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## Feature



### Headgear and Helmets

ASTM Subcommittee Responds to Changing Activities and Perceptions

by Randy Swart

ASTM International's Subcommittee F08.53 on Headgear and

Helmets is one of the most active in Committee F08 on Sports Equipment and Facilities. The group is responsible for 16 active standards, including headgear for football, bicycling, roller skating, skateboarding, snow sports and martial arts.

After the formation of the subcommittee in 1969, it adopted an American football helmet standard, F 429, Test Method for Shock-Attenuation Characteristics of Protective Headgear for Football, as its first approved standard. The development of this standard involved hotly debated issues. Determining the performance measures and requirements of protective headgear — particularly when children will use the product — is a serious and sobering business. In 1968 there were 36 deaths from football reported in high school and college play. The stakes were and remain high when setting performance criteria and test methods for protective



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equipment. Subcommittee members have always taken that task seriously, trying to balance performance with enhanced usage while exploring the latest technologies for accurate and repeatable test methods.

## **Equestrian and Bicycle**

In the 1980s, the recognition spread among consumers that protective helmets were needed in many other sports. The need for standards became woefully apparent when inadequate helmets appeared on the market and the consumer had no basis for distinguishing the adequate ones from those that were marginal or even dangerous.

When equestrian sports advocates needed a helmet standard tailored to the unique hazards of their sport, F08.53 adopted a test method that includes an innovative equestrian hazard anvil that reproduces conditions found when a helmet is impacted by fences or horseshoes. That standard, F 1163, Specification for Protective Headgear Used in Horse Sports and Horseback Riding, is used throughout the U.S. equestrian community. To ensure that an independent test lab verifies adequate performance, many horse sports organizations require that the helmet be certified by the Safety Equipment Institute. Some states now require riders to wear equestrian helmets that satisfy F 1163. Although ASTM standards are voluntary, they are often adopted by governing bodies that demand independent third party certification.

In the early 1990s, F08.53 began creating standards for new helmets at a rapid pace. The subcommittee developed F 1446, Test Methods for Equipment and Procedures Used in Evaluating the Performance Characteristics of Protective Headgear, which permitted much shorter and simpler standards specifications with reference to the test method.

Bicycle helmet sales rose through the 1980s to

more than 10 million per year, and the bicycle helmet became the most used type of helmet in the United States. An earlier voluntary standard was not stringent enough, while another from an independent foundation was more stringent but very expensive for manufacturers, adding to consumer cost. F08.53's standard F 1447, Specification for Helmets Used in Recreational Bicycling or Roller Skating, proved a welcome advance, and quickly became the most used helmet standard in the world. It was supplanted in 1999 by the U.S. Consumer Product Safety Commission's bicycle helmet standard, now a legal requirement. But at CPSC's request, an F08.53 task group worked with their staff on developing the new CPSC standard, and it is based largely on F 1447 and the test methods from F 1446.

### **Snow Sports and Ice Hockey**

Although standards for some new activities were expeditiously developed, the snow sports standard was delayed for years by a classic question: Should ASTM harmonize with a less stringent European standard or raise the bar to call out a helmet with higher performance, at the risk of creating international disagreement? After seven years of debate and balloting, performance — and the consumer — won out, and F 2040, Specification for Helmets Used for Recreational Snow Sports, requires better impact management than the European equivalent. Many European companies have responded by developing helmets for the U.S. market that meet F 2040 requirements.

After interesting jurisdictional discussions, F08.53 now works with Subcommittee F08.15 on Ice Hockey to develop standards for helmets for ice hockey and in-line hockey. The two subcommittees have different points of view on many aspects of helmet performance and design, and the relationship has been an exercise in negotiation and compromise. A recent breakthrough has produced a draft update to the hockey helmet standard that appears to satisfy

both subcommittees, a welcome advance.

## **Soccer**

The development of the soccer helmet standard is an interesting example of the subcommittee's current work. The effort began in 1999 when parents became concerned about concussions in soccer. A study by F08.53 member F. Scott Delaney of McGill University later showed rates of concussion in soccer that were similar to those of American football. In a separate study, he found that over 60 percent of college-level soccer players exhibited symptoms of a concussion in a single season. Manufacturers began to respond with soccer headgear and requested an ASTM standard.

F08.53 appointed a task group, initially chaired by Calvin Williams and now chaired by Dennis Piper. The task group's early work was complicated by a lack of data on the injury mechanism, and a lack of agreement on the nature of the injury to be addressed. There was little information on how concussions were occurring in soccer, and nothing at all on the typical impact velocities of players hitting either each other, the ground or a soccer goal. In addition, widespread concerns about the role of heading the ball, an action unique to soccer, blurred the focus on other injury mechanisms. Soccer coaches and organizations were generally opposed to any headgear that interfered with heading the ball, an action considered an essential part of the soccer game. It was also apparent from the outset that the headgear called out by the new standard must not be a traditional helmet because it must not affect the ball response in heading or contribute to injuries to another player colliding with a headgear wearer. In addition, this is one of the first examples of F08.53 considering concussive and sub-concussive blows, as opposed to the catastrophic impacts addressed by prior headgear standards.

After nearly five years of discussion and research, a number of these concerns have been addressed, and the subcommittee has done the science needed to draft a standard. Heading the ball has not been shown to be a primary injury mechanism that is addressable with headgear, although long-range concerns remain. The primary injury mechanism to be addressed stems from collisions with other players (heads, elbows, knees), with the ground, and with soccer goalposts. F08.53 member Chris Withnall, using technology developed by Biokinetics and Associates, has applied calibrated analysis of sports films to estimate the velocities of head impacts on sports fields. A draft standard is now in the balloting process. Its progress has been impeded by negatives from those who did not understand that the headgear called out by the draft standard is of soft construction rather than a traditional helmet, and would be less likely to contribute to injuries to another player not wearing headgear.

### **Other Sports and Motorcycles**

In addition to soccer, F08.53 is now developing new standards for pole vaulting, rodeo sports, whitewater sports and electric personal assistive motorized devices such as Segways. The pole vaulting effort began after the pole vault community accepted recommendations by subcommittee members and many others to improve pole vault landing pits as a primary injury prevention measure. Pole vault helmets will be a secondary measure to supplement that effort, since no wearable helmet can protect against 6-metre drops to unyielding surfaces.

Although the legally mandated U.S. Department of Transportation standard for motorcycle helmets has dominated that field for decades, the effort to update the venerable DOT standard has been stalled in recent years. F08.53 is working on a new motorcycle helmet standard that might provide the basis for an eventual DOT revision. It may be possible with current technology and

better data on impact mechanisms to produce a standard that improves protection from the most likely impacts while still allowing a more wearable helmet. Other independent foundation standards that attempt to replace the DOT standard with more stringent requirements have resulted in very heavy, very hot helmets that many riders reject. The subcommittee expects this task group will have to conduct a long-range effort.

Subcommittee F08.53 now has 135 members and has always enjoyed a good balance of producer, consumer and other groups. The workload includes a large volume of task groups, drafts and ballots. To assist in handling the volume the subcommittee has broken its work down by addressing technical issues and presentations during informal “shirtsleeves” technical meetings the day before main subcommittee meetings. That permits thorough discussion and clears away many issues before the subcommittee sits down to deal with an agenda of ballots, task group reports and standards administration typically running to 25 items or more. The working relationships within the committee and with ASTM staff have been harmonious over the years, contributing to the subcommittee’s productivity and its ability to respond to the rapidly changing realities of sports headgear. //

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