

## TECHNICAL NOTE

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# A Correlation Between Shoeprint Measurements and Actual Sneaker Size

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**REFERENCE:** VanHoven, H., "A Correlation Between Shoeprint Measurements and Actual Sneaker Size," *Journal of Forensic Sciences*, JFSCA, Vol. 30, No. 4, Oct. 1985, pp. 1233-1237.

**ABSTRACT:** Any correlation of shoeprint to sneaker size must first begin with an examination of sneaker measurements and their relationship to sneaker size. Once this has been established, the relationship between sneaker size and shoeprint measurements in various receiving surfaces can be examined. The purpose then, of this paper, is to form some frame of reference to equate shoeprint to sneaker size.

**KEYWORDS:** forensic science, footprints, footwear, shoeprints, sneaker size, footwear measurements, tread patterns

The forensic science field is almost completely devoid of information on footwear measurements. The idea and related data of correlating shoeprint measurements to sneaker size is noted only in work done by Cassidy [1]. Therefore, before data collection, the manufacturers of the most popular sneaker types were contacted to elicit information and possible data input. The most helpful of these manufacturers was Converse Headquarters in Massachusetts, who supplied actual standard outsole patterns on their one-piece basketball sneaker.

The construction of sneakers can be broken down into three types. The one-piece molded sole has now become the most prevalent tread type on the market. The two-piece sole design incorporates the addition of an outer strip around the sole called the foxing. The third type of construction is the three-piece design, which adds a toe and heel cap to the two-piece type. This third type is primarily found on the Converse All Star® and Nike basketball sneakers. These differences in design could have an effect on the measurement values as will be pointed out later.

### Data Collection

All of the data, except the Converse Standard Patterns provided by Converse, were obtained by measuring sneakers in various shoe outlets. An attempt at measuring ten sneakers of each size from the various manufacturers was made, although sometimes, because of stock availability, this was not possible. Approximately 450 sneakers were measured and the data recorded.

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Sizes and types of sneakers were chosen by frequency seen in the laboratory, most popular models, size, and type most likely to be seen in forensic science work.

### Discussion of Data Results

In discussion with production personnel and in actual field measurements, it was noted that there is some variation in measurements lot to lot and plant to plant. In addition, the foxing and toe caps were not always uniformly positioned, which could affect the measurement values from one sneaker to another. In spite of this, the data conformed quite well to a straight-line plot indicating a uniform progressive enlargement of all measurements with size increases. However, the width measurements increased so slightly with each half size, that the manufacturing deviations often were greater. This gave rise to a wide range of size possibilities for a specific measurement. Therefore, it was concluded that the width measurements varied too much to be usable as a size prediction, unless the type of sneaker making the print is known. The length measurement then is the most valuable for predicting the possible sneaker size.

Table 1 consists of the values used to plot the graphs and their standard deviations. As you will note from Fig. 1, there is a spread among the brands in relation to a specific size. The Adidas most closely paralleled the Converse Standard Patterns, while Nike ran about a half size smaller in tread pattern. The Puma ran about a half size larger than the standards. The Converse All Star was the largest, but, if you subtract for the contribution of the three-piece construction (~ 4 to 7 mm), it falls very close to the Converse Standard Patterns and the Adidas. It was found that the Converse All Star foxing and toe caps were considerably larger than those of Nike. For measurement purposes, the toe cap was included (contributing up to 5 mm), as well as the foxing (contributing 2 to 4 mm), but as the heel cap usually did not extend down to the heel edge it was excluded. The straight-line plots show an average 4-mm increase in length for each half size increase. For any given length measurement, there is approximately a two size spread giving rise to approximately  $\pm 1$ -size deviation in the size prediction (Fig. 2).

### Foreign Trend Influences

This data is from U.S. made major manufacturers (although Adidas is made in Europe, it was included because of its consistency with U.S. made brands and since it also is a major brand name). The large influx of foreign imitations of major manufacturers' patterns and the large numbers of foreign made sneakers on the market were also investigated. The presence of these foreign products makes the identification of a specific sneaker brand, except for a select few such as the All Star, almost impossible. The herringbone pattern prevalent on some Nike and Adidas models appears on many foreign treads. Two very popular imitators of this pattern (the Pony made in Taiwan and the Trax made in Korea) were spot-checked and their length measurements were less reliable. Although the quality control of the foreign treads are often not as good as the major U.S. manufacturers, the ones we tested fell within our data and as such were usable for size prediction information.

### Shoeprint Surface Effect

Thus far we have discussed the sneaker measurement to sneaker size. This same data is applicable to sneaker prints in dust or on paper or cardboard. As we have observed in our laboratory, these types of prints have virtually the same measurement as the sneaker. When the prints are in mud or snow and the prints have been cast, there can be some variation. Prints made in fresh wet snow and measured directly can give measurements that coincide with sneaker measurements. However, castings submitted to our laboratory were found to vary as much as 4 mm or 1/2 size. This should be kept in mind when using the graphed data in relation to cast prints.

TABLE 1—Length measurements and standard deviations of five major brands of sneakers.

Size	Converse All Star			Puma			Adidas			Converse Standard Pattern			Nike		
	Range, mm	Avg., mm	Std. Dev.	Range, mm	Avg., mm	Std. Dev.	Range, mm	Avg., mm	Std. Dev.	Range, mm	Avg., mm	Std. Dev.	Range, mm	Avg., mm	Std. Dev.
6	272-275	273.5	1.08	271-272	271.5	0.58	...	...	...	267	...	...	...	...	...
6.5	277-279	277.5	0.93	274-276	274.8	0.96	...	272.0	0	...	271	...	266-270	267.6	1.82
7	281-286	282.2	1.48	276-280	278.9	1.36	277-279	277.8	0.79	...	275	...	270-275	271.9	2.33
7.5	285-288	286.0	1.15	280-285	283.2	1.99	280-283	281.4	1.35	...	279	...	274-276	275.2	0.75
8	289-291	290.1	0.88	288-290	289.5	0.71	283-286	284.9	0.99	...	283	...	282-285	283.3	1.03
8.5	293-296	294.7	1.16	292-295	293.2	0.92	288-292	289.6	1.51	...	287	...	281-287	285.4	1.06
9	297-300	298.6	0.84	295-298	297.3	1.06	292-296	293.9	1.10	...	291	...	287-290	288.3	1.37
9.5	300-304	301.8	1.40	301-303	302.1	0.57	296-299	297.9	1.25	...	295	...	290-291	290.2	0.44
10	305-308	306.1	1.29	305-306	305.5	0.53	302-304	303.3	0.89	...	300	...	291-299	294.8	2.66
10.5	309-314	310.6	1.51	309-311	310.2	0.79	...	308.0	0	...	304	...	297-303	300.9	2.18
11	314-317	315.0	0.82	312-315	313.8	1.17	308-311	310.0	1.10	...	308	...	301-304	302.5	1.29
11.5	317-321	318.6	1.17	318-323	320.5	2.38	...	...	...	...	313	...	...	...	...
12	322-323	322.8	0.96	321-324	322.4	0.84	320-322	320.8	0.71	...	317	...	310-314	311.7	1.64
12.5	...	...	...	...	...	...	...	...	...	...	321	...	...	...	...
13	328-333	330.8	1.40	...	...	...	326-329	327.1	1.29	...	326	...	...	...	...

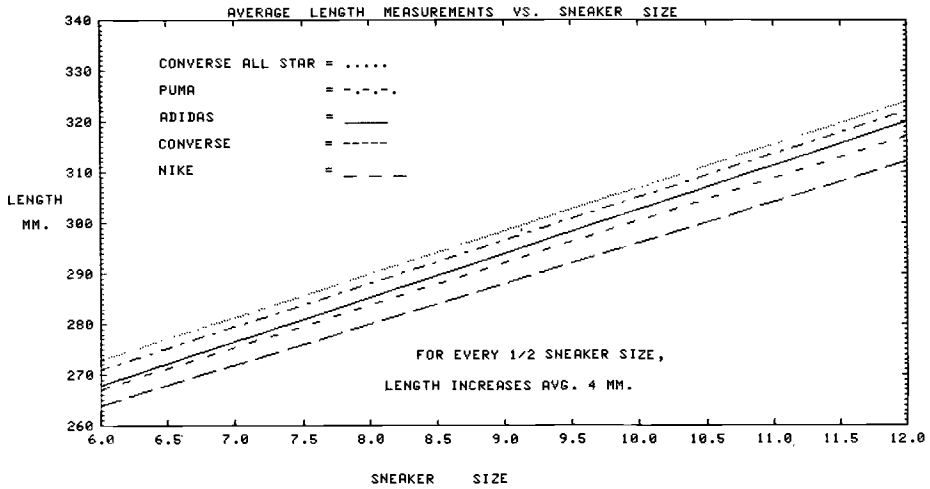


FIG. 1—Average length measurements versus sneaker size.

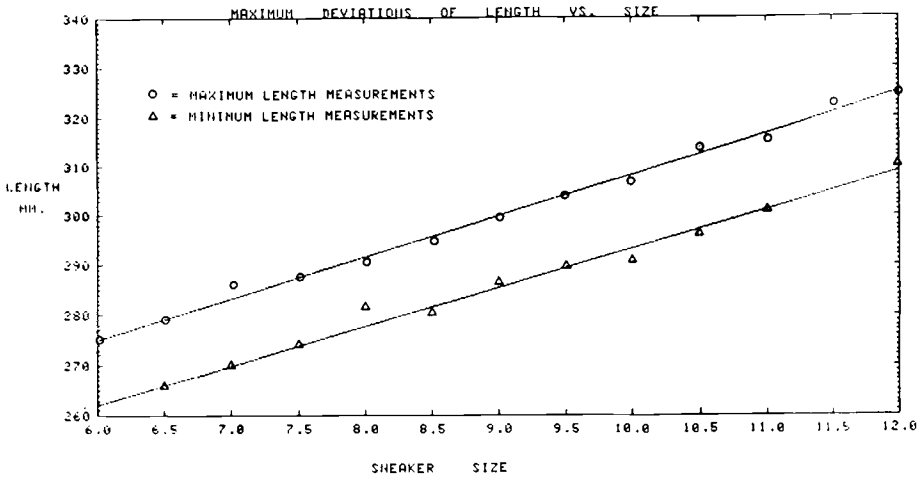


FIG. 2—Maximum deviations of length versus size.

**Other Contributing Factors**

There are other factors that may influence print measurement comparisons and as such should be mentioned. If the print measurements are done from photographic negatives or prints, it is imperative that the camera be centered over the print. This may be checked by measuring the scale at each end. The weather may alter the print dimensions either by shrinkage or expansion. Finally, the medium and technique used to cast a print could have an influence on the measurements.

**Conclusion**

This study encompasses data from the major U.S. sneaker manufacturers. As the sizes are fairly standard in the U.S. industry, the graphed data should be sufficient to predict a possible

sneaker size. The major foreign manufacturer's data was also included, and several other foreign brands common to discount stores were spot checked. These foreign brands all fall within the graphed data, and as such, the sizes of these brands would be predictable. Whether there are some other foreign brands that might fall outside the data range is unknown, as the standardization of foreign measurements is unknown.

The data applies only to sneakers, as other types of footwear were not studied. The Footwear Industries of America publication, "The Art and Science of Footwear Manufacturing," describes the grading and sizing systems used in the footwear industry and may be helpful in further study of boots and shoes (Footwear Industries of America, 3700 Market St., University City Science Center, Philadelphia, PA 19140).

### **Acknowledgment**

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### **Reference**

[1] Cassidy, M. J., "Footwear Identification," Public Relations Branch of the Royal Canadian Mounted Police, RCMP, Ottawa, Ontario, Pbr. 080, 1980.

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