

# TerranearPMC Safety Share

## Week of May 27, 2013 – Foot Protection

It was discovered that about five million years ago, early humans started using footwear to protect them from the extreme weather situations. Early humans wrapped their feet with dried leaves, animal skin or leather they obtained from the wild to protect their feet from the harsh environment. Later, the Egyptians created sandals which led to the creation of other forms of footwear.

The first type of protective or “safety” shoe was wooden boots, called sabots, which originated in the 1600’s. Workers in Europe wore them for protection from falling objects. Wooden boots protected farmers on the field from sharp objects lying in the ground and protected toes in case a horse or cow stepped on them. During the early industrial revolution, workers used sabots by throwing them into the gears of factories to stop production. The word “sabotage” came from this activity. “Sabot” is also a term used for a wooden or metal disk that was attached to a projectile in a muzzle loading cannon.

While a precise date and time for when steel-toes shoes were first used is hard to pinpoint, we know that it was at the beginning of the 20<sup>th</sup> century when industrial safety became an issue. At that time individual states began enacting compensation laws. Until then it was cheaper for the employers to replace an injured worker than to introduce safety measures. Large companies became interested in investing into safer equipment due to liability costs. Red Wing Shoes moved into a steel toe line in the 1930s. Another early example of protective shoes were German marching boots or *Marschstiefels* that were used by the non-commissioned officers in World War II, which were reinforced with metal toe caps.

When OSHA was enacted in 1970, a number of standards for personnel protective equipment (PPE) were included, one of which was 29 CFR 1910.136, *Foot Protection*. This standard states that “The employer shall ensure that each affected employee uses protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects, or objects piercing the sole, and where such employee’s feet are exposed to electrical hazards.”

While specific performance criteria are not listed in this regulation (such as how well they must protect the wearer), it does reference the American National Standard Institute or ANSI performance criteria for footwear, known as ANSI Z-41. Under this ANSI standard specific testing requirements are established, specifying a certain level of puncture resistance as well as resistance to impact. For instance the *Impact* classifications, 1/75, 1/50 and 1/30 are test designations designed to meet 75, 50 or 30 foot-pounds of force. The *Compression* classifications, C/75, C/50 and C/30 are testing designations for compressing safety toes: C/75 at 2,500 pounds, C/50 at 1,750 pounds and C/30 at 1,000 pounds. In addition, ANSI Z-41 stipulates that the toe must have a minimum clearance inside the toe area of the shoe of 16/32 for men’s footwear and 15/32 for women’s footwear after these tests are completed.

Other testing criteria to ensure an adequate level of protection to the wearer include protection of the metatarsal (long bones in the foot, leading to the toes), conductive properties (build-up of static electricity whereby the shoe is designed to drive static electricity away from the body, into

the ground), electrical hazards (footwear having non-conductive electrical shock resistant soles and heels), puncture resistance (designed to reduce the chance of being injured due to sharp object penetrating the bottom of the footwear, as well as having the ability to resist a force of 270 lbs while not showing any signs of cracking after being subjected to 1.5 million flexes!). Another testing criterion is designed for static dissipative properties (similar to conductive protection, but designed to reduce accumulation of excess static electricity by conducting a body charge to ground while maintaining a high level of resistance). And for workers involved with chain saws, ANSI developed a resistance test which classifies a shoe's protective properties. While there are many testing criteria for safety shoes, only the criteria for impact and compression are required to meet ANSI Z-41 standards – the other protective qualities are additional and need to be considered based on the specific work to be performed (i.e..not all safety shoes need to have electrical protection). However, if an employee will be working with or around electricity, the workers' shoes will need to meet ANSI Z-41 testing specifications for electrical work.

In 2005, The American National Standards Institute's Z41 Committee on Personal Protection-Protective Footwear merged with the American Society for Testing and Materials (ASTM) International Committee. With this merger, there was a redrafting of ANSI Z41 performance requirements and test method standards for safety footwear. The result was two new ASTM International standards: F 2412, *Test Methods for Foot Protection*, and F 2413, *Specification for Performance Requirements for Protective Footwear*. In addition, the ANSI Z41 standard, *Standard for Personal Protection Protective Footwear*, was withdrawn.

OSHA's updated Foot Protection regulation, now references the two new ATSM standards, as well as the older ANSI Z-41 testing criteria (as footwear manufactured prior to 2005 will still be acceptable based on the ANSI Z41 requirements – shoes manufactured after this date must meet the ASTM criteria). As a result, OSHA now requires protective footwear to meet the applicable ANSI or ATSM consensus standard (based on the date of manufacture).

The fact is, the new ASTM standards contain minimal changes from the withdrawn ANSI Z41 1999 standard with regard to test methodology. The new standards F 2412 and F 2413 will permit the continued use of safety and performance standards previously provided in the ANSI document (which has been an important part of worker safety since 1967). The new standards continue the long-standing effort to help protect against toe, metatarsal and foot bottom injuries. However, the new ASTM protective footwear standards do modify information for static dissipative footwear, and removing one of the two ANSI classifications. Therefore, the majority of existing industry inventory of product and product-information that is labeled or advertised as in compliance with the ANSI Z41 1999 standard should be compliant with the new ASTM standards. However, manufacturers are cautioned to review the ASTM documents and the changes to ensure such compliance.

It should be noted that both the ANSI and ASTM standards DO NOT allow for the use of "add-on" device, such as strap-on foot, toe or metatarsal guards – they must be an integral part of the footwear, made during the manufacturing process.

**"The two most powerful warriors are patience and time." ...so remember: great achievements take time, there is no overnight success. ó Leo Tolstoy**