

Bentley[®]
Advancing Infrastructure



Project Summary

Organization

China Aerospace
Construction Group

Solution

Buildings

Location

Hohhot, Inner Mongolia, China

Project Objectives

- Deliver a world-class venue that contributes to culture and tourism in Inner Mongolia Autonomous Region.
- Implement coordinated 3D modeling process to accommodate design and site work challenges.
- Simulate construction for optimal planning and communication for timely delivery.

Products Used

AECOsim Building Designer,
MicroStation[®], Navigator Mobile,
ProjectWise[®]

Fast Facts

- CACG leveraged Bentley applications to manage the multi-discipline project team and integrate design and construction of the Inner Mongolia Ethnic Minorities Cultural Sports Center.
- AECOsim Building Designer with ProjectWise provided 3D project control, enabling real-time design and collaborative modeling.
- Navigator enabled collision detection and resolution when arranging the complicated pipeline system.

ROI

- Bentley applications facilitated a coordinated BIM strategy, reducing design time, errors, and rework.
- AECOsim Building Designer optimized earthworks, which saved USD 300 million.
- 4D construction simulations helped choose a rational construction scheme to deliver the facility in time for the region's 70th anniversary celebration.

China Aerospace Construction Builds Cultural Sports Center in Time for Region's 70th Anniversary

AECOsim Building Designer Optimized Design and Earthworks Solutions to Save USD 300 Million in Engineering Costs

A Milestone Event Venue

The city of Hohhot, the diverse capital of Inner Mongolia Autonomous Region in northern China, is set to become a world-class destination for cultural and sporting events with its new Inner Mongolia Ethnic Minorities Cultural Sports Center (EMCSC). The USD 1.1 billion facility includes a main multifunctional building, indoor racecourse, three horse stables, a standard race track, bleachers building, sports museum, and parking plaza across 292 acres of slightly elevated green land. The state-of-the-art facility will increase Hohhot's capacity to host world-level sports competitions and international cultural events.

China Aerospace Construction Group (CACG) and Chongqing Liansheng Construction Project Management Co. were retained by the Hohhot Chengfa Development & Management Group to provide overall project management and integration of design and construction of EMCSC. The project presented numerous design, coordination, and construction challenges. The curvilinear architectural shape of the building required a complex pipeline equipment arrangement with a multi-discipline team on a limited budget. Scheduled to serve as the main venue for the 70th anniversary celebration of Inner Mongolia municipality's founding, the facility needed to be completed and delivered within a tight timeframe. CACG relied on Bentley's BIM advancements to implement an integrated 3D modeling approach from design through construction to cost effectively deliver this key cultural tourism project on time.

3D Modeling Facilitates Coordinated Design Process

The EMCSC features curved styles with combined concrete and steel structural frames clad in glass, an aluminum roof, and a piping arrangement that needs to fit within this complex design scheme. Therefore, traditional 2D layout had dimensional limitations in determining conflicts between the structural components and the various equipment systems. Without external dimensions, the equipment system pipes would go out of architectural boundaries at certain levels in a 2D layout. Implementing an integrated BIM process, the project team developed vivid 3D models to facilitate

collaboration among the different disciplines, coordinate the various design components, and automate spatial conflict detection.

The use of AECOsim Building Designer with ProjectWise enabled real-time collaborative design and reduced the repeated modifications typically necessary with a traditional 2D approach. The team determined the optimal design solution for the curtain wall system, making the lateral and central glass panels in all triangular components. The team also used parametric modeling methods for a unified aluminum roof structure and an easily altered model.

CACG used Navigator for clash detection and resolution of the complicated pipeline system's arrangement, which significantly improved design quality and reduced construction delays prompted by collisions. The team identified approximately 1,200 conflict points during the design phase of the main multifunctional building, allowing changes to be made prior to construction. Bentley's integrated modeling and project management capabilities enabled full 3D project control for multi-discipline design coordination and pipeline distribution, building optimization and reducing costly design errors and rework.

Optimizing Earthworks Solutions

With the architecture blending into the surrounding environment, the team needed to also consider sunlight, weather, and soil work. The team developed different renderings that simulated various climate and lighting conditions and relied on BIM advancements to calculate earthwork volumes for the large architectural site plan.

Prior to implementing the BIM methodology, the original designs called for 370,000 cubic meters of earthwork, of which 300,000 cubic meters was fill. After the modeling of architectural components and site topography using AECOsim Building Designer, the team could manipulate and modify the vertical elevations of the different buildings. They could now analyze different cut-and-fill ratios and optimize earthwork quantities. CACG reduced total earthwork to just 70,000 cubic meters, resulting in USD 300 million in savings.

*“Bentley [applications]
opens up a platform
for data sharing
and communication
between disciplines.”*

*– Zhao Yanyan, Director of BIM
Center of China Aerospace
Construction Group Co., Ltd.*

**Find out about Bentley
at: www.bentley.com**

Contact Bentley
1-800-BENTLEY (1-800-236-8539)
Outside the US +1 610-458-5000

Global Office Listings
www.bentley.com/contact

Construction Simulation Facilitates Timely Delivery

ProjectWise and AECOsim Building Designer provided a platform not only for multi-discipline design coordination, but also for 4D construction simulation and analysis. The team generated a visual construction plan that included construction sequence, deployment of construction material, and machinery scheduling. Using AECOsim Building Designer's BIM technology, the team simulated, analyzed, and refined each step in the construction process before official construction started. Construction units revised the construction program in collaboration with subcontractors and generated a feasible plan to guide the construction and meet defined milestones.

The BIM advancements provided a schedule arrangement of different construction plans that needed to be fulfilled within respective timeframes. This schedule made it easier for the owners to understand when the various construction phases were completed and enabled CACG to track construction

to ensure timely delivery. The team simulated multiple construction scenarios with a 4D BIM methodology early in the design cycle to expose issues prior to construction, allowing designers to choose the most economical and time-efficient construction scheme.

A BIM Driver for the Region

The EMCSC will serve as a world-class cultural and sports venue in Asia, promoting development of the national horse racing industry and tourism in Hohhot and Inner Mongolia. Given the magnitude and complexity of the project, AECOsim Building Designer and Bentley's applications were instrumental in enabling CACG to provide a quality facility on a constricted schedule and within a limited budget. Collaborative BIM advancements provided the team with the capabilities to resolve design and construction issues and streamline project management. Being the first local project to successfully adopt 3D BIM methodology, the project serves as a forerunner in BIM advancements for the region.