

Statistical data of slipping injuries happened in the winter time

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ABSTRACT

Finnish Meteorological Institute (FMI) issues warnings about highly slippery pedestrian weather when extra attention should be paid to the choice of footwear and slip guards should be worn. Slipperiness often occurs when snow or water layer is lying above the ice layer. There may be wide local variations in walkway conditions, depending on factors such as maintenance practices and the volume of pedestrians.

FMI has developed a pavement condition model which a special version of the FMI's road weather model. The model determines the condition existing on pavements from the viewpoint of pedestrians. It differs from the road weather model mainly with respect to the description of wear of ice, snow, etc. and in the interpretation of weather details. In addition, the determination of the forecast initial state uses data from a longer observation simulation period.

The lack of observations is a big problem when developing the pavement condition model and doing the verifications. There are only two weather stations measuring prevailing road condition on walkways. Slipping injuries have been used as an indicator of slippery days. Especially, accidents happening on a way to and from work have been found to be among the best sources indicating the most slippery days for pedestrians.

This study presents statistic of the slipping accidents. The most slippery days can be found from the statistic as a peak days of slipping injuries. Also, accidents statistically compared to given slipperiness warnings for pedestrians are compared and presented in this study. Comparison reveals that during the most peak day cases a warning of slippery pavements is given but not always.

Keywords: Slipperiness, pedestrian slipping accidents.

1 INTRODUCTION

Slipping accidents happens through the year, both inside and outside. Around 50 000 slipping accidents happens in Finland annually resulting in the need of medical attention and two-thirds of those happen when the walkway is covered by ice and/or snow.

Costs of slipping accidents are calculated to be about 2400 million euros in Finland annually [1]. This amount includes costs in health care, lost workdays and welfare. By preventing the accidents for about 1–2 percent the economic savings could be around 115-130 million euros annually.

Slipping accidents can happen for everybody regardless the age (see figure 1) [2] but people between ages 40-70 needs most usually medical attention (see figure 2). Slipping accidents are the most harmful for elderly people because they may get hip or other fractures more often when falling and the consequences of the injuries may lead to failing constitution (see figure 3) [3].

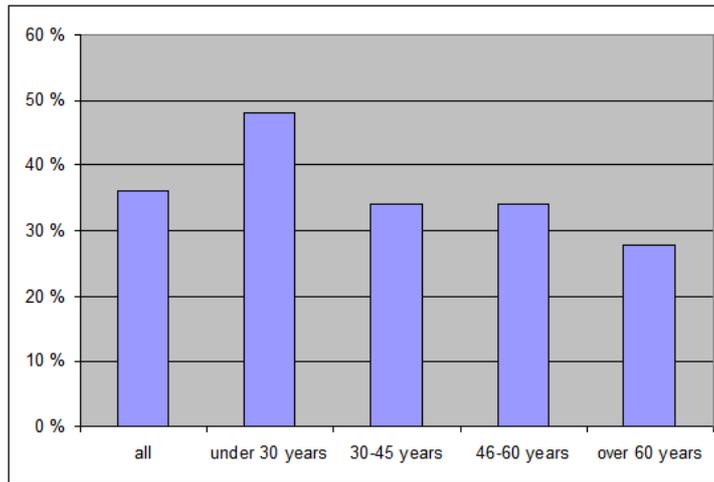


Figure 1. The age distribution of the slipping injuries [2].

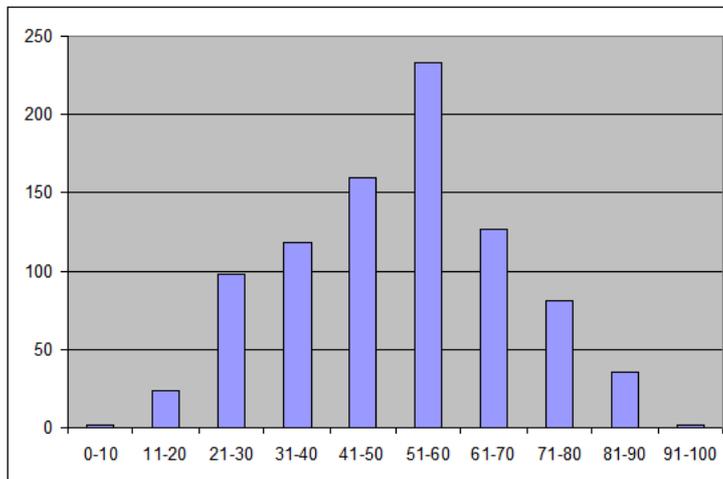


Figure 2. The number of slipping accident patients and different age ranges in Töölö Hospital Emergency on years 2003-2006.

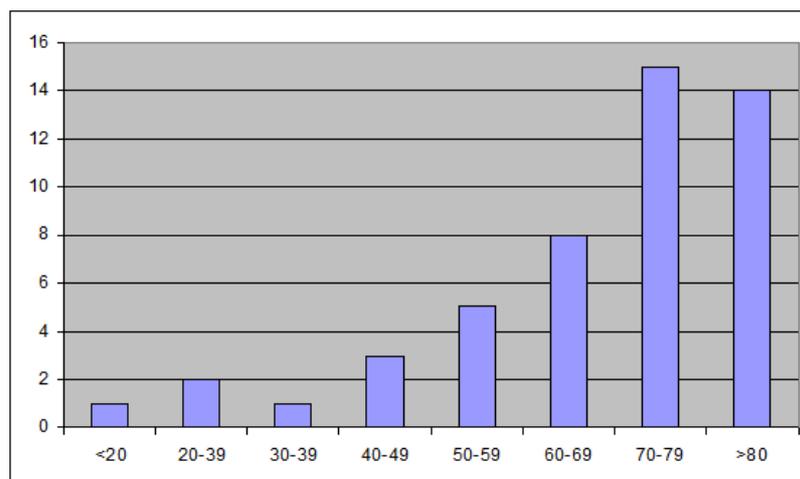


Figure 3. The number of slipping accident patients and different age ranges with hip fracture due to slipping accidents in Töölö Hospital Emergency on years 2003-2004.

2 THE MOST DIFFICULT WEATHER FOR PEDESTRIANS

Slipperiness occurs often when snow or water layer is lying above the ice layer (see figure 4). Packed snow can be very slippery especially if the snow removal machine has passed by leaving a hard and slippery snow layer. Slipperiness can occur in different temperature, but usually the most slippery cases happen when temperature is near zero degrees. Also, precipitation in the form of rain, drizzle or snow is often observed in case of very slippery days.

The most difficult cases and days from the pedestrians' point of view typically differ from the peak days of the traffic accidents. Car traffic is typically in troubles in case of snowfall [4]. In addition to slipperiness, also low visibility caused by snowfall or fog raises the risk of traffic accidents. In the most difficult cases slipperiness and reduced visibility can occur at the same time.

A peak day of slipping accidents is definition for a day when the number of slipping accidents is clearly higher than usually and when the pavement condition can be assumed to be very slippery. Typically about 10% of the days in the winter time are a peak day and 25% a potential peak day. A peak day occurs typically around 10 times and a potential peak day 20-30 times per winter. However, the difference between winters and locations can be large.

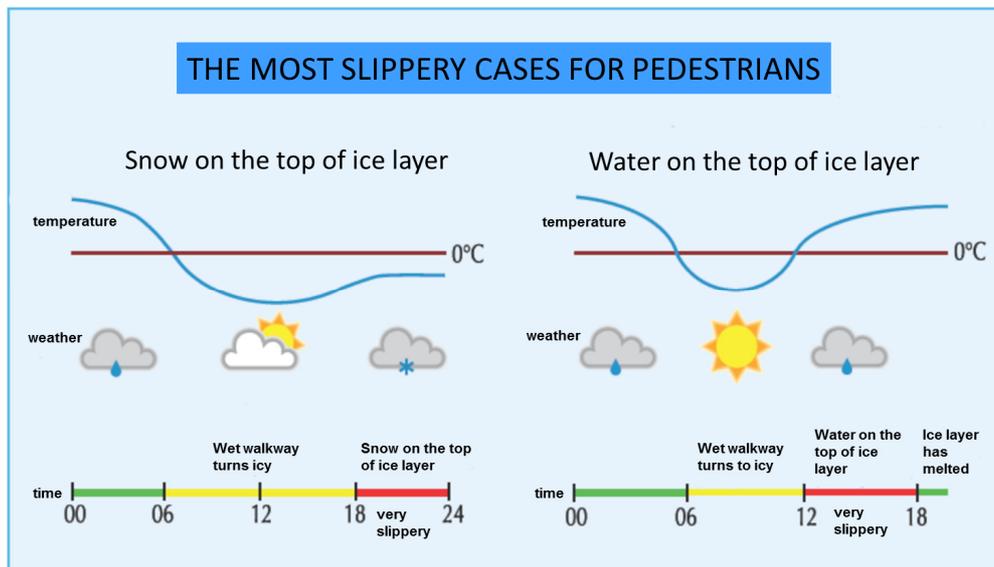


Figure 4. The most slippery weather situations for pedestrians.

3 STATISTICAL DATA OF PEDESTRIAN SLIPPING INJURIES

There is a road weather station network monitoring the road weather and slipperiness along the Finnish road network but those stations are serving highways only. On the walkways there are only two weather stations monitoring the slipperiness in Finland [5]. So, the information of the prevailing slipperiness on the walkways cannot be seen from the observations. The statistical data of slipping accidents has noticed to be a good indicator of the slippery days.

One of the best and most reliable sources revealing slipping accidents is statistics of accidents happened on the way from home to work or vice versa. Those accidents are pretty well documented and the accidents happened when walking are marked separately to the statistics. Statistics are collected by the Federation of Accident Insurance Institutions. The only problem with the data is that the statistics are available after a calendar year. So slipping injuries happened on February 2010 were available only in the beginning of the year 2011.

Figure 5 presents the slipping accidents on the way from home to work or vice versa happened on Uusimaa region on year 2010. It can be clearly seen that injuries happen throughout the year but during the winter time the level of accidents is much higher than in the summer time. Also, the ending and beginning of winter and slippery season can be clearly seen from the figure when the level of accidents decreases and increases dramatically.

Accidents happen throughout the winter but as the columns indicate on the figure 5 there are some days when the number of accidents is clearly higher than normally. It can be assumed that those peak days have happened when walkways have been slippery or very slippery. There seems to be almost ten days in this data when the amount of slipping injuries is 60 or more and those days can be assumed to be peak days of slipping accidents. Days with 30-40 injuries can assume to be a potential peak day.

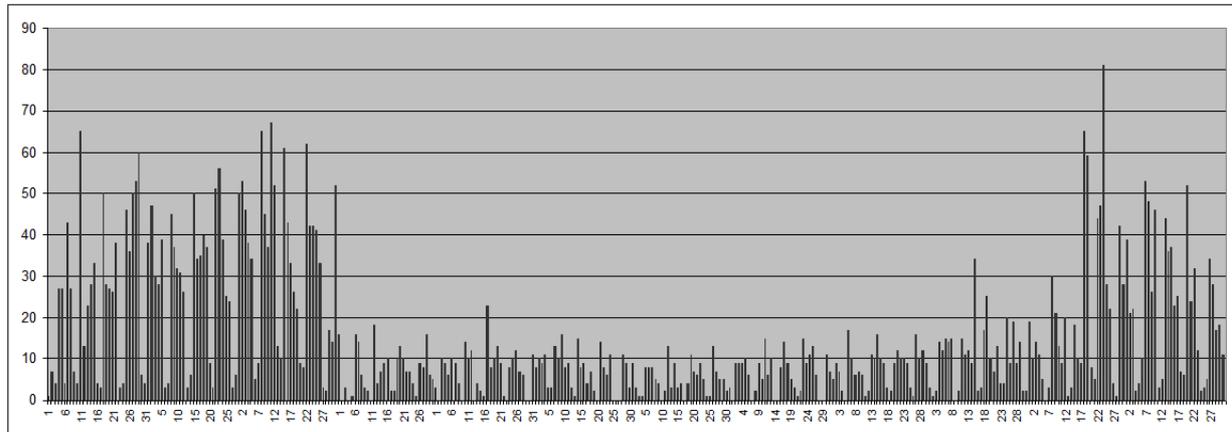


Figure 5. The number of pedestrian slipping injuries happened on the way to work or vice versa. Data includes injuries happened on Uusimaa province between 1.1.2010 and 31.12.2010. Source of data: Federation of Accident Insurance Institutions.

Only Uusimaa region was taken into account in this study. Uusimaa is a province located in the southern part of Finland and for example Helsinki is part of it. Big cities with large amount of citizens and accidents give more reliable results than smaller cities because the contingency will become a bigger role when the number of citizens and accidents are lower.

Other statistics revealing happened slipping accidents are the records of ambulance transport due to falling down and compensations paid by the City of Helsinki resulting from bad walkway maintenance. Also, the visits at the first aid have been used but that data is not available anymore.

The problem with the ambulance transport data is that there is no information available about where the accident has taken a place. Thus, accidents that have happened indoors are also included in the data and cannot be eliminated. Information about ambulance transports is available almost in real-time whereas other data is available after one year. Also, ambulance transport information reveals well when the accident has happened whereas visits at the hospital may have a delay i.e. accidents have happened few days earlier when the patients visit the hospital [6]. The problem with the ambulance transport data is that on weekends and public holidays there are more ambulance transportations carried out than on normal weekdays.

4 GIVEN SLIPPERINESS WARNINGS COMPARED TO SLIPPING INJURIES

FMI started to give warnings considering about very slippery pavement conditions on year 1998 and then the service was in use only in Helsinki metropolitan area [7]. Nowadays FMI issues warnings about highly slippery pedestrian weather to each province two times per day. Warnings can be seen from FMI's internet page but also some local radio channels are reading warnings after news and weather report. There are also some cities where the warnings are given via SMS-message for the user group.

Peak days and potential peak days are compared to the given warnings (see figure 6), in this study the comparison includes the winter 2010-2011. In case of peak days the warning was given in 9 situations and no warning in 8 situations. If there was no peak day, then the warning was given very seldom.

Forecasting slipperiness on the walkways seems to be more challenging than forecasting the slipperiness on highways. Snowfall cause slipperiness on the highways almost always, but the reasons causing slipperiness on the walkways are more complicated. Usually the past and present weather and the existing ice layer are the most important components for the slipperiness on the pavements.

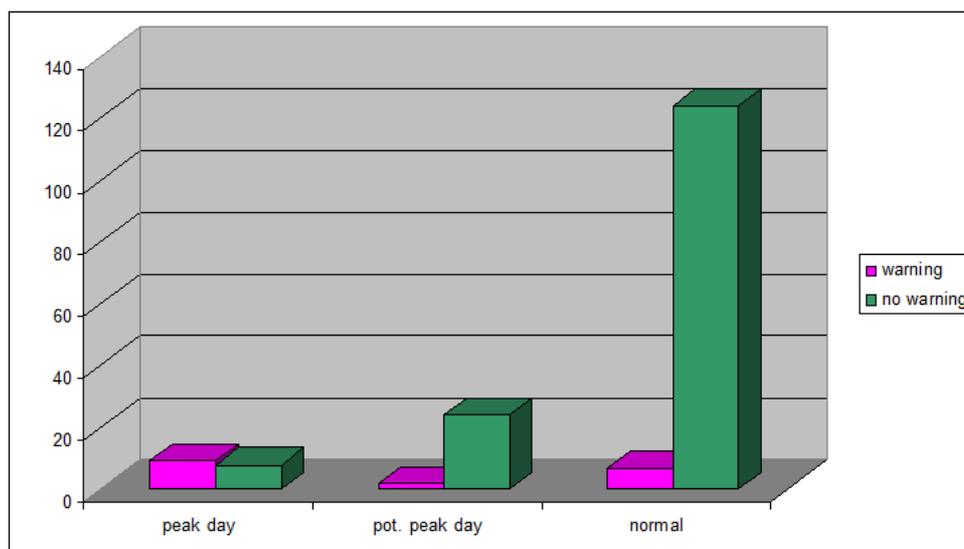


Figure 6. The comparison between given warning and pedestrians slipping injuries in winter 2010-2011. The data includes whole Finland.

5 CONCLUSIONS

Slipping injuries is a big economical problem causing losses in health care, lost workdays and welfare. Slipping injuries happens through the year, but the slippery pavements raise the risk of slipping accidents very dramatically during winter. There are typically around ten days when the pavements are very slippery due to water or snow above the ice layer and the number of slipping accidents is much higher than normally. Those days are called as a peak day of slipping accidents.

Slipping accidents happening when travelling from home to work or vice versa are useful statistics to estimate the peak days of slipping accidents but unfortunately this information is not possible to use in real-time because the statistics are available after a calendar year. The other statistics collecting slipping injuries are ambulance transport data, visits at the first aid and the compensations paid by the City of Helsinki resulting from bad walkway maintenance.

FMI's pavement condition model is a tool when forecasting the expected slipperiness on the pavements but it has been seen that slipperiness can occur during different kind of weather phenomena and the level of slipperiness is not easy to predict.

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