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MECHANICAL ENGINEERING

Owner Is Radiant About Lobby's Radiant Cooling

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By Nadine M. Post

The immediate attention-grabber upon entering Manhattan's year-old Hearst Tower is the world's largest "air conditioner" a two-story, stepped waterfall, sliced in two by escalators that transport occupants to a third-level lobby, its 70-ft-high ceiling rimmed by windows.

Unlike most lobby fountains that simply recirculate water, the water-covered steps are engaged in cooling and dehumidifying the space. Their practical function may be unusual, but the more significant innovation in terms of cooling and heating is underfoot.

The third level of the media giant's 46-story headquarters building, which contains a cafeteria and other amenities, has a radiant floor, with water-filled polyethylene tubing buried in the concrete topping slab. The slab is thermally controlled to keep the space comfortable even in the humid Manhattan summer.



Radiant-floor cooling in the lobby is called a success at the one-year-old Hearst Tower in Manhattan.

"The unique aspect of the system is the cooling," says David Cooper, managing director of the New York City office of WSP•Flack+Kurtz, the consulting engineer for Hearst Corp.'s tower. Cooper says the building is the first commercial highrise in the U.S. with a radiant cooling system in the

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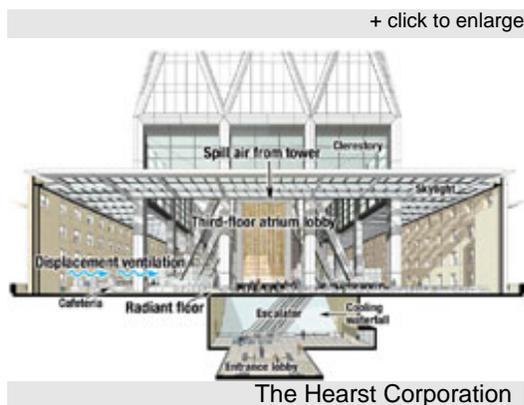
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lobby. The radiant floor is the first in New York City, too, he adds.

The system has been operational through two cooling seasons. The radiant floor has been a success from the start, say sources. "It's terrific," says Vinnie Iacovelli, chief engineer for the building manager, Tishman-Speyer Properties, New York City. "The learning curve was during the commissioning."

The 856,000-sq-ft development, which incorporates Hearst's 1928 landmark headquarters and adds a Norman Foster-designed tower, was engineered to use 25% less energy than a building that meets minimum requirements of prevailing codes (ENR 10/31/05 p. 24). Some of the efficiency is in the radiant floor, combined with displacement ventilation.



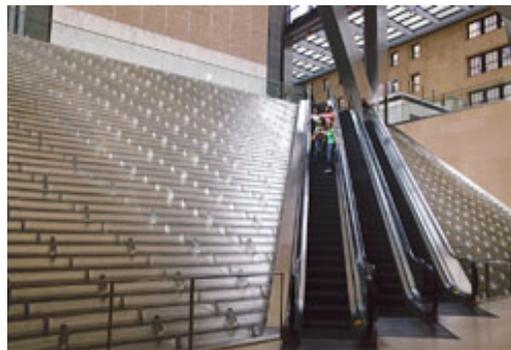
Radiant floors take advantage of "effective temperature," says Cooper.

The true perception of comfort is a function of radiant surface temperatures, air temperature, air velocities and moisture levels, he explains. In most buildings, the only variable controlled is the air temperature.

The radiant-floor system takes advantage of the phenomenon that the sun's rays coming in through the skylight only warm up the surfaces they hit not the air. The heat never really enters the space. With radiant cooling, the sunlight hits the floor, and heat is taken away by circulating water in the embedded pipes, spaced 9 in. on center.

"Because the slab never warms up, the solar energy never becomes a load in the space," says Cooper. Radiant cooling takes advantage of the fact that it is more efficient to remove heat from water than to remove it from air, he adds. The energy required to pump air is more than the horsepower to pump water to remove the same quantity of heat.

The risk of a radiant floor in a hot and humid climate, such as a New York City summer, is puddles on the floor. If moisture gets into the building and passes over a floor colder than the dew point of the surrounding air, moisture will condense. That is why radiant floors historically have not been used in hot, humid climates, says Cooper.



Water-covered steps are used to cool and dehumidify a large lobby space. Evaporation is controlled by precise temperature.

The challenge was to ensure that there was never condensation on the floor under any circumstances. The trick was to keep the surface temperature of the floor above the dew point of the lobby air. In the worst humidity of summer, "we were able to maintain great comfort and no condensation was observed," says Cooper.

Early radiant floors were plagued with problems, says the engineer. Sophisticated digital controls and greater tubing longevity have made systems viable. The key to tubing longevity is an oxygen barrier in the polyethylene. The barrier keeps oxygen in the water from corroding equipment.

Radiant floors do not come with a cost premium, says the engineer. The system is also less visually intrusive because there is no ductwork. "When you factor in the cost of space for mechanical equipment and ductwork, it probably costs less than a conventional system," says Cooper.

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The engineer does not recommend radiant cooling for all spaces. "It's best for large-volume, hardscape spaces with a lot of solar load," he says.

In the lobby atrium, only the occupied space the first 12 ft is conditioned. Solar energy still hits the walls and heats air adjacent to them. In the summer, the air above 12 ft becomes hotter than outside air. "We exhaust hot lobby air and bring in cooler outside air," says Cooper. "We effectively don't have to cool all the heat gain."

Normally in a building, excess air is exhausted to the outside. For Hearst, F+K designed a system that takes excess air from office floors, already conditioned, filtered and dehumidified, and introduces it into the lobby for pressurization and "makeup air" for the kitchen exhaust. The air is already dehumidified, so it does not make the floor wet.

In most buildings, water features use recirculating water that evaporates uncontrollably. "Air moisture levels are high, and odors from the chemical treatment are pervasive," says Cooper. To minimize evaporation, the waterfall is kept 2° F above the dew point.

The owner is very satisfied with the entire system. "The radiant floor works exceptionally well in that it both heats and cools," says Brian Schwagerl, Hearst's vice president of real estate and facilities. "Having a 10-story atrium is quite dramatic but making it comfortable at all times is equally as important, and we've been successful at achieving that."

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