

A Study of Slips and Falls Accidents Related with Human Gait

김인주

(U.of New South Wales Dept.of Safety Sci.)

JEAN A. CROSS

(U.of New South Wales Dept.of Safety Sci.)

In most countries, slips and falls are the leading category of non-traffic accidents in terms of serious injuries and fatalities. There is no doubt that slipping incidents are the cause of a very substantial proportion of industry and the general community injuries.

There are no valid test methods and apparatuses which are adopted as International Standards yet mainly because of the oversimplified image of frictional phenomena given by the classical laws of friction. In view of the research literature of the past few decades these laws appear to be some extent incorrect or insufficiently detailed with regard to visco-elastic materials (such as rubber), which comprise the most common heel and sole materials and floor coverings.

The concern of administration about this problem is shown by industry, shoe and floor manufacturers, and the legal system to find non-slip shoes and/or floor surfaces, and as a criterion for rating slip potentials of various flooring conditions. Such products seem to be attractive as a simple means of reducing the hazard, but much more difficult measures to modify the environment, or take quick action in the case of spills particularly, must not be passed over.

This paper is mainly prepared for introducing one of the recent measuring techniques, which has been developed in our laboratory, for slip resistance of shoes floors by simulation of human foot motions. As a first step, the determination of a valid procedure for objectively measuring and/or ordering shoe-sole and floor surface combinations for slip resistance on each environmental case is a major problem. It is therefore necessary in designing a slip-resistance test to simulate reasonably well the conditions under which slipping accidents tend to occur.

Current slip-resistance evaluation methods measure the coefficient of friction(COF) of the shoe/floor interface. A device to measure the coefficient of friction, especially dynamic friction coefficient (DFC), between the shoe sole and the underfoot surface was constructed, and a method including criteria to evaluate the risk of slipping during walking has been developed.

The apparatus consists of a movable artificial foot controlled by a computer with the aid of hydraulic cylinders and allows changes in the shoe/floor interface velocity and vertical force applied during a test. The frictional force (Ff), the normal force (Fn) and their ratio ($\mu = Ff / Fn$) are measured when the foot slides along its surface. Different sole materials, floors, and contaminants such as water, detergents or oil are testable.

The resulted data from slip resistance tests involving 3 different shoes, 9 floor surfaces and 4 contamination conditions are presented. The results of these tests showed that slip and fall accidents were less likely to happen when both shoe and floor are dry and clean. Therefore, ranking of shoes or floor surfaces and/or their combinations may best be based on the results of the tests where the floor surfaces are contaminated. These results might be applied as a guideline to making the environment to reduce the accidents of slips and falls.