

# Can concrete fly?

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**S**ure, concrete can fly—with help of a helicopter, a fearless pilot, and an experienced ground crew. Transporting fresh concrete by helicopter can be the solution when there is no convenient access to the concrete placement point.

In Vail, Colorado, August 1987, a fixed quad-chair lift was built as an access to Vail Mountain for the residents and visitors of Cascade Village. The lift tower footings are on a steep path at the west end of Vail Mountain where the ½-mile-long lift rises 2,000 feet.

Placement of footing concrete by helicopter was required because of the rugged, steep terrain and the policy of the U.S. Forest Service to limit construction access roads. The total cost of the project was \$1.5 million of which \$950,000 was for the lift and its construction.

## Helicopter abilities

The amount of concrete transported each trip is controlled by the bucket weight, elevation above sea level, air temperature, and the size of the helicopter. The helicopter for this project had a rated capacity of 4,000 pounds at sea level. Performing work at the lift tower's 9,000-foot elevation reduced the helicopter's load capacity to 3,000 pounds. Because of the combined weight of the concrete, bucket, and cable, the maximum volume of concrete lifted was limited to ½ cubic yard.

A larger helicopter was not used

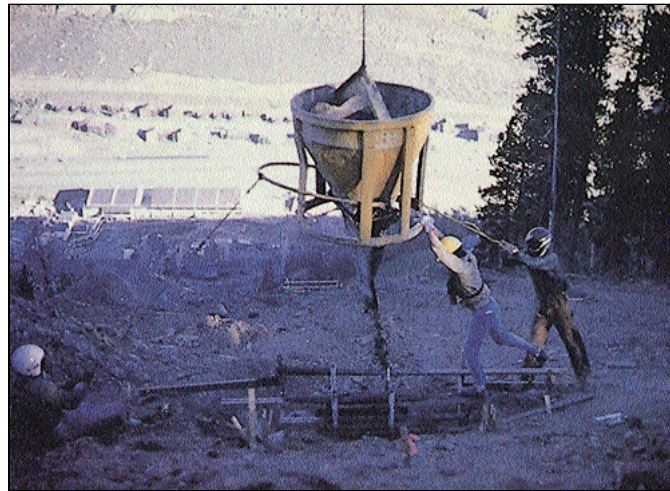


Figure 1. By using ropes, three workers steady and discharge the bucket. Flying dust and debris caused by the downward air blast of the helicopter blades can be minimized by a prejob cleanup and wetting of the site.

because it wasn't cost-effective. The helicopter for this project rented for \$1,000 per hour. A helicopter with a rated lift capacity of 4,600 pounds at sea level, rented for \$1,800 per hour.

Weather also must be considered, although it is not as critical as one might expect. Flying can continue in most weather, even with a steady 40 mph wind. However, wind gusts pose severe problems in handling the helicopter and controlling the swinging bucket, so operations usually cease.

Because helicopter pilots prefer flying above the treetops to allow full view of the project, the bucket was hung on a 100-foot steel cable. Although a 100-foot length is not excessive, a shorter cable would allow easier control of the helicopter and the load.

The helicopter was equipped with

a load cell that measured the load on the cable. After each bucket lift, the pilot could tell the ground crew if the amount of concrete in the next bucket had to be changed. If the load exceeded the lift capacity, or the pilot felt he was in danger of crashing, he could release the bucket and cable. An emergency siren, sounded by the pilot, would alert the ground crew to the danger above.

## Project construction

Each reinforced spread footing required 5 to 9 cubic yards of concrete. The helicopter placed ½ cubic yard of concrete for each trip, taking 7 hours to place the 62 cubic yards in the footings.

The concrete had a specified 28-day compressive strength of 3500 psi, a 4-inch slump, 6 percent entrained air, and a unit weight of 140

pounds per cubic foot (pcf). Helicopter placing on this project did not require any changes in the mix design.

Three workers, including the concrete truck driver, were needed at the staging area. These people were responsible for hooking, unhooking, and loading the concrete buckets. They used two buckets to minimize trip time—one was in transit while the other was being filled.

Five workers were needed at the placement area. Three of them steadied, aligned, and discharged the bucket (Figure 1) as the other two vibrated and finished the concrete. The placing crew was always busy because the helicopter made a round trip in 2 to 3 minutes.


Safety equipment for most of the ground crew consisted of safety goggles and hard hats. Several workers preferred motorcycle helmets for protection from the noise, flying dust, and sudden bucket movements. The staging and placing crews were in constant radio contact with the pilot and each other to coordinate the operation.

### Prepare for special conditions

A helicopter's rotating blades create a downward air blast on the ground. This air blast blows up dirt and debris and has even been known to blow down loosely constructed forms. Securely anchor loose construction materials, like plywood, that can be a flying hazard when the helicopter arrives. Consider wetting the ground surface to minimize dust problems. Occasionally, a wind gust might move the

bucket into the forms. Be prepared to repair or realign forms.

Plan for helicopter refueling. To maximize lift capacity the helicopter on this project carried only one-third of its fuel capacity. Although this maximized load capacity, extra fuel stops were required.

Even though flying concrete to a site may seem expensive, it is a viable option when compared with the cost and hazards of placing concrete by conventional means in areas of limited access and rough terrain. Remember to reserve the helicopter well in advance and you too can feel the excitement of working with flying concrete. 

### Credits

Contractor: CTEC, Inc., Salt Lake City, Utah

Helicopter operator: Timberline Air Service, Inc., Alpine, Oregon

Concrete supplier: Mountain Mobile Mix, Glenwood Springs, Colorado

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