

Winter Maintenance in Europe – Practice and Research

Giloppe Didier⁽¹⁾, Burtwell Marilyn⁽²⁾, Bald Stefan⁽³⁾, Muzet Valérie⁽⁴⁾

(1) Ministère de l'Équipement et des Transports, CETE de Normandie Centre,
10 chemin de la poudrière, BP 254, 76121 Le Grand Quevilly, F, didier.giloppe@equipement.gouv.fr

(2) TRL Ltd, Old Wokingham Road, Crowthorne Berkshire, RG45 6AU, UK, mburtwell@trl.co.uk

(3) Technical University, Petersenstrasse 30, 64287 Darmstadt, D, jsbald@verkehr.tu-darmstadt.de

(4) Ministère de l'Équipement et des Transports, CETE de l'Est, 71, rue de la Grande Haie,
54510 TOMBLAINE, valerie.muzet@equipement.gouv.fr

INTRODUCTION

Effective snow and ice control is an important service for national governments, in order to ensure as far as possible, that road users can travel safely and with minimum disruption in cold and severe climatic conditions. Since national and European road networks have developed substantially over recent decades, so too has the need for innovative snow and ice control techniques and processes. Practices, standards, level of equipment differ among Europe depending on national government and climatic zones (see Figure 2).

The European commission project entitled COST Action 344 : "Improvements to snow and ice control on European roads and bridges" is an exchange platform between 19 European countries (see Figure 1). This three-year project began in 1999 and is a part of COST Transport "Research for sustainable mobility".

Winter conditions affect all member states, often for 5 or 6 months of each year, and even those states in Southern Europe can suffer from such conditions in localised areas. The cost of disruption and injuries through road accidents is substantial, so that measures to further improve winter maintenance arrangements are likely to produce significant benefit in term of safety for road users. The project will provide improvements in the area of programme management, quality of operation for planning, operational practice, less harmful anti-icing products and spreading controls, measures to treat modern surfaces and better driver information.

The action will generate the basis for full-scale European experiment and evaluation of improved winter measures to be carried out under a future transport programme of the Fifth Framework programme for research and development. For road users, more effective management of winter operation will lead to reduce traffic delays and accident.

Different axes of investigations are ongoing and a final technical report will be produced during 2002.

Task Group 1 : Information gathering

Task Group 2 : Definition of requirement

Task Group 3 : Best Practice

Task Group 4 : Recommendations for future research

Task Group 5 : Integration into a pavement management system

Task Group 6 : Recommendations on driver information systems

Since the different task groups did not begin their work simultaneously, the work of TG 1, 2 and 3 will be presented at SIRWEC 2002. The work of TG4 is presented in another paper (Kulmala, 2001).

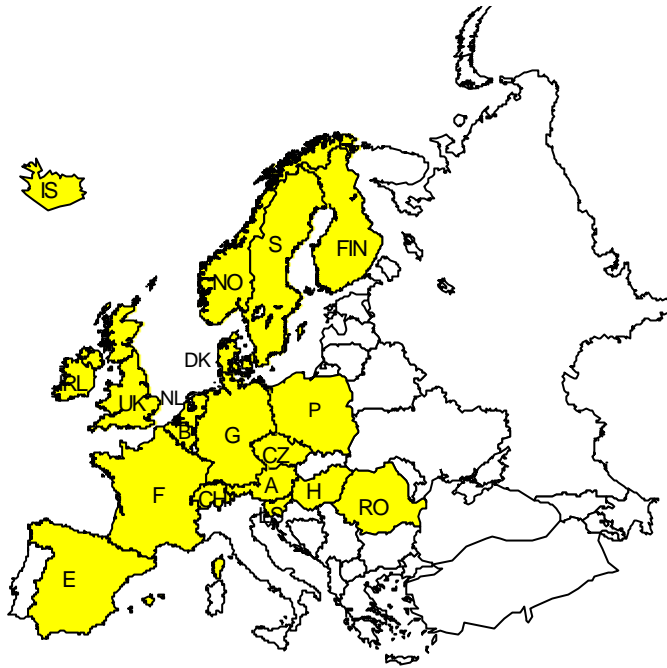


Figure 1 : State members of COST Action 344
Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Iceland, Ireland, the Netherlands, Norway, Poland, Romania, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

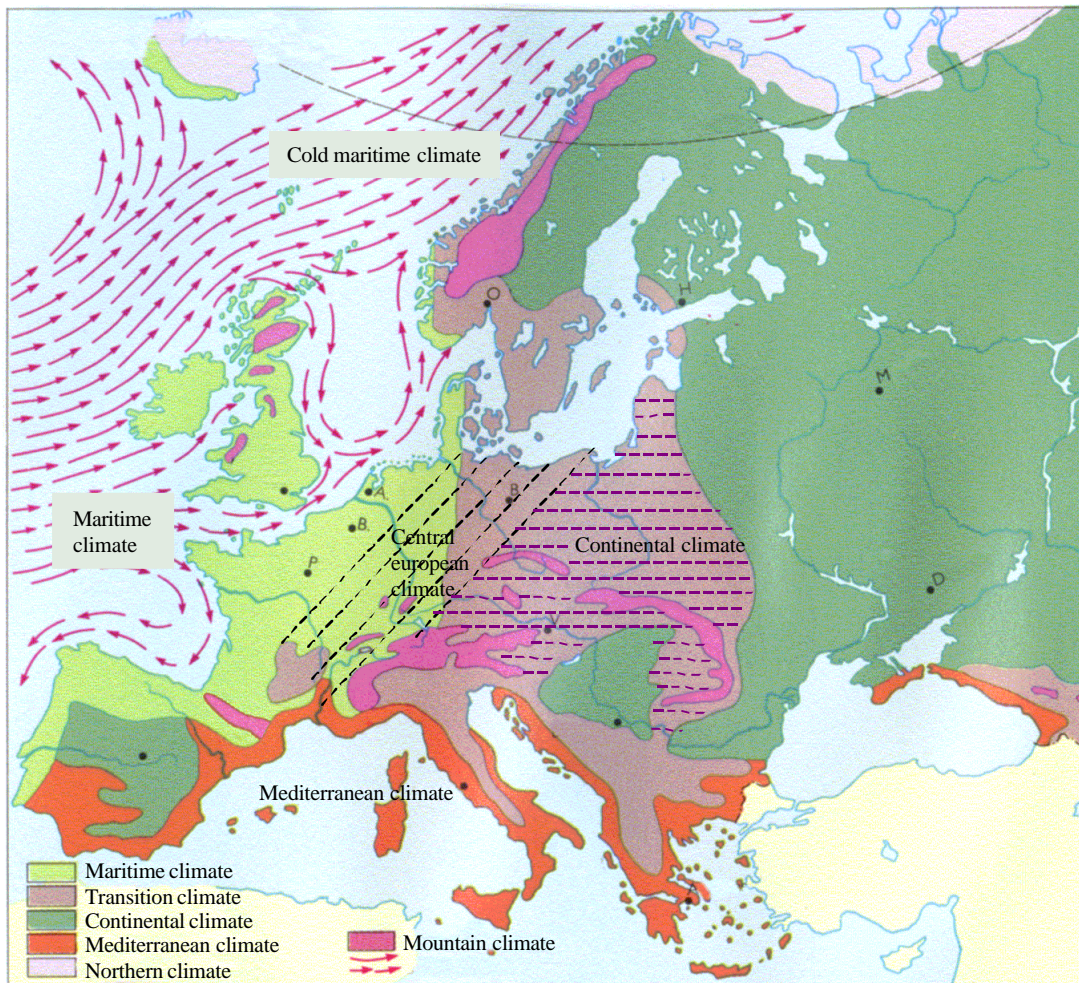


Figure 2 : Climatic zones in Europe

1. PRESENTATION OF TG1 : INFORMATION GATHERING

The objective of the Task Group 1 was to gather information on winter maintenance among Europe. The experts of COST 344 come from different European countries and since English is not their mother language there can be misunderstanding and inaccuracies. These problems can be due to the language itself or because the concepts of certain words are not necessarily the same ones in all the countries. While building international exchanges it is important to make a formalisation of the language through words but also through the definition of these words and of the concept they cover for each country. This is why the task group 1 decided to make of a **glossary** specific to Winter Maintenance.

It is also very important to know what has been done in winter maintenance in every participating country since administrative road services have a lot of knowledge and documents that are not published in international review. So a **state of the art** was made with bibliographical collection of various publications and documents proposed by the countries.

Glossary of terms for winter maintenance called WINTERTERM

In the framework of the European COST 344 Action 'Improvements to Snow and Ice Control on European Roads and Bridges' a Glossary of Terms for Winter Maintenance was developed. It is now available as a preliminary version. The glossary includes about 180 terms and explanations in 8 languages (Dutch, English, Finnish, French, German, Hungarian, Spanish, and Swedish). There is an example for 3 words in the following page.

The terms are sorted in 8 categories: Weather/Climate, Ice, Snow, Spreading, Snow clearance, Ice and Snow Protection, Management of Winter Maintenance and Others.

The database can be used for translations of specific terms and/or to create bilingual dictionaries. It is free on <http://www.durth-roos.de/sb/dsbi00n1.htm> and provided in Microsoft Access 97 and Access 2000 format.

There is the possibility to add new terms and new languages.

Registered users are informed about new releases of WINTERTERM by e-mail and this dictionary will be available on the Cost 344 and on the PIARC Web site.

State of the art and on going projects among Europe

Each of the COST 344 participating country was asked to make a national literature review of his most important documents with an English translation of the title and a brief abstract in English. All these 707 documents were compiled and can be sorted : by item, by country, by author, with the references of the documents.

The classification items are the following :

1 Weather and climate	94 documents
2 Equipment	83 documents
3 Effects	106 documents
4 Management	112 documents
5 De-icing products	96 documents
6 Equipment for road users	9 documents
7 Risk management	39 documents
8 Strategy	49 documents
9 Design and construction of the road	53 documents
10 Cost of winter maintenance	20 documents
11 Road user information	17 documents
12 Overview	29 documents

The consultation of the state of the art is possible on the Web site of COST 344

Example of 3 terms for 4 languages :

Cat		Deutsh	English	French	Swedish
B 2	2.1	gefrierender Regen	freezing Rain	pluie verglaçante	Frysande regn
Definition		Regen der bei Oberflächentemperaturen unter 0 °C fällt, dabei sofort gefriert und zu großflächigem Glatteis führt	A dangerous condition where raindrops fall on to surfaces below 0 °C, thus freezing instantly and causing widespread glaze ice.	Conditions dangereuses durant lesquelles les gouttes d'eau, à une température supérieure à 0°C, qui tombent sur le sol, gèlent instantanément et provoquent un verglas généralisé.	Ett farligt tillstånd då regndroppar med en temperatur över noll grader faller på en yta under 0°C och efterhand fryser till glansis.
C 2	1.1	Schneematsch	Slush	neige fondue	snöslask
Definition		Mit wasser angereicherter schnee	Snow with a lot of water	Neige au sol à forte teneur en eau	Snö med hög vattenhalt
D 1	2.1	Präventivstreuung, vorbeugende Glättebehandlung	Pre-salting (UK), anti-icing (USA)	Epandage préventif	Förebyggande saltning
Definition		Streuen von Auftausalzen vor zu erwartender Eisglätte oder beim einsetzenden Schneefall, um Eisbildungen oder das Anfriren von Schnee auf Verkehrsflächen zu verhindern	Salting procedure to prevent snow and ice formation by lowering the freezing point of the solution on the road surface.	Procédure d'épandage pour prévenir la formation de neige et de verglas en diminuant le point de congélation de la solution sur la surface de la route	Saltning för att förbygga att snö och is bildas genom att sänka fryspunkten i lösningen på vägen

2. PRESENTATION OF TG2 : DEFINITION OF THE REQUIREMENT

Task Group 2 are considering safety issues, environmental and information criteria, the management and operations of snow and ice control, and the identification of improvements that would enable delivery of a more cost-effective and efficient service. To achieve this, it is important to set down the components of a winter maintenance management system which, on balance, will produce a quality service. The work of TG2 complements the work carried out in TG3 - 'Best Practice'.

TG2 members have identified the following generic business areas as being of fundamental importance to road administrations:

- a) **Service levels** – these relate to the winter maintenance operation itself and include the effectiveness of the treatment in preventing ice and snow adversely affecting the highway. It does not however include safety and traffic movement considerations, which it is argued, are secondary effects and can be influenced by factors other than the quality of the winter maintenance operations.
- b) **Environment** – the effect of winter maintenance operations on the natural environment, including flora, fauna and marine life.
- c) **Safety** – the safety of the winter maintenance operatives and the road users. Care must be exercised to ensure that the reasons for safety performance are understood since factors other than the quality of winter maintenance may be relevant.

- d) **Traffic movement** – traffic flow during winter conditions, which may again be affected by factors other than effectiveness of the winter maintenance operation.
- e) **Cost optimisation** – analysis of all the factors that contribute to the delivery of a cost-effective winter maintenance service.
- f) **Information to the administration** – the provision and management of information about the performance of the operation so that proper accountability can be achieved.
- g) **Information to the road users** – the appropriate level of information to road users in various forms both before and during the journeys made.

The factors above have been disaggregated a) to identify more detailed issues requiring analysis and b) to deliver the appropriate quality of winter maintenance service. Items (a), (b), (e), (f) and (g) above are those issues over which the administration has a significant level of control, whereas items (c) and (d) are random occurrences influenced by other factors including driver behaviour.

The type of climate is also a prime factor - this depends on the altitude and geographical location, and is manifest through the frequency, duration and intensity of the winter weather conditions (COST 309, 1992). Conventional classifications can be made ranging from mild to very cold climates. The onset of winter weather triggers the resources needed to re-establish the serviceability of the road. Important characteristics of the road are the road type (high capacity or conventional), carriageway width, layout, gradient, pavement type, frequency and length of bridges and tunnels etc.

For the road users and communities, more effective management of winter operations will lead to a reduction in traffic delays and accidents. For practitioners, implementation of 'Best Practice' should enhance standards and lead to Best Value being achieved. The implementation of Best Value could provide the means to measure the performance of the winter maintenance service within various road administrations.

3. PRESENTATION OF TG3 : BEST PRACTICE

The main **objective** of this task group is to establish and improve the content and performance of snow and ice control methods and operations by defining the requirements and specifying best practice across the EU and other COST member states. This work should provide governments with best materials, techniques and procedures. Impact on the environment and value for money shall be regarded. In addition, as a result of the study of management and operational practices employed at national level, the process shall assess the effectiveness of these within the various situations and conditions encountered.

The specification of best practice will encompass all the needs of the European community and will therefore be specific to particular countries and or climate involved in winter activities. The group will consider a wide range of practice. The aim of this group is not to suggest that one solution is better than another, because regional contexts of the states in term of policy and climate (see Figure 2) are very different and so are the required solutions. There will be no single "best practice" over Europe. Nevertheless, it seems probable that "better practices" for certain contexts can be shown.

The first task was to prepare a **list of topics** able to define winter maintenance practices. This subject list contains 4 chapters:

- Chapter 1 deals with "Fundamental issues" (climatic conditions and standards)
- Chapter 2 is called "Preparing Winter Maintenance and Organisation" and relates to general decisions (strategic decisions; for one winter period or longer).

- Chapter 3 provides information about “Operational issues” that relate to the organisation of individual winter maintenance actions (tactical decisions) - ”.

- Chapter 4 is for road users.

A more detailed description of the topics of the different chapters is given in the following page.

Each member of the COST Action was asked to write a **country report** to describe their winter maintenance practices. Because recommended practice or expert knowledge sometimes differ from operational and actual practices, both were considered and each country presented recommended and actual practices.

The country reports collected are the first description of winter maintenance practices across Europe and contain a great deal of information. Their final versions will be accessible to the public and available on a CD-ROM.

The **compilation of the country’s reports** is ongoing for each topic in the subject list. It has been very difficult to extract best practices since there are no indicators of the quality of the results. Almost no country has an effective measurement of efficiency so it has not been possible to compare practices on the same basis and with reliable indicators. Thus, this report describes actual practices in Europe, with emphasis on similarities and differences with the corresponding reasons where possible. Since this report is not yet finished, only general comments are presented in this paper.

It seems that there are not many differences in winter serviceability in Europe. The concept of "Classification of the roads according to level of winter serviceability" is widespread.

Practices differ more concerning the type of salt used (for example, rock salt or wetted salt) in different climatic zones. Rock salt is mostly employed for maritime climatic regions (humidity is important) and wet salt in drier regions.

Some common problems and concerns have emerged with sometimes no satisfying solution (for example, for the treatment of porous asphalt).

When countries have more knowledge on some topics than others, there will be references in the TG3 final report to the corresponding country report. This international exchange of practice is fundamental to win time and money.

This "**best practice**" report is also a base for international winter maintenance needs. It is important to have an international approach since the needs are closely related and independent of borders. One solution found by a country is useful information for other countries.

DESCRIPTION OF COST 344 TG3 SUBJECT LIST

1. Fundamental issues

1.1 Climatic conditions

Climatic regions in Europe, corresponding winter events, winter indices ...

1.2 Standards

General standards

Legal obligation to do winter maintenance?

Classification of the roads according to level of winter serviceability

Service classes: desired road condition, reaction and service times

Standards on Man Power

Standards on equipment and material

2. Preparing Winter Maintenance and Organisation

2.1 General : codes of practice, overview, how obligatory

2.2 Information provision

Meteorological information, Data collection and transmission, Control posts and patrols

RWIS-Systems, Thermal mapping, Expert systems...

2.3 Methods

Preparative programme for winter activity, Procedures,

Prevention, Route optimisation, Schedules for ploughing and gritting...

2.4 Equipment

Operation centres, equipment : vehicles, ploughs, de-icer spraying installations...

2.5 Materials

Spreading : recommended average rate of spread for m², quantity of stored material ...

2.6 Man power, training and privatisation

3. Operational issues

3.1 Getting Information

Warning and detecting of critical situations

Position of man in the decision process.

3.2 Methods, equipment and materials for snow control

Snow removal, Strategies for clearing multilane-carriageways, "white roads",

Special regulation for traffic...

3.3 Methods, equipment and materials for ice control

Chemical de-icing : type of salt, spread rates, storage...

Gritting, abrasive, mechanical ice removing

3.4 Methods, equipment and materials for special problems

Case of porous asphalt and thin surface pavements, of bridges...

Avalanches (prevention, warning and removal)

3.5 Measurements of Efficiency

Internal : Reports on activities, Forecast verification, Cost of winter maintenance...

External : Accidents, Travel time, Environment, User satisfaction...

4. Information of Drivers

Nature of information given (preparatory information, actual information)

Ways of dissemination

How much information is useful : before winter, during winter events, in case of a crisis.

CONCLUSIONS

The COST Action should provide valuable outcomes as follows:

- 'Best Practice' and emerging developments within and between EU and other COST member states.
- Necessary improvements to RWISs to introduce any latest available features such as residual salt sensors.
- Effective treatments to reduce any harmful effects in the environment.
- Knowledge of the impact of methods designed to maximise traffic flows and reduce accident severity in winter conditions.
- Recommendations for the integration of specified snow and ice control methods into network level road management and maintenance systems.
- Recommendations for further improvement in the dissemination of up to date and reliable information to practitioners and road users.
- Recommendations for improving the level and quality of user input information in snow and ice control decision making.
- Future research that will enable a more efficient and effective winter service to be provided.

BENEFITS

The Action should promote the exploitation of technological advances in the application and distribution of snow and ice control measures leading to significant environmental benefits. With the application of the knowledge gained, millions of EUROS could be saved through lower operational costs and a reduction in adverse effects on highway infrastructure and the environment.

REFERENCES

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