Bentley®
Advancing Infrastructure

CASE STUDY

Arcadis Leverages Digital Modeling and Analysis to Deliver Iconic Lifting Footbridge in London

Bentley and Seequent® Software Helped Create a Functional Yet Aesthetically Striking Design within a Bustling Financial District

ACCOMMODATING GROWING PEDESTRIAN TRAFFIC

The South Dock Bridge project is located at Canary Wharf in east London. The area had been a vibrant trading hub for over 200 years, and is now an iconic business district and the second-largest financial center in the United Kingdom. The South Dock is one of two surviving historical docks that were integrated in the redevelopment of the site that started in the 1980s.

An existing footbridge over the dock connects South Quay with Canary and Wood Wharf, providing a vital pedestrian link for access to jobs, retail, and other services, as well as convenient access to light rail lines and other public transportation hubs. Activity in the bustling area continues to grow, with numerous new developments in the planning stages or under construction. As a result, daily foot traffic across the dock is expected to increase to 85,000 people by 2031, posing a challenge given that the existing footbridge is already near maximum capacity for comfortable travel.

To avoid inhibiting the development of the area, the Borough of Tower Hamlets commissioned Arcadis, with specialist mechanical and electrical engineers KGAL and Knight Architects, to develop the design of a replacement footbridge crossing. The client's brief specified the need for a structure that provided both mobility functions and broader benefits. "The new bridge has been designed to cater to future demand, encourage active, sustainable transport, and improve access to jobs, retail, and other city center services, as well as alleviate pressure on existing infrastructure and reduce carbon emissions," said Andrea Gillarduzzi, senior director and global lead, subsurface modeling at Arcadis.

BALANCING FORM AND FUNCTION

Adding to the project's complexity, public input into the bridge revealed overwhelming support for a striking bascule design that would become a landmark for the area. The new South Dock Bridge, spanning 75 meters, was designed to include a 35-meter section that will lift at a 90-degree angle to allow large boats to pass through. The sleek design features curved shapes in a low profile to complement the dock, as well as a triangular void in the center of the movable span. Balancing form and function, the void makes the structure more transparent and memorable, allowing views through the deck when the bridge is raised while directing people away from an emergency staircase exit at the north landing.

To keep the bridge as sleek as possible and reduce the bridge's energy usage, thus decreasing operation cost and its sustainability credentials, the bascule span will be counterweighted, and the machinery will be housed in a large concrete shell submerged below water level in the dock.

To meet the specific project objectives, secure permits, and ensure spatial coordination of the designs even though they were constrained by challenging site logistics and obstructions in the dock, Arcadis realized that they needed close collaboration and coordination between all parties involved, including the client, stakeholders, and various technical teams.

The design of the crossing also firmly considered future macrotrends including urbanization, climate change, digitalization, and evolving stakeholder expectations. "These are crucial factors to ensure that the bridge will remain effective in supporting the local community to evolve and thrive," said Gillarduzzi.

PROJECT SUMMARY

ORGANIZATION
Arcadis

SOLUTION
Subsurface Modeling and Analysis

LOCATION
London, England, United Kingdom

PROJECT OBJECTIVES
- To create an accessible pedestrian footbridge with an iconic design.
- To improve collaboration and the accuracy of ground modeling and analysis.

PROJECT PLAYBOOK
GeoStudio®, iTwin®, Leapfrog®, OpenBridge®, OpenGround®, PLAXIS®, ProjectWise®

FAST FACTS
- A new pedestrian bridge was needed at South Dock to accommodate growing amounts of foot traffic.
- The South Dock Bridge public consultation identified a unique bridge design and appearance as a high priority for respondents.
- Arcadis faced challenges with laying out the design due to manmade obstructions in the dock and proximity of super-prime facades above ground.

ROI
- Using ProjectWise as a single source of truth significantly improved data management, improving productivity by 20%.
- Producing an accurate digital representation of the site's subsurface reduced the ground investigation scope by around 30%, saving more than GBP 70,000.
- Digital connectivity increased data efficiencies for design cost savings of about 12%, or about 1,000 hours.

"Going digital has improved collaboration between clients, architects, and design disciplines, making it easier to obtain planning permissions, consents, and funding for this exciting South Dock Bridge project."

– Andrea Gillarduzzi, Senior Director and Global Lead, Subsurface Modeling, Arcadis

SOLVING UNIQUE DESIGN CHALLENGES WITH DATA-DRIVEN DIGITAL SOLUTIONS

Arcadis determined that they could overcome the logistical challenges and meet their sustainability goals by adopting applications from Bentley and Seequent, the Bentley Subsurface Company, to create a federated digital model of the project.

ProjectWise was used to establish a single location for managing all project data. "During the planning phase, historical and dedicated project data were collated on a connected data environment within ProjectWise, providing an invaluable single source of truth to the various project teams for the raw data, latest models, and deliverables," said Gillarduzzi. All ground investigation data was validated and released using OpenGround. Arcadis then took advantage of the interoperable nature of Bentley applications to integrate large volumes of data in multiple formats, helping to reduce errors and providing information on the proper file types to be saved and integrated into each specific software. The engineering input data included digital bathymetric surveys, LiDAR, high-resolution imagery, laser scans, topographic surveys, and bridge outline design models created by using OpenBridge, all of which were then integrated using Leapfrog to create a 3D digital model for the site.

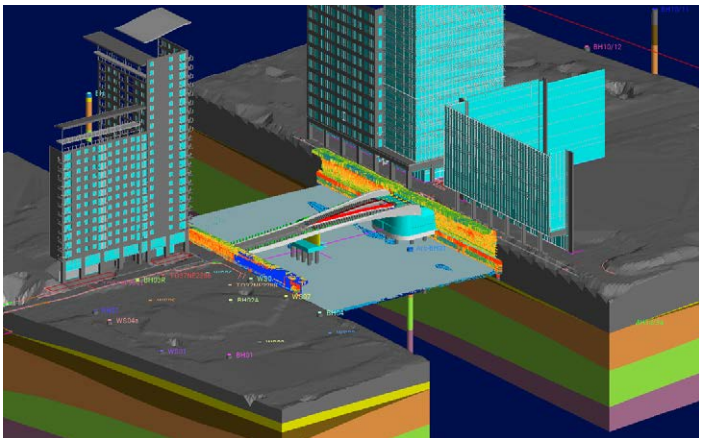
The digital model allowed the Arcadis team to estimate dredging volumes and create geological cross sections for the foundation's spatial layout, while detailed design and back analyses for the existing quay walls were performed with PLAXIS and GeoStudio. "We incorporated the location of the submerged obstructions found at the dock's bottom into the Leapfrog ground model, which helped to determine the best spots for the bridge's piled foundations and reduce construction risks," said Gillarduzzi. 3D subsurface modeling with Leapfrog was key for verifying the project's buildability, addressing the complexities and concerns with spatial coordination, dock operations, and the bridge's unique position close to existing high-rise buildings and valuable architectural facades.

OPTIMIZING DESIGN AND ANALYSIS

Using ProjectWise as a single source of truth significantly enhanced data management, improving productivity by 20%. "The connected data environment helped reduce inefficiencies, streamline processes, and was a valuable source of truth for all teams to easily access raw data, the latest models, and deliverables," said Gillarduzzi. Arcadis used Bentley and Seequent digital solutions to automate document management and quality assurance tasks, which saved them time by keeping everyone connected for reviews and boosting day-to-day productivity. Having accurate representation of the site's subsurface helped managers and engineers across multiple project disciplines and ten offices across two continents make robust decisions, validate survey data, identify risks and opportunities, and monitor the project progress. As a result, they reduced the scope of ground investigations by 30% and saved over GBP 70,000.

Using the iTwin Platform, Arcadis showcased the bold bascule design with stakeholders and demonstrate the structure's accessibility for every user by creating a wide walking area, smooth, step-free slopes, and lighting designed to ensure that the bridge is safe to use at night without impacting adjacent properties or marine life. "Our 3D Leapfrog models were integrated with project visualization software, including iTwin and GIS, meaning that the project could be shared with wider audiences," said Gillarduzzi. Digital solutions from Bentley and Seequent will continue to support the challenging construction, which is scheduled to begin in early 2024. Digital modeling technology will also help future-proof the bridge with ongoing monitoring to optimize energy usage, reduce maintenance needs, and lower lifecycle costs.

The South Dock Bridge provided a unique opportunity to showcase Arcadis' innovative digital design capabilities, together with Bentley and Seequent software. Image courtesy of Knight Architects.



Design features include sculptured geometry that echoes the curved base of historic cranes that once lined the quays along Canary Wharf. Image courtesy of Knight Architects.

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