

## **ROADS DE-ICING AGENTS AND SUSTAINABLE DEVELOPMENT**

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### **THEME 5: WINTER MAINTENANCE AND SUSTAINABLE TRANSPORT Sustainable Strategies**

#### **1. SUMMARY**

Environmental impacts of de-icing agents are usually poorly known. They are mainly diffused within water, which influences its quality and threatens the balance of the ecosystems. Some research studies are committed to identify the sensitivity of natural environments along the de-iced networks.

Mobility issues have kept growing over the years. When dealing with winter services, governance is now necessary to match a sustainable development approach. A reinforcement of the communication towards the population is necessary (pedagogy, road information...) so that the expectations of the society evolve. It could also help turn road users into actors, responsible for their mobility choices and eventually involve them in strategies decision-making process. Prohibition of heavy lorries with storage in full way is an example of such strategies used to make winter maintenance smoother.

The improvement of practices will seek to optimise de-icing agents use. The analysis of their life cycle will help reduce their impacts. Training the employees will strongly contribute to it. Anticipation of meteorological and/or road perturbations along with the quality of snow-scraping leads to better adapted treatments, in both time and quantity.

The analysis of de-icing agents life cycle shows that one can act on purchase, quality of storage, modernisation and calibration of the flux spreaders or choice of used materials.

Isère District Assembly started a high environmental quality approach to deal with its 5100 km of roads; it especially consists in reducing the impacts of fluxes spreading:

- Solutions of winter treatment adapted to the level of service with a campaign of preventive salting and use of salt pulp,
- Awareness campaigns towards the employees on the effects of the salt on the environment,
- Building or covering salt shelters with surface waters recovery,
- Collaboration with environment and water departments in order to identify weak zones along the secondary roads to limit the salting effects.

The district assembly contributes to the preservation of a natural reservation with high salinity rates. In addition to derivation studies, some studies seek solutions to significantly reduce salt effects.

The inevitable compromise between road users safety to access a ski station and the preservation of its close environment will lead to broaden the concept of “reasoned winter maintenance”.

## **1. PREAMBLE**

The expectations of the society about sustainable development lead to question our practices and help them gradually evolve, in every field. Thus, in the field of winter services, it seemed necessary to think about some possible evolutions and propose them. Indeed, most actors in the field of winter services agree to say that de-icing agents improve road users safety and help maintain the economic activity; however, they also agree to say that their use may have environmental impacts depending on the sensitivity of the natural environment along the treated network.

Given those observations, better practices can be implemented in order to get a sustainable use of road fluxes: from purchase to storage and spreading. A governance idea also needs to be taken into consideration to improve the winter services practices.

## **2. STAKES**

### 2.1. Identifying the impacts of road fluxes on the environment

In France, almost all used road fluxes are sodium chloride (NaCl) for many reasons (efficiency, availability, cost). If sodium chloride is known to be a product that affects the environment, the impacts of its use on the whole chain are difficult to identify. Some studies are currently trying to describe the systemic impacts of this spreading. However, the environmental impacts can sometimes be easily noticeable: increase of the salinity level of a lake or groundwater, deteriorating sensitive fields, change in the local flora with apparition of opportunist plants such as the ambrosia... Some network managers have already had to face some lawsuits for environmental deteriorations.

On a more legislative level, the law on water remains very general: the authorised salt rejects do not depend on a treated surface area. However, some prefectorial decrees can prompt the network operators to treat surface waters and prevent them from being discharged in the environment if they are not diluted enough (ex: threshold of 400mg of salt/l – but the impacts of the salt at this threshold are unknown).

Protected zones could be treated separately. In foreign countries, such as Finland and Canada that had salted intensively in the past, it has been decided not to treat road sections along protected areas anymore. Abrasives had then to be used. In France, Isère District Assembly noticed a salinity increase in a natural reservation, the Luitel peat bog, gone through by a secondary road leading to the ski station Chamrousse. Many talks and actions were carried out in partnership with all the different actors, especially the ones protecting the environment. Isère District Assembly also modified its practices such as spreading with salt pulp. Furthermore, it starts now a study of identification of sensitive areas on its network. A similar study could be made by other network managers to limit the impacts on protected areas on their respective networks. The RST has already carried out a study of comparison between sensitive areas and salt storage areas in most French departments.

The issue of finding an alternative to the salt appears then. The other road fluxes are not necessarily less harmful for the environment and can also cause other problems, such as some risks for human health. However, research studies are not very developed on this matter.

## 2.2. Mobility stake: necessity to treat with fluxes

In our society today, it is difficult to imagine not treating roads anymore, even if some managers think about it or actually do it. Indeed, the society (road users, elected representatives...) relates the winter perturbations to the salt treatment of the roadway; there would be a general lack of understanding if the treatment would stop. Changing behaviours and habits is necessary. Often working in lean production, companies also consider roads as a part of their production chain, making it all the more difficult to accept any flaw in their trips. In the 90s, Germany experimented not treating some parts of its network. But, salting had to be reinstated given the increasing number of accidents.

If the treatment still seems necessary today, some solutions to limit the quantity of spread salt appeared during the round-table conference. For example, **not treating some roads** with low traffic or with no connection purpose could be possible. In the same way, **communication** can be reinforced to make road users and elected representatives understand that treating everything is impossible and that salt is not as effective as one would think. In order to salt better, road managers need to make sure that the spreading equipment is well calibrated but they also need to fund a better quality equipment. Moreover, the approach has to be **adapted to the phenomenon that needs to be dealt with**. Indeed, it is necessary to keep using NaCl to deal with black ice since the accidents related to it are more serious. However, the way of dealing with snow has to be thought again: scraping the snow before spreading the salt for instance.

Road users get ambiguous messages during winter phenomena: on one hand, network managers intervene to make the roads usable and on the other hand, users are asked to limit the number of their trips. Knowing their precise expectations remains difficult: CREDOC (Research Centre for Analysis and Observation of Life Conditions) studies show that the satisfaction rate does not evolve much.

One solution to improve this rate would be to **give a sense of responsibility to road users**, as it happened when yellow jackets had to be worn; another would be to prompt them to buy some specific equipment. It can be noted that in Quebec, snow-tyres are compulsory from now on.

The speech “salting less, salting better” was positive for the salt consumption. However, given the will of employees to do well and also given some noticed problems, it seems that there is a **tendency to salt “just in case”**. Indeed, the employee still has a lot of pressure: fear of doing wrong and fear of accidents. To reduce this risk and at the same time decrease the salt quantity, training the employees remains a prerequisite, even more in this context of decentralisation and team reorganisation. It is also necessary to set a strong organisation. Those measures can also be completed by means of decision-making tools (such as meteorological stations...), efficient to limit the treatments if possible.

## 2.3. Adaptation of levels of service and of treatments

It can be noticed that the levels of service are different one network manager to the other (N1, N2, N-...). But the definition of those levels of service is not necessarily the main problem, the most important issue being what road users perceive. Road users do not know the extent

of the network that they are using. The diffusion of the information to road users helps compensate for this problem, but it is also necessary to work on a **standardisation of levels of service for a same itinerary**. Collaboration between network managers is then essential.

The Zoned Bad Weather Plans enable the different partners to deal with **heavy lorries** and store them if needed. However, the **difficulty is to stop them at the right time and at the right place according to the forecast of one given event**. The network configuration (bi-directional, 2x2 ways with service areas...) can also make the manager's task even more difficult. Heavy lorries storage remains difficult on secondary roads; only the Prefect can prohibit them. Abroad, Germans use VMS on motorways to assign heavy lorries on the right lane with a specific speed limit. In Spain, a colour code "los colores de la nieve" (literally: "colours of snow") enables a levelled management of heavy lorries from the assignment on the right lane to the stop to let the winter services machines pass.

### 3. IMPROVEMENT OF PRACTICES

#### 3.1. Purchase

During a public contract finalisation process, the public buyer has one obligation: identify the nature and the extent of the needs, while **taking into account some sustainable development objectives** (article 5 of the public contract code).

However, the **road fluxes needs are difficult to anticipate** since there are related to both meteorological and road perturbations. Indeed, road fluxes consumption for one manager can vary from 1 to 7 depending on how harsh the winter is. Wintry intervention sequences are usually limited on short periods of time (2 to 3 days) between October and April and only affect geographically concentrated areas but those areas can potentially be anywhere in France. Needs are then unpredictable in the medium term. However, markets cannot face an exceptional situation, that is why anticipating road fluxes purchases is necessary.

To take into account sustainable development while buying road fluxes, some ideas can be explored. Anticipating while setting a good global organisation of wintry service is important, because the purchase issue is only one component of it. In terms of road fluxes logistics, **giving priority to storage rather than to lean production management** is advised. This can be done through storage capacity **optimisation** and re-supplying **regularisation**, while giving priority to cleaner transport means.

#### 3.2. Storage

Today, there are about 20 000 road fluxes stocks in France. Storage can be done in a silo (disappearing), under a shelter or directly on a platform. **Water discharge conditions are more or less concerned with the environment**. Losses because of non covered stocks are estimated between 5 and 8 % per year (about 40 000 to 70 000 tons per year) because of rainfall. According to the results of a 2002 RST study, for most storage places, the discharge of surface waters go to rivers and to the ground (42%) or to the sewage system (24 %). Only 9% of stocks are equipped with basin plugs and disconnection tanks to reuse those disposals for brine manufacture to make pulp.

Given those observations, it appears necessary to start a national debate on road fluxes storage conditions. The **installation of storage sites should be as rationalised** as possible by

functional geographic sector, avoiding establishing them next to rivers. Storage under shelters makes it possible to limit losses on platforms and reduces useless disposals in the environment. At the same time, protecting stocks from bad weather also makes it possible to keep the initial quality of products and reduce excessive doses during the spreading when fluxes are too humid. Stocks covering may be done by shelters built in wood, concrete or metal. Wooden shelters have the advantage of being modular and having a low energy consumption construction. Those observations come from a study lead by the CETE de l'Est (research centre of the Ministry) with the ENSTIB (National Engineering School of Wood Industry) as a partner.

Besides, **loading platforms should be laid out** in front of the stocks to limit discharges in the environment. Those constructions can also make it possible to promote the reuse of surface water discharges for brine manufacture to make pulp.

### 3.3. Optimisation of interventions

Salting better consists in reducing spread quantities while insuring safety and mobility for users, that is to say controlling the spreading. A better knowledge of fluxes and techniques makes it possible to adapt the uses.

First of all, network managers are asked to check if the intervention is adapted to the phenomenon: snow-scraping is a fundamental issue. Snow treatment is by far more effective and less fluxes-consuming when scraping is done before hand.

Furthermore, good calibrations and adjustments of the equipment are essential. To optimise road fluxes consumption, spreading needs to be adjusted first. When adjusted properly, salt trucks can save 2.5% of salt. An adjusting tool was developed by the RST: the Device of Optimisation of the Adjustment of Salt Trucks (DORSA in French). Using a fast knowledge of road fluxes dosing, this DORSA device enables an optimisation of spreading tools adjustments and a perfect command of spread fluxes quantities every winter. The SANEF, a road management company, uses it to adjust its salt trucks and saved 640 tons over 22 000 tons of fluxes over one season.

Services organisation, employees training and information will also help interventions optimisation. To reduce spread quantities, the employees need to be trained on the equipment. It is important to involve drivers and pass on the results within the service.

## 4. THE EXAMPLE OF DISTRICT ASSEMBLY 38

Isère District Assembly adopted its engagement book 21 in 2006, aiming at developing a high environmental quality approach for all its road activities.

This goal lead the technical departments to modify their practices about road fluxes use using an analysis of the environmental stakes and to work on exploitation measures.

A strong communication stake remains.

### 4.1. Road fluxes use

The road departmental network (5100 km) is organised into a hierarchy of five levels of service, for which intervention periods and return conditions have been defined according to the meteorological conditions. The hierarchy criteria mainly are the access to the county town, to the economic activity areas, to the touristy sectors, the folding back on a structuring network, and the presence of school transport.

The treatment solution is adapted to the level of service (salt and by-products, pozzolanas, clinker...), except for the settings of the functional intervention circuits sometimes with several levels of service.

Field teams are advised to make preventive spreading, in order to avoid delicate situations that would overconsume fluxes. Furthermore, a contract with Meteo France giving the predictions for each sector along with a field team surveillance are precious decision-making tools.

The equipment park was adapted to promote pulp salt use in some sectors.

“Salt better, salt less” trainings were given to employees in order to explain them the effects of salt, present them the environmental impacts and show them how to optimise the salt trucks use.

A real estate plan was started to build salt shelters or to cover existing shelters and get surface waters back before discharge.

The district assembly was taking part in the preservation of a natural reservation (the Luitel) along a secondary road. Monitoring highlighted high salinity rates with a strong impact on the peat bog balance. Some derivation works enabled a decrease of the rates but the results are still unsatisfactory. Some feasibility studies lead with State departments are currently running to find solutions to obtain a significant decrease of the effect of the salt on the reservation and at the bottom of the zone as well. This case brings the issue of the conflict between road users safety on an access road to a ski station and the local environment preservation.

Road departments plan to start a collaborative work with the environment department and the water department in order to identify all the risky areas along the secondary roads (wetlands, sources areas...) and in each case, examine the technical solutions that may limit the salting effect.

#### 4.2. Exploitation

Isère District Assembly defined levels of service in its winter services organisation file. Snow removal operations are not done 24/7. Delicate zones have been identified in the territory (mountain pass crossings). Some exploitation measures are carried out in order to avoid blocking solutions such as heavy lorry prohibition leading to their storage or even punctually road cuts and the necessary time to treat the road.

All those measures are deployed in collaboration with the Prefecture, the police or other road managers involved with the circulation restriction.

#### 4.3. Communication

During snow events, road users only care about traffic conditions and environmental concerns are brought back to a lower level.

The evolution of practices must come with a demand from the society. Road user behaviour change is related to a realisation of all stakes and this can only happen if the district leads a global communication on winter services in a sustainable development context. The concept “reasoned winter services” needs to be shared. That still needs to be done.

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