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SUSTAINABLE WINTER SERVICE FOR ROAD USERS

Wintertime road conditions and accident risks in passenger car traffic

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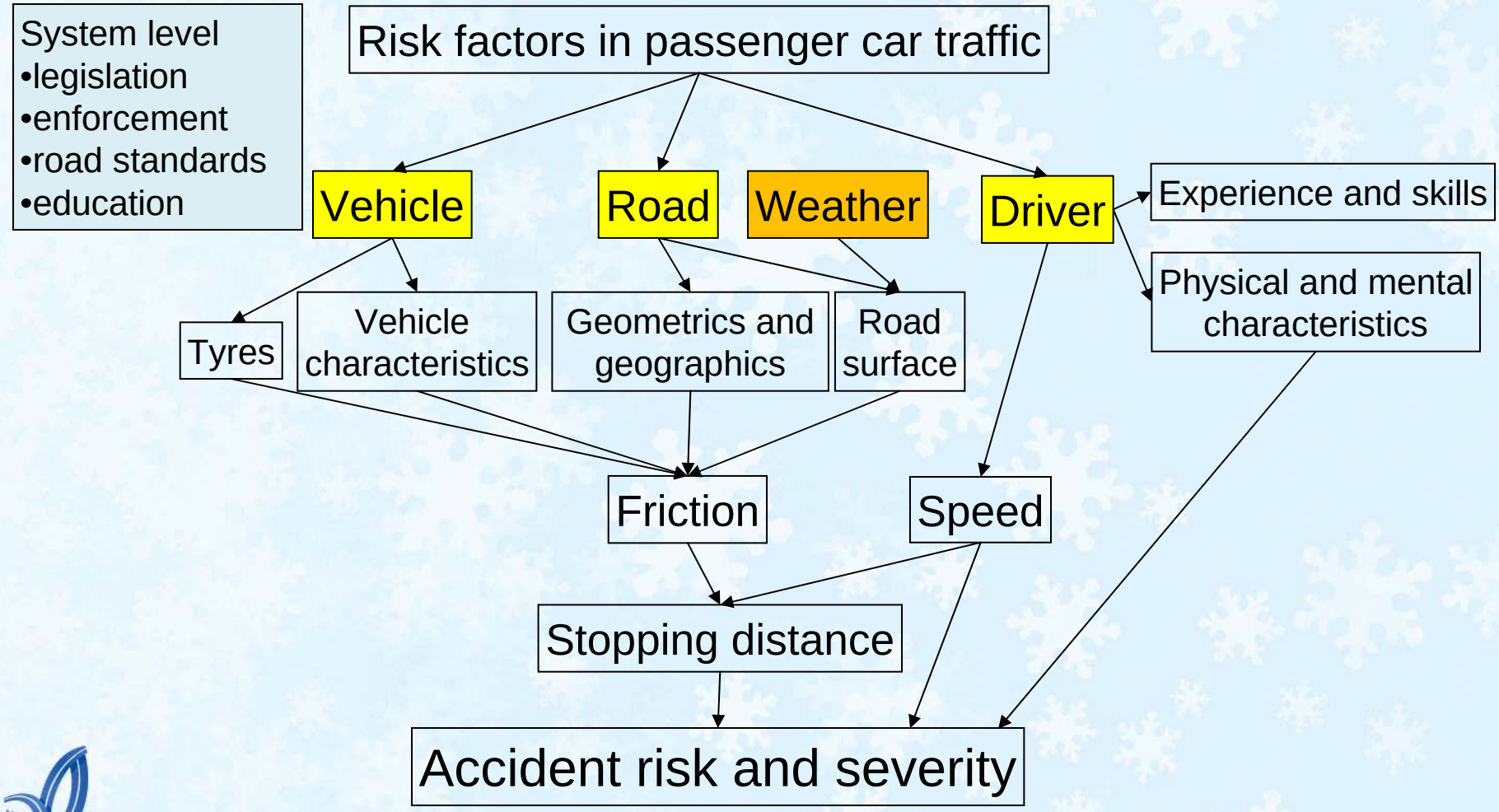
CONTENTS

- The general framework and the connection between road safety and road condition
- Wintertime traffic in Finland (climate, accidents and the amount of traffic)
- Literary research: results from previous studies
- Statistical analyses with new data

– Fatal accidents in different road conditions
– The prevalence of different road conditions
– Relative accident risks in different road conditions

- Discussion of the future

FACTORS AFFECTING THE ACCIDENT RISK AND THE SEVERITY OF ACCIDENTS



RESEARCH METHODS

- **A literary research**
  - Focus on research done in the Nordic Countries on how different factors affect the risk
  - Discussion about the future (climate change, road condition information to the drivers)
- **Statistical analyses by combining different data**
  - Accident data (Finnish Motor Insurers' Centre)
  - Road condition data (Finnish Road Administration: follow-up data on the quality of wintertime maintenance)
  - Vehicle mileage data (Finnish Road Administration)

TERMS IN THIS PRESENTATION

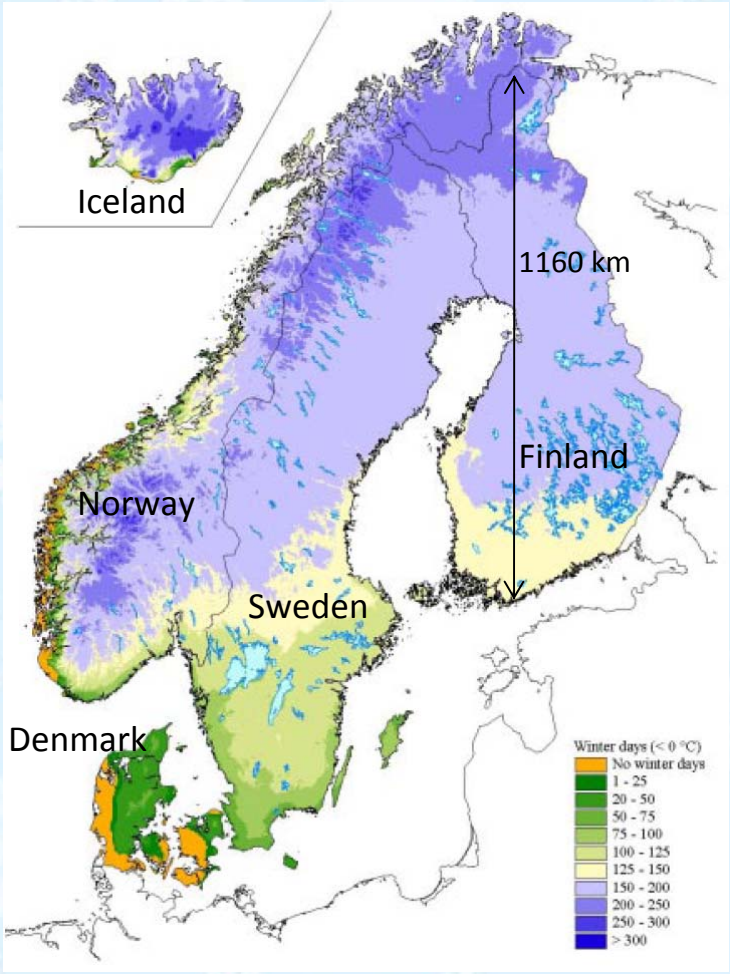
- Road condition = condition of the road surface which is influenced e.g. by the weather, road characteristics and road maintenance; varies in time and place
- Wintertime: months from December to March
- Accident risk in a specific road condition = accidents that occurred in a specific road condition / vehicle mileage in the corresponding road condition

CHALLENGES IN DEFINING THE RISK

- Classifications of road conditions are dissimilar in different sources
- The road condition is a subjective estimate
- No precise data exists on vehicle mileage in different road conditions
- Accident data is often small which adds the possibility of contingency affecting the results

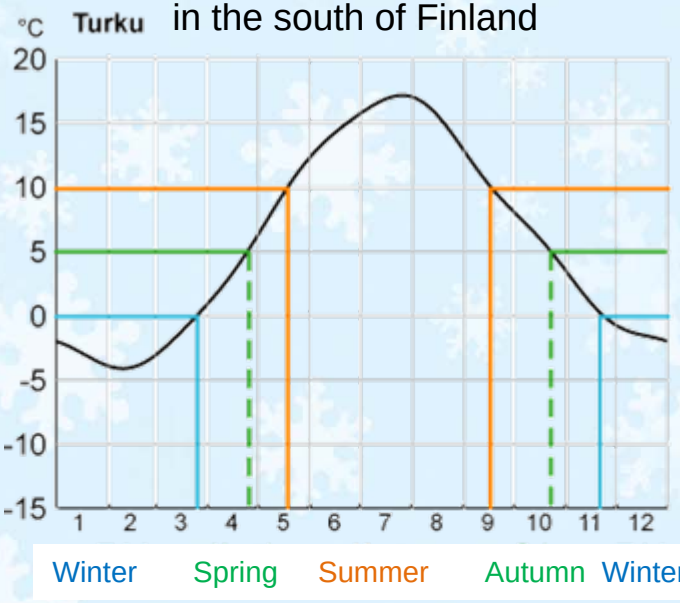
FINLAND AND ITS CLIMATE

Picture: **findis.org**



The average length of winter (mean temperature under 0˚C) in the Nordic countries 1961–1990. (Tveito et al. 2001)

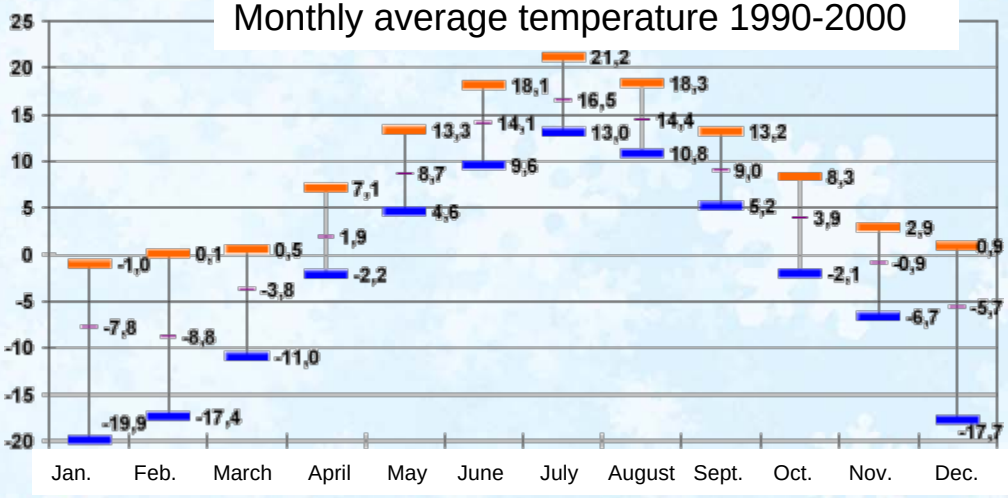
WINTERTIME IN FINLAND

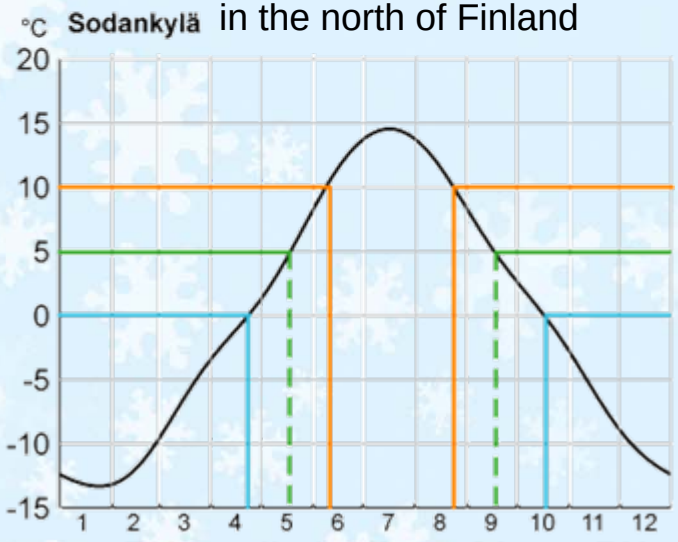


in the south of Finland

Jyväskylä in Central Finland

Monthly average temperature 1990-2000



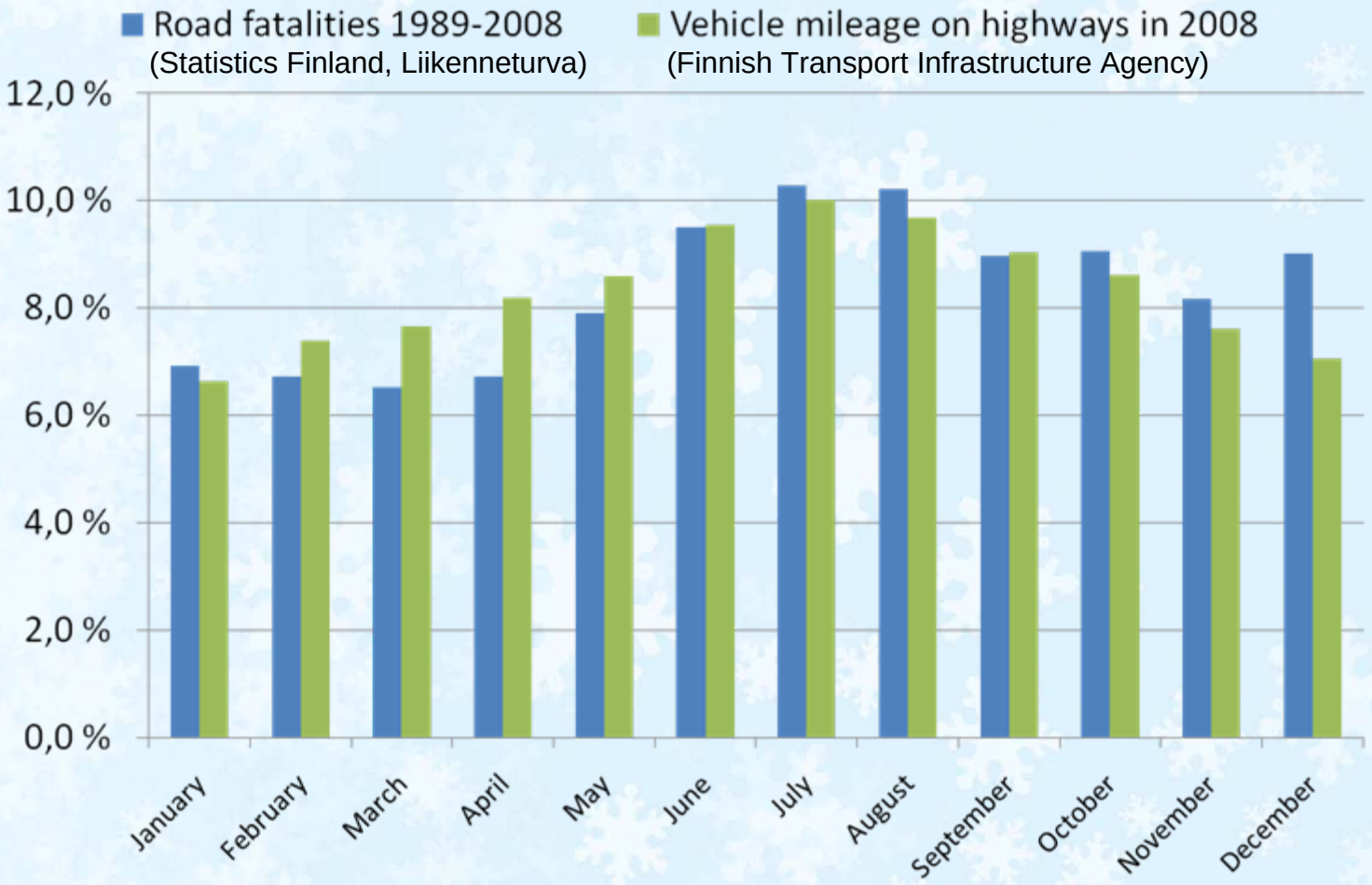


in the north of Finland

Charts: Finnish Meteorological Institute, www.fmi.fi

Data from the years 1970-2000

SHARES OF ROAD FATALITIES AND VEHICLE MILEAGE IN FINLAND THROUGHOUT THE YEAR



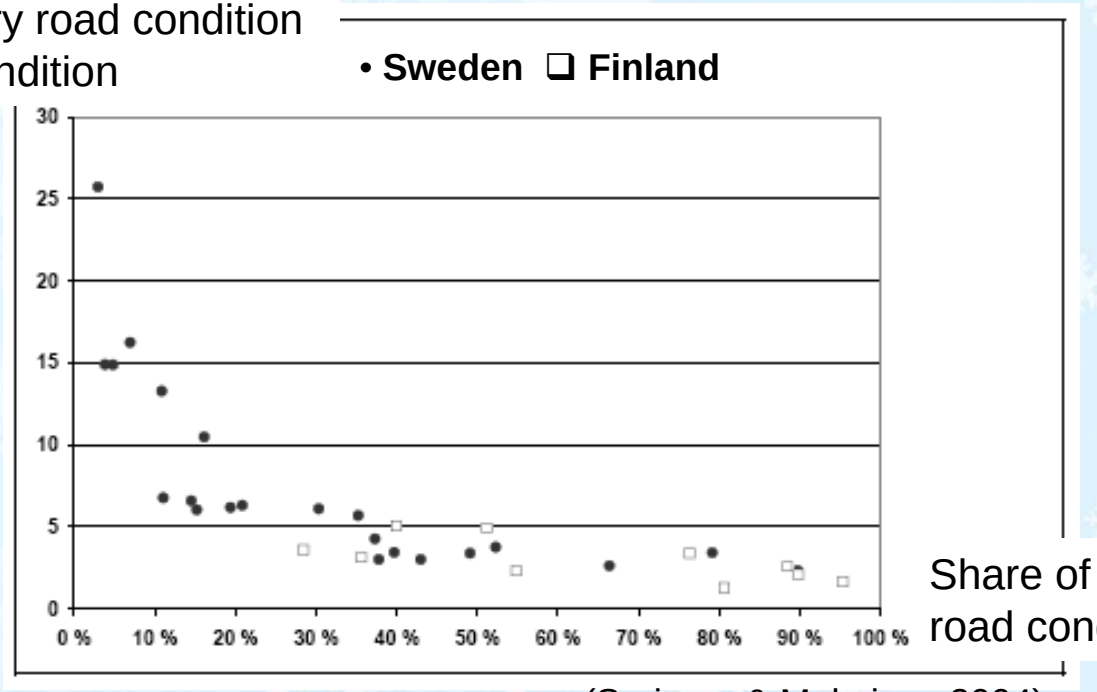
- There were 281 road fatalities in 2009 (advance information)
- The population of Finland was 5.35 million in the end of 2009

-> 5,3 road fatalities / 100 000 inhabitants

MAIN RESULTS FROM PREVIOUS STUDIES

- The more infrequent a specific wintertime road condition exists, the higher is the accident risk (see figure)
- The risk is higher in the south than in the north
- Accident risk is higher in the early and late winter compared to midwinter

Risk ratio on wintery road condition / summery road condition



(Sarjamo & Malmivuo 2004)

THE EFFECT OF THE ROAD CONDITION ON THE RELATIVE ACCIDENT RISK IN EARLIER STUDIES

- The relative accident risk is highest on icy or slushy roads

Study (risk ratio)	Year	Result			
Polvinen (icy/bare)	1985	14–20			
	1987	25–35			
Talvi- ja tieliikenne (slippery/antiskid)	The 1990s	Southern Finland	Central Finland	Northern Finland	
		4.2	2.1–3.3	3	
Malmivuo & Peltola	1997	Bare	Snowy	Slushy	Icy
		1	8	12	17
VTI (snowy or icy/bare)	1997	Daylight	Darkness		
		2–20	2–7		
Hvoslef (icy or snowy/bare)	1986	3–6			
Malmivuo & Kärki	1990–2002	Snowy/dry	Slushy/dry	Icy/dry	
		1.7–3.1	8.4–28.8	12.4–28.9	

(Malmivuo & Kärki 2002)

STATISTICAL ANALYSES: FATAL ACCIDENTS

- Data from the fatal accidents investigated by the Finnish road accidents investigation teams

– years 1997–2006

– months: December to March

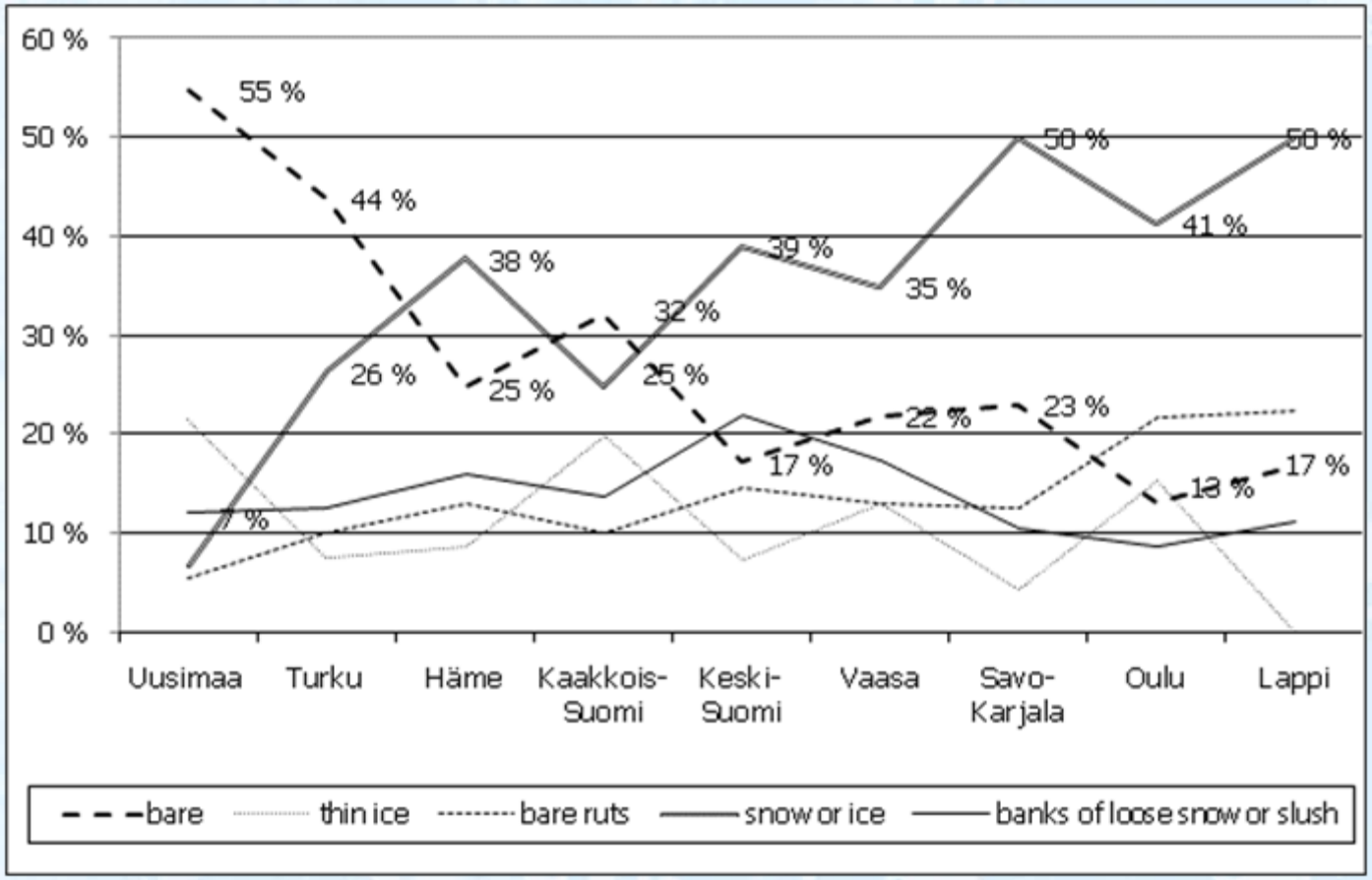
– accidents involving a passenger car

– one and multiple car accidents and animal accidents

→ 598 accidents

ROAD CONDITIONS IN FATAL ACCIDENTS IN DIFFERENT PARTS OF FINLAND

Of all the fatal accidents in wintertime, 31 % happened on bare road. In southern Finland, Uusimaa road region, 55 % of the accidents were in these circumstances, in Lapland 17 %.



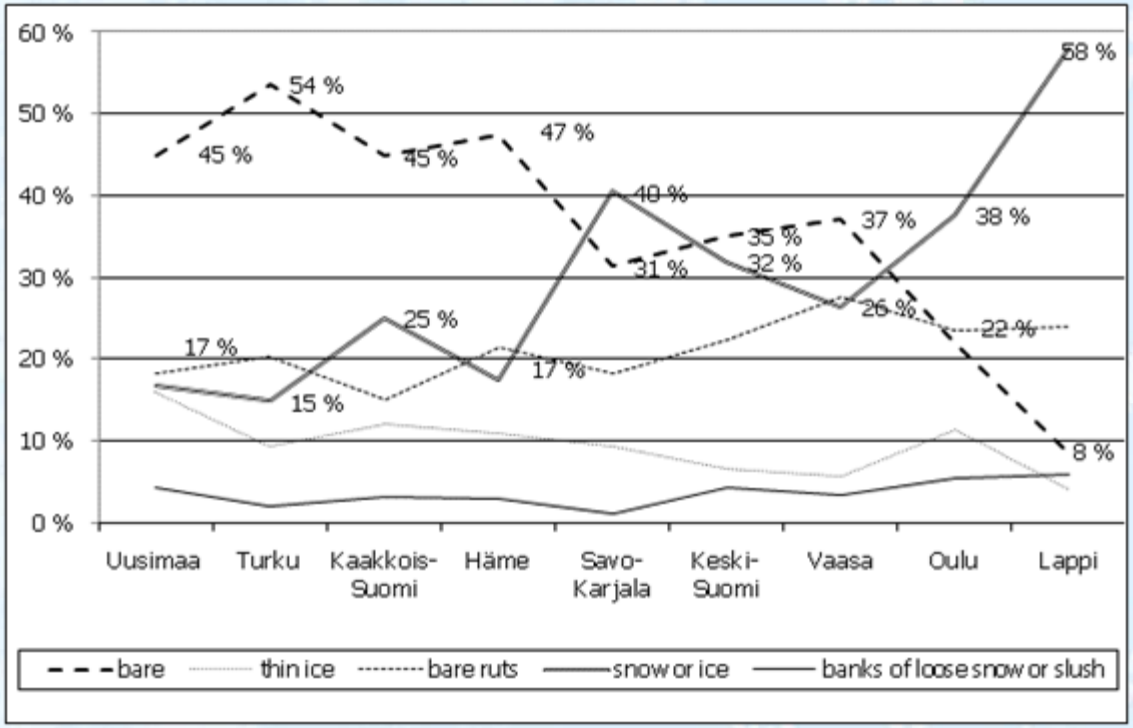
Fatal accidents in 1997-2006 December-March

ROAD CONDITION DATA

- Data from Finnish Road Administration: follow-up data on the quality of wintertime maintenance
  - Months December-March
  - The monitoring aims at getting information of road condition in different road classes and different areas (road regions)
  - The monitoring gives road condition codes that are based on visual observations (a subjective estimate of the road condition)
- The amount of observations of the road conditions and vehicle mileage were coupled in each road region without using vehicle mileage on every road condition observation point as adjusting key

ROAD CONDITION (OBSERVATIONS) IN DIFFERENT ROAD REGIONS

- Bare road is the most common road condition in the winter
- Big differences in different parts of Finland (as expected)
- Big differences between winters (for example 2006-2007 very mild)



Data: Finnish Road Administration: follow-up data on the quality of wintertime maintenance, years 2003-2004, 2005-2006 and 2006-2007

THE ROAD CONDITIONS IN DIFFERENT ROAD CLASSES IN WINTERTIME

- Bare road is most common on main roads as expected, as the highest winter maintenance standard is applied on these roads.
- The main roads are located mainly in southern Finland.

Road condition	Main roads (Class I)	Main roads (Class II)	Regional roads	Connecting roads	Whole country
Bare	53 %	33 %	26 %	18 %	37 %
Thin ice	15 %	8 %	6 %	4 %	10 %
Bare ruts	23 %	30 %	22 %	12 %	21 %
Snow or ice	7 %	26 %	42 %	62 %	29 %
Banks of loose snow or slush	3 %	3 %	4 %	5 %	3 %
Total	100 %	100 %	100 %	100 %	100 %

Data: Finnish Road Administration: follow-up data on the quality of wintertime maintenance, years 2003-2004, 2005-2006 and 2006-2007

THE RELATIVE ACCIDENT RISK IN DIFFERENT ROAD CLASSES

- Accident risk = fatal accidents / million vehicle-kilometres
- Risk index for bare main road (class I) = 1.0
- The accident risk for fatal accidents in the road condition ‘loose snow and slush’ was 4.9 times higher compared to bare road surface in Finland

Road condition	Main roads (Class I)	Main roads (Class II)	Regional roads	Connecting roads	Whole country
Bare	1.0	1.1	1.4	1.5	1.1
Thin ice	1.5	1.5	1.6	1.3	1.5
Bare ruts	0.8	0.4	1.1	0.7	0.8
Snow or ice	3.2	1.0	1.4	0.5	1.2
Banks of loose snow or slush	8.8	5.8	2.8	0.8	4.9

CLIMATE CHANGES - POSSIBLE AFFECTS

- Since the data is available, all the 15 warmest years have been during the last 20 years
- Even if the climate gases were stabilised to year 2100, climate would continue to chance even thereafter
- The temperatures will rise faster in the northern hemisphere's high latitudes than the global average. The temperatures will rise faster in winter compared to summer. (IPCC 2007)
- The mean temperature is predicted to rise 2 ºC to year 2030 in Finland
- The need for antiskid treatment will diminish in Southern Finland and increase in Northern Finland
- Winters will be more rainy and the rains will be heavier → slippery and surprising snowy conditions will increase (Saarelainen ja Makkonen 2007)
- **Wintery road conditions will be more rare**

→ the relative accident risk in wintery road conditions will grow?

SUMMARY

- The results with the new data in this study are in line with previous studies
  - the accident risk is higher when the specific wintery road condition is more rare
  - accident risk on wintery road condition is greater in the south compared to the north
- Climate change will probably increase the unsteadiness of road conditions which leads to a bigger demand in real time and spot-on road condition information