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Monitoring slipperiness on walkways

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Background

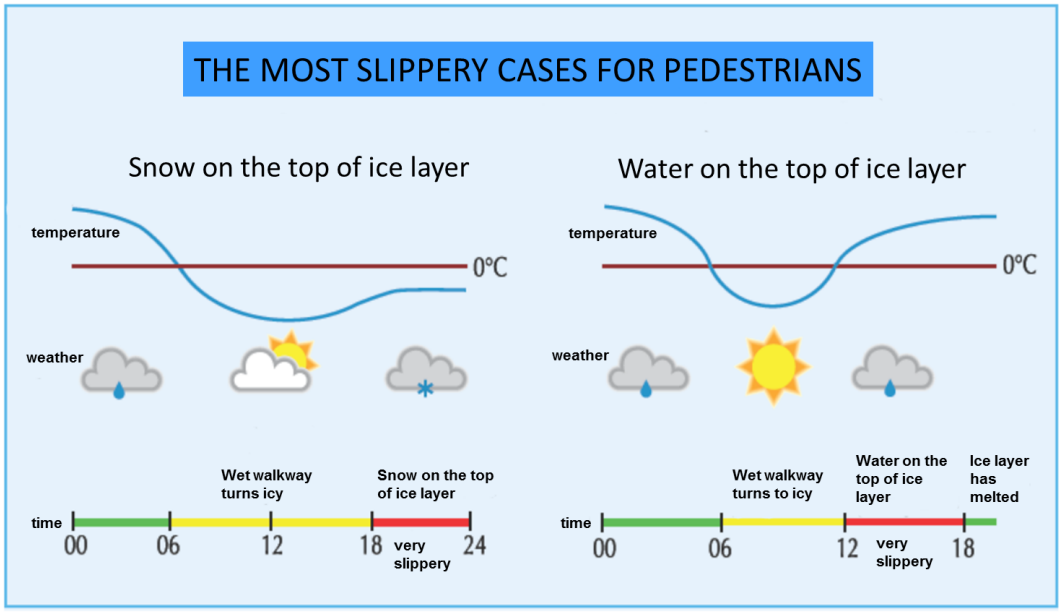
- **Lot's of slipping injuries happen for pedestrians → big economic problem → the number of slipping accidents need to be reduced**
  - Around 50 000 slipping accidents requiring medical attention happen in Finland annually
    - two-thirds of injuries happen when walkways are covered by ice and/or snow
    - Slipping injuries can be severe for older people
  - Costs of slipping accidents are about 2400 million euros in Finland annually. This amount includes costs in health care, lost workdays and welfare
  - The economical loss is bigger in case of pedestrian slipping accidents than traffic accidents

Background

- **FMI has developed a pedestrian pavement condition model to simulate slipperiness on walkways**
- **No slipperiness observations available → Not possible to do verifications, also model development difficult**
  - The peak days of slipping injuries used as an indicator of slippery pavement condition
    - More information available on poster ID 61
- **The condition of pedestrian pavement seems to be more challenging to predict than the condition of highways**
- **Pavement condition may vary dramatically even within short distances**

Slippery walkway condition

- **Car traffic has typically problems in case of snowfall → low visibility and reduced friction**
- **New snow means usually good grip for pedestrians (if no ice below the snow)**
- **The most difficult walkway conditions are:**



Friction measurement devices

- **There are several devices and techniques available to measure friction for different purposes**
- **But friction on walkways is not that commonly measured or studied**

µTEC


Portable Skid Resistance Tester

BV-11

ASFT2GO


Portable Friction Tester (PFT)


Traction Watcher One

Friction measurement devices

- **FMI has tested two devices which measure slipperiness on walkways**

Vaisala DSC111 optical sensor

- Two sensors installed in Helsinki
- Observations from winters 2010/11 and 2011/12

Slipmeter developed by Finnish Institute of Occupational Healthy

- One case study measurement

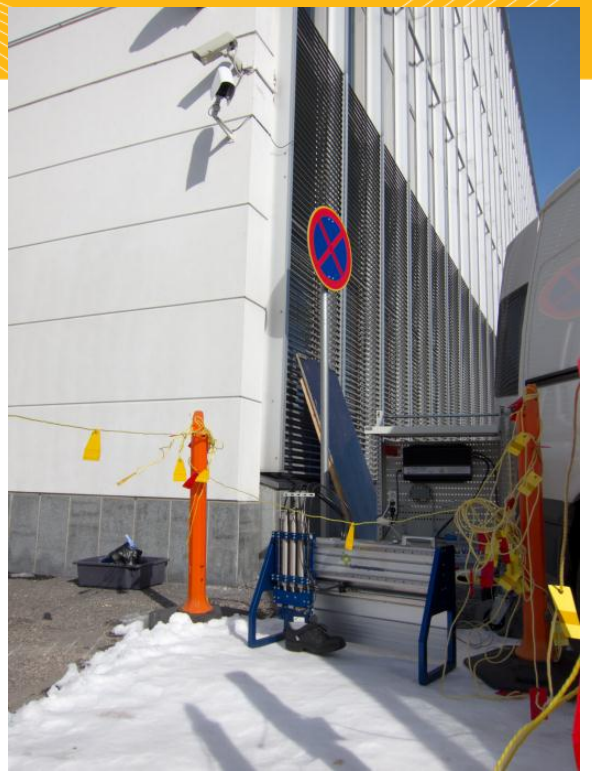
Vaisala DSC111 instrument

- Measures optically thickness of water/snow/ice on the surface
- Classifies the road surface condition into following classes: dry, damp, wet, snowy, icy
- Gives an estimation of prevailing friction
- Used to monitor highways along the Finnish road network for several years

Slipmeter developed by Finnish Institute of Occupational Healthy

- **Simulates stepping**
- **Different footwear can be tested**
- **Different stepping force can be tested**
- **As a result: friction between surface and shoe sole**

Measurements between DSC111 and FIOH's slipmeter on 17th March 2011



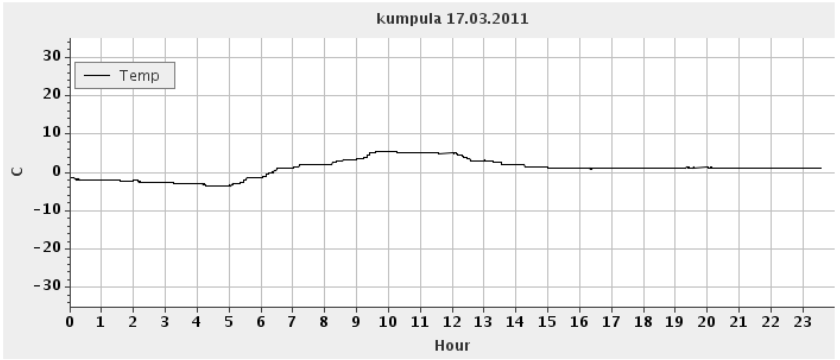
- **Snow was taken to the test site and packed by stepping day before**

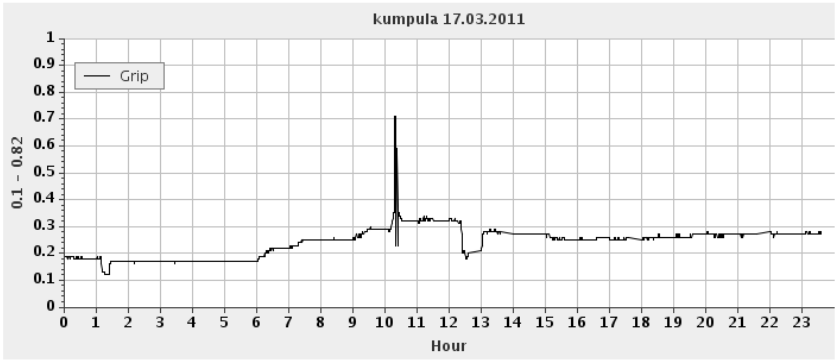
- **Two shoe soles were tested with the slipmeter**
  - A: shoe sole with good grip
  - B: very slippery shoe sole (like curling shoe)

Measurements between DSC111 and FIOH's slipmeter

Measurement	Shoe A	Shoe B
#1	0.33	0.10
#2	0.24	0.09
#3	0.16	0.11
#4	0.26	0.09
#5	0.31	0.07
Mean	0.26	0.09
SD	0.17	0.02

Friction measured by slipmeter





Measured friction was around 0.3 with shoe A and DSC111 instrument

Friction measured by DSC111 (error peak caused by people on the test site)

Results

- **FIOH's slipmeter**
  - Good device to measure slipperiness on walkways
  - Uneven surface disturbs consecutive measurements
  - Cannot be used operationally

- **Vaisala DSC111 device**
  - Easy to install and use
  - Gives continuously low values for friction in case of lot of ice on the surface
  - In case of thin layer of ice more reliable results
  - Affect of gritting unknown

Conclusions

- **The condition of pedestrian pavement seems to be more challenging to predict than the road condition of highways**
- **Big economical loss caused by slipping accidents**
  - The number of slipping accidents need to be reduced
- **Problem how to measure slipperiness on walkways operationally need to be solved**