Pipe dreams

Gillette Stadium's turf conditioning system

Photos by John Vastyan

BY JOHN VASTYAN

In the world of professional football, money talks. You might even say it's the foundation for everything that happens on the field. Unless, that is, the field itself is deemed unfit for play, something that quickly affects the bottom line.

Last year, one NFL team learned a costly lesson when their network-broadcast game was cancelled amid furious controversy moments before kickoff. TV images captured the root of the problem when layers of tough artificial turf were peeled back, leaving viewers with the only graphic images from a game that just wasn't gonna' happen. The fans, managers and players were livid. TV audiences aimed their remotes elsewhere, and advertisers wanted a refund. Total damage: an $8 million loss in revenue and some measure of embarrassment.

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A sports turf professional recently said, "The field is the game's foundation. If it's unsafe, you place the entire franchise at risk. A $20 million QB can fall hard and spend the rest of the season in recovery. The condition of the field can be our worst nightmare or an answer to dreams."

There's a trend afoot: Real grass. What gives real turf an advantage, and players the best surface going, lies hidden in the soil where roots receive gentle warmth from miles of pipe that circulate heated fluids.

Gillette's Field

One of the newest and most advanced turf conditioning systems is now hard at work under the field at Foxboro's new Gillette Stadium, home to this year's Super Bowl champs, the New England Patriots. According to Dennis Brolin, the Patriot's field superintendent, the application of technology to enhance turf performance has "finally come of age."

The Patriots' new radiant heating/turf warming system, manufactured by Springfield, MO-based Watts Radiant, uses 153,000 lineal feet, or 29 miles, of cross-linked polyethylene (PEX) pipes that feed warmth to the soil. The manufacturer has installed similar systems for other sports facilities, including Safeco Field and BankOne Ballpark.

Watts Radiant engineer Kolyn Marshall, who designed Gillette Stadium's system, says that turf warming and turf conditioning systems are gaining broad and enthusiastic acceptance in the realm of professional sports especially turf sports, such as soccer and football. The reason is a growing need to protect a team's investment, the players themselves.

According to CNN Sports Illustrated, at the end of the 2001 season there were over

160 injuries reported in the NFL. Of these injuries 21 were ankle-related and 46 were knee-related. Almost half the injuries can be attributed to turf related conditions.

"New turf conditioning systems have evolved substantially in just the last year," says Brolin. "It's an evolutionary process, and Kolyn's's on the grass-cutting edge. You might say he's the Charles Darwin of sports turf technology."

At just 25, Brolin was hired in 1996 as the protégé of Pierre Landry, one of the most respected sports turf professionals in the NFL. When Landry moved on, Brolin stepped in. Within months, the Patriots put him in charge of the 93,200 square-foot playing field Gillette Stadium project.

Unlike what many of us might have done at such an early age, Brolin moved deliberately to research the technology. He recalls many 18-hour days when his focus was entirely set on pounding down the learning curve. He visited experts, hit the books, spoke with manufacturers and installers, logged a thousand-some calls and took trips to turf-conditioned NFL fields in Baltimore, Cleveland, Green Bay and Cincinnati.

Says Brolin, "The turf professionals at each of the facilities I visited were incredibly gracious. They gave me more insight into the technology than I could have expected. Most importantly, I learned from them what went wrong with their systems, or where improvements were needed. Each had a different set of problems, which they shared with me, giving me a huge advantage in making preparations for our field." (See sidebar.)

Even with new developments in irrigation and soil management, the ability to grow turf is directly related to the condition and temperature of the root zone. Constant root zone temperatures help to accelerate turf growth, allowing for faster repair of damaged areas, and also help to maintain a more pliable soil condition, the perfect environment for roots to grow.

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With a turf conditioning system in place, and doing its job, the result is a healthy grass playing surface that's better cushioned, causes fewer skin abrasions or deeper, more serious injuries, and plays well. It improves turf quality, extends the growing season because roots don't go dormant, and greatly reduces maintenance costs because the field is so much more durable. Typically, all sodding, seeding and patching are eliminated.

Does it melt snow?

A turf warming, or turf conditioning, system is similar to a snowmelt system, but there are key differences that separate them. "The main difference is what our goal is," says Marshall. "In a snowmelt system we are trying to melt snow at the surface. To do this we need a surface temperature greater than 32 degrees. In a turf sys-

Each layer adds its own special tweak to the system, e.g., it's important to know what type of stone is to be used so its conductivity value can be accommodated.

tem our target isn't the surface, but rather an area 6"-10" down where the root zone is. This layer is designed to maintain anywhere between 50-60 degree temperatures, depending on the turf, soil conditions, and climatic conditions."

There will be times when a turf system will melt snow, though it's really not designed to do this. According to Marshall, most turf systems aren't operational during the weekends when most games are played.

"The underground pipes are usually moving fluids [a water/glycol antifreeze mix] Monday through Friday," said Marshall. "Typically, the radiant system in the field is turned off a few days before game day, just the opposite of what you'd think. If it did snow, and the system was on, there's a chance that slush would form, becoming a real problem, endangering both players and field."

With the turf system turned off a few days before a game, this also allows the turf to stabilize. In most cases, the heat will have dissipated before Sunday, so the likelihood of seeing snowmelt action during a weekend game isn't too great. A natural, dryer, more stable snow is better.

Before a radiant design can be done, several factors must first be determined. "Among these," says Brolin, "are the actual soil conditions. Most professional fields are multi-layered beginning with a solid base of compacted earth."

According to Brolin, this layer will typically contain the main drain lines that will pull excess moisture from the field. A covering of 1/2 inch washed stone typically supports everything in this layer. Above this, a layer of 3/8-inch peastone stone, or something like it.

"It's in this layer where the irrigation lines and radiant tubing are contained," says Brolin. The next layer is called the root mix layer; it contains a wide range of soil and sand mixtures. Each field will require a different root mix mixture depending on how the field is to be used, the abuse level, the turf conditions and the type of turf used, to name a few.

In addition to the physical properties of the stone, the material's "cut" plays a relatively important part. "Rough-cut stones tend to capture more air pockets than smooth ones," said Marshall. "The captured air pockets decrease the layer's ability to conduct energy. Most stone layers range between 20-40 percent air, give or take, amounting to a considerable amount of 'insulation.'"

The root mix layer introduces an entirely new set of variables into the equation. Here's where all of the root growth takes place, the layer is fanatically fertilized, watered, and aerated. Of these, says Brolin, "Water is the most important factor. Most root mix layers will maintain anywhere between 30-50 percent moisture at any given time, depending on the turf that's used. Water helps to increase this layer's conductive ability, creating a much more even temperature distribution."

Understanding how each of these layers is constructed is just the beginning. The next step is to determine where the radiant tubing is to be placed. This decision is influenced by layer construction and also by how the field is to be maintained.

Aeration is a key component. Different fields will require different aeration techniques, but one thing is the same: something must penetrate the field in the aeration process. The radiant tubing, and any irrigation equipment, needs to be deep enough not to be damaged or interfere with the aeration process. In most fields, the construction is such that the build up is uniform, creating a "domed" effect as one looks across the field. This method helps with water control and also allows for even depth of all components.

To Brolin, the most critical part of the system's performance happens at the point where heat moves from the pipes to the root zone mix. Fluids in a pipe of up to 130° to 140°F would be very hard on grass roots, so this became a key interest of his. He learned that, if exposed to those temperatures, the roots would gradually die, root pathogens would proliferate and moisture would be pushed up to the surface where field-tenders least want it.

Zoning a radiant turf warming system plays a critical role. It's influenced by mechanical constraints, such as how the supply and return lines are accessed, field abuse (which areas need faster recovery) and solar exposure, based on knowing when certain areas of the playing field will be warmed by the sun. The shape of the stadium and the shadow it casts chiefly determines the amount of solar exposure each section of the field receives.

For the Patriots, a six-zone system was created with three zones on either side of the 50-yard line. Tubing runs parallel to the sidelines, from the end zones to the midfield and back. Four-inch manifolds were installed along each end zone for the 3/4-inch E-PEX to connect to.

"After seeing the system go in, and studying the plans, we recently were told by professionals with a large commercial construction firm that our tolerances were tighter and more demanding than those made of the firm when building high-rises," says Brolin. "I guess that didn't surprise me entirely!

"Nothing will ever replace grass," says Brolin. "But you've got to have the system in place to support it. Every detail has to fall in place. It all comes down to quality control, the right plan, the right installers, and the right materials manufactured to perfection. ST

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