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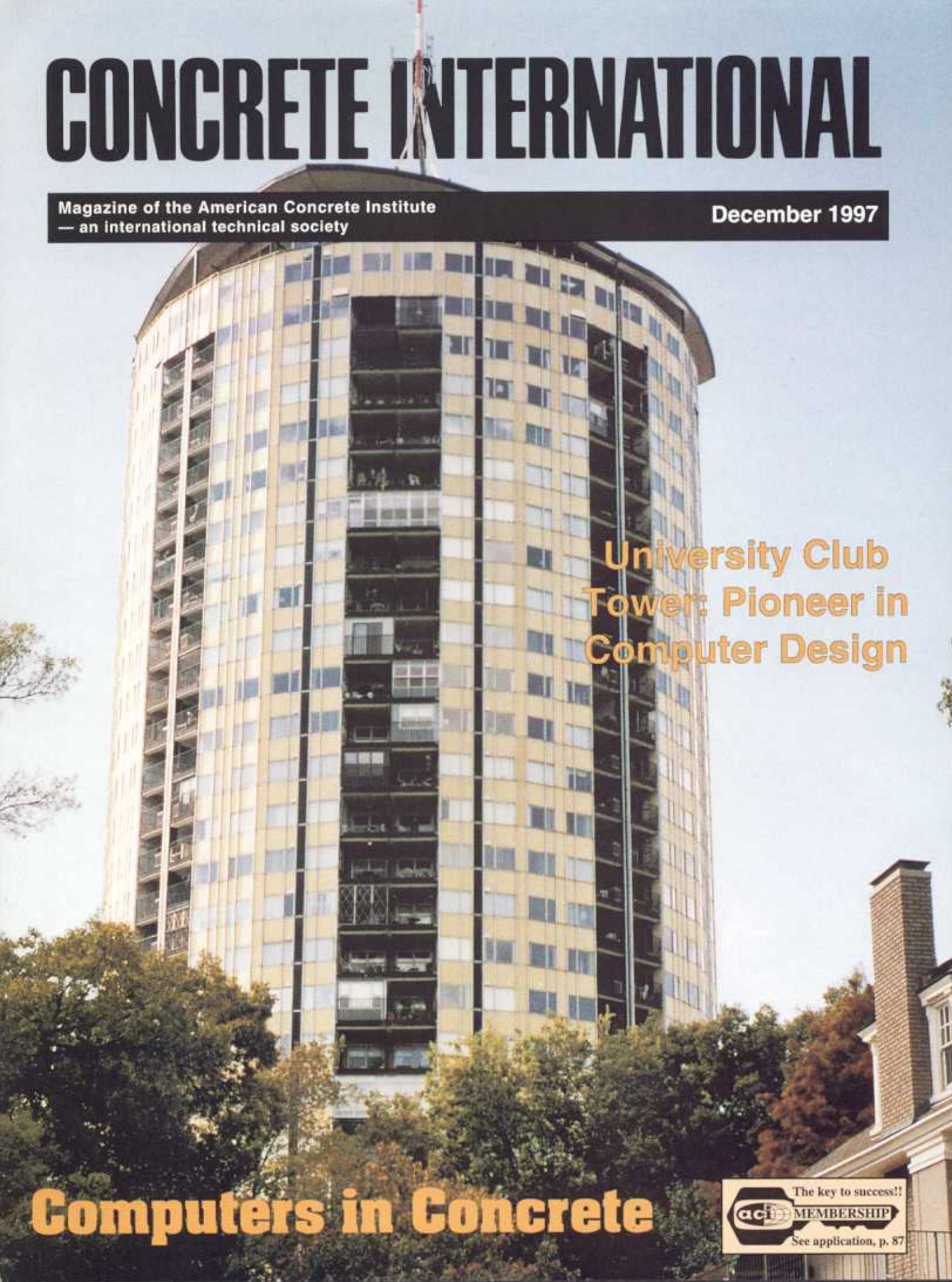

University Club Tower: Pioneer in Computer Design

Computers in Concrete

Looking Back...

by Bill Martin and Fred N. Gauger

A Structure in the Forefront of Computer Design

The 31-floor circular University Club Tower, designed in 1964, was the first major building in the United States designed by a computer. Spearheaded by Fred N. Gauger, a Tulsa, Okla., consulting engineer and former engineering instructor at Oklahoma State University, this unusual multipurpose building used more than 14,000 yd^3 (10,700 m^3) of lightweight concrete. Use of lightweight concrete reduced load significantly and resulted in a reduced column size and extended spacing, a particularly important factor in parking ramp design.

Gauger, one of the first engineers to develop a series of computer programs to determine engineering data for the frame of a building, spent a total of 40 computer hours on the project. Without the computer-aided design, it would have taken four engineers or mathematicians an equivalent of 2 years to do the same thing.

Concern about side sway prompted the computer studies. Similar buildings built at the time allowed for 24 to 36 in. (610 to 915 mm) of sway at the top. This was unacceptable to the owners, who were concerned about the amount of elasticity the building would have to have — tenants might get a little uneasy when their bath water "sloshed" and their light fixtures "swayed" during high winds. With accurate floor-by-floor side sway deflections, the resultant secondary stresses were factored into the overall analysis and were quite significant — about 20 percent. This inclusion is now a part of all building codes as the "P-Δ effect."

Gauger "fed" the building frame information into the computer in 10 minutes. The computer did the rest — solving 248 simultaneous equations in 27 minutes. The completed design indicated the maximum top sway was 10 in. (254 mm), with wind accounting for 5.4 in. (137 mm), and the remainder by a shifting strain from the weight of the structure.

The lightweight concrete used for the entire structure was specified at 5000 psi (35 MPa) at 28 days with a maximum unit weight of 110 lb/ft^3 (1762 kg/m^3) (tests show the splitting tensile ratio was 5.75). Framing of the building is a ring, radial T-beams, and two-way slabs. The first seven floors are a spiral parking ramp with a step-back at the top of the spiral. The exterior of the structure is a curtain wall of glass, aluminum, and insulated wall panels, and the interior consists of metal stud and Sheetrock partitions. The elevator shaft and stair complex consist of both block and cast-in-place lightweight concrete.

Designed as an urban apartment dwelling offering "living in the round," the $7 million building has 236

apartments, ranging from efficiency apartments to two-bedroom units, with each one offering a spectacular "skyview" balcony, where residents can enjoy the panoramic view. Parking facilities provide space for 324 vehicles, with 277 of those enclosed within the main building. The rounded tower apartments, parking facilities, dining rooms, businesses, and club facilities are grouped in an unusual but practical way that revolves around a center core, where residents and visitors alike are whisked from floor to floor by three elevators traveling 850 ft (259 m) per minute.

Selected for reader interest by the editors.

Challenge

The authors would like to issue a challenge to the readers of *Concrete International*: Do you know of a computer designed concrete building that predates the 1964 designed University Club Tower? If you do, submit verifying documentation to *CI* and we'll publish it in an upcoming issue. Send the information to:

Bill Semioli, Editor
Concrete International
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Bill Martin has been the engineer for Chandler Materials Co., Tulsa, Okla., for 15 years. Chandler provided the lightweight aggregate for the ready-mixed concrete and the lightweight concrete block for the construction of the University Club Tower. He is also a founder of the local Tulsa ACI chapter.

Fred N. Gauger is a consulting engineer based in Tulsa, Okla. He received his master's degree in civil engineering from Oklahoma State University in 1961. He has extensive experience in road and building construction, and has developed computer programs for building design.

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