SmartCitiesWorld Insight Report

Building smarter cities with digital twins

How digital twin technology can transform urban environments and increase community collaboration and transparency in cities

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***SmartCitiesWorld* Insight Reports examine an emerging or growing trend in smart cities, highlighting progress so far and future potential, as well as spotlighting case studies from cities around the world. In this report, we explore how cities are using digital twin technology to transform urban environments and enhance collaboration with stakeholders and the community, focusing on the Communauté d'Agglomération de Pau Béarn Pyrénées in France.**

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Introduction
The rise of digital twins in smart cities

Cities around the world are recognising the potential of digital twin technology to transform how they work and what they do. Such technology allows city planners to create an accurate and detailed 'living' representation of their urban environments, which in turn can spawn a vast range of use cases across all city departments, including those focused on urban planning, traffic management, economic development and climate change and resilience.

The strength of digital twins lies not just in their ability to collect vast amounts of real-time data from often disparate sources around the city, but in making it accessible and meaningful to a far broader set of people – be it decision-makers across the city or members of the community. These are among the themes discussed in this SmartCitiesWorld Insight Report, published in association with global infrastructure engineering software company Bentley Systems. It sets out to demonstrate the transformative potential of digital twins for cities and demonstrates best practice from a real-world case study of the French commune of Pau Béarn Pyrénées.

The potential for digital twin technology in cities is vast and continues to evolve. Against this backdrop, Bentley is continuously identifying new ways can cities harness this technology to address their key challenges in the most effective and efficient way possible.

As cities around the world, no matter their size, are looking to embrace smart technologies, Bentley sees new opportunities for growth in digital twin technology to modernise and drive more efficient infrastructure, address climate resiliency and sustainability goals, and alleviate urbanisation pressures.

Many of the themes discussed in the following report will be common to cities around the world and we hope it serves as a blueprint for those with similar aspirations.

The case for digital twin technology

The Communauté d'Agglomération de Pau Béarn Pyrénées (CAPBP) in the New-Aquitaine region of France launched a major regeneration programme to improve quality of life and encourage economic development across its jurisdiction. This included improving the visual appeal of the territory. CAPBP comprises 31 municipalities spread across 370 square kilometres, meaning the project involved many different stakeholders and communities.

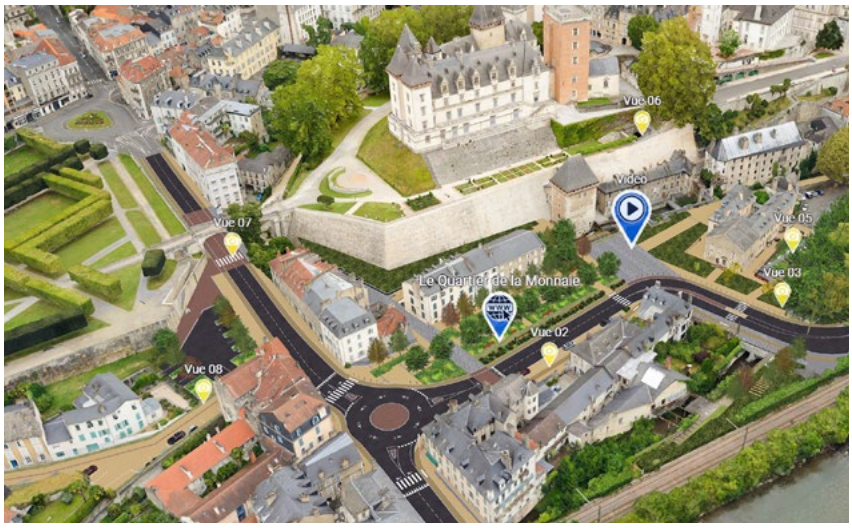
From the outset it recognised that it had to overcome several challenges. Firstly, it had to put in place clear and accessible communication lines between city officials and the community to avoid any dissatisfaction with city planning. It also wanted to ensure "right first time" construction to prevent any unnecessary spending.

It needed a solution that would enable more effective and efficient urban planning, visualising designs, including the desired transformation of streets, landscape, buildings, lighting and traffic movement. In addition, the city leaders needed to be able to communicate the complexity of the programme to all the relevant parties. They needed a platform for city officials, engineers and other decision-makers in the city to consult and collaborate with each other and the necessary technical and political authorities. This would help to ensure inclusivity and transparency throughout the programme's timeline.

Another challenge was to find a way to deliver cost- and time-savings when it came to asset capture and monitoring and collecting data from the urban environment. Previously this had involved making costly and time-intensive videos created by professional videographers. Meanwhile, accessing and recording asset information such as leases and contracts further added to time and costs. Given the number of municipalities involved, CAPBP recognised that this all added up to a major data collection exercise.

After exploring several options, CAPBP concluded that creating a digital twin of the city would achieve all of these aims and embarked on the project with infrastructure engineering software company Bentley Systems. "We wanted to support the regeneration plan for the area launched by the mayor using 3D visualisation as a communication and presentation tool for residents," explains Sébastien Heuzé, 3D digital innovation officer for Urban and Regional Planning at Communauté d'agglomération Pau Béarn Pyrénées.

Dorothea Manou, industry advisor, smart cities at Bentley Systems, explains that to build the twin, CAPBP required a connected data environment – "a platform that enabled them to bring and manage different datasets from various sources to create an accurate, city-scale digital twin," she says. "Bentley already had this technology with our iTwin Experience/OpenCities Planner. Combined



The digital twin of Pau collates data into a single connected environment and provides real-time insight for all stakeholders

with the users' expertise and the available data, it facilitated the creation of the multipurpose digital twin, scalable to multiple workflows and stakeholders."

Manou goes on to explain that the tools aim "to close any digitalisation gaps" by streamlining complex processes, enhancing project delivery and performance.

Data collection

CAPBP began by collecting data at resolutions ranging from 5-10cm and this was then woven into a multiscale reality mesh using iTwin Capture. The high-resolution reality mesh served as the foundational dataset for the city's digital twin.

It then used the iTwin platform to build a digital twin that could collate data into a single connected environment and provide real-time insights for all those involved in the project. Geospatial, engineering, design and other relevant data was processed by the platform and connected to multiple uses cases such as utility development architectural design and events planning.

"Through the unified, immersive view, CAPBP managed to enhance collaboration and communication between various departments and stakeholders, increase transparency with the public on development and urban planning projects, and improve project delivery and data accessibility," says Manou, adding that the digital twin project from CAPBP is one of many global city examples of Bentley's digital twin technology being deployed in major cities across the world. "Our iTwin platform has enabled city planners to globally integrate disparate datasets into a single view to simulate scenarios and transform a vision into impactful urban development."

Cross-departmental adoption and community access

Implementing a digital twin does involve a learning curve for a city. CAPBP adopted a structured change management approach to support its teams in adopting the digital twin, which Heuzé says was essential to ensure a smooth transition to the use of the 3D model and the digital twin. A dedicated internal resource also played a key role in transforming the existing data into a format compatible with the model and facilitated the gradual adoption of the tools by the various departments of the conurbation.

“Today, these departments have gained in autonomy by producing their own 3D data during the design phase,” explains Heuzé. “This data is then integrated by the team dedicated to managing the digital twin platform. This inter-departmental collaboration not only simplified data integration but also fostered fluid communication within the conurbation. By actively involving employees in the process, the project has increased buy-in and facilitated the adoption of a new way of working around digital tools.”

Breaking down data and departmental silos

Cities are sometimes accused of failing to break down departmental as well as data silos when embarking on smart city projects. Manou confirms that one of the major challenges cities are facing is fragmented and siloed data, systems and departments, negatively impacting collaboration and transparency. Bentley’s tools can help city managers and planners to break down the data silos, she explains: “The capabilities delivered from Bentley’s open platform technology support better visualisation of infrastructure performance, while prioritising critical maintenance and asset operations, and overall integrated workflows. These solutions simplify cross-team collaboration to accelerate project delivery for better outcomes with fewer resources.”

CAPBP’s digital twin platform has become a true cross-functional tool, covering a wide range of tasks and activities within the city’s departments, while also involving external stakeholders.

Internally, several departments benefit directly from this:

- **Roads department:** integration of projects carried out by the municipality’s urban planning engineers with different scenarios, enabling effective visualisation and evaluation of development options
- **Communications department:** dissemination of projects via social networks, trade fairs and the city’s website, providing clear and attractive communication for residents

> *"Involving employees in the process has increased buy-in and facilitated the adoption of a new way of working around digital tools"*

- **Events Department:** preparing facilities, managing rights of way and planning mobility for special events
- **Urban planning service:** used for urban management and development, facilitating better coordination
- **Sports department:** showcasing sports facilities through immersive, interactive visualisation
- **Culture department:** organisation of virtual tours of museums and cultural venues, enriching the user experience
- **Economic development department:** promotion of the region at trade fairs with the location of available commercial sites and the connection of existing databases from the trade department to the 3D model.

Externally, organisations such as the Agence d'Urbanisme de l'Agglomération de Pau, the Société Immobilière et d'Aménagement du Béarn and the Architecte des Bâtiments de France also use the platform. Heuzé says they utilise its functionalities to improve urban planning, collaborate more effectively and evaluate architectural projects.

"This collaborative approach has not only strengthened synergies between the city's various departments but also created a bridge between internal and external stakeholders, consolidating a shared and coherent vision of territorial development."

Community access to the digital twin

Of course, one of the aims of the digital twin was to promote community engagement and communication and make urban projects more accessible and understandable for residents. Heuzé says to achieve this objective, it was essential to develop a 3D model that was both accurate and detailed, offering

The Communauté d'Agglomération de Pau Béarn Pyrénées launched a major regeneration programme to improve quality of life

"a faithful vision of the urban environment". "This has enabled the city of Pau to establish clear, transparent and engaging communication with its population, while strengthening citizen support for the projects."

At present, the city's digital twin is accessible to citizens via an interactive touch screen application, enabling people to view detailed 3D visualisation of future projects, shown from different angles.

Videos generated automatically from the digital twin are shared during public consultations with the mayor, enabling a constructive debate with the community on any potential adjustments that need to be made. They are then used in the press and media to extend their reach and inform a wider audience.

"These sessions provide an opportunity to gather opinions and suggestions from residents, which are then taken into account to improve and refine the projects," says Heuzé. "The response from local residents has been very positive, thanks in particular to the clarity and interactivity offered by the 3D model. This approach strengthens their involvement and their feeling of belonging to the projects for transforming the area."

Mission accomplished and future plans

CAPBP reports that the digital twin has improved productivity in urban planning and reduced the cost of asset visualisation produced internally, which can now be done directly and easily from the digital twin software, saving almost €200,000 a year.

Meanwhile, accessing information on assets such as leases and floor planning takes less than three minutes, which translates to a 95 per cent cost-saving on information access.

As already demonstrated, it has also clearly delivered on its aims of facilitating closer consultation and collaboration between city officials, city stakeholders and the community. Manou observes that more and more cities are embracing digital twin technologies to help enhance collaboration, communication and transparency: "The urban digital twin is where city professionals and stakeholders virtually meet and align their targets and actions before they execute in reality.

"It provides them the means and tools to move infrastructure development projects from idea to reality, as communication and frictionless collaboration with a variety of stakeholders across the lifecycle, including public-private partnerships, engineering partners and directly with the community."

Manou adds that a city's multipurpose digital twin is an asset that can always be enriched with more data to support new use cases and it is currently collaborating with CAPBP to test and validate the inclusion of additional enterprise data to expand the range of use cases.

Indeed, CAPBP says it is actioning a number of strategic developments, including planning regular updates to improve accuracy and usefulness, as well as the creation of a "heritage history". "The aim of these initiatives is to optimise urban planning, decision-making and collaboration within the agglomeration community," says Heuzé.

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It is also developing a 3D supervision tool connected to Internet of Things (IoT) objects, which will be combined with artificial intelligence (AI). This system will make it possible to cross-reference data, generate predictive analyses in various fields and, above all, support the energy and environmental transition.

In 2025, it also plans to launch the Pau metaverse, an immersive tool that will enable users to explore future projects in pedestrian mode and in multi-user mode, even before work begins. Heuzé continues: “This innovation will offer a new way of visualising, understanding and interacting with planned urban developments, while at the same time strengthening civic involvement.”

Top tips for city digital twin projects by Sébastien Heuzé

1. **Cover the whole of the city:** creating a comprehensive digital twin, encompassing the entire urban area, is essential. This will provide a complete and coherent vision, while making it easier to manage projects at different scales and take strategic decisions.

2. **Opt for cross-platform online distribution tools:** choose solutions that are accessible via the web, without the need to install specific software, such as iTwin Experience/OpenCities Planner (Bentley Systems) for example. These tools enable data to be distributed fluidly and instantaneously to internal and external stakeholders, improving collaboration and accessibility for all.

3. **Start with simple projects:** take the time to explore the capabilities and possibilities offered by the digital twin by starting with modest projects. This allows teams to gradually familiarise themselves with the tool, develop skills and build a solid foundation before embarking on more complex initiatives.

Conclusion

The evolution of digital twins and cities

Cities are at varying stages of the learning curve when it comes to the adoption of digital twin technology and CABPB's structured change management approach shows how it can not only ensure a smooth transition but, crucially, also promote inter-departmental collaboration and increase buy-in from employees. Not only did this give departments more autonomy to produce their own 3D data during the design phases but it also builds a strong foundation on which to build on in the future.

The case study also shows the benefits of setting clear aims at the beginning. Chief among these for CAPBP was to take the community with them on the regeneration journey and improve collaboration and communication. Thanks to the three-dimensional representation, Heuzé says residents can now better grasp future developments and "project themselves" into the changes to come.

Digital twin technology, further strengthened by developments in areas like AI, will have an ongoing role in our cities going forward. As Manou stated, they can always be enriched with more data, giving rise to the potential for more use cases as cities meet new challenges or identify new opportunities.

"It's exciting to see how this technology is being adopted and adapted across the globe," adds Manou. "We see examples of digital twin technology used in emergency response or disaster management like earthquakes or floods, or by leveraging digital twins to monitor and optimise green infrastructure, assessing for instance the impact of green initiatives on air quality.

"The possibilities are endless, and as technology continues to advance, digital twins will likely become even more integral to the way cities function and thrive."

About Bentley Systems

Bentley Systems is the leading provider of infrastructure engineering software with more than 40 years of advancing the world's infrastructure for better quality of life. Bentley Systems empowers people to design, build, and operate better and more resilient infrastructure through the adoption of their intelligent digital twin solutions.

For more information visit: www.bentley.com