Underneath Soldier Field: turf-conditioning system

Only a decade after their introduction, turf-conditioning systems have become state of the art in new and newly renovated stadiums throughout the National Football League. Two powerful trends spur the demand for green and pliable playing surfaces, even as the NFL season skids into December: owner concern for player health and safety, as well as the drive to maximize the game's visual impact.

Stadiums from Baltimore to Chicago to Green Bay and Denver, among others, now feature turf-conditioning systems, But even groundskeepers in warmer climes are curious about the benefits of underground warming.

"We recently had an inquiry from Florida stadium operator," says Jeff Wiedemann, strategic products development manager for Uponor Wirsbo, Apple Valley, MN. Wirsbo has provided turf-conditioning systems in eight different NFL stadiums, including the very first at Mile High Stadium in Denver in 1994. Wiedemann himself has been the chief designer and engineer on all but that inaugural effort.

Why would a stadium in the South be interested in a heated field? "Because they were intrigued that M&T Bank Stadium (nearly 1,000 miles to the north in Baltimore) can grow Bermudagrass year-round," Wiedemann says. Even in Florida, the temperature will often hit 40 degrees. When it does, depending on the grass-type, their fields may go dormant."

Most turf-conditioning systems will provide some snow melting as the temperatures hover around the freezing mark, making it easier for spectators to follow the action. But protecting falling players against frozen playing surfaces is an equal or greater priority. "The players are the game," says Ken Mrock, head groundskeeper with the Chicago Bears, which moved into its new, turf-conditioned Soldier Field in September 2003. "By keeping the root zone beneath the grass at a temperature well

above 32 degrees, we will make sure the players have a safe and relatively soft playing surface, even in sub-zero conditions."

30-40 miles of tubing

Installed on pea gravel 10-12 inches below the field surface, a turf-conditioning system consists of thousands of feet of high-quality plastic tubing laid in a series of loops on six-inch to nine-inch centers (the spacing depends on the design specifications) and covering the entire gridiron. For most applications, these long loops usually span sideline to sideline, although in Soldier Field they run end zone to end zone. A typical football stadium footprint measures 100,000 square feet, which would require 150,000 to 200,000 linear feet of 3/4-inch or 5/8-inch cross-linked polyethylene (PEX) tubing. Installation generally runs six to 12 days, depending upon the size of the installation crew.

This gigantic loop field is connected through a series of manifolds and heat exchangers to some type of heating plant, usually a staged series of hot water boilers. (Boilers fire one at a time, in "stages," depending on demand.) Pumps move heated water (around 120 degrees) from the boilers through the PEX, which radiates the heat into the root zone above, warming it to a temperature of between 55 and 80 degrees, depending on system parameters. Called "design conditions," these parameters define a root zone temperature (RZT) during a worst-case, winter scenario; e.g., "80 degrees

RZT for outdoor conditions of 8 degrees with a 5 mile-per-hour wind."

Heating plant inputs range from 6.5 million BTU to 11 million BTU, with the higher figure delivering proportionately warmer root zone temperatures. A higher RZT, in turn, will keep the ground softer and the snow at least partially melted through all but the bitterest cold.

So far, so good. But there are serious disadvantages to a high RZT. For one, such a system involves bigger installation and operating costs, because it demands a larger heating plant, bigger pumps, etc. More importantly, a high RZT can destroy what it was intended to protect, says Wiedemann: "There have been cases in which the RZT ran so high, it actually killed the grass."

Wirsbo invariably defers to the field agronomists on the ultimate root-zone design parameters: "They know what their grasses need and can handle," says Wiedemann, who adds that many turf managers employ other types of protection, such as field covers, to keep the field free of sleet and snow when not in use. High-density tarps trap BTUs in the ground during colder conditions, helping to keep the grass warm.

For their part, the Chicago Bears chose to maintain a relatively cool RZT of 55 degrees. "When I first ran the calculations, I was concerned," says Wiedemann. "With a root zone temperature that low, Soldier Field would probably freeze at design conditions [outdoor temperature of 5 degrees with a bracing 15 mph wind]. Ken was aware of that possibility, but his first priority was to protect the grass."

Wiedemann subsequently built in enough extra boiler capacity to accommodate an RZT of 65 degrees. "That way, Ken still has the option of melting snow in December or January," says Wiedemann, "but without jeopardizing the root system and the grass."

Zone defense

Just like your home heating system, the turf-conditioning system in a football stadium is divided into zones. Wirsbo engineers insist upon four at a minimum, sometimes more, depending on conditions. "We have had people approach us for a single-zone system," says Wiedemann, "but we have always managed to talk them out of it." In doing so, Wiedemann uses a two-fold rationale:

• Better control: Different areas of the field experience different temperatures at any given time, espe-

cially in colder months when the temperature differential between sun and shadow can be substantial. This pursuit of control is why the Bears chose to run the loop field in Chicago end zone to end zone, rather than sideline to sideline. Soldier Field is oriented north to south, with a significant portion of the field shadowed by the western grandstand in November or December. The longitudinal layout of the loop field made it easier to balance temperatures between the sunny and shady sections, as the afternoon sun zips across the winter sky. Zoning facilitates this equalizing effort.

"We install multiple sensors in a zone, which typically measures 25,000 square feet," Wiedemann says. "The system's microprocessor then calculates an average across all of these sensors and adjusts the temperature of the water coming from the boiler accordingly. For example, a sunny section of the field will need lower water temperatures than one in shadow: Supply the same water temperature to both, and you either sacrifice effectiveness or energy efficiency."

• Redundancy: Zoning also prevents disaster in the event of a system breakdown, no small matter on game day. "Let's say a pump malfunctions," Wiedemann says. "With zoning, we would lose control only of the zone that pump serves. We can do our troubleshooting and repairs in that zone without having to shut down the entire field."

Owners of other types of sports facilities are growing curious as. Most such inquiries remain strictly in the "kicking-tires" stage, according to Wiedemann, as these operators weigh the advantages against the per-square-foot cost range of $4.50 to $7.50.

"Very few college stadiums have gone to turf-conditioning at this point because the majority host only five or six games annually," says Wiedemann. "Plus, their home seasons end in November rather than late December or January, as in the NFL."

Then again, if a television network is going to pay large sums for the rights to broadcast, its producers will understandably want that product to look first-rate to viewers.

"In addition," says Wiedemann, "many stadiums have become multipurpose, used for other sports as well as for concerts. Studies have shown that turf-conditioning makes the grass more resilient, so it snaps back much faster after the 100,000 pairs of feet have gone home."

Inevitably, word-of-mouth promotion driven by the early adopters of turf conditioning will spur interest and eventually demand. "We use to have to fight to get stadium owners and managers to even consider turf-conditioning," Wiedemann recalls. "But now it has become a routine part of the bidding process, not merely an alternative. ST

Uponor Wirsbo supplied this article. For more information contact Jeff Wiedemann at jwiedemann@wirsbo.com or 800-321-4739.

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