

# Determining the significance of outsole wear characteristics during the forensic examination of footwear impression evidence

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## Abstract

Wear found on the outsoles of shoes, in the simplest description, is *the gradual erosion of the shoe's outsole material that occurs during contact with a substrate*. This erosion is due to friction, which in time results in the elimination and degradation of portions of outsole material. This causes changes in appearance of shoe outsoles and consequently of impressions made by the shoes. Wear should be considered in all footwear examinations in the same manner as design, physical size and individual characteristics. In some cases general wear may allow for the exclusion of the footwear. In other cases, correspondence of general wear between the questioned impression and the shoe will contribute to reducing the population of shoes that could have made that impression. To properly evaluate the value of wear in a forensic footwear examination, factors must be considered with regard to the accuracy and clarity of the wear as it was reproduced in the crime scene impression as well as any limitations or considerations of distortion or degradation as a consequence of both the impression making and the recovery process. It is also important to understand the differences in comparative value and appearance between general wear and more advanced damage such as holes and tears.

## General wear changes as shoes are worn



Progression of general wear on one outsole element from new (A) to approximately 150 miles of use 4 months later (E).



5 months of general wear on an outsole

## General wear can be visually similar on shoes belonging to the same person

Different shoes from the same runner worn approximately the same amount of time



## General wear can be visually similar on shoes belonging to different people

Different shoes of two different people, both shoes worn primarily to the same work place.



## General Wear

Reduces the population of shoes



## Holes and Tears

Used to individualize



## Terminology

The standard set of terminology recommended by the Scientific Working Group for Footwear and Tire Track Evidence (SWGTTREAD)<sup>10</sup> which relates to wear characteristics:

**Class characteristics:** A feature that is shared by two or more shoes or tires. The shoe outsole or tire tread design and the physical size features of a shoe outsole or tire tread are two common class characteristics which are acquired in the manufacturing process. General wear of the outsole or tire tread is also a class characteristic. Agreement of class characteristics alone does not provide a basis for identification however they reduce the possible number of shoes or tires that could have made an impression.

**Degree of Wear:** The extent to which a shoe outsole or tire tread is eroded. Examples of degree of wear range from a shoe outsole or tire tread that is in a new and unworn condition to those that have considerable wear. The degree of wear continues to change as a shoe outsole or tire tread is worn.

**General wear:** The overall condition of a shoe outsole or tire tread related to its degree of use. General wear may be used to include or exclude shoe outsoles and tire treads based on similar or different degrees and positions of wear.

**Holes:** The result of erosion of a shoe outsole or tire tread that is so extreme that it results in removal of the outer layers of sole or tread materials, often resulting in irregular edges. These irregular edges are individual characteristics. Random holes due to punctures are also individual characteristics.

**Position and Orientation of Wear:** The location and direction of an area of erosion on a shoe outsole or tire tread. Examples of location of wear include wear along the medial edge of the shoe outsole and wear along the outer edge of a tire tread. The position and orientation of wear can change as a shoe outsole or tire tread is worn.

**Specific Location of Wear:** A defined area of erosion on a shoe outsole or tire tread. Examples of a specific location of wear are a worn tire sipe or a small area of worn stippling on a shoe outsole. Specific locations of wear may allow for a greater level of discrimination or association between shoe outsoles or tire treads.

**Wear:** Erosion of the surfaces of a footwear outsole or tire tread during use.

**Tears:** Fractures that have occurred in shoe outsoles or tire treads that reflect irregular edges. Tears are

## Factors to consider during evaluation of wear

- Time interval**  
The possibility of additional wear having occurred to the collected shoes must be considered if there is a significant time interval between the crime and the seizure of the shoes.
- Clarity and distortion**  
Substrate material, collection methods, movement during impression making, and residue (matrix) issues can limit the quality and quantity of detail available for comparison of wear characteristics.
- Manufacturing characteristics**  
Manufacturing characteristics such as mold warp, foxing strip placement and design of inner shoe sole may be mistaken for wear.



Snow substrate limiting detail



Excess blood limiting detail



Grid construction of insole from manufacturing design



Mold warp from manufacturing process

## International survey regarding the use of wear in casework

The examples below were sent to 13 examiners outside of the United States to survey the ~~the~~ ~~examiners~~ ~~asked~~ if the examiner agreed with the classification of general wear as a class characteristic.



11 answered yes wear 2 classified as or manufacturing

Question 2: In the case of a new shoe, with no wear apparent in the crime scene impression, would you consider (A) the wear to correspond or (B) not consider the wear as significant.

10 answered (A) 3 answered (B)



Question 3: In the case that there is some wear apparent in the impression and on the shoe, would you consider that the wear corresponds and (A) is not significant or (B) reduces the population of shoes but is not highly significant or (C) is significant and is strong support that the shoe made the impression.

2 answered (A) 11 answered (B) none answered (C)



Question 4: In the case of texture pattern with corresponding wear, is this considered (A) to reduce the population of shoes or (B) strong support or (C) very strong support or (D) enough to identify.

4 answered (A) 7 answered (B) 2 answered (C) none answered (D)



All 13 agreed on Question 5: that once wear is advanced enough to produce cuts and tears, it is considered an individualizing characteristic.

The results of the survey indicate that general wear is considered to reduce the population of shoes that could have made the impression, but is not used to identify a shoe as the source of an impression.

## Conclusion

General wear is an important and necessary characteristic that must be evaluated during the examination of footwear evidence. Although thousands of shoe soles of the same design and size may be manufactured and in circulation, they are not all worn in the same precise areas or to the same degree. General wear can be visually similar in appearance and its value. If correspondence of general wear can be established, is in reducing the overall number of footwear that potentially could have produced an impression. General wear alone is insufficient to establish an identification. The survey conducted indicates agreement among the international community of footwear impression experts.

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