



# Low-volume roads – adapting to climate change

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12.03.2014 Timber Transport Forum Conference

# ROADEX?

- 1998-2012
- Trans-national roads co-operation
- Northern Periphery Area of Europe
- Aimed at developing ways for interactive and innovative management of low traffic volume roads

[www.roadex.org](http://www.roadex.org)



The ROADEX network was created to share experiences of managing low volume rural roads in harsh climates.

# Climate Change Adaptation

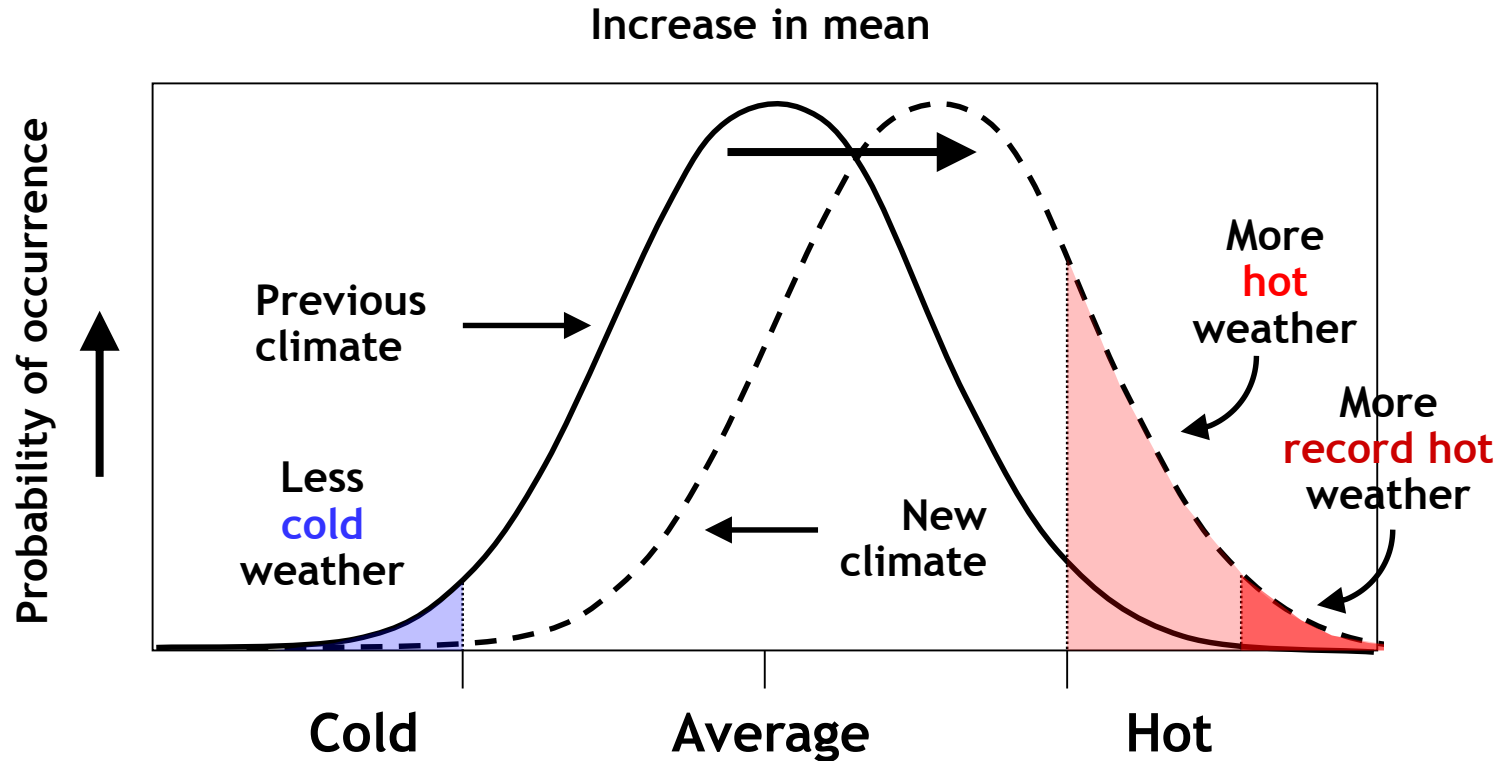
- 2009-2012
- Guidance for local engineers to help them to manage the effects of climate change on their local networks
- Thorough study of national adaptation plans and state-of-the-art not only from the partners but also from places with similar climate – Canada or Alaska



Climate Change Adaptation report,  
2012

# Global climate change

Effect of shift in climate:



# Climate Change in Scotland

- Warmer (+3.5 °C), drier summers (-15 %)
- Milder (+2.5 °C), wetter winters (+17 %)
- High intensity rainfalls



Roads near Closeburn (Source: <http://www.bbc.com/news/uk-scotland-25557246>)



Whitesands in Dumfries (Source: <http://www.bbc.com/news/uk-scotland-south-scotland-25629614>)

# Natural variability or climate change?



Storm damage, northern Sweden, late September 2011

# Natural variability or climate change?



**Landslide at Enafors, Jämtland, 2006**



**Porthcawl harbour, South Wales, 2014**

# Natural variability or climate change?

## Landslides in Scotland



A83



A85 Glen Ogle



A9 Dunkeld

# Climate Change - possible impacts on roads:

- Disruption of the network by extreme weather events (rain, snow, high temperatures)
- Damage to roads through deterioration, deformation and subsidence
- Flooding from rivers, seas and inadequate land drainage
- Severance of routes by landslides and avalanches
- Damage to roadside infrastructure by high winds
- Frost damage (including freeze-thaw cycles and frost heave)
- New road safety issues

# Adaptation & Good Practice Measures



Greenland (photo Arctic Technology Centre)



Norway (photo Norwegian Public Roads Administration)

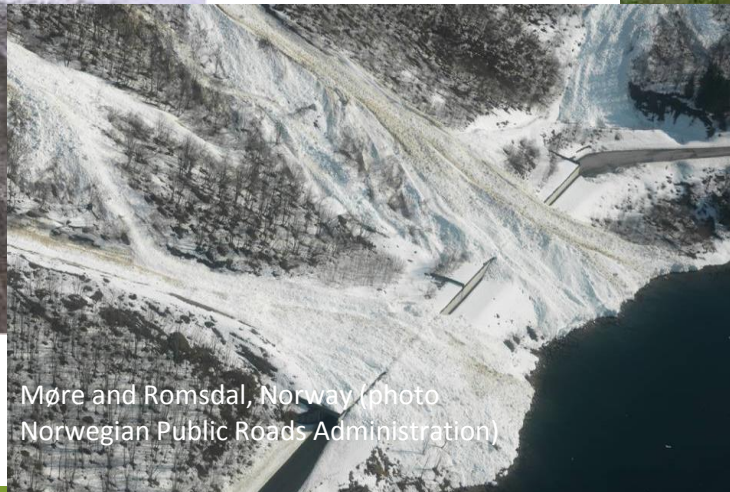
E10 Lofoten



Finland



Raattama, Finland (photo J. Leskinen)



Møre and Romsdal, Norway (photo Norwegian Public Roads Administration)



A9 Raigmòre Slip Road, Inverness (photo BEAR Scotland Ltd)

# Adaptation & Good Practice Measures

- Upgrading the road network is not always an option
- Frequent inspection and maintenance is needed
- Immediate reaction – e.g. sealing of cracks
- Adapted winter maintenance – more freeze-thaw cycles
- If necessary restrictions – size and number of vehicles especially during the thawing period
- Converting paved road back to gravel road
- One of the main message of ROADEX:

***Keep the road drainage in good condition!***

# Adaptation & Good Practice Measures

Forest road in Trondheim, Norway



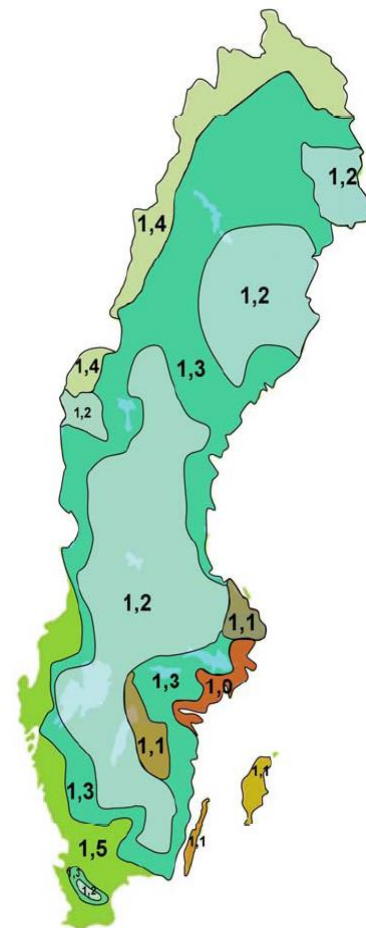
# Adaptation & Good Practice Measures

## Examples of adaptations in the Partner areas:

### *Reviewing design standards*

- *Iceland*: increase the design sea level with 50 cm
- *Scotland*: one storm event in 100 years to one in 200 years
- *Sweden*: regional drainage factor (1-1.5)
- *Norway*: introducing climate factor in drainage design

$$Q = C \times I \times A \times K_f$$



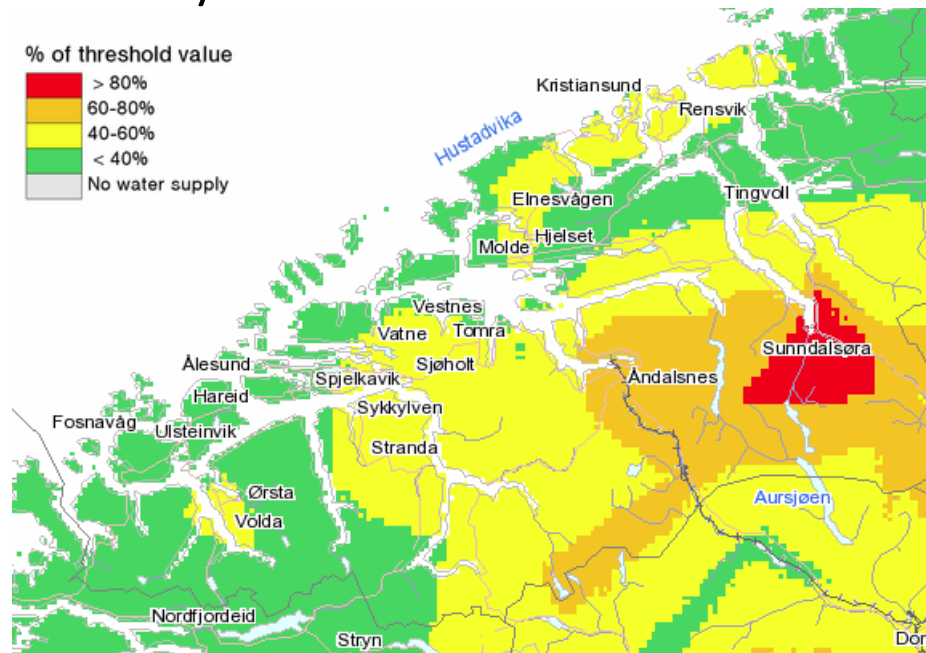
# Adaptation & Good Practice Measures

## Examples of adaptations in the Partner areas:

### *Mapping*

- *Climate and Transport*

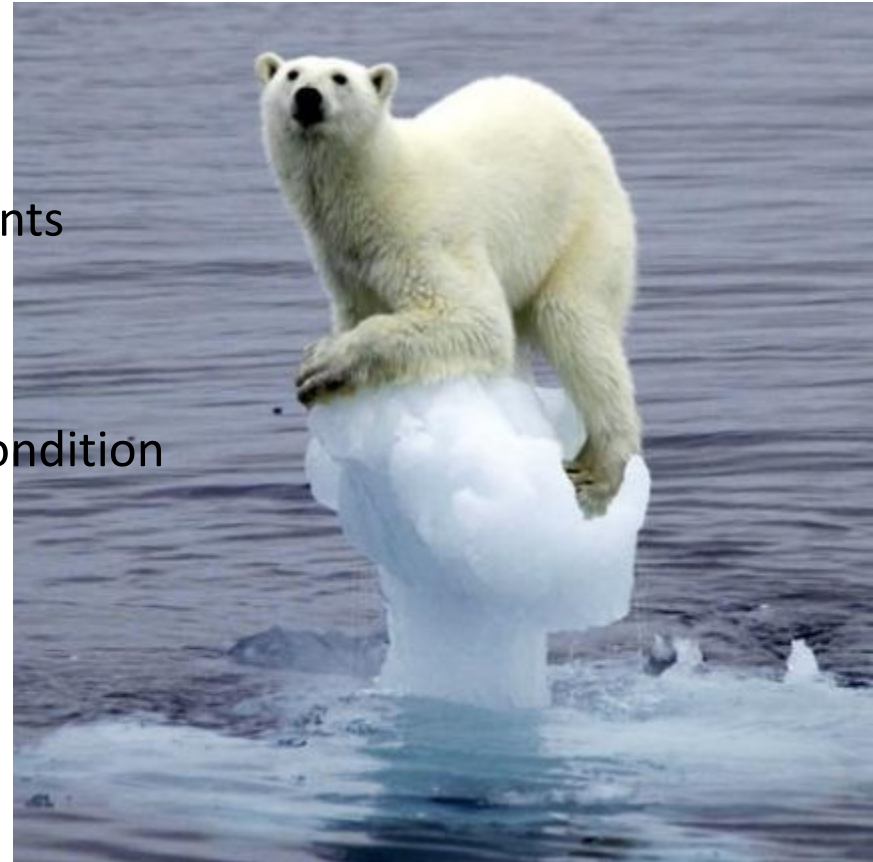
Landslide risk analysis



# Conclusion

## Key points:

- Climate change is happening
- More frequent extreme weather events
- More frequent freeze-thaw cycles
- Actions are needed
- Keeping the road drainage in good condition
- More frequent maintenance





# Thank you!

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