

Synthetic/Natural Turf Task Force report

We are publishing this report for two reasons: 1) As a resource for less experienced turf managers, and 2) so sports turf managers have something they can share with all stakeholders in athletic field-related choices and decisions.

The Sports Turf Managers Association (STMA) prepared this guide to provide basic information about the selection and maintenance of synthetic turf and natural turfgrass fields. Because each field is different, the guide offers general information with additional sources to access for your specific situations. This information is not relevant to indoor facilities or to baseball/softball fields. All references to synthetic turf are to the newer rubber infill technology, which has had more widespread use since 1997. All references to natural turfgrass are for native soil fields, unless otherwise specified.

Constructing the field

The most commonly asked question about sports fields relates to the cost to construct them. Just as many factors affect the maintenance of fields, so does the cost to construct them. The cost to construct either field type will vary dramatically depending upon field size; geographic location; labor costs; amount of site work required; irrigation system (needed for each field type); and number of estimated games or activities.



Natural field being aerified. Photo by Ross Kurcab, CSFM.

There also may be state and local regulations governing construction, such as requiring an environmental impact study before construction. Items that should be considered when developing a scope of work for athletic field construction:

- Architectural/Engineering
- Light Towers
- Environmental Impact
- Consulting
- Excavations/Site Prep
- Permits
- Bonds and Insurance
- Engineering & As-builts
- Surveys
- Earthwork/Grading
- Erosion & Sediment Control (silt fence, inlet sediment trap, construction entrance, permanent grassing, and monitoring)
- Storm Drainage System (perimeter drain, tie into catch basin, outfall installations, and base trench drain)
- Bleachers
- Sidewalks
- Fencing

Synthetic turf

Additional factors may affect the cost of constructing a synthetic turf field:

- Accessibility for heavy equipment
- Type of underground drainage system
- Drainage profile
- Design and engineering
- Edge material
- Type of attachment along edges
- Turf density or denier as they vary from product to product
- Type of backing
- Sewed or glued lines
- Type of pad and its thickness
- Rubber and/or sand infill
- Intricacy of logos and end-zone lettering

Following is a typical cost range and what is included in that range to build a synthetic field in the Southeast with the excavated subgrade already provided. (Numbers provided by Tony Strickland, CSFM, Athletic Construction, Inc.)

Synthetic Infill- \$7.80 to \$110.75 per sq. ft. Cost includes:

- Rough Grades
- Curbing and Tack Strip
- Carpet & Rubber Fill
- Lines and Logos
- Geo Textile
- Labor
- Base design and Installation
- Stone & Freight for base
- Drain Collector
- Lateral Drains
- Padding
- Sod & Topsoil Backfill of Curb
- Laser Grading & Compaction
- Equipment & Trenching
- Material Distribution Labor
- Meters
- Backflows

- Irrigation System
- Cleanup and Goal posts

To help you calculate average construction costs for synthetic and natural turfgrass fields, the actual playing surface of (American) football fields are typically 360 x 160 feet, or 57,600 square feet. Normally, a field will extend at least another 15 feet around the playing field boundary.

Natural turfgrass

Here are some specific items that may affect the cost of native soil fields:

- Drainage modifications
- Top soil costs
- Type of cultivar, propagation and its accessibility
- Thickness and mixture
- Accessibility for heavy equipment
- Design and engineering
- Soil interface issues, if sodding a field

Following is a typical cost range and what is included in that range to build a natural grass field constructed of native soil(s) in the Southeast with the subgrade already provided.

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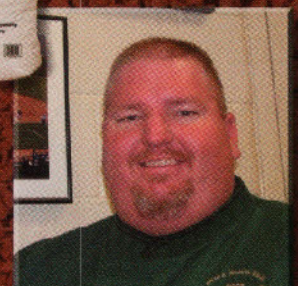
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- Sod & Installation
- Field Lay-out & Stripping
- Topdressing
- Laser Grading & Compaction
- Equipment & Trenching
- Material Distribution Labor
- Meters
- Backflows
- Irrigation System
- Cleanup and Goal posts
- Grow-in Maintenance

Natural with On-site Native Soil (less than \$1 per sq. ft. with no added topsoil or sod). Includes:

- Rough Grades
- Laser Grading
- Seed or Sprigging
- Minimal Irrigation System
- Clean Up
- Final Tillage, Fertilization, Lime Addition
- Grow-in Maintenance

Although this guide specifically focuses on native soil fields, it may be helpful for comparison purposes to have cost ranges for constructing two types of sand-modified fields. These ranges also assume that the excavated subgrade is already provided and are for fields constructed in the Southeast.

Natural with Sand and Drainage \$6.50-\$7.95 per sq. ft. This includes everything noted in constructing a natural with native soils field, excluding the topsoil, including the addition of a 2-inch choker layer, 6-inch sand peat layer, geotextile and geotextile install, 4- and 6-inch perforated piping, and a gravel layer. These fields are typically built for colleges or professional sports where play must occur during almost any weather condition.

Natural with Sand Cap \$3.50-\$5.25 per sq. ft. This includes everything noted in constructing a natural with native soils field, but replaces the topsoil with a 2- to 4-inch sand layer.

Because many factors can contribute to the field's construction cost, it is recommended that your sports turf manager research recent field construction that has like characteristics and a similar environment. For further information, contact the STMA at 800-323-3875 for referral to relevant local and regional resources. Additional information may be obtained by contacting the ASTM, www.ASTM.org, which has released a standard on sand-based field construction (F2396-04); the Synthetic Turf Council, www.syntheticturf.org, the American Sports Builders Association, www.sportsbuilders.org, or the Turfgrass Producers International (TPI) at www.turfgrass.org.

Protecting the asset

As with any major asset, synthetic and natural turfgrass sports fields need well-planned and funded management programs to protect the owner's investment. This includes hiring a dedicated and knowledgeable sports turf manager to develop and implement the program. Management of both surfaces also requires a budget that reflects the amount of activities that may be on the fields. The budget must have the flexibility to expand as the demand for field time increases.

Maintenance and cultural practices will vary based upon these factors:



Rubber mix used for resiliency on synthetic fields. Photo by Darian Daily.



Example of synthetic field padding. Photo by Darian Daily.

FACILITY & OPERATIONS

- Amount of use and level of play
- Multi-sport use
- Weather and climate
- Soil and terrain
- Water availability and irrigation system
- Budget including personnel availability
- Owner's goals
- Type and quality of field construction
- Field security (protection against vandalism, non-regulated play, etc.)

A sports turf manager can develop a cost effective program specific to each field's requirements.

Synthetic turf

All synthetic turf manufacturers have recommended grooming practices. Generally, these include sweeping, dragging, and watering for a clean, uniform appearance. Depending upon use and weather conditions, a sand-rubber mix may need to be added annually to help restore the field's resiliency. The sports turf manager will also need special knowledge in troubleshooting and minor repairs, such as seam repair and snow removal. The installer can provide this information per the manufacturer's guidelines. Special solvents and cleansers are used to remove tough debris. Proper testing and a good design will usually mean that drainage is not a problem, if the field is constructed correctly. If the field is used for more than one sport, a plan will need to be developed that follows the manufacturer's recommendations for changing markings. Options may include using different paint colors for different sports; painting over existing lines with green paint; or actually removing the lines and repainting.

Typical maintenance costs to maintain a synthetic field will vary and can range from \$5,000 to \$25,000 per year (cost range provided by Dr. A.J. Powell, Jr., University of Kentucky) including labor, minimal

equipment depreciation and water. It is much more expensive to maintain synthetic fields that are highly visible, frequently televised, or when used for multiple sports. The cost can even be higher if field markings must be painted and cleaned often, or if frequent repairs are necessary.

Natural turfgrass

The most commonly constructed fields for schools and recreational use are native soil fields. These fields usually drain more slowly than synthetic turf and sand-modified fields, and a 1.5% crown is suggested for most fields.

Just as sand-modified fields are more costly than native soil fields to construct, they are also more expensive to maintain. Although sand-modified fields are playable during heavy rainfall, they do not generally wear better than natural soil fields and intensive maintenance is necessary.

All natural turfgrass fields are living, breathing organisms that require mowing, watering, fertilizing, time off from play, and, depending upon disease and pests, the application of plant protectants. To help ease compaction from heavy play, fields may be aerified once or twice a year. Debris is usually removed by mowing, and flushing the field with water removes most other foreign materials. Painting these fields is fairly simple and involves mowing out or washing out existing lines and painting new ones.

Here are some examples of maintenance costs: A Denver-area native soil field, with Kentucky bluegrass and perennial ryegrass that hosts approximately 110 soccer events annually will cost between \$5,500 and \$8,000 per year to maintain, not including equipment and labor. (Provided by Dave Rulli, Jeffco Stadium, Lakewood, CO.)

In New York state, a high school native soil field with perennial ryegrass and Kentucky bluegrass that hosts approximately 15 fall



Dragging the field to prepare for game day. Photo by Darian Daily.



Topdressing a football field. Photo by Ross Kurcab, CSFM.

football games and 30 lacrosse games in the spring will cost approximately \$4,000 annually (not including equipment and labor. (Provided by John Gaffney, Central Henrietta Schools, Henrietta, NY.)

Managing special events

Is there anything special required to host non-sports events for synthetic turf and natural turfgrass, and how will the special event affect the warranty?

These events could include concerts, graduations, dirt shows, fireworks, overflow parking, etc. Care must be taken to protect each type of field surface. Typically, a sports turf manager will place a protective covering over the turf and will develop a plan to safeguard the turf during the event. Types of materials that should be considered to protect the field surfaces for staging and roadways are: 3/4-inch plywood (may require two layers); pre-manufactured road mat; and geotextile blanket.

Other materials are available for flooring protection under the staging and for the seating areas. These products should be investigated to find the one that best suits the event situation. The use of these additional materials to host such events should be taken into consideration and incorporated into the overall cost to produce the event.

For synthetic turf, concerns from these events include: burns from fireworks, cigars and cigarettes; surface contamination (debris);

security; and the weight of materials (staging) resulting in major damage to the grade, which can be expensive to repair.

Flooring that is more specialized for seating may be necessary for certain events (graduation and concerts). Warranties should be reviewed before holding events to prevent voiding them.

For natural turfgrass, preventive fungicide applications may be necessary based on the climate conditions and the duration of the event. Surface contamination (debris), weight of materials (staging) are concerns that should be addressed during planning. Sod and grade may be affected by the weight, length, and type of event, which could result in repairing the grade or replacing the sod. When planning for the event, the field's normal schedule must be able to accommodate the additional time necessary following the event to repair the turf. If the length of the event has caused irreparable damage to the turfgrass, time and resources must be allocated to replace it.

Developing an equipment list

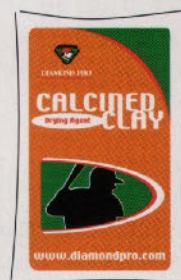
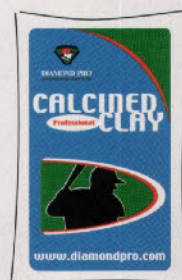
Your sports turf manager will develop a capital budget and replacement schedule, and a utilization schedule to optimize the use of all equipment and accessories. School districts and parks districts often share equipment among different departments. Care should be taken to use all equipment per the manufacturer's instructions.



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Synthetic turf

- Grooming equipment; typically some type of broom, brush or tine that is dragged over the field to stand the synthetic fibers up and to distribute the crumb rubber.
- Utility cart for grooming/cleaning equipment, pushing snow or operating sprayer.
- Spraying equipment to stop weeds from growing through the synthetic surface, to lessen the static charge from the crumb rubber, and to apply wetting agents.
- Sweepers to remove trash and other materials from the playing surface.
- Blowers (backpack and 3-point hitch) to blow clean the turf of trash.
- Vacuum to remove small items, such as sunflower shells and peanut shells.
- Topdressing equipment to periodically re-dress areas that have lost crumb rubber.
- Sanitation equipment and sprays for the spot removal of bacterial growth from bodily fluids

Optional:

- Pressure washers or other flushing equipment to remove unwanted fluids or contaminants.
- Spiking equipment for de-compaction and/or to help with redistribution of crumb rubber.
- Irrigation system (some manufacturers require irrigation to maintain warranty)
- Painters for adding additional lines and mechanical scrubbers for cleaning painted lines on the synthetic turf.
- Special rubber blade snow plow

Natural turfgrass

- Mower; rotary or reel depending on turf species, quality requirements, etc.
- Irrigation system
- Aerator: core or plug type, typically pulled behind a tractor or utility vehicle.
- Fertilizer spreader/weed and pest control sprayer; typically pulled by a tractor or utility vehicle.
- Line Painter: available in walk-behind or riding configurations

Optional:

- Blower and/or sweeper for debris /litter management
- Deep tine aerator
- De-thatching equipment, typically pulled behind a tractor
- Seeder, typically pulled behind a tractor
- Topdresser; utility vehicle mounted or pulled behind a tractor

Addressing heat on fields

There are temperature differences between synthetic turf and natural turfgrass fields. On synthetic fields athletes may experience high field temperatures on sunny days. One study published in the Journal of

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Installation of a special logo on a synthetic field. Photo by Darian Dally.

Health, Physical Education, and Recreation, showed surface temperatures as much as 95 to 140 degrees Fahrenheit higher on synthetic turf than natural turfgrass when exposed to sunlight.

High humidity can also cause a high heat index that can cause fields to have high surface temperatures. Higher temperatures transfer heat from the surface to the sole of an athlete's foot, which can contribute to serious heat-related health problems. Watering the field before a game on a sunny day may lower the surface temperature. However, more research is needed to determine the effectiveness of pre-game watering. If the majority of your games are played in the daytime in a hot, humid, or sunny climate, you may need to alter your game schedule and work with your sports turf manager to implement specific techniques to reduce the field's surface temperature.

In these situations, it is strongly suggested that you purchase an infrared thermometer so that the surface temperatures can be monitored continuously and activity delayed if the temperature rises above a set level. Some have set this temperature at 125 degrees. For more information, go to <http://cropsoil.psu.edu/mcnitt/Infill7.html> and <http://cropsoil.psu.edu/mcnitt/infill7a.cfm>.

Natural grass has been shown to be a temperature reducer. According to a United States Golf Association study, natural grass keeps areas cooler on a hot day. The temperature of natural grass rarely rises above 85 degrees Fahrenheit, regardless of air temperature.

Athletes' health and safety

The most important element of a sports turf manager's job is to provide the safest fields for athletes, regardless of the level of play.

In addition to heat, limited research has been conducted on the safety and playability of synthetic surfaces. These surfaces continue to evolve, so long-term data is not available. The National Collegiate Athletic Association (NCAA) is collecting injury data from numerous men's and women's sporting events across the U.S. but presently does not have sufficient data. Research studies are being conducted on field hardness and epidemiological issues.

Because these are new surfaces, environmental issues such as disposal of these materials (which contains metals) and their ability to be recycled has not yet been addressed by the EPA.

It is important to budget for the future disposal of a synthetic field. A typical cost range is: Tear-out and Disposal=\$1.75 to \$2.25 per sq.ft. (range provided by Tony Strickland). This does not include transportation costs or additional landfill surcharges for environmentally controlled products.

Properly maintained natural turfgrass provides a less abrasive surface for play than a synthetic surface. Studies by the USGA have shown turfgrass to be a natural filter of environmental pollutants. There are no disposal issues with natural turfgrass field material.

Assessing warranties

Warranties provide the sports turf manager with assurances from the provider that the product is what was specified in the contract and that it will perform as expected. A warranty should not be confused with the expectation for the life of the product.

What are some key points of the warranty?

Synthetic turf: measurable benchmarks (Clegg impact testing, GMAX); pile fiber loss; shock-absorbency; drainage; seam and inlay integrity; events that would void warranty.

Some synthetic turf installers will have a separate warranty for the adhesive that was used during installation. The adhesive manufacturer should provide this information. Warranties may have exclusions. Examples may include:

- Use of improper cleaning methods
- Acts of God and other conditions beyond reasonable control
- Normal wear
- Failure to properly maintain, protect, or repair
- Burns, cuts, accidents
- Failure of subbase
- Use of incorrect grade of infill
- Failure to maintain infill at correct level
- Use of improper footwear or equipment

Currently, the Synthetic Turf Council is working to develop a wear warranty that will help ease fears and give "realistic expectations" of the life of a field. For more information regarding this topic go to www.syntheticurf.org.

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Natural grass usually has limited warranty coverage for newly constructed and renovated fields only, typically from grow-in until the start of play. Drainage and irrigation are usually covered for the first 12 months. The following may be defined in the warranty:

- Installation benchmarks (survey/grading marks)
- Soil testing (particle testing-sand specific)
- Seed/sod testing (verify product) and certified as weed-free
- Events that would void warranty
- A recommended maintenance schedule

A warranty is a promise to perform from the contractor. It is best to investigate the financial strength of the product manufacturer and check existing customer references to determine how different companies honor warranty obligations. Failure to follow prescribed maintenance practices can void a warranty. Insured warranties help ease fears that the warranty is protected in case a company goes out of business. Most bonds will protect the field in case of bankruptcy by the contractor. Insured warranties are not all the same. Make sure that you read the warranty, ask questions about the warranty and get answers in writing. Consult with a non-biased party to determine if they are worth the extra monies that they cost.

Other Considerations

As you evaluate your specific needs for a new sports field, you may want to consider the following:

STMA Task Force

There were many in the industry that provided information for the Guide. Special recognition goes to the STMA Synthetic/Natural Turfgrass Task Force for their dedication to this 10-month project and for their collaborative work on this guide.

Task Force members include:

Chair Abby McNeal, CSFM, The Chicago Fire
Mike Boekholder, Citizens Bank Park, Philadelphia
Darby McCamy, Evergreen Synthetic Turf LLC
Mike McGraw, Surface Solutions North America
Dr. Andrew McNitt, Penn State
James Newberry, Graff's Turf Farms
Dr. A.J. Powell, Jr., University of Kentucky
Tony Strickland, CSFM, Athletic Construction, Inc.
David Wallace, Tee and Green Sod, Inc.

- Hiring an independent consultant to represent your interest. Only select qualified consultants. You may want to seek a certified sports field manager, a sports turf manager, or an agronomist who has prior experience with the construction of natural and synthetic sports fields.

- The qualifications of the contracting firm, and in particular the experience of the project manager assigned to your project. The number of fields the project manager has installed is particularly important. Other information to obtain could include the company's project references, length in business, insurance coverage, litigation history, warranty coverage, etc.

As you move through the qualification process, you may want to ask these questions of a contractor:

- Explain the most common things that can go wrong with a project and how you fix those things?
- How can we save money on the construction of this field?
- How do you see the field performing in light of the usage we have described? ■



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