



# **WIN-WINTER - Nordic winter road maintenance research program**

*Preliminary study*

**PROJECT REPORT**

**Kaisa Karhula, Markus Pöllänen, Jorma Mäntynen, Harri Rauhamäki, Marika Leppäniemi & Terhi Luukkonen**

**May 2015**

## **Steering group**

**Pekka Rajala**, *Finnish Transport agency*

**Tuovi Päiviö**, *Nordisk Vägforum/Centre for Economic Development, Transport and the Environment*

**Eetu Pilli-Sihvola**, *Finnish Transport Safety Agency*

**Tuula Smolander**, *City of Jyväskylä*

**Anna Keskinen**, *City of Helsinki*

**Pasi Leimi**, *City of Lappeenranta*

**Jaakko Rahja**, *Finnish Road Association*

## **Research group**

**Jorma Mäntynen**, *Project leader*

**Kaisa Karhula**, *Project manager*

**Markus Pöllänen**

**Harri Rauhamäki**

**Marika Leppäniemi**

**Terhi Luukkonen**

Published in May 2015

# Table of contents

<b>Preface</b>	<b>4</b>
<b>Introduction</b>	<b>5</b>
<b>Background</b>	<b>5</b>
<b>Goals</b>	<b>5</b>
<b>Realisation of the study</b>	<b>6</b>
<b>Results of the study</b>	<b>6</b>
<b>Base project: Promoting Nordic winter maintenance know-how</b>	<b>7</b>
<b>Suggestions for future research projects</b>	<b>8</b>
<b>Other research topics based on the preliminary study</b>	<b>13</b>
<b>Conclusions</b>	<b>15</b>

## Preface

Winter maintenance has significant impact on our society. With properly managed winter maintenance it is possible to create safe conditions to travel in the point of view of both individuals and the business life. But when there are problems in maintenance the effects for the whole traffic system can be significant. Winter maintenance does not have an impact only on the traffic safety and traffic flow but it also affects the reliability of business life and creates significant economic consequences.

The purpose of the preliminary study was to find out what are the most important development needs in winter road maintenance in Nordic countries in the point of view of different stakeholders. Information was gathered with interviews, Internet-surveys and workshops. The idea for the project came from Jaakko Rahja and his editorial in Tie & Liikenne (Road & Traffic) -magazine (1/2014), in which he emphasised the need for Nordic winter maintenance research program.

We would like to thank all stakeholders participating this study. During interesting interviews and discussions a lot of information about the research needs in Nordic countries was gathered. The study also revealed that Nordic co-operation in winter maintenance already exists especially at the road administration level. The work done in Nordiskt vägforum is an essential part of this co-operation. But to make sure Nordic winter maintenance know-how exists in the future and ensure safe conditions to travel we need to work together even more profoundly. In order to tackle challenges in winter maintenance now and in the future a strong co-operation will be needed.

Tampere 8.5.2015

# Introduction

## Background

Winter road maintenance has significant social and economic impacts that reflect to for example our mode of travel, road safety and reliability of operation of business life. With good planning and realisation of winter road maintenance it is possible to achieve significant savings through, for example, choosing right methods for snow removal and antiskid treatment and optimising snow logistics.

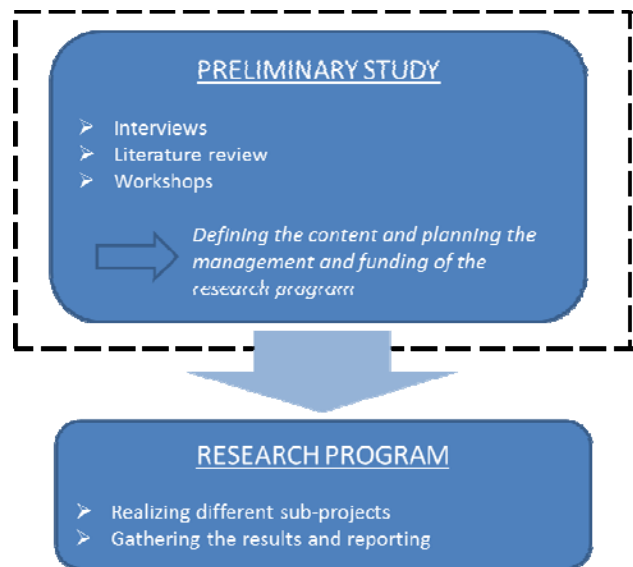
Even though winter conditions vary even inside one country, Nordic countries share many of the same challenges concerning winter maintenance. There is a need for co-operation and even better level of maintenance can be achieved by tackling problems together, sharing information and learning from each other.

## Goals

The purpose of the preliminary study was to find out the most important research needs concerning winter road maintenance in the point of view of different interest groups in the Nordic countries. The main goal for the study was to prepare for a broad Nordic winter maintenance research program. In addition to studying the research needs, also possible research partners, funding and management of the research program were explored. The goals for the study were:

- Find out research needs of different interest groups in Nordic countries regarding winter road maintenance.
- Examine existing research projects concerning development of winter road maintenance.
- Plan the practical realisation of the research program: research partners, funding, project management.
- Make sure the research program concentrates on essential issues that benefit different interest groups.

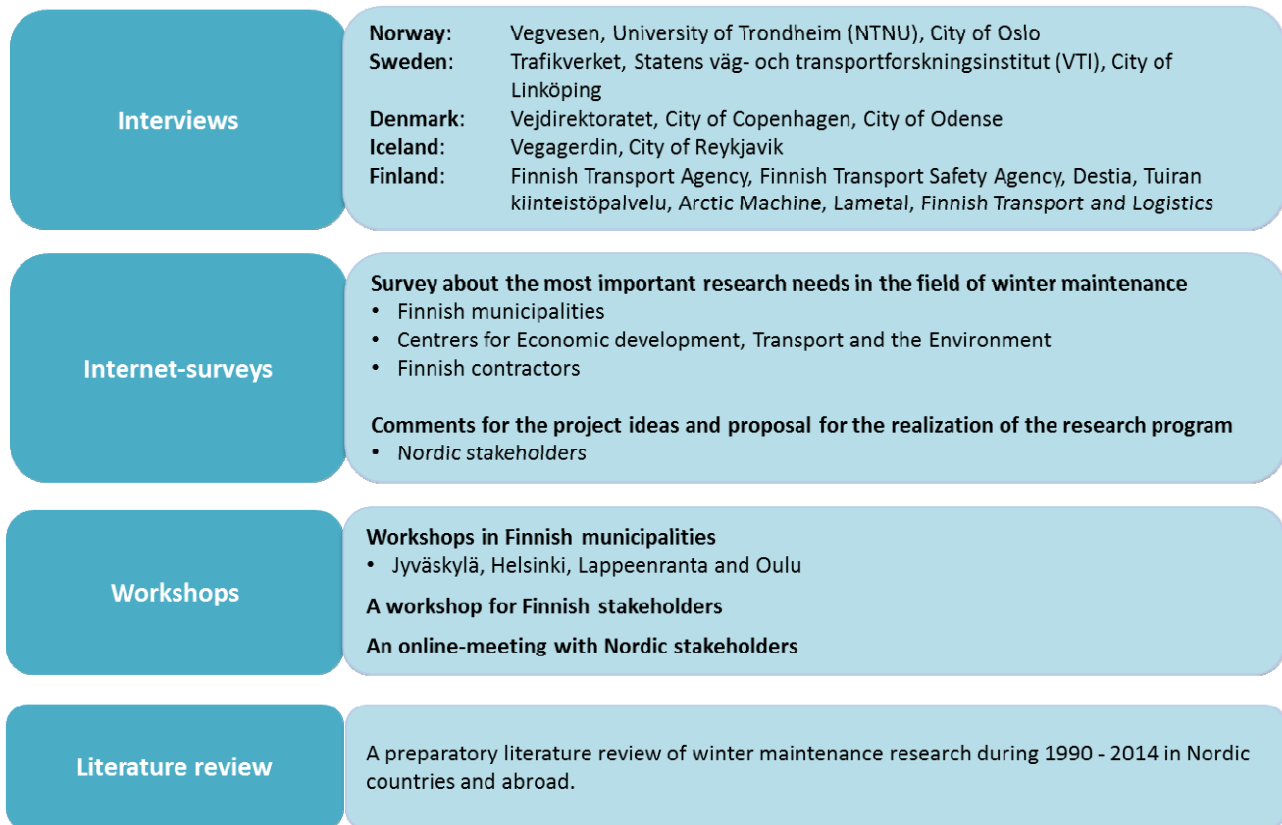
The study was funded by Finnish Transport Agency, Finnish Transport Safety Agency (Trafi) and three Finnish municipalities: Jyväskylä, Lappeenranta and Helsinki. The project was realized in close co-operation with the Nordiskt Vägforum (NVF) and Finnish Road Association. Transport Research Centre Verne from Tampere University of Technology was responsible for the practical realization of the project.



**Picture 1.** The preliminary study acts as a base for possible realisation of a Nordic winter road maintenance research program.

## Realisation of the study

The preliminary study consisted of four main parts: interviews, Internet-surveys, workshops for stakeholders and literature review. The parts are described more detailed in picture 2. The main goal for the interviews, Internet-surveys and workshops was to find out what are the most important research needs among different stakeholders in the Nordic countries and how could a broader research program answer to these needs.



**Picture 2.** The preliminary study consisted of four main parts: interviews, Internet-surveys, workshops and literature review.

## Results of the study

Based on the knowledge and information gathered during the preliminary study a suggestion for the realisation of the Nordic winter maintenance research program was created. As a start for the research program a base project is realised. During the base project all information about winter maintenance is gathered into one portal and the state of the art for different fields are studied for the base of future research. One of the main goals is to support the development of Nordic winter maintenance know-how and promote the knowledge internationally.

Besides the base project several research projects can be started during the realisation. Some of the possible future research projects are described in this report. These research ideas were acknowledged during the interviews and discussions in the Nordic countries. Descriptions are preparatory and will be developed further after this study.

## Base project: Promoting Nordic winter maintenance know-how

### Short description

The purpose of the base project is to collect the knowledge of winter road maintenance in Nordic countries into one place so that it is easily accessible by different stakeholders. The information will be reported in English to enable marketing the Nordic winter maintenance know-how internationally. Also open dialogue between different stakeholders and knowledge sharing will be encouraged. During the study state of the art for different fields of study will be explored for the basis of future research. The base project is divided into three work packages:

#### WP 1 State of the art

Studying what kind of research has been already done in Nordic countries (and internationally). Collecting state of the art for the base of future research.

#### WP 2 Sharing knowledge internationally

Creating a portal for promoting Nordic winter maintenance know-how internationally and sharing information to different stakeholders. Collecting data into one portal in an easily readable and accessible way.

#### WP 3 Strengthen networking

Building on the existing networks and information channels for winter maintenance and creating new procedures for strengthening co-operation.

### Goals

- ⇒ Make the research results of winter maintenance easily accessible for different stakeholders.
- ⇒ Find out research gaps in winter road maintenance.
- ⇒ Create and promote knowledge exchange of winter maintenance in Nordic countries.
- ⇒ Encouraging research exchange and strengthening high quality research in Nordic countries.
- ⇒ Promote Nordic winter maintenance know-how internationally.

### Details

- ◆ Duration of the project: about 2 years
- ◆ Financing through NordFoU (road administrations and transport authorities in Nordic countries)

## Suggestions for future research projects

### 1) Economic impact of winter maintenance

#### Short description

The economic impact of winter maintenance interest the road authorities and municipalities as well as decision makers and politicians. It is important to know what kind of effects does good or poor winter maintenance have so that we can better understand the real meaning it has on the society and economy. Some information already exist but it is important to try to get a broader view of the impacts taking into consideration different aspects of winter maintenance e.g.

- safety
- environment
- business life
- organizing models.

#### Goals

- ⇒ Creating a more comprehensive picture of the field of winter maintenance and its effects on the economy and society.
- ⇒ Calculating the costs and benefits of winter maintenance comprehensively so that the actual costs could be presented more profoundly.
- ⇒ Giving municipalities and road administrations more information for planning winter maintenance.
- ⇒ To support decision making and give politicians and decision-makers more information of the overall costs associated with winter maintenance.

#### Possible participants

- Nordic road authorities
- Municipalities
- Special expert in research: economy, cost-benefit analyses



## **2) Winter maintenance for walking and cycling**

### **Short description**

Winter maintenance has a significant impact on cycling and walking in winter. Good conditions to walk and cycle are created with well planned winter maintenance that takes into consideration the needs of human-powered transportation. A lot has already been done to create better possibilities for people to move by foot and by bicycle during winter. But still new information is needed in order to make walking and cycling even more attractive and safer ways of moving. Especially the needs of the elderly, children and people with visual or physical impairments need to be taken into consideration more profoundly.

### **Goals**

- ⇒ Study what are the biggest reasons for people not to walk or cycle during winter among different user groups.
- ⇒ Study the most effective winter maintenance methods for e.g. cycleways, cycle lanes, walkways and pedestrian areas.
- ⇒ Study what kind of impact does infrastructure have on winter maintenance and what kind of infrastructure could support walking and cycling most effectively.
- ⇒ Give municipalities, road authorities and contractors more information on how to take the needs of cyclists and pedestrians into consideration more profoundly.

### **Possible participants**

- Municipalities
- Nordic road authorities
- Special expert in research: the health sector, advocacy organizations (e.g. The age institute, Federation of the visually impaired)

### **3) More effective snow logistics**

#### **Short description**

Snow logistics is an important part of winter maintenance and it usually covers a great deal of the maintenance budget in municipalities. Transporting the snow from city centres and neighbourhoods to snow disposal areas is not only expensive but it also has great environmental impacts. There is a great potential in decreasing the costs of winter maintenance by planning snow logistics in a more comprehensive way. Especially among municipalities there is a need for more information on how to manage snow during winter since more dense cities means less space for snow alongside roads.

#### **Goals**

- ⇒ Study the best practices of snow logistics in municipalities and in public roads.
- ⇒ Comparing the costs and effectiveness of different kinds of ways of managing snow e.g. melting equipment and local disposal areas.
- ⇒ Creating a visual and practical guide on how to plan for snow logistics.
- ⇒ Give municipalities, road authorities and contractors more information on how to plan snow logistics so that safety is taken into consideration and the costs could be minimized.

#### **Possible participants**

- Municipalities
- Nordic road authorities
- Contractors
- Special expert in research: land use planning, street planning, snow melting equipment manufacturers

## 4) Quality assurance in winter maintenance management

### Short description

Organizing winter maintenance has on the past years strongly focused on the economic aspect of maintenance and at the same time the quality aspect has in some way gone unnoticed. When the economic situation is tightening in many countries and municipalities, it is essential to focus on the quality of winter maintenance and think how it is possible to achieve high level of quality with the resources given. The high quality should not be compromised since it can have significant impacts on e.g. traffic safety and the reliability of business life.

### Goals

- ⇒ Study how quality assurance has been organised today in road authorities and municipalities and how it could be developed taking into consideration different organizing models.
- ⇒ Create a model for quality assurance and test it in winter maintenance contracts.
- ⇒ Consider how ITC could support the quality assurance more effectively.
- ⇒ Give municipalities and road authorities information on how to take quality assurance into consideration more profoundly in winter maintenance.
- ⇒ Strengthen co-operation between municipalities, road authorities and contractors in order to achieve high quality in winter maintenance.

### Possible participants

- Nordic road authorities
- Municipalities
- Contractors
- Quality management consultants

## **5) The utilization of information and communication technology in winter maintenance**

### **Short description**

Anticipation is one of the key elements of traffic safety. When giving road users information of the maintenance situation on the streets, they can better prepare for their trip. Being aware of the maintenance situation makes people more conscious. That is why it is important to give road users information of the current conditions of the roads so that they can take the delays caused by winter into consideration. Real time information of the conditions is rarely available even though the enabling technology already exists. Information of the maintenance is not interesting only for drivers but also for municipalities and road authorities who are responsible for the maintenance of the roads and streets.

### **Goals**

- ⇒ Develop a system which would share information of the state of maintenance to all stakeholders.
- ⇒ Increase safety when people are aware of the circumstances on the road network.
- ⇒ Give municipalities and road authorities a good picture of the current status of the maintenance.
- ⇒ Make people aware of the winter maintenance and help them being more alert of the winter situation.

### **Possible participants**

- Nordic road authorities
- Municipalities
- Contractors
- Special expert in research: ICT and traffic safety

## Other research topics based on the preliminary study

In addition to the five project ideas described earlier, many other needs for research were acknowledged during the preliminary study. These needs are listed below. Most of them are quite extensive which is why they are more like a preliminary descriptions for research ideas rather than actual exact research projects. These ideas should be anyhow acknowledged and taken into consideration during the base project. The ideas are divided under three topics: organizing winter maintenance, methods and equipment and societal relevance.

### Organizing winter maintenance

#### **Organizing winter maintenance on public road network in Nordic countries**

Studying and comparing the organization and realization of winter maintenance (e.g. contracts, budget, actual costs, methods used)

#### **Organizing winter maintenance in municipalities in Nordic countries**

Studying and comparing the organization and realization of winter maintenance (e.g. contracts, budget, actual costs, methods used)

#### **Developing incentive schemes for maintenance workers**

The use of incentive schemes for maintenance workers (drivers of the maintenance equipment) to ensure quality and effectiveness of winter maintenance (in addition of education)

#### **Best practices for monitoring winter maintenance actions**

Best practices for monitoring winter maintenance actions in municipalities and public road network considering cost-effectiveness and quality

#### **Developing decision support systems**

Studying how the decision making concerning winter maintenance could be as effective and timely as possible (e.g. how to use road-weather information systems effectively)

### Methods and equipment

#### **Methods for slush removal**

Studying existing methods and needs for new methods for slush removal

#### **Developing monitoring of winter maintenance actions**

Developing real-time methods and equipment for monitoring winter maintenance actions and quality

#### **The effectiveness of different kind of winter maintenance methods**

Studying which methods are most effective and optimal for different kinds of roads and road classes and in different weather situations

#### **Optimizing the timing of salting**

Studying when would be the most effective time to use salt (e.g. before rush hour or another time)

#### **Collecting data of the methods used in winter maintenance**

Studying methods used in winter maintenance in Nordic countries and their applicability for different situations, costs, effectiveness etc.

**Materials used in winter maintenance**

Studying materials already used for winter maintenance (e.g. salt, brine, sand) and needs for developing new materials for different situations

**Best practices for winter maintenance of cycleways and cycle lanes**

Studying what are the best methods and equipment to maintain cycleways and cycle lanes in different weather situations

**Societal relevance****Environmental impacts of winter maintenance**

Studying the effects of e.g. salting, snow logistics, melting snow on the environment and calculating their economic impact

**The effects of winter maintenance to road safety**

Studying safety on different kinds of roads considering weather conditions and maintenance actions taken

**The effects of winter maintenance to cycling and walking accidents**

Studying e.g. where, when and in which kind of circumstances accidents happen to cyclists and pedestrians

**Future challenges of winter maintenance**

Studying what kind of impact e.g. climate change has on winter maintenance and how to prepare for it

**Accessibility during winter**

Studying how to best ensure accessibility and safe conditions to walk and cycle during winter

## Conclusions

During the preliminary study a lot of information was gathered about the needs for research and development in winter maintenance in Nordic countries. Based on the interviews, discussion, workshops and Internet-surveys, the goal was to prepare the realization and content of a broader winter maintenance research program.

Nordic countries already do co-operation in winter maintenance and common research projects are realized more or less systematically. Nevertheless, there still is a chance to strengthen the co-operation between different stakeholders. Especially in municipalities there is a need to strengthen co-operation in research and develop sharing of best practices and knowledge. The Nordiskt vägforum and its winter maintenance group is one of the most important channels for co-operation today. The maintenance group however consists mainly of participants from the road authorities.

As a result from the preliminary study a base project for the start of the research program is planned to be realized. During the base project the goal is to strengthen the co-operation in winter maintenance in Nordic countries, collect information of winter road maintenance research into one portal and create a base for co-operation in research. It is important to ensure that the high quality research is also in the future done in the Nordic countries. With the base project it is also possible to consolidate the know-how and competence of winter maintenance in the point of view of different stakeholders.