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Improving Field Safety for Athletes

Administrators, facility managers, athletic directors, coaches, and sports turf managers are responsible for providing safe, playable athletic facilities for all athletes. If dangerous field or facility conditions exist, an incident may occur, putting the facility and/or individuals at risk of fault. A facility may be liable if it can be proven that the typical/normal standard of care was violated. Be familiar with common hazards on sports fields to reduce the possibility of athlete injuries.

What causes an athletic surface to be unsafe?

Compaction

Compacted soil typically results in bare, hard surfaces on athletic fields. Soil compaction is the compression of soil, primarily due to foot or vehicular traffic. Areas that sustain high amounts of traffic, such as goal mouths or sidelines, are susceptible to compaction, and heavy traffic on a wet soil will increase the rate of compaction even more. When soil is compacted, turfgrass plant health is affected because air, water, and nutrients cannot reach plant roots. In the absence of proper maintenance practices to relieve compaction, continuous stress to the plant can eventually lead to the loss of the grass and a bare, hard surface.



The continuous patterns created by marching bands compacts turfgrass areas, resulting in thin turfgrass growth and exposed soil. Photo courtesy of Pamela Sherratt.



Compaction is typical in goal mouths for sports such as field hockey, soccer, and lacrosse. Photo courtesy of A. J. Powell, Jr., Ph.D.

What can I do to help reduce compaction?

- Rotate or shift the field layout. Depending on space allowances, rotating the field or shifting the field side to side can spread out the wear that contributes to compaction. For example, if the field is normally oriented north to south, consider rotating it so it is oriented east to west.
- Change the location of daily practices so athletes are not concentrated to the same area of the field. Using portable goals or portable goal posts and moving them around the playing area can help reduce compaction.

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- Add aeration to the annual field maintenance plan. Aeration is the process of disturbing the soil to relieve compaction. There are many different aeration methods that can be used, including hollow tine aeration, solid tine, deep-tine, verticutting, slicing, spiking, and water injection. Aerifying several times per year while plants are actively growing will help combat compaction problems, making your field safer and healthier.



Compacted area in a baseball outfield. Players typically stand in the same spot, eventually compacting the area, thinning the turfgrass, resulting in bare soil that compromises safety and playability. Photo courtesy of Grady Miller, Ph.D.

Worn Areas

Worn areas are spots on a sports field that have less than 75% coverage of turfgrass. Heavily trafficked areas on athletic fields are going to see changes in turf density due to the amount of play, the grass and its ability to tolerate the traffic and/or spread, and the time of year. Worn areas and bare soil are most often caused by field overuse and/or compaction, but might also be caused by pests, environmental extremes, etc. When the turf coverage drops below 75%, playability and safety start to become compromised. Worn areas are unsafe because they can be hard and do not provide a stable surface for athletes to gain traction.



Bare areas on a soccer field. Photo courtesy of Rich Watson.



Less than 75% turfgrass coverage on center field of a football field. Photo courtesy of Doug Linde, Ph.D.

What can I do to help prevent or repair worn areas?

- Seed often and with the right species. Start seeding after the first game and continue to seed before and after each game. Give the most attention to high-wear areas. Perennial ryegrass is desirable for its quick germination rate and sufficient wear tolerance.
- Increase the mowing height and never remove more than 1/3 of the leaf blade in a single mowing. Turfgrass maintained in the upper range of the recommended height will be better able to withstand heat, drought, and stress and be more wear resistant. Removing more than 1/3 of the leaf blade length at one time places stress on the plant.

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- Fertilize fields based on soil test results. Apply nitrogen leading up to and into the playing season to help promote new growth during the active season. Application of 0.7 to 1 lb. of nitrogen per 1000 square feet at the beginning of the growing season and midseason will improve turfgrass recuperation, as well as stress and wear tolerance.
- Keep traffic off of heavily used areas by rotating or shifting the field, using portable goals and goal posts, or moving practice drills to a different location. On game fields, restrict all practices to a minimum and do not allow unofficial play. Have regularly scheduled rest time for the field to repair damage and allow plants to recuperate.



Portable goal posts help distribute field wear. Photo courtesy of Grady Miller, Ph.D.

Weeds

Turfgrass is desirable for surface coverage because it is durable, provides stable footing, and a more predictable ball roll and bounce. When weeds encroach on a playing surface, traction is compromised because weeds crowd out preferred turfgrass species, they do not withstand wear and tear of a field, and they do not provide stable footing for athletes.



Worn crabgrass provides poor footing and no stability. Photo courtesy of Rich Watson.



Clover should not be tolerated on high traffic areas because it is not durable, it compromises traction, and crowds out desired turfgrass. Photo courtesy of Rich Watson.



Perennial ryegrass (a cool-season grass species) continues growing during cooler months while bermudagrass (a warm-season grass species) is dormant. The clumpy growth of perennial ryegrass makes for very unsafe playing surfaces for spring sports. Photo courtesy of Mike Goatley, Ph.D.

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What can I do to reduce weeds on the field?

- Increasing mowing height will reduce germination and establishment of weeds by reducing the amount of sunlight that reaches weed seeds at the soil surface. Increasing mowing frequency improves turfgrass density, which also reduces the likelihood of weed infestation.
- If irrigation is an option, water deeply and infrequently. Apply enough water to moisten the soil to a depth of 4-6 inches. A general rule on a loam soil is to apply ½ to 1 inch of water (depending on soil texture) no more than twice per week during periods of active growth. This schedule must be adapted as rainfall and environmental conditions warrant. When soils dry out they become more hospitable to weed growth.

- Conduct a soil test to determine soil conditions, including soil pH and nutrient requirements. Maintaining an optimal pH range (6 to 8 with 6.5 as the target) will help turfgrass maximize available soil nutrients. When the pH begins to drop, essential turfgrass nutrients become limited and weeds that thrive in low pH conditions (clover, dandelion, etc.) may begin to appear. Soil test results will provide recommendations for how to remediate the soil.
- Apply seed whenever turfgrass density is reduced. Seeding before and after games can help reduce the occurrence of weed infestations.
- Only after you have changed the environment and/or cultural practices that have resulted in a weed problem should you consider the use of herbicides. Only licensed applicators can make an herbicide application to the field.

Puddles and Muddy Areas

Standing water and muddy areas of a field are caused by improper or inadequate field drainage. If water cannot run off the surface or infiltrate into the soil, the field will be wet, muddy, and slippery. Playing on a wet, muddy field can increase incidence of athlete injuries and will cause lasting damage to the field's soil structure, likely increasing soil compaction. One event on a field too wet for play can destroy an entire season's worth of efforts in providing a great playing surface. For example, once footprints on a muddy field dry, the surface becomes very uneven and not only causes abnormal ball bounce, but can cause injuries such as twisted ankles and knees.



Dried footprints on a field that was used in wet conditions. Photo courtesy of Doug Linde, Ph.D.

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Standing water indicates improper drainage and can lead to unsafe conditions if the field is used before it has sufficient time to dry. Photo courtesy of Grady Miller, Ph.D.



Playing on a wet, muddy field is dangerous for athletes. Photo courtesy of Brad Fresenburg, Ph.D.

How do I manage puddles and muddy areas?

- Restrict use when a field is too wet. Postpone games and practices if there is standing water or the field is muddy. Wait until the field dries before allowing access.
- Use topdressing to repair low spots and level the playing surface of a field. When making a decision about topdressing material, ensure the medium is chemically and physically very similar to the existing soil on the field.
- Compacted soil prevents water from penetrating the soil surface, resulting in standing water. Aeration practices can help relieve soil compaction, thereby improving water infiltration.
- Depending upon the severity of the lack of drainage, field reconstruction may be the only option. A qualified sports turf manager or local Cooperative Extension agent may provide consultation to help develop a plan to correct field issues.

Uniformity

Maintaining a uniform playing surface eliminates tripping hazards for athletes. If the field has holes, mounds, ruts, or trenches, conditions are not safe. Humans, maintenance equipment, and animals can all be responsible for disrupting field uniformity.



A combination of exposed soil and tufts of grass lead to a very uneven surface with poor playability and greater risk for injury. Photo courtesy of Doug Linde, Ph.D.



Maintenance equipment can cause unnecessary ruts on the athletic surface. Photo courtesy of Scott Bills, CSFM.

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Animals digging into the playing surface create holes. Photo courtesy of Rich Watson.

How can I improve surface uniformity?

- Conduct regular maintenance. Mowing, fertilization, irrigation, seeding, and aeration are all essential to achieving a uniform playing surface.
- Visually assess the field for areas that have less than 75% turfgrass coverage, weeds and/or clumpy weed growth, wet or muddy areas, and holes, mounds, ruts, trenches, etc. Improve the consistency of the playing

surface by leveling bumps and ruts and filling in divots and holes. When using topdressing with sand or soil to level the playing surface, use material that matches the existing soil medium.

- Restrict field use and especially avoid bringing equipment onto the field when conditions are too wet to avoid trenches, ruts, footprints, etc.



The presence of holes and clumpy weed growth create an inconsistent playing surface that is unfit for athletic use. Photo courtesy of Pamela Sherratt.

Baseball and Softball Infields

A baseball or softball infield can be hazardous for athletes if the soil is too loose, too hard, or too wet. A loose infield is easily identified if the player's running traction is compromised and it resembles running in a sand pit. Alternatively, compaction and wear and tear can result in an infield that is excessively hard, which can pose safety risks to players sliding into bases. An infield that is too wet can cause slippery conditions for athletes or become sticky and adhere to athlete shoes. Additionally, the infield should be uniform and free of weeds, low spots, holes, or worn areas. There should be no hazardous soil buildup (referred to as a "lip") between the skinned area and turfgrass.



A 12-inch elevation change (lip) between the infield skin and outfield. The transition from infield to turfgrass should be flat. Photo courtesy of Scott Bills, CSFM.

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The infield should be free of weeds. Photo courtesy of Jim Reiner.

What can I do to improve the condition of baseball/softball infields?

- Test the infield mix to evaluate the sand, silt, and clay content. Based on results, you may consider changing the infield mix or amending the existing mix to adjust the sand or clay content accordingly.
- Apply irrigation if the field is too hard. Typically, a surface hardens because the clay in the infield mix is too dry. Adding moisture will build up a good moisture base in the skinned infield.
- Nail drag the infield to loosen up a hard infield mix. Nail dragging also helps clean up imperfections and cleat marks. Care should be taken to nail drag only the top surface of the infield mix and not dig down too deep, which can cause the field to get too soft or fluffy.
- A field that is too soft or powdery may be an indication that silt or sand levels are high. Apply irrigation (if

possible), roll the infield, and reduce the amount of nail dragging. Remixing the existing infield using a rototiller can also help return the field to a more playable condition. After rototilling, the field should be rolled and graded to regain its firmness and playability.

- Avoid dragging or raking any infield mix into the turfgrass to prevent formation of a lip. Edges should be hand-raked and dragging should be done slowly across the infield (and never within 18" of the turfgrass). If a lip has formed, a sod cutter may be needed to remove some of the higher portions of the lip. A sharp-tooth rake could also be used to pull some of the excess material back into the infield skin and out of the grass surface. A roller can then be used to smooth the transition.
- Regularly add infield mix to fill low spots and maintain surface drainage. Maintaining proper infield surface grade is the best way to allow water to runoff the surface and keep the infield playable for athletes.
- Use soil conditioners as a short term solution to reduce standing water and puddles during rain events. Soil conditioners, such as calcined clay, are ideal to dry the infield. Following the weather event, soil conditioners should be removed and low spots should be repaired with infield mix.
- Maintain mound and plate areas after each game or practice to keep holes from forming over time. Ideally, the high use areas on mounds and batter's boxes should be clay-based, however, the clay requires regular and careful maintenance to keep in ideal playing condition and provide a firm foundation for pitchers and batters.

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Sports Equipment – Goals and Bases

Goals that are not securely anchored or adequately padded create a hazard for athletes. In addition, any sharp edges, protrusions, or bolts or screws that are not secure can be dangerous. Baseball and softball base coverings with rips or gouges are unsafe. Additionally, base anchors, home plate and the pitcher's rubber need to be firmly secured and properly seated below (base ground anchor) or level (home plate and pitcher's rubber) with the surface grade.



Unsafe soccer goal areas. Photo courtesy of Pamela Sherratt.

What can I do to ensure sports equipment is safe?

- Inspect the facility. Goal posts should be straight and securely anchored with adequate padding. There should be no sharp edges, protrusions or fractures on the goal. Concrete footers should be below the field surface. Goals should be securely anchored with all bolts, screws, and connections intact and securely tightened.

Exposed Objects

Any object that does not belong on the field and disrupts uniformity creates a safety hazard. This can include maintenance equipment that has been left behind by grounds workers, litter and unsafe debris, and even improperly installed irrigation heads.



Exposed objects, such as this drain, can create safety hazards for athletes. Photo courtesy of Pamela Sherratt.

What can I do to eliminate exposed objects?

- Thoroughly inspect the playing surface. Walk the field and pay attention for debris, maintenance tools, and any other objects that are out of place. Remove any hazards or make immediate repairs before athletes access the area.

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Out-of-Bounds Areas

Not only does the playing surface need to be safe, but a minimum of 25 feet around the perimeter of the field is also needed to meet safety standards. Players need to be able to run out of bounds safely without encountering tripping hazards or exposed objects. Fencing and bleachers should be installed the appropriate distance from the playing field with no hazardous protrusions. Concrete footers, fencing, fence posts, and other hard structures should all have the proper padding and protection to keep athletes safe.



Compacted, bare soil in sideline areas is hazardous for athletes running out-of-bounds. Photo courtesy of Pamela Sherratt.



Unstable benches and exposed concrete footings in team areas present a safety hazard. Photo courtesy of Scott Bills, CSFM.



The concrete box in the out of bounds area should be properly padded to protect athletes. Photo courtesy of Pamela Sherratt.

What can I do to eliminate hazards in out-of-bounds areas?

Conduct routine facility inspections to check the following:

- All catch basins are adequately covered and level with the soil surface.
- Transition areas, such as between track and field, is easily identifiable and level.
- Fencing is securely set in the ground with concrete footers below the soil surface. The fencing is securely attached to fence posts with no large gaps in the fencing or between the ground and the fence. There are no exposed wires or damaged areas that protrude, are sharp, or are loose.
- Bleachers are constructed so that nuts and bolts are tight and in sufficient number. Guard rails and railing end caps are securely in place. There are no splinters, worn areas, hazardous protrusions, or sharp edges.
- Signage is prominent to notify players and spectators of rules, appropriate behavior, and deficient conditions.
- Public telephones and medical facilities are available for emergency situations.
- Areas that are hazardous or under repair have been blocked off or identified.

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Additional Considerations to Improve Field and Facility Safety

Hire a Professional with Field Maintenance Experience

A qualified professional will understand and provide the care athletic surfaces need to be safe. Hiring or involving a sports turf manager who can oversee daily operations and maintenance of a natural grass field is important for its success. A trained sports turf manager on staff will ensure that safety standards and field maintenance are priorities. On a daily basis, your sports turf manager can oversee the care of the athletic fields, maintain the budget, manage staff, and communicate with users. A sports turf manager will understand and schedule the necessary cultural practices. Mowing, irrigation, fertilization, aeration, seeding, and integrated pest management practices are essential for maintaining field safety.

Keep Detailed Records

Whether it is done by a volunteer or a sports turf manager hired to manage the fields, staying organized and maintaining accurate records for all aspects of your facility is essential for a successful program and to have documentation available should a problem arise. Keep track of field maintenance by recording dates of maintenance activities, total hours spent on the activity, and any special notes about the activity, such as equipment and materials used. Record all chemical and fertilizer applications made to fields. This includes product name, cost, total amount of nutrients or chemicals applied, weather conditions, date, applicator name, and purpose of treatment.

Plan and document regular field safety inspections. Prior to practices and games, assess field conditions and make any corrections to safety hazards before allowing players on the field. Be sure to record issues and corrective measures. Photos are an excellent means of recording before and after corrections of a safety hazard. STMA provides checklists to assist with field safety checks for [Football/Soccer](#) and [Baseball/Softball](#). STMA also provides educational videos that promote field safety for [Baseball/Softball](#), [Natural Grass](#), [Synthetic Turf](#), and [Facilities](#).

STMA also offers the [Playing Conditions Index \(PCI\)](#) to help assess the playability of fields. The PCI is used to provide a snapshot of your fields' playability at a specific

point in time. The continued use of the assessment tool provides information that can help guide field management practices, assist with communication to user groups, help to substantiate the need for more resources, and provide information to the media relations department when necessary.

Test Surface Hardness

Tools and specifications to assess athletic field surface hardness are now commercially available, although their unit cost typically results in this testing being done by a commercial contractor. Surface hardness can be tested using a Clegg Impact Tester or F355 device.

Surface hardness is measured by dropping a weight from a fixed height onto the playing surface. A numerical value, referred to as Gmax, is generated, with higher values indicating a harder surface. Gmax should be tested at various locations across the field, with special attention being paid to high-use locations, such as mid-field areas and goalmouths. The results from various locations helps to gauge overall playability and safety and if remediation needs to occur.

Clegg Impact Tester*	F355 Device*
According to standards set by the NFL, each test location must be below 100 Gmax .	The American Society for Testing and Materials (ASTM) standard (F1936) sets an upper limit of 200 Gmax . A value greater than 200 Gmax qualifies for the expectation that life threatening head injuries may occur.
If hardness levels begin to approach 100 Gmax, field remediation must take place to lower Gmax values.	The Synthetic Turf Council (STC) recommends Gmax does not exceed 164 when using the F355 device.

*Note: The Clegg Impact Tester and F355 device are different instruments and their Gmax values are not interchangeable.

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The use of these instruments continues to grow as both volunteer and trained sports field managers alike continue to demonstrate to the public their commitment to providing safe athletic fields. Having these types of data in your records is a great way to verify the safety of your fields when it comes to surface hardness.

Have a Risk Management Plan in Place

Having a risk management plan is important if a potential crisis arises. A sample plan can include the following:

- Develop a safety committee.
- Establish standard operating procedures for field safety assessment.
- Inspect the premise regularly and keep maintenance records customary for the site or sport.

- Repair defects immediately or prevent exposure to users, participants or spectators until the premise is made safe.
- Keep users, participants or spectators safe during the use of the premises by having a plan for reasonable supervision and security.
- Use reasonable employee recruiting, selection, hiring and training practices.
- Have a written emergency and medical plan. Determine the location of medical facilities both on and offsite. Make sure instructional and directional signage is prominent in case of an emergency.
- Practice the plan.

All athletes deserve a safe place for recreational activities. Failure to meet the proper standard of care for a given situation is negligence, and any resulting damages may be claimed in a lawsuit by the injured party. Limit your risk by taking the proper precautions to ensure both your field and facility are safe. Be attentive to daily field conditions, keep detailed records for maintenance and repairs, and have a risk management plan in place to protect yourself and the facility in the event of a catastrophe.

Produced by 2016 STMA Information Outreach Committee