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**Unleashing Potentials
Shaping the Future**

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RECENT TOE CAP SHOE APPLICATIONS AND DIRECTION FOR FUTURE RESEARCH: A REVIEW

INTRODUCTION

Safety shoes are essential gear to keep employees safe in various situations. Safety shoes are designed to shield the foot from flying debris [1-2]. For comfortable use, they must also be as light as possible. After a long shift, wearing more lightweight footwear makes your legs feel less worn out.

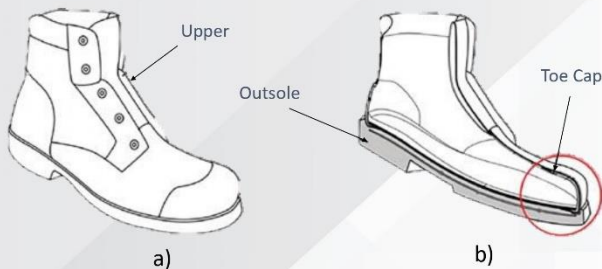


Figure 1: a) Safety shoes and b) Cross sectional of the Safety shoes. Source <https://www.iso.org/home.html>

The outsole, toe cap, and upper are the three main components of safety shoes show in Figure 1. The shoe section that touches the ground, the outsole, weighs between 50% and 60% of the entire shoe.

MECHANICAL REQUIREMENTS FOR SAFETY SHOES

Category of Safety Shoe		
Toe Cap Requirements	Safety ISO 20345	Protective ISO 20346
Impact energy (J)	200	100
Compression load (kN)	15	10

CONCLUSION

The purpose of journal review is to provide literacy knowledge about recent toe cap shoe applications and direction for future research. Workers utilise personal protection equipment (PPE), such as safety shoes, to shield themselves from various health and safety risks at work. Such safety shoes must adhere to fundamental health and safety standards during the design and manufacturing stages to provide the user with suitable protection.

TOE CAP SHOE OVERVIEW

Title	Material Toe Cap Shoe	Author	Year
Thermal aspects of steel toe caps in footgear	Steel	K. Kuklane et al	1999
A Study on plastic Toe-Cap for safety shoes	Plastic	K. S. Cho et al	2004
Effect of a Steel Toe Cap on Forefoot Injury Pattern in a Cadaveric Model	Steel	John Y. Kwon et al	2011
Innovative Geometric Redesign of Safety Footwear Components Using A Reverse Engineering Approach	Advanced High strength Steels (AHSS),	Sérgio L. Costa et al	2016
Study on the impact behaviour of a new safety toe cap model made of ultra-high-strength steels	High-strength steel	Sérgio L. Costa et al [11]	2016
Analysis of Toe Caps for Safety Shoes	Nylon 66 and carbon fiber (CF)	Mr. Hulesh Ram Kurre	2018
Kajian Awal Material Pembuat Toe cap (Safety shoes) Menggunakan Metode Elemen Hingga	i. Steel ii. Aluminum iii. Carbon/epoxy iv. E-glass epoxy v. Kevlar/epoxy	Hendrix Noviyanto Firmansyah et al	2021
Comparative life cycle assessment of safety shoes toe caps manufacturing processes	i. Steel ii. Aluminum iii. Polycarbonate iv. Prepreg	Iacopo Bianchi et al	2022

COMPARISON OF TOE CAP BASED ON STEEL VS COMPOSITE

Type of Material	Advantages	Disadvantages
Steel	i. cheaper price ii. strong iii. already tested iv. many models, sizes, and shapes	i. heavier ii. can be influenced by the ambient temperature iii. Act as conductor
Composite	i. Light and has good durability ii. Not affected by temperature environment iii. Act as insulation	i. High cost ii. Limited on models, size and shape