



Baseball Field Maintenance

A General Guide for Fields of All Levels



The Baseball Tomorrow Fund

This publication is provided by the Baseball Tomorrow Fund, a joint initiative of Major League Baseball and the Major League Baseball Players Association.

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Introduction

Preface

The information in this document is provided as a general reference guide for the maintenance of a baseball field or facility. Professional and international baseball federations and organizations follow similar guidelines pertaining to the dimensions and needs for baseball field development. The information provided in this document should be used only as a resource in the development of a baseball playing field; this information does not represent the only means and methods of baseball field development.

This document is a summary comparison of field establishment processes. These findings may illustrate potential solutions for construction, maintenance and safety for the field of play; however, all areas regarding potential field development may not be identified in this document.

Please note that certain country or regional laws and standards may apply to the construction of athletic fields. Therefore, the guidelines found in this document do not imply that a specific field does not comply with worldwide baseball standards. This document was written in 2006.

About the Author

Murray Cook, President of Brickman Sports Turf and field consultant for Major League Baseball and the Baseball Tomorrow Fund, has over 30 years of experience in the management of professional, collegiate and youth baseball fields worldwide. Mr. Cook, in collaboration with the Baseball Tomorrow Fund, created this document to provide a resource for baseball field development and field maintenance for organizations involved in all levels of the game.

About the Baseball Tomorrow Fund

The Baseball Tomorrow Fund is a joint initiative of Major League Baseball and the Major League Baseball Players Association. The program is designed to promote and enhance the growth of baseball throughout the world by funding programs, field projects, equipment, uniforms and other selected program expenses to encourage and maintain youth participation in baseball and softball. Since its inception in 1999, the Baseball Tomorrow Fund has awarded more than \$10 million in grants to organizations that serve thousands of children across the United States, Canada, Latin American, the Caribbean, Europe and Asia. To further facilitate the growth of youth baseball and softball, the Baseball Tomorrow Fund established a national used equipment drive initiative with the support of the Major League Baseball Clubs in 2005.

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Chapter I - Field Maintenance

Developing a Field Maintenance Plan

Providing adequate field maintenance is the key to a safe and quality baseball program and facility. Significant time and resources are required to maintain a field properly. Developing a feasible field maintenance plan is a very important part of any baseball or softball program.

Planning

To develop a field maintenance plan, the following questions must be considered:

- What organization will be responsible for the maintenance of the field?
- What experience, expertise, equipment is available to maintain the field?
- What is the annual field maintenance budget?
- What are the funding sources to sustain the annual budget?
- Should the field have synthetic or natural turf?
- Will the field be used for other sports or events?
- How many games will be played on the field per day, week, month and year?
- Will the field be a site for tournaments?

Determining the answers to these questions during the planning stage of a new field construction or renovation project is critical.

Staffing

While professional fields are often maintained by a full-time staff, recreational and youth fields often require volunteer help.

Providing basic field maintenance checklists to coaches, players and volunteers can ensure proper maintenance of the field. Basic checklists that can be used a starting point can be found in Chapter V. Once a checklist is developed, the checklist can be laminated and posted in each dugout for the reference for all coaches and players.

Budget

While the average, annual field maintenance budget for a professional field can range from \$50,000-200,000, depending on use and event schedules, maintenance budgets for recreational and collegiate levels of fields will vary. All field maintenance budget considerations should include the level of use and condition of the field. The type of field (i.e. natural or sand-based, type of grass, artificial turf, availability of field lighting) will also dictate the amount of funding needed annually to maintain the field.

- TIP -
Players in older age groups can help maintain the fields by removing trash, sweeping dugouts and dragging and lining the field.

Suggested Maintenance Equipment

Many pieces of equipment are considered necessary to provide adequate field maintenance. This list provides a snap shot of the many tools and equipment used by groundskeepers for the maintenance of a field. Descriptions of several key equipment items follow.

<p>Tools and Equipment</p> <ul style="list-style-type: none"> • Batter's box chalker • Base hole covers • Batter's box and catcher's box outline frames • Push broom • Drags • Edge cutter • Line marker • Mound and hitting mats • Rakes • Shovels • Small backpack-style sprayer • Spiker • Sprinkling (watering) can • String line • Tamp • Tarpaulins • Watering equipment - hoses, spray nozzles • Wheelbarrow <p>Materials</p> <ul style="list-style-type: none"> • Calcined clay - granulated • Diamond dust - ground calcined clay - for drying wet balls • Fertilizers • Herbicides and pesticides • Line marking material • Stockpile of mound clay – approx. 2 tons per field • Stockpile of soils for fill and topdressing – approx. 25 tons per field

Rakes

Each field should have an assortment of rakes. Two each of the following rakes are suggested:

Type of Rake	Suggested Use
Board or Smoothing Board Rake	For smoothing the clays
Garden Rake	For deeper raking to dry areas and to mix materials into the clays
Fan or Leaf Rake	To rake clay and soil from the edge of the grass after each game. The best fan rakes are made of plastic. Metal fan rakes are not recommended.

Mound and Home Plate Compactors, Rollers and Tamps

A "hand" tamp, as shown in the photo on the right, is a rectangular piece of iron measuring 6" x 8" x 1 1/2" welded to a 4-foot length of 1 1/2" pipe. A tamp is used to pack the clays around the pitcher's mound and home plate area.



- TIP -
Cover the bottom of the tamp with a piece of burlap. Tie the ends of the burlap around the handle of the tamp. This will reduce the sticking of moist clays to the tamp.

Drags

A drag is used to smooth the skinned (dirt) areas of the infield. Various models of drags are available. A drag can be pulled by hand or attached to the back of a vehicle and pulled. Some motorized maintenance vehicles come equipped with dragging implements. Drags are built from steel mesh. Some drags used for finishing the field are made from cocoa mats. This natural fiber ensures a smooth appearance.



It should be emphasized that the drag should not overlap the grassed areas. If overlapping does occur, a dangerous "lip" of built up dirt will occur at the edge of the grass area.

The drag should always be picked up and carried away and never dragged across the grass area.



A nail drag, as shown in the bottom right corner of the photo above, is used to scarify, or loosen, the skinned areas of the infield. A variety of nail drags are available from baseball equipment retailers; however, to cut costs, a simple nail drag can be easily constructed.

How to Make a Nail Drag

Materials Needed:

- 5 – 2 X 4 in. wood boards, each 3 ft. long
- 5 – 1 X 4 in. wood boards, each 3 ft. long
- 100 metal spikes
- 4 eye bolts
- 20 ft. of nylon rope or link chain
- Hand saw, power drill, hammer

Construct a 3 X 3 foot frame using five, 2 X 4 inch wood boards. The corners and the ends of the center board are dovetailed, or slotted together, to allow the frame to lie flat. Staggered holes are drilled (slightly smaller than metal spikes) through the board approximately 1 inch apart. The metal spikes are then driven into the holes. A frame is attached by nailing a 1 X 4 inch board to cover the nail heads to prevent them from coming out. Attaching an eye bolt in each corner of the board, a rope or link chain is attached to drag the spiker in either direction. When more weight is needed to loosen more compacted surfaces, cement blocks or other weights may be placed on top of the drag.

Tarpaulins

Tarpaulins, also known as tarps, are used for several purposes – to protect the field from rain and to retain moisture in the mound and home plate areas when the field is not in use.

- TIP -
Tarps are used to maintain moisture in the pitcher's mound and home plate areas. **The use of tarps is recommended anytime the field is not in use.**



In the event of rain, the mound and home plate areas should be covered as quickly as possible. A heavy plastic cover, at least 6 mm in thickness, or nylon cover is suggested. The tarp should be as heavy as possible to keep the tarp on the ground during high winds. The tarp should be large enough to just overlap the grass by

approximately eight inches.

A tarp that covers the entire infield is also available, as shown in the photo above. This tarp is usually made of the same fabric and measures approximately 165 ft. by 165 ft. The folding and rolling of the tarp can be difficult and should be consistent to cover the field as quickly as possible when it is raining.

How to Mow a Field

The mowing of the infield and outfield grass should be completed based on the grass growing heights. A rule of thumb is mow no more than one-third of the blade of grass at any given time. Mowing the grass more than one-third at a time can result in discoloration or “scalping” of the turf, or cutting the turf too low. The following chart provides the suggested heights of common types of grasses.

Common Types of Grasses and Suggested Mowing Heights

Type of Grass	Best Height
Bluegrass	1-1 ½ in.
Tall fescue	2 in.
Zoysia	½ - 1 in.
Bermuda	½ - 1 in.

Turf Mowing Maintenance

There are two types of mowers available to cut the field: 1) rotary, and 2) reel mowers. The most common type of mower is a rotary mower. Rotary mowers are used primarily on residential lawns.

Reel mowers are more specialized and are used on higher maintenance facilities like golf courses and athletic fields. These mowers require additional training to operate properly. Reel mowers are used to provide better quality cutting and allows very low cutting heights. These mowers also have striping capabilities, as shown in the following photos.

- TIP -
Mow no more than one-third of the blade of grass at any given time.

The number of times per week the field is mowed will vary depending on the budget, weather and fertility program. Baseball fields are mowed everyday to once a week, depending on the specific needs and standards of the facility.

When mowing a baseball field, keep in mind the following items:

1. It is important to train employees on equipment to reduce the potential for damage and ensure safety.
2. Check oils and lubricate the equipment prior to mowing. Proper equipment maintenance is critical.
3. Always use sharp blades and/or adjust reels prior to every mowing.
4. If the mower makes turns on the skinned areas and warning track, remove any clippings on those areas.
5. Mowing the field when wet is not recommended and should be avoided whenever possible.

There are four traditional patterns to mow a baseball field:



Home Plate to First Base



Home Plate to Third Base



Home Plate to Second Base



Foul Pole to Foul Pole and the Infield Arc

How to Maintain the Base Paths



It is best to maintain as much of the base paths by hand as possible. Use a drag that is narrower than the width of the base paths. Make sure that the drag does not overlap the grass area to prevent the formation of a “lip” or ridge at the edge of the grass.

Prior to raking the base path, remove any white chalk material with a shovel. This will keep the clay more stable and not cause a hump, or raised area, down in the middle of the baseline.

Rakes should also be used on the base paths. When raking the base paths, do not rake across the path, but go up and down the baseline. Raking across the path can cause a low spot to develop down the middle of the path.

Weeds in the base paths, as shown in the photo above, should be removed by hand.

- TIP -

When raking the base paths, **do not rake across the path**. Rake up and down along the length of the path.

How to Maintain the Infield Skin

- DEFINITION -
Infield Skin – the areas on a field composed of clay, such as base paths, pitcher’s mound and home plate area. These areas are composed of **infield mix**, also called **infield clay**.

The following is a suggested method to properly maintain the skinned areas of the infield:

1. Rake excess dirt from underneath each base area to make it level.
2. Remove any debris, including grass clippings, rocks, weeds, etc.
3. Water the skinned area to allow the infield to be nail dragged. If the skinned area is already moist, this step can be skipped.
4. Nail drag the infield.
5. Add soil conditioner as needed.
6. Screen or drag the infield.
7. Monitor and water infield as needed to ensure desired moisture levels.

While maintaining the infield, the drags should be kept at least 6 inches away from the grass so that the loose dirt does not get into the grass thus forming a “lip,” or ridge, in the grass edge. A regular rake should be used to rake along the grass edge. Should dirt get into the grass edge, as shown in the photo to the right, a stiff brush broom should be used to “sweep out” the dirt back onto the skinned area, removing any grass clippings that may be swept onto the skinned area in the process.



Anytime a “lip” begins to develop where the grass and dirt area meet, use a water hose to wash the dirt out of the grass and back onto the skinned area.

- TIP -
If a “lip” begins to develop along the turf line, use a water hose to wash away the dirt out of the grass into the skinned area.

To drag the infield skinned area, make a spiralling circle with the drag mat from the infield grass line to the outfield grass, starting at the third base foul line, across the skinned area to the first base foul line. This circular spiral should measure 9-10 ft. in diameter.



Edging the field should be done on a bi-weekly basis during the growing season. This will greatly reduce built-up edges. Always use a string line when edging the turf.



How to Maintain the Pitcher's Mound, Home Plate and Bullpen Areas

During every baseball game, damage occurs to the pitcher's mound and home plate areas. Regular, proper maintenance will reduce time and money needed to rebuild and renovate these areas. It is also critical to maintain these areas properly to reduce the potential for injury.

The following is a suggested method to properly maintain the pitcher's mound and home plate areas on the main baseball field and in the bullpen areas:

1. Sweep debris material from the landing area and table of the mound. This allows the packing clay to be exposed. The landing area is the location on which the pitcher steps to pivot and throw. The table is the area at the top of the mound, measuring 36 inches by 5 feet.
2. Tamp any uneven packing clay level prior to watering.
3. Using a small roller, as shown in the photo to the right, can provide consistency in the mound and home plate areas.
4. Lightly moisten the clay to ensure new packing clay will bind to the existing clay.
5. Scuff-up, or loosen, damaged areas with a shovel.
6. Add new packing clay to the damaged areas.
7. Tamp newly installed packing clay into the ground.
8. Rake down the newly repaired areas.
9. Rake all debris from the pitcher's mound, such as weeds as shown in the photo on the right.
10. Add new soil conditioner (if needed.)
11. Water the entire pitcher's mound.
12. Allow the mound to dry; however, do not allow the packing clay to dry too much to the point of cracking.
13. Once the pitcher's mound is completely prepared for the game, cover it with a tarp to maintain a proper moisture level.



Repeat this process for the home plate, mound and in the bullpen areas.

In some cases, clay bricks are used to establish a firm throwing area. The photo to the left shows the use of moist clay bricks. These bricks are a very acceptable material because they have not been hardened by heat, like bricks used in construction.

Chapter II - Turf Management

Control of Weeds, Pests and Disease

- SAFETY NOTE -
Environmentally-safe methods of weed control, such as pulling weeds by hand, should be considered whenever possible.

The turf on the field of play must be protected from weeds, pests and disease. There are recommended chemicals that have all been tested. Many new types of chemicals are entering the market regularly and it is important to determine if the geographical area allows specific types of chemicals to be applied.

The products noted in this section are suggestions only. The type of weed control selected should be determined based on the field conditions and level of weed growth.

For broad leaf weeds such as dandelion, ground ivy, plantain and buckhorn, the types of herbicides used across the industry varies. Pre-emergent herbicides are applied in mid-spring, and post-emergent herbicides are applied in the fall. It is suggested that these products should not be used in hot weather because it may cause discoloration.

- SAFETY NOTE -
If weed control products with chemicals are used, appropriate measures regarding the use of fields should be established to ensure safety.

Pre-emergent herbicides have been effective for grassy weed control such as crabgrass. Treflan, Daethal, Bandane, and Zytron are pre-emergent herbicides.

For control of different types of cut worms and beetles, turf managers have used products such as Heptachlor, Chlordane, Adrin, and Malathion. Each one is different and the exact material will be recommended by the testing lab chosen as a source to determine fertilization needs. All products should be watered in immediately after application. Follow the manufacturer's label of the product closely.

It is important to remember that some bugs are our "friends" when it comes to growing healthy turf. Earthworms and beetles aerate the soil and create organic matter. Bugs are beneficial in many areas of our world; however, on a professional level baseball field, an infestation of bugs can cause slight undulations in the finish grade.

Aeration

- DEFINITION -
Aerate – to ventilate or expose to air; as in the soil or turf; aeration.

High use areas on a baseball field require aeration. The greater the use of the field (or specific area of the field) the more aeration is needed.

There are several types of aeration. The type selected is based on the time of season and the specific issues to be addressed with the soil. The types of aeration include: hollow tine aeration, solid tine, open tine, slicing tines, water jet, and event deep tine. A tine is a spike: the pointed part of the aeration machine that is driven into the soil or turf.

Some aeration machines mechanically drive the tines into the ground. Other aeration machines pull the tines across the field, while the tines penetrate the soil based on the weight of the machine. Most turf managers prefer the mechanical approach. The mechanical machines provide a more even distribution of aeration allowing the depth of the tines to remain constant.

On average, natural soil fields require more aeration than sand-based fields due to compaction issues. The amount of aeration depends on the use of the field. It is recommended to aerate at least 2-3 times per year.

After the field is aerated, it is also recommended to top dress the field.



Topdressing is applied with a machine pulled behind a cart, as shown in the photo to the left.

To aerate the field requires a machine to remove small cores of the turf. Aerating machines are sometimes mechanical devices pulled behind a cart or vehicle. The mechanical, self-propelled type of aerating machine is highly preferred.

- TIP -
It is recommended that a field be aerated **at least 2-3 times per year.**

On Bermuda turf, the field should be verticut to remove the thatch layers. The verticut process uses a power machine with vertical blades to remove the thatch and allows the turf to grow properly. This procedure should be completed at least once per year. On Bluegrass or cool season grasses, the process of verticutting or de-thatching is required; however, all efforts should be made to perform this procedure in the fall. In addition, good judgment must be used to determine the depth of the dethatcher so that the root structure is not removed or damaged in the process. Following the removal of the thatch on Bluegrass turf in the fall, the field should be over-seeded and top dressed.

Renovation vs. Reconstruction



When determining whether to renovate or reconstruct a field, the rule of thumb is as follows: "Reconstruct if the turf has more than 50% weeds with a large proportion of crabgrass or, if in the north, poa trivialis." In other words, renovate the field if it has less than 50% weed infestation. However, this decision also depends on the type of weeds present and location of the field.

- TIP -
The **best time to renovate or reconstruct** a field is autumn.

If total reconstruction is chosen, fumigation of the field to kill off the weeds properly may be necessary. If only a slight renovation is chosen, plan to aerate, top dress with sand, fertilize, overseed or sod and water adequately to obtain proper growth. Renovation may be necessary in small sections. Be sure to match the seed or sod to existing materials to avoid a "patch" look in the spring when the turf grows in. In most areas, the best time for either renovation or reconstruction is autumn.

Grass Selection

- TIP -
Call the local agricultural or agronomic school to determine the best type of grass for the area.

Selecting the type of turf needed is partially determined by geographic location. Fields located in northern U.S. use cool season turfs such as Bluegrass, fescues and rye grasses. In the southern U.S., Bermuda-type turf and Zoyzias grasses are commonly used. In Europe, Pos type turfs are used. Determining the best grass for the area is as simple calling the local agricultural or agronomic school. Thousands of varieties of grasses are available, but all grasses can be categorized in the groups noted above. No one type of grass is perfect, but there are some excellent grasses adapted to fit nearly all conditions.

Irrigation

All turf will need water, or irrigation, for establishment, growth and repair. If nature does not provide rain in sufficient amounts, the turf manager must provide the water. The ability to have a consistent water supply is critical to field maintenance. Installing an automatic irrigation system should be one of the highest priorities in any field renovation or construction. Watering thoroughly to allow the water to soak deeply is required. Deep watering encourages deep root growth. Frequent shallow watering encourages shallow surface roots, compactions, crabgrass and other weeds.



Some engineered soils can hold up to 1,000 gallons of available water per 1,000 square feet to a depth of 6 inches. Under severe drought conditions, the turf may lose a quarter to a third of an inch of water per day.

- TIP -
Deep watering encourages healthy turf. Frequent shallow watering encourages crabgrass and weeds.

It is possible to over water a field. Grassy weeds such as nut sedge may appear. Over watering also limits the oxygen supply to the turf and may cause yellowing which can create turf that is susceptible to disease.

A soil probe should be used to check the depth of moisture saturation. A soil probe can be purchased from local lawn and garden stores. It is a very valuable tool used to pull small cores of soil from your field to check root depth and moisture. If the penetration is slow, aerating may be necessary because the soil is compacted. Frequent use of the aeration equipment will keep the soil open and provide the necessary porosity, or porous quality of the soil.

Fertilization

Turf must have the following nutrients in order to grow and heal after wear and tear: nitrogen, phosphorous and potassium. **The formula for the accurate amounts of these products should be determined by having a soil analysis completed by an agronomic agency specializing in the evaluation of athletic turf grasses.** All athletic turf should have an application of a complete balanced fertilizer throughout the year.

- TIP -
Healthy turf needs nutrients such as nitrogen, phosphorous and potassium.

The chart below provides several types of balanced formulas, depending on local soil conditions.

Nitrogen %	Phosphorous (Phosphate) %	Potassium (Potash) %
10	10	10
15	5	15
10	5	5
8	6	4

Nitrogen is a main staple for leaf growth and is supplied in either organic or inorganic form. The organic type is also available in sewage sludge, cottonseed meal and urea form. The inorganic is available as sulphate of ammonium, urea or ammonium nitrate. Sport turf managers use both organic and inorganic blends. This produces a more uniform and steady grass growth.

A general rule of thumb is to provide ½ to ¾ pound of nitrogen (actual) per 1,000 square ft. during each month of the growing season. In most sports field environments it is better to feed lightly and frequently. A consistent supply of nitrogen will provide for steady growth and recovery from injury and wear. In contrast, too heavy of feedings may create a tender, even slippery turf that has a lower tolerance for wear. Again, perform soil and tissue tests regularly, approximately 3 to 4 times per year. Bermuda and Zoysia grasses should be fed regularly during the long summer growing season.

- TIP -
 For sports fields, it is better to **fertilize lightly and frequently.**

Soils in the cool temperature areas, which are northern hemisphere, require different fertilizers than those in the south. The area separating the two hemispheres is called the transition zone. The transition zone is the area located between cool season grasses and warm season grasses. Growing turf in the transition zone is very difficult as neither variety of grass is ideal. Therefore, consult a local agricultural/agronomic school for the appropriate types of fertilizers for the area.



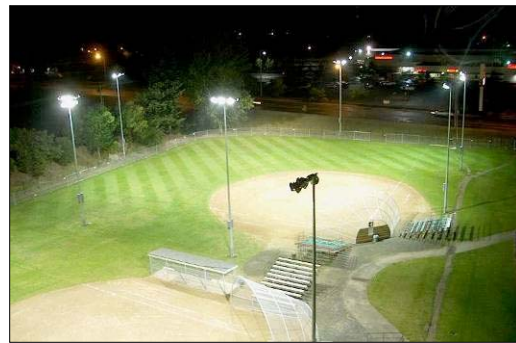
Using a cyclone, walk-behind fertilizer spreader, as shown above, is preferred by most sport turf managers. Determine if the grass is dry before applying a fertilizer. It is considered a good practice to aerate the area before applying fertilizers. Afterwards, the soil should be dragged and watered to insure the chemicals get to the roots. Under normal conditions, ground limestone should only be needed every other year.

Chapter III - Baseball Field Equipment

The following items of equipment are necessary to meet the general requirements of the rules of baseball and the minimum standards used by the International Baseball Federation. Numerous variations of equipment are used in baseball, but this section may assist the understanding of the level of detail needed at the field to host a tournament or higher level of competitive play.

Field Lighting

When considering field lighting, remember that the addition of field lighting will result in greater usage of the field and more time and funding required for on-going field maintenance and renovations. However, if field usage is managed properly, with time allowed during the season to rest the field, field lighting can be a useful addition to the field and the programs that utilize the field. If funding allows, the installation of field lights (or the required electrical infrastructure for the future installation of field lights) during the initial field construction stage is highly recommended.



When planning the installation or replacement of field lighting, it is important to understand that each level of play requires different levels of lighting requirements; therefore, several factors should be considered. These factors include the size of the facility, the durability of the lighting system, the age of the facility, the requirements of the applicable governing body (i.e. NCAA, IBAF, Little League, Inc., etc.), the potential for televised games or international play. It is important that these issues are discussed with a field lighting professional during the planning process.

To demonstrate the differences in lighting guidelines based on level of play, the following chart provides general lighting guidelines for various levels of fields.

General Lighting Guidelines Based on Field Level

Field Level	Horizontal Illumination Foot-Candles (Lumens)*	
	Infield	Outfield
International/Olympics	150 (1,500)	100 (1,000)
Minor Leagues – AAA and AA	100 (1,000)	70 (700)
Minor Leagues – A and Rookie	70 (700)	50 (500)
College – non-televised	70 (700)	50 (500)
College – televised	100 (1,000)	70 (700)
High School, Youth (competitive)	50 (500)	30 (300)
Recreational	30 (300)	20 (200)

* Please note: In the U.S., lights are measured by the amount of Foot Candles (FC.) In Europe, lights are measured in Lumens (Lux.)

Bases

Each field will need three bases, three base plugs and a clean-out tool to clear any soils that may enter the base anchors. First, second and third bases are 15 inches square, and cannot be taller than 3 inches.

The Hollywood style base, as shown in the photo on the right, has been accepted as the base to use for baseball throughout the U.S. This style of base is tough, durable, convenient to handle and can be permanently located on the field. There is no slipping of the base, which makes it very safe. The base can be cleaned and painted prior to each event to provide a professional appearance to the field. This type of base does not require spikes or straps. Strap down bases have been ruled as unsafe in some tournaments.



Backstop



The backstop can be made from chain link fencing and or nets and cables, which is preferred for higher level and competitive fields. The backstop netting is suspend between the dugouts and normally covers an area directly behind home plate that is 80 feet wide and 24 feet high. The backstop should be located 60 feet from home plate on regulation baseball fields and 25-35 feet on youth baseball fields.

Hire an architect to design a backstop system that best suits the needs of the facility.

Dugouts

- SAFETY NOTE -
Dugouts with roofs
provide players
protection from
the sun.



Dugouts are used to protect the players from inclement weather and to provide an area where they can rest while the opposing team is in the field. Typical dugout structures should be designed to hold a roster of 20 players plus coaches. This would require a dugout to be at least 60 feet long.

Some dugouts are totally enclosed while some may have a low fence in

front of the dugout, which is highly recommended. This will help to protect the players in the dugout from foul balls and thrown bats. Some dugouts are actually sunken into the earth by 2 or 4 steps. This is not required but does provide a more traditional setting. The dugout can be built at field level. The floor of the dugout must be covered with some type of rubber material to provide safe footing to players wearing metal cleats.



Outfield Fencing

In most cases, fencing for the “perimeter of the field of play” is composed of chain link fencing. For higher level of play, the outfield fencing is padded with 3-inch thick foam. This provides the player with a sense of security allowing him or her to pursue difficult plays without the threat of being injured. The average height of outfield fencing is 8 feet; however, 4-6 foot fencing is often used on recreational fields.



Protective fence cap, as shown in the photos on this page, is also installed on chain link fencing on recreational fields for player safety. This product is made of plastic and is attached to the top of the fence.

Batter's Eye



One of the key components of the outfield is the size and location of the batter's eye. The batter's eye is what the batter sees behind the pitcher.

This area must be one consistent, dark color, preferably black, and is normally 60 feet wide and 30 feet high. It is generally a metal structure covered in wind screen material. The wind screen material is made with a solid mesh-like material which allows some air to flow through it.



Coaches' Boxes



There are two coaches' boxes on the field: one for third base and one for first base. The coaches' boxes are marked with a white line. It is better to paint this line than use white chalk or lime. The first and third base coaches stand in these areas. The box is located 15 feet from the foul line in foul territory. The box is 20 feet long and the sides of the box are 10 feet long. The box is closed in the back, toward the baseline fencing, as shown in the photo on the left.

Foul Poles

Foul poles indicate the foul territory of the outfield field. However, despite the name, a ball hitting a foul pole is considered fair. These poles are normally 30 feet high and have 2 foot wing attached to the fair side of the pole. The proper location of each foul pole is identified by using a transit to find a perfect 90 degree angle with the apex of home plate. Each foul pole will be inside this angle, in the left and right field corners of the field. Poles are located off the field of play and behind the outfield fence. In some cases, the foul poles are a part of the outfield fencing and are padded for player safety.



Warning Track Materials



The warning track can be made from a variety of materials. It can be made of a rubberised material and poured onto asphalt or constructed using red crushed brick material and or shell rock. The goal is to ensure the warning track material is different in color and texture than the playing field surface. It is also important that

the warning track material is a stone or aggregate material that is consistent in size and meets certain specifications. For example, stone used in warning track material should be no larger than 3/8ths of an inch, as shown in the photo below.

- TIP -

The warning track is normally 15 feet wide and should extend around the entire field to provide player safety and to reduce wear of turf in front of the dugouts and around the home plate area.

The depth of the warning track material and the method it is applied will vary depending upon the type of material. On average, approximately 4 inches of material is required over a stable sub base. The warning track is normally 15 feet deep in front of all obstructions; however, consult the leagues and associations that will utilize the field regarding rules and regulations. For instance, the outfield warning track on an Olympic field is 20 feet wide as opposed to a Major League field, which requires a width of 15 feet.



Protection Screens

The purpose of protection screens is to provide protection to baseball players during training and pre-game practices. Protective screens are not used during the game. The following protective screens are recommended:

1. Pitching Protection Screens – also known as L-Screens – 1 per field
2. First Base Protection Screen – 1 per field
3. Second Base Protection Screen – 1 per field
4. Ball Shagger Screen – 1 per field
5. For batting tunnels, one L-screen for each tunnel is recommended.

Pitcher's Protection Screen

During batting practice, the pitcher is normally throwing from a shortened distance (10-15 feet shorter than regulation, in front of the pitchers mound.) This places the batting practice pitcher in great danger as his reaction time to protect himself is greatly reduced. Therefore, a pitcher's protection screen is highly recommended.



The size of this screen varies for a regulation screen with 2-inch aluminium tubing designed in an "L" shaped is recommended. The recommended dimensions are 8 feet wide with an overall height of 8 feet with the lower wing 40 inches high. The screen should be covered with a strong baseball batting cage-type netting made from nylon if possible. Metal fencing can be used; however, this type is not preferred due to the damage caused by batted balls.

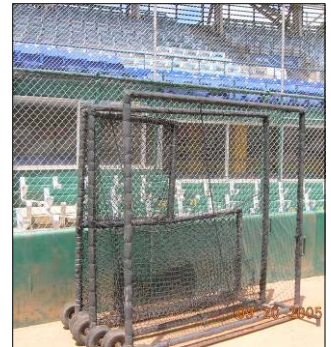
First Base Screen



First base screens, like the one shown on the left, also should have framework of either 1-inch pipe or 2-inch aluminium tubing. The recommended dimensions are 8 feet wide with a height of 8 feet. Again, the screen should be covered with a strong baseball batting cage-type netting made from nylon if possible. Braces can be welded (attached) to the bottom pipe to help the stability of the screen. Wheels can be attached to allow for easier handling.

Second Base Screen and Shagger Screen

Second base and shagger screens are identical and are normally 12 feet wide and 8 feet tall. Construction is similar to the first base screen. It is used to provide protection to the second baseman and shortstop as they practice double plays. The other screen serves a similar purpose as it is used to protect the "ball shagger," who is located behind the second base area during practice.



Portable Batting Cages



the other two are stationary. The cage is rolled and positioned very close to the field turf with no more that 3 inches between the lower rail and the grass; therefore, moving it across the field requires a smooth access on and off the field of play.

A portable batting cage structure is normally 10 feet high, 20 feet wide and 20 feet deep. It is igloo-shaped (or arched) and is constructed with 2-inch aluminium tubing covered with foam padding for safety of the players inside the batting cage. The structure is usually built with three wheels. One wheel swivels to direct the cage and



Batting Tunnels



Batting tunnels are often used when the field is too wet for practice or to provide additional hitting practice. The average tunnel is 18 feet wide and 80 feet long and 10 feet high. Some batting cages are suspended by cables; although, many batting cage structures are supported with aluminium tubing. If using aluminium tubing, the tubing should be covered with foam padding for safety. The netting on batting tunnels is similar to that used on portable batting cages. The cage

netting behind the batter requires a much heavier nylon or a pad to stop the thrown or fouled ball during practice sessions.

Field Signs

Field signs can be helpful to provide rules of the game or use of the field for the players and public. Field signs can also be used as a source of revenue to sell to sponsors and local businesses.

Suggested field signs may include:

- Outfield wall distances
- Field rules
- Sponsor logos



Chapter IV – Softball Field Construction and Maintenance



The maintenance of softball fields is very similar to baseball fields. Although similar, there are several issues regarding the maintenance procedures of infields, mounds and plate areas that vary.

1. A softball field is predominately flat with a 1% grade, falling from the center of the mound. Due to the large area of clay, the infields require extensive dragging and shaping to reduce low spots.
2. The pitcher's mound is flat and requires similar maintenance as a baseball mound such as watering the clays and packing the mound after use.
3. The home plate area is also treated the same as on a baseball field, as softball and baseball players dig similar holes during the course of play. Follow the same maintenance procedure for the home plate, mound and infield areas.
4. The field layout is different for softball fields for varying ages. Please see Chapter V for suggested field dimensions.
5. The depth of a warning track on a softball field is normally 10 feet.
6. Due to the large size of the softball infield, irrigation systems are installed to irrigate the infield clays. An automatic irrigation system will allow more time for the ground crew to focus on the mound, home plate and dragging requirements.

Chapter V - Resources

This guide provides a broad range of information pertaining to field development. However, specific practices and expertise related to the construction and maintenance of fields is difficult to translate into writing.

For additional information regarding field development and maintenance, we suggest the following resources:

www.brickmangroup.com

www.sportsturfmanager.org

www.softball.com

www.musco.com

In addition, if you have specific questions not covered in this guide regarding field maintenance, please feel free to send an e-mail to Murray Cook at address murrayc@brickmangroup.com. Please allow two weeks for a response.

In this chapter, the following information is provided for reference:

- Suggested Field Dimensions
- Diagrams of Field Layouts
- Daily and Annual Field Maintenance Checklists
 - Checklists can be used as a helpful guide to develop a proper maintenance routine. These checklists can be modified to meet the specific needs of each field. Post the checklists in each dugout for reference by the grounds keeper, coaches and players.
- Metric Conversion Chart

Suggested Field Dimensions

Baseball

Age Group	Left Field	Center Field	Right Field	Pitching Distance	Distance Between Bases
Ages 17 and older	321 ft.	400 ft.	321ft.	60 ft. 6 in.	90 ft.
Ages 15-16	280 ft.	350 ft.	280 ft.	60 ft. 6 in.	90 ft.
Ages 13-14	250 ft.	315 ft.	250 ft.	54 ft.	80 ft.
Ages 11-12	200 ft.	200 ft.	200 ft.	46 ft.	60 ft.

Girls' Fastpitch Softball

Age Group	Home Run Fence	Pitching Distance	Distance Between Bases
High School (NFSHSA)	185-235 ft.	40 ft.	60 ft.
Ages 15-19 (ASA)	200-225 ft.	40 ft.	60 ft.
Ages 14 and under (ASA)	175-200 ft.	40 ft.	60 ft.
12 and under (ASA)	175-200 ft.	35 ft.	60 ft.
10 and under (ASA)	150-175 ft.	35 ft.	55 ft.

Suggested Space Requirements

Field Dimension	Age Group	Space Requirement
Regulation baseball (90 ft. bases)	High school level and 16 year olds and up	110,000 sq. ft.
Regulation baseball (90 ft. bases)	13-15 year olds	90,000 sq. ft.
Youth baseball (60 ft. bases)	12 and under	60,000 sq. ft.
Fastpitch Softball (60 ft. bases)	12 and under to 19	60,000 sq. ft.

Metric Conversion Chart

LENGTH				
Symbol	When You Know	Multiply by	To Find	Symbol
in	inches	2.54	centimeters	cm
ft	feet	30.48	centimeters	cm
ft	feet	0.3048	meters	m
yd	yards	0.9144	meters	m
mi	miles	1.6097	kilometers	km

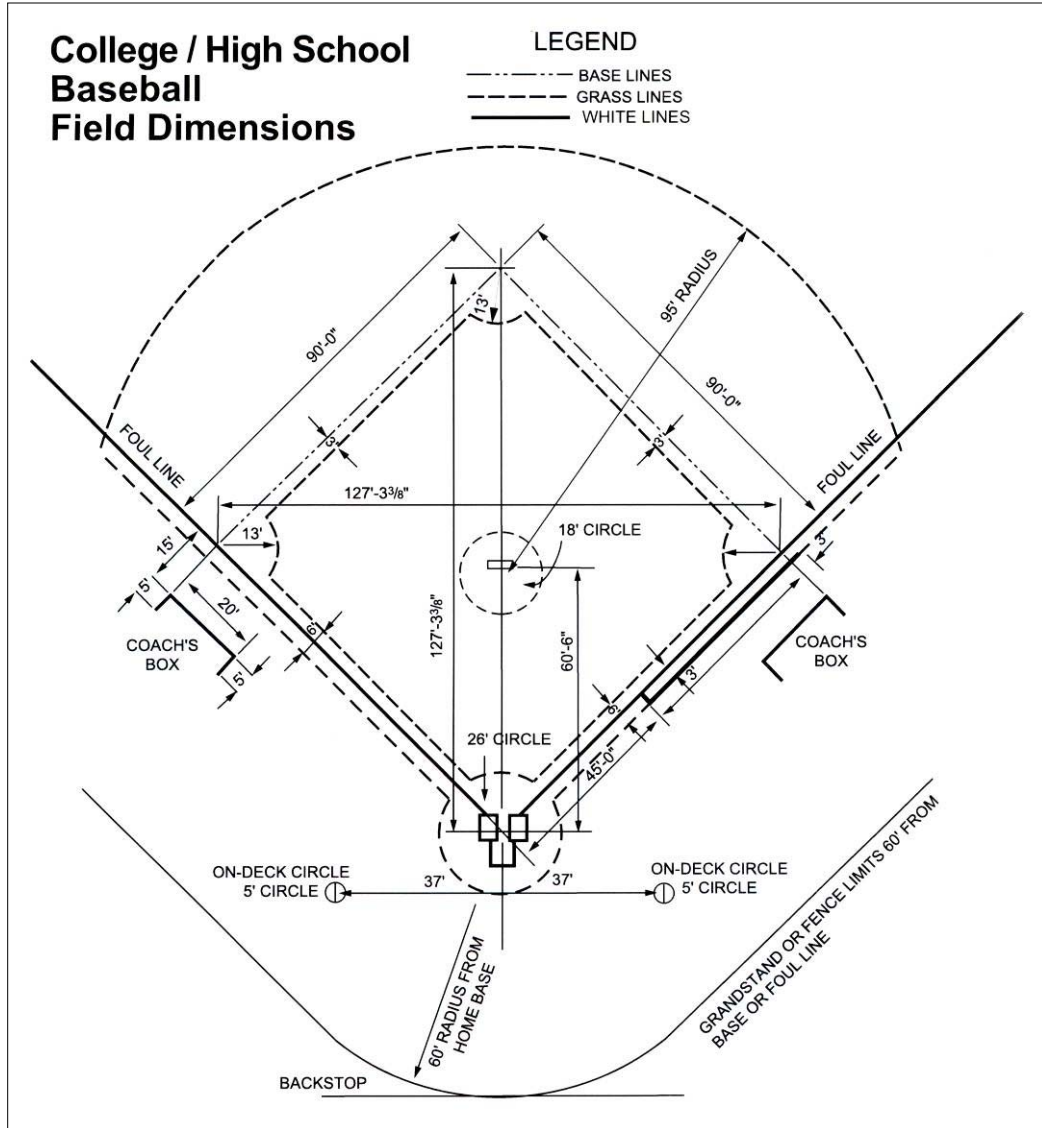
AREA				
Symbol	When You Know	Multiply by	To Find	Symbol
sq. in. (in ²)	square inches	6.45	square centimeters	cm ²
sq. ft. (ft ²)	square feet	0.093	square meters	m ²
sq. yd. (yd ²)	square yards	0.836	square meters	m ²
	acres	0.405	hectares	ha

WEIGHT (MASS)				
Symbol	When You Know	Multiply by	To Find	Symbol
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg

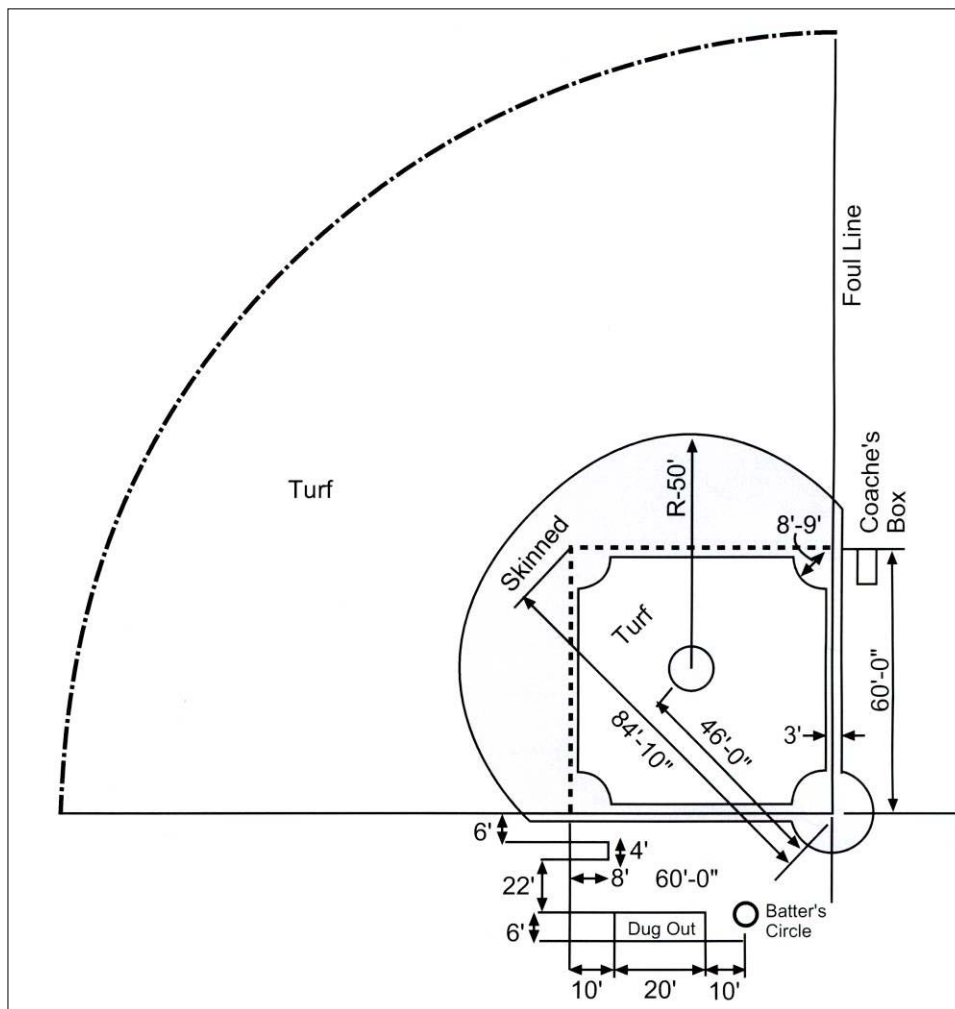
Diagrams of Field Layouts

(Diagrams from www.markersinc.com)

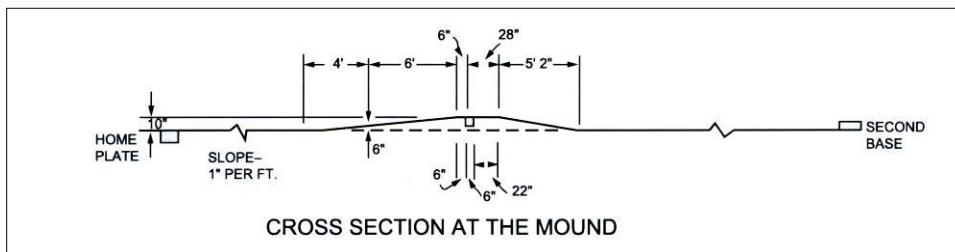
Regulation Baseball Field



Youth Baseball Field



Baseball Pitcher's Mound



Daily Field Maintenance Checklist

Daily Routine before Practice:

Remove tarps
Water skinned areas and baselines
Install the bases
Erect safety screens for pitcher, first base and second base
Place the batting cage at home plate

Daily Routine after Practice and Games:

Remove the bases and cover the base anchor sleeves
Drag the skinned areas and baselines
Recondition the mound and home plate area and cover areas with tarps
Recondition the bull pen mound and home plate area
Replace and tamp any loose divots in turf areas
Dispose of trash in and around field and bleacher areas

Day of Game Routine:

Remove tarpaulins
Mow the grass
Scarify the skinned areas with a spiker
Drag the skinned areas smooth
Water the infield area
Sweep and clean dugouts
Set the chalk lines and mark officially
Place the batting practice pitcher's mat on the mound
Place the safety screens: pitcher, first base and second base
Paint or wash bases, pitching plate and home plate
Prepare the bullpens
Hang flags on the foul line poles and flagpole
Check the operation of the field lights
Check the operation of the scoreboard
Prepare the press box and operation of the public address system
Check the operation of the electrical equipment in the concession stand
Clean and prepare the locker rooms and umpire rooms
Dispose of trash found in and around field and bleacher areas

Annual Field Maintenance Checklist

Spring Routine:

Perform soil and tissue tests
Aerate the field
Top dress the field
Fertilize the field
Apply pre-emergent herbicides
Clean, paint or repair dugouts, fencing, bleacher areas and field signs

Fall Routine:

Perform soil and tissue tests
Aerate the field
De-thatch or verticut turf
Over-seed and top dress the field
Fertilize the field
Apply post-emergent herbicides
Add ground limestone every other year
Complete renovations or reconstruction projects if needed

Winter Routine:

Review field maintenance plan and budget
Review upcoming field use schedule
Clean, repair or replace field maintenance equipment
Plan future renovations or reconstruction projects to be completed next fall