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Advancing Infrastructure



## Project Summary

### Organization:

CVB JV (Costain, VINCI Construction Grands Projets and Bachy Soletanche Joint Venture)

### Solution:

4D Construction Modeling

### Location:

London, United Kingdom

### Project Objective:

- To push the boundaries of conventional construction methodologies, safely deliver a sustainable sewer system, and prevent pollution of the River Thames.
- To implement 4D construction modeling to streamline workflows, improve understanding, and optimize decision-making.

### Project Playbook:

OpenBuildings™ Designer, ProjectWise<sup>®</sup>, SYNCHRO 4D

## Fast Facts

- CVB JV established a connected data environment and implemented 4D construction modeling for the GBP 850 million Thames Tideway East Tunnel.
- SYNCHRO 4D helped create more than 30 digital 4D construction models at five sites, streamlining construction planning activities and improving progress tracking and management.
- The team facilitated 4D collaborative planning to optimize on-site construction works.

## ROI

- Using 4D modeling reduced the overall construction program by over 90 days over two years, saving GBP 1 million.
- Through 4D collaborative planning and digital workflows, CVB JV optimized constructability, avoiding night work while reducing the construction program by 50%.
- CVB JV is piloting SYNCHRO 4D during the remainder of this “super-sewer” project, expected to reduce manual work by 50% at each construction site.

# Costain, VINCI, Bachy JV Industrializes Delivery of UK’s Largest Water Infrastructure Project

Leveraging SYNCHRO™ 4D Saves 90 Days During Two Years of Construction

## Reconnecting London with the River Thames

Originally built in 1858, London’s 150-year-old sewer system lacks the capacity to meet modern demands of the city’s growing population, resulting in millions of tons of raw, untreated sewage spilling into the River Thames each year. To accommodate the current 8.8 million Londoners and expected continued growth, Tideway initiated a GBP 4 billion super-sewer initiative. Known as the Thames Tideway Tunnel, the construction project will not only upgrade the old sewer system to intercept the spills and clean up the river, but also leave behind a legacy that will benefit Londoners for over a century. The project consists of a 25-kilometer-long interception and transfer tunnel that travels through the heart of London at depths varying between 30 and 70 meters, relying on gravity to transfer waste from west to east. Expected to be complete in 2024, the tunnel is split into 24 sites, 11 of which are located along the banks of the River Thames.

The work is divided into three packages for the west, central, and east sections of the tunnel, each one having a main drive site. Costain, VINCI Construction Grands Projets and Bachy Soletanche (CVB) JV is responsible for the GBP 850 million east-section contract that includes the main tunnel from Chambers Wharf to Abbey Mills Pumping Station, and a connection tunnel from Greenwich to Central London. The route includes 10 kilometers of tunnel works located 70 meters beneath the city of London, as well as six shafts. The project involves 12 design disciplines and numerous supply chains and stakeholders, presenting coordination and communication challenges. To successfully organize and manage construction amid the constraints of tight scheduling and small project sites, CVB JV promoted digital innovation to transform conventional construction practices and reconnect Londoners with their river.

## Integrated Technology Drives Construction

The transformational vision of Tideway is pushing the boundaries of traditional ways of working to reduce complexity and deliver value, right-first-time quality, and sustainability. To validate its program, work safer, enhance efficiency and productivity, and communicate more effectively, CVB JV relied on Bentley’s integrated technology applications to drive construction across all five east-section construction sites through 4D modeling. The project team established a connected data environment based on ProjectWise as the common platform for coordinated 3D modeling, information sharing, and data storage.

“To achieve very high-quality models, the use of ProjectWise is the key to success,” stated Lampros Arvanitis, BIM coordinator, CVB JV for the east section of the Thames Tideway Tunnel. Working in the connected data environment, using OpenBuildings Designer as the main 3D authoring application, facilitated integration of supply chain models in different file formats with the 4D models developed in SYNCHRO 4D. The interoperability of SYNCHRO 4D facilitated this innovative workflow that combines 3D models with the construction schedule to produce a digital 4D plan, demonstrating project development over time.

Using SYNCHRO 4D, CVB JV created over 30 4D models to analyze constructability and streamline construction planning. Integrating SYNCHRO 4D allowed site teams to open and integrate the models, creating a fully collaborative digital process between engineers, designers, and on-site construction teams that helped identify, mitigate, and manage unforeseen risks. The 4D modeling solution optimized construction, enabling different construction scenarios to be evaluated for the Chambers Wharf ventilation chamber, located in South East London, to accommodate the poor access, egress, and limited available space. Similarly, at the Greenwich site, where the Docklands Light railway crosses the construction area, the team analyzed different schemes to identify potential risks and make decisions to determine a safe and viable construction solution. By implementing digital 4D workflows within a connected data environment, CVB JV is driving construction to efficiently deliver a safer, more reliable, and sustainable Thames Tideway East Tunnel.

## 4D Collaborative Planning Streamlines Construction

“We are not trying to perfect the model; we are trying to get it right on site,” explained Arvanitis. To achieve this “right-the-first-time,” on-site deliverable, CVB JV integrated 4D modeling with lean construction principles to create a 4D collaborative planning process. The process consists of regular planning sessions where all disciplines review the 4D models three weeks in advance of the scheduled works. Team members could discuss safety and constructability, as well as access, resources, potential risks, and opportunities. During the meetings, the team resolved any clashes, chose the optimum construction methodology, and updated the models to reflect any changes in the construction program, reducing delays and field-change requests.

*"[Bentley's] technology shortened design time, reduced resource hours, made meetings more productive, and eliminated tedious tasks. The collaborative approach achieved through SYNCHRO 4D has been key to involving the client, designers, and fabricators during early decision-making."*

*— Sandra Reis  
BIM Manager  
Tideway*

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*Using SYNCHRO 4D, CVB JV created over 30 4D models to analyze constructability and streamline construction planning.*

Bentley's integrated modeling platform provides a digital environment for 4D collaborative planning that facilitates value-engineering activities. The platform accounts for all design, environmental, health and safety, logistical, cost, and time constraints to streamline workflows and construction planning activities. With updated, comprehensive 4D construction models, the main contractor and specialist subcontractors gain a visual understanding of the works and can influence, improve, and accelerate decision-making.

During a one-hour start-up meeting between CVB JV and Network Rail, the team discussed a number of key interactions relating to safety and major deliverables. To achieve an optimal solution, the team reviewed the site conditions at several key schedule milestones and took measurements on the 4D model to identify asset protection requirements and explore potential crane locations. As a result, the team revised the work schedule to avoid unnecessary setup and relocation, which compressed the time to complete this phase by 50%.

### **SYNCHRO 4D Solution Delivers Savings**

Using SYNCHRO 4D for 4D construction modeling improved design integration and facilitated digital planning to validate the Tideway construction program. Working with the models in the connected data environment applying lean construction methodology, optimized collaboration and enhanced efficiencies and productivity to achieve significant time and cost savings. Arvanitis stated, "So far, we are two years into construction, and we have saved over 90 days in our construction program, equal to GBP 300,000 in direct cost savings, and over GBP 1 million in indirect cost savings." Incorporating screenshots of the 4D models into risk assessment method statements saved 20% in time to produce the reports, reduced the document size by 30%, and simplified client review and site operative understanding, streamlining approvals and construction sequencing.

The SYNCHRO 4D construction models have also been useful when engaging with local residents, community groups,

and councils, all of whom are unfamiliar with interpreting traditional technical drawings and reports. When the Port of London Authority, for example, objected to marine works required to construct the tunnel, CVB JV used SYNCHRO 4D to create a 4D model in just three or four days and, in just one meeting, visually demonstrated the amount and degree of dredging. Compared to the original 2D drawings, the 4D models simplified communication, resulting in approval to move forward and avoid a 30-day construction delay. "The SYNCHRO 4D model was well received by the Port of London Authority. They were very impressed, as it clearly explains all the different facets of the work," stated Ross Edgar, project engineer for marine works, CVB JV.

### **Committed to Industry Digital Advancement**

Working in the connected data environment using 4D modeling facilitated digital collaboration and mobility that optimized construction and industrialized project delivery. Recognizing the value that 4D and digital workflows brought to the east section of the tunnel, CVB JV is exploring the use of SYNCHRO 4D to further improve 4D implementation and streamline connection between the construction sites and offices. The cloud-based digital process will enable simultaneous accessibility to the 4D model by multiple staff members and is expected to reduce manual work by 50% for each site during the remainder of the project.

4D implementation at Thames Tideway East Tunnel has challenged traditional working methods and contributed significantly to the wider digitalization of its construction sites. The digital collaborative approach promoted through 4D modeling has been key to streamlining workflows among all Thames Tideway East Tunnel project participants and stakeholders, accelerating and optimizing decision-making for a safer, more sustainable super-sewer initiative. Harnessing other digital advancements, CVB JV is committed to implementing innovative best practices within the construction industry to drive workforce efficiencies in a leaner, faster and more reliable way.