The Sovereign Apartments

Case Study: 4D Modeling using Synchro

- **Project highlights**
  - Multi-Family Residential
  - Size: 21-story, 615,555 SF
  - Completion: June 2014
  - Budget: $63 million
  - Building Partners:
    - Owner: GID Development Group
    - Architect: Ziegler Cooper Architects
  - Location: Houston, TX
  - Contact: Brady Grace, Dave Dlugosh, Sara Curry & Matt Barchman

**Project Description**

JE Dunn is completing a $63 million, 615,555 square-foot, 21-story luxury apartment building in Houston, Texas. The project includes 290 apartment units and a swimming pool, fitness center, game room, and meeting rooms. The project also includes a 179,000 square-foot, 7-story above-ground parking structure that accommodates 434 cars, which is surrounded by residential units on three sides. The project started in July of 2012 and is scheduled for completion in June 2014.

JE Dunn is self-performing over 30% of the project, including all concrete and masonry, as well as a large general carpentry package that includes installation of wood blocking, doors/frames/hardware, balcony railings, residential cabinets and Division 10 items.

**Challenge**

Constructing a complex, 21-story concrete structure with an internal 7-story parking garage on a tight site during the hot weather months.

**Solution**

Applying 4D modeling with BIM and Synchro to better visualize and plan the sequencing and scheduling of the concrete structure.
Challenge Overview

The building design placed a parking garage in the center of the first eight levels, surrounded by a perimeter of residential units. The design required that either the parking garage or residential perimeter be placed first. The formwork required two floors of separation between the two structures, to allow materials to be flown in/out using outriggers. The project team elected to start up with the garage structure and let the residential lag behind two floors.

At Level 8, the parking garage was capped by a pool/patio deck and the residential tower, in the northeast corner, would continue up 13 more levels to achieve 21 stories. At Level 8, there were large transfer girders that spanned the expansion joint between the garage and residential where the tower went vertical. This transition created a complex sequencing issue relative to the overall progress of the project schedule.

The original schedule specified four weeks of work on Level 8 that could not start until after the Level 7 structure was 100% complete. This left a five to six week lull on the garage structure with minimal work being done until the residential portion caught up with the garage. Therefore, it would be roughly 10 weeks from the time Level 7 of the garage was complete and Level 9 of the tower was ready to pour.

Solution Overview

To analyze the complex sequencing issue at the Level 8 deck concurrent to the existing schedule, the team decided to utilize Synchro with the project BIM model. This 4D analysis allowed effective visualization of the current schedule and approach relative to the structural design.

By utilizing Synchro, they were able to demonstrate the schedule activities by color coding the structural components. For example, forms (light green/pink), reinforcement (green), concrete pour (blue). In addition, reshoring (orange) activities were included to verify sequencing and to provide effective scheduling for the mechanical and electrical rough-in activities that needed to follow up under the structure.

“By using Synchro, we immediately found sequencing challenges with the transfer girders (red) relative to the progress of the residential,” stated Dave Dlugosh, project superintendent.
They quickly realized that the concrete schedule would be tough to achieve if they continued with their current approach.

After running numerous sequencing iterations with Synchro, the team gathered all the subcontractors in a meeting to discuss different possible solutions. The JE Dunn BIM team demonstrated the sequence issues and helped with visualizing resolution options, which was projected from a large monitor in the jobsite office. At the end of the meeting, the project team and subcontractors changed the plan of attack to transition past Level 8 in order to maintain both the concrete and overall project schedule.

The concrete crews started forming and pouring smaller sections of Level 8 above the garage while the residential caught up. The smaller pours also helped with the concrete delivery challenges because better service was available in the mornings from 7 a.m. to 12 p.m. Temperature tendons were added to the structural design to enable the transfer girder tie-in to the Level 8 slabs in conjunction with the pour sequences. This evolved approach allowed Level 8 of the garage to be 50% complete by the time the residential was up to Level 7 and ready to start framing the residential tower portion of Level 8.

Through use of 4D modeling, this complex sequencing challenge was able to be visualized, better planned, and overcome.