



The Dirt on Turf

What You Need to Know
About Synthetic Turf and
Natural Grass for Athletic Fields

Written by:

David Millar of Red Hen Turf Farm, New Carlisle, Indiana

and

Aaron Loan of Blue Grass Enterprises, Cedar Rapids, Iowa

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For people to completely understand all the costs, use restrictions, and maintenance tasks of artificial turf, they either need to have had many years of experience maintaining natural turf, attended numerous artificial turf seminars and spoken with people who actually maintain artificial turf, or have been directly involved with all areas of managing an artificial field for over 10 years.

The chance that a school or park department has such a person is very slim. Aaron Loan of Blue Grass Enterprises and David Millar of Red Hen Turf Farm have developed a Beginner's Guide to Artificial Turf and a Fact-Finding Guide to assist schools and park departments as they consider artificial turf. The Beginner's Guide follows a logical path of learning about the important details of owning artificial turf and then follows with a worksheet you can fill in with your own costs. Upon completion, you will have a good understanding of the risks and true costs of owning an artificial field.

Who wrote this and why

David Millar of Red Hen Turf Farm, New Carlisle, Indiana, and Aaron Loan of Blue Grass Enterprises, Cedar Rapids, Iowa, are turfgrass producers who independently explored installing artificial turf as an additional division to their turfgrass production. After a lengthy investigation period, both decided not to install artificial turf because they concluded that artificial turf is not an economical alternative to natural grass in most school and city situations.

They have watched though, as schools and towns decided to install artificial turf

without ever seeming to have considered many important facts. Artificial turf is so new to most people that they simply don't know what questions to ask.

This is exactly why they wrote this booklet. The Beginner's Guide to Artificial Turf is a concise "What a Board member needs to know" education about artificial turf. The Fact-Finding Guide is a step-by-step model schools and towns can use to ask the tough questions and gather their own figures.



A Beginner's Guide to Artificial Sports Turf

The only thing that natural grass and artificial sports turf have in common is that they are green and used for sports fields. Because they are both referred to as “turf,” people tend to think they are similar. Some may think artificial turf is better because it does not need to be mowed, watered or fertilized. However, there are many crucial differences between natural and artificial turf. Schools and individuals should be educated about differences in maintenance, pricing, repair, injury risks and environmental concerns.

How to use this information

The purpose of this paper is to provide you with information that may not be provided by artificial turf salespeople, so you will be empowered to ask the right questions as you go through the process of deciding if artificial turf is right for your situation. If your school is in the process of making a decision about whether to install an artificial or natural turf field, please read through the information found in this Beginner's Guide first, and then use our Fact-Finding Guide to help with your decision of whether an artificial field makes sense for your situation.

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Comparisons

In recent years, artificial turf has emerged as an alternative to natural turf. However, we are only now beginning to understand the long-term effects of an artificial field on our athletes and environment as well as our budgets. Before you make comparisons, remember that natural grass fields offer a range of quality when it comes to construction (i.e., good, better or best). Be sure you are not comparing a “good” natural grass field that was installed 20 years ago with today’s “best” artificial field. One should compare a newly installed natural grass field with a newly installed synthetic surface. Lastly, be sure to check that the costs of the field are kept separate from other stadium improvements, such as bleachers, concession stands and lighting.



Background Information on Artificial Turf

There are two parts to an artificial sports field, the base and the infilled carpet. The base is comprised of a layer of coarse stone or rock that contains drain tile. The infilled carpet has fibers that are about two inches long and an infill material (usually a mix of crumb rubber and sand) is brushed into the fibers, leaving about half an inch of exposed “leaves.”

The carpet has a life of about eight to 12 years and must be replaced for appearance and player safety. Often this replacement is necessary because the infill is too hard and the plastic fibers have broken off.

Maintenance:

- Artificial turf fields must be vacuumed to remove all leaves and debris. They must have the fibers brushed up regularly and occasionally be deep raked to loosen up the infill. Fields must also be disinfected, washed, and have loose seams repaired. Chewing gum and hard candy must be softened with a solvent and then hand pried out of the fibers. Sunflower seed shells are particularly difficult to remove.



- Most artificial turf companies routinely promote greatly reduced maintenance costs with their product, which can be misleading. For example, it is true that less fertilizer is used, but more labor is needed. In the Midwest, artificial turf maintenance managers report a range in savings from a little to none with artificial turf.

- At least four specialized tools are needed for artificial turf maintenance:
 1. A brush for the fibers.
 2. A rake to stir the infill (to keep it from getting too compact).
 3. A sweeper to pick up debris.
 4. A sprayer to disinfect and spray anti-static material. (Since a football field is about two acres, a hand sprayer would take too much time, so a bigger sprayer is needed and it must be dedicated to the artificial field and cannot be used for spraying weeds.)
- Fields with nearby trees need more sweeping than those without trees.
- Repairing loose seams is a common problem that becomes more frequent as the carpet ages. These loose seams need to be repaired promptly to avoid liability issues. Every different color of infill, like hash marks, logos, or lines is a glued seam and these will need repair. (Some artificial manufacturers are reducing the number of onsite seams by weaving some lines in during the manufacture of the carpet, but a football field with hash marks and yard lines still has many seams.)
- To repair a loose seam, or fix a spot in the field that has settled or been torn, the process is to vacuum out the infill. If the damage is below the carpet, the carpet must be cut in order to reach the problem. The base must then be re-leveled, the carpet put back and the seam glued. The infill is dumped from the vacuum and brushed back into the carpet until level.



Health and Safety Issues of Artificial Turf

Heat:

The surface of an artificial sport field on a sunny day in the summer can reach more than 140° F. This is hot enough to cause dehydration, heat stroke and blisters on the bottoms of the feet of players. Watering an artificial sports turf field will lower the playing surface temperature, but only for about 20 minutes. The following is a video link to a report on the temperature of artificial fields from Greenwood, Indiana:

http://www.wishtv.com/dpp/news/Turf_Temperatures_20090730

Player safety:

Many reports show players suffer more joint injuries (especially knee, ankle and foot) on artificial turf when compared to players competing on natural grass, especially in contact sports. This is because artificial turf generally gives better traction, which allows for tighter cuts and faster speeds than natural grass. Unfortunately, artificial turf is less likely to “release” an athlete’s planted cleat, which can result in more severe injuries more often.

<http://www.medpagetoday.com/MeetingCoverage/AAOS/19020>.
<http://www.x-cdtech.com/nacob/Abstracts/37.pdf>



“As of 2010, all professional baseball teams who play outside do so on natural grass.”



The MLB:

As of 2010, all professional baseball teams that play outside do so on natural grass. Teams that once had artificial grass, like the Reds, Phillies, Pirates, Cardinals and Mariners, have chosen natural grass when updating their fields.

The NFL:

In 2008, the players in the NFL were given a survey regarding their opinions on playing surfaces in stadiums. The NFL conducts player surveys every two years, and the results have been consistent since 2002:

- 84% of NFL players believe they had more injuries when they played on artificial grass over natural grass.
- 92% of NFL players said they had more soreness after a game when they played on artificial grass.
- 71% of NFL players prefer to play on natural grass.
- 92% of NFL players felt that playing on artificial grass shortens their playing career.

<http://www.turfgrasssod.org/images/documents/033120094200980.pdf>

Environmental Impact of Artificial Turf

Environmental costs of artificial turf

- In 2006, the Athena Institute conducted a study researching how much a school would need to do in order to offset the carbon footprint of an artificial field. The purpose of the study was to estimate the greenhouse gases emitted during the life cycle of an artificial turf field as opposed to a natural grass surface. The study determined the number of trees to be planted to achieve a 10-year carbon neutral synthetic turf installation. The result was that 1,861 (+23%) coniferous trees would be needed to be planted as a carbon offset.

http://athenasmi.org/projects/docs/UCC_project_ATHENA_technical_paper.pdf

- Researchers have analyzed compounds emitted from the crumb rubber used in artificial fields. They found over 25 chemicals were released over time, some of which are known to cause cancer. Artificial fields have not been in use long enough to determine if this exposure is harmful to people; however, we can be sure that athletes, coaches and fans are being exposed. Once the chemicals are in the water, exposure becomes a community-wide risk. These compounds will be washed into the soil, the ground water, or collected by a sewer system (depending on how the field was designed to handle rain).

http://www.ehhi.org/reports/turf/turf_report07.pdf

- The current working cost for disposal of an artificial turf field is more than \$1.00 per square foot (some estimates are as high as \$2.25 per square foot). The crumb rubber and sand infill mix can weigh more than 120 tons. Currently, car tires cannot be disposed of in a landfill, but crumb rubber infill can. Whether landfills will continue to accept crumb rubber at their sites is unknown.

Environmental benefits of natural turf



Natural grass does not need a carbon offset. A new study conducted by Dr. Ranajit (Ron) Sahu, an independent environmental and energy expert and university instructor, shows that responsibly managed lawns sequester, or store, significant

amounts of carbon, capturing four to seven times more carbon from the air than is produced by the engine of today's lawnmowers. The findings are based on several peer-reviewed, scientific studies and models in which carbon sequestration had been measured in managed and unmanaged turfgrass. The study, titled "Technical Assessment of the Carbon Sequestration Potential of Managed Turfgrass in the United States," goes on to report that to maximize carbon intake benefits, lawns and other turfgrass areas must be actively managed by doing the following:

- Choose quality turfgrass species right for your area
- Keep your mower in good shape
- Leave your clippings on your turf
- Water responsibly

If one compares a well-managed lawn to a poorly managed lawn or unmanaged grasslands, the net carbon intake of a well-managed lawn is five to seven times higher than the carbon output of mowing. Dr. Sahu says the key is to actively manage your lawn to improve its carbon intake.

Comparison of Financial Investments

	Top Quality Sand-Capped Natural	Professional Stadium Sand-Based Natural	Synthetic
Construction	\$350,000	\$700,000	\$900,000
Annual Maintenance x 10 Years	\$150,000	\$500,000	\$100,000
Replacement After 10 Years	\$35,000	\$50,000	\$540,000
Annual Maintenance x 10 Years	\$150,000	\$500,000	\$100,000
Replacement After 20 Years	\$35,000	\$50,000	\$540,000
AVERAGE ANNUAL COST	\$36,000	\$90,000	\$109,000

One way to compare costs between natural grass and artificial turf is to estimate the costs of constructing the field and divide it by the years of life. For example, envision a brand new football field within a track (usually around 90,000 square feet). The chart above shows the estimated costs for three different fields of this size: a Top Quality, Sand-Capped Natural Field (considered to be a top quality high school or NCAA field); a Professional Stadium Sand-Based Natural Field (an NFL field); and a Synthetic (Artificial) Field. The following quoted prices are estimates from an actual sports field contractor for local new construction football field projects.



Financial costs of artificial turf

- **Construction Costs:** The cost of the base is \$5.00 per square foot. The cost of the carpet and infill is also \$5.00 per square foot. The total cost is \$900,000.
- **Maintenance costs included for artificial:** painting, top dressing, brushing, disinfecting, carpet repair, water cooling and weeding (does not include cost of buying new equipment). The cost shown above is a minimum maintenance schedule. Actual costs may be higher.
- **Artificial fields have a set life of eight to 12 years (sometimes less) and must be replaced** because they become very compacted or the fibers have been worn away. The base of an artificial field is expected to last 20 years or perhaps more. The cost to remove and dispose of the field after 10 years is \$1.00 per square foot (or more) which would be \$90,000. The cost of the new carpet and infill is \$5.00 per square foot for \$450,000 for a total cost of \$540,000. (Current industry quoted figures are used. No one knows whether replacement carpet and infill will come down in price or go up in price.)



Financial costs of natural turf

- There are two parts of a natural grass field: the base and the rooting medium that holds the plants. Providing a rooting medium and base that have good drainage is the goal. As a general rule, a better draining field costs more. The Top Quality Sand Capped Natural would be viewed as one of the best high school or NCAA fields in the Midwest that could easily handle 25+ games per season.
 - Maintenance costs included for natural grass: painting, top dressing, fertilizers, pesticides, aeration, sod replacement, irrigation, equipment and manpower. These costs would provide for a very extensive maintenance program and are more than what most schools spend on maintenance for a single playing field per year.
- Natural grass fields do not have a fixed life. A field could feasibly be used for more than 20 years and not have to be replaced. Thirty (or even more) years are possible before renovating would need to be considered. If budgets are tight, natural fields can often be coaxed to last a few more years.
 - Should an event or weather problem damage natural turf more than over-seeding can repair, it can be cut and replaced with sod between sporting event seasons. Advances in equipment technology have made this a quick, easy and inexpensive task. This fix works well, especially for soccer goal wear areas.
 - On a football field, the area between the hash marks receives the most wear. With newer equipment, this area (around 22,000 square feet) can be renovated with new sod for about \$9,000. This includes removal, grading, sod and installation.
 - Based on these figures, natural grass is about \$70,000 cheaper per year than artificial grass. Installing natural grass instead of artificial turf can save the school in excess of \$1,460,000 over 20 years, money that could be spent on other projects or programs.

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Additional costs of artificial turf fields

Artificial sports fields are more fragile than natural grass fields. For example, if a vehicle spins out when driving on natural grass, the plants simply grow new leaves. On artificial grass, the damaged fibers remain damaged and need to be cut out and replaced with a service call from the artificial turf company. Anything that pokes into artificial turf (i.e. high-heeled shoes, folding chairs, a table, etc...) will push the fibers down into the carpet, need repair and void the warranty.

Liquid spills are also a problem on artificial turf. Mold can be problematic and sugary drinks will increase mold growth on artificial turf. Vomit and animal droppings also require cleaning. Oil or fluids from a vehicle can stain the fibers. Water and cleaners are often needed to dissolve the spills and wash them away from the fibers and into the crumb rubber. On the other hand, natural grass repairs itself or is unaffected by any of these circumstances.

Non-sporting events, like a graduation ceremony, can be damaging and costly to artificial turf. To protect the artificial field from damage, the school should put down tarps for liquids, and then a layer of 3/4" plywood. (They would need two 10,000 square-foot tarps that cost about \$1,500 each. They would need about 600 sheets of 3/4" plywood costing about \$20 each and weighing 50 pounds each. The plywood would cost about \$12,000 and would weigh about 18,000 pounds). In addition, the school would need employees to lay down, pick up and store the materials. Or, the school could rent a temporary floor. A typical rent would be \$0.75 per square foot, plus the delivery to and from the renting facility. It would take four people about six hours to lay down the floor and another six hours to pick it back up. Just the rental of the product would be about \$15,000.

“Artificial sports fields are more fragile than natural grass fields.”



Fact-Finding Guide for Artificial vs. Natural Turf Fields

Questions to Ask if Your School is Considering an Artificial Sports Field

Artificial sports fields are a relatively new technology. As a result, it is difficult to know enough about them to know what questions to ask. This guide provides an informed list of questions to ask the school board, architects or salespeople about artificial versus natural turf in order to decipher the best solutions for your situation. The answers you receive should help you decide to accept or reject a proposal, based upon accurate information and a financially responsible budget for your project.

This guide is intended for board or committee members who are evaluating whether to install an artificial sports field and parents or taxpayers attending an informational meeting about installing an artificial sports field.

Major renovations to a sports facility can be very expensive. Consider all of the information carefully before making your decision.

Fact-Finding Guide



“ Major renovations to a sports facility can be very expensive. ”

Background Information for Your Current Natural Grass Field (and most common responses)

1. How long ago was the field constructed? (Natural grass fields have a life of 20-plus years.)
2. How does the school rate the original installation or last renovation? (Good, better or best)
3. Does it have native topsoil or a special root-zone mixture? (Native topsoil generally means it probably is an average quality field.)
4. Has it been renovated? If so, when?
5. What is the reason for renovation? (Can't keep grass in wear areas, not level or smooth, weeds, always muddy...)
6. How old is the in-ground irrigation system? (They last about 20 years.)
7. How many sporting events are hosted on the field each year? Has the number increased in recent years?
8. What other events is the field used for? (Graduation, Relay for Life, physical education classes.)
9. What is the school currently spending in labor and materials for the maintenance of the current natural grass field? (The school will have to dig through records to find the material costs. They will likely have to estimate the labor due to poor tracking. Do not accept figures supplied by the artificial turf salespeople.)
10. How many times per year does the school core aerify the field? (Should be two to five times a year and make two to three passes per time.)





11. What sports turf training has been provided to the groundskeepers?
12. If none, has the school employed a person who specializes in sports field maintenance either as a consultant or contractor to assist in improving the field? (Local landscapers and golf course superintendents, while having good intentions, are not specialists in sports turf maintenance any more than your family doctor is qualified to be your heart surgeon.)
13. Has the school reduced the amount of labor or money available for sports field maintenance as a result of budget cuts?
14. What are the costs for constructing a new, state-of-the-art, sand-capped natural grass field with excellent drainage and irrigation? (\$250,000 - \$350,000 for a football or soccer field.)
15. What are the estimated annual costs for a top-notch maintenance program of a sand-capped natural field? (\$15,000)
16. What would be the cost of natural turf replacement for the entire field? (Approximately \$35,000 for a football or soccer field.)
17. What would be the cost of sod replacement for the heaviest wear areas? (Football fields would be around \$9,000 for between the hash marks.)
18. Has the school reviewed the environmental benefits of natural grass?

Basic Questions About Artificial Turf

(and most common responses)

1. What is the fixed life of the artificial sports field? (Generally, artificial fields have a life of 8 to 12 years and must be replaced.)
2. What are the reasons the field must be replaced? (Fibers get worn away exposing the infill and the surface becomes very hard.)
3. What is the life of the base? (No one knows for sure, but at least the life of two infill, or about 16 to 20 years.)
4. Is a sprinkler system recommended, and if so, what is the cost? (Sprinkler systems are sometimes installed as a way to cool the playing surface to reduce heat stress on players.)
5. Has the school board investigated the current status of heat issues of artificial turf (surface temperatures can reach more than 140°F)? What policy will the school have to protect players?



6. How long is the warranty of the new field? (Eight years.)
7. What types of problems are covered with the warranty? (Defects in manufacturing.)
8. Generally, what types of problems are not covered by the warranty? (Normal wear, damage caused by non-sport events, improper maintenance, loose seams, fading color.)
9. What turf protection measures are required to maintain the warranty for non-sport events? (A tarp is needed to collect spills. A layer of 3/4" plywood is needed to protect the turf from high-heeled shoes.)
10. What maintenance practices are necessary for artificial turf? How often must these things be done? (Sweeping up debris like leaves and trash, brushing to stand up fibers, raking to loosen infill, spraying disinfectant or anti-static, hand removal of gum, repairing loose seams by re-gluing and cleaning of vomit, spit, sweat, blood and animal droppings.)
11. What record-keeping requirements are required by the school maintenance people to submit to the turf manufacturer? (Generally, number and type of events and maintenance practices performed.)



“Artificial sports fields are more fragile than natural grass fields.”

12. What equipment is needed? (Sweeping unit, brush unit, rake unit, and sprayer.)
13. What equipment is included with the purchase of the field?
14. Which pieces of equipment will the school need to purchase, and what is the estimated cost?
15. What is the estimated cost to remove and dispose of the old infill at the end of life? (Depending on where the artificial turf comes from, the range could be from \$0 to \$2.50 per square foot. Make sure to check with your local landfill, as well as local trucking companies, for estimated costs.)
16. What is the estimated cost of the new carpet and infill? (About \$5.00 per square foot.)
17. How does the school plan to pay for the carpet replacement in eight to 10 years? (Save up each year? Issue a bond?)
18. Will the school try to remain carbon neutral on this project? (This would mean planting 1,861 additional trees to remain carbon neutral.) If so, what are the projected costs for the new trees, installation and maintenance?
19. Has the school board investigated the current status of increased injury issues of artificial turf? (Artificial turf has been linked with increased injuries and ranks poorly among NFL players in opinion polls because of this.) What policy will the school have to protect players?
20. Has the school board investigated the current status of chemical exposure issues of artificial turf? What policy will the school have to protect players?



Coming to a decision

1. Try to estimate the annual cost over 20 years of having a natural grass field and do the same for artificial turf.

	Natural Turf Field	Synthetic Turf Field
Initial Construction Costs		
Costs of Additional Equipment Needed		
Costs of Additional Plantings to Remain Carbon Neutral		
Estimated Annual Maintenance x 10 Years		
Estimated Removal & Replacement After 10 Years		
Estimated Annual Maintenance x 10 Years		
Estimated Removal & Replacement After 20 Years		
AVERAGE ANNUAL COST (total cost/20 Years)		

2. Is the additional cost of having artificial turf the best place to spend that money?
3. Are the additional health and increased number of joint injuries on artificial fields worth the risk?
4. Is the negative environmental impact of artificial turf being properly considered?
5. Would budgeting money for reconstruction of a natural sports turf field be possible?
6. Would additional budgeting for the annual maintenance program of a natural sports turf field be worth the money?

“Is the negative environmental impact of artificial turf being properly considered?”





Other things to consider:

- If a school has an ample budget, enough labor, attends sports turf maintenance seminars or employs a sports turf specialist, and the natural turf is not acceptable, the next thing to look at is the quality of the field when it was constructed. For example, fields constructed with the “soil that was there” will not look as good or stand up to wear as well as a field with a good draining soil, ample irrigation and good drainage system.
- If a school does not have land near it to expand, and the turf is used for physical education classes, recess, and multiple sporting events all year long, artificial grass should be considered.
- Some fields are used by several schools intensely in the fall and spring, which may not allow the turf a chance to recuperate. In this case, the best option may be to have the turf replaced with new natural grass every year. Surprisingly, when considered over 10 or 20 years, this option is likely to be less expensive than artificial turf.

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