

EBMUD CARISBROOK RESERVOIR ROOF DEMOLITION

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East Bay Municipal Utility District (EBMUD) has a history of providing high-quality drinking water for 1.4 million customers in Alameda and Contra Costa counties in the San Francisco bay area. EBMUD decided to replace its three million gallon Carisbrook concrete reservoir with a smaller prestressed concrete reservoir and use the post-tensioned walls of the old reservoir as permanent retaining walls. Sierra Mountain Construction was low bidder on the project in the Oakland (CA) hills. Work included removing the roof and columns of the 159±-ft inside diameter tank prior to installing wall-strengthening rebar and shotcrete, cutting a hole in the wall, grading, and installing new structures inside the walls.

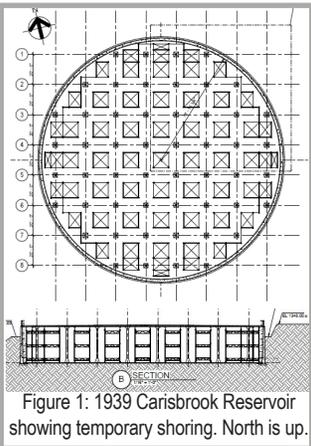


Figure 1: 1939 Carisbrook Reservoir showing temporary shoring. North is up.

Walls of the 25± ft deep tank had been post-tensioned with high-strength rods and then covered with shotcrete. The roof slab was a two-way slab (no beams) with supporting columns at 20-ft centers each way with top and bottom capitals. See Figure 1. The slab was reinforced with #4 rebars top and bottom at 4-inch to 10-inch spacing. Drawings indicate a 100-psf design live load and 88-psf dead load for the 6.75-inch thick slab. The two-way slab was divided into continuous column strips and middle strips each way, in 10-ft widths. Most of the rebar was in the column strips.

This type of slab gets its strength from the full slab-column structure being in place, with the middle slab strips gaining support from the presence of the column strips. Only the middle strips of this type of flat slab (without beams) can be demolished safely with people working on it, assuming that it is first cut into pieces using a relatively light concrete saw. Without shoring, removal of the column strip would collapse the adjacent middle strips.

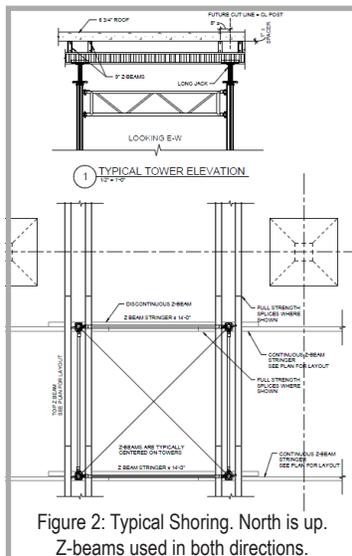


Figure 2: Typical Shoring. North is up. Z-beams used in both directions.



Figure 3: Typical 5-ft by 10-ft panel being removed. Work was eased by the four adjustable stop post prongs extending from the spreader that allowed the use of only two Monkey Fist removable concrete anchors.

In order to remove the roof from east to west as needed, it was necessary to install temporary shoring. Sierra retained Brierley Associates to design the shoring and the group chose EFCO E-Z Deck Shoring towers for deck support. The modular system was relatively easy to install. Basic towers were 10-ft square in plan and used Z-beams in both directions. Our Kanab, Utah office prepared CAD drawings, thereby simplifying the detailing process so that the shoring could be installed in its correct location without any hitches. Most of the Z-beams were made continuous by end bolting.

First, an access hole was cut in the slab and the shoring was installed. Then concrete saws were used to cut the roof panels into 5-ft by 10-ft maximum rectangular panels. Once cut, the panels were then picked by a 28±-kip Broderson IC-200 roof crane, moved on the roof with forklifts, and loaded onto trucks with a large exterior crane. Except for those panels attached to the columns, the concrete roof panels were completely removed from east to west as planned, leaving the 52 columns and the supporting shoring below. See Figure 4.



Figure 4: Temporary Shoring shown in area where slab panels have been removed. Columns with 5-ft by 10-ft roof panels remain in place, supported by the shoring beneath.



Figure 5: Fifty-two 14-inch square columns with roof panels attached remained. These were pushed over onto tire cushions and then removed. Columns attached to the 6-inch base slab with 4-#4 rebar dowels.

After the shoring was completely removed, the large exterior crane lowered a forklift onto the base slab. The forklift pushed over the columns as shown on Figure 5. Demolition work was completed with no major problems or difficulties.

Click on the photo to view a short video of column demolition.