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Item 1

Ballot Rationale:

As the use of infill synthetic turf sports fields has increased so have associated user safety concerns. The recent attention to concussions and other injuries at the professional level sports has further promoted these concerns and also media attention. The importance of suitable type and amount of infill material has been proven been clearly demonstrated. Performance characteristics such as impact attenuation, deformation, rotational resistance, linear friction, and others are partly dependent upon infill material composition and depth. Currently ASTM F1936 requires the recording of infill depth at g-max test locations further stating the importance of this component of synthetic turf systems. The relationship between infill depth and g-max, although not precisely definable at this time, is significant within the framework of any given infill synthetic turf system. The measurement of infill depth is currently performed by many individuals using a wide variety of devices and approaches. In consistency between device size, bearing surface area, the ground pressure of the device, number and size of probes, measurement scale, reading accuracy measurements, variation in the density of in place infill, variation in the depth of infill within small areas, and other conditions such as buried fibers and thin backing systems, makes consistency not possible. It is the intent of this intent of method to provide a consistent uniform method for measurement of infill depth.

This method uses a gauge with a constant ground pressure plate to minimize user errors associated with varying hand pressure and gauge accuracies, and device inconsistencies associated with devices of varying mass and surface contact area.

STANDARD TEST METHOD FOR MEASUREMENT OF SYNTHETIC TURF SYSTEM INFILL MATERIAL DEPTHS IN THE LABORATORY AND FIELD USING A CONSTANT GROUND PRESSURE 3-PRONG GAUGE

This standard is issued under the fixed designation X XXXX; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This method is used to measure synthetic turf infill material depth a 3-prong gauge with a constant ground pressure plate with a standard contact surface area to minimize user errors associated with varying hand pressure and gauge accuracies, and device inconsistencies associated with devices of varying mass and surface contact area. In addition to decreasing variation associated user and device variability, this method will provide a baseline ground pressure to minimize the impact of loose or poorly compacted infill, inconsistently compacted infill, and trapped synthetic grass fibers. This method is suitable for measuring infill material depth in the laboratory and in the field.

1.2 This method can be used for synthetic turf athletic fields, playgrounds, and landscape areas.

1.3 This method is used in conjunction with ASTM F 1936 Standard Specification for Impact-Attenuation of Turf Playing Systems as Measured in the Field, and for general measurement of infill depth for the field.

1.4 This method is not intended to provide depth or thickness measurement of resilient underlayment padding that may be integral with the synthetic turf system. It shall only be used for measurement of material placed above the carpet backing system.

1.5 The values stated in inch-pounds are to be considered the standard. The values given in parentheses are mathematical conversations to SI units that are provided for information only and are not part of the standard.

1.6 *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 limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

2.1.1 F 355 Test Method for Impact-Attenuation Properties of Playing Surface Systems and Materials[1]

2.1.2 F 1292 Specification for Impact Attenuation of Surface Systems Under and Around Playground Equipment[2]

2.1.3 F 1551 Test Methods for Comprehensive Characterization of Synthetic Turf Playing Surfaces and Materials[2]

2.1.4 F 1936 Standard Specification for Impact-Attenuation of Turf Playing systems as measured in the Field

2.1.5 *ISO Standard:* ISO 6587[2]

2.1.6 NOTE 1—Additional references are listed at the end of this specification.

3. Terminology

3.1 *Definitions:*

3.1.1 *Infill Depth*–Is the thickness of the layer or layers of infill as measured from the bottom of the weighted shoe, as it rests on the top of the playing surface, to the bottom of the prongs as they rest on the top of the synthetic turf backing below.

3.1.2 *Prong*–A rigid probe using in combination with other probes for penetrating the infill material to the top of the turf primary backing. Probes are normally 3 inches in exposed length below the probe shaft, for measuring infill used in athletic fields, but can be longer or shorter based on specific system type.

[1] *Annual Book of ASTM Standards*, Vol 15.07.

[2] Available from the American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

3.1.3 *Shaft*–the inner core of the device, which rides within a sleeve. The shaft is fixed to a shoe which is fitted to the bottom of the shaft. The shaft, shoe and handle system constitute the constant mass portion of the device.

3.1.4 *Sleeve*–the sleeve is the tube in which the shaft resides. The tube is fitted with a lower plate onto which the prongs are attached at the bottom, and an upper plate provided for support during storage.

4. Summary of Test Method

4.1 A test specimen or in-place synthetic turf surface infill depth is measured by:

4.1.1 Lowering and inserting the multiple device prongs into the surface of the infill material to a point where it fully rests upon the carper backing below,

4.1.2 aligning the level bubble at the top of the tube to within the target,

4.1.3 then the weighted shaft and shoe are lowered to the surface of the infill until its weight fully rests upon the surface,

4.1.4 the set screw located at the top plate of the sleeve is then set to lock the shaft into position,

4.1.5 then the depth of the infill is then read at the gauge and recorded.

5. Significance and Use

5.1 Depth gauges are used in the industry to measure to amount on infill material included within the cross section of a synthetic turf surface. This measured dimension is a valuable metric of a system in that oftentimes the depth of infill is critical to the Impact-Attenuation properties of a surface system. For example in ASTM F 1936 depth is measured and recorded at each test location. Having a minimum infill depth may provide separation for athletic shoe cleat penatrations between the top surface and turf backing. Knowing the measured in-place depth of the infill material may be required for contract compliance.

5.2 Infill depth measurements can be impacted by conditions such as device weight, device bearing surface area, infill density, hand pressure on the probe, the presents of trapped fibers within the cross-section.

5.3 For these reasons having an accurate and consistent method for measuring the depth of infill material in any given system is a valuable tool for the industry.

5.4 There are currently approximately half a dozen different types of devices for measuring infill in use today. Each device having its own physical characteristics. These varying characteristics include; overall size, surface area of the bearing plate, the number and diameter of surface prongs, the finished condition of the prongs (rounded, blunted, sharp), the weight of the device, and the units included on the measurement gauge. In addition to the physical characteristics, there is significant user variation in how the devices are used. Some have low weight and are only brought down to the top of the infill material without compressing the layer or layers. Others have a higher weight and actually compress the layer or layers. Some prongs are sharp and easily pierce the carpet backing system thus including the backing in the depth dimension. From a user standpoint the amount of pressure placed on the device can vary the amount of system compression obtained while using a device. From an infill synthetic turf system perspective, conditions such as over or under compacted infill material, or trapped synthetic grass fibers, add variability to the process. In all, this variability results in inconsistent and non-accurate depth readings.

5.5 This Standard will provide a uniform and consistent method, using a standardized bearing plate area and a standardized bearing unit weight, for measuring infill material thickness while minimizing or eliminating the effect of this variability on the measured dimension.

6. Interferences

6.1 The conditions at edges, field inlaid markings, and deviations associated with the base below the carpet backing may impact how the prongs rest on the carpet backing. Care should be taken to check that the three prongs rest on the carpet backing in a uniform manner. This can be determined by gently wiggling the device from side to side to determine how well seated the device is. If the device needs to be leaned to one side to allow contact on all three prongs then the test side should be moved slightly.

7. Apparatus

7.1 The device consists of a three prong probe with a 5.00 cm (1.97 inch) diameter bearing surface contact plate having a 0.14 Kg/cm^2 (2.00+/- 0.1 psi) surface bearing pressure connected a shaft that slides within a sleeve. The shaft has a handle connected to its top surface for ease of operation (Figure 1).

7.2 The sleeve consists of a 79.0 cm (31.10 inch) long section of sch 40 aluminum pipe that is equipped with a lower plate to which the three prongs are attached and an upper plate provided with a target type leveling bubble to allow the device be held vertically while in use, and to lay flat and ease storage. The sleeve has a diameter which will allow for a 0.75 inch diameter shaft and associated top and bottom linear alignment bearings. Both the lower plate and upper plate have a diameter of 5.00 cm (1.97 inch) and a thickness and configuration that is adequate for making rigid connections to the tube, the top and bottom bearings, and the probes. Each plate has in inside diameter suitable for smooth operation without binding of the shaft within the sleeve. The sleeve has a set screw to lock the shaft in place when in storage and while making a measurement.

7.3 The prongs consist of hardened tapered 0.1250 inch to 0.1875 stainless steel rods with threaded top ends that are threaded into the bottom plate of the sleeve. The three prongs are set at a 120 degree configuration around the bottom plate. The standard device is intended to be used on infill synthetic turf sports fields and is equipped with prongs that allow a maximum of 2.50 inches of infill penetration.

7.4 The shaft consists of a 1.905 cm (0.750 inch) diameter stainless steel rod with a length of 92.00 cm (36.125 inch) equipped with a 5.00 cm (1.97 inch) diameter shoe at its bottom end and a tee type handle at the top. The shoe has a thickness that is adequate to allow attachment of the shoe to the shaft. The shoe shall have three tapered holes which align with prong locations through which the probes freely slide. The shaft freely slides within the upper and lower plates of the sleeve and maintains alignment by the use of a guide and linear alignment bearings. At the upper end of the shaft a gauge calibrated to the nearest millimeter which will be read at top edge of the sleeve. The upper end of the shaft also has a collar to prevent the device shaft from passing past the top plate of the tube.

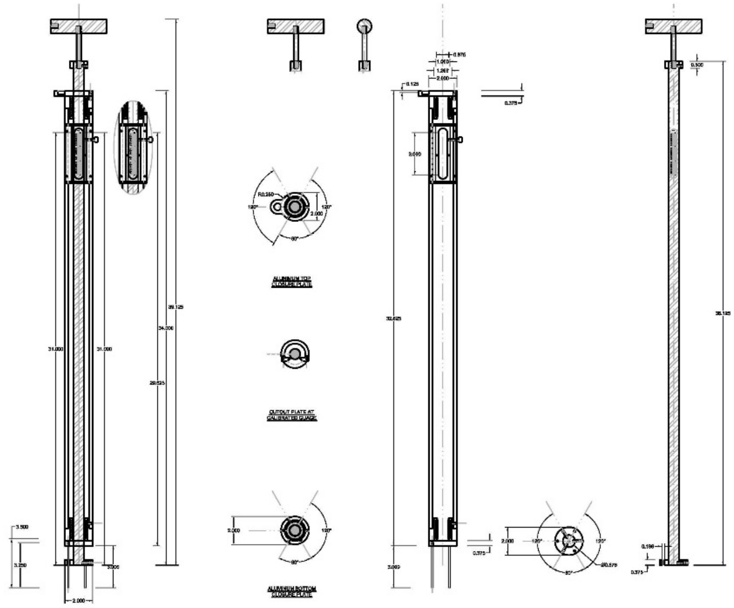

Figure 1 - Constant Ground Pressure 3-Prong Gauge (Courtesy of Sluice Gate Innovations)

8. Procedure

8.1 The device is intended to be used as a standalone measurement of infill depth or measurement of in fill depth in support of other test methods such as ASTM F 1936, Force reduction or Vertical Deformation.

8.2 When used as a standalone measurement the number of test points, test locations or frequency of testing should be should be determined prior to start.

8.3 Where determination of an average infill depth or range of infill depths is the goal a test grid may be a suitable approach for measurements and data collection.

8.4 When used in support of other test methods required test points and the number of tests should be determined prior to start.

8.5 A diagram of test locations shall be prepared depicting the general position of test locations. This is required whether testing is standalone or in support of other methods.

8.6 A table for organizing data should also be prepared. This is required whether testing is standalone or in support of other methods.

8.7 Prior to testing the set screw shall be released and the action of the linear alignment bearings must be confirmed. The shaft shall slide freely without binding or catching within the tube and associated bearings. The set screw shall then be reset to confirm that the set screw locks the shaft in place without slipping or sliding.

8.8 While holding the top handle the set screw should be released and the tube shall be allowed to slide down the shaft exposing the full length of the probes. The set screw shall then be reset to anchor the weight of both parts together. The probes shall then be placed into the infill and allowed to settle into the infill with the full weight of the device. Once settled the tube shall be leveled using by bringing the level bubble into target. At this point, while still supporting the handle and shaft, the set screw is released and the shaft is then lowered onto the infill surface. This will apply the uniform pressure onto the surface. The level bubble shall be rechecked and once plumb the set screw will be re-engaged to lock the shaft in place.

8.9 The device is then removed from the infill and the graduated gauge is read and the measurement is recorded.

8.9.1 Where testing is general readings to develop an average of an entire field or a section of a field, and where the precise locations are not critical a single number and single test shall represent each point. Where precise locations are critical to a given purpose each test point shall have three depth readings within a 6 inch diameter circle. All three readings shall be recorded and the average shall serve as the reading for that test point or location

9. Calculation or Interpretation of Results

9.1 Where testing is general readings to develop an average of an entire field or a section of a field, and where the precise locations are not critical a single number and single infill depth measurement shall represent each point. The following data shall be calculated and recorded on a given set of readings:

9.1.1 Total number of test points,

9.1.2 The average value for a given field or test site,

9.1.3 The high value of infill depth,

9.1.4 The low value of infill depth.

9.1.5 The standard deviation.

9.2 Where precise locations are critical to a given purpose, such as impact attenuation testing, each test point shall have three depth readings within a 6 inch diameter circle. All three readings shall be recorded and the average shall serve as the reading for that test point or location. The following data shall be calculated and recorded on a given set of readings:

9.2.1 Total number of test points,

9.2.2 The average value of three readings for a given test point location,

9.2.3 The average value of all the calculated average values for a field or test site,

9.2.4 The high value of infill depth,

9.2.5 The low value of infill depth.

10. Report

10.1 Data contained in the report will depend on whether the test method is being performed as a standalone measurement of infill depths or being performed in conjunction with another test method. Where measuring infill depths in conjunction with another test method follow the report criteria of that method. Where performing a standalone procedure the following reporting requires shall be followed:

10.1.1 Record the property owner's name,

10.1.2 The site reference or facility name,

10.1.3 The date of the test,

10.1.4 Weather conditions,

10.1.5 Surface conditions (such as newly installed, compacted, irregular, wet, dry, frozen, or other)

10.1.6 Surface type and manufacturer if known,

10.1.7 Infill composition (rubber, sand and rubber, TPE, cork, cork and fibers, etc)

10.1.8 Test location diagram including adjacent reference information to allow general positioning:

10.1.8.1 Where general or approximate positions are acceptable for a given application locations shall be tied to field lines or markings or reproducible field positions. This type of testing can be a simple gird such as a five yard line on a North American Football Field or other practical configuration.

10.1.8.2 Where precise locations are required for a given application measurements shall position a given test to allow a point to be revisited at a future date for additional or other testing.

10.1.9 Record the test number or test identification for each reading.

10.1.9.1 Where testing is general readings to develop an average of an entire field or a section of a field, and where the precise locations are not critical a single number and single test shall represent each point.

10.1.9.2 Where precise locations are critical to a given purpose each test point shall have three depth readings within a 6 inch diameter circle. All three readings shall be recorded and the average shall serve as the reading for that test point or location.

10.1.10 Record each test reading and where multiple readings at a single point are required record all readings and the average of those readings.

11. Precision and Bias

11.1

12. Keywords

12.1