

Skin surface selection and management for infields

By Bradley S. Park, and Dr. James A. Murphy

This article provides information on infield mix (soil) selection for use as baseball and softball skin surfaces, as well as maintenance guidelines to provide uniform playing conditions.

Soil used to construct a skin surface is referred to as infield mix. Thus, soil selection and management of skin surfaces will affect playability. A high quality skin surface is smooth, uniform, and provides consistent footing and ball response; whereas a poor skin surface can result in errors by players fielding ground balls, player injury, and chronic puddling in rainy weather.

A high quality skin surface is often described as one that is moist and cork-like, as opposed to hard and dry; the surface should allow players' cleats to penetrate the surface and leave an imprint with very little soil disturbance or displacement. The skin surface should not give way (break loose) when players plant their feet to throw, field a ball, or run. These characteristics are strongly controlled by the physical properties of the infield mix and its maintenance.

Physical properties of an infield mix are strongly affected by its sand and fines (silt and clay) content. Maintenance of a skin surface involves managing water (irrigation and tarping), dragging and grooming, and the use of conditioners. Dragging and grooming loosens, levels and smooths the skin surface to maintain safety and playability. Conditioners are typically granular, clay-based materials used to maintain playability over a range of weather (water) conditions.

Selecting an infield mix

ASTM (2007) suggests that infield mixes consist of 60 to 81% sand with the remainder being comprised of silt, clay, and gravel (preferably none) according to the particle size specifications. A 4- to 6-inch layer of mix is placed above the subsoil and finished to final grade. In cases where the infield mix contains greater than 85% sand and exhibits high internal permeability after heavy compaction, the mix should be placed above a gravel drainage blanket to improve water retention and stability of the skin surface.

Mixes with less than 19% silt and clay are better suited for rainy climates due to better internal drainage; however, these mixes will require more irrigation in dry periods to minimize dust and provide a firm stable playing surface. In contrast, mixes with greater than 19% silt and clay will drain more slowly and retain more water; hence, the need to irrigate (frequency) will be less. Mixes with > 19% silt and clay will also be more prone to compact and be difficult to loosen, especially when dry.

Some field managers prefer skin surfaces that contain a greater percentage of fines (silt and clay) compared to the ASTM recommendation for infield mixes. An infield mix should contain between 50 and 75% sand because mixes with > 75% sand can become too loose and are readily moved (displaced) during play or dragging leading to high and low spots, as well as the formation of lips at the skin-turf boundary. Infield mixes should not exceed 40 to 50% silt and clay because these materials can become compacted, reducing the ability of the surface to accept water, and thereby limiting the grounds manager's ability to "soften" a hard skin surface with irrigation. [We] recommend infield mixes be comprised of approximately 60% sand, 20% silt, and 20% clay.

Skin surfaces should be constructed with a finish grade that provides adequate surface drainage (water runoff) away from and off the skin due to the limited permeability of most infield mixes. Baseball and softball skin surfaces should be designed with a finish grade of 0.5 to 1.5% slope away from the center of the infield.

Baseball and softball fields designed into multi-sport fields should surface drain water away from the infield and skin surfaces. Field designs that position skin surfaces of infields at the lowest elevation can render the baseball/softball field unplayable for several days after rain.

The following design parameters will provide reasonable skin surfaces for the majority of municipal and board of education baseball and softball infields.

1) Excavate 4 to 6 inches of native soil from the site.



- 2) Match the subgrade to the finish grade contours (ideally 1.0% slope away from the middle of the infield) using laser-guided equipment.
- 3) Firm, if necessary, but do not overly compact the subgrade (i.e. roll with a small [< 1 ton] pavement roller disengaging any vibratory function); any internal drainage that can be achieved through the subgrade will be beneficial.
- 4) Replace the excavated layer with 4 to 6 inches of infield mix containing no more than 70 to 80% sand (remainder silt and clay). Ideally, there should not be any gravel in the mix.
- 5) Use laser-guided equipment to final grade the skin surface to mimic the contour of the subgrade. This will ensure the correct contouring required for proper surface drainage.
- 6) A calcined clay conditioner product can be applied as a topdressing (0.25-inch or less) to the surface to create more consistent ball bounce and desirable sliding conditions.

Skin surface management

Skin surface management is typically as much art as science and practices have often been handed down from one field manager to the next. The skills of the grounds manager are often a greater contributing factor to the playing quality of skin surfaces than the infield mix itself.

Grounds managers must use practices that are appropriate for the specific field or modify the field conditions to match a given maintenance program. While skin surface management techniques may differ from one grounds manager to the next, there are specific tasks that need to be performed to produce safe playing conditions on skin surfaces. These tasks include but are not limited to watering, scarifying and dragging, leveling, lip removal and conditioning.

The frequency and intensity of these tasks is strongly influenced by the particle size distribution (sand, silt and gravel content) of the infield mix.

Water management

Water availability is probably the most important factor affecting the overall performance of skin surfaces. The water content of a skin surface affects both ball and player reaction. Water is needed to soften fine-textured infield mixes (high silt and clay content) and firm coarse-textured mixes (high sand content).

Field design should include water supply to the skin surface.

A quick coupler (hose connection) should be located approximately 6 feet behind the mound on a baseball field; the safest and most logical place for the coupler. More involved irrigation designs include automatic pop-up irrigation sprinklers to lightly water (syringe) skin surfaces.

Differences in the approach to watering skin surfaces are attributable to water accessibility, budget, labor, climate, particle size distribution of the

infield mix, and coach and player preferences. Irrigation water for skin surfaces and turfgrass is often unavailable in the case of municipal fields. Conversely, managers of professional fields often "flood" skin surfaces before a homestand, immediately after a game, before lunch on game day, and conclude with a final light watering in between batting practice and pre-game activities.

Water held within a skin surface produces the "corky" feel that players desire; water is often provided through irrigation after games in addition to supplemental game day irrigation dictated by weather. [We] recommend skin surfaces be deeply irrigated at a rate that allows water to infiltrate slowly into the surface and be retained for a considerable amount of time. Care must be taken to avoid overwatering areas surrounding skin surfaces.

Infield dragging and grooming

Periodic scarification, leveling, and smoothing of skin surfaces is required; this can be accomplished with commercially purchased grooming machines or constructed drags which can be hand-pulled or towed by a small tractor or utility vehicle. Scarification and leveling methods should produce a thin (0.25-inch) loose layer or "cap" on the skin surface. This cap provides more uniform ball bounce and roll and a good surface for sliding. Scarification of this layer should not exceed 0.5-inch (too deep) otherwise traction (footing) will decrease and ground balls can skid rather than bounce. Scarification often involves dragging the skin surface with a nail-drag (or similar) to loosen the surface 0.25- to 0.5-inch.

This loosened material is used to level-out high and fill low spots, which decreases the time to dry the surface after rain (puddles are reduced in size after leveling). After scarification and leveling, a steel drag or cocoa mat is often used to groom (smooth) the surface before play.

Proper infield dragging, leveling, and grooming techniques maintain/improve surface drainage, safety and playability of skin surfaces. Improper techniques that physically move infield

mix into turf will encourage the development of a lip. A "lip" is a mound or ridge at the boundary between a skin surface and turf. Lips impede surface water drainage off the skin surface as well as present unsafe playing conditions. Therefore, it is imperative that infield dragging and leveling along the perimeter 12 inches or more of a skin surface be performed by hand in a direction that

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Skin surface selection...

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moves soil away from or along the skin-turf boundary, not toward the turf. Wind and water erosion can also move infield mix into border turf areas resulting in a lip.

Invariably, movement of infield mix into the bordering turf does occur and routine corrective practices should be used to reduce lip development. Stiff-bristled brooms are often used to brush 6 to 8 inches of the bordering turf towards the skin surface. Blowers, irrigation hose spray and power washers have also been used successfully.

If allowed to develop, large lips require costly and time consuming methods to correct. A sod cutter will be needed to remove the grass and buildup of infield mix from the lip along the skin surface-turfgrass border. Repair of large lips may also require substantial re-grading to re-establish an acceptable grade along the skin surface and turf boundary area. Typically, the turf-skin boundary is re-established with sod.

Adding infield mix to "eliminate" a lip is a common mistake because this action elevates the skin surface relative to surrounding turf, decreases playability and safety, and often stops surface drainage. Repeated addition of infield mix eventually results in major renovation work to fix these compounded infield problems. Renovation involves the "extra" infield mix being removed and re-grading to reset the proper infield contours. The turf-skin boundary can then be re-established with sod.

Use of infield conditioners

Conditioners are materials designed to be spread on top of skin surfaces to improve playability over a range of weather conditions. Calcined clay is one of the most commonly used conditioners. Typically montmorillonite clay is fired at approximately 1200F to form granules of calcined clay that remain hard even when wet.

Conditioners are often used to soak-up excess water after rain; finer-textured conditioners work best for this purpose. Conditioners used for this purpose should be swept-up (removed) from the skin surface after play, stored and allowed to dry for re-use.

A 0.25-inch layer of conditioner can be spread (topdressed) evenly across the skin surface to produce the loose cap described previously. Using a granular conditioner as the cap material rather than infield mix generally makes it easier to remove migrated material from the turf boundary back onto the skin surface and prevent the development of a lip.

Skin surface water retention is a function of the amount of silt and clay in the infield mix, not the amount of calcined clay on the surface. Calcined clay applied to the skin surface will often dry before the underlying infield mix resulting in some grounds managers applying unneeded irrigation water. Fine-textured infield mixes can be modified to react more like coarser-textured mixes by incorporating calcined clay. In contrast, coarser textured infield mixes would be less affected by adding calcined clay because of the similar particle sizes between the infield mix and the conditioner. Thus, a particle size analysis of the existing infield mix is necessary when deciding whether to incorporate a conditioner; the addition of calcined clay to a coarse-textured infield mix often will not improve playability.

Mounds and batter's boxes

Clayey soil or "bricks" (clay >35%) are used to construct a stable, wear resistant surface for the "table" (the area behind and to the sides of the pitching rubber), landing area of the pitcher's mound, and the batter's and catcher's boxes around home plate. The installation of a clayey soil often minimizes the damage caused by a pitcher digging in front of the rubber. Clayey soil should be placed and compacted (hand tamper) about 0.5-inch below the surface of the mound; infield mix is used to bring the area to final grade.

Particle size guidelines for an infield mix to be used in the construction of a skin surface range from 50 to 81% sand and 20 to 50% silt and clay. Infield mixes that contain greater than 75% sand will require substantial irrigation to provide a firm and stable playing surface during dry weather. Conversely, infield mixes with less than 60% sand will be very firm when dry and irrigation will be needed to "soften" the skin surface for play.

Regardless of infield mix selection, skin surfaces must be graded to provide surface drainage away from the infield (0.5 to 1.5% slope). It is also important to provide a water source to irrigate the skin surface. If irrigation is not available, playability of a skin surface will be less than optimum during drought. Grooming methods are needed to produce a uniform 0.25- to 0.5-inch cap over the skin surface and preventative maintenance is necessary to minimize lip development. Lips along skin surface perimeters present a hazardous condition and require costly, time consuming renovation work.

Conditioners can be applied (topdressed) to skin surfaces to act as the cap; finer-textured conditioners can improve playability during rainy conditions. Additionally, conditioners can be incorporated into finer-textured infield mixes to improve surface hardness and increase permeability. A particle size analysis should be performed on the conditioner and infield mix to determine compatibility before incorporating conditioner into the infield mix.

Pitcher's mounds and the batter's and catcher's boxes should be constructed with clayey soil or "bricks" containing > 35% clay to provide the stability, traction and durability needed in these high traffic areas. ■

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