



How to Measure and Manage Surface Hardness on Synthetic Turf Athletic Fields

Penn State's Center for Sports Surface Research

Managing surface hardness on synthetic turf athletic fields requires both routine testing and proper field maintenance. Approximately 15% of concussions in football and soccer result from the head impacting the playing surface¹. Head injury risk can be reduced by ensuring playing surfaces meet industry-established Gmax thresholds, contain proper infill amounts, and receive routine maintenance.

Measuring Surface Hardness

- Surface hardness is measured by determining the 'Gmax' of the playing surface. Gmax is a numerical value representing the hardness of the surface, with higher values indicating a harder surface.
- The Clegg Impact Soil Tester and the ASTM F355 device are tools commonly used to measure Gmax. Testing agencies typically have both instruments or they can be purchased by field owners.
- The NFL requires the Clegg Impact Soil Tester be used to measure Gmax prior to every game. All areas within the field of play must be below 100 Gmax. If the ASTM F355 device is used, the maximum limit is 200 Gmax. If areas are above these limits, additional infill should be added and re-tested.
- Gmax should be tested at various locations across the field, with special attention being paid to inlays, painted areas, seams, and high-use areas. Testing should occur yearly, with more frequent testing on heavily-used fields.

Measuring Infill Depth

- 'Infill' is the material that fills the area between synthetic turf fibers and typically includes a mix of sand and crumb rubber. The infill absorbs impact energy and provides surface cushioning.
- Infill depth can be measured using an infill depth gauge that can be purchased for less than \$30. These gauges are also known as fire-proofing depth gauges.
- The target infill depth range for each field should be obtained from the turf manufacturer. Special attention should be paid to inlays, painted areas, seams, and high-use areas. If the infill depth is below the minimum amount, infill should be added by spreading a small amount, then brushing/dragging the material into the turf and repeating as often as needed. Monitoring and adding infill when needed on a routine basis may prevent the need to outsource large-scale infill additions in the future. Proper infill depth also helps prevent premature breakdown of synthetic turf fibers. An infill depth worksheet is available under the 'Resources' section of our website: ssrc.psu.edu.
- There is a strong correlation between infill depth and Gmax. Routine infill depth measurements can be used to indicate if a Gmax test is needed. If infill levels are below the target range, a Gmax test should be performed.

Synthetic Turf Maintenance

- Synthetic turf is not maintenance-free. Routine maintenance helps reduce surface hardness and should be performed according to turf manufacturer recommendations.

Additional information can be found in the 'From the Field' section of our website: ssrc.psu.edu.

¹Meehan WP III, d'Hemecourt P, Comstock RD. 2010. High school concussions in the 2008-2009 academic year: mechanism, symptoms, and management. *Am J Sports Med.* Dec;38(12):2405-9.