



Football Helmet Standards Overview

NOCSAE, the National Operating Committee on Standards for Athletic Equipment, is an independent and nonprofit standards development body with the sole mission to enhance athletic safety through scientific research and the creation of feasible performance standards for protective equipment. Formed in 1970, NOCSAE is a leading force in the effort to improve athletic equipment and provide informational resources to the public, with the goal of improving athlete safety. NOCSAE efforts include the development of performance and test standards for football helmets and facemasks, football gloves; baseball and softball batter's helmets and face protectors, catcher's helmets with faceguards, and baseballs; ice hockey helmets; soccer shin guards; lacrosse helmets and facemasks, lacrosse balls; field hockey headgear and field hockey balls; chest protectors in lacrosse and baseball for commotio cordis; and polo helmets.

First Football Helmet Standard to Address Concussion Risks from Rotational Forces

In 2017, the NOCSAE Standards Committee finalized revisions to its existing football helmet standard that limits maximum rotational forces involved in many concussions. The new football helmet performance standard incorporates rotational accelerations in the pass/fail specifications. Rotational accelerations are thought by the majority of neuroscientists to be more injurious to the brain than linear accelerations. This standard incorporates the pneumatic ram test standard revised in 2014 and again in 2018, which includes provisions for adjusted pneumatic ram impact velocities for youth helmets that manufacturers may use if they choose to obtain certification for youth helmets. Manufacturers are required to meet the new football helmet performance standard which took effect on November 1, 2019.

Third-Party Helmet Certification

“Meets NOCSAE Standard®”

In January 2015, NOCSAE began requiring third-party certification of compliance with NOCSAE standards, in accordance with ANSI/ISO 17065 international guidelines. This program replaced manufacturers' self-certification of compliance with NOCSAE standards. Third-party certification is the gold standard for product compliance and conformance and involves independent on-site audits of a manufacturer's quality assurance and quality control programs, evaluation of production testing data, and independent certification testing on randomly selected samples. When all of the requirements provided in NOCSAE standards are met, this accredited body issues a letter of certification for each specific manufacturer's model.

NOCSAE's Football Helmet Standard Applies to Youth and Adult Players

NOCSAE's football helmet standard applies to helmets of all sizes, worn by players of all sizes from youth to adult.

The NOCSAE standards utilize variable-mass biofidelic headforms to account for the different-size players. Helmet sizes likely to be worn by players at the youth level are tested on the smallest headform which represents a 10-year-old male in the 50th percentile of head mass and shape.

As helmet sizes get larger, headforms with more mass are used in the testing protocol. The largest headform represents the 95th percentile adult male for head mass and shape.

Third-party certification of compliance with NOCSAE standards is done by the Safety Equipment Institute (SEI); an independent ANSI/ISO 17065 accredited certifying body. SEI manages the NOCSAE standards certification testing through several accredited, independent laboratories that are responsible for testing to determine if products meet NOCSAE standards. SEI also conducts regular product testing and quality assurance audits of each manufacturer to assure continued compliance. SEI publishes a current list on its website of all athletic equipment it has certified as compliant with NOCSAE standards. [See SEI certified athletic equipment.](#)

Setting the Standard

NOCSAE helmet performance standards are based on accepted and recognized scientific and medical data. Using input from physicians, academic researchers, coaches, certified trainers, manufacturers and leading scientific experts, NOCSAE establishes standards that test football helmet performance across multiple impact velocities and locations. Helmets either pass or fail the standard based on their ability to reduce impact forces to the head as measured by a Severity Index (SI) value. Because of the very high level of quality assurance required to pass the test, helmets must score substantially less than 1200 SI for all impacts. NOCSAE standards are performance-based and have always been design neutral so manufacturers are not restricted in design or engineering, which in turn provides freedom for innovation in design.

How Helmets are Tested

The [NOCSAE helmet testing standards](#) utilize a twin-wire impactor that relies on gravity to accelerate the headform and helmet combination to the required impact speeds. The standard also requires the use of a pneumatic ram impactor to deliver impacts in locations and directions that are not possible with the twin wire system. The NOCSAE headform is a biofidelic and variable-mass headform scientifically instrumented with triaxial accelerometers at the center of gravity to measure headform accelerations in three different directions.

The testing involves mounting a football helmet on an appropriately sized and mass-specific headform. The headform and helmet combination is then dropped at specific velocities onto a steel anvil covered with a ½-inch hard rubber pad. A single helmet test involves 29 impacts at seven different impact locations, including three random impact locations, four lower-velocity impacts, and four impacts at high temperatures.

For the pneumatic ram testing, the helmet and headform are mounted onto a linear bearing table and impacted with a pneumatic ram at 19.6 meters per second on six different locations, including one random location. Helmets must meet the standard at all impacts in both testing configurations.



Pneumatic Ram Impactor

In 2004, after significant research and investigation, NOCSAE drafted a proposed revision to its helmet testing standard that would allow helmets to be hit in additional directions and with different speeds, which NOCSAE believed would be necessary once consensus science identified a basis for a concussion-specific addition to the NOCSAE standard. This test standard was finalized in 2016 and took effect on November 1, 2019.

The pneumatic impactor is an air-powered ram based on plans developed by NFL research and given to NOCSAE in a cooperative effort.

Recertification of Reconditioned Helmets

Shortly after the first NOCSAE football helmet standard was published, American Reconditioning Inc. decided to test helmets that were being reconditioned. This testing showed that 84% of all helmets in use at that time, and made before 1973, could not pass the NOCSAE test. As a result, NOCSAE established a standard to permit the recertification of football helmets to the original standard applicable when the helmets were new. There are currently 17 reconditioners nationally that are licensed by NOCSAE to recertify football helmets.

Recertification Requirements Under the NOCSAE Standard

The NOCSAE recertification standards and recertification license agreement require the following:

The Facility: The testing laboratory at each reconditioning facility must be in a separate room apart from the general reconditioning work. The room must be temperature controlled at a specified range. Compliance also requires a written quality control protocol that includes issues such as sample selection protocol and documentation of responses to any test failures.

The Sample: Helmets selected for testing must be a statistically significant sample of the helmet models that will likely be reconditioned and recertified that year. The helmets selected for testing must be tested prior to any reconditioning or repair work being done. This means the helmets are tested in the condition they were in as of the last play of the last game of the last season. Once the helmet is selected, it is tagged, tested and followed through the entire recertification process, and when the process is finished that exact helmet is tested again. No helmets in the batches represented by those samples may be recertified or returned to a school or club until all the samples have passed the post-reconditioning testing.

The Test: Reconditioners use the same drop-testing equipment for recertification as is required for newly manufactured helmets. The entire testing process and data collection process is controlled by NOCSAE computer software specifically developed to ensure that the recertification testing data is accurate, valid and reliable.

The testing software:

- Requires successful equipment calibration and recalibration both before and after helmets are tested; if the post-test calibration and validation fails, helmet tests cannot be used for recertification, and they must be redone after calibration issues are corrected.



- Dumps all invalid test data generated as a result of a non-calibrated or invalid test into a special file for review by the NOCSAE technical advisor.
- Collects all valid and verified testing data – including date; time of day; temperature; SI results; helmet make and model, age and size; and the last year reconditioned – and stores it in a separate encrypted file, accessible only by specific personnel in the laboratory of the NOCSAE technical advisor.
- Currently NOCSAE has more than 12 million data points from recertification testing that covers more than 500,000 helmets of all models, years and sizes.

Reconditioning: Once the pre-reconditioning test is complete, the helmet begins the reconditioning process. Reconditioning includes the complete disassembly of all helmet parts, cleaning, sanitizing, replacement of worn parts and shell inspection. Helmets also may be repainted and have the faceguard, jaw pad and chin strap replaced. Once the helmet has finished the reconditioning process, the shell may be the only original part of the helmet that remains. In a helmet older than five years that has been regularly reconditioned, the only part of the helmet that is *actually* five years old is probably the shell. Helmet shells cannot be replaced as part of the reconditioning process.

Recertification: When the sample helmets have passed the recertification tests, a recertification label with the current year’s recertification date and a statement that the helmet has been recertified to the NOCSAE standard is placed on the inside of all the helmets represented by those samples that were tested. In addition, a permanent label containing the recertification logo may be placed on the outside of the helmet indicating the year of recertification.

Round Robin: Reconditioners also must submit their testing systems to a round-robin calibration program to validate that each reconditioning and recertification laboratory test rig is properly tuned and assembled. The NOCSAE technical director coordinates this calibration process.

Additional Requirements: Licensed reconditioners are required to provide testing data results to NOCSAE when requested. NOCSAE analyzes this data and maintains a database of all recertification tests performed from all reconditioners licensed to recertify helmets.

RFID Technology: NOCSAE is funding and validating a helmet identification system using a passive RFID label technology. This program uniquely identifies each individual helmet and provides an easy method for inventory, tracking the history of reconditioning and recertification testing, and providing consumer access to model and helmet age information and the status of the original new helmet certification. This program is in the third year of evaluation and development, and so far the results have been very favorable.