Project summary

Organization:
Pennoni

Solution:
Bridges and tunnels

Location:
Philadelphia, Pennsylvania, United States

Project playbook: MicroStation®, OpenBridge®, OpenRoads®, PLAXIS®, ProjectWise®, RAM®, STAAD®

Project overview

Philadelphia wanted to reconnect its downtown to the waterfront—something the I-95 highway had been blocking for decades with its 145,000 vehicles a day.

The project presented several geotechnical, technical, and organizational challenges with terrain uncertainties and an extensive collaborative team.

Pennoni implemented Bentley applications and cut down design hours by half, sometimes even more, and streamlined communication between disciplines.

ROI

Over five acres, which represents 62% of the site, will be converted from impervious to pervious surfaces, allowing to add 56,000 new plants.

Using OpenBridge, Pennoni was able to halve the time required for the landscape design and utility routing on the bridge.

They also saved an impressive 300% of time required for the design of the breezeway domed structure and 100% of design time for the café and transfer platform by using Bentley's RAM software.

Pennoni reconnected Philadelphia's downtown with its waterfront

Implementing a digital model allowed a team of 21 subconsultants to collaborate seamlessly, accelerating work by up to 300%

Reconnecting the city with its river

Pennoni is a Philadelphia-based engineering firm with six decades of multidiscipline expertise. They played a central role in transforming the city's large waterfront assets. As part of the broader plan to revitalize the Central Delaware River area, Pennoni was tasked with leading 21 subconsultants to convert the 2011 planning-level concepts into a buildable project that would re-establish a meaningful connection between the city and the river.

"Interstate 95 (I-95) through central Philadelphia is a major transportation artery that is critical to the region's economy and mobility," noted Joseph Viscuso, senior vice president and director of strategic growth at Pennoni. Yet its physical imprint had limited the community's ability to reach the riverfront easily or enjoy it as a true public space. To rehabilitate this connection, Pennoni led the design of a new public landscape above both I-95 and Columbus Boulevard—an 11.5-acre elevated park stretching from the city down to the river. The park bridges the gap between downtown and the waterfront, creating a natural flow between the two. The cap structure itself served as the foundation for this new public space, creating new gardens, gathering areas, and cultural amenities.

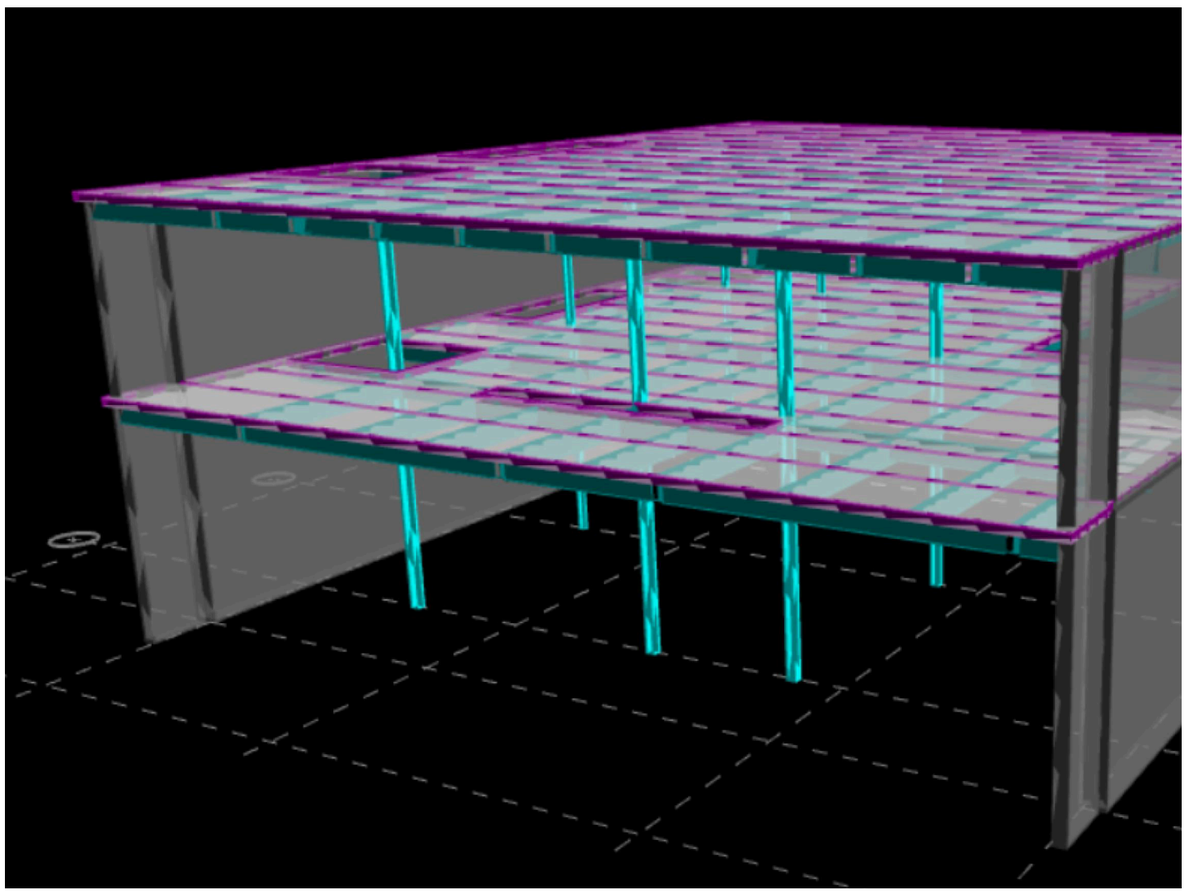
In addition to the cap, it was decided to extend the South Street pedestrian bridge. This part of the project was conceived to carry both pedestrians and cyclists over the I-95 highway, creating a more welcoming gateway into the southern end of Penn's Landing. By focusing on accessibility, public life, and a renewed relationship between the built environment and the landscape, the project aimed to reconnect the urban core with the riverfront and support new opportunities for community, mobility, and economic activity.

Technical, geotechnical, and organizational challenges

From the beginning, the project faced multiple complex challenges. The site itself posed significant geotechnical uncertainty. "The portion of the park on fill [was] constructed in the area referred to as Penn's Landing, created in the 1960s through the placement of fill materials in the river, including old timber from abandoned piers," said Viscuso. The condition of these materials was unknown and required an exceptional level of investigation to assess settlement risks, load behavior, and potential impacts on the structures.

The new bridge spanning over I-95 introduced another layer of difficulty. The geometry was inherently irregular, squeezed between the lowered interstate below and the new park built on top. Early on, one of the biggest obstacles was making sure that there was enough vertical clearance between the two levels. "If [the] software was not available, the less efficient alternative was to cut cross sections at each of the eighty roadway

The new bridge and park over the I-95 improved multimodal access to the Delaware River waterfront.



Bentley RAM software reduced design time by 100% for the café and transfer platforms.

> **This transformational, once-in-a-generation project will reshape the urban fabric of Philadelphia, enhancing quality of life for residents, offering new experiences for visitors, and strengthening the region's identity. […] Bentley Systems' advanced modeling and design software was critical to the project's success by enabling the team to visualize, coordinate, and execute this complex cap structure with precision, helping bring this iconic project to life."**
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> *— Joseph Viscuso, Senior Vice President and Director of Strategic Growth, Pennoni*

beams and recut them with every frequent change in bridge design to verify the vertical clearance," explained Viscuso, which would have created major disruptions. The constant evolution of park features, grading adjustments, and structural refinements would also have required repeated recalculations through entirely manual processes, making the task both time-intensive and vulnerable to error.

With 21 consulting firms, Pennoni led an extensive collaborative team with a wide range of specialties and sizes. The challenge was coordinating this large group of subconsultants, each contributing essential expertise to the development of the cap structure, architectural features, utility design, park systems, and multimodal connections. At the same time, "multiple team members were all using different software," said Viscuso, adding data-sharing complications to the organizational challenges. Managing this constellation of disciplines under a fast-tracked schedule created significant pressure to maintain alignment, and control information flow while the project's design was continuously evolving.

The digital model enabled bigger and more impactful design

But the challenges and constraints allowed room to design and engineer solutions when the team fully adopted a model-based workflow powered by Bentley applications. The irregular geometry of the cap structure became manageable through advanced digital modeling. Using OpenBridge Modeler, the team was able to continuously adapt the bridge configuration as park features evolved without resorting to labor-intensive manual recalculations. "The OpenBridge Modeler software also allowed the team to more efficiently design the park features within the irregular bridge design," said Viscuso, enabling Pennoni to create a "heat map of fill depths to assist the team in routing utilities, designing the park amenities, and assessing fill depth for large trees."

The bell-shaped roof of the domed breezeway, connecting the café and pavilion, required highly specialized calculations. Pennoni used a finite element analysis model in RAM Elements to study load transfer and structural behavior with greater accuracy than manual analysis could provide. "If Pennoni had to perform the calculations of this domed structure by hand, most likely we would have recommended an alternative design," stated Viscuso. Through this suite of Bentley software the teams were able to see through the technical and organizational challenges.

A new infrastructure with social and sustainable targets

The completed design delivered social and environmental benefits that aligned directly with Philadelphia's long-term sustainability goals. The project targeted zero-carbon operations and LEED Platinum certification, and introduced "Philadelphia's first mass timber and zero-carbon structure for public use," said Viscuso. By extending multimodal access, the new design improved mobility for all users, incorporating "a cycle track, raised intersections, safer crossings, and full ADA-accessibility," said Viscuso, enabling inclusive and safe access to the waterfront for pedestrians and cyclists.

The transformation of the site was also environmental. The project converted nearly six acres—62% of the site—from impervious to pervious surfaces, greatly improving stormwater performance and creating space for 470 new trees and 56,000 plants. These landscape interventions supported the city's broader commitments to net-zero energy and zero-carbon public infrastructure.

The adoption of Bentley tools also led to significant project-wide efficiencies. Design hours were dramatically reduced across multiple tasks, including a complete elimination of hours previously needed to verify bridge design clearances and half of the time required for utility routing and landscape design over the bridge. The time needed for the modeling of civil and highway components was reduced by 50% as well, and the analysis of the domed breezeway structure was accelerated by 300%. The use of digital modeling improved the accuracy of cost estimates by 25%, reduced geotechnical settlement durations from four months to three, and created a more predictable construction environment across the base slab, caisson drilling, and box-culvert interfaces. In total, 45,000 hours of labor were saved.

Through these environmental, social, and operational outcomes, the project demonstrated how rethinking infrastructure can generate long-term value—setting a new standard for sustainable urban engineering.

Find out more at Bentley.com
1.800.BENTLEY (1.800.236.8539)
Outside the U.S.: +1.610.458.5000
Global office listings: bentley.com/contact