Architecture, Engineering, and Construction

Key industry trends

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The architecture, engineering, and construction (AEC) sector is no stranger to change and ever-evolving trends. The global pandemic and the climate emergency have forced many industries to change course. As a result, global players are altering their businesses and several change-inducing trends have made themselves prominent fixtures in today's AEC sector.

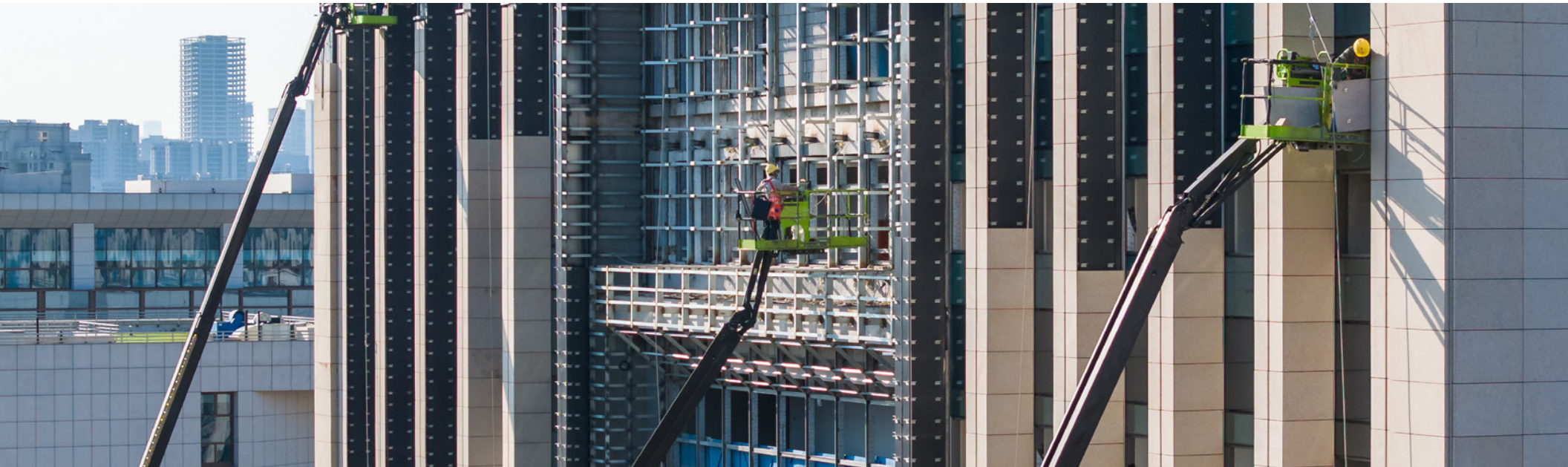
With that in mind, let's explore the AEC industry trends that professionals can expect to see in the near future.

The drive to decarbonize construction

56% of the world's population—4.4 billion— live in cities:

- The urban population is expected to double its current size by 2050.
- The surge in urban population demands a rapid development of new cities, which means construction of new infrastructure assets and the emission of more carbon into the atmosphere.
- Ongoing new construction is consuming a massive quantity of raw materials while contributing to an estimated 39% of the world's carbon emissions.

The construction sector has become a significant contributor to adverse environmental impacts, making it imperative that industry players reduce their negative climate influences by decarbonizing construction processes.



Emergence of carbon databases

Steel and concrete, used in construction, are major contributors to embodied carbon.

Managing the source of these materials in a more carbon-efficient manner can help curb emission levels.

The AEC sector needs access to the fabricators of these materials.

Making informed choices

Various services and databases that provide detailed technical descriptions of building products have been created to help users track individual manufacturers. This will ensure that infrastructure organizations can make informed choices on the suppliers and materials they use.

Embodied Carbon in Construction Calculator (EC3) and One Click LCA are leading database providers that allow users to assess supply chain data while enabling the specification and procurement of low-carbon options.

The Bentley iTwin Platform

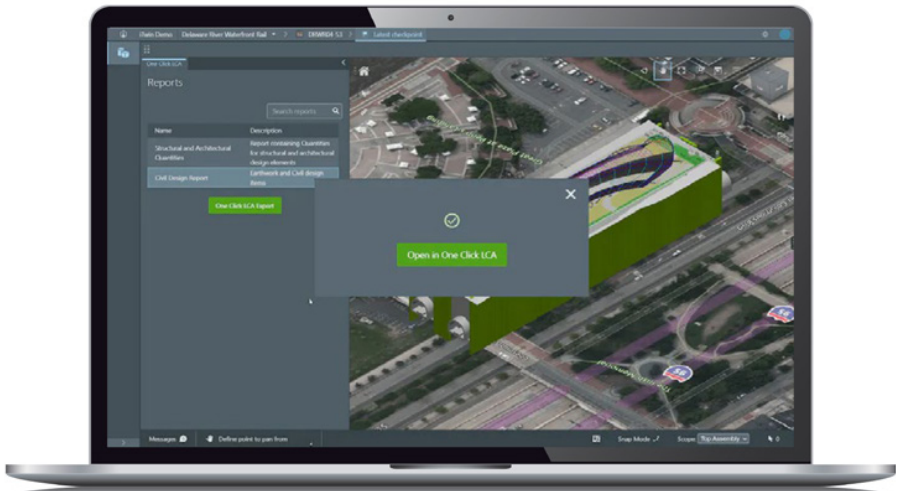
The Bentley **iTwin** Platform, the foundation for creating and managing digital twins, can be integrated with both **EC3** and **One Click LCA.** This allows users to access quantity takeoff reports and export them to either **EC3** or **One Click LCA**, thereby facilitating convenient lifecycle analysis of infrastructure projects.

The Bentley iTwin Platform enables users to incorporate engineering data created by various design tools.

Users can export a summary of the design data through this integration, allowing them to gain insights into the environmental impacts of the infrastructure project.

Implementing crucial design changes:

- Along with choosing suitable construction materials, architects should look to implement straightforward measures in their designs to reduce a building's carbon footprint.
- For instance, structure with underground parking is not as beneficial as ground floor parking as the amount of carbon used to construct an underground car park is significantly high.



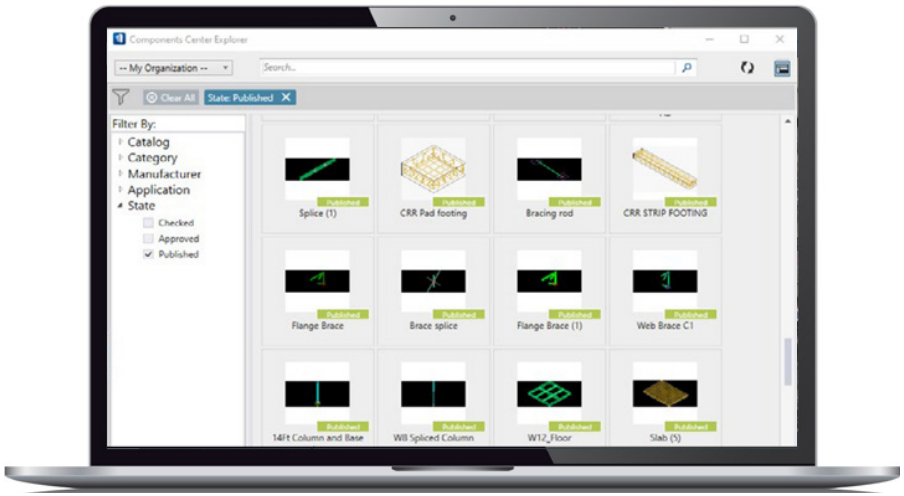
Using standardized components

There has been a rising interest in standardizing the components used in construction.

Many of Bentley's Open Platform users have started importing standardized components into the Bentley component catalog, enabling a digital view.

These standardized objects can be reviewed and approved for material conformity and buildability.

Users can select them with a high degree of confidence that they meet the project requirements.



Making better use of existing stock

Every infrastructure asset has embodied carbon, which is spent while constructing a building.

There is operational carbon generated from the day-to-day economics of powering a facility, and if its business purpose or internal functions change, the industry needs to be mindful when redesigning or building to adapt.

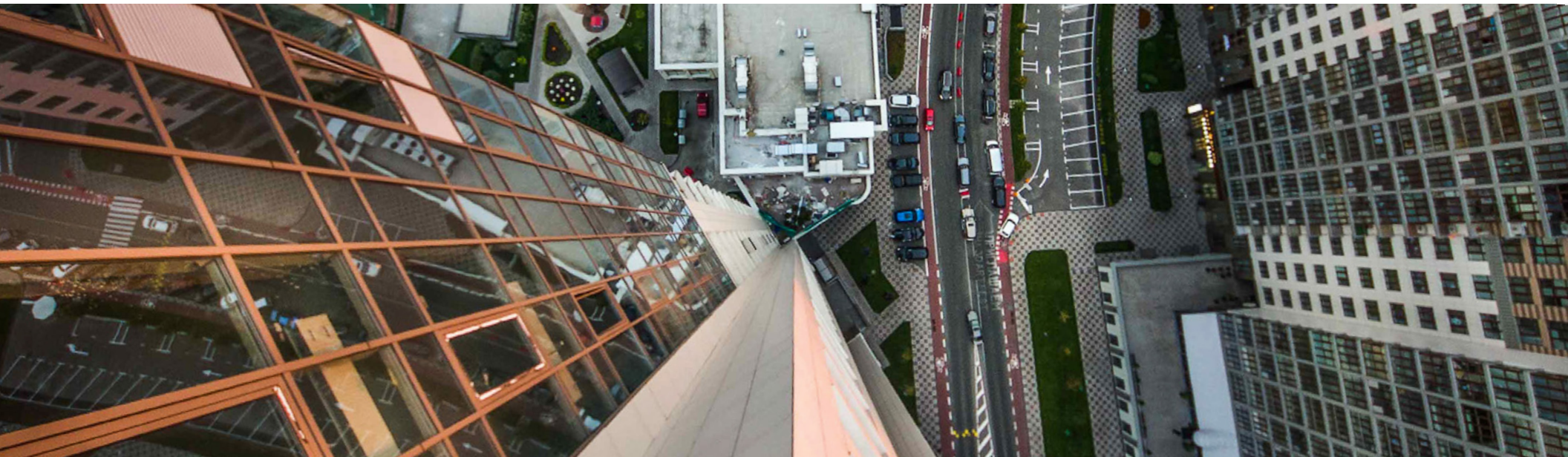
While performing carbon lifecycle assessments, professionals should consider one of these options:

- **Cradle-to-gate:** Under this practice, consideration is given to the end of a building's life (i.e. when it's demolished) and the carbon cost of those actions, including any material recycling.
- **Cradle-to-grave:** With this approach, there is thought given to adaptation or a refit. These can be significant in carbon terms and may occur more than once during a facility's lifespan.

Design planning

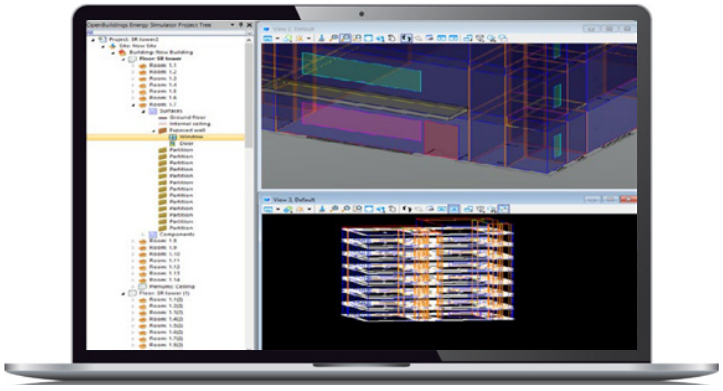
Should designers consider adaptability and flexibility in their initial design planning to make gate stage changes less costly in terms of carbon and therefore extend the facility's life and decrease the need to demolish?

- Early planning during design phases can help control operational carbon emissions from a building.
- Several layout options can be assessed from energy and material considerations for lifecycle and operating costs, allowing professionals to arrive at the greenest option.
- Embodied carbon must be considered not only during initial construction but also during refits and adaptions. One approach is the concept of Buildings as Material Banks, which is based on reversible building design and material passports.
- The latter is information about material reuse and recovery, while the former references the efficient access to and retrieval of materials during adaptations and refits and may occur more than once during a facility's lifespan.



Bentley’s OpenBuildings® Designer and OpenCities® Planner

- OpenBuildings Energy Simulator—the energy analysis capability of Bentley’s OpenBuildings Designer—allows engineers, architects, and designers to integrate lighting, thermal, and solar analysis into their workflow, as well as empowering them to develop sustainable building designs.
- Users can predict energy behavior and fuel efficiency while analyzing the thermal properties of different construction materials, which in turn will lead to the design of more energy-efficient buildings that consume less energy during operation.
- Digital twin technology can also play a crucial role in helping decarbonize existing buildings. Owners and facility managers can use OpenCities Planner, Bentley’s infrastructure digital twin solution for cities and campuses, with Microsoft Cloud to create digital twins of their physical assets.
- By integrating digital twins with Internet of Things sensors and devices, owners and facility managers can gain a comprehensive understanding of how a building is used and reduce its environmental footprint by decreasing energy consumption from various components and systems.
- Users can also understand the building’s carbon lifecycle and predict future carbon emissions across the asset’s lifecycle, helping them make informed decisions about the building’s expansion or modification plans.

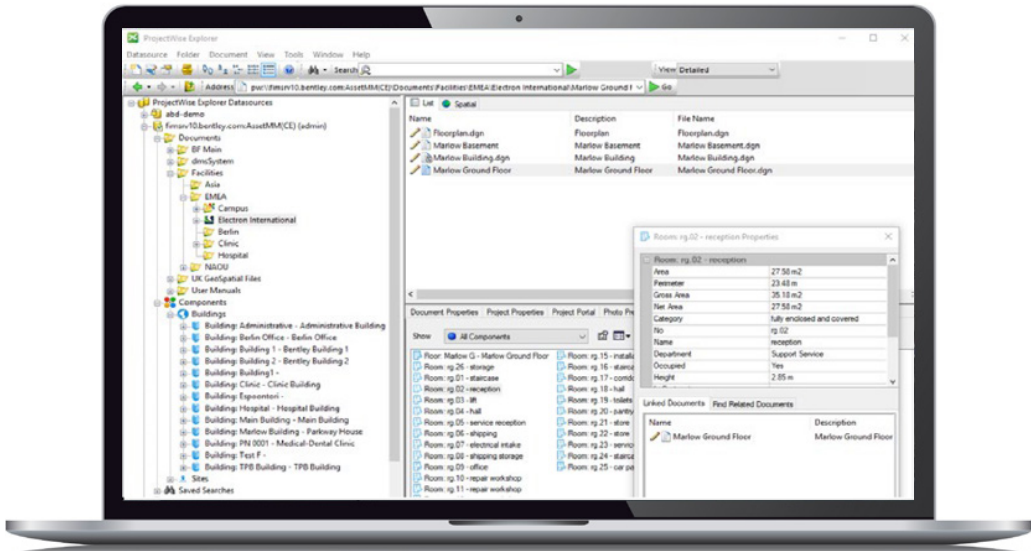


The push for openness and collaborative working

Interoperability, or the flow of graphical and nongraphical data between software applications or technology platforms, has always been a challenge for the industry In the post-pandemic era, the adoption of new technology platforms, such as the cloud, has changed the technology landscape while increasing the importance of the push for openness. The search for new ways of working has also increased.

The International Foundation Class (IFC) standard has been at the heart of many approaches to solving these issues. Its status as ISO 16739-1:2018 has seen its use in typical vertical construction for years. The IFC4.3 standard, which has been submitted to the ISO council, has expanded this approach for linear projects, such as road and rail, thanks to behind-the-scenes work by the buildingSMART organization to incorporate various aspects of infrastructure. IFC standards are the heart of data sharing and data flow within the emerging cloud-based carbon databases and calculators, thus helping the industry drive decarbonization from construction projects.

The pandemic and the subsequent changes to remote working patterns have provided challenges that have been met by the adoption of better work-sharing options, such as **ProjectWise®** and ProjectWise 365 with ProjectWise Drive. This latter offering mixes the power of the ProjectWise collaborative common data environment platform with the convenience of Microsoft's OneDrive document platform.



Many users are realizing the benefit of the Bentley iTwin Platform, where engineering data and data from enterprise systems, IoT sensors, and data lakes can be brought together. iTwin.js—built as an open platform with published, freely available application program interfaces—is extensible for users to create integrations with other available systems.

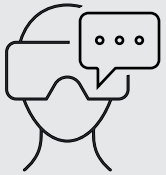
One prominent example is the ability to connect to external APIs like One Click LCA and EC3, which allows data to be published directly from iTwin to One Click LCA/carbon calculators. In the future, we may see more vendors publishing or opening APIs to facilitate openness and work sharing.

More examples of the drive to openness and collaboration are the connections made via the Bentley iTwin Platform to NVIDIA's Omniverse platform, the Unity engine platform, and the Unreal Engine platform; all are powerful collaboration platforms used in the design industries to deliver more effective and sustainable solutions.

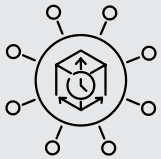
Embracing innovations and disruptions

Mixed reality (MR) combines augmented reality (AR) with virtual reality (VR), offering new and exciting benefits to the construction sector.

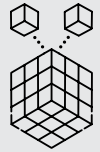
MR headsets can provide architects and engineers with virtual tours of models or construction sites.



MR headsets can also allow workers to hear and see step-by-step instructions for installations and repairs and then overlay that information onto their own projects.



AEC professionals can leverage MR to control remote equipment or owner-operators using MR to monitor HVAC, lighting, and access control systems remotely.



Inputs from laser scanning or photogrammetry of a site or an existing building can be fed into artificial intelligence and machine learning enabled applications ensuring higher accuracy and time savings.

The future of MR technology in the AEC sector looks promising. Ultimately, the wider adoption will depend on the readiness of the industry to go through digital transformation and the maturity of the technology itself.

A paradigm shift

The AEC sector is going through a major paradigm shift as it transitions from physical to virtual environments. This eBook has covered a few opportunities within the AEC sector for engineering and architecture firms, as well as owner-operators, that are willing to leave their comfort zone and transform themselves with evolving technology.

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