



Ergo Tip of the Month - March 2008

Friction in the Workplace: It isn't all bad!

There are several factors to consider in the design or evaluation of a workstation! Some of the common risk factors an Ergonomist will watch for include exposure to high forces, awkward postures, and frequent or repetitive actions. They will also likely consider the potential effects of vibration, extreme heat or cold, as well as lighting, to name a few. This month, we would like to draw your attention to another important workstation parameter which has been shown to play a significant role in task performance. In simple terms, this can be thought of as *floor slipperiness*, or the frictional conditions of a floor at a workstation. Recent research has shown that footwear-to-floor friction conditions can have an effect on the maximum acceptable weight of manual material handling tasks (Li, et. al, 2007).

What is Friction?

Friction refers to the resistance an object encounters while moving over another object. The Coefficient of Friction, often represented as μ or COF, is a number between 0.0 (no friction) and 1.0 which represents the friction between two surfaces (www.mathsrevision.net).

What is the Recommended Coefficient of Friction for Walking Surfaces?

Recommendations on COF or slip-resistance vary somewhat, based on geographical region as well as by measurement method. COF can be calculated statically (SCOF) and dynamically (DCOF). In the USA, a SCOF of 0.5 is recommended for normal walking conditions (Miller, 1983). If loads are being carried this may increase. According to researcher, Gronqvist (1995), Europe measures COF dynamically, and a value greater than 0.3 indicates a very slip resistant surface.

What does the Research Say?

Researchers at the Liberty Mutual Institute for Safety (Hopkinton, MA, USA) and Tsinghua University (Beijing, China) recently studied the physiological and psychophysical responses to various floor to shoe friction conditions on maximum acceptable weight of material handling (Li, et. al, 2007). Eight males performed material handling tasks (lifting, carrying, lowering, walking) under 3 different friction levels (SCOF=0.19, 0.43, and 0.89, from low to high, respectively). Results show that as the friction level increased, so did the maximum acceptable weight of handling (from 8.15 kg at low friction to 9.34 kg at high friction). In addition, energy efficiency (which was measured as kg/ L of O₂ consumed/minute) was significantly decreased for the lower friction conditions than for higher friction. Lastly, the researchers stated that perceived sense of slip was highest when COF was lowest.

What does this mean for Workstation Design?

In terms of workstation design and analysis, the results of this research suggest a couple of important points;

Friction level should be considered as an important environmental factor in the design of manual material handling tasks.

Is the floor surface made of a non-slip material?

Has the worker chosen the appropriate footwear?

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Is the workstation exposed to the elements (rain, snow, ice)?

Will the workers be exposed to spilled liquids at the station, such as grease or lubricants?

When conducting an assessment with common material handling tools (i.e. the NIOSH Lifting equation, which assumes a COF of 0.4 or more) (Waters et. al, 1993), attention should be paid to the assumptions made within the tool regarding floor friction level. It is important to ensure the job you are assessing, has the same friction levels as those assumed in the assessment tool.

References:

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Waters, T.R., Putz-Anderson, V., Garg, A., Fine, L. 1993. Revised NIOSH equation for the design and evaluation of manual lifting tasks. *Ergonomics* 36, 749-776.

www.mathsrevision.net (information retrieved Feb 18th, 08)

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