THE KEY AT 1100 BROADWAY

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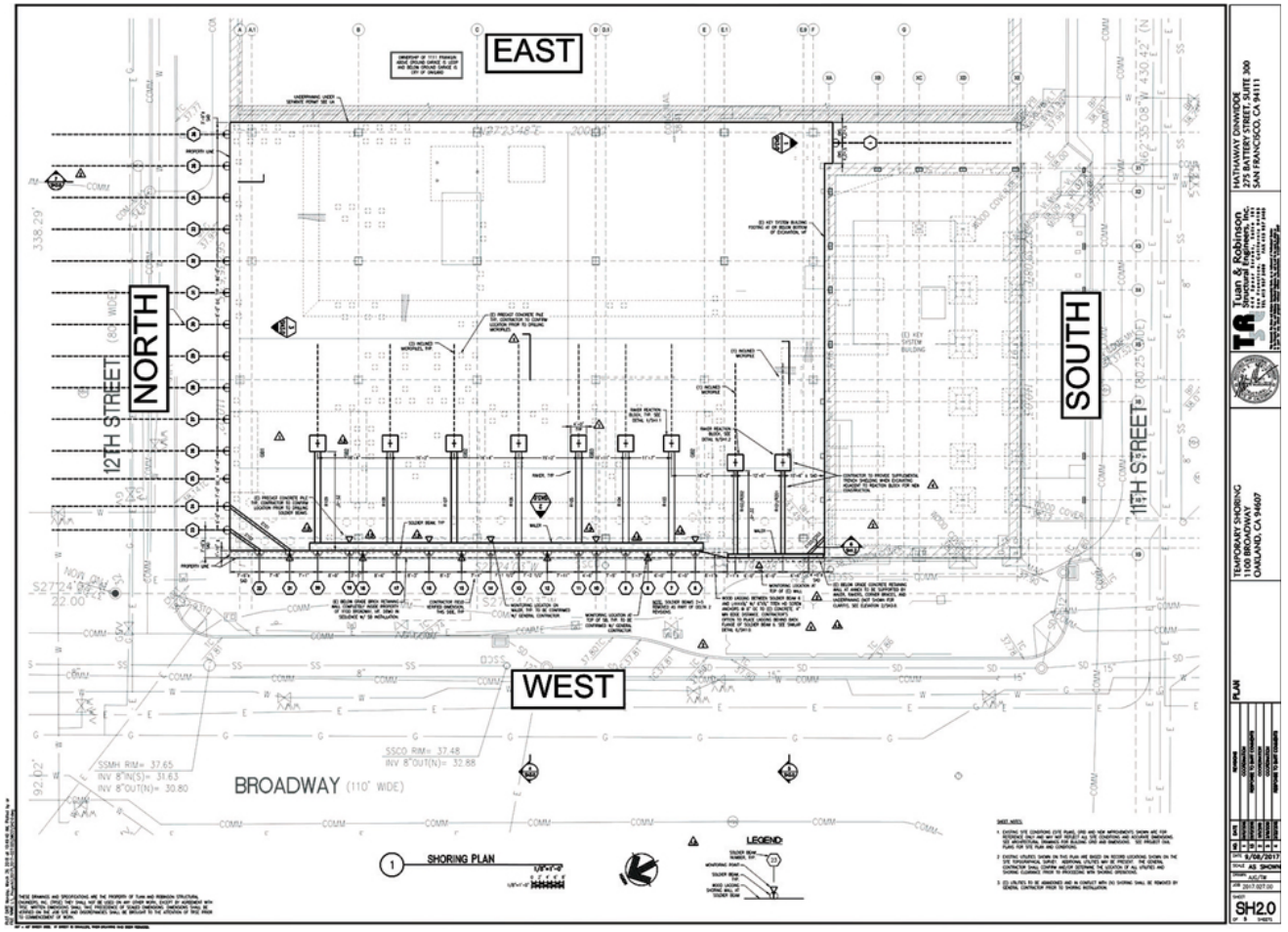
SITE HISTORY

The historic Key System Building, located at 1106 Broadway, was constructed in 1911. The eight-story building sits on the corner of 11th and Broadway in Oakland, California. In 1943, the building became the headquarters for the Key System Transit Line. At the time, they operated all of the local streetcar systems in the East Bay and a line across the Bay Bridge, until 1960 when AC Transit took over operations. The building continues to be an important contributor to the Downtown Oakland Historic District and was placed on the National Register of Historic Places in 1984, then later closed after the 1989 earthquake, due to seismic concerns. The building sat vacant for years, too expensive to retrofit, but is now protected against demolition.

The adjacent lot, 1100 Broadway is the site of the new 18-story tower dubbed “The Key.” The site had been approved for development two times prior to this project breaking ground. In 2000, a prior developer began construction on a hotel, later cancelled due to funding, but not until after hundreds of twelve-inch driven piles had been installed. The project site sat for years until given approval in 2007 for construction of an office building that never actually started. In 2017, Ellis Partners did what neither of the past two developers could do, finally bringing the project to fruition and incorporating the retrofit and remodel of the key building into the equation. The owner, Ellis Partners, chose Hathaway Dinwiddie as the general contractor for this project and Case Pacific was the successful low bidder on the shoring/excavation/foundation package. Construction began in early 2018.



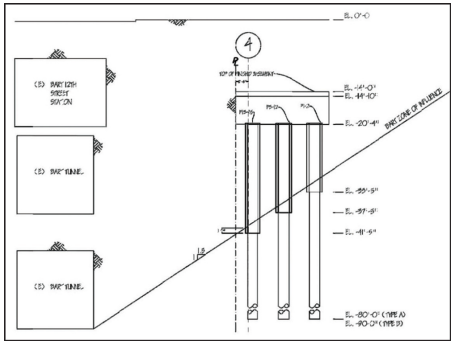
SHORING AND EXCAVATION ELEMENTS

Shoring was required on three sides of the project, with the fourth side marrying up to the existing key building basement and the above-grade, eight-story structure.

The east side of the project borders a four-story concrete structure with a single level, below-grade parking garage terminating on average five feet above the new mat slab. Due to the weight of the building, the high sand content of the native soil

mat slab. Due to the weight of the building, the high sand content of the native soil and the depth of the new foundation system, it was necessary to install 38

underpinning pits extending the full length of the building. Adding to the difficulty of underpinning was the presence of the old beams and lagging used for the adjacent garage from previous construction.



The north side of the project sat up against 12th Street, the only side with a simple beam and tieback shoring system, but made difficult as the home to the entrance/egress from the site.

The west side of the project on Broadway borders the below grade BART (Bay Area Rapid Transit) lines and the 12th Street transfer station. This transfer station features one level of station and two additional levels of track tunnels.

NOTCHES DUG INTO EXISTING BRICK WALLS TO FACILITATE

With land costs at a premium, the intent is to squeeze every inch out of the existing square footage of property. Our shoring system was installed beyond property lines though old brick and concrete walls left behind from a pre-existing basement. Due to the manmade subsurface conditions, construction of the shoring system from grade was an everyday surprise. To minimize impacts, slot cuts were excavated perpendicular to existing basement walls with selective demo performed to remove brick, concrete and old backfill

left from previous excavations and BART construction. Following the installation of beams, lagging was installed as the brick walls were demolished lift by lift, leaving the face of our beams at property line and the future removal of the beams to five feet below-grade still to come.

SOLDIER BEAM INSTALLATION

Due to the BART tunnels sitting just adjacent to our shoring walls, the deflection criteria for the shoring was basically zero. This strict requirement was set forth by the BART authority and required multiple rounds of revisions and resubmittals. Without the ability to use tiebacks due to the tunnels, the project was left with only one means of preventing lateral movement to meet the criteria required. The entire

one means of preventing lateral movement to meet the criteria required. The entire Broadway side had to be internally braced. A total of nine each of raker beams

found their way down into an equal number of thrust blocks, each of which housed three each of 200 to 320-kip micropiles, two battered (one on top of the other) and one vertical. These had to be constructed at a higher elevation than anticipated due to the shallow nature of the upper row of battered micropiles, otherwise placing the mast of the drill rig within the newly constructed shoring wall just 20 feet away.

Adding to the issues along Broadway was the existence of an old basement in the Key Building. This basement not only sat beneath the existing seismically unsound structure, but also extended 20 feet beyond the building into the site of the new construction. The basement wall separated the new project site and old Key building basement. The old basement wall was being surcharged on the new project site side and the old brick wall only being supported by the basement roof slab acting as a diagram. Removal of this wall would require equalizing loading on both sides. Because this was not possible, the existing basement wall and the wall

INSTALLING VERTICAL AND BATTERED MICROPILES FOR THRUST BLOCKS

existing basement wall and the wall bordering BART/Broadway would have to be braced and underpinned from within the existing basement. Once completed, they could later be tied into the balance of the west side shoring prior to the demolition of the diagram.

COMPLETED THRUST BLOCK READY FOR FORMING AND POURING

EXISTING KEY BUILDING BASEMENT WALL AND DIAPHRAGM LEFT INTACT UNTIL BRACING AND UNDERPINNING PITS WERE IN PLACE

FOUNDATION ELEMENTS

The foundation system for the new building was a combination of a matt slab along the east side with large drag beams tying into an even thicker footing bordering the west wall containing 33 each 24-inch diameter, double-cased shafts with a maximum length of 108 feet, with ultimate loads of 900 kips. The upper portion of the shafts extended to five feet below the ZOI of the Bart system. This section acted much like the unbonded zone of a tieback, with a three-inch annulus between the outer and inner casings. This eliminated load shed from the building until below the ZOI. Due to the unconfined nature in upper limits of the shaft, as well as to prove pile capacities, a testing program was implemented. A total of two production piles were load tested. Dynamic load testing was performed by GRL Engineers, Inc. These tests proved both that the upper limits of the pile met rigidity and that the lower portion of the shafts held load.

Construction of the piles was done at ten feet below grade, but approximately ten feet above the terminal depth of the excavation. This was done for three reasons.

The first reason was that the piles were constructed on what would later become

the berm for the raker system, so excavation depth could not proceed past this elevation. Secondly, casing of these wall thicknesses isn't cheap, times two. Lastly, the slab for the old basement was at this depth and needed to be removed while also confirming no precast piles were in our pile locations.

The installation process required drilling a 34-inch diameter shaft 35 to 40 feet deep to set the outer casing, followed by the installation of the inner can and locked in place. Lastly, the pile was drilled to tip. Setting cages that were nearly as long as the site proved to be difficult, but was achieved by splicing cages onsite as they were lowered into the holes. Pouring holes with cutoffs 15 feet below drilling elevations required overpour of concrete to ensure sound concrete. Later, excavation in this area proved to be extremely tight, requiring work between raker beams, while excavating a footing, demolishing brick walls, installing lagging and demolishing precast piles. Coordination with our excavation subcontractor, Pacific States Environmental, was integral at the last push of the project.

The design of “The Key” features a cantilevered upper section that overhangs the old Key building, then extends up to its new top 18th floor. Due to this load, the building required additional 24-inch, double-cased piles and a series of thickened mat slabs with 19 eight-inch diameter ground improvement piles with 400-kip capacities for additional support. These ground anchors sat at the lowest elevation of the job and were the last scope of work performed prior to digging ourselves out of the hole.

PULLING IT ALL TOGETHER

INSTALLATION OF GROUND IMPROVEMENT MICROPILES

The construction of the shoring system and foundations utilized the most techniques on one jobsite Case Pacific has ever performed: soldier beams and tiebacks, internal bracing and a pre-loaded raker systems with micropile thrust blocks, hand dug underpinning pits, temporary lagging and shotcrete, micropiles, ground improvement piles, dual-cased drilled shafts and testing programs for all foundation elements. All of this work was performed on schedule, with zero incidents. The site was 110 feet by 150 feet and had at least three of the above

tasks being performed simultaneously, many of which were at different elevations, all while additional equipment was performing demolition and/or excavation/off-haul was occurring. This was a true case of trying to fit ten pounds of concrete into a five-pound bag.

LESSONS LEARNED

With any project in our industry, changes on the job are imminent. No matter how much pre-planning is put into a job, things change. Changes are often out of our control and it's our ability to pinpoint and tackle them as quickly as possible that leads to the overall success or failure of a project. On a project like this, with so many tasks running simultaneously, small changes had large impacts on the overall project. For this reason, presenting our plan to the general contractor, through scheduling software and detailed staged drawings, painted a clear picture of our intentions going into the project. Looking back at the project, our success wasn't only the completion of a very difficult scope, but the communication between the office and the field that made it possible. It was because of the notes and pictures taken in the field that we were able to maneuver through changes and conversations with the design team, schedule timely deliveries, alter work plans and ultimately be compensated for impacts. While we may pride ourselves on the installation of foundations, the true foundation of the work we do is the hard-working individuals who show up to work smart and stay safe that make Case Pacific turn to the right every day.

PROJECT TEAM

OWNER Ellis Partners

GENERAL CONTRACTOR Hathaway Dinwiddie

SHORING/FOUNDATION CONTRACTOR Case Pacific

SUPERINTENDENT Robert Tanguileg

PROJECT MANAGER Charlie Bower

PROJECT ENGINEER Cameron Lane

SHORING DESIGNER Tuan and Robinson

STRUCTURAL ENGINEER MKA

ARCHITECT Gensler

"Changes are often out of our control **and it's our ability to** pinpoint and tackle **them as quickly as possible that leads to the** overall success or failure **of a project."**