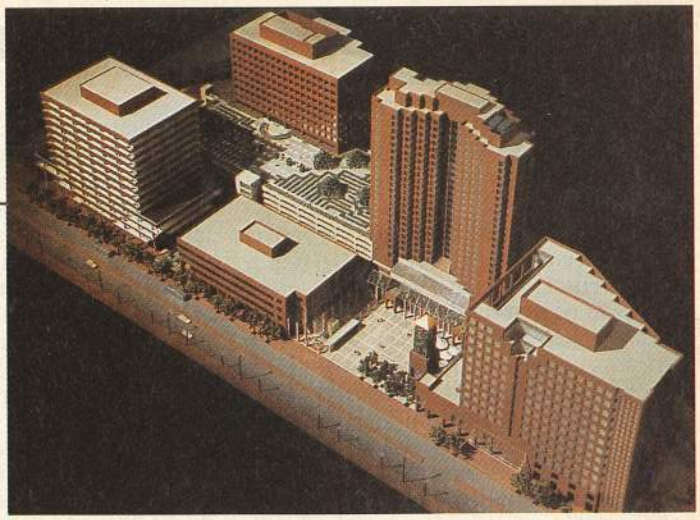
Office building rides ballroom, wraps substation

Time constraint adds pressure to the job



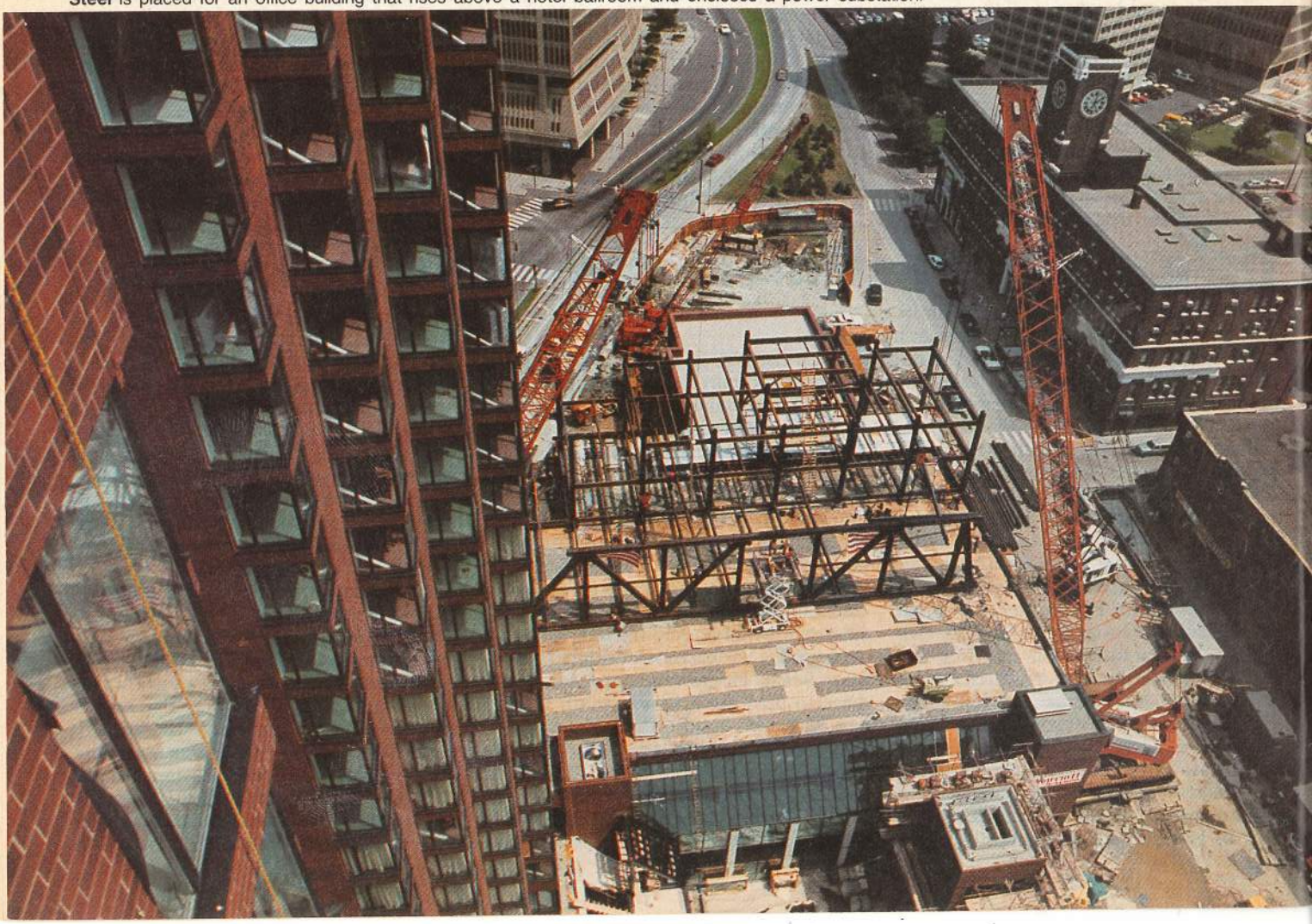
Multi-use complex in Cambridge, Mass., has 2.5 million sq ft.

It took timing and logistics, but they did it. Half of a 12-story office building in Cambridge, Mass., is suspended over a substation that powers the subway line running alongside it. The other half is supported on steel columns rising through the ballroom of the hotel next door.

Although the hotel was scheduled to open in October 1986, the general contractor, the Boston office of Turner Construction Co., couldn't start work on the office tower until last July. The developer, Boston Properties Inc., held off giving the go-ahead on construction until enough leases were signed to make sure the building was economically feasible. Then when Turner did get the green light, the building's foundations, six steel trusses and most of its steel framework had to be in place by October so the hotel could welcome its first guests without cranes on its doorstep.

Turner had separate teams for the hotel and the office building contracts. Andrew M. Fraser, project manager for the office building, says, "It took close coordination of planning

Steel is placed for an office building that rises above a hotel ballroom and encloses a power substation.



and scheduling." Work is now continuing on the upper floors and completion is scheduled for next September.

The 240,000-sq-ft office building is the final unit of the six-building Cambridge Center. The 2.5-million-sq-ft complex will have office, retail, hotel and parking space on a choice 24-acre site near the Charles River. The architect for the current buildings (an early building was erected in 1980) is Moshe Safdie Associates, Somerville, Mass.

Substation enclosed. As well as riding above the hotel ballroom, the office building completely encloses a power substation for the subway. To meet fire codes, up to 8 ft of clearance separates the roof and sides of the freestanding substation from the office building. But massive underground cables radiate from the substation. John R. Roma, vice president of subcontractor New England Foundation, says, "We were tightly restricted as to where we could put the foundations. The power ducts were close to our column lines."

The subcontractor, based in North Andover, Mass., used slurry to drill and pour in place 13 straight-shafted caissons. The caissons are located on three sides of the substation and are socketed into the argillite bedrock 80 to 85 ft down. New England Foundation used compressed air to push bottom soil mixed with slurry from the caisson drill to the surface. At the surface the slurry was desanded and recycled. The caissons were capped, and the caps were joined by grade beams to help distribute lateral loads.

The geotechnical and structural consultants worked closely with the contractor's teams to integrate the construction sequences of the 25-story, 431-room Marriott Hotel and the future office building. Of the 575 piles that had been driven for the complex a year earlier, 40 were placed to support the ballroom and the columns of the office building above.

When work on the office building started, two 20-ft-long caps were constructed atop 16 of the piles placed earlier. "The tops of these caps would have been about 5 ft below the substation's mat foundation," says Keith E. Johnson, senior engineer for geotechnical consultant Haley & Aldrich, Cambridge. "We recommended pouring them in sections and then splicing them in order not to undermine the mat." Screw couplings were used to splice horizontal and diagonal bars to short projections through the forms in the tight excavation.

In preparing for the office building, structural engineer Andrew Lewis of LeMessurier Consultants, Cambridge, arranged for certain columns coming up through the ballroom to be brought through the roof. Stubs were left ready for welding to the office building superstructure elements. The 135-ft-long, 26-ft-high truss—the basic lateral-load-bearing element of the office building—was later set on a line of the stubbed columns. Thames Valley Steel Inc., New London, Conn., delivered the truss just six weeks after getting the specifications from the structural engineers. "In that time we did our shop drawings, bought the material, fabricated the steel, bolted the sections together on the shop floor for inspection, disassembled and delivered," says Walter D. Ohlson, Thames Valley's sales manager.

Ballroom dancing. A truck crane and a crawler crane, each 300 tons in capacity, were used to lift the two sections of the main truss from the streets at opposite sides of the ballroom. The cranes couldn't make the full reach, however. Smaller cranes had to be used as well to hold the sections steady while they were bolted together and secured.

To safeguard the subway tunnel from the danger of cracking or tilting under the weight of one of the cranes loaded with the truss, the crawler crane was assembled in place on a platform supported by four 6-ft-dia caissons. The caissons were sunk 30 ft down on the side of the subway tunnel. From the platform, the crane reached 12 ft across the tunnel. The truck crane at the opposite end of the ballroom was assembled in a vacant lot 300 yd away. To protect a 30-in.-dia gas line from the weight of the crane, the crane traveled to the hoisting position on steel plates bridging the gap between 8-in.-thick concrete walls poured on each side of the pipe.

On the day the two-section truss was hoisted into place, "We had luck with the weather," says Turner's Fraser. If the truss hadn't been placed that day, United Steel Erectors, Everett, Mass., would have had to disassemble the crane and wait for the next weekend. "We couldn't block the street for a whole week," Fraser says.

In the following weeks, five smaller trusses were put in place, spanning the power substation and the 40-ft-wide ramp to the hotel service basement from the ground floor of the office building. Three 80-ton, 80-ft-long trusses were picked in two pieces by 165-ton cranes on each side of the substation. The other two weighed 40 tons and 25 tons and could be handled by single cranes. ■

By Herb Lass in Boston

Main truss 26 ft high was lifted into place in two sections by two 300-ton cranes and smaller cranes.