



The roof is lifted in three stages. When the lifting is complete, as shown, reinforcing bars, which protrude 6 inches, are spliced. New concrete is then poured in a form, leaving an 8-inch gap at the top. The gap is filled with shotcrete.

# Raising the Roof

*How a Florida contractor raised a shopping mall roof more than 10 feet*

BY ALLISON CAWOOD

**H**ow would you like to raise a 4-million-pound concrete roof slab over your head without the use of shoring? A contractor in Florida accepted this challenge and completed the job successfully, all in the name of entertainment.

The Mayfair Shopping Mall is an exclusive mall located in Coconut Grove, Fla., near Miami. The changing character and lifestyle of the neighborhood prompted the owners to do a little remodeling. A three-story department store was converted into a night spot with the

construction of a Planet Hollywood and a 10-screen movie theater. At 11 feet, 6 inches above the third floor, the existing roof of the building was too low to accommodate the movie screens. The existing roof either had to be demolished and rebuilt or raised. Time constraints and site conditions opposed demolition so the roof was raised 10 feet, 8 inches to a new height of 22 feet, 2 inches above the third-floor slab.

## Lifting Equipment

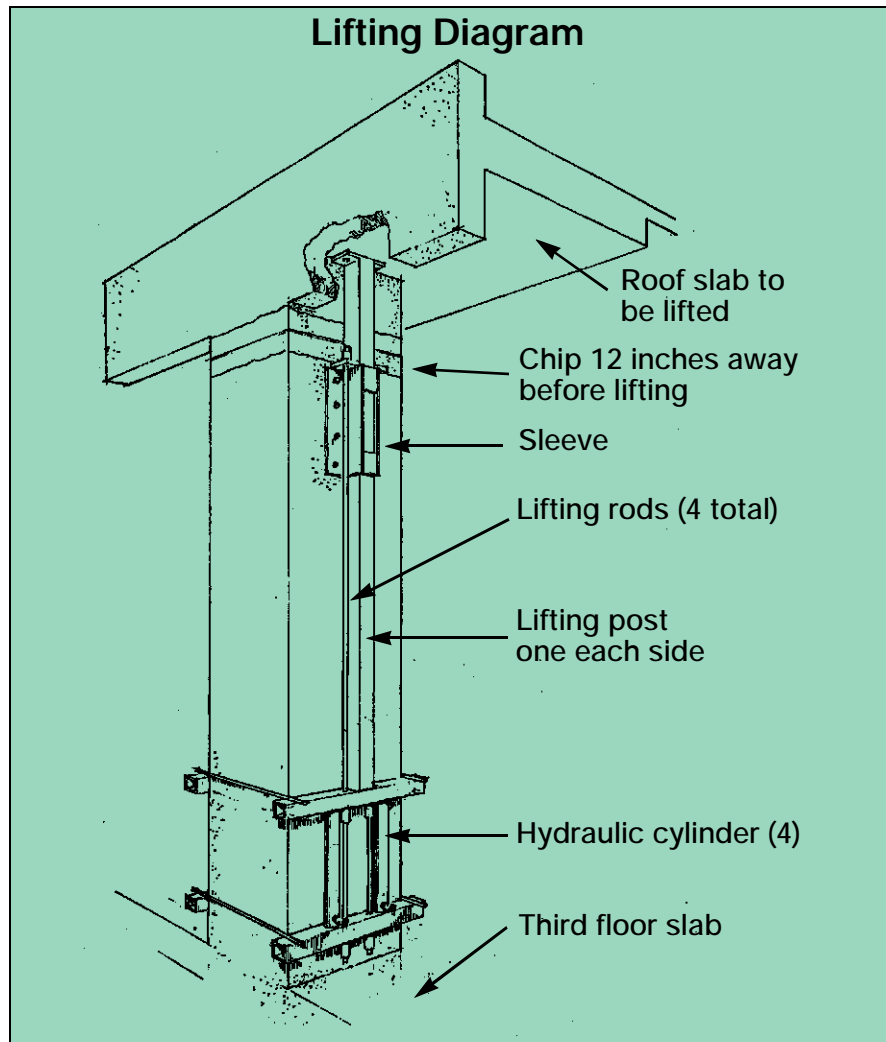
The contract to lift the roof was awarded to Liftplate International

Inc., Miami. Shoring was not possible, so the lifting mechanism, consisting of two sleeves with telescoping lift posts, was mounted on each column. The 18-inch-high sleeves were fastened to the columns 6 feet, 5 inches above the floor using epoxy-grouted threaded rods. The lifting equipment, suspended from each sleeve by two threaded rods, was designed to climb on the rods, pushing the lifting post upward. Four 25-ton hydraulic cylinders provided the lifting force at each column. The cylinders were powered by electric/hydraulic pumps located at each of the 37 lifting points.

### Lifting the Roof

Before the contractor could raise the roof, workers had to disconnect it from the column supports. First, they chipped out a 12-inch-wide section of the column, starting at 8 feet, 4 inches above the floor. This was done after the lifting equipment was installed and the lifting posts were pressed under the roof.

The final step to disconnect the roof was to flame-cut the column rebar, leaving 6 inches of rebar protruding from the cut surfaces of the concrete. Workers inserted and welded new rebar to the protruding



bars after the roof was lifted. Before the columns were severed, the roof was reinforced by external tendons. This external reinforcing was necessary to relieve the moment that was transmitted to the columns by the existing roof. The tendons were anchored at each end of the span. A 12-inch post exerted pressure in the middle of the span, replacing the effect the columns had before they were severed.

Since the lifting posts could only

extend 3 feet, 6 inches at a time, the lifting had to be done in three stages to achieve a total lift of 10 feet, 8 inches. After each stage, the load of the roof was transferred to a steel staging post placed in the gap created in each column. This allowed the lifting equipment to be lowered to its original position. Workers then extended the lifting posts at each column for the next lift. The extensions were welded to the original lifting posts using  $\frac{5}{16}$ -inch fish plates.

### Synchronizing the Lift

To ensure that the roof was being raised at the same rate at each column, a system of stainless steel tapes, patented by Liftplate, was used to monitor the relative movement at each column. A stainless steel tape is attached at each lifting point and runs through a pulley at



After the roof load is transferred to the lifting posts, a 12-inch-wide segment is chipped out of the column. The reinforcing bars are cut just prior to lifting.



The roof is pushed up by lifting posts telescoping from a sleeve mounted on the face of the columns. Four 25-ton cylinders, located between the two crossheads and supported by suspended threaded rods, provide the lifting force.

the bottom of the column. All tapes converge in the center of the floor, where they run parallel. A sensor placed over the tapes monitors the relative movement of each tape. When one tape runs faster than the others, its pump automatically switches off until the other tapes have caught up.

### **Pouring the Columns**

When lifting was complete, workers poured the columns. They placed plywood forms extending the full height of the column on three of the column sides and left an 8-inch gap on the remaining side for placement of concrete. The concrete was poured to the top of the lower side and the remaining 8 inches of the column were shotcreted.



### **Credits**

Engineer: Douglas Wood & Associates, Coral Gables, Fla.

General contractor: Waas-Phillips Construction Co., Miami

Lifting contractor: Liftplate International Inc., Miami

Post-tensioning contractor: PTSI, Miramar, Fla.

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