Professional Series: Building Athletic Fields

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Athletic fields are a significant investment for any organization and it is critical to make good decisions during the planning, construction, and establishment of a field. Good planning decisions lead to quality fields that perform well, are safe for athletes, and may last for many years. Poor decisions can lead to unsafe fields that may need premature renovation or even reconstruction. This publication highlights several principles of construction to help produce an athletic field with good playability and player safety.

Construction Scheduling

When planning construction of any turf area that will be seeded to cool-season turf, the optimum target completion date is August 1. This is because mid-August is the best time to seed cool-season turfgrasses like Kentucky bluegrass, which is the preferred grass for athletic fields throughout Nebraska and the north central states. To determine the start date for construction, work backwards from the target planting date, allowing ample time for grading, settling, installation of irrigation and drainage, etc. If seeding Kentucky bluegrass occurs in mid-August when growing conditions are exceptional and irrigation is supplied, the fields will normally be usable within 12 months after seeding. On the other hand, if seeding occurs at any other time of the year, it could take 18 months or longer before the field is ready for play. Sod can also be used instead of seed. Sod must be laid by winter in order for it to be playable by late in the following summer. Sod laid in the spring rarely has enough time to root and stabilize to be played on in August. Additionally, it is important for the soil in the sod field to be similar to that in the new athletic field. Laying sod on soil significantly different than where it was grown will limit rooting.

Area Needed

Regulation size athletic fields range in size depending on the athletes' age level. A complete list of field dimensions is available at the Sports Turf Manager Association's web page http://www.stma.org/field-dimensions. When building athletic fields, it is important to plan extra fields if possible to rotate play allowing turf to recover from damage (Fig. 1). Another alternative is to make fields and surrounds large enough and with borders to rotate direction of play. For example, if a practice field runs north-south, allow enough space to rotate the field 90 degrees, creating two parallel fields that run east-west. Avoid permanent fixtures like bleachers, goals, and observation platforms to allow flexibility in use areas. This strategy spreads out turf wear on the heavy use areas like goal mouths and sidelines. Dedicated practice areas and parking should also be taken into consideration when planning athletic field complexes.

Figure 1. It is critical to rotate play around fields in order to allow fields to recover from damage.

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Types of Fields

The three basic construction types are native soil fields made of existing soil or topsoil brought on to the site, modified soils where the existing soil is modified with amendments such as sand or peat, and sand fields which are essentially 100% sand. The most common type of field is the native soil field. Rarely are modified soil fields built because it requires at least 80% by volume of amendment to improve the native soil. DO NOT modify soil for a field without extensive testing. Sand fields can be 12-14 inches deep or sand-capped to only 4-6 inches deep. Sand fields are difficult to maintain and expensive to build. If you are considering a sand field, contact the information sources listed at the end of this booklet. The rest of this publication describes construction of native soil fields.

Figure 2. Establishing a garde with up to 2% slope is critical for the fastest surface drainage to allow for use shortly after rain storms. Poor grading on this relatively new field has left depressions that hold water that will eventually thin turf.

Grading and Drainage

It is critical to establish adequate surface drainage on an athletic field. Without proper surface drainage, depressions will gradually develop that will hold water, make it difficult to maintain turf, and possibly risk injury to players (Fig. 2). Though most coaches and players prefer to have a perfectly flat field, this is only possible with an expensive sand field. A 2% slope is preferred on most turf areas, but a 1.0 to 1.5% slope is acceptable on native soil fields if used only occasionally. For native soil fields, it is imperative to have at least a 1.0 to 1.5% slope from the centerline of the field to both sidelines. This will make a crown from 9 to 18 inches at the center of the field depending on the width. A less desirable alternative is to slope the field from one sideline to the other at a 2 to 3% grade. This will provide a "flat" field and allow surface drainage off the field, but requires water too move twice as far to reach drain lines at the edge of the field. Some will consider substituting subsurface drain tile lines for surface drainage. This is not recommended because water can be removed from a field more rapidly by surface drainage and will allow play within hours after a rain. Subsurface drainage is much slower and water will move through a field only within days or weeks after a rain. However, subsurface tile lines with open surface grates are important to install at the edge of a field to collect the surface drainage from the field (Fig. 3).

The initial step in grading an athletic field is to remove the topsoil and stockpile it out of the way. The second step is to establish the

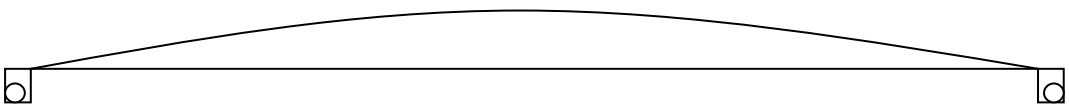

Figure 3. Diagram of preferred design of a field showing slope from the center crown to the sidelines with catch basins around the perimeter that are connected with subsurface tile leading off-site.

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subgrade using subsoil which will conform to the final grade. Therefore, the subgrade should be created with a center crown running the length of the field and sloping off at 1.0 to 1.5% to both sidelines. When moving large amounts of soil, account for about 15% settling on fine textured soils and less for coarse soils. In other words, if a foot of fine- textured soil is moved to create the subgrade, that soil will settle about 1.5 to 2 inches.

After settling or compaction, topsoil should be brought in over the rough grade. Ideally, four to six inches of topsoil is needed for optimum turf performance. After the topsoil is replaced, tile drainage with risers and/or catch basins should be installed on the sidelines of the field. In-ground irrigation should also be installed at this time. Though in-ground irrigation is relatively expensive to install, it is required to maintain playable athletic fields in in the north central US. After drainage and irrigation installation, the topsoil will usually need to be tilled to break up clods and to create a uniform seedbed. Avoid tilling soils that are too wet because it will smear the soil and decrease drainage. Overly aggressive tilling should also be avoided because it will create a "fluffy" and fine particle soil that is prone to compaction, poor drainage and poor aeration. Inclusion of soil amendments during tillage provide marginal effects and thus generally are not recommended.

Table 1. Kentucky bluegrass top performers in 2001-2005 NTEP study in IA, NE, or SD (at least 2 of 3 states) under irrigation to prevent stress that also performed well in wear tolerance trials in Massachusetts

Alpine	Freedom III
Award	Ginney
Awesome	Impact
Barrister	Midnight II
Bedazzled	North Star
Champlain	Quantum Leap
Courtyard	Rugby II

Prior to final grading, allow adequate time for soil to settle to avoid uneven turf later. Irrigation or rainfall will accelerate settling. During this time, a soil test should be taken from the site to determine fertilizer recommendations for the area. Correct any deficiencies in nutrients or pH by following the recommendations on the soil test report (more information is available under Additional Sources at the end of this publication). Final grading follows tilling and serves to smooth and level the surface. Hand rakes, sand trap rakes, or other tools are used to establish the seeding surface. A final shallow raking should occur immediately before seeding to prepare the seedbed. After the seedbed is prepared, apply a starter fertilizer (high in P) at the rate of 1.0 to 1.5 lbs. P_2O_5/1000 sq ft to help promote rooting and establishment.

Selecting a Grass Species

Kentucky bluegrass is the preferred species for athletic fields in the north central US. Though slow to germinate and establish, Kentucky bluegrass has the best combination of wear resistance, recuperative ability, winter tolerance, and summer tolerance. When establishing an athletic field, 100% Kentucky bluegrass blend containing three or four cultivars should be used. At establishment, it is extremely important to achieve the highest percentage possible of Kentucky bluegrass in the stand, because it is the last chance to efficiently establish Kentucky bluegrass in an athletic field. Acceptable cultivars are listed in Table 1, but cultivar availability is constantly changing. Therefore refer to the National Turfgrass Evaluation Programs website at http://www.ntep.org for the latest data. Perennial ryegrass is sometimes included with Kentucky bluegrass in a seed mix at establishment, but perennial ryegrass should be used only where winterkill or diseases like gray leaf spot and pythium are not a problem. The most recent research on mixing Kentucky bluegrass and perennial ryegrass was done

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at the University of Wisconsin under athletic field traffic conditions. Their research recommended limiting perennial ryegrass to no more than 10% to maximize the amount of Kentucky bluegrass in the final stand. Their report with full results can be found in the additional sources list.

Tall fescue is generally not recommended for athletic fields even though it is exceptionally drought and wear tolerant. Tall fescue is not recommended because it requires 12-18 months to establish before it can tolerate traffic, and it can become uneven and "clumpy" with extended heavy traffic. When tall fescue thins from wear, tall fescue should preferably be overseeded back in because of similar texture, and thus 12-18 months will be required before use. Tall fescue is only recommended for lightly trafficked athletic fields without irrigation and when there can be 12-18 months between seeding and use.

In special cases in the north central US, bermudagrass could be used as an "annual crop" for play in late summer and fall. Minor to severe winterkill would be expected, followed by renovation in May. This could be used where substantial damage occurs and there is not enough time to establish Kentucky bluegrass/perennial ryegrass prior to the season. Please contact the turf specialists at UNL before embarking on planting bermudagrass in the north central US.

Buying Good Seed

It is important to purchase high quality grass seed for any turf area, but it is especially important for athletic fields. High quality seed will probably be some of the most expensive seed available. However, the cost of seed is minuscule compared to the amount of money spent on maintaining the athletic field for the lifetime of the field. The best way to purchase high quality grass seed is to contact a reputable company with experience providing seed for athletic fields. Additionally, the ability to understand seed labels is critical when selecting quality seed. Table 2 lists preferred ranges of items found on the label of a quality seed lot. Be sure to save the label from the seed in case you need to purchase more seed later or a problem with the seed lot develops after seeding.

Table 2. Preferred ranges for items on the label of a good quality seed lot.

	Preferred range
Purity	>90%
Germination	>80%
Crop	<0.5%
Weed	<0.3%
Noxious Weed	0
Inert	<8%
Date Tested	last 9 months

Late Summer Seeding

As mentioned previously, the best time of year to seed cool-season grasses is in late summer. Adequate soil moisture, warm soil, and limited weed pressure allow for excellent seedling growth. Between August 15 and September 15 is the optimum seeding date for most of the north central US, but seeding earlier is preferred north of Nebraska. It is critical to seed as early as possible within these windows. Even when seeding within these windows, waiting one week later to seed will result in two to four additional weeks to mature and be ready for play.

Seeding in Spring or Winter

Seeding in the spring is possible, but less effective than late summer seeding. It is important to seed as early in the spring as possible to maximize the competition of turfgrass over crabgrass. Dormant (winter) seeding or early April seeding is preferred. Dormant seeding occurs when seed lies dormant until the soil temperatures warm in April or May. Depending on your location, dormant seeding can be done as early as Thanksgiving and as late as March. The benefit of dormant seeding is that as the soil heaves and cracks during the winter, crevices (honeycombs) are created for the seeds which create ideal germination conditions. Additionally,

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dormant seeding is easier to schedule than spring seeding, because spring rains make it difficult to seed after March. Though seed-soil contact is important regardless of seeding date, it is especially important when dormant or spring seeding. Irrigate often as soon as temperatures favor germination (soil temperatures above 55F). As root systems develop, gradually reduce frequency but increase duration of irrigation. Continue irrigation throughout the summer until an adequate root system is established. More information on dormant seeding can be found in the list of additional sources.

Seeding

Seed should be applied using a gravity-type spreader, either a walk-behind drop spreader or a tractor-mounted seeder such as a Brillion®. Rotary spreaders do not disperse the seed uniformly. There are no spreader calibration guides for turfgrass seed. The easiest way to apply seed uniformly to a single field or smaller area is to set the spreader adjustment very low, sow one half of the seed in one direction and then sow the other half at right angles to the previous passes. It might take three or more passes over the field in a single direction, but it is well worth the time to get a uniform seeding. Hydroseeding can be used where seed is combined with paper-based mulch and sprayed onto the field. Though this is more expensive than traditional drop seeding, it delivers excellent results with good germination and the added benefits of mulch. Contact a local reputable landscaper for hydroseeding. Whether drop seeding or hydroseeding, use a seeding rate of 2-3 lbs/1000 sq ft or 90-130 lbs/acre for Kentucky bluegrass.

Mulching other than hydromulch is generally not recommended for an area as large as an athletic field. However, since mulch conserves water, it is important to mulch athletic fields that cannot be watered two to four times daily during establishment. One bale of clean (weed-free) straw per thousand square feet will give a light covering that will not have to be removed after germination. Oat or wheat straw is strongly preferred over hay or soybean stubble. Do not apply too much mulch since it can shade seedlings and will have to be raked off later. Apply the mulch very lightly so you can still see approximately 50% of the soil through the mulch layer. Regular mowing following germination will help control most of the annual grassy weeds that are brought in with straw mulch.

Common Mistakes in Athletic Field Construction

1. Allowing inadequate time for construction in order to seed by mid-August.
2. Planning too little time between seeding and use to allow for turf establishment.
3. Not planning proper surface drainage.
4. Not including in-ground irrigation.
5. Not planning for adequate maintenance following construction.

Irrigating

Seedlings are susceptible to drying out, and the seedbed should not be allowed to dry. A newly-seeded athletic field will need to be irrigated two to four times daily depending on the weather. This is why automatic irrigation is extremely important. Enough water should be applied during each irrigation cycle to moisten the top half to one inch of the soil profile, but avoid over-watering and saturating the area. Once the seedlings are two inches tall, gradually reduce the frequency of irrigation and water more deeply (longer cycles). After the turf has been mowed two or three times, deep and infrequent irrigation to the depth of the root system is most effective.

Mowing

Mowing a new field will encourage the turf to fill in quickly. Mowing should begin when the first few seedlings are tall enough to mow. You may only mow 10% of the plants in the first mowing, 20-30% of the plants in the second mowing, and so on. Most wait

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too long to mow a newly-seeded field, so mow early and often. Mow Kentucky bluegrass at 1.25 - 2.5 inches and never remove more than 1/3 of the grass blade at any one mowing. Mowing will also eliminate most of the weeds in a new stand.

Fertilizing

New seedlings have poorly developed root systems, and thus they cannot effectively absorb nutrients from the soil. Therefore, it is important to fertilize frequently after seeding to encourage establishment. Use the same starter fertilizer as used when seeding and apply every four to five weeks after germination. Assuming seeding in mid-August, these applications would be mid-to-late September and again mid-to-late October. If dormant or spring seeding, apply the starter fertilizer four to six weeks, eight to ten weeks and again 12-14 weeks after germination.

Controlling Weeds

There is little weed pressure in the fall so weed control may not be needed for fall seedings. If broadleaf weeds such as clover and dandelion become a problem later in the fall, they can be easily controlled with a broadleaf herbicide application in October or November, after the third or fourth mowing. Annual grasses such as crabgrass can be easily controlled the first year with preemergence herbicides applied in the spring. Avoid applying a preemergence herbicide in early spring to newly-seeded fields not fully established because it may damage late-developing seedlings. In this case, consider using a postemergence crabgrass herbicide later in summer to control crabgrass.

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Additional Sources of Information

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