Québec 2010
AIPCR · PIARC

XIII INTERNATIONAL WINTER ROAD CONGRESS

QUÉBEC, FEBRUARY 8 TO 11, 2010

# SUSTAINABLE WINTER SERVICE FOR ROAD USERS

## *WHAT IMPACT WILL CLIMATE CHANGE HAVE ON ROADS IN SWEDEN AND HOW TO DEAL WITH IT*

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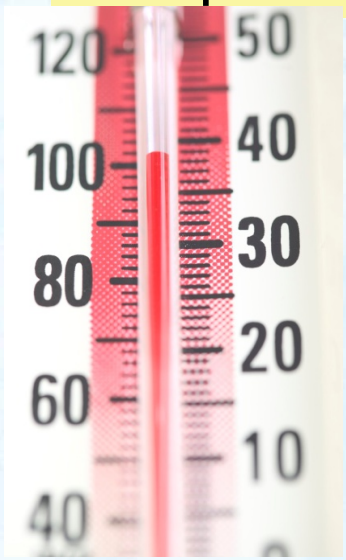
Vägverket

# CLIMATE CONDITIONS THAT INFLUENCE THE ROAD SYSTEM

Temperature



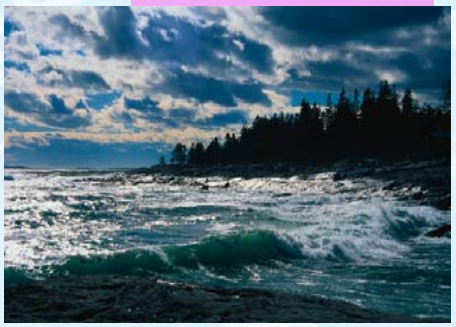

Rainfall

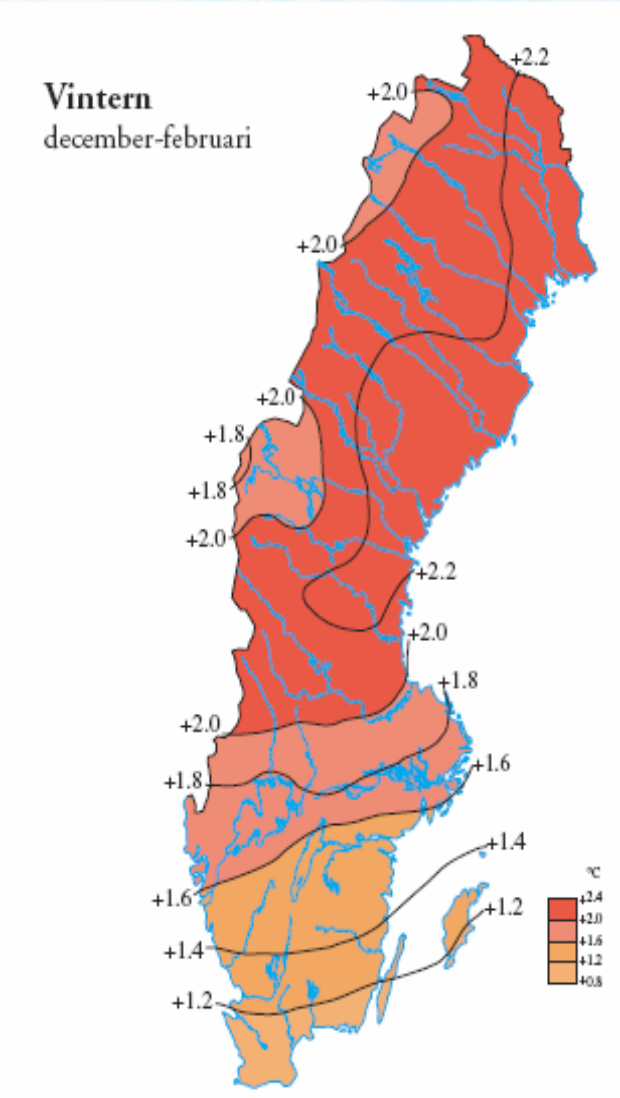
Wind

Ice load

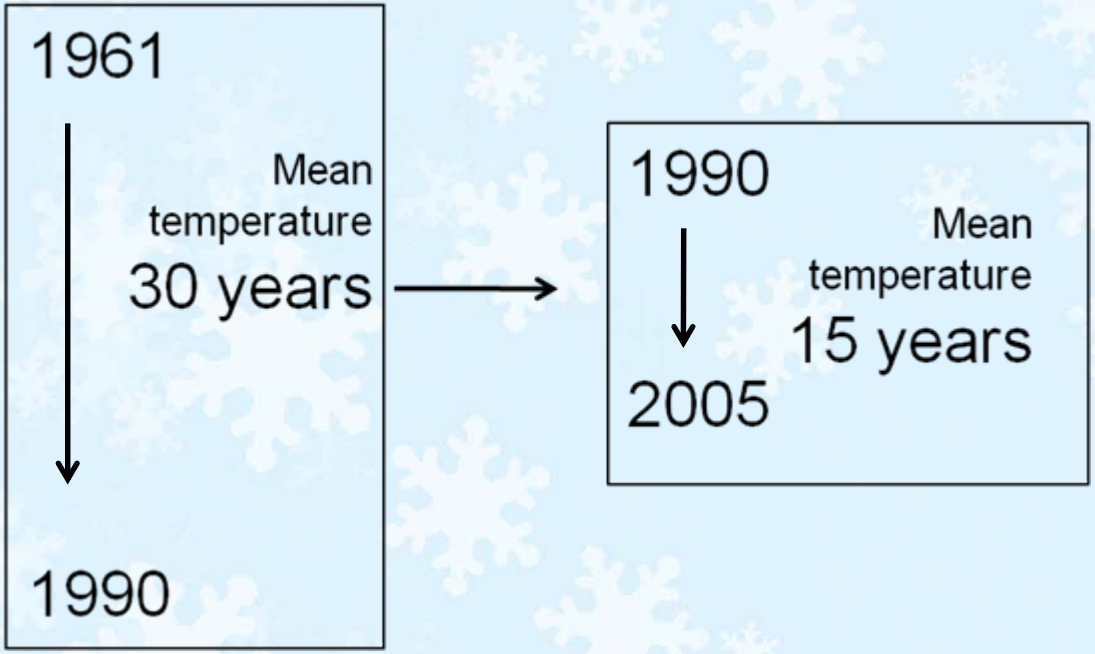
Floodings

Sea level






# Temperature



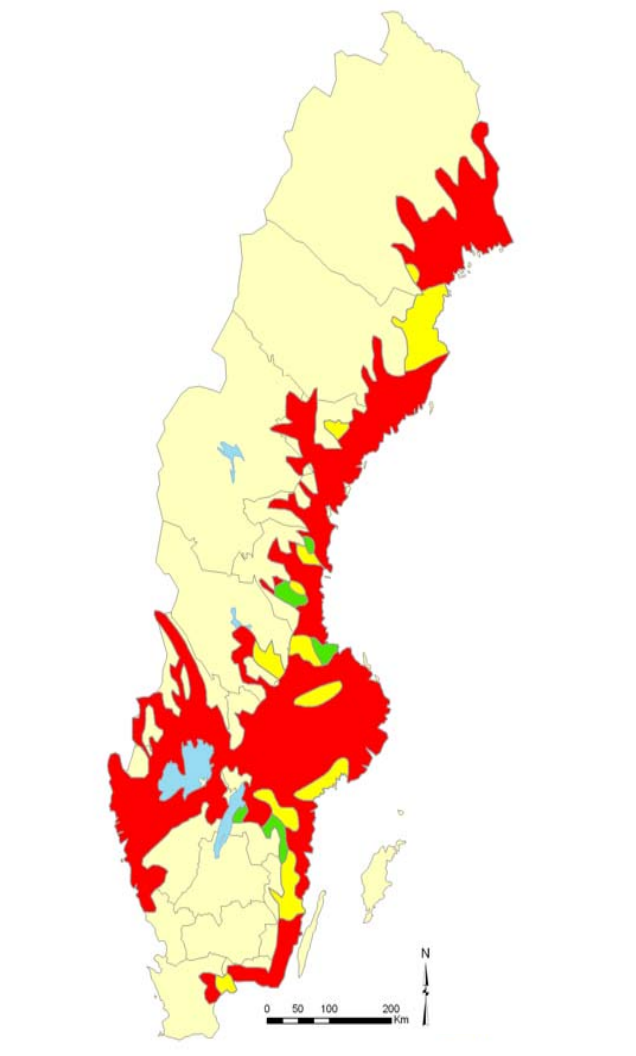

Observed change in mean temperature during the winter between the period of 1961-1990 and 1991-2005.

# FERRYS

- Iceroads will disappeare

- Higher sea level will cause rebuilding of ferry berths and connecting roads

# LANDSLIDES




= Increase

= Unchanged

= Decrease

# LANDSLIDE SAFETY, IN THE SOUTHWEST PARTS OF SWEDEN, WILL BE TOO LOW ALREADY IN A SHORT TIME.

# ROAD MAINTENANCE AND OPERATIONS

- Unchanged costs for winter maintenance totally
- More expensive in the north and less expensive in the south
- Removal of water by ditch or otherwise will be the most important issue

# BRIDGES, STORM FLOODS

- Stemming at low bridges

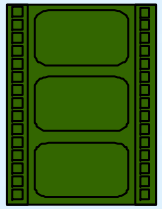
  *Irrespective of the watercourse width*

- Bridges over small watercourses

  *Intensive rainfall on small catchment areas*

- Erosion damages on bridge support

# SMALL WATERCOURSES WITH INTENSIVE FLOW DURING A SHORT TIME



**Landslide at Enafors, Jämtland, 2006**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# PROPOSALS IN THE LONG-TERM PLANNING

- Improvement of competence
- Research and development
- Review of rules and regulations
- Risk analysis of existing constructions
- Studies of vulnerable areas pointed out

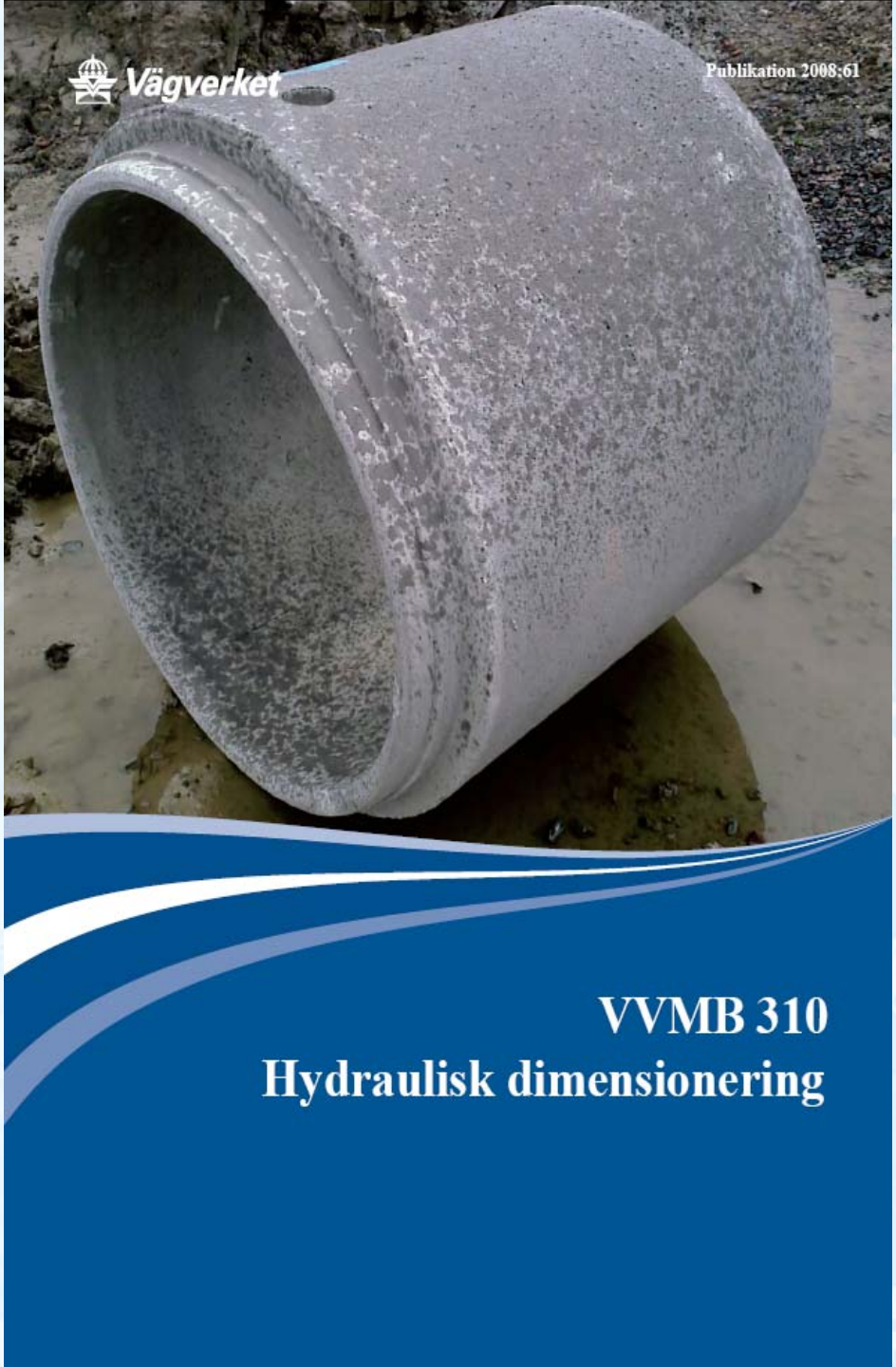
# RESEARCH AND DEVELOPMENT

• Research and development ought to be done together with other countries. The work in ERA NET ROAD and PIARC are good examples.

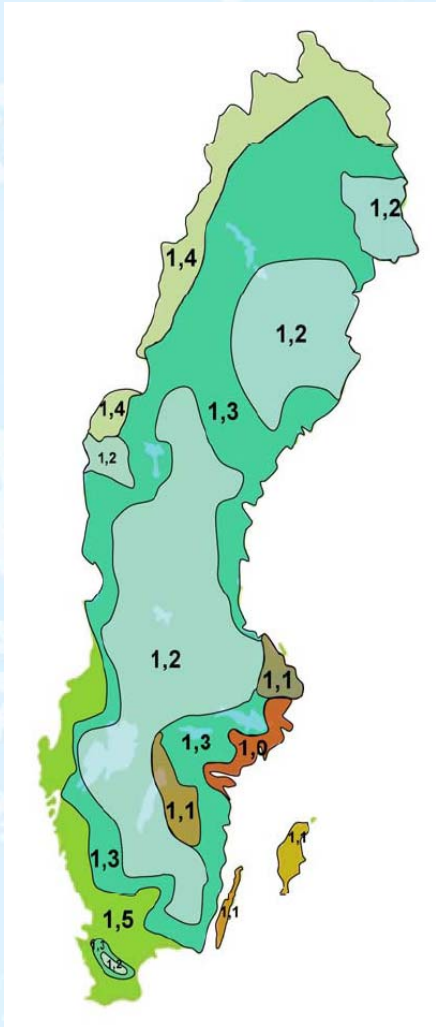
• It is of the highest importance to develop methods concerning risk analysis methods as regards storm floods and land slides.

# REVIEW OF RULES AND REGULATIONS

- When constructing new roads the effects of climate change should be a part of the dimensioning.
- Risk based functionality specifications ought to be introduced for all components in the whole road network.
- Criteria for accepted risk levels ought to be decided.




# Hydraulic Dimensioning

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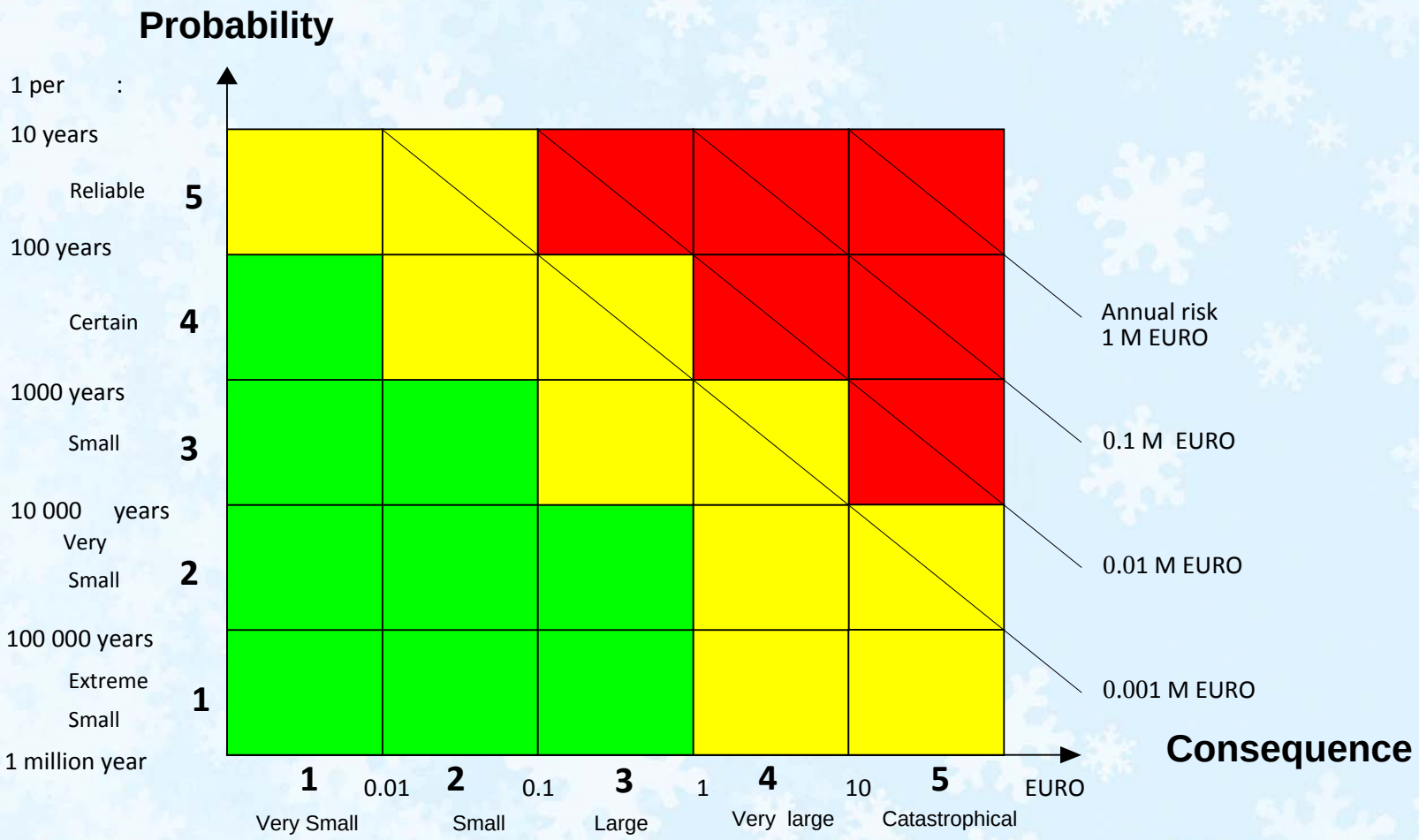
# EXISTING CONSTRUCTIONS

- Areas with higher risk due to climate change should be specifically noticed at risk analysis.
- Take into consideration that smaller roads often have the highest risks depending on construction.
- Preventive measures are carried out when the risk level is not acceptabel or when the measures are motivated on a cost/benefit analysis.




Risk classes in matrices:

- Class 3, high risk level, not accepted in general
- Class 2, medium risk level, safety action should be considered
- Class 1, low risk level, accepted in general

# INSTRUCTIONS
# - RISK ANALYSIS CHOSEN ROAD STRETCH

**2005:54**

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Thank you for listening!