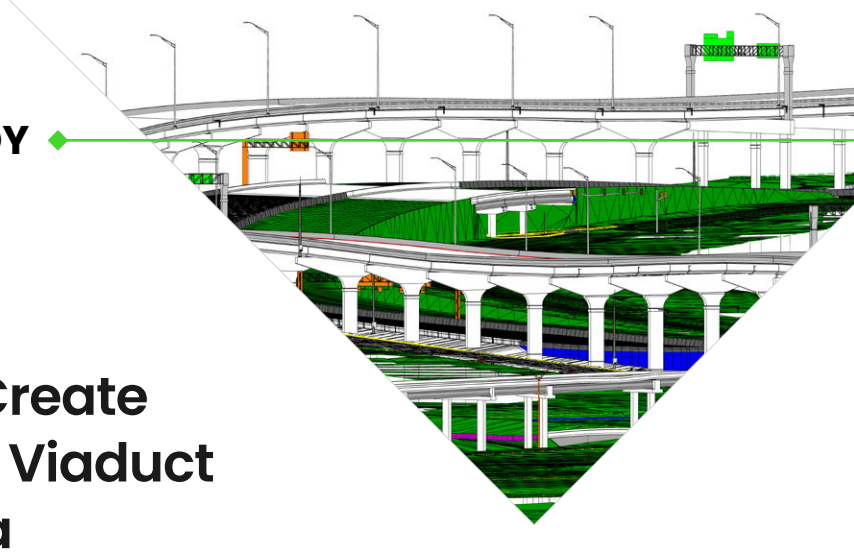
Bentley
Advancing Infrastructure

CASE STUDY



Ferrovial and Alamo NEX Create a 3D Digital Twin to Build a Viaduct Road in a Tight Urban Area

Bentley Applications Improve Collaboration among Teams and Resolve Thousands of Clashes during Design

EXPANDING ROADS WITHOUT MAJOR LAND PURCHASES

As traffic in San Antonio continued to grow, the city needed to expand its road system. In particular, the section of Interstate 35 between Loop 410 and Loop 1604 needed extra capacity. As well as adding three lanes in each direction with a total of 21.8 miles, the project required the development of new interchanges at each loop, full pavement reconstruction of loop 1604, and partial replacement of existing barriers and sidewalks. The Texas Department of Transportation (TxDOT) awarded the project to Ferrovial Construction through its subsidiary Alamo NEX Construction.

However, since the project is in a dense urban area, TxDOT was unable to make major land purchases to expand the highway in a traditional manner. As a result, the highway had to be constructed within an elevated viaduct to avoid disrupting adjacent buildings. Alamo NEX had to determine the optimal method for designing the number of lanes needed within a tight space.

REACHING THE LIMITS OF 2D DESIGN

As Alamo NEX planned how to accommodate the viaduct, the potential design grew increasingly complex. They needed to determine how to place the substructure of bridges between the existing mainlines and frontage road. This was no easy feat as the footprint had to be minimized, and the frontage road would have to be moved to create room for the foundation. The new viaducts would overhang existing roads, requiring traffic to be moved away due to safety requirements.

Even with the viaduct design, Alamo NEX had to reuse as much of the existing infrastructure as possible. As a result, they needed to determine how to connect the new elements to existing assets. Since the company also faced a challenging supply chain, the team wanted to eliminate the most expensive elements that would normally go into a road project, such as steel spans. Alamo NEX previously designed road projects using traditional 2D methods, though this technique typically resulted in conflicts during construction that resulted in costly redesigns and a considerable loss of productivity. "More often than not, we will find a substantial amount of conflicts in the field that need a significant effort by our company," said Carlos Gonzalez, vice president, engineering services, design operations lead North America with Ferrovial Construction. The organization needed a more efficient way to design the project to meet its strict requirements.

REVEALING AND RESOLVING CLASHES BY GOING DIGITAL

After studying their options, Alamo NEX determined Bentley applications could help teams collaborate on the 3D design, enabling them to work within the tight space while keeping clashes to a minimum. They began by using ProjectWise to establish an open, connected data environment with clearly defined servers and tight control over who accesses information, ensuring all information is up to date and accurate. "This is very beneficial to the group as there is absolutely no doubt of the most current version of a specific design file, as no consultant can work on their server," Gonzalez said. Team members then used MicroStation, OpenBridge, and OpenRoads to create and refine models for each portion of the project.

ProjectWise enabled the team to share designs to the iTwin Platform, enabling all team members to review options, highlight elements, and make comments. By comparing design proposals with

PROJECT SUMMARY

ORGANIZATION
Ferrovial Construction and Alamo NEX Construction

SOLUTION
Bridges and Tunnels

LOCATION
San Antonio, Texas, United States

PROJECT OBJECTIVES
- To determine how to build an elevated viaduct road in a tight urban environment.
- To establish a 3D digital twin that could help them eliminate clashes.

PROJECT PLAYBOOK
iTwin®, MicroStation®, OpenBridge®, OpenRoads™, ProjectWise®

FAST FACTS
- A total of 21.8 miles of Interstate 35 needed three new lanes in each direction, requiring an elevated viaduct design in a tight urban area.
- Ferrovial Construction and Alamo NEX Construction determined traditional 2D design methods would lead to numerous clashes and costly rework.
- Using Bentley applications, they established an open, connected data environment and created a digital twin of the project.

ROI
- Combining clash detection software and LiDAR information for existing elements eliminated approximately 3,500 clashes, preventing costly rework.
- Digital design helped them determine how to reduce the use of expensive elements like steel spans while keeping the design strong.
- By simulating the view of drivers within the digital twin, they removed, raised, or moved elements of the viaducts that could block views of signs.

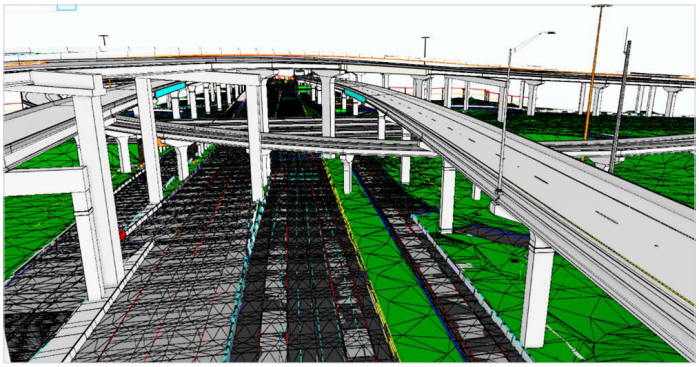
"By having the entire project modeled in 3D and having the digital twin, we have increased the efficiency of the communication and approval process by leaps and bounds. Construction segment directors no longer have to wait for a finalized 2D plan and then sit down for days and try to understand it."

– Carlos Gonzalez, Vice President, Engineering Services, Design Operations Lead North America, Ferrovial Construction

real-world data captured from LiDAR scans, the teams created a digital twin that could help them determine available vertical clearances, available spaces for machinery, the types of retaining walls required, and the dimensions of columns. As the project incorporated numerous elevated viaducts, having strong 3D visualization helped designers immediately realize the impact of designs on the urban environment. Finally, combining individual components and real-world assets enabled them to reveal and resolve clashes, ensuring seamless connections between all elements.

IMPROVING THE DRIVER EXPERIENCE WITH A DIGITAL TWIN

By designing all elements of the project within a single environment, Alamo NEX enabled all team members to contribute to every portion of the project. Combining clash detection tools and LiDAR information for existing elements greatly reduced the number of clashes and errors, ensuring seamless connection during the design phase and preventing costly redesigns during construction, such as having to rebuild elements that were demolished by mistake. The team estimated that approximately 3,500 clashes were detected and eliminated during design. Additionally, they determined how to reduce the use of expensive elements like steel spans while keeping the design strong. Alamo NEX also worked to improve the experience of commuters. Team members took care to view assets in the design applications from the point of view of people driving on the highway. With that perspective, they removed, raised, or moved elements of the viaducts that could block views of signs. Designing the highway with a 3D digital twin helped them overcome the tight design area to create the unusual but effective viaduct form, all while greatly improving efficiency.



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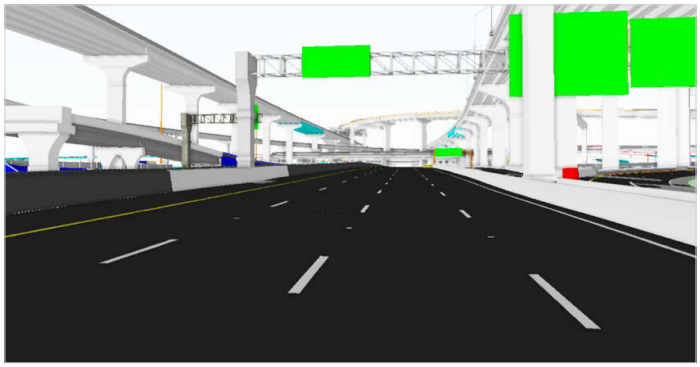

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