

Affirming Firmness

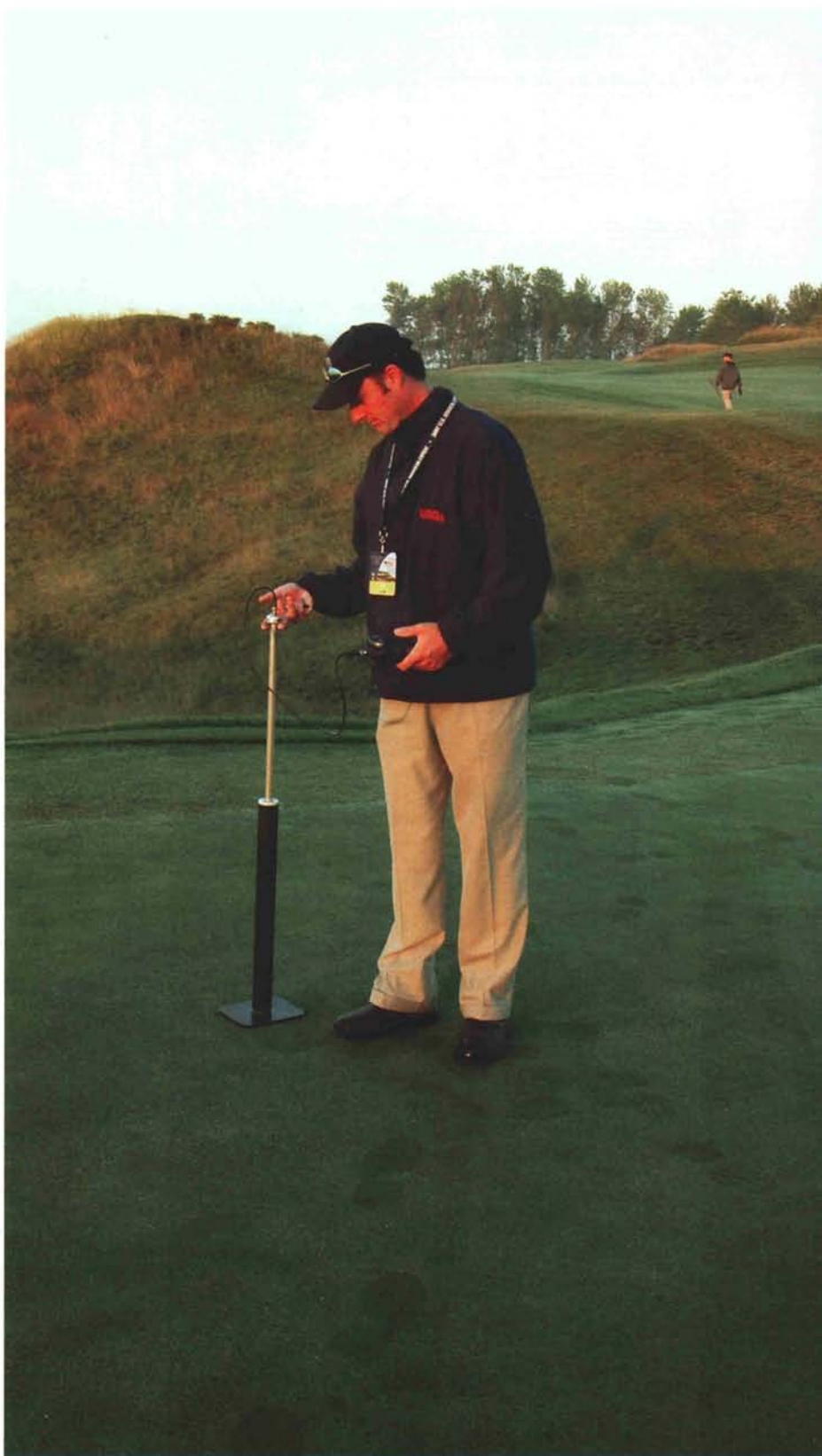
The golf turf maintenance industry has a new tool. Properly used, it will assist and even improve course maintenance and playability, while helping to guard turf health.

BY BOB BRAME

The pursuit of “firm and fast” playing surfaces is the time-honored objective for championship golf. Yet, keeping that in mind, it is possible to achieve a fast pace with soft surfaces or a slow speed with firm surfaces. As such, it is important to define both *firm* and *fast* to avoid extremes that can compromise turf health and/or playability. Much has been written about putting surface pace and the importance of drawing a line relative to variables such as design, budget, play volume, players’ skill level, weather conditions, and the grass(es) being maintained when using the Stimpmeter and defining site- or event-specific *fast*. Not nearly as much has been written about *firm* and the direct tie between firmness and soil moisture — the dry end of the continuum is essential to *firm*. Like *fast*, *firm* must be defined to achieve balance. Acknowledging the importance of site- or event-specific balance, generally speaking, pushing toward the dry end of the continuum yields healthier turf and more consistent playability, which should be the primary objective with all golf turf conditioning. Bottom line — fast and firm are related and yet independent. We have the Stimpmeter to aid in determining the proper speed for a given operation or event, and now we have a device to assist with firmness and soil moisture effects.

DEVICE DESCRIPTION

Developed by Matt Pringle, Ph.D., Senior Research Engineer with the USGA’s Technical Department at Golf House, the original purpose was to (1) compare the USGA’s test range to fairways found on championship golf courses



Developer Matt Pringle, Ph.D., spends some time in the early morning hours to collect data. The device slide hammer is fully extended prior to its release and recording of data.



A handheld PC is connected to the slide hammer to record data. The added GPS receiver correlates the location of each data collection drop.

and (2) to predict golf ball/turf bounce and roll characteristics on fairways, approaches, and greens. The tester (final name to be determined) is similar in principle to other impact tools like the Clegg Hammer, which measures soil strength and compaction. The advantage of this unit is that the design includes a hemispherical face (1.68 inches in diameter, the same as a golf ball), and the mass and impact speed of the device is set to mimic the impact energy and momentum of a golf ball. This yields a more representative simulation of the failure mode of the turf on impact. Since both energy and momentum cannot be replicated, the device is a compromise between both. Pitch marks left with the device are very similar to those left by golf balls. The device is equipped with an accelerometer to measure the force/time history of the impact (raw impact signal integrated with acceleration to calculate velocity and penetration time history). The test hammer is connected to a handheld PC to record data. It is also equipped with a GPS (Global Positioning Satellite) receiver, and the location of each impact can be plotted. The mass is dropped from a consistent height, and after the hammer impacts the turf, the acceleration is recorded. This can then be integrated to calculate velocity and penetration time history, yielding the maximum turf penetration depth. The penetration value is the indicator of surface firmness — the lower the penetration value, the firmer the turf.

PAST USAGE

The device has been used at the 2005, 2006, and 2007 U.S. Open Championships. It was also used at the 2005 U.S. Women's Open and the 2007 U.S. Senior Open. Design improvements have been made over this time to yield the current configuration. The information gleaned has played an increasing role in management decisions, particularly water management. At the referenced championships, before and after play each day, the greens were measured at nine locations, spread representatively across each surface. The nine measurements were used to establish an average for that green, which then allowed green-to-green and day-to-day comparisons. With GPS information added, it was possible to map variations in firmness across the test area. Fairway landing zones and approaches were measured only once daily, with six locations across each site. Data collection was started

Sunday before the championship and continued through the morning of the final day. Firming trends were analyzed and merged with weather conditions and other site-specific factors to guide watering.

At the 2007 U.S. Open at Oakmont Country Club, turf areas firmed up at similar rates during periods of no rainfall or irrigation. Conversely, the rainfall on Wednesday, June 13, softened all areas significantly. On the mornings of Saturday and Sunday, June 16 and 17, hand watering was used on all greens. Measurements taken approximately 30 minutes after the watering showed noticeable softening, and firming/drying increased gradually from June 10 to the morning of June 13 (the day before the championship started) prior to the rainfall. No irrigation was applied during this time. The softening from the rainfall was then offset by dry weather and no watering on June 14 and 15. By the afternoon of Friday, June 15, the greens were the firmest they had been all week. Saturday morning readings confirmed continued firming, and all greens were hand watered and extra water was applied to the firmest surfaces. The same occurred on Sunday, the final day. Fairway landing zones were, as expected, significantly softer than greens. The firmness of approaches fell between that of fairways and greens. Both fairway landing zone and approach firming trends, before and after the June 13 rainfall, were similar to greens.

Similar data were recorded at the 2007 U.S. Senior Open at Whistling Straits. The greens firmed during dry weather and no irrigation, whereas rainfall during the practice rounds and again on Thursday (first day of the championship) softened all surfaces. With subsequent drying, hand watering was needed on Saturday and Sunday mornings to hold the desired firmness. As with Oakmont, extra water was applied to the firmest greens in an effort to align the averages. There was less difference between fairway landing zones and approaches as compared to Oakmont; although, here again as expected, greens were significantly firmer than either the fairways or approaches.

APPLICATION

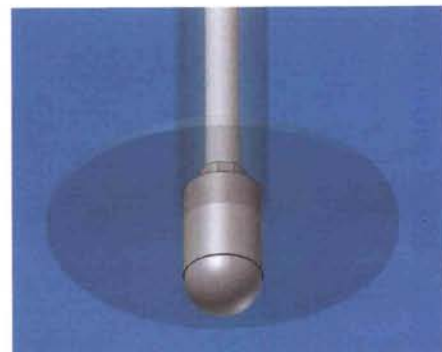
It has become clear — there is a direct relationship between soil moisture and firmness. However, it is not possible to automatically apply what works at one course or championship to

another. The firmness desired and achieved at Oakmont was different from that obtained at Whistling Straits. Comparing courses and championships can be useful, yet site-specific data over a period of time should be factored into the decision-making process in order to achieve the best results. This is why the use of this new tool has been initiated several days in advance of a championship.

The softest and firmest surfaces can be identified with one data collection cycle, but collections over time should be considered with site-specific factors to properly determine the appropriate firmness for an event. Weaving firmness data with site-specific factors involves taking into account things like design features, soil structure, the grasses being grown, the impact of past maintenance, weather patterns, and available resources (e.g., budget, equipment, irrigation system, and water quality).

The median skill level of players should also be incorporated into the process of zeroing in on the most appropriate firmness. The careful monitoring, by a few key individuals, of different types of shots and how they respond to the different surfaces will assist in identifying the correct firmness. The existing setup, which includes design, hole length, fairway landing zone width, rough difficulty, hole location, cutting heights, growth rate, and putting surface speed (lightweight rolling and/or multiple mowing will affect putting surface speed, but they have minimal impact on firmness), is directly tied to what is doable for a particular skill and firmness level. Once the ideal is identified, judicious water management can be applied to align and hold all surfaces.

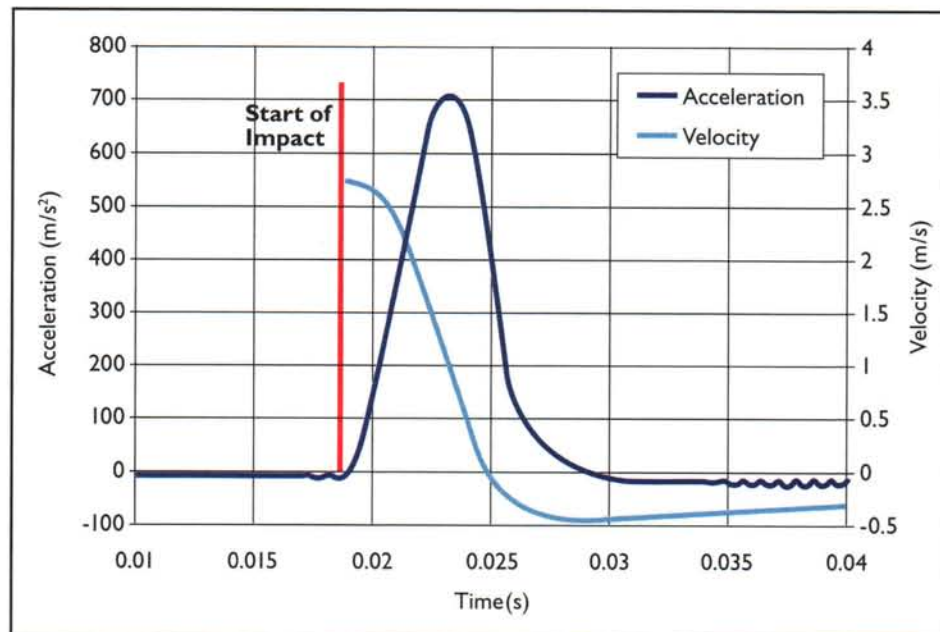
Turf health also must be carefully considered. In fact, turf health is the trump card that serves to draw lines — too dry and too wet. Too dry means too firm, which can result in turf loss and/or poor playability, possibly even unplayable surfaces. Too wet means too soft, which can



The hemispherical face on the slide hammer is the same size and shape of a golf ball.

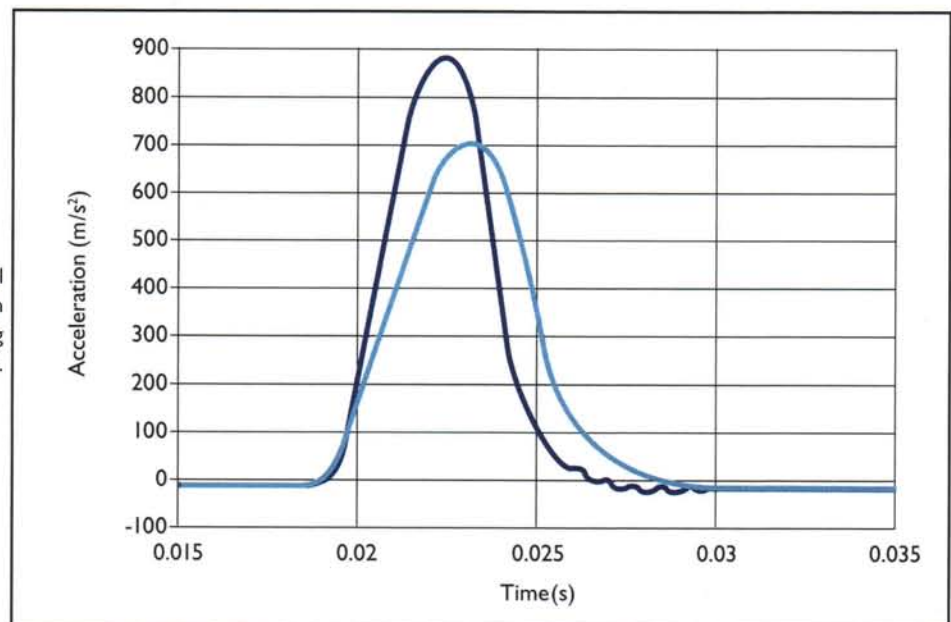


The slide hammer within the tube and its hemispherical face are designed to mimic the energy and momentum of a golf ball. The design provides the same drop height at each test location when the shaft is fully extended.



The device is equipped with an accelerometer to measure the force time history of the impact. The initial velocity is calculated from the drop height. After the hammer impacts the turf, the acceleration is recorded. Acceleration is integrated with velocity to identify penetration time history. The point of maximum penetration is the firmness reading.

The data signal differences between soft and firm putting surfaces are obvious.



bring on more intense disease pressure and greater vulnerability to traffic- and weather-related weakening/loss. Although it is much better to miss on the dry (firm) side as opposed to the wet (soft) end of the continuum, the proper use of this device greatly reduces the chances of crossing either line (too wet or too dry), which should be drawn site- and event-specifically relative to the factors outlined in this article.

Beginning in 2008, USGA Green Section agronomists will carry, or have available, the new firmness indicator device. The technology

will be used at certain USGA championships and on Turf Advisory Service visits to the extent that courses want feedback on this aspect of golf turf conditioning. In the final analysis, this new tool offers technology that when properly applied will better guard turf health while accommodating improved playability. Healthier and more dependable turf, along with improved playability, does in fact affirm firmness.

BOB BRAME is the director of the North-Central Region, where firmness is a common discussion topic during TAS visits.