

An aerial photograph of a modern cityscape, likely Singapore, featuring a mix of high-rise residential buildings and green, landscaped structures. A prominent river or canal winds through the city, and a large body of water is visible in the background. The scene is captured from a high angle, showing the intricate layout of roads and buildings.

GeoBIM: A new era in digital engineering

See how global innovators are transforming the way the built environment is visualised and planned to deliver smarter infrastructure design.

 **esri** Singapore



GeoBIM: Redefining possibilities for the architecture, engineering, and construction sectors

Operating in the multidisciplinary digital engineering sector can often cause frustration and delays in project delivery due to inherent breakdowns in communication between functions and departments.

But a new technology solution being used by global leaders such as Mott Macdonald and Cardno has emerged as the best practice approach for bringing the entire digital engineering process together.

The seamless integration of Geographic Information Systems (GIS), Building Information Modelling (BIM), and Computer-Aided Design (CAD) technologies enables all project data - including infrastructure plans, renders, and imagery, as well as topographical, geological, structural, and environmental data - to be displayed in real-time via one centralised portal that's accessible on any device.

This synergy - commonly referred to as GeoBIM - has been sought after for years, answering a need

from architects, engineers, and construction industry professionals alike for a single means to view accurate, detailed, and timely project information.

Even before the first brick is laid, the surrounding geospatial data can be visualised in 3D to gauge the design impact on the existing environment and landscape. Further insights into a project's business needs can be derived from location-based data by analysing consumer patterns, demographics, and existing services and amenities. And from the outside to in, facilities can be viewed on the same user interface for full operational awareness and improved management.

By placing BIM and GIS at the centre of construction projects, project teams can optimise designs, make smarter decisions, accelerate project approvals, reduce costs, and ultimately create a more resilient infrastructure - all through an open and interoperable platform.

GeoBIM in action

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Building an ecosystem of open innovation Singapore

From planning and construction, to marketing and operations – GeoBIM is shaping the future of the country’s first smart and sustainable business park.

A key building block of Singapore’s Smart Nation vision, the Punggol Digital District (PDD) is a 50-hectare development along the island nation’s north-east that will house and cluster businesses in key growth sectors of the digital economy such as cybersecurity and technology.

Pioneering the project is JTC Corporation (JTC), which has taken a contemporary approach to the digital building life cycle, by integrating its BIM data within GIS technology to create a comprehensive 3D map of project insights.

By enabling JTC’s planners to visualise and analyse BIM data – from a structure’s location and orientation, down to its construction materials – in a geospatial environment, JTC planners can easily assess a design’s impact on the existing environment.

Aerial imagery of a project site is captured by drones and mapped in the system against plans, allowing

progress to be monitored to ensure construction remains tightly aligned with the design intent.

Information about assets inside buildings can also be analysed to provide full operational awareness throughout the project life cycle.

By enabling all data relating to the business park’s facilities – both inside and out – to be viewed via the same user-friendly interface, planners can more easily analyse dependencies, decrease costs, make better decisions, and improve overall project management.

GeoBIM is enabling JTC’s designers and architects to visualise and understand the impact of their designs on existing surroundings via a 3D map to ensure optimal community outcomes.



Artist's impression of the completed Punggol Digital District (image courtesy of JTC)



Location-based data is visualised in 3D to help planners decide on the right combination of businesses (image courtesy of Esri Singapore)

Breaking new ground in transport infrastructure design Kuala Lumpur

To accommodate population growth and urban sprawl, Kuala Lumpur took a revolutionary approach to the design and delivery of a new 52.2km rail network that will service a corridor of over two million people.

When the need arose to deliver Kuala Lumpur's new Sungai Buloh-Serdang-Putrajaya Line (SSP Line), the Mass Rapid Transport Corporation (MRT Corp) saw the opportunity to create a new digital engineering technique.

By integrating Autodesk's BIM technology into Esri's ArcGIS platform, the organisation created a new company-wide project management portal; a single Cloud-based system to view, analyse and manage all project data.

MRT Corp's senior manager of planning and design, Aswadi Yusof, said MRT Corp's 500 site managers, architects, engineers, and project managers can now extract timely reports, run predictive modelling, and provide accurate project management of incidents, permits, and site details – for the first time.

"We now have complete operational oversight on all build sites," he said. "The ability to render real-time scene views of station construction components or rail line models, into geolandscape imagery layers means we can drill down to a granular level with precision accuracy, giving us the confidence and trust to action decisions based on evidence."

"From field reporting components such as logging drilling progress, recording incidents, and storing site permits in a geotagged dynamic view, to real-time operational dashboards used to track project progress against benchmarks, MRT Corp has been able to replace cumbersome processes and eradicate the thousand-page paper reports that were previously used."

To date, MRT Corp's integrated Autodesk and Esri solution has increased project productivity by over 35% – a clear demonstration of why this innovation is a game changer for the AEC sector globally.

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See MRT Corp's solution in action – watch the video at:

esrisingapore.com.sg/geobim



The SSP Line Geospatial Portal unifies and visualises the project's BIM data and Reality Models (image courtesy of MRT Corp)



Combining 3D GIS and BIM to drive greater ROI London

Through a state-of-the-art 3D mapping system, teams can share information and make better decisions to reduce costs and improve safety on a multi-billion pound engineering project.

With a network spanning more than 555km that will be responsible for transporting over 300,000 passengers daily, Britain's second and latest high speed railway line, High Speed 2 (HS2), is a revolution in engineering.

A key section of development, which stretches from Euston to the edge of Greater London, is overseen by the Skanska, Costain and STRABAG Joint Venture (SCS JV).

Given the magnitude of the multi-billion pound project, SCS JV needed to deploy numerous teams during the design and construction phases. Further compounding the complexity of the project, each team was required to share, manage and visualise data relating to how surrounding areas and assets would be impacted by proposed new infrastructure.

To ensure no room for error, a pioneering GeoBIM solution was deployed, which integrated BIM and GIS technology to provide a 3D view of the HS2 route, buildings, and surrounding landscape,

all in one place – for the first time.

High quality BIM models could be accessed through intuitive web apps, allowing teams to perform 3D analysis of the environment and query BIM models in ways that were not possible before.

“GIS already supported collaboration in our business by giving everyone easy, intuitive access to all our project information in 2D,” said James Gasson, SCS JV GIS Manager. “What we did next was to move this up a level and create a platform for sharing 3D GIS data, integrated with our 3D BIM data.”

Now, hundreds of employees have fast and easy access to accurate information, which accelerates business processes, helps them make right decisions, and avoids unnecessary construction delays.

By integrating BIM with 3D GIS models, the GeoBIM solution gives hundreds of employees fast and easy access to accurate information.

Restoring the city's Lower Catskill Aqueduct through data integration

New York

By creating a digital twin, project contractors have access to valuable insights to expedite repairs.

As part of New York City's water supply system for over a century, the Catskill Aqueduct delivers over 2,000,000 m³ of water daily around networks of 150km – which equates to roughly 40% of the city's drinking water.

Given the importance of the historic utility, the need to constantly monitor and maintain the Aqueduct is vital, leading to a 10-year repair plan that was launched in 2008.

Global engineering consultancy Mott Macdonald was tasked with overseeing the rehabilitation of the 19km-long Lower Catskill Aqueduct. The firm used LiDAR (Light Detection and Ranging) scanning to capture its surface and subsurface details, which were catalogued for engineering evaluations.

However, this aqueduct data was literally given a new dimension when merged with BIM and GIS data in Esri's ArcGIS platform, transforming into a digital twin model that could be orbited and

explored. Additional ArcGIS tools also allowed users to segment and pick apart the digital model – defects could be identified and examined while cracks and spalls could be quantified.

This valuable and detailed information is stored in a database and provided to contractors to expedite repairs. Visibility into the ongoing progress and performance of the maintenance life cycle can also be easily accessed – all within a single environment.

"The resulting digital inspection process will help reduce engineering costs and restore the 100-year-old aqueduct to a state of good repair and long-term operational reliability," said Esri's founder and President Jack Dangermond.

This engineering-grade digital model can be orbited and explored, allowing users to segment and slice through it like never before.



BIM data and physical scale models were used to optimise the hydraulic design of the interconnection (image courtesy of Mott Macdonald)

An innovation in infrastructure planning and operations

Ohio

Complete access to GIS, BIM, and CAD data supports decision-making and long-term maintenance across the life cycle of a university's present and future buildings.

Ohio State University (OSU) has an infrastructure that rivals a small city. It enrolls nearly 60,000 students, has six regional campuses throughout the state, and has multicampus facilities with 1,283 buildings that occupy more than 65km².

To manage this massive undertaking, OSU's Facilities Information and Technology Services (FITS) department integrated and standardised the geospatial data from its AutoCAD, space management, and building data systems onto Esri's ArcGIS platform.

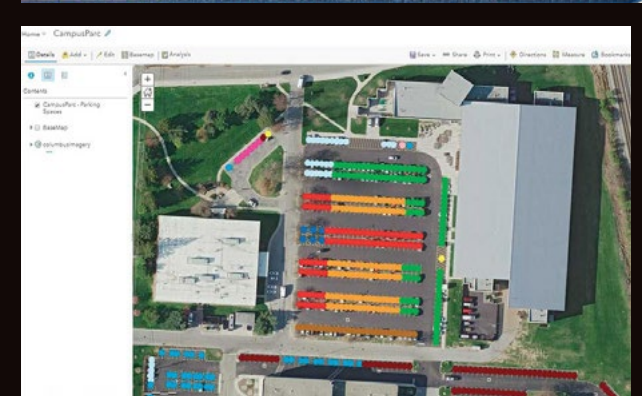
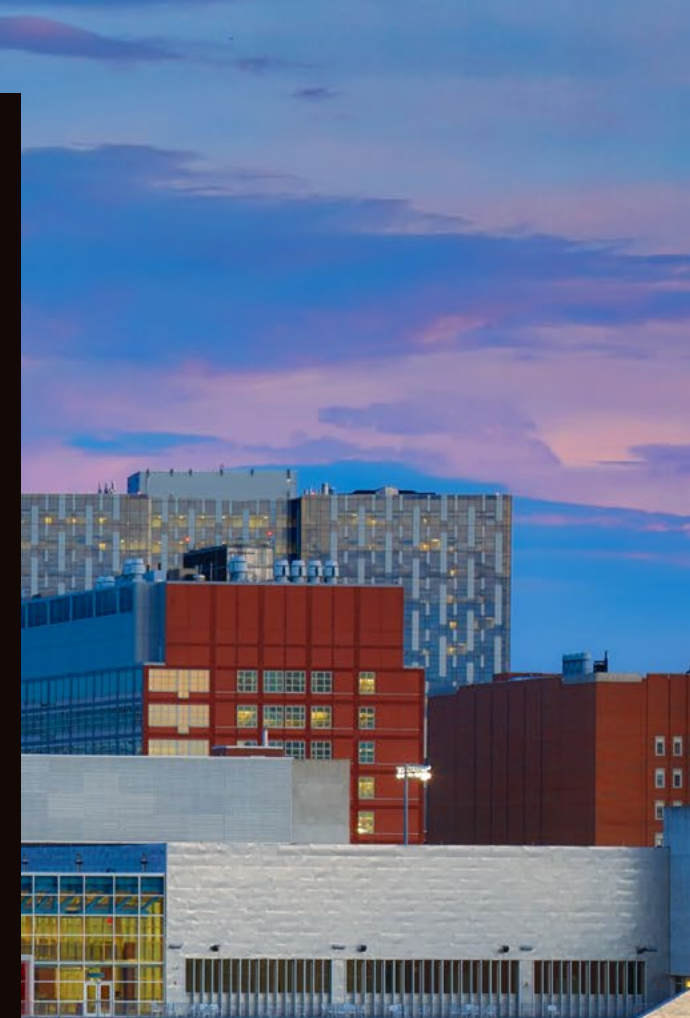
Currently, it is used as an asset management system for data/asset collection, management, and analyses; planning; design; and construction. A primary application is GIS Maps, which provides answers to queries about assets, buildings and available transportation options.

Related information includes each asset's location, condition, and general specifications like the materials used in its construction. Links to leases, CAD drawings, and other documents are also available through the centralised system.

GIS Maps is also interactive, featuring a crowdsourcing tool which allows users to mark the map to indicate features that are incorrect or need updating.

"Our goal is to make robust facilities data available across our entire campus through user-friendly systems," said Larisa Kruger, OSU GIS manager. "Our team exists to support decision-making across the life cycle of our building and infrastructure assets. We will do this by ensuring all decision-makers have access to the data they need, when they need it, and in an easy-to-use format. Having access to more data from the construction process aids in our ability to maintain our facilities long term."

Integrating GIS technology with other core business systems gives staff access to all data from one source to support decision-making and long-term maintenance across the life cycle of OSU's building and infrastructure assets.



GIS Maps shows campus roads, parking lots, landscape information, available transportation options, and more (image courtesy of Esri Inc.)



Delivering better value in home construction through AR, CAD, and GIS integration

Las Vegas

Embracing new technologies like Augmented Reality (AR) has introduced new rigour to residential construction projects in Las Vegas.

The Silver Lake Construction Company of Las Vegas wanted a solution that could help its concrete construction crew dig foundation cuts on bare-earth plots with better than two-inch accuracy.

At the time, the process was manual, involving laying out numerous tape measures to transcribe the foundation dimensions and spray paint to mark them. These were based on numbers and measurements from CAD diagrams using paper on a clipboard. However, many environmental elements risked disturbing the layout.

Silver Lake addressed the issue by introducing a GeoBIM solution that took advantage of Augmented Reality (AR) to tag and anchor the precise geospatial points.


Lines no longer needed to be manually spray painted to mark out and maintain alignment; instead, the solution –

known as ARCAD – would create an AR projection of the new structure's design onto the ground. The spray paint can was swapped for an iPad to measure, mark, and stake the points for cutting, then verifying each position. Construction teams also take their own photos, adding them to the digital models to guide and document the process.

The level of precision introduced through the innovative approach has provided Silver Lake with a new BIM workflow that ensures they cut foundations within the required two-inch accuracy.

Combining AR, CAD, and GIS technologies has empowered construction teams to maintain foundation alignment accurately and easily.

A field demo of ARCAD combines AR and GIS to project CAD data into the view on an iPad (image courtesy of Argis Solutions and Silver Lake Construction)



Whether it's architecture, engineering or construction – discover how you can leverage a GeoBIM approach to optimise designs, reduce project costs, and create more resilient infrastructure that supports Singapore's smart nation goals.

Call **+65 6742 8622** to speak with our specialists or visit: esrisingapore.com.sg/geobim

