



Staff Report

To the Committees on Appropriations of the House and Senate on the Voluntary Industry Standards and Product Labeling Requirements for Youth Protective Headgear and Helmets

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1 Introduction

The House of Representatives report 114-194, *Financial Services and General Government Appropriations Bill, 2016*, included the following section:

Youth Sports Concussion.-Within 180 days of enactment, CPSC shall report to the Committee on voluntary industry standards and product labeling requirements for youth sports protective headgear and helmets, including Commission participation and Commission employee involvement in voluntary standards activities.¹

U.S. Consumer Product Safety Commission (CPSC or Commission) staff is actively involved in developing and revising voluntary industry standards for protective headgear and helmets. CPSC staff actively participates in the voluntary standards organizations working on developing standards for protective headgear and helmets. Staff regularly attends conferences, symposiums, and meetings on concussions, brain injuries, and improvements in headgear, including youth sports headgear and helmets.

2 Voluntary Standards for Headgear

2.1 General Requirements

There are common requirements found in the voluntary standards for protective headgear. These include specifications for headforms, impact testing, headgear coverage area, retention testing, labeling, warnings, and instructional literature.

- *Specification for headforms.* Recreational helmet standards typically use half headforms with either fixed or variable mass for impact tests. Many of the headforms are based on the ISO/DIS 6220-1983, *Headforms for Use in the Testing of Protective Helmets*.²
- *Impact testing* involves a drop test using various impact surfaces and drop velocities. Performance requirements for impact testing are based on:
 - Peak acceleration (peak g), or
 - Head impact criteria (HIC), or
 - Severity index (SI).

¹ <https://www.congress.gov/114/crpt/hrpt194/CRPT-114hrpt194.pdf>

² Draft Standard ISO/DIS 6220-1983, *Headforms for Use in the Testing of Protective Helmets*, was never adopted as an international standard; however it is used as a consensus national standard in the United States for testing bicycle and other helmets to establish headform dimensions.

Helmet samples are conditioned before testing in a variety of use conditions, such as wet, cold, hot, and ambient. The drop mass of the test fixture in impact testing is either fixed or variable, depending on the standard. The trend is toward the use of variable mass over fixed mass, as this is believed to be more representative of actual impacts.

- *Coverage area* refers to the area the headgear must cover when properly fitted on the test headform. Coverage area is based on the intended age of the user. More coverage is required for very young children.
- *Retention testing* is used to evaluate the components of the helmet's fitting system, such as webbing, straps, or buckles that are designed to keep the helmet in place on the consumers head.
- *Labeling and marking* requirements include information such as the manufacturer's contact information, model, production date, standards compliance, and certifications. In addition, care and maintenance information, such as cleaning methods, are included.
- *Warnings* are provided to inform consumers about the limits of safety and importance of wearing the headgear properly.
- *Instructional literature* is required to provide the consumer with additional detailed information for properly fitting the headgear, making adjustments to the fit, function, and care of the headgear.

Although the voluntary standards generally share common requirements, there are some substantial differences among the standards. The major differences are between recreational (single-impact) and sports (multi-impact) type helmet standards; these differences are discussed for each voluntary standards organization.

2.2 ASTM Headgear Standards

ASTM International (ASTM) has 16 active headgear standards, including one youth standard specifically for infants and toddlers.

ASTM F1446-15b *Standard Test Methods for Equipment and Procedures Used in Evaluating the Performance Characteristics of Protective Headgear* is the base standard that includes the procedures for headgear testing that are used in many of the activity-specific headgear standards. The purpose is to provide a consistent test procedure for all helmet testing.

Recently, ASTM developed a headform standard, ASTM F2220 *Standard Specification for Headforms* that is based on ISO/DIS 6220 but clarifies some design issues that were not addressed by ISO and were used in ASTM F1446. The variable drop mass based on headform size accounts for the differences in the weight of a head according to size. Smaller headforms use lower drop masses, which can lead to design differences in smaller helmets, which could

decrease the risk of injury, especially in lower-impact incidents. The only ASTM standard specifically designed to test youth helmets references many of the requirements of this standard.

ASTM 1898 Standard Specification for Helmets for Non-Motorized Wheeled Vehicles Used by Infants and Toddlers is the sole youth headgear standard maintained by ASTM; it is intended to address helmets for young children participating in recreational activities. The standard states the desirability of lightweight construction and ventilation, while still requiring helmets certified to ASTM 1898 to meet the requirements in the standard. Testing required in ASTM F1898 is similar to other ASTM helmet standards; however, there are some slight differences in coverage requirements and impact testing to support lighter weight designs. For example, impact testing allows the use of any combination of hemispherical and flat anvil impacts but restricts the impacts on the more severe curbstone. This is believed to align better with real-world impact scenarios. CPSC staff has not evaluated any helmets designed specifically to meet this standard; however, a lighter weight helmet, specifically designed for young children that effectively manages the impact energy applied during this test that is smaller in size or less mass, and with better ventilation would be beneficial. Either way, staff encourages developing any standard that promotes a lighter mass helmet that maintains at least the same level of protection because it may have a positive effect on rotational energy. There is no evidence that helmets designed to this standard would have any effect on concussive injuries. Ventilation will increase the level of comfort and could be used as a design method for reducing weight.

ASTM maintains other headgear standards for activities that include football helmets, horseback riding, bicycling, roller skating, skating, skateboarding, snow sports, martial arts, bull riding, women's lacrosse, off-road motorcycle, and ATVs. These standards have similar requirements to F1898 but are not limited to youth-sized helmets. All include testing requirements for youth-sized headgear but include all sizes through adult and do not have any youth specific requirements, with the exception of coverage area. Some standards still use fixed drop mass for impact testing and have not adopted the variable mass requirement in F1446. The football helmet is an exception. Currently, this standard is undergoing a major revision and is likely to use a substantially different impact test than the other ASTM standards. Equipment, such as the headforms, is likely to be those used by the National Operating Committee on Standards for Athletic Equipment (NOCSAE) as they have a better headform design for testing football helmets than ISO or ASTM.

A guide, *ASTM F2727 Standard Guide for Manufacturers for Labeling Headgear Products*, was developed providing a baseline for labeling in helmets, warnings, and instructional literature standards that other ASTM headgear standards can reference. It requires labels to have similar information as 16 C.F.R. part 1203 *Safety Standard for Bicycle Helmets*. Manufacturer's contact information, size, model, date of manufacture, applicable standards, and certification information are examples of required information. Additionally, information on care, cleaning, maintenance, recertification, warnings regarding damage and replacement are required. More detailed information must be provided with the helmets accompanying literature on care, cleaning, fitting, use, and replacement. Safety issues addressing helmet modifications, following applicable laws, and compliance with rules applicable to the activity in which the consumer is participating must also be provided per this standard.

2.3 Snell Foundation Headgear Standards

The Snell Foundation (Snell) maintains multiple standards for recreational and motorsports headgear. Snell headgear standards include motorcycle, automotive sports, go-cart, moped, and non-motorized activities, such as equestrian, bicycling, skateboarding, skiing, and snowboarding. There are two Snell standards specifically for youth:

- CM 2016 Snell/FIA *Helmet Standard for Use in Children's Motorsports*
- B-95 *Standard for Protective Headgear for Use in Bicycling*

CM 2016 is intended for small-sized helmets that are primarily intended to fit youth participants in children's motorsports, such as motorcycles, powerboats, go-karting, all-terrain vehicles (ATVs), and snowmobiles. ISO headforms are used similar to other recreational helmets but do not include the two largest sized headforms. The remaining requirements include headform coverage, retention system test, peripheral vision, impact test, label and marking requirements. This standard has a specific weight requirement. Helmets that comply with this standard must be below the maximum weight specified for the corresponding headform size.

B-95 is the Snell bicycle helmet standard that includes specific requirements for helmets intended for children under the age of 4 years. The standard has performance requirements similar to 16 C.F.R. part 1203 but with some minor differences. Specifically, Snell differentiates helmets intended for young children differently than CPSC. Snell uses age 4 as the age separation, and CPSC uses age 5 years. However, Snell recognized this difference and amended the standard to allow helmets certified to Snell standards to meet the CPSC regulation as well.

2.4 NOCSAE Headgear Standards

NOCSAE maintains standards used for the certification of multiple sport helmets, including football, baseball, softball, hockey, lacrosse, and polo. Construction of these helmets is different based on the need for durability to manage multiple impacts and provide continued impact protection. Performance requirements and testing in NOCSAE standards differ than those developed for recreational helmets. NOCSAE uses a full-face, fluid-filled headform with a flexible support structure intended to simulate a human head and neck. Helmets are drop tested and impacted in specific locations on a Modular Elastomer Programmer (MEP) pad to simulate on the field impacts. There is both a low- and higher-energy impact requirement to ensure helmets are designed to provide protection across the spectrum of impact severities known to occur during participation in respective sports. Additionally, helmets are subjected to sport-specific testing, such as a simulated baseball impact to the head. Development of a performance requirement addressing rotational energy is under way; the test method has been approved, but there is no active performance requirement at this time.

NOCSAE has a Scientific Advisory Committee (SAC) tasked with assisting in creating a youth football helmet standard. A standard has been under development for multiple years and is currently in the draft status; no imminent advancement of this standard is expected at this time. Each NOCSAE standard addresses youth helmets based on the headform sizes included in the standards. However, the youth football helmet standard is the only NOCSAE standard meant to address youth-specific issues.

At the most recent NOCSAE standards meeting held on June 10, 2016, the Board decided to extend the effective date of ND081-14m15, *Standard Pneumatic Ram test Method and Equipment Used in Evaluating the Performance Characteristics of Protective Headgear and Face Guards*. It was elevated from proposed to active status with an effective date no earlier than January 2017 but will be extended at least 6 months. The intent of elevating the standard was to encourage more use by test labs to identify any unforeseen issues as the procedure and test method are very complex and technically challenging to accomplish. This has resulted in potential revisions to the properties of the end cap. A prototype is currently under development that will likely require validation testing. Currently, there are no active pass/fail requirements related to this test procedure and it is not included in any active helmet standard.

2.5 Other International Standards

Many other headgear standards are used outside the United States. CPSC staff is aware of Canadian, EU, Japanese, and Australian standards on headgear but is unaware of any headgear standards specifically intended to address youth headgear. All standards have similar performance requirements to U.S. voluntary standards. Some have slightly lower impact thresholds, as low as 250g³. Although it seems intuitive that lower impact energy would be more effective in lowering the risk of injuries, it is unclear if a lower impact energy that could be reasonably obtained would better address any known and quantifiable injuries. CPSC staff believes that a lower impact requirement may be safer, but there are not enough data yet to support a specific threshold.

3 CPSC Staff Activity on Standards for Youth Headgear

Staff continues to be actively engaged in many areas related to headgear, including voluntary standard development and improvements related to youth helmet standards. To gain a deeper understanding of the complexity of the problem of reducing brain injuries to youth and how helmet performance standards could reduce brain injuries, staff regularly attends conferences, symposiums, and meetings related to brain injuries or headgear. These activities include:

- On April 4-5, staff attended the 2016 Traumatic Brain Injury (TBI) Symposium hosted by the National Institutes of Health (NIH).
- Staff regularly engages with leading researchers from various universities and agencies, including the University of Ottawa, Virginia Tech, the Cleveland Clinic, the University of Alabama, and Boston University.
- Staff organized visits to research facilities and technical discussions with experts in brain injuries regarding the state of current research, and paths forward to better address head injuries, especially to youth.
- Staff has taken a similar proactive approach by reaching out to major headgear manufacturers, including Bell Sports, Inc., and Riddell, plus regular communication with smaller manufacturers, independent product developers, helmet reconditioners, sports

³ “g” represents the acceleration due to gravity

organizations, trainers, and athletes. These outreach efforts have included work with federal government agencies, including the Centers for Disease Control and Prevention (CDC), and the National Institute of Standards and Technology (NIST).

- CDC and CPSC staff work together to provide public information for sports-related head injuries to youth. CPSC and CDC have worked together to develop publicly available guidelines.⁴
- Recognizing CPSC staff's expertise on helmets and voluntary standards, staff was invited by NIST to present at a June 2016 conference hosted by the Bureau International des Poids et Mesures on impact absorbing materials. The conference was canceled but is expected to be rescheduled in 2017.

A benefit of this approach has provided staff with a much deeper understanding of the outstanding problems in addressing brain injuries to youth and how voluntary standards intended to specifically address youth could be improved. This has resulted in CPSC being better positioned to work with voluntary standards organizations and other stakeholders to develop new and safer products.

CPSC staff's participation in voluntary standards development involves active and monitoring efforts to improve the safety and reduce the risk of brain injuries to youth. Staff is most active in the ASTM headgear standards subcommittee, which maintains sports and recreational helmet standards. CPSC recently requested that ASTM develop a new standard for helmet sensors.⁵ The concern is that these types of products lack any standards and are being used by consumers to evaluate or track brain injuries to youth from impacts that may cause unsafe head accelerations. A performance-based standard could include basic warnings, labels, user instructions, and testing requirements for any type of sensor that is provided with, or that can be used with a sports helmet, recreational helmet, or worn on the head without a helmet. Developing a new standard is a long-term project that is expected to take at least two years to complete, due to the complexity of the issues related to these products. CPSC staff intends to be engaged in the process to support completion.

CPSC's other primary voluntary standard activity related to headgear involves engagement with NOCSAE. The Commission has an "observer" position on the NOCSAE SAC that is tasked with developing recommendations, including recommendations for a youth football helmet standard, to the NOCSAE board. CPSC staff attends the NOCSAE SAC and board meetings to monitor standard development. The CPSC National Product Testing and Evaluation Center (NPTEC) in Rockville, MD is developing the capability to perform NOCSAE testing, to increase knowledge and understanding of sports helmet testing. A better understanding and ability to perform NOCSAE-type testing will enable CPSC staff to engage more effectively in the area of traumatic brain injuries.

⁴ <http://www.cdc.gov/headsup/helmets/index.html>.

⁵ CPSC staff letter dated October 15, 2015, to Dave Halstead, Chair, ASTM F08.53 Subcommittee on Headgear and Helmets, requesting a task group to develop an ASTM voluntary standard for head impact sensors. <http://www.cpsc.gov/Media/Documents/Regulations-Laws--Standards/Voluntary-Standards/Gas-Appliances/Letters-and-Correspondences/CPSC-staff-letter-to-ASTM-F0853-subcommittee-on-Sensors/>.

Although not all voluntary standard activity is specific to youth helmets and headgear, such activity nevertheless has a direct application to youth head sizes and is intended to address risk of injuries to youth. Staff believes that continuing to engage in these areas that address youth helmets and headgear, either directly or indirectly, will ultimately benefit the safety of youth participating in helmeted activities.

4 Discussion

Youth helmets are largely addressed as part of comprehensive standards that apply to helmets intended for any age, but there are a few youth-specific standards currently in existence. Both the ASTM and Snell youth standards have provisions that attempt to promote smaller helmets that are lighter weight, have greater ventilation and potentially promote designs focused on protecting against head impacts specific to youth. These are considered to be characteristics that would benefit youth wearing the headgear. Other standards, including some that are youth specific, include performance requirements that have adopted variable mass headforms that vary the weight of the drop mass during impact testing. This allows the youth-sized helmets, which are likely to be the smaller sizes, to have less weight, allow designs that could better manage impact energy, and potentially result in thinner, lighter helmets. Not all standards have adopted variable mass headforms, including CPSC's bicycle helmet regulation.⁶ For this reason, it is possible that bicycle helmet innovation may be restricted for some youth size bicycle helmets as they may not be able to meet both CPSC's bicycle helmet regulation and voluntary standards such as ASTM F1447-12, *Standard Specification for Helmets Used in Recreational Bicycling or Roller Skating*.

Head impact data are very important to the development of voluntary standards and have not been developed specifically for youth. Epidemiological information can give standards development organizations insight into the behavior of participants, insight into incident scenarios, and the mechanism of injuries for various activities or sports. Until recently there has been very limited data available for youth. Most head impact data were collected from high school age athletes and above. This has been of great value to the development of universal standards applicable to all ages, youth through adult, but is not specifically focused on youth and, therefore, may allow youth specific issues to be overlooked. CPSC staff is aware of one ongoing study, by Virginia Tech, that is specifically looking at youth football players and collecting helmet impact data.⁷ Staff is encouraged that this ongoing research will eventually support the development of improved youth headgear in football and beyond. While the amount of research being directed toward youth specific head impact issues is limited, CPSC staff believes the ongoing data collection efforts on youth will have a positive effect on youth standards development.

Labeling requirements do not vary greatly across standards, and there are none specific to youth. Some standards, such as NOCSAE and Snell, certify headgear and include certification specific labels. NOCSAE is the only organization that has a certification lifetime limit that makes proper labeling critical. Normally, labels provide basic safety, use, and care information

⁶ 16 CFR part 1203, Safety Standard for Bicycle Helmets.

⁷ <https://www.vtnews.vt.edu/articles/2011/10/101811-engineering-biomedchildfootballhelmetstudy.html>

for consumers, which is consistent across standards. This is intended to inform the consumer about the hazards associated with not wearing the helmet as intended, proper care, size, model, and the helmet manufacturer's contact information. Lastly, there are minimal safety warnings to address the fact that helmets will not protect against all potential head injuries, and advise that the helmet should be replaced following a fall. Currently, no standards require any warning statements specific to the types of injuries that can occur. Warnings and labels on headgear are limited by the surface area available inside the helmet. However, there is the potential to update safety-related messaging in the helmet or other areas, such as in packaging and supplemental material. Effectiveness of this information is considered limited.

CPSC staff continues to actively engage voluntary standards groups on protective headgear and continues to advocate for the development of better youth protective headgear standards. Staff has been actively involved in many ASTM task groups, including helmet-mounted accessories, equestrian helmets, low-impact requirements, rotational requirements, and most recently, the sensor standard development task group, which CPSC staff requested. Monitoring NOCSAE standards and being involved with NOCSAE will continue. CPSC is expanding headgear testing capabilities to include testing to NOCSAE standards, so that staff can better understand sports helmets performance testing.

5 Conclusion

There are no headgear standards that specifically address youth helmets only; however, most standards have provisions that include youth-sized helmets. Each youth-specific helmet standard attempts to address weight, size, and coverage issues. The general standards provide extra coverage, and some address weight for drop testing, but do not necessarily address helmet size or helmet weight directly. There are no youth helmet specific labels that address safety.

Standards bodies that maintain headgear standards are actively engaged in working on improving their standards. CPSC staff expects continued improvement and refinement of these standards to improve the safety of helmets intended for youth, but does not anticipate the imminent development of any new youth protective headgear standards or youth-specific requirements from any national or international voluntary standards organization.