Concrete Is Thrown a Curve

In Construction of Las Vegas Stratosphere Tower

12 Million Pounds of Concrete Got a Hydraulic Push—Talk About Pressure!

In Las Vegas, Nev., topping the competition isn't the goal, it's the ante for play. Succeeding here requires the unlikely combinations of unbridled imagination, fiscal restraint, fun and business. Minnesota-based Grand Casinos Inc. will enter Las Vegas by literally topping anything in Nevada's gambling capitol for years to come. And they're doing it with help from Minnesota-based Power Team hydraulics.

Grand Casino will top Las Vegas—and the rest of the country, for that matter—with a spectacular full-service entertainment complex. Upon completion, the tower will stand 1,149-feet tall—the same height as the Eiffel Tower, more than 400 feet taller than the Seattle Space Needle, and three times taller than any existing building in Nevada.

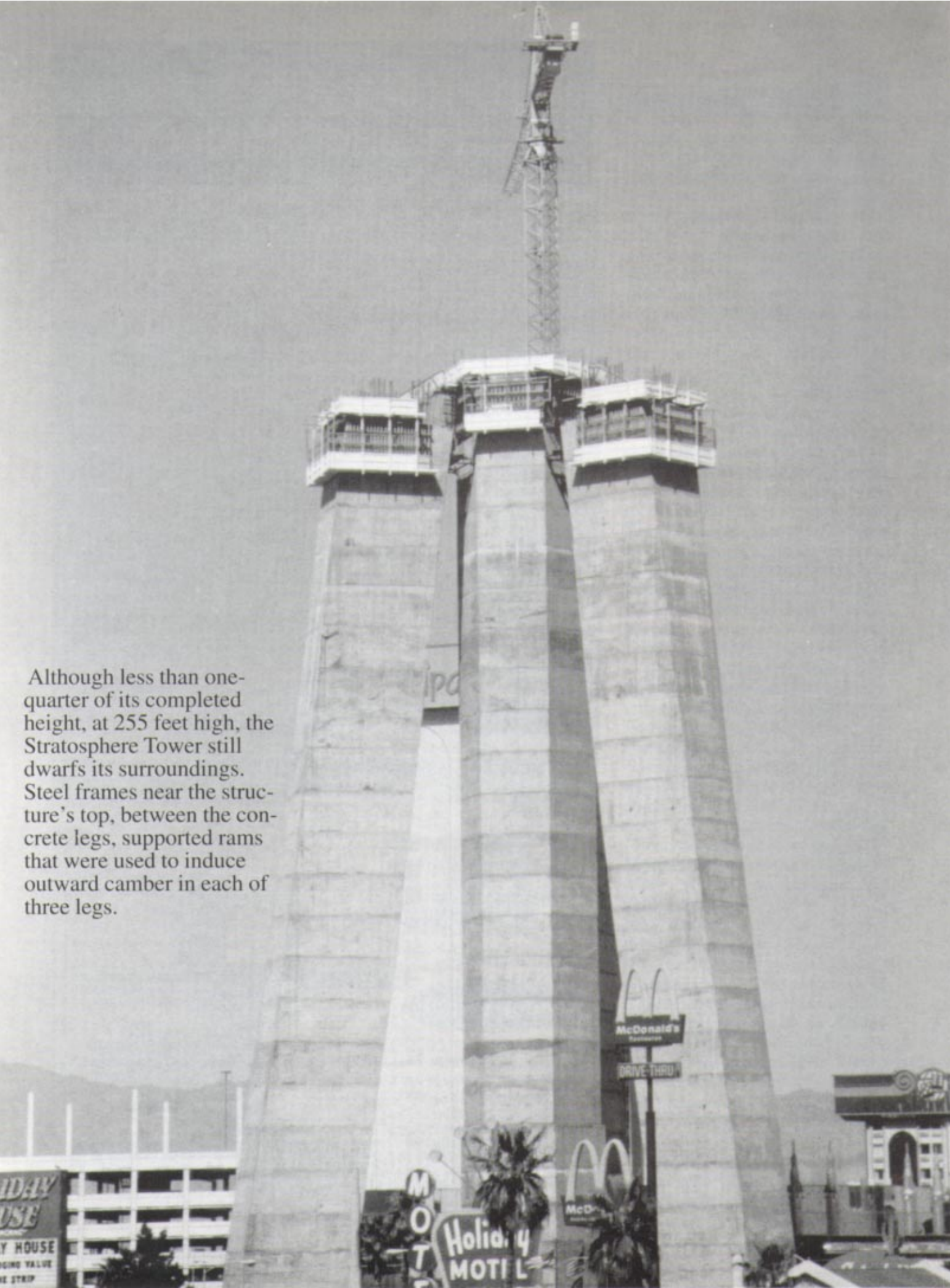
The "mushroom-like" tower begins with three concrete legs positioned like a tripod with a center concrete hexagon core with 20-foot-wide walls ranging from 12 inches to 24 inches thick. At the tower's base, three 20-foot-by-32-foot rectangular legs ranging from 12 inches to 32 inches thick, are on a 12-foot-thick concrete pad foundation. All legs taper toward the center, coming together at the 264-foot level. The legs turn out to rise an additional 535 feet to support the tower's "pad" base at the 775-foot level. This building will house wedding chapels, indoor and outdoor observation decks, a 360-seat revolving restaurant, a cocktail lounge and two thrill rides: a roller coaster and a simulated "space shot" that propels riders toward the 1,100-foot level.

The Leg Problem

From a construction viewpoint, one critical phase was the use of hydraulics to help form the concrete legs' outward curve. Power Team hydraulics counteracted the natural force of gravity and the concrete leg design, which pulled the three legs inward, toward the core. (Each leg weighs about 4 million pounds from the base to the point where rams were attached, which was at 255 feet.) According to Roy Welborn, a Power Team distributor with Twilann Inc. of Boise, Idaho, "I was approached by the contractor to develop ideas to execute the structural engineer's design requirement of 'pushing' the legs outward to induce a camber in the foundation. I knew Power Team hydraulics could get the job done."

In addition to accomplishing this task at 255 feet above ground, additional challenges included applying no more than 240 tons of pressure per leg and applying equal and simultaneous pressure/push on all three legs to induce a 3-inch to 4-inch outward movement of each leg.

Sub-contractor Advanced Steel Systems used a system of six 150-ton Power Team rams with locking collars. Power Team customized the rams, adding a pad at the base of each cylinder to accommodate one-inch bolts. A Power Team electric hydraulic pump powered the operation. One two-valve manifold per leg was used. The pump, pressure switch, gauge, pressure regulator, hoses and valves were assembled and tested at Twilann. Pressures



Although less than one-quarter of its completed height, at 255 feet high, the Stratosphere Tower still dwarfs its surroundings. Steel frames near the structure's top, between the concrete legs, supported rams that were used to induce outward camber in each of three legs.

were preset at 240 tons per leg. The hydraulic system was "work ready." Twilann also provided precise operating instructions.

Fraser Smith, the project's structural engineer with Mendenhall & Smith, Inc., of Las Vegas, designed rectangular steel frames (7 feet by 201 feet) to straddle the distance between each leg and center tower. A crane hoisted the frames to the 255-foot level of the tower, where workers bolted each frame to concrete anchors within the center tower and each leg. Once all three frames were in place, workers mounted the rams horizontally by bolting rams to the end of the beam. With all three frames in place, workers attached manifolds to the Power Team pump.

Pump It Up—and Out

Workers set the pump in the middle of the tower at the 255-foot level. They set the pressure switch to prevent pressure from exceeding 240 tons per leg. Next, workers connected hoses from the pump to a two-valve manifold connected to each of six rams, two rams per leg.

One person at each of three converging points monitored the ram, flow of fluid and pressure delivered. The fourth worker operated the pump and monitored the leg-to-tower dimension and leg-to-tower parallel. (The flat side of a square leg must face the flat side of the hexagon, so every other side of the hexagon will parallel a leg side.) Workers secured the rams' locking collars when the desired pressure and position were achieved. The pressure held the rams in place. The legs each moved between 3 inches and 4 inches outward, as predicted.

The concrete was then poured and cured for two to three weeks, whereupon the rams were removed and construction continued.

The Stratosphere's construction workers make final adjustments on the steel frame supporting the rums. The rams' hydraulic force deflected the concrete to induce a camber in each of three concrete legs.

According to Smith, "The jacking procedures were completed without a problem. The deflections of the concrete legs were just as predicted. The system, using jacks at each leg, was surprisingly simple, and yet produced the results we wanted."

Stratosphere is scheduled to open by April 1, 1996. A 354,500-square-foot two-level building located at the base of the tower will be included. The first level of the base building will include a 97,000-square-foot casino and restaurants. The second level will include a retail shopping area and specialty restaurants. ***CD***

About the Author

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