


**REVIEW OF
MULTI-USE PLAYING FIELD
SURFACES**

by

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MULTI-USE PLAYING SURFACES

Introduction

Virginia Tech is considering developing a new soccer complex. Many choices need to be made about the construction of the facility, including the soil composition essential to supporting a new soccer pitch and the types of surfaces that can be used for the playing field, either natural grass or artificial turf. The type of soil composition will be based on the type of surfaces selected. Natural surfaces have three basic cost levels: expensive, moderate, and low. In addition to the natural surfaces, there are two common types of artificial turfs which are typically used. These two types of turfs vary in price. An athletic department should make informed choices about the type of surface to be utilized within budgetary constraints.

Purpose

The purpose of this project was to gather and present information that allows the Virginia Tech Athletic Department to make an informed decision on the best choice of a new multi-use playing surface. The project provides information on initial costs, different types of surfaces and maintenance costs of five different potential surfaces.

Justification

Virginia Tech has recently added a women's soccer program. With this addition, a need for a new soccer pitch has arisen. This field will be utilized by

the men's and women's soccer programs, so it must be able to withstand approximately (20) home games, each fall and spring. The athletic department has begun investigating the costs of a new field. Virginia Tech administrators have expressed interest in artificial surfaces that could be used by men's and women's soccer, as well as lacrosse and field hockey teams.

Delimitations

This project addresses building a multi-use field at Virginia Tech only. This geographic limitation affects which natural surfaces can be considered. For instance, there are two surfaces which utilize types of Bermuda grass that will only grow in the southern United States. The author researched three different types of natural turf that could grow in this particular locale. The author, based on his own personal experience, chose the best two natural surfaces to play soccer on. These two were Bermuda grass and Kentucky Bluegrass.

Review of Literature

Throughout the last few years a great debate has raged: artificial turf or natural grass. This is the question that many athletic departments and professional teams have had to answer. King (1993) discusses the positive and negative aspects of each surface and he points out that artificial turf is less forgiving than a natural turf field. In his research, he has found that professional athletes prefer to play and practice on natural turf. These athletes

believe that the natural surface extends their playing career.

Although most athletes prefer natural surfaces, some athletic directors prefer artificial turf because the artificial surfaces can be used for several sports without having to remark or resod the field. Although this may be true, many athletic departments have been very successful in developing natural surfaces which can be easily maintained with little cost.

For instance, Rutgers University has just built a new soccer/lacrosse facility (Athletic Administration, 1993). This facility will be used by both men's and women's soccer in the fall and by men's lacrosse in the spring. The athletic administration at Rutgers University believes that the cost of maintaining a well used natural surface will be minimal compared to the overall cost of an artificial field (Athletic Administration, 1993).

Another reason athletic directors like artificial turf is the perceived cost savings. Some athletic directors believe that in the long run they will save money by installing an artificial turf field. One article explores the cost of artificial turf cost and maintenance (Schmidt, 1988). Artificial turf is said to be very costly initially. Prescription Athletic Turf (PAT), the most expensive type of natural surface, is considerably less costly than artificial turf to install. The upkeep of the natural turf field, especially the painting of the lines and symbols, is more expensive over the long run than artificial turf. According to a senior Chicago Bears Executive, the cost of a PAT field and an artificial turf field are

relatively the same over a ten year period (King, 1993). Ten years is the commonly recognized "life span" of an artificial turf field.

Even though the debate continues as to which type of surface is preferable, there is agreement on how both types of surfaces should be installed. Both must have a good base soil composition and a good drainage system. The base soil should consist of a good mixed loam with a depth of twelve inches. This loam should be ninety percent sand and ten percent clay (Penman, 1977). The soil should be packed for natural surfaces and crowned with no greater than one percent slope for artificial surfaces.

There are standard dimensions and direction that guide an installation of a multi-purpose field. The dimensions of the field should be one hundred and twenty by eighty yards, set in a north - south orientation (The American Institute and American Association for Health and Physical Education, 1974).

In regard to natural surfaces, the drainage systems should be arranged so that water conservation is maximized. Moisture sensors can be installed with sump pumps that will maintain proper water levels for the base soil. This moisture control system will promote growth and strengthen the root system (Schmidt, 1988). There are many similarities for the installation of natural and artificial surfaces. The issue becomes one of cost balancing. The cost over time will be very similar but the choice becomes one of high present costs as opposed to long term cost spreading.

Athletic departments should also consider how athletes view the surface choices. Most research has shown that athletes prefer to play on a natural surface. Athletic departments should consider the athlete's view and the recent trend in the professional leagues to move to natural surface facilities (King, 1993).

Methods

The author gathered available literature on multi purpose turf surfaces. This was followed by personal and phone interviews with representatives of established natural surface and artificial turf companies to gather information and to obtain pricing information. The author interviewed professionals from two architectural firms who had expressed an interest in the new facility at Virginia Tech. Virginia Tech's turf grass research professors were also interviewed.

The author talked on the phone to three sellers/installers of artificial turf: Ballsom (Mr. Lee DeFrites), EDEL (Mr. Duke Oxford), and Southern Turf Nurseries (Mr. Bennie Jones). Three sellers/installers of natural surfaces were contacted by phone: Southern Turf Nurseries (Mr. Bennie Jones), PAT (Mr. Motz), and Graviturf (no name given). Both artificial and natural turf companies quoted prices over the phone and sent information about the multi-purpose fields to the author. The author talked on the phone with Dr. Channel and personally interviewed Dr. Chammers of the Virginia Tech Turf and grass

Research Department. Two architectural firms were contacted and interviewed in person. International Sports Management (Mr. Don Paige) and WMBO (Mr. Rob Moje) were contacted and interviewed. The architectural firms and Turf and Grass Research professors provided information about the kinds of surfaces that the could be used and the companies that carried the products needed.

The author reviewed the National Collegiate Athletic Association (NCAA) rules that govern the field dimensions and characteristics for the sports that may use the new surface. At this time, the Virginia Tech Athletic Department has expressed an interest in holding NCAA tournament competition for men's soccer and women's soccer at the new facility. It is, therefore, imperative that the field meet all NCAA regulations for tournament play.

The author has been involved in planning meetings for a new soccer facility. Site constraints have been raised at the meetings. These constraints are addressed in the project.

The following is an outline of the project:

I. Introduction

II. Initial Needs and Constraints for a Multi Purpose Playing Area

III. Natural Turf

A. Prescription Athletic Turf (PAT)

- 1. What is it**
- 2. How it is installed**
- 3. Initial Cost**
- 4. 5-year maintenance (projected)**

B. Bermuda Grass Sod

- 1. The grass's needs in order for it to grow**
- 2. Drainage system to be used**
- 3. Initial cost**
- 4. 5-year maintenance cost (projected)**

C. Kentucky Blue Grass Sod

- 1. The grass's needs in order for it to grow**
- 2. Drainage system to be used**
- 3. Initial cost**
- 4. 5-year maintenance cost (projected)**

IV. Artificial Turf

A. Conventional Turf

- 1. What it is**
- 2. Drainage system needed**
- 3. Initial cost**
- 4. 5-year maintenance cost (projected)**

B. Sand Based Turf

- 1. What it is**
- 2. Drainage system needed**
- 3. Initial cost**
- 4. 5-year maintenance cost (projected)**

V. Choice of Turf for Tech

A. Materials for Choice

B. Analysis of Potential Problems

VI. Conclusion

**REVIEW OF
MULTI-USE PLAYING FIELD
SURFACES**

Introduction

Virginia Tech has recently added a women's soccer program, and the Athletic Administration is considering adding women's lacrosse, men's lacrosse, and women's field hockey. With the prospect of these teams having to use the same facility at different times throughout the year, the Athletic Department is looking at several multi-purpose surfaces which could accommodate all the different athletic teams. Preliminary assessment of the playing surface established five different types of natural and artificial surfaces that could be used at this new multi purpose facility. The five different types of surfaces are three natural turfs: PAT Vamont Bermuda, Vertical Drainage Vamont Bermuda, and Crowned Kentucky Blue Grass; and two artificial turfs: sand based and conventional artificial turf. A site for the new facility has been chosen by the Athletic Department. The site is located at the band practice area which is to the left of Rector Field house. The author will assume that the new multi-purpose facility will be located there.

Initial Needs and Constraints for a Multi-Purpose Playing Surface

The predetermined site has an initial drainage cost which will be constant for all five types of surfaces. This cost is associated with the water run-off from all five surfaces. It will cost \$100,000.00 to dig an irrigation ditch to allow for the excess run-off.

The ground at the site is ready to be graded, and no additional dirt or clay

is needed. The irrigation system is the same for all three types of natural surfaces. The system will be a Toro watering system, which is already used by the Athletic Facilities Maintenance group at Tech. The artificial turfs will not require a irrigation system. The cost of the grading and irrigation systems will be included in the prices quoted for all five surfaces. Four of the surfaces will be crowned (4) to (6) inches or 1/2 percent. The fifth will be crowned ten to twelve inches or one percent. The crown will help with drainage and the esthetics of the new facility. No new dirt will be needed to make the crown; the cost will be part of the price quoted.

Virginia Tech would like to hold NCAA Division I playoff matches at this new facility. The multi purpose field will be 380 feet by 230 feet (87,400 square feet); this will allow Virginia Tech to host a playoff game in all three sports: soccer, lacrosse and field hockey. The multi-purpose field meets the NCAA regulations for all three sports.

Automated Drainage for a Vamont Bermuda Grass Field

This would be the most expensive natural surface field considered for the new facility. The automated drainage system or Prescription Athletic Turf (PAT) system is an electronically controlled irrigation and drainage system allowing the user to control the water level above and below the field. The PAT system works with a vacuum drain that takes excess water and stores it until needed. When water is needed, the vacuum can reverse itself and provide

water directly to the root system.

The PAT system utilizes a twelve inch excavated area. An extensive network of trenches are then cut into the excavated area. Then the excavated area is filled with layers.

Insert Figure 1 about here

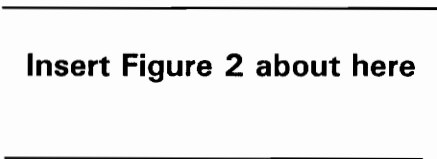
Figure 1 provides a look at the layers required to support the PAT system. First, a plastic liner is laid down over the whole field. Two four inch collector drains with several two inch slitted tubes are placed on top of the liner. The two inch surface irrigation pipes are placed on the barrier and pairs of moisture sensors are implanted in the root zone in pre-selected locations throughout the field with insulated wires extending to the site where the control panel is. The PAT vacuum system pumps are then installed. The main drainage lines are connected to the PAT system. A bed of sand is laid next followed by a two inch layer of sand, peat, and soil mix that forms a root zone. Then the Vamont Bermuda sod is laid down on top. Because a field with no crown will look concave, a crown of 1/2 percent should be used to make the field look flat. This is accomplished by adding more sand, peat and soil mix where needed.

An average cost for this new turf facility would be \$5.75 a square foot, which would total \$502,550.00 (\$5.75 per sq. ft. * 87,400 sq. ft.). The

annual projected maintenance program can be broken down in terms of labor, equipment, and supplies, which on average totals \$30,000.00 a year. This multiples to a five year total of \$150,000.00. As such, the total projected total cost for the first five years is \$652,550.00.

Vertical Drainage for a Vamont Bermuda Surface

The vertical drain or Gravity drain system is similar to the automated drainage system described previously. Gravity drain is a system of layered surfaces that drains off excess water when needed.



In Figure 2, the gravity drain system is shown with four different layers involved. To install the field an area 14 inches deep must be excavated and lined with plastic. Two six inch perforated collection drains with several two inch slitted tubes are situated on top of the plastic liner. Then three to four inches of pea size gravel is placed on top of the collection tubes. A six inch layer of sand is put on top of the pipe and gravel. On top of the sand a two inch root zone is formed by combining sand, peat, and soil. Then the Vamont Bermuda sod is laid down. The field should be sloped 1/2 percent for better drainage and esthetics.

This gravity drain system will cost on the average \$2.50 per square foot

or \$218,500.00 for the initial installation. The average projected maintenance cost for a year is \$15,000.00, including labor, supplies and water. Thus, a five year projected cost is \$75,000.00. The projected total cost over the first five years is \$293,500.00.

A Crowned Kentucky Bluegrass Surface

The Kentucky Bluegrass surface would be the least expensive type of any of the surfaces discussed in this project. One would only need to excavate seven inches deep, replacing the excavated soil with a four inch layer of sand, and then two inches of a mixture of peat, sand, and soil for a root zone. The top soil completes the field and crowns the field ten to twelve inches or one percent. The larger crown is required to permit any excess water to run off to two collection drains placed on either side of the fields. The Kentucky Bluegrass sod will then be laid on top.

The average cost of this surface will be \$1.25 per square foot or \$109,250.00. The yearly maintenance cost will average \$5,000.00 for water, labor, and supplies. The five year projected cost is \$25,000.00. The projected total cost for this type of facility over it's first five years is \$134,250.00.

Conventional Artificial Turf

For conventional turf, one would need to excavate an area fourteen inches deep.

Insert Figure 3 about here

Figure 3 shows that this area should be filled with a twelve inch layer of stones or asphalt. Underneath this layer of stone or asphalt two four inch perforated drainage pipes will be laid down. On top of the stones or asphalt a one inch elastic layer or impact cushion of synthetic rubber is added as a shock pad. Then the patches of knitted nylon artificial turf are laid on top and sewed together. Holes are punched through the artificial turf and elastic layer in order for the water to reach the drainage system. The field should be crowned six inches or 1/2 percent for esthetics.

The average initial cost of the materials needed for the surface is \$8.75 per square foot or \$764,750.00. The installation cost of these materials will be \$3.50 per square foot or \$305,900.00. The annual maintenance cost for the conventual turf averages \$10,000.00. This would cover any painting, stitching, or replacing of turf that may be needed. A projected five year total maintenance cost is \$50,000.00. Accordingly, the projected total cost for this surface over five years is \$1,120,650.00.

When considering artificial turf the one needs to look at the replacement cost. An artificial turf surface is guaranteed by warranty for an average of seven years. The expected life of an artificial turf surface is ten years. This

means after ten years the surface must be replaced, requiring another million dollars at that time for a new surface.

Sand Based Artificial Turf

The sand based turf is installed and layered exactly like the conventional turf, but the top layer is different. After the patches of nylon turf are sowed together a layer of sand is imbedded at the base of the nylon. This makes the bristle of nylon stand up, which gives the surface a more grass like quality. Different types of athletic balls will roll "truer" on this surface compared to the conventional artificial surface. Sand based turf will play more like a natural surface field than a conventional artificial turf field.

The sand based turf material costs on average about \$7.50 per square foot or \$655,500.00. The installation of the turf will be the same as the conventional, \$3.50 per square foot or \$305,900.00. The total average cost of material and installation is \$961,400.00. The yearly average maintenance cost is \$12,000.00. This cost will cover replacement of sand or turf, stitching, or painting of the turf. The projected five year maintenance cost is \$60,000.00. The total cost for the surface over a five year period will be \$1,021,400.00.

As with conventional turf, the sand based turf is only guaranteed for seven years on average. The sand based turf will also need to be replaced after ten years of use on average. A new surface will cost over a million dollars.

Surface to be used at Virginia Tech

The new facility at Virginia Tech must withstand the home games of at least four different athletic teams throughout the year. Over (30) soccer and field hockey matches will be played on the surface during the fall season and in the spring over (20) lacrosse games will be played on the surface. The surface must be tough and durable. The author believes that the PAT surface and drainage system will be the best choice. The Vamont Bermuda grass is a durable grass that is perfect for a field that will be used this often. The PAT's automated drainage system can drain over twenty-four inches of water an hour, keeping the field dry and safe to play on. Teams could play on the surface during or immediately after a rain storm and not tear up the field.

Since Virginia Tech is hoping to host a Division I playoff game for men's soccer and women's soccer, the NCAA is more likely to give a first round game to a facility that has a natural grass surface than one with an artificial turf field. In the long run a PAT system would be less costly because the sod and drainage system will not have to be replaced as often as an artificial surface and drainage system.

Like any mechanized system problems can arise. This is why it would be important to get a warranty on installation of the PAT system. The guarantee could take care of any problems that might arise.

Some turf and grass researchers have speculated that Bermuda grass will

not grow or might die during the region's first frost. Virginia Tech's Turf and Grass Research Department has assured the Athletic Department that the new strand of Vamont Bermuda grass will grow and survive at Virginia Tech.

The major downfall of the PAT is that it is very expensive to install. The cost of the system may not be within the budget of the Athletic Department at Virginia Tech. However, the new surface will be used by four or more athletic teams; if the Athletic Department combined their facility budgets for all four sports, they may find enough money to afford this state of the art facility.

After conferring with the Turf and Grass Research Department and receiving the assurance that the climate in Blacksburg will support Vamont Bermuda grass field and after considering the other factors discussed in this project, it is the author's belief that a Vamont Bermuda PAT field should be used for the new multi-use facility. A field of this quality would be able to withstand the abuse from several athletic teams. The initial cost of the PAT system will be outweighed by the benefits in recruiting and longevity of the surface. If Virginia Tech's Athletic Department is serious about being competitive with the top athletic programs in the nation, its facilities must be competitive. A state of the art facility, with a PAT system will be a step in the right direction.

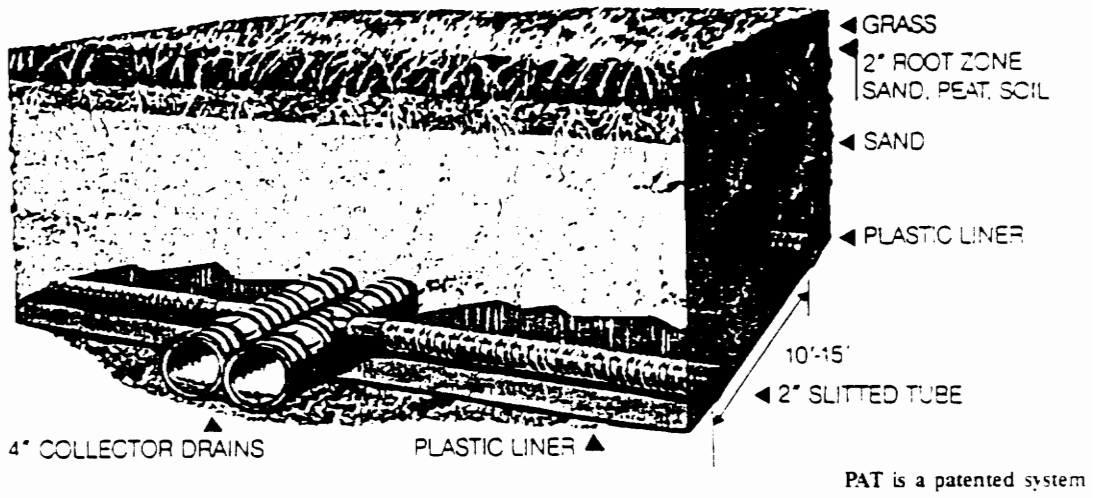


FIGURE 1 - Automated Vertical Drainage System

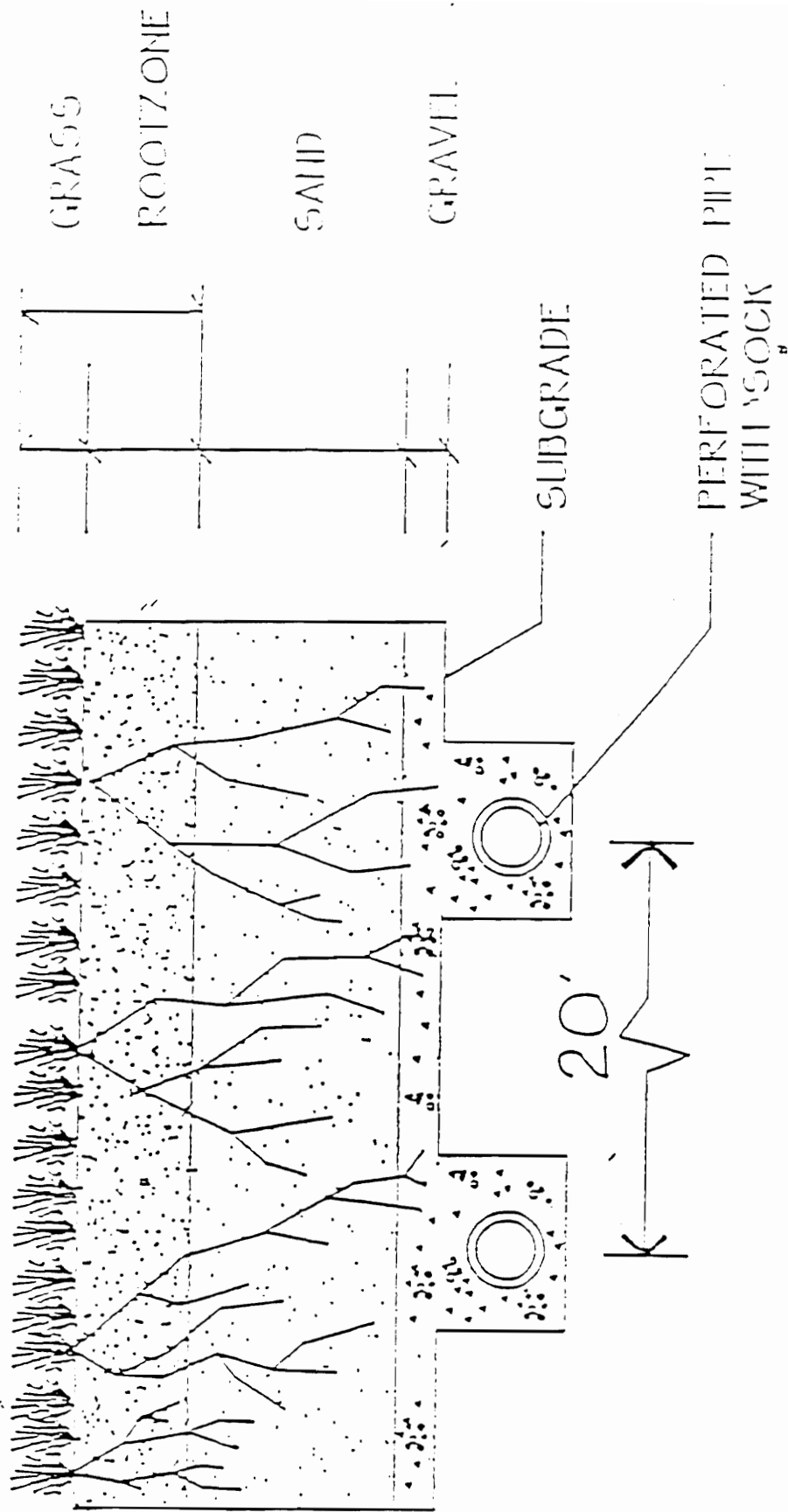


FIGURE 2 - Vertical Drainage System

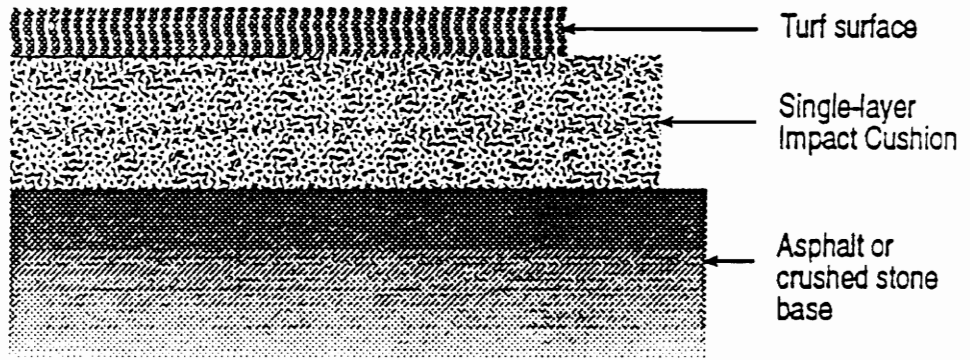


FIGURE 3 - Artificial Turf System

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