





Factors that influence safety shoe usage

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In a period of increasingly complicated social, economic, technological and managerial problems, today's safety director may have a tendency to seek sophisticated solutions for safety problems. He may

concentrate his efforts on what he perceives to be the more complicated serious safety problems, while neglecting the simpler mundane problems like occupational foot protection. Workers' Compensation statis-

tics indicate that approximately 10 percent of the lost workday reportable injuries occur to the feet, toes and ankles.¹

Although the use of personal protective equipment should not be sub-

stituted for proper hazard control procedures, often employees are neither encouraged nor required to wear proper foot protection. Although the solution to this kind of injury may seem to be so simple, why did approximately 252,000 lost workday foot, toe and ankle injuries occur in the U.S. in 1980?² This article addresses this question and suggests some simple strategies for those responsible for worker safety to use to prevent many of these injuries.

To obtain data on why foot injuries occur, and to examine the use of protective footwear, the Bureau of Labor Statistics (BLS) conducted a survey of 1,251 employees in six selected occupations, who sustained occupational foot injuries in 1979. In the survey period, July-August 1979, 20 State Workers' Compensation agencies examined about 142,000 occupational injury reports of which 2,005 foot injury cases were selected for this survey. A questionnaire was mailed to these workers on foot injury causes and usage; and about 62 percent of the workers selected responded. These questionnaire data were tabulated and can be summarized as follows.³

The major occupational groups reporting foot injuries were Laborers, 39%; Operatives, 28%, and Craftsmen, 27%.

Some of the specific occupations which had a large proportion of foot injuries (at least 3 percent or more of the total foot injuries) were carpenters, mechanics and repairmen, assemblers, welders and flame cutters, machine operators, construction laborers, freight and material handlers, warehousemen, and general laborers. Some of the major survey results of accident type and part of body injured are summarized in Table 1.

The majority of the employees injured (58%) were struck by falling objects which weighed 30 pounds or more in 67 percent of the cases. Approximately 57 percent of the foot injuries were to the toes and 38 percent were to the metatarsal area. The next largest injury category involved employees stepping on sharp objects (16%); most of these occurred in construction, utility, warehousing or other primarily outdoor activities. The final large category involved objects rolling over the foot (13%).

Most of these injured workers shared a common characteristic, ap-

Table 1. Foot Injuries by Description of Accident

Item	All workers		Workers Wearing Safety shoes	
	Number	Percent	Number	Percent
How did the accident occur?				
Total	1,251	100	283	100
Stepped on sharp object	194	16	24	8
Struck by falling object	721	58	191	67
Object rolled onto or over foot	168	13	36	13
Squeezed between two surfaces	59	5	13	5
Struck foot against object	28	2	3	1
Occurred in another way	81	6	16	6
What part of foot was injured?				
Total	1,251	*	283	8
Toes	719	57	118	42
Toes only	557	45	69	24
Toes/other parts of foot	162	13	49	17
Metatarsal	475	38	179	63
Metatarsal only	291	23	124	44
Metatarsal/other parts of foot	184	15	55	16
Sole	241	19	45	16
Sole only	153	12	19	7
Sole/other parts of foot	88	7	26	9
Heel	69	6	19	7
Heel only	29	2	4	1
Heel/other parts of foot	41	3	15	5
Ankle/other parts of foot	59	5	19	7

*Because the categories listed are not mutually exclusive, the sum of the parts will exceed the total. SOURCE: Survey questionnaire—Bureau of Labor Statistics.³

proximately 77 percent did not wear safety shoes. Thus, it appears that the vast majority of these employees and their employers failed to recognize the potential hazard of foot injury and failed to protect against it.

In order to determine why employees were not wearing safety shoes, the National Institute for Occupational Safety and Health (NIOSH) asked six basic questions of the injured employees. These questions and the results are shown in Table 2.³ First, it appears that 77 percent of all workers were not required by their employer to wear safety shoes. Second, 71 percent of the employees were given no instructions that pertained to the wearing of safety shoes. Third, 54 percent of the employers either had no safety shoe policy or it was not communicated to their employees. Fourth, over 84 percent of the employees had to purchase their own safety shoes. Only 10 percent of the employers paid for the complete cost of safety shoes. Fifth, 25 percent of the employees said the wearing of safety shoes was

not practical. Finally, in 52 percent of the cases, either the employer took no action or the employee knew of no action taken to prevent this type of injury from recurring. After the injury occurred only 4 percent of the employers required or provided safety shoes.

These statistics indicate a perceived lack of interest, knowledge, and action by the employer of these employees toward the prevention of foot injuries. This tends to indicate a need for a good long look at the basics of occupational foot protection.

Factors influencing wear

In order to determine what factors tend to influence the wearing of safety shoes, the Division of Safety Research of the National Institute for Occupational Safety and Health, examined the differences in responses to the BLS questions between safety shoe wearers and non-wearers. In this analysis, four factors alone and in combination were identified that influenced the wearing or non-wearing of safety

Table 2. Foot Injuries by Foot Protection Practices and Policies

Item	All workers		Workers Wearing Safety shoes	
	Number	Percent	Number	Percent
Were you required by your employer to wear safety shoes or strap on foot protectors?				
Total	1,226	100	270	100
No	948	77	79	28
Yes	229	19	193	69
Don't know	49	4	6	2
What instructions, if any, were you given concerning safety shoes?				
Total	1,146	*	270	*
Where and when to wear	165	14	111	41
What type to wear	113	10	62	23
Different features available	52	5	23	9
How to maintain in good condition	26	2	15	6
Limitations and advantages of safety shoes	102	9	42	17
Other	25	2	5	2
None	816	71	106	39
What is your employer's policy on wearing safety shoes?				
Total	1,136	100	269	100
Required when performing certain kinds of work and/or in certain areas	304	27	193	72
Encouraged but not required	226	20	41	15
No policy	373	33	19	7
Don't know	233	21	16	6
How would you obtain safety shoes?				
Total	1,007	100	273	100
Available at no cost from employer	98	10	47	17
Must be purchased at your own expense	847	84	189	69
Other	62	6	37	14
Do you feel that wearing safety shoes is practical in your job?				
Total	1,158	100	273	100
No	290	25	7	3
Yes—sometimes	406	35	38	14
Yes—all the time	462	40	228	84
What actions, if any, did the employer take after your accident to prevent this type of injury from recurring?				
Total	1,181	*	274	*
Investigated accident	280	24	78	28
Altered equipment or eliminated hazard	114	10	35	13
Required use of safety shoes	37	3	2	1
Provided safety shoes	11	1	—	—
Conducted training	21	2	3	1
Warned other employees about the hazard	275	23	64	23
Other action	36	3	9	3
Employer took no action	271	23	57	21
Don't know	341	29	77	28

*Because more than one response is possible, the sum of the responses and percentages may not equal the total. Percentages are calculated by dividing each response by the total number of persons who answered the questions.

NOTE: Dashes indicate that no data were reported. Due to rounding, percentages may not add to 100.

Because incomplete questionnaires were used, the total number of responses may vary by question. SOURCE: Survey questionnaire, Bureau of Labor Statistics.

shoes among the survey respondents. It appears that the following are the important factors:

1. A policy requiring the wearing of safety shoes;
2. Instructions to employees on safety shoe usage;
3. Employer payment for the employee's safety shoes;
4. Employee belief that safety shoes are practical.

Analysis showed that each of the above factors when taken alone has a positive influence on the wearing of safety shoes. However, when combinations of these factors are considered, it becomes clear that a commitment to several of these at once maximizes protection. For example, of those claiming all four of the above, 83 percent (24 of 29) wore safety shoes. For those reporting any three of the four, 64 percent (94 of 148) wore them. Those reporting any two of the four factors showed 40 percent (55 of 136) wearing safety shoes, while those reporting just one factor showed only 11 percent (32 of 298) wearing safety shoes. Finally, only 1 percent of those with none of the above influences reported wearing safety shoes.

Since 75 percent of the people in the 1972 BLS survey felt that safety shoes were practical on the job at least sometimes, the critical factors in the usage of safety shoes appear to be the actions of the employer toward shoe usage. A good shoe program should be built on developing the concept of need. First the employer should decide where safety shoes are needed by:

1. Looking at the history of past accidents in the establishment and industry;
2. Examining work processes to determine whether materials being handled are heavy, and

likely to fall or be dropped;

- Determining whether significant numbers of employees believe that there are foot injury hazards.⁴

Next, the employer should develop a definite policy by job or area on the exact requirements of safety shoe usage. After the policy is well defined, the employer should use his supervisors and safety personnel to educate his employees to use safety shoes. Then he should either purchase or subsidize the purchase of the required safety shoes. Finally, he should reinforce the policy by making periodic checks on the condition and usage of the safety shoes and by taking appropriate predefined sanctions against violators.⁴

The type of safety shoe selected should be one that is properly designed and manufactured to meet protection needs. This is brought home by the fact that 93 percent of the people surveyed by BLS who wore safety shoes and were injured had no idea what the rating of their shoe was. Also while nearly 40 percent of the injuries involved the metatarsal area, less than 9 percent of the people who wore safety shoes had on a metatarsal guard.³ When this information is taken in context with the variable performance among tested brands that men's and women's safety shoes showed in NIOSH tests to check whether shoes meet their stated ANSI standard strength, it is obvious that more effort must be made in selecting the proper safety shoe for the job.^{5,6}

Factors to consider

There are three basic factors which should be considered. First, the employer should decide the level of protection needed. The American National Standards Institute (ANSI) Z41.1-1967 (R1972) footwear standard establishes three levels of protection: Class 30, Class 50 and Class 75.⁷ The requirements of this standard are summarized in Table 3 as follows:

The class of the safety shoe necessary is determined by the impact energy and/or compression hazard to which the employee is exposed. For example, if the hazard exposure is created from a 20 pound cylinder falling from a 3 foot table onto the foot of an employee, the impact energy would be 60 feet/pounds because $E (60 \text{ ft. lb.}) = W (20 \text{ lbs.}) \times H (3 \text{ ft.})$. Therefore, for this hazard exposure, a class 30 or class 50 shoe would be inadequate and a class 75 shoe would be the required shoe to protect against this hazard. An example for a compression hazard can be illustrated by an employee's exposure to a 2400 pound rolling cylinder. If the cylinder is likely to roll over the toe of the employee's foot, and the toe of the shoe will only have to support half the weight of the cylinder, there is a probable compression weight of 1200 pounds. Therefore, a class 50 or class 75 shoe would be adequate, but a class 30 shoe would be inadequate because it is designed to withstand only 1000 pounds of compression as shown in Table 3.

Next, the employer should determine whether a metatarsal guard is necessary. If the top of the foot or ankle is as likely to be struck by a heavy object as the toe is, then a metatarsal guard is necessary. The guard can be obtained as an accessory to be added to the shoe, or as an integral part built into the shoe.

Finally, the employer should decide whether puncture protection is necessary. Construction, utility, sanitary or outdoor yard storage work usually will require puncture protection. Once these things have been determined, the employer should then consult both the NIOSH publications on manufacturer's test performance and his local safety shoe dealers for information on shoe performance.^{5,6}

To prevent some future occupational foot injuries, employers should take an interest in the basics of foot protection. They should assess foot

hazards, develop policy on safety shoe requirements, educate their employees, purchase or encourage their employees to purchase shoes and enforce the safety shoe policy requirements. If employers adequately perform these functions, then employees will see the need to use safety shoes and the incidence of occupational foot injuries should be reduced. ☐

References

- This percentage estimate was obtained from a 1980 Supplementary Data System data 3 tape set of thirty-three participating State Workers' Compensation Agencies, provided by the Bureau of Labor Statistics. This tape was cross-tabulated by part of body, foot, ankle and toe according to the *Supplementary Data System, Microdata Files Users' Guide, 1976-1977*, U.S. Bureau of Labor Statistics, Washington, D.C., October 1978 U.S. Department of Commerce, National Technical Information Service, PB-288258.
- This numerical estimate was created by the National Institute for Occupational Safety and Health, Division of Safety Research, Safety Surveillance Branch using the following equation: Supplementary Data System Foot, Toe and Ankle Injuries for 33 States / Supplementary Data System Total Injuries for 33 States / Annual Survey Lost Workday Foot, Toe and Ankle Injuries / Annual Survey Lost Workday cases for Private Sector
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Table 3

CLASS	IMPACT*		COMPRESSION	
	Weight (W) (Pounds)	Height (H) (Feet)		Impact Energy (E) (Feet/Pounds)
75	50	1.5	75	2,500
50	50	1.0	50	1,750
30	50	0.6	30	1,000

*Impact Energy (E) = Weight (W) x Height (H)