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CCC Enhances ROI on Midfield Terminal Project at Abu Dhabi Airport Using BIM-driven Approach

Bentley's BIM Software, including AECOsim Building Designer and ProjectWise, Enables Seamless Information Sharing and Collaboration across All Project Disciplines and Stakeholders

Project Summary

Organization:
Consolidated Contractors Company on behalf of TCA-JV (The Joint Venture of TAV, CCC, and Arabtec)

Location:
Abu Dhabi, United Arab Emirates

Project Objective:

- Design and construct a USD 3 billion, 7 million square-foot terminal building for the Abu Dhabi International Airport.
- Run the design/build project employing a totally BIM-driven approach using one BIM platform so all stakeholders could share information and collaborate with ease.

Products used:
AECOsim Building Designer, ProjectWise, InRoads, Bentley Navigator, MicroStation

Fast Facts

- ProjectWise stored, managed, and secured all project BIM data and enabled efficient distribution of the latest project files to all stakeholders.
- TCA-JV used a wide range of integrated Bentley products to operationalize a comprehensive BIM process spanning the entire project lifecycle.
- Leveraging information in ProjectWise, TCA-JV accurately forecasted construction schedules, performed logistics studies, and validated resource requirements.

ROI

- TCA-JV saved a considerable amount of money and 900 man-hours by eliminating just one major clash.
- TCA-JV reduced the cycle of critical RFIs from 28 days to two to seven days.
- TCA-JV saved on the cost of buying and leasing five new cranes by relocating the tower crane to meet needs using a 4D BIM model simulation.

Envisioning a Highly Complex, Large-scale Project

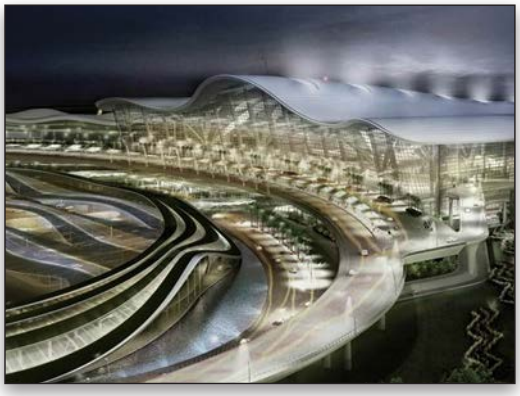
When Consolidated Contractors Company (CCC), part of the TCA Joint Venture (TCA-JV) of TAV, CCC and Arabtec, was awarded the contract to build the USD 3 billion, 7 million square-foot Midfield Terminal Building at Abu Dhabi International Airport, it had to meet a key customer requirement: completing this design/build project using a totally BIM-driven approach. "It was the first time that a customer asked us to run a project of this scale and complexity within one BIM platform so all stakeholders could share information and collaborate," explained CCC Manager IS-Automation and Engineering Project BIM Manager Issam El-Absi. To meet this requirement, TCA-JV turned to Bentley software to implement a BIM solution.

The client's vision for the new Midfield Terminal Building project was both exciting and ambitious. It would involve the design and construction of a complete terminal building including passenger and cargo facilities, duty-free shops, and restaurants for a total capacity of up to 40 million people per year. The unique, X-shaped building would be located between two runways, making design and construction particularly difficult. "The client also wanted the design to provide an open and airy feel by incorporating large, column-free zones with steel-leaning arches supporting the soaring roof," explained El-Absi. "The complexity of the structure in both design and shape posed a number of unusual engineering, construction, and procurement challenges."

Because of the complexity and scale of the project, the client, the Abu Dhabi Airports (ADA), required the main contractor awarded the contract to develop, communicate, and share a comprehensive BIM solution for all disciplines – including subcontractors and manufacturers. Specifically, the general contractor had to support:

- **Engineering and design** – including clash mitigation, design coordination, an RFI system, and shop drawings;
- **Project controls and planning** – including earned value and 4D studies;
- **Contractual and quantity surveying** – including quantity take-offs and measurements;
- **Manufacturing** – including digital fabrication;
- **As-Built and hand-over** – such as facility management.
- **Other areas** – including site logistics, temporary installations, scaffolding, and formwork.

Using a BIM-driven process would facilitate the delivery of the project through the entire project lifecycle – and ultimately help to minimize risk and to ensure project success.



Use of BIM allowed TCA-JV to guarantee constructability, saving time, money, and effort.

Leaning on Trusted BIM Technology from Bentley

The TCA-JV was chosen as general contractor for this project because of its many years of experience using BIM to drive large, complex projects to completion. "Our BIM department has been using Bentley software for 17 years to create our own BIM environment for client projects," explained El-Absi. "For this project, we decided to consolidate our knowledge and years of experience – and all of our systems that we have implemented – to prove to ADA, the industry, and our company that our BIM focus since 1997 has been worth the time and investment."

While TCA-JV had never applied its BIM environment to complete a project of this scale, management knew Bentley software was capable of managing a megaproject like this one. It used Bentley's comprehensive software offerings for the collaborative design and multi-discipline engineering,

"We could customize Bentley's software to support our own workflows and integrate with our in-house systems and project control applications. Bentley's solutions are interoperable and support Bentley's native i-model format, which we use to facilitate cooperation with other BIM solutions and stakeholders."

Issam El-Absi, manager IS-automation and engineering, Consolidated Contractors Company project BIM manager – CCC Centers BIM manager

construction, and delivery of the building project to meet most of the project's requirements. "We could customize Bentley's software to support CCC workflows and integrate with our in-house systems and project controls applications," noted El-Absi. "Bentley's solutions are also interoperable and support Bentley's i-model format, which we use to facilitate data exchange/information sharing among other BIM solutions and project stakeholders. And Bentley delivers a strong quantification engine for capturing and managing the project scope and creating the material take-off."

Operationalizing BIM

In addition to integrating Bentley and in-house BIM systems to create a single solution, TCA-JV focused on other aspects of operationalizing BIM, including the development of trade-specific electronic data interchange (EDI) documents for each subcontractor to enable seamless data interchange with the BIM system. El-Absi explained, "Every subcontractor and stakeholder must comply with our EDI requirements so that we can take everyone's information and put it into our BIM environment – consolidating it and solving interoperability and interchange issues along the way."

TCA-JV also defined object naming conventions to systematize asset naming for the entire project. "We had to make sure that each and every component used in the design and construction of the terminal had a unique identifier so that all properties, attributes and other information (including part number, supplier, and cost) associated with a given component could be communicated throughout the BIM system."

Using ProjectWise to Collaborate Effectively

"We used ProjectWise – a robust system – to hold all project BIM-related information, as well as manage it, keep it secure, and enable efficient distribution to all stakeholders," explained El-Absi. "ProjectWise was also the only place where people can extract quantities, manage quantities, make claims, and communicate issues." The software's core functionality also enabled TCA-JV to organize its modeling environment and BIM production environment, as well as to communicate models with stakeholders, all of whom were integrated within the same workflow. This ensured that everyone working on the project – at any stage – could easily access the latest models, and other data from any location and be sure they had the correct files.

ProjectWise also enabled efficient collaboration among stakeholders by supporting and enforcing a review process that simplified handoffs and tracked the status of all reviews, comments, and changes, reducing the cycle of critical RFIs from 28 days to two to seven days.

Achieving Significant ROI Using BIM Workflows with AECOsim Building Designer

The data contained in ProjectWise, which is tightly integrated with other engineering systems, is used to drive all other BIM processes. For example, employing AECOsim Building Designer for 3D modeling, stakeholders performed highly accurate material take-offs using data embedded in 3D models. " This approach allowed us to reduce the number of people needed for the quantity surveying team by 90 percent – from 60 people to six," stated El-Absi. BIM workflows also reduced the man-hours needed to develop shop drawings. "We managed to save 119 days and USD 65,000 in the production of shop drawings for just one blockwork zone. And this is just the ROI for using this technique on one zone for one discipline. The project has about 120 zones," added El-Absi.

Similarly, using AECOsim Building Designer and Bentley Navigator, teams could pull data from files in ProjectWise and perform automated clash detection – which was required by the client before files could be approved and finalized – as well as design coordination. The ROI realized using BIM workflows was huge. For just one discipline – resolving clashes between the façade and other disciplines – TCA-JV saved over USD 1 million and 51,000 working hours. In another case, during the steel structure phasing and construction and design coordination, TCA-JV saved considerable amount of money and 900 man-hours simply by eliminating one major clash.

Forecasting Construction Schedules, Logistics and Resource Requirements

The benefits of BIM extended to construction as well. For example, leveraging information in ProjectWise, the construction team could forecast construction schedules, perform logistics studies, and validate resource requirements.

In one case, the construction team performed a logistics study indicating that TCA-JV had to purchase five additional tower cranes for 12 months – no small investment. But before proceeding, TCA-JV validated the study using a 4D BIM model. "We found that only 20 percent of the capacity of these proposed cranes – maximum – would be used throughout the year," added El-Absi. "Based on this information, we decided not to invest in any cranes, as we could meet project requirements in other ways." For example, TCA-JV used existing mobile cranes and tower cranes to complete necessary work.

The 4D BIM models were also used to accurately forecast the time needed to complete tasks so construction teams could better coordinate resources and contractors. As an example, planners could use data embedded in these models to optimally sequence tasks to eliminate bottlenecks. In one instance, BIM workflows were used to facilitate and manage the complex interface coordination process. This eliminated costly delays, rework, and claims between stakeholders. In another instance, BIM workflows eliminated the need for lengthy approval cycles for construction schedules. "We're able to accurately simulate construction schedules and get everyone to agree on whether they are feasible or not, all in real time during meetings," explained El-Absi. "This is a very important benefit."

Validating Bentley for BIM

This project validated what CCC knew at the start of the project: that Bentley software can support comprehensive BIM for megaprojects and deliver exceptional ROI. When asked why they chose Bentley solutions, El-Absi said, "I'd describe Bentley solutions for BIM in five words: robust, scalable, integrated, customizable, and collaborative. I did not mention the longevity of the file format – it is very important to be able to use the files you created many years ago; the quantifiable results validate why we keep investing in Bentley's BIM solution."

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