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Standard Guide for Construction and Maintenance of Warning Track Areas on Athletic Fields[1]

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1. Scope

1.1 This guide covers techniques that are appropriate for the construction and maintenance of warning track areas on sports fields. This guide provides guidance for the selection of materials, such as soil and sand for use in constructing or reconditioning warning track areas and for selection of management practices that will maintain a safe and functioning warning track. Although this guide has applications to all sports where a warning track surface may be required or desired, it has specific applications to baseball/softball.

1.2 This guide does not address synthetic warning tracks such as rubberized surfaces, artificial turf, or paved surfaces.

1.3 Decisions in selecting construction and maintenance techniques are influenced by local soil types, climatic factors, level of play, budget, and training/ability of management personnel.

1.4 The values stated in SI units are to be regarded as the standard. The values in parentheses are for information only.

1.5 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory requirements prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

F1815 Test Methods for Saturated Hydraulic Conductivity, Water Retention, Porosity, and Bulk Density of Athletic Field Rootzones

F2651 Terminology Relating to Soil and Turfgrass Characteristics of Natural Playing Surfaces

3. Terminology

3.1 *Definitions*—Except as noted, soil- and turfgrass-related definitions are in accordance with Terminology F2651.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *aggregate material*—a soil-like or earthy material without appreciable soil structural properties such that an aggregate material is essentially granular or single-grained in nature.

3.2.2 *warning track*—a section of a sports field area typically devoid of vegetation, that provides a change in surface texture such that an athlete can sense without looking the proximity to a hazard such as a fence, post, or wall.

4. Significance and Use

4.1 Warning tracks are playing surfaces located on the margins of the playing area for the purpose of providing a warning to the player that he or she is approaching a hazard (commonly a fence) or out-of-bounds area. In order to provide for an effective warning track surface, the warning track must be constructed and maintained in such a manner so that the player can sense the change in texture from the regular playing surface and the warning track without having to look. This feature is very important in that the player is often visually focused on the ball during play and would not be looking at the ground as he/she is running toward the warning track. The warning track must also be constructed and maintained in such a manner that the warning track itself, or the surface transition, does not pose a hazard to the players.

4.2 The warning track areas of sports fields should provide a uniform surface with good footing. The change in surface texture of the warning track from the surrounding playing surface must be of enough contrast such that the player can sense the change without looking. Most often, warning track surfaces are devoid of turf or other vegetation. However, turfed warning track areas may be used in instances where such purpose is to "warn" the player of an impending hazard where the primary playing surface is a skinned area. This may be the case in softball where the entire infield playing surface is a skinned area and a turfed warning track is used along the first base and third base fencelines. Undulations, rough surface,

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

hard or soft surface, weeds, stones, debris, wets spots, etc. detract from a good, safe warning track. The safety and effectiveness of the warning track is largely affected by construction and maintenance procedures and this guide addresses those procedures.

4.2.1 During construction, consideration should be given to factors such as the physical and chemical properties of materials used in the area, freedom from stones, sticks, and other debris, and surface drainage and internal drainage. Consideration should also be given to the surface elevation such that a drastic change is not produced by the transition from the playing surface to the warning track area which may create a tripping or falling hazard.

4.2.2 Maintenance practices that influence the playability of the surface include edging, dragging, rolling, watering, vegetation control, and removal of stones and debris that may adversely affect play and safety.

4.3 Those responsible for the design, construction, or maintenance, or a combination thereof, of baseball and softball fields, or play areas where the need for a warning track area has been identified, will benefit from this guide.

5. Design

5.1 *Composition*—Most warning track constructions will be an area devoid of vegetation as a transition from a turfed (natural or artificial) playing surface. While areas devoid of vegetation are technically "skinned" areas, for the purpose of this guide the term "warning track" is utilized to differentiate the areas of the playing surface that are not part of the skinned infield area.

5.1.1 Warning tracks can be constructed of various materials and still meet the objectives of an effective warning track surface. Various soil components and amendments may be specified. The concept of a warning track surface with firm footing is that the particle sizes of the materials used or blended for the construction are of a wide enough range so as to provide a substrate that binds together or has good interlock of the components. Clay soil materials may be used in such constructions in that they will bind together. However the plastic nature of clay materials when wet could preclude high-clay warning tracks in that they would not provide safe and effective footing under conditions of high moisture.

5.1.2 The most effective warning tracks should be composed largely of granular or aggregate materials (fine gravel and sand) of a wide enough particle size range such that the particles interlock. Angular grains of aggregate (as opposed to rounded grains) provide more interlock due to the increased internal friction they provide within the soil profile. Small additions of clay or clayey material may be appropriate to provide some characteristics of cohesiveness and color. It is often desired for the color of the warning track to match as closely as possible the color of the skinned areas of the field. In these instances, the clay material used in the skinned infield constructions may be included in smaller proportions in the material mixed for the warning track areas.

5.2 *Dimensions*—Typically, warning track dimensions are not included in rule books and the recommended widths are typically based upon such factors as the age, size, and ability of the players. For warning track areas adjacent to the backstop fence and extensions, the distance used for a warning track is typically ⅓ of the distance from home plate to the back stop. For example, where the rule book specifies a home plate to back stop distance of 7.6 m (25 ft), the appropriate dimension for the warning track in this instance would be 2.5 m (8.2 ft). The warning track dimension therefore would tell the catcher and infielders that they have covered two thirds of the distance to the backstop/fence. Other criteria for warning track dimensions include the rule of thumb for a distance equivalent to three full strides of a running player. The concept here is that the player has a distance equivalent to three strides in order to adjust his position/speed to protect himself from the impending obstruction. A distance of three full strides of a running player can vary from about 2.5 m (8 ft) for youth players up to 5.5 m (18 ft) for collegiate or professional-level athletes. It should be noted that warning track dimensions that are too great may lose their effectiveness in that a dimension that is too vast (too much playing area contained within the warning track area) will fail to provide effective "warning" of the impending obstruction.

5.2.1 A warning track construction should be designed to allow for surface drainage. A surface slope between 1 and 1.75 % should be incorporated as a design element in the warning track.

5.3 *Performance*—A warning track could be constructed by blending an aggregate amendment into the on-site or existing soil or could be constructed of entirely imported materials.

5.3.1 *Aggregate*—The aggregate material used for a warning track blended material (whether blended with on-site materials or imported materials) should meet the following criteria:

5.3.1.1 *Particle Size Criteria for Aggregate Component of Warning Track Material:*

(1) Less than 5 % material greater than 6.35 mm (0.25 in.).

(2) Relatively uniform or homogeneous in size fractions between 6.35 and 0.3 mm. Sieve sizes used for characterizing the aggregate material shall include: 6.35 mm, 4.75 mm, 2.36 mm, 1.18 mm, 0.6 mm, 0.3 mm, and 0.05 mm.

(3) Less than 20 % of the particles in the <0.3 mm fractions combined.

(4) Less than 5 % silt and clay size particles (<0.05 mm).

5.3.2 *Soil*—If on-site soil materials are used in a warning track blend, the final mixture should contain no more than 15 % of the soil material in the final blend. Lesser amounts of soil material additions may be required for the resulting blend to meet the recommended physical criteria in 5.3.3. If a finer-textured import soil material is blended with an aggregate material, the soil material should meet the following criteria:

5.3.2.1 Soil shall consist of a clayey soil material (>30 % clay size particles).

5.3.2.2 Soil material shall have <2 % organic matter by mass.

5.3.2.3 Soil material shall have a silt to clay ratio of <2.

5.3.2.4 Soil material shall have <5 % particles greater than 2.36 mm.

5.3.3 *Resulting Blend*—It is anticipated that a resulting blend of warning track materials shall have <15 % soil materials in a blend with the specified aggregate material. The

proportion of components in the resulting blend should be determined based upon laboratory analysis to meet the following criteria:

5.3.3.1 Permeability determined as saturated hydraulic conductivity, >5 cm-h^{-1} (2 in.-h^{-1}) when compacted to a bulk density of 1.7 kg-m^{-3} and using hydraulic conductivity testing procedures as described in Test Method F1815.

5.3.3.2 A material that can easily be packed or compacted by hand or with the use of a lightweight missile to a bulk density of 1.7 kg-m^{-3} or higher in the laboratory.

5.3.3.3 Total porosity <35 % when compacted to a bulk density of 1.7 kg-m^{-3}.

5.3.4 *Color*—Different colors of soil, calcined amendments or other materials may be included to impart color desired for aesthetics as long as they do not adversely affect the performance of the warning track.

6. Construction

6.1 The warning track material that meets appropriate specifications should be installed to a minimum depth of 7.5 cm (3 in.) over subgrade. The subgrade should be evenly sloped between 1 % and 1.75 % to match the slope of the finish grade of the warning track. Installations of subsurface drains may be used under warning track areas. For new constructions, the extension of subsurface drains servicing the playing surface into the warning track area may be appropriate. Geotextile fabrics may be used between the subgrade and warning track profile to prevent weed growth. If a geotextile fabric is used, the fabric should not cover drainage lines unless it has been specifically manufactured for this purpose.

6.2 Once the area of the warning track has been excavated, the subgrade should be thoroughly compacted (>85 % compaction) to avoid differential settling of the subgrade materials. Once compacted, the slope of the subgrade should be rechecked and any irregularities or depressional areas should be corrected before proceeding. Once the subgrade is sufficiently prepared, the warning track material may be installed and leveled. Once the material is leveled, the area should be rolled and the final grade established so as to provide an even grade transition from the play area to the warning track. The smooth transition is imperative to lower the potential for tripping or stumbling. Tripping or stumbling could lead a player head-on into a fence or hazard.

6.3 A physical barrier (boards, landscape edging, etc.) placed in the soil to prevent encroachment of turfgrass into the warning track or to minimize mixing of materials in warning tracks and adjacent areas may minimize the need for edging to create a sharp boundary line; however, such barriers are not maintenance-free and may be safety hazards.

7. Maintenance

7.1 Routine warning track maintenance is primarily composed of five processes: edging, dragging, watering, rolling, and topdressing. Warning tracks may also require periodic renovation to restore the performance or appearance, or both. With some installations, periodic weed control may also be required. Weed control can be accomplished by hand (mechanical) or through the use of herbicides (either post emergent or pre-emergent). Care should be taken to reduce the effects of an excessive edge, lip, or uneven transition.

7.2 *Edging*—Edging prevents the encroachment of turfgrass into the warning track area. Edging also creates a neat and professional appearance. Edging also prevents the formation of a lip caused by warning track materials migrating into the adjoining turf area. Tools that are typically utilized for edging include powered sidewalk edgers, string trimmers, hand edgers, or flat-nosed shovels.

7.3 *Dragging*—Dragging helps to condition the warning track leading to a neat professional appearance. Periodic dragging also fills and levels depressions and undulations that may begin to form in the warning track. Dragging operations should consist of a nail drag procedure followed by a mat drag. It is recommended that dragging operations be performed at least once per month during the playing season. Mat dragging may be performed prior to each game for appearance. Care should be exercised in the dragging operation so as not to promote the formation of a lip at the transition with the grass playing surface caused by dragging loose warning track material into the turf. Material forming a lip can create a potentially hazardous condition for tripping or stumbling.

7.4 *Watering*—Watering is used to keep dust down during periods of play or maintenance, or both. Watering is also an essential practice to control moisture to achieve desired results from other maintenance practices. The moisture status of the warning track materials in preparation for other maintenance practices is primarily a matter of personal preference of the maintenance manager. Considerations for supply of water to the warning track should be considered during the field design or renovation planning stages. Water can be supplied by an irrigation design specific for the warning track area or by designing strategically placed quick disconnect outlets that will allow for the attachment of irrigation heads or hoses for hand watering.

7.5 *Rolling*—Rolling is required to continuously produce a surface that will provide firm footing. Rolling should be performed periodically throughout the season upon a moistened warning track profile. It is imperative that rolling follow any tillage operations that may be used to loosen up the warning track profile. Rolling should also follow any procedures where moderate to heavy topdressing applications have been applied. Mat dragging may follow rolling to eliminate any lines or marks left by the edge of the roller.

7.6 *Topdressing*—Topdressing material should meet the same characteristics as the warning track profile construction. Topdressing should be performed periodically to replace material that may have been lost due to erosion or to relevel the surface due to settlement. Topdressing can be broadcast over the entire surface and then leveled by dragging or topdressing may be applied to depressional areas. It is recommended that the warning track be conditioned prior to topdressing by utilization of a nail drag. The topdressing material may then be applied and then leveled with the mat drag, rolled and then mat dragged a second time.

7.7 *Renovation*—The warning track may require renovation from time to time due to the formation of undulations, an

excessive edge or lip at the turf interface, or an excessively hard or inconsistent surface. Generally, renovation activities should occur when the surface becomes too hard for the penetration of the nail drag. Renovation generally consists of 5 steps; tillage, topdressing, leveling, rolling, dragging. The profile should be prepared for tillage by softening the profile with water applications. The surface should then be tilled with a rotor tiller, ripper, or other suitable device. Care should be taken to assure the depth of penetration is not so deep as to disturb the subgrade or any geotextile layers. Following tillage, additional material should be applied as topdressing if required. The surface should then be releveled, rolled, and dragged to restore the finish grade.

7.8 *Lip or Edge*—Care should be taken in any and all construction, maintenance, and renovation procedures such to assure that an excessive edge, lip, or uneven transition is not formed between the playing surface and the warning track surface. The idea is for the player to sense the presence of the warning track (without looking) by a change in texture between two contrasting surfaces. To be avoided is the creation of a hazard that could lead to tripping or stumbling of the athlete as he changes from one surface to the other.

8. Keywords

8.1 athletic field; baseball; clay skinned area; softball; soil; sports field; warning track

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