SLIPPING AND FALLING DUE TO CONTAMINATION FACTORS ON RAMP AMONG WORKERS IN INDUSTRIES

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To my beloved father, mother and sister for their endless supports and encouragements. To my friends who has been great source of motivation and inspiration

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ABSTRACT

Slips and falls are a major cause of serious injury, disability and death at work. This research focus on slips and falls events due to contamination factors on different ramp angles among workers because employees are exposed to such danger at the workplace. The goals of this study were to identify; the main factors that cause slips and falls on inclined surfaces, the effects of contaminants on gait, and walking speed downhill before the slips occur. Three different contaminants variaty in viscosity (water, suds and oil), three ramp angels (3^o, 7^o and 14^o) and two shoe types (Saftey boot and Sneaker) were used during the trials. In addition, eight healthy male subjects (22-28 years) were asked to walk as naturally as possible throught testing. This project produced an outcome of the slip distance based on the interaction of the factors that causes the incident of slips and falls. As a resualt, slope and contaminant factors are known as the main elements that increase the risk of sliping and falling on ramps. Furthermore, the walking speed increase while the ramp angle will rise. Based on the result, suggestion and guideline can be produce to overcome the slips and falls instances.

ABSTRAK

Gelincir dan jatuh adalah punca utama kepada kecederaan parah, kecacatan dan kematian semasa bekerja. Kajian ini difokuskan untuk kejadian gelincir dan jatuh yang disebabkan oleh kejejasan faktor-faktor didalam penggunaan sudut tanjakan yang berbeza oleh pekerja. Justeru, perkara tersebut boleh membahayakan pekerja di tempat kerja. Objektif utama kajian ini adalah untuk menentukan; faktor utama punca gelincir dan jatuh pada permukaan condong, kesan kejejasan pada gaya jalan, dan kelajuan pejalan semasa menuruni bukit sebelum gelincir. Terdapat tiga bentuk kejejasan iaitu kelikatan (air, buih dan minyak), tiga sudut tanjakan (3^{o}, 7^{o} dan 14^{o}) dan dua jenis kasut (kasut keselamatan dan kasut sniker) yang digunakan dalam percubaan ini. Sebagai tambahan, lapan subjek lelaki yang sihat (22-28 tahun) diarahkan berjalan secara mudah sepanjang ujikaji ini. Projek ini akhirnya akan menghasilkan jarak gelincir berdasarkan interaksi antara faktor-faktor yang menyebabkan berlakunya kejadian gelincir dan jatuh. Hasil daripada kajian ini juga mendapati kecondangan dan kejejasan faktor adalah elemen utama yang menyebabkan peningkatan risiko gelincir dan jatuh pada tanjakan. Selain itu, didapati kelajuan pejalan meningkat apabila sudut tanjakan meningkat. Akhir sekali, cadangan dan garis panduan dapat dihasilkan untuk mengatasi contoh gelincir dan jatuh berdasarkan keputusan yang diperolehi daripada kajian ini.

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INTRODUCTION

1.1 Introduction

Slip and fall accidents increase specific ergonomic concerns. According to the U.S. Bureau of Labor Statistics (BLS), twenty-three percentage of nonfatal occupational injury and illness cases (requiring days away from work) in 2012 happened due to slips, trip and fall accidents BLS (2012).

More than 22 percent of workers that sustain falling injuries miss approximately 15 days at work(BLS, 2012). Occupational related falls from work surfaces such as ladders, roof, and scaffolds are cited on as of the main causes of male fatal occupational injuries(Lord, 2007).

Furthermore, falling incidents account a considerable cost of the particular entire health treatment. Analyses of USA workers compensation claims between the years 1989 and 1990 showed a twenty-four percent influence of fall-related injuries to the direct cost of all claims filed during this time period(Leamon and Murphy, 1995).

Many researchers have carried out understand the interface between the footwear and flooring and measuring the slip resistance. The measurement of slip resistance of flooring and footwear has always been the subject of much debate with respect to the validity of the data that the test methods involved present. Many tests claimed to operate according to the parameters derived through biomechanical measurements made through studies of walking or slipping in the laboratory, yet agreement between the results such tests generate, in terms of the Coefficient of Friction (COF), seems to be poor at best(Grönqvist et al., 1989)

Consequently, this research is carried out to recognize the factors of the main causes of slips and fall on ramp to determine the slip distance caused by the interaction of the factors. From the result of this study, it is expected that solution can be produced useful to industries hence decrease their loss of human power at their workplace, also reduce loses to the company.

This study is significant because slips and falls happen among employees and employers who spend minimum seven hours per day at the workplace. Thus, there are potential risks that can be prevented with their recognitions of the threat. As human, accident cannot be avoided due to mistake or others, but human can reduce it.

1.2 Background of the statement

In fact, slips, trips, and falls are a serious public health concern especially in the workplace. They can result in a variety of injuries, including fractures, sprains, strains, cuts, abrasions, and even death.

According to the 2006 Liberty Mutual Workplace Safety Index, the annual direct cost of disabling occupational injuries due to slip, trips, and falls is estimated to exceed $11 billion. The statistics say it all slips, trips, and falls (STF) are a leading cause of injury. These injuries may result in employee absence, lost productivity, high workers compensation claims, and reduced employee morale.

The researchers believe that causes of falls are complex involving environmental and human factors. Environmental factors include characteristics of walking surfaces, shoes, contaminants, elevations, incline, lighting and even floor compliance. Human factors include sensory capabilities, biomechanics, neuromuscular control and Information processing.

In addition, they discovered that reduction of traction between shoe sole/heel and floor surface area is the most common precipitating event leading to slip and fall. In most cases, falls occur from an inability of the individual to adapt to the environmental conditions. For example, increasing the slipperiness of a floor surface (from dry to oily) would create a high risk of slip and fall if the biomechanics of gait were not altered.

Research by Health and Safety Laboratory (HSL) and Health and Safety Executive (HSE) show that a combination of factors can lead to slip incidents. HSL tried to develop a slip potential model, which identified the important factors contributing to a slip as shown in Figure 1.1.

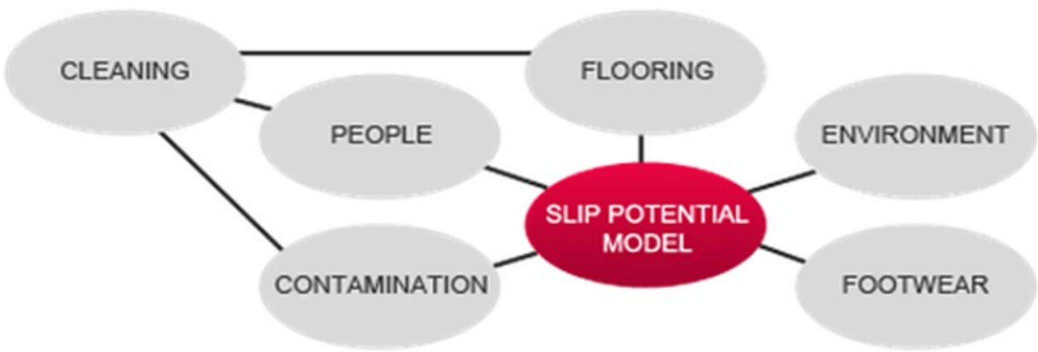

Figure 1.1 Slip potential model (Source: Health and Safety Executive, 2000)

According to Swedish data, the rates of STF have been about 5 per 1000 employees. Hence, there is a need for preventive actions against STF accidents. However, the contributing factors for STF accident have been sparsely studied, which caused the direction of prevention unclear(Leamon and Murphy, 1995).

Many of the research on work-related STF are insufficient in try to be acquainted with fundamental processes of the particular incident. The recent studies begin to provide important information for use in identifying preventive measure. Nonetheless, intellectual information from the death victims is lost. Common for many studies is that investigations are often begin relatively long after a particular incident.

Although Occupational Safety and Health Act (OSHA) 1994 have lined out the regulations to prevent fall accident at workplaces but these still happen. So, what is problem? Where are the mistakes? According to Heinrich et al (1980), 90% of accidents happen at workplace due to unsafe act(Henrich et al., 1980). It means the accidents occur because of workers cognition and behaviour. The study based on workers cognition and behaviour before the accidents might decrease the number of fall accidents if the worker have awareness and followed the guideline.

Figure 1.2 is a bar chart showing the proportion of fatal accidents due to various causes between the years 2012 and 2013(HSE, 2013). The statistics indicate all fatal fall injuries were males. While the number of fatal injuries has generally fallen over the past decade, the percentage of fatal injuries due to falls has not decreased, it is shown by Figure 1.3.

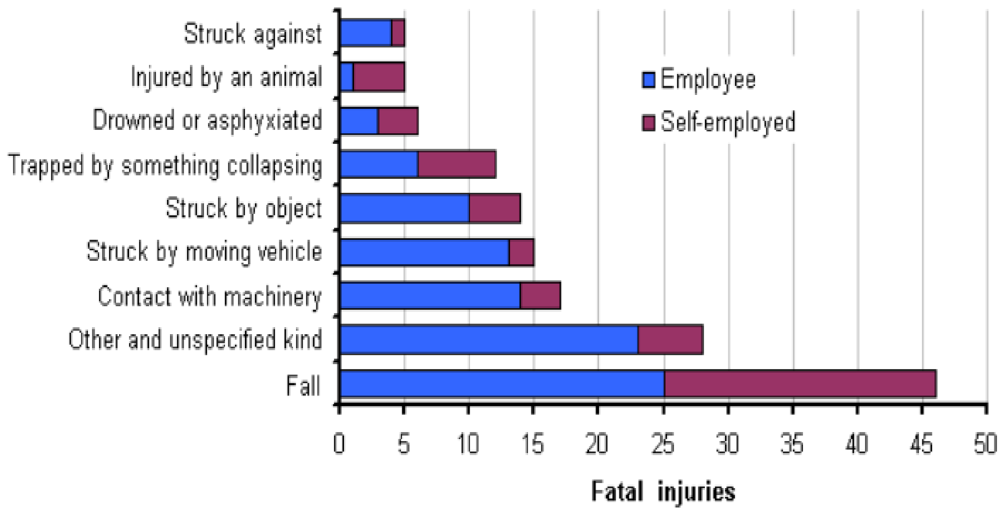

Figure 1.2 fatal injuries to workers 2012/ 13 (HSE, 2013)

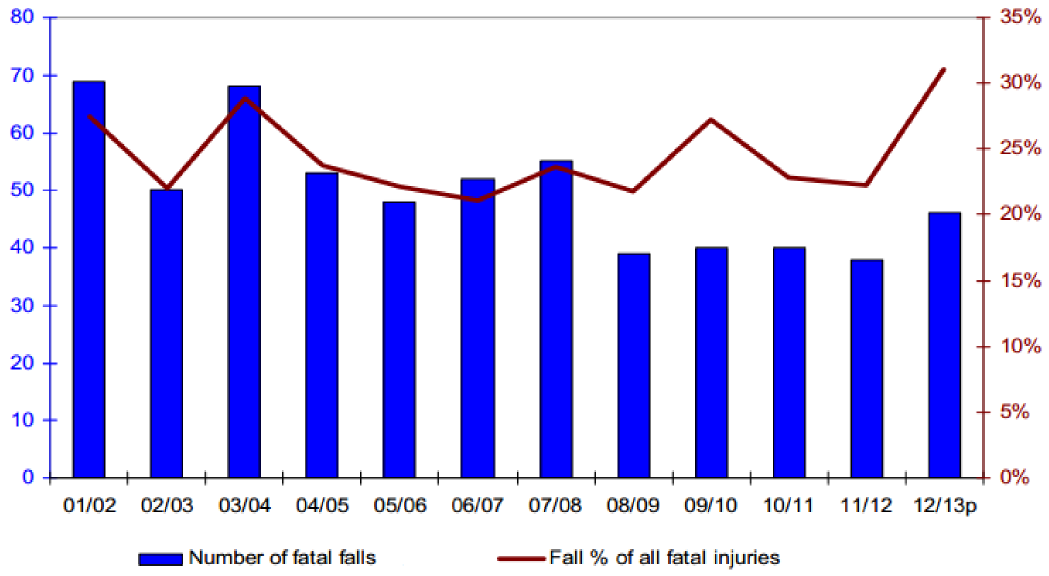

Figure 1.3 fatal fall injuries to workers 2001/2 to 2012/13(HSE, 2013)

1.3 Problem statement

Slips and falls are the frequent types of accident at the workplace. Although such event is not a major accident but slips and falls can contribute to serious injuries when it occur especially to workers in the workplace who are prone to such problem.

The reduction of these incidents has occurred over recent decades but has remained at consistently high level when many studies anti slip products have been produced to tackle such problem. However a standard have been introduced to address the situation.

Even though the factors that cause slips and falls have been identified in previous studies but there is still little ambiguity how these factors interact with each other contributing to STF and the effects of contaminants on STF. To find out such problem, slip distance need to be computed to see the different in various levels of the factors. For this study, human approach was necessary for data collection so a more explicable result are produced rather than using simulation approach where human biomechanical characteristic may vary in many ways. With the result, it can reduce the main causes that contribute to accident quantitatively (performance) and a more improve guideline can be produced.

1.4 Terminology of slips and falls

1.4.1 Slip

A sliding motion where the foot (shoe) loses traction with the floor surface resulting in a loss of balance.

1.4.2 Fall

A drop in height of human body.

1.4.3 Trip

Involves a loss of balance when the natural movement of the foot is interfered with momentarily.

1.4.4 Ramp or Inclined plane

A flat supporting surface tilted at an angle, with one end higher than the other, used as an aid for raising or lowering a load.

1.5 The significance of the study

This study offers a clear approach on the cause of slips, falls and the potential risks it brings to workers at the work environment. In order to better understanding of the problem, subsequent action may be taken such as installing the anti-slip product of certain quality and adjusting the optimum angle for ramp, hence capable to reduce the risks of accident. Additionally this project can also provide an instruction for UTM to apply to reduce slips and falls incident from occurring especially in the laboratory and workshop, hence reducing the cost of medical care.

1.6 Objective of the study

The objectives of the project are:

1. To determine the main factors that cause slips and falls on inclined surfaces.
2. To identify the effects of contaminants on ramps.
3. To establish the walking speed before the slips occur.

1.7 Scope of study

The scope of the study aims to determine the boundaries or limit of research. The scope of this research is based on the following:

1. Focus on falls accident among male workers while working downhill.
2. Focus on contamination factors and ramp angle contributes slips.
3. This study would only investigate slips and falls incidents that occur on the ramp or inclined surface.

4. Eight students and laboratory employees voluntarily in UTM university participate in this study with the mean mass 76±9 kg, the mean weight 1.70±0.09 cm, and the mean age 25±3.

1.8 Conclusion

Simply, this chapter make available some information as an introduction to slips and falls on ramp. It is also clarified the problems arise related to this research. The objective and scope of the research are stated and the problem statements are provided. The literature review is discussed on next chapter.

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