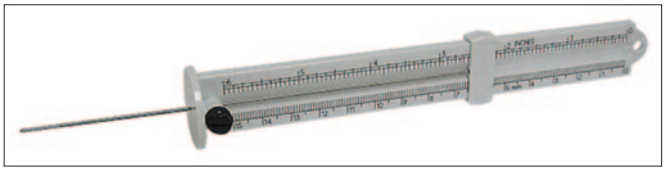
Maintaining synthetic surface safety

WITH THE INCREASING FOCUS on concussions in sports, many aspects associated with athlete safety are under higher levels of scrutiny. The hardness of the playing surface is one of them. While both natural and synthetic turf fields can reach unsafe hardness levels, synthetic turf fields seem to receive the most attention. Assuming a proper installation, synthetic fields start off well below hardness thresholds in the months after install. Over time, these fields may get harder and in some cases, if not properly cared for, can reach unsafe levels. So, why do synthetic turf fields get hard? Is it compaction? Or is there something else going on?

It is a common belief that compaction of the infill is the reason fields get hard. For many of us, that seems to makes sense. We know that heavy use on a natural turf fields leads to soil compaction and, in turn, increased surface hardness. But, to what degree does crumb rubber and sand compact? Certainly there is a "settling-in" period in the weeks after installation, but based on our observations, compaction is minimal after the settling-in period in most cases. In fact, most infill is sized such that only limited compaction is even possible due to the relatively uniform size of the infill particles.



>> **Top: A FIREPROOFING DEPTH GAUGE** is a good tool to measure infill depth and can be purchased for less than $15.

>> **Bottom: THE SMALL AMOUNTS OF INFILL** collected in shoes, clothing, equipment bags, etc., may seem insignificant individually, but those small amounts add up.

RESEARCH RESULTS

Our research plots at Penn State provide an interesting example. In 2002, various synthetic turf companies installed their products which were then used in a research trial that concluded in 2010. Over the course of 8 years, a section of each of these plots was exposed to 96 simulated games per year using our traffic simulator. By the end of the trial, those trafficked sections were exposed to more than 1,500 passes with our traffic simulator. However, by the end of the study, surface hardness values were still well below the published threshold of 200 G's set by the American Society for Testing and Materials (ASTM) and the US Consumer Products Safety Commission. Even wheel ruts caused by the tractor repeatedly pulling the traffic simulator over the same area for 8 years tested to be well below the 200 G level. This example helps illustrate that compaction alone is most likely not the main cause of excessive surface hardness.

We have also observed specialized machines remove infill from an existing field, "clean" it, and reinstall it back into the carpet in an effort to reduce surface hardness. The Gmax values before and after this process were essentially the same. It was only after new rubber was added that the Gmax was reduced.

Other factors, however, can compromise the infill resiliency and thus increase surface hardness. For example, excessive and repeated painting of lines and logos without the occasional cleaning of the painted areas, including removal or wash-through of old paint, can lead to a hard surface. Excessive deposits of debris and particulate matter may compromise the infill if the surface is not cleaned over time. The build-up of this type of debris takes many years in most cases and typically is not a major concern for fields with even moderate maintenance.

So why do some fields become hard over time? We believe that "walk-off" crumb rubber and the associated loss of infill depth is the main cause for increases in surface hardness of synthetic turf fields. "Walk-off" crumb rubber refers crumb rubber that leaves the field in the shoes, clothing, equipment bags, etc. of field users. While it seems like an insignificant amount on an individual basis, when looked at collectively for all field users, it begins to add up. Add in the infill material that is removed from necessary regular maintenance activities such as grooming, brushing, sweeping, and blowing, and the amount of infill removed from the field can be substantial.

OBSERVING "WALK-OFF" CRUMB RUBBER

This idea of "walk-off" crumb rubber is supported by our observations as we have tested many fields in the United States. Almost every time our tests show a high surface hardness value, it is associated with a low level of infill. The infill creates the padding and shock-absorption for the synthetic turf system. As the thickness of that "padding" is reduced, there is less of a cushion between the surface and the hard base under the turf, thus resulting in elevated surface hardness. This is often most evident in the high-use areas of the fields, where the majority of play occurs and, in turn, the majority of the rubber "walks off." Thinking back to our research plots here at Penn State, infill depth remained at or very close to installation levels

even after 8 years of intense simulated field use. The only difference between our plots and real fields is a lack of field users and therefore a lack of "walk-off" rubber. The traffic simulator did not carry a significant amount of infill off the plot areas.

To combat this problem, it is important to monitor infill levels—especially in high-use areas of the field. Knowing the target infill depth from your turf's manufacturer is the first step. Once infill levels begin to drop by more than several millimeters, it is time to topdress additional rubber onto those areas. This means that extra crumb rubber should be on site at all times.

Infill depth can measured by using specialized depth gauges (gauges used for measuring fire proofing materials work well and typically cost less than $15) or something as simple as the end of a landscape flag. When measuring infill depth, it is important to make sure you reach the back of the turf; this may require a few "stabs" until you feel the backing. If using a landscape flag, after you feel the backing of the turf with the tip of the flag, place your finger tip onto the surface of the infill, pull the flag out, and measure the distance between your finger tip and the end of the flag.

Once you determine that additional rubber is needed, you can either use a topdresser for large areas or apply infill by hand for small areas; experiment by using very small amounts at first. Be sure to work the rubber into the carpet fibers with a groomer or broom and then apply another small amount and repeat. Pay special attention to areas of intense use such as lacrosse and soccer goal mouths and sliding areas on baseball fields. It does not take long for infill levels to drop in these areas. An added benefit to maintaining proper infill levels in these locations is increased fiber life. As infill levels drop, more of the fiber is exposed to UV light and wear and tear, increasing the speed of fiber degradation.

MATCH YOUR MATERIAL

It is extremely important to use the same infill that the manufacturer used when constructing the field. This way the infill sizing and type will match your existing infill. If you mix infill types, you will be lowering the compaction resistance of the infill and won't be getting the maximum benefit from your infill padding.

Once the infill is at the optimum depth, it is important to remember that regular maintenance practices should continue to be performed in order to maintain the best possible surface conditions. Be sure to check with your turf's manufacturer for the recommended practices for your field. And, if it is not part of your routine maintenance now, we recommend that you add the monitoring of infill depth and subsequent addition of infill when needed.

The issue of surface hardness on athletic fields is an important one. Proper maintenance practices, including monitoring infill levels and adding infill when necessary, are the key to providing a playing surface that maximizes both playability and safety. ■

Tom Serensits is manager of the Center for Sports Surface Research at Penn State. Dr. Andy McNitt is the Center's director, as well as program coordinator for Penn State's turfgrass science major, and a professor of soil science.