Building a resilient and dynamic future.

As we look beyond 2025, we find ourselves at a pivotal moment, one that requires moving beyond the comfort of traditional thinking and established practices. The challenges and opportunities in the built environment industry demand a visionary approach, an openness to uncertainty, and a readiness to embrace new paradigms. Responsible for the foundation of civilization, this industry must now take the lead in guiding the world toward a more sustainable and resilient future. This journey forward necessitates more than just incremental improvements; it calls for a fundamental shift in how we design, construct, and manage built spaces. The integration of emerging technologies like AI-driven design, digital twins, and smart materials will help create buildings and infrastructures that not only meet today's demands but are also resilient and adaptable to tomorrow's uncertainties. Any traditional, linear design processes must give way to more iterative, collaborative cycles that allow for continuous innovation and responsiveness.

Part of this means adopting regenerative design principles, where what is produced from new projects and products actively contributes to communities. Rethink urban planning to prioritize self-organization in convergence with biotechnology that promotes well-being. The vast historical and institutional knowledge within the industry should serve not just as a foundation but as a launchpad for pioneering solutions that address the looming threats of climate change, demographics shifts, and infrastructure degradation. By embracing sustainable practices, harnessing advanced technologies, and fostering a culture of looking ahead, the industry can create interconnected, adaptable spaces, systems, and products that foster thriving communities and new ways of living in a connected and augmented life.

The built environment has always been more than just the physical structures we inhabit; it is the canvas upon which life unfolds, communities flourish, and the future takes shape. There is the opportunity to build a future that is not only sustainable but also vibrant, dynamic, and full of possibility.

Aging infrastructure and climate change are creating risks that can no longer be ignored.

1

Residents move into a new $10.3 billion smart city at the foot of a volcano

Toyota's Woven Smart City near Mount Fuji, where the company will test prototypes of renewable, self-driving vehicles, is set to welcome its first 2,000 residents.

2

Baltimore bridge collapse highlights declining infrastructure

Nearly one in 10 of the 617,000 bridges in the US are "significantly compromised," with Americans making 178 million trips daily on structurally deficient bridges.

3

Sustainability targets are not being met

Despite some reductions in energy intensity, overall energy demand and emissions from buildings have increased, indicating that current efforts are insufficient to meet global climate targets.

4

Extreme weather spells disaster for property care and costs

Heatwaves, droughts, and heavy rainfalls in Brazil and the UAE led to significant loss of life and property damage, marking some of the worst climate-related disasters in history.

5

Luxury office costs rise while demand for lower-end spaces declines

The cost of Miami office space hit a new record last year with rents hitting around $200 a square foot, double 2022 prices.

The industry will choose commoditization or transformation—and the decision has yet to be made.

The built environment industry is standing at a crossroads of either commoditization or transformation, provoked by a convergence of technological innovations, demographic shifts, and environmental challenges. Technological advancements, particularly in modular construction, digital tools, and AI-driven automation, are becoming increasingly critical for enhancing efficiency, cost-effectiveness, and flexibility in construction projects. These technologies are especially vital in fast-growing regions such as Africa and Asia, where rapid urbanization and population growth are driving unprecedented demand for housing, infrastructure, and digital services. But the sector is also grappling with significant challenges, including rising labor costs, supply chain disruptions, and the need for sustainable practices in response to global climate goals.

In regions like Australia and the Middle East, public sector investments in large-scale and “giga” projects are laying the foundation for future growth by meeting the infrastructure needs of expanding urban populations and creating opportunities for companies to participate. Meanwhile, in Europe, Asia, and emerging markets, the push toward net-zero carbon emissions is spilling over to construction projects, with regulatory pressures and shifting consumer expectations prodding both governments and corporations to integrate sustainability into operations. And, pretty much everywhere, critical infrastructure continues to age, underscoring the urgent need for investment.

At the same time, the built environment is being reshaped by iconic projects such as the Grand Egyptian Museum in Giza, the restoration of Notre Dame Cathedral in Paris, and innovative developments in Asia like the Beijing City Library, Kaohsiung Station, and the solar-powered Sun Rock facility. These projects not only exemplify ongoing investment in cultural and public spaces but also highlight the increasing emphasis on sustainability. To succeed and thrive, the built environment industry must move past stagnation to embrace new practices and innovations. The integration of advanced technologies, sustainable practices, and a focus on adaptability will be essential in shaping the future of the built environment.

Changes in cities and processes are fueling advancements.

APRIL 2024

Laser-Induced Graphene MDF

Medium density fiberboard with laser-induced graphene surfaces is developed to sense touch, heat, and pressure.

MAY 2024

Flea-Size Cobots for Inspections

These micro-cobots are made to conduct detailed inspections and repairs in confined construction spaces.

JULY 2024

Dubai's Green Spine Project

The plan is to turn 40 miles of highway into parks, with a million new trees, for urban cooling.

JULY 2024

Mobile Scanning for Digital Twins

GeoCue's mobile scanning systems update digital twins in real time during site walkthroughs.

AUGUST 2024

South Korea's Hydrogen Apartments

The first-ever hydrogen-powered apartment complex uses regenerative energy systems.

« PAST

Governments and municipalities will focus heavily on infrastructure development and maintenance in the near future.

FUTURE »

EARLY 2025

Data-Driven Design Verification Becomes Standard

Clients will increasingly require integrated data models during preconstruction phases to ensure predictability and proof of financial performance for projects.

MID 2026

Public-Private Partnerships for Smart Infrastructure Expand

Governments and private companies will ramp up collaboration on smart infrastructure projects, including grid modernization and urban safety systems.

EARLY 2027

Rewilding Gains Momentum as Mental Health Initiative

Governments worldwide will adopt rewilding initiatives to support mental health, using natural spaces for therapeutic and community activities.

MID 2028

Demand for Resilient Infrastructure Peaks

In response to escalating extreme weather events, architects and engineers will integrate climate-resilient features into urban and regional infrastructure projects.

MID 2030

Distributed Manufacturing Networks Take Hold

Regional 3D printing hubs will become mainstream, enabling companies to reduce costs by manufacturing parts closer to their points of use.

Emerging built environment trends will revolutionize operations, workforce needs, and technology strategies.

Commoditization Unlocks New Services

Many aspects of built environment projects can be commoditized by technology—a threat that is increasingly becoming a possibility. However, this also presents new opportunities for services and business models that could offer more stability for some companies.

Processes Are Changing

As trends like automated design and augmented construction scale, project and product development will potentially become expedited. The process is also changing at the city and client level due to new trend developments that will change how professional services integrate with both the city and their clients.

Community Integration Is Possible and Necessary

Many communities are putting a premium on boosting their social infrastructure so their members can have a say in decision-making at the local level, but access to the development process is often elusive. Communities will increasingly now have an informed voice in what should be built and created.

Today's Talent Lacks Tomorrow's Skills

With institutional knowledge leaving the industry in droves, those who remain are struggling to maintain the pace of work, let alone the pace of leveling up their skills to prepare for the future. New skills development can become a new service platform or a method of attraction and retention for tomorrow's projects.

Digitization of Assets Is Lacking

The problematic lack of digitized historical data so far has no clear solution. Businesses that make a point of understanding the industry's future direction can plan for what materials should be digitized and in what format.

Risks Are Increasing

Cyber and environmental risks continue to climb. Companies should shore up their processes and tools to prevent hacks and prepare for extreme weather and climate disasters—and to provide assurance to clients and partners.

These individuals are at the forefront of development and transformation in the built environment industry.

- **Baharash Bagherian, CEO of URB,** for leading this ambitious initiative, which aims to transform Sheikh Mohammed Bin Zayed Road into the world's greenest highway.
- **Carlos Moreno, scientific director at the Sorbonne Business School,** for promoting the 15-minute city model and its integration with technologies like citizen participation platforms.
- **Dr. Joseph Paradiso, professor at MIT,** for innovatively transforming waste textiles into functional electronic fabrics.
- **John Folan, professor and head of the Architecture Department at the University of Arkansas,** for The Wave Layered Timber project, which addresses housing shortages with an innovative glue-free timber system.
- **Young-Jin Kim, professor at Korea Advanced Institute of Science and Technology,** for research into creating graphene-based smart materials.
- **Diane Hoskins & Andy Cohen, co-CEOs of Gensler,** for their book on the ways design can help address some of the world's most pressing issues.
- **Franz-Josef Ulm, professor at MIT,** for work using cement and carbon black to store renewable energy.
- **Coen van Oostrom, founder and CEO at Edge,** for the continued development of intelligent buildings and built environments.
- **Zack Jackowski, general manager at Boston Dynamics,** for his work using Spot robots for construction.
- **Robert Piconi, CEO at Energy Vault,** for his work on gravity energy storage systems that can turn skyscrapers into energy storage.
- **Misak Terzibasiyan, principal architect for UArchitects,** for the Community for Refugee project, which uses modular housing for displaced people.
- **Melodie Yashar, vice president of Architecture & Building Performance for ICON,** for her work on space architecture and additive construction.

Technology enables community input and advanced experiences...

OPPORTUNITIES

Citizen Participation Platforms

Digital technologies that enable citizen participation in urban planning can lead to more inclusive and democratic urban development, the kind of city projects that align with residents' needs.

Advanced Deconstruction Technologies

Integrating machine learning, robotics, and optimization into deconstruction processes enhances the efficiency and safety of material reuse, opening up more sustainable practices.

Smart Home Holography

Innovations like holographic telephony and AI-driven personal assistants can create more interactive and personalized living spaces, making home automation more intuitive and engaging.

Additive Manufacturing for Cultural Customization

New additive manufacturing capabilities will make truly unique, community-connected projects possible.

...but, technology shouldn't replace traditional talent and trusted practices.

THREATS

Overreliance on AI in Urban Planning

A heavy dependence on AI may marginalize other communities that don't have access to technology, potentially exacerbating social inequities.

Regulatory Challenges for Metamaterials

The introduction of metamaterials for noise reduction and other urban applications may be slowed down by regulatory hurdles, limiting their potential impact.

Cultural Insensitivity in Global Immersive Experiences

The worldwide expansion of XR experiences may lead to cultural insensitivity or homogenization, where local traditions and values are overshadowed by standardized experiences.

Cybersecurity Risks in Intelligent Buildings

The increased reliance on intelligent building systems makes them vulnerable to breaches that compromise building operations and occupant safety.

It's time for companies in the built environment industry to invest in earnest in emerging technologies.

Businesses must fully commit to the development and deployment of digital twins. As this technology advances, the emergence of digital twin mesh networks will revolutionize how data is shared and utilized across projects.

Clients will expect to have a choice of AI versus human work, and firms should strategically evaluate how AI-driven efficiencies might impact pricing models. Companies will need to decide new value models for human and AI work, and predict which clients will prioritize which type of work.

In light of the growing capabilities of additive manufacturing, it's time to rethink the location of production facilities. Embracing localized production not only aligns with sustainability objectives but also enhances responsiveness to project needs.

The construction industry, a sector historically slow to adopt new technologies, must address its growing technological debt, or else the widening gap could hinder its competitiveness and efficiency.

As climate change and unpredictable global events continue to challenge urban infrastructures, the emphasis on resilience is no longer optional. Cities must pivot their focus toward new investments, prioritizing resilient projects over traditional ones to secure a safe and adaptive future.

The absence of clear guidelines and protections for AI creates significant risks as the technology continues to be embedded in business operations. By establishing these safeguards now, companies can ensure that AI initiatives are secure, ethical, and aligned with long-term strategic goals.

Technology Deployment
Capital Expenditure
Talent Development
Regulatory Influence

Important terms to know before reading.

ADAPTIVE REUSE
The process of repurposing existing buildings and infrastructure for new uses, reducing the need for new construction and preserving cultural heritage, while aligning with sustainability goals.

ADDITIVELY MANUFACTURED (AM) PRODUCTS
Items or materials produced through additive manufacturing, including 3D printing, where layers of material are added sequentially to create a final product. This process is increasingly used for customized, sustainable, and efficient production across various industries.

AUTONOMOUS VEHICLES (AVS)
Vehicles that operate without human intervention using a combination of sensors, cameras, artificial intelligence, and advanced computing power. AVs include cars, drones, and other transport solutions that are transforming logistics, urban planning, and mobility services.

BUILDING INFORMATION MODELING (BIM)
A digital representation of physical and functional characteristics of a facility. BIM serves as a shared knowledge resource for information about a facility, forming a reliable basis for decisions during its life cycle, from inception onward. Unlike digital twins, BIM models typically do not update in real time.

BIODIVERSITY
The variety of life in all its forms and levels, including species, ecosystems, and genetic diversity. In 2025, the focus on biodiversity includes the integration of biological diversity into business practices and urban planning to ensure sustainable development.

BUILT ENVIRONMENT
The human-made surroundings that provide the setting for human activity, encompassing architecture; interior design; civil engineering; mechanical, electrical and plumbing (MEP) engineering; structural engineering; landscape architecture; product design; manufacturing; construction; experiential design; and urban planning. This field is increasingly influenced by smart technologies and sustainability imperatives.

CIRCULAR DESIGN
A design philosophy aimed at minimizing waste and making the most of resources. Circular design principles encourage the development of products and environments that will be repurposed, reused, or recycled, contributing to a regenerative economic model.

CROSS-LAMINATED TIMBER (CLT)
A type of mass timber product made by stacking layers of wood perpendicular to each other and gluing them together, for high strength and stability. CLT is used in various applications, including walls, floors, and roofs.

DIGITAL TWINS
Highly detailed, dynamic digital replicas of physical objects, systems, or environments that use real-time data to mirror and predict their real-world counterparts' performance. Digital twins are integral in optimizing operations and facilitating decision-making across industries, from urban planning to manufacturing.

ENVIRONMENTAL, SOCIAL, AND GOVERNANCE (ESG)
A framework used by organizations to guide their practices and policies in the areas of sustainability, social responsibility, and corporate ethics. ESG criteria are increasingly expected for investment decisions and regulatory compliance.

EXPERIENTIAL DESIGN
A multidisciplinary approach to creating environments, products, and services that prioritize user experience and engagement, often incorporating sensory and interactive elements. This design practice is central to developing immersive experiences in retail, entertainment, and digital spaces.

EXTENDED REALITY (XR)
An umbrella term that includes augmented reality (AR), virtual reality (VR), and mixed reality (MR). XR technologies are used to blend digital and physical worlds, enhancing how we interact with environments, products, and each other in real time.

GLULAM (GLUED LAMINATED TIMBER)
An engineered wood product made by gluing together individual pieces of lumber. Glulam is used in large structural components, such as beams and columns, in mass timber buildings, to achieve both high strength and flexibility.

INTERNATIONAL CODE COUNCIL (ICC)
An organization that develops model codes and standards used to design and build safe, sustainable, affordable, and resilient structures. The ICC's codes are widely adopted and influence construction practices in more than 50 countries, playing a key role in global building safety and compliance.

INTERNET OF THINGS (IOT)
A network of physical objects embedded with sensors, software, and other technologies to connect and exchange data with other devices and systems over the internet. IoT enables smart environments, from homes to cities, and drives innovation in industries such as health care, manufacturing, and logistics.

ISOCHRONE MAPPING
A method of mapping areas that can be reached within a specific time frame using various modes of transportation. It is used in urban planning to evaluate accessibility and mobility.

LARGE LANGUAGE MODELS (LLMS)
Artificial intelligence models trained on extensive datasets of text to perform language-related tasks such as translation, summarization, and content generation. LLMs are foundational in developing AI applications, particularly in natural language processing and conversational interfaces.

LIGHT DETECTION AND RANGING (LIDAR)
A remote sensing method that uses light in the form of a pulsed laser to measure variable distances to the Earth. Lidar is critical in applications ranging from autonomous vehicles to environmental monitoring and urban planning.

MASS TIMBER CONSTRUCTION
A construction technique using large or solid engineered wood products for structural components. Mass timber is gaining popularity for its sustainability, carbon storage capabilities, and potential to reduce the environmental impact of buildings.

MECHANICAL, ELECTRICAL, AND PLUMBING (MEP)
The three key technical disciplines involved in building design and construction. MEP systems ensure the comfort, safety, and efficiency of buildings and are increasingly integrated with smart building technologies.

METAVERSE
A collective virtual shared space that converges virtually enhanced physical reality and physically persistent virtual reality. In 2025, the metaverse is expanding beyond entertainment into areas like work, education, and commerce, driven by advances in XR, blockchain, and AI.

MODULAR CONSTRUCTION
A method of construction where buildings are made from prefabricated sections (modules) that are manufactured off-site and then assembled on-site. This approach offers faster construction times, cost efficiencies, and reduced waste, and is being increasingly adopted for a variety of building types.

NET ZERO
A state where the amount of greenhouse gases emitted is balanced by the amount removed from the atmosphere. Net-zero projects are designed to minimize energy consumption and maximize the use of renewable energy sources, while aligning with global sustainability goals.

OCCUPANT-CENTRIC CONTROL (OCC)
Building systems designed to optimize environmental conditions (e.g., temperature, lighting) based on real-time data about occupants' preferences and activities, ultimately to improve comfort and energy efficiency.

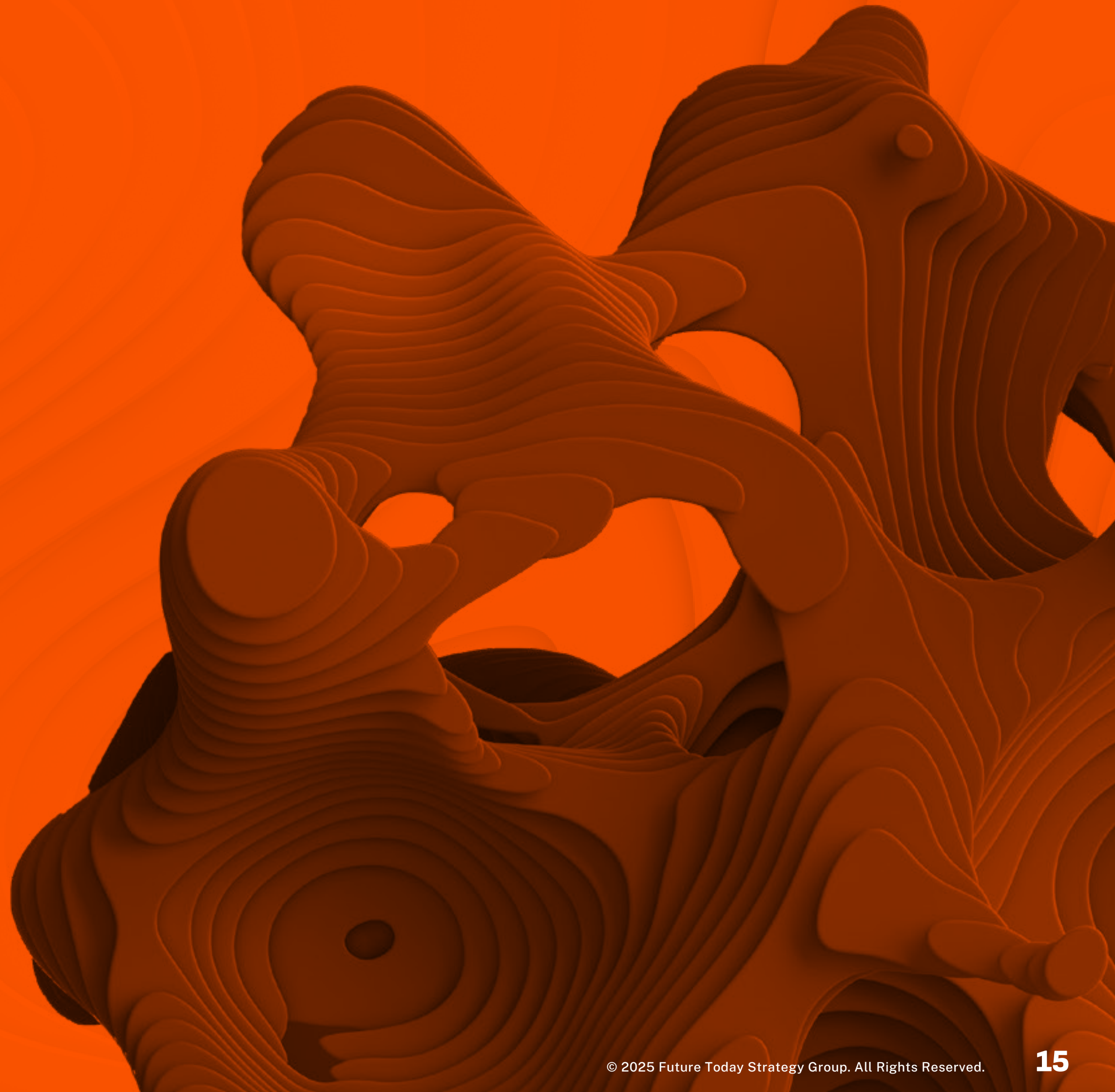
PARTICIPATORY DESIGN
A design approach that involves stakeholders, including community members, in the design process, often enhanced by immersive tools like VR to simulate user perspectives and improve collaboration.

PROXIMITY-BASED URBAN MODELS
Urban planning models that emphasize the importance of spatial relationships and proximity between different functions and services in a city. These models integrate digital technologies to connect makers, citizens, and services, fostering distributed economies and localized governance.

REALITY CAPTURE
The use of technologies such as laser scanning, drones, and lidar to create detailed digital models of physical environments, for planning, deconstruction, and adaptive reuse purposes.

UNMANNED AERIAL VEHICLES (UAVS)
Aircraft systems that operate without a human pilot on board. UAVs, commonly known as drones, are used for various applications, including surveillance, delivery services, environmental monitoring, and agricultural management.

URBAN CENTER
Traditionally the central area of a city where commerce, culture, and governance converge. In 2025, urban centers are increasingly redefined by smart city initiatives, green spaces, and mixed-use developments that promote sustainability and livability.



BUILT ENVIRONMENT TRENDS

ADAPTIVE URBAN ENVIRONMENTS

2ND YEAR ON THE LIST

CHRONO-URBANISM

WHAT IT IS

Sometimes referred to as "15-minute cities," chrono-urbanism seeks to enhance urban living by making essential services, amenities, and work opportunities accessible within specific time frames, typically within a 5-, 10-, or 15-minute walk or bike ride.

HOW IT WORKS

Chrono-urbanism embraces the concept of focusing on incremental changes rather than complete urban overhauls. In South Korea, the city of Busan has a 15-minute city model aimed at enhancing residents' quality of life by increasing public facilities and distributing a "15-minute life card" that encourages them to engage with local programs. Recent research is taking technology's role in chrono-urbanism to a new level, by using it to connect makers, designers, citizens, and digital fabrication/3D printing sites and create distributed economies through proximity-based urban models and policies. The goal is to integrate digital production tools like 3D printing at key city locations to support future chrono-urbanism efforts.

Other chrono-urbanism innovations include Citizen Participation Platforms, which give residents the ability to engage in urban planning and ensure projects meet community needs. Additionally, a study in Hamilton, New Zealand, used GIS technology to identify areas suitable for the 15-minute city concept. And in Chengdu, China, researchers aimed to make chrono-urbanism more practical by moving beyond walkability. Their work expanded the 15-Minute Community Living Circle concept to include multiple transportation modes—walking, cycling, public transportation, and driving. Then residents would have enhanced access to health care and other daily necessities, based on spatial accessibility and real-time travel data.

WHY IT MATTERS

While the concept has yet to achieve widespread adoption, ongoing research and pilot projects highlight chrono-urbanism's transformative potential in urban planning. By prioritizing accessibility and proximity, cities can reduce long commutes, lower environmental impact, and strengthen community ties. And by integrating digital technologies and real-time data systems into urban management, cities can better optimize their services and allocate resources.

Practical challenges such as existing infrastructure, high population density, and economic constraints hinder the full-scale implementation of chrono-urbanism. Additionally, the concept of walkability, though appealing, may not be feasible in all urban contexts, particularly in sprawling or rapidly expanding cities. Despite these challenges, chrono-urbanism presents a compelling vision for the future—one where cities are less reliant on vehicles for mobility, more sustainable, and better aligned with the daily lives and needs of their residents. The framework could redefine how we live and interact within urban environments, making them more resilient and responsive to both current and future demands.

2ND YEAR ON THE LIST

SELF-ORGANIZED PLANNING

WHAT IT IS

Self-organizing technologies are setting the foundation for smarter, more adaptive cities that can plan themselves. These innovations are paving the way for more efficient resource management and sustainable growth in urban environments.

HOW IT WORKS

Traditionally, AI models in urban planning were specific to one geographic location, and struggled to adapt to new environments. But the new InvarNet framework marks a breakthrough by focusing on consistent underlying relationships rather than geography-specific correlations. This approach enhances the reliability and precision of urban planning tools, improving resource management, urban growth prediction, and sustainability efforts.

New remote sensing technologies further complement these AI advancements with unprecedented accuracy in mapping and categorizing land use. AI models trained on high-resolution remote sensing data can now identify land categories with up to 99.19% accuracy, enabling better planning for future resource use. Innovations in urban building energy modeling (UBEM) are also advancing how cities estimate and predict energy demand, aiding sustainable energy planning processes.

Cities like Lebanon, New Hampshire, and Gainesville, Florida, now use AutoReview.AI to streamline development application processing and site-plan reviews, automating time-consuming tasks and accelerating urban planning. Additionally, some cities are using AI through LLM frameworks like multi-agent collaboration and fishbowl discussion mechanisms to stimulate citizen input. This ensures more inclusive and participatory urban planning—and ultimately more equitable and effective decisions.

WHY IT MATTERS

As urban populations expand and environmental concerns intensify, the ability to manage resources efficiently and plan for sustainable growth becomes increasingly critical. To realize the full potential of self-organizing planning, firms will need to incorporate seamless workflows, prioritize data transparency, and implement continuous reinforcement learning. And to derive future work from cities, they may need to adjust their project development process to accommodate these changes.

However, there are potential misuses to be wary of, such as AI being employed to identify and disperse homeless encampments. While AI can streamline many aspects of urban planning, it shouldn't entirely replace human input. The advancements in AI, particularly those that reduce the technology's former reliance on geographic specificity and allow for it to help in the planning process, have shown to lead to better outcomes in resource management, infrastructure development, and environmental protection. These technologies also democratize the planning process, encouraging greater citizen participation and ensuring that urban development reflects the needs and desires of the community.

2ND YEAR ON THE LIST

REWILDING

WHAT IT IS

Urban rewilding initiatives are reshaping cityscapes, enhancing biodiversity, reducing carbon emissions, and fostering community engagement through innovative uses of AI, urban planning, and community-driven projects.

HOW IT WORKS

In Dubai, the Sheikh Mohammed Bin Zayed Road is being turned into a 40-mile "Green Spine," with parks, community gardens, and more than a million trees improving air quality and reducing temperatures. The Dubai Mangroves initiative plans to plant 100 million mangroves along 43 miles of coastline by 2040, to capture carbon and create a natural barrier against erosion.

Community-driven efforts like urban beekeeping are also advancing rewilding. Capgemini's Tech4Positive Futures Challenge, in partnership with Pollenize, developed an urban rewilding tool to help residents plant native, pollinator-friendly vegetation. Others are exploring using trees to reduce noise pollution: Researchers studied how trees interact with the soil to dampen vibrations, and identified strategic tree placement that block specific vibrations from urban trains.

By integrating natural elements with technology this way, we could have healthier, more livable cities. AI advancements suggest what such efforts could look like. AI models like image-to-image translation and inpainting create realistic visualizations, aiding planners in integrating green spaces. In Denmark, the technology has been applied to a rewilding framework for identifying and prioritizing rewilding sites that could be adaptable to cities worldwide.

WHY IT MATTERS

Urban rewilding represents a crucial response to the challenges posed by climate change and urbanization. By restoring natural elements within cities, it can mitigate the effects of urban heat islands, improve air and water quality, and provide residents with spaces that enhance mental and physical well-being. Pretty soon, residents may prioritize cities with rewilding projects, as they will be viewed as more climate stable. For the many firms and products that do not currently consider rewilding, incorporating these aspects could be a point of true innovation for the industry. This could take the form of products and places that include the ability to grow local plants once installed.

The use of AI in these efforts is particularly important, as it allows for precise planning and visualization of urban green spaces. Some new AI tools facilitate community-driven initiatives, which empower local residents to take an active role in improving their environment. As cities continue to expand, it will be increasingly essential to integrate both soft technology (such as plants and trees) and hard technology (like AI) into urban planning. Rewilding will create resilient urban environments that are better equipped to handle future environmental challenges.

> We must rewild the world. Rewilding the world is easier than you think. A century from now our planet could be a wild place again.

Sir David Attenborough

REGENERATIVE PRACTICES

2ND YEAR ON THE LIST

ADAPTIVE REUSE AND DECONSTRUCTION

WHAT IT IS

Adaptive reuse and deconstruction are redefining urban renewal and sustainability by repurposing existing structures and materials, reducing waste, and preserving embodied carbon.

HOW IT WORKS

Adaptive reuse repurposes old buildings, structures, and materials, reducing the need for new construction and preserving embodied carbon—the energy used to create original materials. This approach minimizes demolition waste and revitalizes aging infrastructure, such as the transformation of Kansas City's Rock Island Bridge into an entertainment district or London's 8 Canada Square from an office building into a sustainable mixed-use space, while reducing carbon impact.

Recent innovations include employing AI and machine learning to assess residential buildings' potential for reuse, by evaluating their structural integrity and suggesting sustainable strategies, such as retaining the structure or conducting a selective demolition. Deconstruction now uses machine learning to predict costs, assess material reusability, and optimize waste categorization. Robotics enhance safety and efficiency in separating and removing building components. Laser scanning, UAVs, lidar, and XR technologies capture detailed building data, reducing the work that goes into deconstruction planning and making decisions easier. But adaptive reuse goes far beyond buildings: The textile industry is upcycling waste fabrics into multifunctional electronic textiles, and exploring end-of-life solutions for its products.

WHY IT MATTERS

Amid rising costs, many projects will only move ahead if they reuse existing infrastructure, and the significance of adaptive reuse and deconstruction lies in their contribution to sustainability and urban renewal. By repurposing existing structures and materials, these practices reduce the environmental impact of construction and demolition, preserve cultural heritage, and create vibrant new spaces. The integration of advanced technologies in deconstruction not only enhances efficiency but also supports the circular economy by maximizing material recovery and reuse. As cities and industries continue to prioritize ESG goals, adaptive reuse and deconstruction will play a critical role in the projects that are greenlit to move forward, potentially shifting funds for current and future investments.

For industry professionals, adaptive reuse and reconstruction could add to their current design and practice processes, while the advanced technology will cut down on time and expense. As cities and industries continue to prioritize sustainability, professionals who master adaptive reuse and deconstruction will be at the forefront of shaping smarter, greener, and more resilient urban environments.

2ND YEAR ON THE LIST

METAMATERIALS

WHAT IT IS

Metamaterials are engineered materials whose properties enable them to exhibit unique abilities not found in nature, including new ways to address noise control, structural resilience, and adaptive textiles.

HOW IT WORKS

While metamaterials that can heal themselves or exhibit other man-made properties have been around for years, now there are metamaterials that have a unique ability to manage acoustic energy. Researchers are developing versions that can redirect sound waves, effectively rendering objects acoustically "invisible." This acoustic cloaking is promising for reducing noise pollution in urban areas. Additionally, these materials are being designed to absorb the energy from earthquakes, making them ideal for use in seismic zones. Some metamaterials can even convert sound into electrical energy, adding a sustainable energy-harvesting capability.

At TU Delft in the Netherlands, researchers have developed an AI tool that accelerates the discovery and fabrication of customized metamaterials. This "inverse design" process starts with desired properties and works backward to create the necessary structure, taking into account the practical limitations of 3D printing. The result: highly durable and efficient materials that overcome previous design limitations.

These advanced materials also have applications in smart textiles. MIT's FibeRobo fiber changes its properties with temperature, potentially leading to fabrics that adapt to weather conditions. Researchers at the Okinawa Institute of Science and Technology have created a polymer that glows brighter under mechanical stress, which could be used to identify weaknesses in bridges or buildings.

WHY IT MATTERS

Metamaterials are redefining how we address structural resilience, energy efficiency, and noise reduction in urban environments, leading to innovations in infrastructure that are both sustainable and adaptable. However, very few firms are experimenting with these new materials. This offers an opening for startups or new players to capitalize on this trend, and clients may be willing to pay a premium—especially for products that can last longer and are reconfigurable. It also changes the design paradigm by offering living and dynamic materials.

Metamaterials also provide an opportunity to enhance the resilience and functionality of cities, particularly in areas struggling with noise pollution and structural challenges. The ability to incorporate sound management directly into building materials means future urban environments could become not only quieter but also more energy-efficient and sustainable. Additionally, the development of smart textiles and adaptive materials, which respond dynamically to environmental conditions, opens new possibilities for personal and structural applications, from wearable technology to buildings that can adjust their properties based on external stimuli.

SCENARIO YEAR 2044

QUIET POWER

By 2044, cities have turned nuisance sound into a valuable resource, creating urban environments that are both quieter and more energy-efficient. Imagine walking down a busy street—except it's not as noisy as you'd expect. That's because the buildings, sidewalks, and even streetlights are equipped with smart materials that absorb and redirect sound, cutting down on the usual urban din. But these materials do more than just quiet things down; they actually convert the captured sound into electricity. So, the chatter from a crowded sidewalk café or the hum of traffic isn't just noise—it's energy being funneled into powering streetlights, public Wi-Fi, and electric vehicle charging stations.

Public parks and squares have become hubs for both community activities and energy production. Now, a lively street fair in the heart of the city not only entertains but also helps power the nearby public transit system with the sound energy generated by the crowds. Sound-harvesting tech built into the ground and nearby structures captures the vibrations from the music and crowd noise, converting them into electricity to keep the transit system running. And it's not just about fun and games—cities have also become smarter about using sound to improve safety. Buildings in earthquake zones are now fitted with acoustic cloaking systems that can redirect seismic waves around them. So, when a quake hits, these buildings remain standing, keeping critical services like hospitals and emergency response centers operational. It's a world where sound doesn't just fade into the background—it's actively shaping the way we live, work, and play, making urban life in 2044 more sustainable, resilient, and connected than ever before.

2ND YEAR ON THE LIST

RESILIENT DESIGN

WHAT IT IS

The rise of resilient design in response to climate change, disease, and humanitarian disasters is transforming the built environment.

HOW IT WORKS

The need for resilient infrastructure has led to new methods for tilt detection and crack analysis, and increasingly AI is being used to identify potential structural failures before they occur. Similarly, new digital twins are using cloud-based geospatial dashboards to provide a visualization of potential flood impacts to better understand risks. Similar systems combine real-time monitoring with predictive analytics to identify and classify harmful substances, such as pollutants or toxic gases.

At the same time, researchers are exploring new ways to integrate resilient design into urban infrastructure. In Spain, they're testing prototypes of cooling bus stations to help combat extreme heat in urban areas. Similarly, in California, they're developing resiliency hubs as community centers that can offer shelter and resources during emergencies. Newly created hydrogels enhance resilient design by providing sustainable, scalable, and durable protection against wildfires, keeping buildings and infrastructure safe even under extreme conditions. Inside buildings, innovations like new antiviral flooring and the integration of beneficial bacteria into interior surfaces and air systems can potentially transform furniture and fixtures into active elements that promote healthier indoor environments. New research from Carnegie Mellon on using drones to explore collapsed buildings could also change how interior spaces are created in disaster-prone regions.

WHY IT MATTERS

The growing impact of climate change is forcing a rethink of how we design, build, and manage our infrastructure. Resilient design, supported by cutting-edge technologies like digital twins, AI, and advanced sensors, offers a pathway to creating urban environments that are not only more resistant to disasters but also more sustainable and adaptable to changing conditions. And while currently, resiliency is mainly thought of in terms of climate change, the concept goes much deeper to encompass topics like mental health where resiliency interventions can make humans better prepared for their daily lives.

As the demand for resilient products, projects, and spaces grows, there is a clear opportunity for companies to offer resilience planning as a service. This could involve consulting to help cities and property developers design more resilient buildings and neighborhoods, or it could mean developing new products specifically tailored to address these challenges. For example, companies might create modular, deployable structures that can be rapidly assembled in disaster-prone areas, or they might develop software solutions that integrate digital twins and AI to provide real-time monitoring and decision support.

2ND YEAR ON THE LIST

ADDRESSING HOUSING SHORTAGES

WHAT IT IS

Technological advancements and policy changes are driving new solutions to address global housing shortages, with a focus on efficiency, affordability, and sustainability.

HOW IT WORKS

Affordability challenges have intensified worldwide, and technological innovations like AI are emerging as crucial solutions. One example is a new system that uses a graph neural network to evaluate affordable housing applications; it assesses risks and enables real-time, accurate decision-making, significantly speeding up the approval process. Additionally, financial tools like Walker & Dunlop's Apprise platform are enhancing the real estate valuation process. By integrating data from multiple sources into a centralized system, Apprise improves the accuracy and speed of appraisals, which is critical for securing financing and accelerating the development of affordable housing projects.

In Kazakhstan, Central Asia's first 3D-printed house was completed in five days, reducing both time and costs, while also being designed to withstand severe environmental conditions such as earthquakes and extreme temperatures. This project highlights how 3D printing can make affordable housing more accessible and sustainable.

In the US, the University of Arkansas is advancing affordable housing through its Wave Layered Timber (WLT) system, a glue-free timber construction method that uses a wave shape to interlock components, providing structural strength without adhesives. This innovative approach not only reduces the environmental impact but also offers a scalable solution to meet the growing demand for sustainable housing.

WHY IT MATTERS

The convergence of AI, 3D printing, and sustainable construction methods represents a significant step forward in addressing global housing shortages. These technologies not only promise to make housing more affordable and accessible but also introduce new standards for sustainability in construction. As governments and industries adopt these innovations, the potential for alleviating one of the most pressing global issues—the widespread housing crisis—grows over the long term. However, many cities are not prioritizing these innovations and are instead relying on outside developers to address their housing problems.

When these advancements are pursued, they must be fully integrated into mainstream construction practices to make a substantial impact. However, for these innovations to truly address the housing crisis on a global scale, they must overcome significant hurdles. High initial costs, the need for extensive testing, and the challenge of integrating these technologies into existing construction practices are major barriers. Governments, industries, and financial institutions must collaborate to create incentives, funding mechanisms, and regulatory frameworks that support the adoption and scaling of these technologies. Ensuring these solutions are both scalable and profitable will be crucial for their success in the broader market. This approach not only addresses immediate housing needs but also will set a new standard for future construction.

2ND YEAR ON THE LIST

REGENERATIVE DESIGN

WHAT IT IS

Regenerative design is a holistic approach to built environment projects and products, making them contributors to greater community health or the environment rather than just addressing sustainability.

HOW IT WORKS

Regenerative design embraces the principle that projects and products can enhance the environment by using sustainable materials and energy sources. NASA's Mycotecture Off-Planet project is a prime example, where astronauts use mushroom-based materials to grow sturdy structures in space—it's a minimal-impact construction method.

In the energy sector, South Korea's hydrogen-powered apartment complex exemplifies regenerative design by using hydrogen fuel cells for 100% of its energy needs, reducing reliance on fossil fuels and presenting a replicable urban energy model. Similarly, Trane Technologies' cold-climate air-source heat pumps utilize the natural environment more effectively to help create buildings that are more in tune with their surroundings. MIT's new concrete can turn buildings into energy hubs by storing energy within the structure, while its new ultralight solar cells use printable electronic inks to make energy production more decentralized and resilient. While these are currently standalone initiatives, their implications are that they could one day provide regenerative energy to communities.

Urban projects like IoT-equipped community gardens optimize resource use while enhancing local food security. In Philadelphia, repurposing wood waste into building materials integrates sustainability into urban development and supports urban forestry.

WHY IT MATTERS

Traditional sustainable practices focus on reducing harm, but regenerative design aims to give back to the environment—and change the parameters around what substantial completion of a project means. A building built with regenerative practices can provide its community with tangible immediate benefits, which could be in the form of carbon credits, free electricity, new jobs, or increased resiliency. This approach addresses the obvious urgent need for sustainable practices in the face of climate change and resource depletion, but also has the potential to address other community-wide needs.

By leveraging advanced materials, energy systems, and self-sustaining technologies, regenerative design can help create resilient, self-sufficient structures that contribute positively to their surroundings. This trend could eventually push projects and products to go beyond sustainability, perhaps by addressing food shortages or other basic human needs, which in turn will mean new design parameters and consultant services. As these innovations scale, they ensure that our built environments will give back more than they take from the planet.

SCENARIO YEAR 2032

DISASTER GLOW

“It would be heartbreaking if it weren’t so pretty” is the general sentiment of Tokyo residents, hours after an earthquake hit the city causing chaos and damage. Now, in the aftermath, disaster glow has begun. Tokyo was one of the first cities to adopt the seismic stability platforms being integrated into new buildings and bridges, and part of the seismic restoration parameters put in place by the Tokyo Metropolitan Government in 2026 included the use of the new glowing polymer that indicates structural damage. Now, while the earthquake has caused pervasive damage, its harm was minimal to these residents. As they walk through the streets after the disaster, they marvel at their surroundings, which are lit by a soothing light creating intricate patterns on the buildings, sidewalks, and nearby structures. As they watch, drones fly through the air to capture and document the damage, feeding this information into the city’s AI-based system to evaluate and prepare repair plans.

AUGMENTED PRACTICES

2ND YEAR ON THE LIST

IMMERSIVE AND SENSORIAL EXPERIENCES

WHAT IT IS

Immersive technologies and advanced sensorial systems are revolutionizing how we design and interact with built environments, creating the opportunity for individualized experiences anywhere.

HOW IT WORKS

Immersive experiences are rapidly expanding in public and recreational spaces, as demonstrated by attractions like Singapore's Sentosa Sensoryscape, where digital light art, soundscapes, and AR interactions create a multisensory environment that deeply engages visitors. The city of Harbin in China showcases advanced XR technologies in its indoor ice and snow theme park, using lighting and synchronized sound systems to bring ice sculptures with edible pigments to life. In retail, Xydrobe's collaboration with Harrods involves a multisensory VR cinema that enhances storytelling by immersing customers in brand experiences.

Emerging technologies are further enhancing interactivity in environments through holograms and digital signage. Innovations like foldable holographic displays and AI-powered assistants, such as Emma, offer new ways to engage with interactive and immersive content almost any place. Additionally, no-code AR/VR platforms democratize content creation, making immersive experiences more accessible for personal and professional use, fostering creativity and innovation across sectors.

Advancements in XR are also being leveraged for mental health, with research indicating their potential to manage conditions like seasonal affective disorder and ADHD through therapeutic lighting environments. The use of these technologies could lead to more personalized immersive spaces and products.

WHY IT MATTERS

The integration of immersive and sensorial technologies in our built environments is a significant development, reshaping how we interact with the spaces we inhabit. These technologies are not merely about visual or auditory stimulation; they engage multiple senses, creating experiences that are richer, more engaging, and more memorable. This shift is crucial in both public and private spaces, as the demand for environments that cater to personalized emotional and psychological needs keeps increasing, and it also provides new service opportunities for selling shared virtual senses.

This shift towards integrating immersive and sensorial technologies in built environments is also about rethinking the way we interact with our surroundings on a fundamental level. By allowing for pre-experiencing and adjusting environments before they are physically realized—for example by letting potential residents walk through amenity spaces—XR and other advanced technologies help reduce waste, improve user satisfaction, and ensure that spaces better align with human needs. This approach makes sense for our increasingly complex and multifunctional environments that need to adapt to a wide range of users.

2ND YEAR ON THE LIST

AUTOMATED DESIGN

WHAT IT IS

The automation of design processes can enhance creativity, efficiency, and accessibility—and it's rapidly having an impact on the architecture, landscape design, and engineering sectors.

HOW IT WORKS

Automation in design has become integral in the built environment. Landscape architects use these tools for detailed renderings and master plans, while designers leverage AI to generate color palettes and unique conceptual inspirations. Automation similarly has revolutionized building information modeling (BIM). The Semantic Reconstruction for Building Information Modeling (SRBIM) framework automates the conversion of existing 3D models into accurate, standardized BIM models. Engineers can now also easily convert outdated CAD files into modern BIM systems, significantly reducing time and labor.

Recent advancements have introduced "prompt to plan" capabilities, enabling users to generate entire design plans by inputting parameters like the number of bedrooms or roof styles. A dynamic graphical user interface allows even those without architectural training to engage in the design process. New models also include real-time compliance checks, automatically evaluating design changes against local building codes, reducing errors and costly revisions.

Besides its usefulness to professionals, this technology can empower nonprofessionals to design their dream homes, making sophisticated design accessible to a broader audience. This democratization of the design process marks a significant shift for the industry.

WHY IT MATTERS

The integration of automation into the design process is not just about speeding up tasks; it represents a paradigm shift in how design is conceived and executed. For architects and engineers, these tools facilitate faster iterations and more collaborative efforts, enabling teams to explore a wider range of design options without the traditional time constraints. This leads to better-designed structures, as more possibilities can be tested and refined in less time.

The implications extend beyond individual projects. As more firms adopt automated tools, the industry as a whole could see a significant reduction in costs associated with design and construction. Real-time compliance checking, automatic adjustments for structural integrity, and enhanced visualization tools reduce errors and rework. Additionally, this shift may prompt a reevaluation of industry practices and governance, as firms seek to balance the benefits of automation with the need to retain critical human expertise and creativity. However, the widespread adoption of these technologies also raises important questions about the future of the design profession. As automation handles more routine tasks, the primary responsibilities of the human designer may move toward more strategic, high-level decision-making. Firms will need to navigate these changes carefully to make sure that automation enhances rather than diminishes the creative process.

2ND YEAR ON THE LIST

METAVERSE ENABLING

WHAT IT IS

As the concept of the metaverse evolves, it's clearly becoming more than just a virtual world; it's a hybrid space that merges physical and digital realities. This new environment is leading to the development of metaverse architecture that is adaptive and responsive.

HOW IT WORKS

The integration of metaversal hybrid technologies is driving the creation of shared virtual spaces where users interact in real time with both physical and digital worlds. Retailers are leveraging worldbuilding techniques, commonly used in storytelling, to create immersive brand narratives that blend both types of environments. To ensure these environments are secure, AI will monitor for security threats, while blockchain maintains data integrity and privacy. Spatial computing enhances cognitive and sensory interaction within these hybrid spaces, enabling environments to adapt based on user input and surrounding factors. AI-driven placemaking offers additional support by creating culturally relevant environments that evolve with user behavior, strengthening community connections in the digital realm.

In participatory design, stakeholders can use metaverse tools to engage directly with 3D models, overcoming the challenge of uninformed design decisions due to a lack of input. Similarly, an "Automatic Space Generation" method leverages AI to design metaverse spaces based on user activities, improving efficiency over traditional 3D modeling. By analyzing behaviors and preferences, AI creates personalized, innovative virtual spaces, free from physical constraints. Feedback on these designs highlights AI's potential to tailor environments to individual needs, suggesting a pivotal role for AI in future virtual architectural design.

WHY IT MATTERS

The integration of the metaverse in the built environment is transforming how we design, use, and experience spaces. By merging physical and digital worlds, hybrid environments are emerging that offer new opportunities for interaction and engagement. This shift challenges traditional notions of space and place, pushing the boundaries of urban design and architecture. Architects and designers will need to adopt new tools, frameworks, services, and offerings that provide both virtual and physical user experiences. As these technologies mature, more personalized and dynamic spaces will proliferate and potentially lead to novel forms of interaction and engagement across work, leisure, and community activities.

Exploration in the metaverse will also mean stretching traditional design forms and function, opening up even more innovations in the built environment. How these innovations evolve will look different, as the metaverse can serve as a place of collaboration with communities and stakeholders—reducing travel costs even while increasing inputs. AI's and blockchain's roles in ensuring safety and privacy will be necessary for keeping these dynamic spaces secure.

2ND YEAR ON THE LIST

INCLUSIVE DESIGN

WHAT IT IS

Innovative technologies are increasingly enabling designers to better understand and accommodate the needs of individuals with disabilities. This shift is fostering a more inclusive built environment, enhancing the lives of those with visual, motor, and sensory impairments.

HOW IT WORKS

Something we forecasted years ago is now a reality today: VR is being used to simulate the challenges faced by disabled individuals in public spaces, letting non-disabled users experience these barriers first-hand. This immersive experience is designed to foster empathy and understanding while encouraging more inclusive design practices. In addition to VR, new AR and AI tools are being developed to provide enhanced situational awareness for those with sensory impairments through devices like AR glasses, which can translate visual information into auditory cues or haptic feedback, to help users navigate their surroundings. Occupant-centric control technologies achieve thermal inclusivity by optimizing building temperatures based on an individual's needs.

Advancements in robotics are making significant strides in mobility accessibility. For instance, robotic wheelchairs are being designed to adapt to a user's environment. They know to avoid obstacles and choose the most comfortable paths. Researchers are developing robotic exoskeletons to assist with movement in complex environments, such as staircases or uneven terrain, to improve users' independence. Increasingly, robots are also becoming emotionally intelligent companions. One example is the creation of robotic dogs that utilize AI and wearable technologies to detect and respond to human feelings. They're not just functional aids; the robotic dogs provide emotional support and companionship, addressing mental health and well-being.

WHY IT MATTERS

These advancements in inclusive technologies are crucial for creating environments that are accessible to all, regardless of ability. As the global population ages, the demand for such technologies will only increase, making it imperative for designers and developers to prioritize accessibility in their projects. Designers should begin by considering the impact on spatial allowances based on a user's actual needs rather than generalizations. Engineers will need to consider the impact on urban infrastructure and power consumption due to new robotic companions and enablers. Manufacturers will likely need to create companion products that meet the diverse needs of individuals while also adjusting durability parameters.

By integrating these technologies, firms can create spaces and products that not only meet regulatory standards but also enhance the quality of life for individuals with disabilities. The focus on inclusive design should not just be about compliance, however; it should be about recognizing and addressing the varied needs of all people, ensuring that everyone can participate fully in society—especially as humans are starting to live longer.

2ND YEAR ON THE LIST

REAL-TIME DATA FOR ENHANCED DECISIONS

WHAT IT IS

Cutting-edge technologies are turning built environment materials, products, and spaces into intelligent, data-collecting tools, enabling real-time monitoring and control.

HOW IT WORKS

The integration of sensors is turning various materials, such as wood and plywood, into data-collecting surfaces. One breakthrough is the creation of laser-induced graphene on medium-density fiberboard (MDF). By using a femtosecond laser, the MDF's surface becomes a highly conductive material that both collects data and functions as touch, heat, and pressure sensors and controls. The applications of this technology could create sensors and controls for any surface.

A significant application of this technology is in furniture, particularly chairs, which are increasingly being embedded with health monitoring sensors—everything from sensors that monitor and provide feedback on the user's posture, to radars that track heart health. These advancements could make furniture a part of personal health management, offering real-time insights into physical well-being.

Another example is Tagnoo, a type of plywood embedded with RFID tags. This plywood can sense the presence of objects and activities within a room in real time, making it a valuable tool for creating responsive, data-collecting environments. Like conventional materials, this plywood functions like ordinary wood in construction but has the added benefit of computational abilities, a plus for smart buildings.

WHY IT MATTERS

The potential for integrating sensors directly into building materials represents a significant leap in smart technology. By turning walls, floors, and even furniture into interactive surfaces that collect data, this technology can enhance automation, provide new sources of information, improve energy efficiency, and increase comfort and safety in residential and commercial spaces. These innovations also reduce the need for additional electronic devices, which can lead to more aesthetically pleasing designs and lower energy consumption. Fully realizing this integration will require changes to production, manufacturing, and electrical planning, as well as increase the need for connectivity within the built environment.

The convergence of health monitoring with smart environments underscores the growing importance of technology in enhancing everyday life, from comfort to wellness. The new data collection and sensor integration could turn more spaces into places of care and extend the health care system into homes and offices. As we move towards smarter environments, the ability to embed technology seamlessly into our surroundings will be a key driver of change, making our interactions with our spaces more intuitive, smart, and personalized.

SCENARIO YEAR 2034

INCLUSIVE AGING FACILITIES OF THE FUTURE

March 18, 2034—Today marks a groundbreaking moment in senior care as the highly anticipated VidaFutura Senior Residence opens its doors, setting a new standard for how we support our aging population. This state-of-the-art facility, located in the heart of Madrid, combines cutting-edge technology with compassionate care to create an environment where seniors can live comfortably, safely, and independently.

At the heart of VidaFutura's inclusively designed facility is its fully integrated smart furniture and wearables: seemingly-ordinary items like the living room coffee tables are anything but ordinary, and deliver a new level of convenience and care. Embedded with advanced touch controls, these tables offer a seamless blend of functionality and design. With just a simple touch, residents can adjust the room's lighting, control the volume of music, or start their favorite TV show. The tables also include temperature-controlled coasters that monitor the heat of a cup of coffee, automatically cooling it to the perfect drinking temperature or sending a reminder if it's getting cold. For those with sensory impairments, wearables help by translating visual information into auditory cues or haptic feedback, making navigation and daily activities more accessible. And of course, there's VidaFutura's most remarkable feature: personalized comfort. The entire building utilizes occupant-centric control technologies, optimizing temperatures based on individual needs, ensuring that every resident feels just right in their living space.

This focus on thermal inclusivity is just one example of how VidaFutura is leading the way in creating environments that adapt to their residents, rather than the other way around. VidaFutura Senior Residence stands as a beacon of what's possible when technology and care come together. This facility not only offers a glimpse into the future of senior living but also provides a model that will undoubtedly inspire similar advancements around the globe.

SMART CITY IMPLEMENTATIONS

2ND YEAR ON THE LIST

INTELLIGENT BUILDINGS

WHAT IT IS

The next generation of intelligent buildings, structures that can think and operate on their own, is focusing on both exterior innovations and the integration of advanced interior systems, to significantly enhance energy efficiency, sustainability, and security.

HOW IT WORKS

New intelligent building technologies include exterior features like walls with rotatable units that automatically open for ventilation or close for insulation based on real-time data, to optimize energy and comfort. Designs are now integrating kinetic, movable architectural elements with AI, leading to more dynamic and responsive exteriors. And intelligent, interconnected buildings are using networked photovoltaic glass to share surplus energy, creating efficient microgrids.

Inside, significant progress has been made with new platforms like Honeywell's Advance Control for Buildings, which integrates cybersecurity, faster network speeds, and autonomous decision-making tools. This platform meets the rising demand for energy-efficient, intelligent buildings by identifying maintenance issues, reducing emissions, and improving operational efficiency.

Security systems have also advanced, incorporating deep learning-powered facial recognition for better identity verification, even in complex scenarios. Smart devices' voice controls are more sophisticated, enhanced with speech recognition systems that better distinguish between words and background noise, for user-friendly interactions. New AI-driven platforms can now, on their own, optimize separate subsystems like HVAC, lighting, and security by making simultaneous real-time adjustments to all of them.

WHY IT MATTERS

The shift toward intelligent buildings is significant for several reasons. For one, it reduces the need for constant supervision and manual processes in facilities. It also addresses the growing demand for sustainable and energy-efficient solutions in urban environments. But these innovations are also paving the way for a more interconnected urban infrastructure. As intelligent buildings become more sophisticated, they can offer better protection against intrusions, optimize work environments, and even improve the overall quality of life for occupants. The convergence of AI, IoT, and advanced building materials is driving a new era of design, where structures, places, and spaces are not just passive spaces but active participants in their communities or within a company.

While the exterior of buildings is becoming increasingly intelligent, kinetic elements may soon go beyond simple adjustments like adjusting window shades or lighting, evolving into fully adaptable architectural features that respond to the needs and preferences of occupants in real time. As exterior elements become more dynamic due to AI integration, so too will interior spaces, creating opportunities for self-managing intelligent space allocation.

2ND YEAR ON THE LIST

SMART HOME AUTOMATION AND MONITORING

WHAT IT IS

Smart home automation is rapidly advancing with adaptive systems that optimize energy efficiency, safety, and comfort.

HOW IT WORKS

One of the most innovative developments in smart homes involves using AR to proactively identify and mitigate potential hazards. Based on sensor data, the system detects risks such as slippery surfaces or low-hanging obstacles. The AR then generates a visual overlay that suggests actions like placing a rug or adjusting an object's height, so homeowners can address safety concerns before they escalate. Other advancements significantly enhance automation and monitoring. Equipped with sensors, these systems continuously gather data on environmental factors like humidity, temperature, and air quality across various rooms. The core innovation lies in AI algorithms that process this data in real time, filtering out noise, detecting anomalies and reacting. For example, if the humidity reaches uncomfortable levels, the AI automatically activates a dehumidifier, to maintain optimal conditions without unnecessary energy use. Companies like LG, with new platforms like ThinQ, analyze user behavior and environmental data to automatically adjust lighting, temperature, and other settings based on the time of day, personal preferences, or weather conditions. Beyond comfort, AI plays a critical role in detecting hazardous anomalies. If these systems notice risks like water leaks or fires, they can execute preprogrammed responses, such as shutting off water or activating fire suppression, to mitigate potential damage based on insurance parameters.

WHY IT MATTERS

In the era of remote work and rising prices, homes continue to evolve. The increased expense of homeownership means people are staying put; they are preferring to do renovations over buying a new home and keeping multiple generations under one roof. More renovations could become about smart home integration, but since most construction and renovation companies don't offer these services, it may open the door for new players to enter the built environment market. AI's inclusion in smart home systems looks to not only enhance comfort and convenience but also play a critical role in energy efficiency and home safety. By automating responses to environmental changes and potential hazards, smart home technology reduces the need for constant human oversight, freeing up homeowners to focus on other tasks. As these technologies become more sophisticated, they will likely influence broader aspects of daily life. For example, AI-powered home management systems could eventually integrate with broader smart city infrastructures and contribute to more sustainable urban environments. Additionally, as the technology matures, it may offer more personalized living experiences that adapt to the specific needs and preferences of individual occupants in real time.

2ND YEAR ON THE LIST

SMART PARKING AND ROADWAYS PREDICTABILITY

WHAT IT IS

AI-driven advancements in parking and roads are poised to create safer, more efficient urban environments by optimizing traffic flow, parking logistics, and city management.

HOW IT WORKS

The US Department of Transportation has allocated $15 million to the Complete Streets AI Initiative, which aims to enhance street infrastructure by addressing data gaps in traffic and pedestrian patterns. A new patent looks to explore the potential of UAVs and drones to monitor roadways and patrol streets for issues like crime and congestion. In parking facilities, AI-based systems continue to dynamically improve space management and vehicle movement. New patents are exploring vertical parking along with automated parking and storage of bikes and cars. Meanwhile, AI upgrades to streetlights and cameras are making driving safer: A new bio-inspired event camera system, integrated with AI, detects obstacles and pedestrians much faster than traditional cameras by capturing motion instantly, without the delay of sequential frames. This technology, up to 100 times faster than current systems, helps autonomous vehicles and other systems respond rapidly to changes and safety issues. Researchers are also developing AI-driven highways to help autonomous vehicles navigate more safely by processing real-time data from vehicles, traffic signals, and environmental sensors. These highways provide that information to the vehicles to reduce accident risks.

WHY IT MATTERS

The complexity of future urban environments requires smarter, more responsive infrastructure, with AI playing a critical role. By improving traffic flow and managing parking dynamically, AI reduces congestion, lowers emissions, and enhances urban mobility and safety. It also brings economic benefits, such as better space utilization in parking garages. For city governments, the integration of AI into street management can reduce the costs associated with traffic incidents and infrastructure maintenance. The use of UAVs for real-time city monitoring allows for proactive management, addressing issues like road damage before they get worse. As our on-demand world grows, these AI advancements lay the foundation for smarter, more resilient cities capable of meeting future demands.

As UAVs and other new methods of transportation continue to be developed, the structures that house them and the roadways they use will need to evolve. However, because most infrastructure lags behind on today's technology, municipalities should look for ways to leapfrog into what is needed for tomorrow. Cities should also begin to develop a communication plan for what these tech-enabled roadways and parking structures will be able to do so that residents do not default to today's use strategies.

2ND YEAR ON THE LIST

UBIQUITOUS SENSOR DISTRIBUTION

WHAT IT IS

Sensors—embedded in everything from bridges and buildings to public utilities and roadways—make smart cities possible. New ways to deploy the sensors and transmit their data will spread their use even further.

HOW IT WORKS

Sensors in smart cities collect a vast amount of data. They're essential for monitoring and running these cities. But one hurdle in the way of more extensive sensor networks is the need for reliable power and regular maintenance. Researchers are addressing this with triboelectric nanogenerators with sensors that harvest ambient kinetic energy, such as vibrations from traffic, which will provide continuous operation without external power.

Sensors now can feed data into existing platforms like Software AG's Cumulocity IoT, which Itron uses to enhance utility management. The platform's support for Lightweight M2M allows for the efficient integration of devices like smart meters and streetlights, crucial for cities with limited connectivity. Other new adaptive transmission systems for indoor multi-lidar sensor networks adjust data size in real time, prioritizing critical 3D sensing data and enhancing the safety and efficiency of autonomous systems. Two patents for audio-based sensors look to analyze sound patterns and noise monitoring, using IoT and edge computing, to identify high-noise-pollution areas; this data could help urban planners decide, among other things, whether to implement zoning regulations or design noise barriers. The success of these sensor-driven systems hinges on education and skilled labor, exemplified by Saudi Arabia's Vision 2030, which trains engineers in IoT sensors to support the development of NEOM, a smart city focused on sustainability.

WHY IT MATTERS

The potential for smart cities to transform urban life is immense. The deployment of sensors across smart cities and homes significantly increases the amount of structured data available—data that's vital for powering informed decisions to improve urban living conditions, enhance infrastructure resilience, and support the development of sustainable smart cities. As cities evolve, these sensors will become even more central to their operation, but many new buildings and infrastructure projects are not planning for their full-scale use. Training workers on sensor integration like what is being done in Saudi Arabia needs to rapidly increase, and data collection practices should be folded into upskilling and current education models. We will also need to begin to add new services for repairing and replacing sensors in ways that do not disturb finished surfaces. While it may seem apparent that sensors and data collection can benefit residents, they will need to know what sensors are being deployed where and how to manage their own data. Messaging from developers, city officials, and all built environment professionals needs to begin immediately so that the public embraces the technology and is on board when sensors become an everyday presence in their cities.

2ND YEAR ON THE LIST

DIGITAL TWIN PREDICTIVE PLANNING

WHAT IT IS

Digital twins are replicas of physical structures that evolve alongside their real-world counterparts, thanks to continuous input from sensors and other technologies, making them invaluable for predictive maintenance and planning.

HOW IT WORKS

Building information modeling (BIM) has long been essential in architectural planning, streamlining design with detailed, data-rich models. Digital twins are the next step up. However, just as with initial BIM models, creating digital twins has been time-consuming and costly. Now, advanced 3D scanning is revolutionizing the process. These scanners rapidly produce accurate digital models from physical prototypes, drastically reducing modification time. Companies like GeoCue are advancing the field with mobile scanning systems that enable real-time updates to digital twins as technicians walk through sites. This feedback will benefit industries requiring precise monitoring and quick decision-making, such as manufacturing and urban planning.

Engineers, designers, and manufacturers are also using digital twins earlier in product development and throughout a project's lifecycle, simulating building material performance and design changes, and optimizing energy efficiency and occupant comfort. Researchers are developing blockchain-based encryption to secure the vast data these digital twins generate, for integrity reasons and to facilitate smooth project completion handovers. Emerging technologies are also making digital twins more accessible by enabling voice-controlled searches through natural language processing. These advancements make digital twins more of a management tool beyond mere predictive reports.

WHY IT MATTERS

With the ability to provide real-time insights and predictive analytics, digital twins are set to become a cornerstone of the built environment, offering unprecedented levels of control, efficiency, and sustainability. They're also rapidly becoming more than just a tool to generate predictive reports for engineers and architects—they are evolving into comprehensive advisors that can guide decision-making throughout the lifecycle of a building or product.

Digital twins will become an essential part of the built environment. They will also drive innovation and offer new opportunities for efficiency and sustainability. Soon, everything could have a digital twin. The next step will be to enable larger digital twin mesh networks so that these technologies can speak to one another. These two potential futures present vast challenges to an industry barely managing to create smart BIM models. Products and spaces in development today can benefit from planning for future conversion into digital twins. Companies should consider finding partners that can convert existing BIM assets into digital twins to increase their connective capacity in the future. They should also be prepared to connect with a city's digital twin for project planning, bidding, and reviews.

1ST YEAR ON THE LIST

INTELLIGENT URBAN MANAGEMENT

WHAT IT IS

Smart city intelligent management systems promise to automate spaces and communities by optimizing resource allocation, monitoring health and safety, and improving access to city services.

HOW IT WORKS

A new patent is upending urban management by using AI and machine learning to monitor and predict pedestrian traffic in public spaces like parks and entertainment venues. The system divides areas into subsections, and analyzes real-time data and historical patterns to forecast crowd density. When pedestrian volume nears capacity, alerts prompt city operators to take action, such as redirecting visitors or closing areas, to prevent overcrowding and ensuring safety. AI is also improving health and safety through automated route planning for tasks like street cleaning and dust suppression. These systems analyze environmental data to optimize routes, reduce pollutants and also conserve resources. This automation leads to cleaner, safer streets with less manual effort. Other new systems look to optimize police patrols, fire rescue allocation, and respond to resource requests. And tools like New York City's MyCity portal are augmenting how residents interact with city services. The AI-powered platform streamlines access to services, so that residents can check eligibility, apply, and track applications in multiple languages. This reduces bureaucratic hurdles and boosts resident satisfaction, especially in cities facing urban decay. Other intelligent platforms are more tactical for uses like property management, such as TruBoard Partners' asset management and monitoring platform that integrates with existing systems to provide real-time updates and predictive analytics for the real estate industry.

WHY IT MATTERS

As urban populations grow, the need for smarter, more efficient city management systems becomes critical. The integration of AI into urban planning not only enhances safety and efficiency but also significantly improves residents' quality of life. In particular, these innovations can benefit cities facing rapid growth or struggling with urban decay. By making city services more accessible through advanced apps and portals, local governments can improve resident satisfaction and engagement, helping to revitalize areas in decline. These technologies also provide cities with agility to respond to unexpected events, such as natural disasters or public health emergencies.

Underserved communities may be wary of these systems, as they already struggle to keep up with newer developments. However, properly created and utilized management systems could help highlight and allocate resources to these impoverished areas—as long as they are accounted for in the initial data. Ultimately, these intelligent urban management systems represent a significant potential step forward in creating smart cities that are better managed to meet the needs of their inhabitants.

SCENARIO YEAR 2032

FIRES RAGE AROUND FOREVER PARK

It's a warm summer evening in 2032, as families gather in Forever Park for a picnic and children play on the resilient playground equipment. Suddenly, a small fire ignites in several trash bins near the park's entrance. The sparks that lit the trash were from a nearby wildfire that suddenly shifted course. At first, families were alarmed, but the park's UAV broadcast an XR alert to their wearables to remind them that this park was prepared for just such an occasion. When the park was built, all of its equipment was additively-made using self-healing materials, with a topcoat of fire-retardant smart gel to extinguish the flames. Park workers selected trees and shrubs to resist the flames, and any damaged materials will be picked up for reuse in a local additive manufacturing hub. As the families watch, UAVs run by the city's smart hub appear and the fire is extinguished almost as quickly as it started, leaving only a faint trace of smoke. Nearby, the fire-resistant trees stand unaffected, and the park's self-healing benches and playground equipment quietly begin to repair the minor damage caused by the heat. Within hours, the park looks as if nothing had happened at all.

In the days following the fire, the park's automated systems continue their work. Areas that were slightly scorched are already being assessed, with new fire-resistant plants scheduled for replanting, so that the park remains as vibrant as ever. Forever Park stands as a testament to the future of urban design—where technology not only enhances the resilience of public spaces but also enables them to evolve and adapt, to keep them sanctuaries of safety, sustainability, and natural beauty for generations to come.

CONSTRUCTION PRACTICES

2ND YEAR ON THE LIST

MASS TIMBER CONSTRUCTION

WHAT IT IS

Mass timber construction is set to transform architecture and sustainability by pushing technological and structural boundaries.

HOW IT WORKS

Mass timber, including cross-laminated timber (CLT) and glulam, is gaining popularity for its ability to reduce carbon footprints and speed up construction. Increasingly, these timber structures contain other innovations like real-time moisture sensors that could soon help prevent mold and mildew, to enhance durability. Robotic automation patents in mass timber panel production aim to further improve precision and efficiency, by having robots manage tasks like cutting and assembling large timber elements for rapid onsite assembly.

A key advancement is an adaptive lumber management system, which optimizes CLT panel creation. Using X-rays, lasers, and multichannel vision systems, the system analyzes each piece of lumber in detail. AI-driven optimization ensures each board is positioned for maximum bondable area and visual quality. The industry is also exploring new wood species, such as hardwoods, for CLT production. Researchers are identifying optimal resins, pressures, and processes to certify these materials, potentially expanding the range of mass timber options globally.

Mass timber's appeal also includes aesthetic and environmental benefits. Vertiv's TimberMod data centers, built with mass timber instead of steel, reduce carbon footprints by up to threefold. Timber structures meet structural requirements, are attractive, and withstand extreme conditions like seismic activity and high winds.

WHY IT MATTERS

As urbanization accelerates and environmental concerns mount, mass timber offers a renewable, carbon-sequestering alternative to traditional construction materials. Projects like the proposed 55-story timber skyscraper in Milwaukee highlight the scalability and potential of mass timber in high-rise construction, pushing the envelope on what's architecturally possible. Timber, being renewable and requiring less energy to produce than steel or concrete, is an attractive option for increasing sustainability in the built environment. Also, the integration of advanced sensor technology and robotics in timber construction enhances durability, safety, and precision, making it a more competitive choice for developers who traditionally have shied away from this construction method because of costs and longevity concerns.

These advancements signify a pivotal moment for the construction industry, where mass timber could become a mainstream material for various types of buildings, from residential to commercial and industrial projects. This trend not only supports the push for greener cities but also addresses the need for faster, more efficient construction methods. As mass timber technologies continue to evolve, we can expect to see more ambitious projects and broader adoption across the globe.

2ND YEAR ON THE LIST

ADDITIVE CONSTRUCTION

WHAT IT IS

Additive manufacturing, commonly known as 3D or 4D printing, is expanding beyond its traditional boundaries, scaling up in both practice and innovation. These developments are helping to make the additive construction of structures, materials, and buildings become more of a norm.

HOW IT WORKS

ICON's Phoenix, a robotic-arm-mounted 3D printer unveiled at SXSW in 2024, is pushing the boundaries of large-scale 3D printing by constructing fully enclosed, multistory buildings from a low-carbon mixture. This innovation allows for complex structures, such as domed roofs, which are currently being prototyped in Austin. Meanwhile, photonic chip integration with 3D printing is revolutionizing rapid prototyping. These chips can steer light beams to print 2D patterns at unprecedented speeds, with applications in device manufacturing and on-site engineering.

The sustainability potential of 3D printing is exemplified by Ecoalf's Madrid retail space, featuring a 3D-printed interior made entirely from 3,300 kilograms of recycled plastic, reducing its environmental footprint. In Barcelona, La Manso's store incorporates 3D-printed elements that echo the city's architectural heritage, demonstrating how 3D printing can blend modern design with cultural motifs, offering customization that traditional methods struggle to achieve. However, speed remains a challenge, especially for detailed work, where the resolution of printed layers—ranging from low (faster, less detailed) to high (slower, more detailed)—dictates the balance between speed and quality. Innovations in 3D printing materials, such as plant-based composites and recyclable natural-material floor panels strong enough to replace steel, are also driving more sustainable building practices.

WHY IT MATTERS

The scaling of additive construction is set to have a profound impact on multiple industries throughout the built environment. However, most companies think of 3D printing as still being in its infancy, a judgment that puts them at risk of disruption. They'll be unprepared for how to design additively made spaces and products. The rapidity of the printing methodology and its possibilities for creating reactive materials will mean that firms that embrace this technology will win out over their competitors who do not. To fully realize these benefits, the industry must overcome the challenges of speed and material limitations, and ensure that additive manufacturing can scale efficiently across various applications.

As additive manufacturing continues to mature, it promises to reduce the environmental footprint of construction, lower costs, and provide innovative solutions that are not feasible with traditional building methods. The ability to incorporate local cultural elements into designs offers new opportunities for spaces and products to connect with users and communities in new and meaningful ways. The technology's applications for humanitarian efforts like housing should prompt cities and governments to heavily invest in its adoption, which will require relevant training and education for future professionals.

I can’t think of any other industry for which you prefer the hundred-year-old thing instead of the brand new thing.

Jason Ballard, Co-founder & CEO of ICON

2ND YEAR ON THE LIST

INTERACTIVE PROJECT MANAGEMENT

WHAT IT IS

Interactive project management platforms are transforming construction management by integrating data acquisition, decision-making, and real-time feedback.

HOW IT WORKS

The construction industry is undergoing a major transformation with intelligent project management platforms that manage the entire project lifecycle. These platforms leverage advanced AI and neural networks to handle complex 5D data, including city, security, quality, progress, and cost information. A key innovation is Sage's native-cloud solutions, particularly the Sage BidMatrix platform, which simplifies the subcontractor selection process, enabling estimators to manage bids, assess risks, and optimize strategies effectively. The new web interface, integrated with Microsoft's Power BI, enables real-time collaboration and detailed analysis of centralized estimating data among all team members.

Managing change orders, traditionally a cumbersome process, is also revolutionized by platforms like Clearstory. The company handles over 19,000 change orders every month, but uses AI to automate categorization and reviews, reducing administrative burdens and increasing project transparency. This not only saves time but also minimizes costly errors, leading to more efficient project completion. Platforms like Trunk Tools further streamline operations by automating scheduling and documentation through its AI-powered Schedule Agent, which proactively identifies and addresses potential issues. INGENIOUS 2.0 exemplifies this shift with an upgraded interface and real-time project tracking, enabling managers to oversee complex projects with precision.

WHY IT MATTERS

Through interactive project management systems, construction companies will be able to address long-standing issues such as inefficiencies in cost estimation, the complexity of managing change orders, and the cumbersome nature of project scheduling. By automating these processes, AI platforms help construction teams deliver projects more quickly and with greater accuracy, all while staying within budget.

For an industry that has traditionally lagged in digital adoption, these AI-driven tools represent a critical step forward. They can help managers, teams, and clients to respond to issues as they arise, rather than after the fact. This proactive approach minimizes the risk of project delays and cost overruns, which are common in large-scale construction projects. These advancements also bring to light the industry's persistent challenges, particularly the digitization of historical data, which remains a costly and cumbersome process. However, the adoption of AI and cloud-based tools is driving significant improvements in efficiency and project outcomes, signaling a shift that firms must embrace or risk falling behind. Construction companies waiting for proof of financial savings should begin by experimenting with these new systems in order to not fall completely behind as they are outbid by competitors using their new tools.

2ND YEAR ON THE LIST

MODULAR CONSTRUCTION

WHAT IT IS

Modular construction is evolving beyond traditional applications, driven by innovations in office design, temporary housing, and renewable energy infrastructure.

HOW IT WORKS

Modular construction, known for its efficiency and sustainability, is evolving thanks to advanced technologies. Designers can use AI-driven generative design to quickly optimize layouts, especially for open-plan offices, through performance-based algorithms. Recent patents further drive this trend: A new modular desk frame that is collapsible and movable is transforming office layouts, enabling flexible, nontraditional workspaces. Additionally, a modular floor assembly, including adjacent walls, is designed to speed up construction by simplifying on-site integration.

The need for resilient infrastructure has led to innovations in modular materials that can be assembled and reconfigured by robots. These building blocks are used to create large structures for disaster recovery. In the Netherlands, modular construction is being applied to build transportable and reusable housing for refugees to promote self-sufficiency and long-term community integration. In energy infrastructure, the m-Presa modular steel buttress dam system is transforming the construction of pumped storage hydropower facilities. By using prefabricated steel modules, this system cuts costs and construction time, making renewable energy storage more feasible as cities face aging infrastructure and increased demand for disaster-resistant construction.

WHY IT MATTERS

This trend and the signals underlying the trend represent a potential paradigm shift in the industry. The integration of AI and generative design into modular construction not only accelerates the design process but also improves the adaptability and functionality of built environments. As global cities grapple with the need for rapid, cost-effective, and sustainable building solutions, modular construction offers a pathway to meet these demands. This is particularly important in a post-pandemic world where the flexibility of workspaces and residential areas is paramount. The expansion of modular construction into renewable energy and temporary housing sectors underscores its versatility and relevance in addressing contemporary challenges. The ability to quickly construct and deploy modular structures in response to crises—whether due to natural disasters or humanitarian needs—demonstrates its potential as a tool for resilience.

For urban planners, architects, and policymakers, the trend represents an opportunity to rethink how we build and maintain our cities. It offers a scalable solution that can be tailored to specific needs, from temporary housing to permanent infrastructure. The technology's evolution puts the modular construction industry in a position to shape the future of urban development, making it more responsive to the needs of a rapidly changing world.

2ND YEAR ON THE LIST

AUGMENTED CONSTRUCTION

WHAT IT IS

The use of robots and other automated processes is changing construction practices and reporting, reducing both project timelines and worker risk.

HOW IT WORKS

AI-driven platforms like Buildots monitor the progress of tasks such as laying concrete or installing windows by creating a digital twin of the building, using data from strategically placed sensors and cameras. This real-time tracking system helps to keep construction projects on schedule and enables quick decision-making to address delays. While manual inspections still remain vital for tasks requiring human expertise, field engineers can now use mobile apps to verify that installations are meeting both efficiency and quality standards.

Worker health and safety are also improving through augmented safety technologies. Companies like Balfour Beatty have instituted a requirement for AI-powered cameras that recognize human forms on heavy machinery to detect workers near hazardous equipment, reducing accident risks. AI is further revolutionizing construction through advanced simulation frameworks like RoboCasa, which train cobots to adapt to various tasks in virtual environments resembling real-world sites. Additionally, micro-cobots, such as a flea-sized robotic crab developed by Northwestern University, are ideal for detailed inspections and repairs in confined spaces, reducing the need for large-scale interventions and streamlining construction processes.

WHY IT MATTERS

While controversial, this trend holds a potential solution to an industry dealing with a diminishing workforce. It is important that leaders and their teams see that this trend is not about replacing human workers but augmenting their work. It enables new workflows and practices that may be challenging, but the integration of augmented construction technologies is revolutionizing how projects are managed by enhancing both efficiency and safety. These advanced systems offer real-time insights so that companies can act quickly at any hint of a delay, to maintain project timelines. By continuously monitoring and addressing potential hazards, augmented construction tools significantly lower the risk of accidents.

As these technologies evolve, they will redefine industry standards for safety, quality, and operational flexibility. This will be an adjustment for a traditional industry that is already dealing with technological debt. Adopting some of these new capabilities will come at a cost. However, strategic planning can aid in understanding and prioritizing which technologies to adopt first. Companies that embrace these innovations early could be leaders in setting new benchmarks, as augmented tools will become essential for managing complex tasks.

SCENARIO YEAR 2032

REWILDED EARTHQUAKE FORESTS OF SAN FRANCISCO

As I walked through San Francisco's newly unveiled "Rewilded Earthquake Forest," I couldn't believe my eyes. It's hard to describe the feeling of being surrounded by towering trees that aren't just here for their beauty—they're actively protecting the city from earthquakes. As I strolled along the winding paths of this green sanctuary, I learned that these trees, like Mediterranean cypress and coast redwood, were chosen not only for their resilience to fire but also for their incredible ability to absorb and dampen seismic waves. It's like walking through a living, breathing shield that's constantly adapting to keep the city safe.

What really blew my mind was seeing the robot construction workers in action. These aren't your typical construction robots; they're part of a fleet that can move and reconfigure the structures and trees based on what the city needs at any given moment. As I explored more of the park, I realized just how much thought had gone into every aspect of its design. The city's AI system continuously monitors and updates the park, ensuring that every tree and structure is perfectly placed to maximize its protective capabilities. Walking through these parks, I felt an incredible sense of security, knowing that this green belt around the city isn't just a beautiful space—it's a vital, living barrier that adapts and evolves to keep us safe. It's a glimpse into the future of urban living.

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