



Project Summary

Organization:

Mortenson | Clark, a Joint Venture

Solution:

4D Construction Modeling

Location:

San Francisco, California, United States

Project Objective:

- To simultaneously build all elements of a large and complex stadium and office complex.
- To adhere to a tight schedule and deliver the project before the 2019-2020 NBA season.

Products used:

SYNCHRO®

Fast Facts

- The USD 1.4 billion project included an 18,000-seat arena, two 11-story office buildings, more than 20 unique retail locations, and a 925-space, below-grade parking structure.
- Mortenson | Clark broke the arena into four key quadrants to advance construction in the most efficient way possible and enclose the venue at the earliest possible date.
- The joint venture used 4D visualization to create 1,674 critical schedule activities with over 150,000 individual resource elements.

ROI

- By using automated scripts and 4D visualization, designers addressed 468 sequence issues and saved an estimated 720 resource hours.
- 4D simulations boosted construction efficiency, drove stakeholder meetings, improved communication with all trade partners, and kept the community informed of the project's impact.
- Design and construction proceeded on schedule, and the complex project was delivered in advance of the 2019-2020 NBA pre-season.

Mortenson Uses 4D Construction Modeling to Build USD 1.4 Billion Sports Destination

SYNCHRO Software Facilitated Simultaneous Construction on All Portions of the Arena to Save 720 Resource Hours

Building a Massive Project Against an Aggressive Deadline

The Golden State Warriors had made Oracle Arena their home since 1971. However, after decades of basketball battles, the team's ownership decided to move into a new space across the bay in San Francisco. It would have been a massive undertaking to develop and construct any arena capable of hosting games for the National Basketball Association (NBA) that would accommodate thousands of fans and offer the latest amenities. However, the Golden State Warriors didn't only want an 18,000-seat arena. Plans for what would eventually become the USD 1.2 billion Chase Center grew to include two 11-story office buildings that would become the headquarters for Uber, a broadcast studio named the Gatehouse, more than 20 unique retail locations, 3.2-acres of publicly accessible plazas and open space, and a 925-space, below-grade parking structure.

Beyond the complexities of the project's 11-acre site and five interconnected structures, Mortenson | Clark, a joint venture team with decades of experience of constructing sports facilities, faced numerous other challenges on the project. Since construction was set for the Mission Bay neighborhood along the San Francisco Bay, the organization would have to work around neighboring construction projects, as well as an adjacent medical center with an active helipad. The Mission Bay Area was created from infill from the 1906 earthquake. The ground was, therefore, so saturated and soft from the nearby water that it was semi-affectionately called "bay mud." Lastly, the Warriors gave the joint venture a firm deadline for completion – the start of the 2019-2020 basketball season. That meant the joint-venture team had to work quickly.

Making Sense of Complexity with 4D Visualization

During the project's pursuit phase, Mortenson | Clark created a 4D model of the proposed arena using SYNCHRO, Bentley's digital construction management software. The application's visualization capabilities separated the facility into definable features, clarified the relationship between the base structure

and a façade inspired by flowing water forms, and enabled the schedule to be accelerated. During the early stages, the Mortenson | Clark project team laid the groundwork for site logistics and produced plans for several construction phases.

When the Warriors selected Mortenson | Clark as the general contractor in 2014, the project team detailed the 4D model further. Throughout development, planning and collaboration revolved around the visualization. The schedulers, superintendents, trade partners, and more than 1,500 craftworkers that would make the development a reality relied on near real-time feedback from the 4D model to ensure the quality and accuracy of their work. Beyond the project team, local residents, businesses, and basketball fans could view video simulations of construction over time to understand the full impact of construction on the surrounding neighborhood.

Managing Relationships to Build Four Cores at Once

During the extensive planning process, Mortenson | Clark determined that the only way to develop an effective, expedient construction schedule within the looming deadline was to break the project into manageable pieces with unique, but interconnected schedules. For example, the arena itself was built separately from the other structures and broken up into four cores. Under this plan, each core had its own schedule for concrete and steel work. Within each core, each vertical level had its own timetable for mechanical, electrical, plumbing, and finish works. The plan required meticulous scheduling, with trade partners providing multiple teams that would rotate around the arena. Therefore, all four cores would take shape simultaneously, rather than the traditional method of finishing one section and then moving onto the next. This approach ensured that construction progressed as quickly as possible, while ensuring safety and quality.

Chase Center's construction schedule involved more than 36,900 individual tasks and over 92,800 relationships. Visualizing the construction schedule using SYNCHRO allowed Mortenson | Clark to develop a fast, efficient process to identify issues and assign responsibility for resolving them.

“Chase Center’s 4D construction model established trust and confidence in the plan and provided a platform for alignment of a craft workforce of more than 8,000 men and women.”

*— Trevor DeLong
Senior Superintendent
Mortenson | Clark*

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

Innovating New Applications for XR

Prior to breaking ground in 2017, the Golden State Warriors partnered with a local vendor to produce an augmented reality experience of the proposed arena to help visualize the project. Inspired by the presentation, Mortenson | Clark looked for ways to implement mixed reality (XR) within its own visualization to improve communication among project team members. Partnering with local SYNCHRO experts, the project team tested large data sets, drag-and-drop capabilities, animated model reviews, and multi-user views within Microsoft HoloLens.

Months later, Mortenson | Clark began incorporating 4D visualization capabilities into HoloLens. Key features included placing the model within the augmented reality (AR), reviewing nonanimated storyboards when animation would distract the audience, and providing feedback on the stability, framerate, and user interface of the presentation. Using the Chase Center model, Mortenson | Clark established cloud-based XR capabilities that will improve collaboration, create more advanced AR model engagement, and provide status elements on 4D visualizations for future projects.

Saving Time through Streamlined Processes

Mortenson | Clark and its partners iterated the design during the planning process, with 44 defined building features incorporated into the 4D model. Over time, the visualization grew to include all supporting model elements, data flow, touch points, and expectations for contractors. In-house designers and trade partners also contributed to the design. The Mortenson | Clark team created numerous scripts to

save time by automating model maintenance and transferring data between model elements. The team also worked with the SYNCHRO support team to modify the user interface and streamline import processes, which allowed for real-time integration into the model. The shortened process lowered data import times from up to 20 hours to minutes.

Though Mortenson | Clark began the process by hard-coding tasks into model elements, which introduced the potential for error, a SYNCHRO update released in 2018 enabled designers to auto-match codes based on the scope of the work and the level of detail in the project. With an efficient data flow and monthly reviews, the team created 1,674 critical schedule activities and 151,635 individual resource elements in the 4D visualization. The 44 defined features of work and building elements became organized into 154 import files. The final visualization includes more than 175 steel activities, 84 concrete core sequences, 20 major mechanical, electrical, and plumbing equipment components, and 18 field and logistics equipment elements with 92 associated paths.

During 18 audit meetings, key stakeholders identified and addressed 468 potential sequence issues. The 4D model enabled Mortenson | Clark to improve construction efficiency in several ways, including maximizing the efficiency of the tower and crawler cranes by animating their movements. Automation within the project saved the team an estimated 720 resource hours. Though Chase Center was one of the most logistically challenging sports and entertainment projects in the United States, development and construction never fell behind schedule and was completed in 31 months, in time for NBA pre-season events.



Using SYNCHRO for 4D visualization, Mortenson | Clark created 1,674 critical schedule activities with over 151,635 individual resource elements.