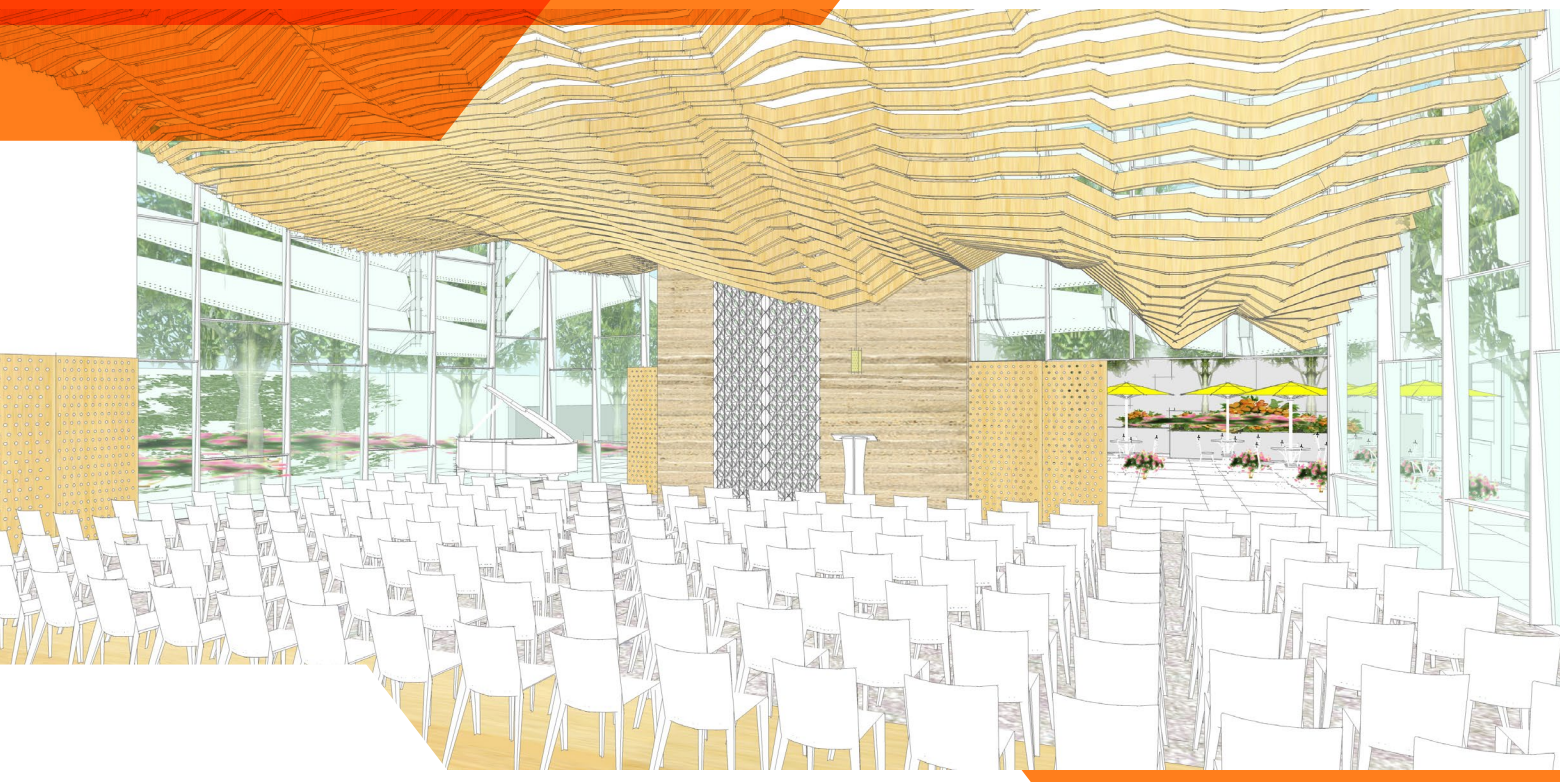


A rendering of the finished space.
Courtesy of Koning Eizenberg

SCANNING FROM COAST TO COAST

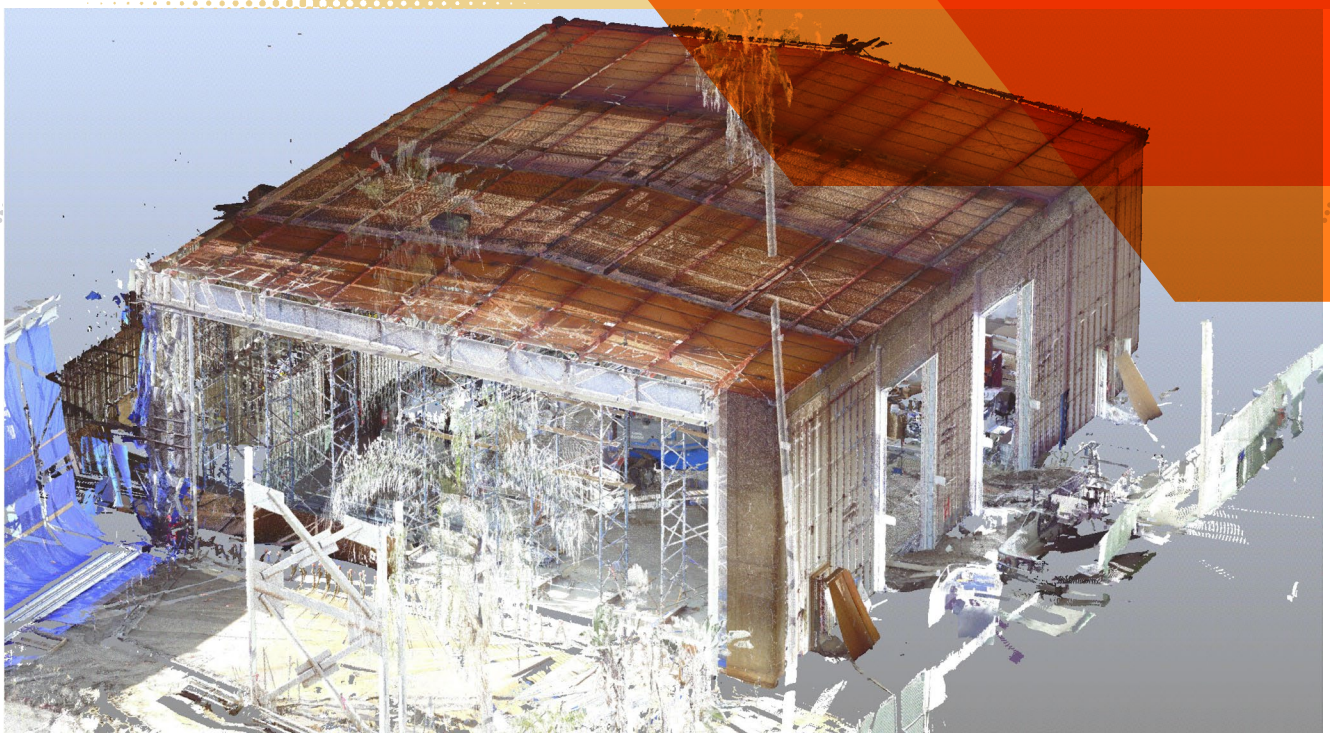
Last winter our firm, CW Keller was asked to bid on a project that would have been difficult to consider just a few years ago. The scope was to engineer and fabricate a suspended sculptural wooden ceiling inside the chapel of the Temple Israel of Hollywood as part of their facility-wide renovation. It was also an opportunity to work with Koning Eizenberg Architecture, winners of the 2013 World Architectural Festival Housing Award.

A crucial part of our work would be documenting the existing chapel space. Our company is an engineering and fabrication firm and while this has long been the type of complex architectural feature element work that we excel at, this was a detailed project on the opposite side of the country. The job site in Hollywood, CA was situated over 2,500 miles from our office in rural New Hampshire—a distance that would typically make a competitive bid impossible.

In the past, we would have sent a team of people equipped with a burdensome load of laser range finders, blueprints, tape measures and transits to get the necessary measurements for a job like this. It would have cost us thousands of dollars on travel expenses and after all that, the chances that we would need to make a return visit to the site for something that had been changed or overlooked would still be high.

By incorporating 3D scanning technology into our methodology for documenting site conditions it has allowed us to reconsider the viability of working on projects outside of our region. One member of our team was able to measure the entire chapel space

BY LES HOLLAND



Six individual scans were used to develop the point cloud needed for the space.

in an afternoon and then send the scan file electronically back to the office before he left Los Angeles. Our engineers were able to double-check that they had everything they needed and give them the all-clear before getting on the plane to come home.

On site, we made six individual scans around the room, based on parameters we predetermined in our New Hampshire office. By placing several registration targets throughout the space, we were able to rapidly combine the scans into a single, comprehensive model.

Shawn Keller, principal of CW Keller, noted, "Scanning allows us the opportunity to gather all the information that we need at a higher degree of accuracy than we ever could before, all in a matter of hours. If there's something we need to know after the space that has been scanned, or another trade wants to know a particular dimension, the point scans are so complete that we can pull up the file and easily figure out the information they need. The money we save on the expenses involved in the traditional method can be devoted to making the project better."

Using 3D scanning has made a project on the other side of the country feel as accessible as if it were right next door. On an early March day with a wind chill that left the New Hampshire air feeling like it was 2 degrees outside, it was 65 and sunny in Hollywood, a balmy temperature exacerbated by the palm trees we could see through the windows in the registered site scan.

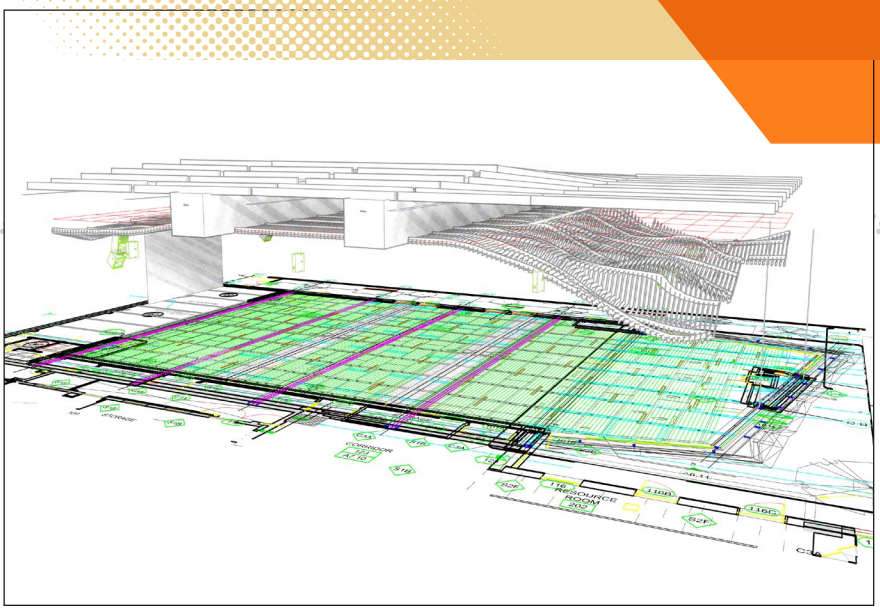
We could also see all of the framing members, the frames for the glass windows and doors, the walls and ceilings, and the framing for the doorways to the courtyard on the scan. We were then able to combine the scan with the high-definition photos that our scanner takes, which allowed us to easily color code the different building materials of everything within range of the scanner's lens.

"Creating a detailed point cloud scan also gives us measurements we can offer back to the other trades on the project, making our work more valuable to the entire renovation team," says Keller. "If the HVAC team comes in and wants to confirm the size of a space, they can often look at our scan and figure out what they need to know. Ditto for contractors like acoustics, lighting and electrical—they're all looking at our scan."

When the plumbing team installing the sprinkler needs to know the distance between two points on the ceiling, they don't have to get on a lift, now they can just check the scan. If something on site doesn't line up according to the original plan, their work can be adjusted before it even starts, saving time and money.

Simply looking at our screens in New Hampshire, we could already feel where the space was heading and the effect of what Koning Eizenberg's ceiling design would have, creating a light, airy space that functions on its own, and is able to flow into the neighboring social hall to create a unified feeling on High Holy Days.

"We wanted to rethink the conventional idea of what a chapel can be by creating a space that felt like a room in a garden. This allowed us to turn the view outward rather than the inward-focused style of older chapels," says Koning Eizenberg principal Nathan Bishop. "To do this, we came up with



CW Keller's fabrication model of the ceiling.

the idea of having the chapel extend out into a landscaped garden courtyard so the space around the altar is open on three sides. The forms and geometries of the ceiling and the sunshade over the courtyard just outside were derived from common liturgical items such as the kittel, the tallit and the chuppah, design elements that connect to history through memory and embedding stories, an important cultural facet of Judaism."

At CW Keller, our part in the building process is to create and aid in the installation of the suspended sculptural ceiling, a design element made of Baltic birch plywood that rises from the floor behind the altar and extends over the heads of the congregants in the chapel.

The ceiling will be built in segments on our Plaistow, NH shop floor using information garnered from the scan to fine tune our work as we go. To create and suspend the ceiling, our scan helps us determine exactly how it ties in with the rest of the structure. It allows us to choose the best hanging points where the ceiling will be fastened to the steel I-beams that make up the temple's frame, taking into consideration the seismic requirements that allow us to safely suspend a 100-foot long ceiling that weighs more than 14,000 pounds above a 6,000 square foot room full of people.

With Hollywood on the seaward side of the San Andreas Fault, this project has also meant a particularly close collaboration with the engineering firm of Simpson Gumpertz & Heger (SGH) and their teams in Los Angeles and Boston.

"When engineering the chapel ceiling to account for seismic activity, it is not necessarily expected that the building will be serviceable, or even damage-free, it is merely intended that the building is relatively safe to exit during and immediately following the earthquake. These loads must be transferred through the ceiling system and its supports and into the building's primary frame," says Eric Twomey, project engineer at SGH.

To do this, discreetly-located vertical cables connect the ceiling components and the building's I-beams to support the weight of the ceiling. Additionally, diagonal cables and compression struts resist the horizontal earthquake loads and transfer these loads to the primary building frame. These systems work together to provide resistance to the loads that the ceiling will be subject to during day-to-day operation as well as during an extreme event like an earthquake.

"For us, 3D scanning means we can be sure that the geometry is accurate, that we don't have any busts in our fabrication or analysis and it prevents needing any changes in the field," says Twomey. "The laser scan is exactly what's in the field."

For us at CW Keller, that degree of precision and added safety is exactly what we want for every job regardless of which coast or even which country the project happens to be in.

Les Holland is the head of engineering at CW Keller. Along with his in-depth knowledge of automated equipment, Les also leads our talented group of engineers and programmers, who keep CW Keller at the forefront of the industry.

All existing conditions are comprehensively captured in a single site visit.