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Severity index

Severity index takes into consideration the Gs as well as the time over which the force is applied.

"Studies show that a person can tolerate a hard surface for a short amount of time. That's usually figured in milliseconds," Schefsky explains. In other words, if the surface absorbs the shock of the impact quickly, then that surface may not be as "hard" to a human body as a surface which absorbs the impact slower. One surface with a G-max of 200 may have a higher severity index than another surface which peaks at 200Gs.

Most standards such as ASTM and the severity index are based on head injuries. Original tests in this area dealt with heads hitting automobile dashboards.

Some researchers went as far as dropping animals on surfaces and even cadavers. "What damage occurs in a cadaver's head may be undetectable, while it could produce a concussion in a human being," says Bruce Martin, Ph.D., of the biomechanical engineering department at the University of California at Davis. Martin, along with Dr. Douglas Bowers of West Virginia University Medical Center, completed perhaps the study most critical to the natural turf industry on impact absorption of natural vs. artificial surfaces.

The 1974 test showed that five-year-old synthetic turf was almost as hard as asphalt, while bluegrass sod provided a softer surface. Bowers had planned to re-do the test this year, but the field he had been testing was ripped out. His plans are currently on hold.

The future

Rogers' impact absorption research, along with the work of other turfgrass scientists on turf strength and cultural practices will have profound effect on the future of the athletic turf industry.

"There are many things it could do," Rogers says. "I think we'll start seeing more people in the athletic field service industry. It's cheaper for schools to hire out for services. I think we need this research for athletes and parents of kids at the high school and junior high school level."

"There are many variables to be considered," adds Waddington. "We don't have the resources to do everything at once, but we are making progress." **LM**

PRACTICE MAKES PERFECT

It's an ironic situation, but it happens at schools everywhere: athletes spend more time on practice fields, while turf managers spend more time on game fields.

In 1984, Penn State University researchers published the first study correlating field conditions with player injuries. The researchers found that more injuries happened on practice fields, and that turf managers work less on those fields.

Since the publication of that study, the hardness issue also has come to the forefront of athletic turf management. The two issues combined have given athletic field researchers a new perspective on field management. While natural turf managers need to be aware of "G-max" levels on game and practice fields, the actual turf surface also is a concern.

Matt Leonard and Steve Cockerham look over the traffic simulator they created to produce wear on athletic field research plots.

Rich Henderson, who completed a masters thesis at Penn State in August, looked at the impact absorption properties of various surfaces. "Rich laid the groundwork for my research," says Trey Rogers, a doctoral candidate at Penn State. "He did his research in the lab, while my system is portable."

Henderson's results show that the presence of bluegrass sod on clay and coarse sand soils made the surface softer, but had little effect on a silt loam soil. A turf cover of 60-day-old ryegrass on the silt loam was softer than bare soil. Core cultivation decreased surface hardness of a silt loam soil.

The drop-test instrument used to measure impact absorption is not the only instrument which is important in evaluating turf strength.

Henderson also looked into the use of the pentrameter, a device which is pushed into the soil and measures the force per unit area.

Turf density, soil moisture and bulk density influenced the ease of pushing it into the soil. Turf density influenced a pentrameter with a 1.0 or 2.0 sq. cm. cone, while bulk density influenced a 0.25 or 0.50 sq. cm. cone. The 1.0 sq. cm. cone correlated best with soil moisture.

More research

Another problem researchers face is simulating actual field conditions on research plots. In order to do this for athletic turf, Steve Cockerham, superintendent of ag operations at the University of California-Riverside developed a "traffic simulator."

Cockerham says the invention evolved from "25 to 30 ideas" from other researchers across the country.

"Visualize the center of a football field," Cockerham explains. "It's torn up and compacted. In trying to develop new grasses you have to duplicate the wear of a football player over a plot. You can't tell a turf manager what to do if we're evaluating turf under different conditions than he lives with."

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The booklet *Athletic Fields—Specification Outline, Construction and Maintenance* is available from:
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The booklet *Athletic Field Construction and Maintenance* by D.H. Taylor, G.R. Blake and D.B. White are available for $1 from:
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The machine consists of two steel rollers, one foot in diameter with cleats welded to the rollers and connected by bike chains. The rollers move at different speeds.

The traffic simulator hooks onto a Kubota tractor. It is run over plots at different rates to imitate different conditions.

Cockerham and his colleagues are testing a Bermudagrass plot built as a sand sports field; various cool-season species used to overseed Bermuda; and tall fescue which represents golf fairway turf.

They can then test cultural practices, such as irrigating and fertilizing, to tell which will give an athletic field manager a healthier field. Preliminary results show that *Poa trivialis* on common Bermuda wears out rapidly, while Caliente perennial ryegrass holds up to wear best.

"I don't think you can say whether hardness or shear strength is more important," says Rogers. "They both go hand-in-hand in developing a good surface.

The answers to athletic turf problems may be slow in coming, but new technology, such as accelerometers and oscilloscopes, pentrameters and the traffic simulator, will provide safer turf in the future. **LM**