

## Recent Developments in the French De-icing Salt Market: The Response of a Producer

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### ABSTRACT

In winter, preserving optimal traffic conditions (safety of road users, continuity of commercial activity) is of the highest priority for the authorities. This must be achieved despite structural constraints (climate, road network, traffic) and changes in attitude and behaviour (costs, environment, user demand). We are therefore facing the expression of a real political interest from the authorities in the use of deicer, thanks to such measures as: gathering of winter maintenance expenses in the maintenance budget, standardization (market standards for deicers), training of personnel and optimization of treatment. Faced with all these constraints, the supplier's answer must be technical, commercial and media-related: snow-fighter training, control of the logistic process (decentralized storage), the perfection of techniques and patented processes, product quality improvement, participation in the elaboration of standards and the promotion of producers' interests and salt use. These actions lead to standardization of brine manufacturing units and to the use of salt slurry on road and motorway networks, and have confirmed the French producer's adaptability to future developments in this market.

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### INTRODUCTION

For the last 25 years, salt has been the most widely used deicing agent in France. Its usage has changed progressively to meet the evolving needs of deicing salt users and the requirements of road users. Due to the instability of this market, it is important for a salt producer to define and apply a policy that allows him to adapt to market constraints and to anticipate its development.

### DIAGRAM OF WINTER MAINTENANCE

#### Geography, climate and road meteorology of France

Located in a temperate zone, with a coastline that makes up half its frontiers and with mountainous areas covering a quarter of its surface, French climatic geography is characterized by noticeable contrasts between mild maritime zones and very cold mountainous areas. In between, there is a wide range of intermediate climates, according to relief, exposure and distance from the coast (Bessemoulin, 1979). As a consequence of these differences, snowfall distribution varies considerably over the territory, the parameters being number of days with

snow and number of days with snow-covered soil. The territory is therefore divided into zones corresponding to four types of winter conditions, according to the nature of atmospheric influences (snow and ice) and the resulting state of the roads (See Table 1).

#### The road network, traffic and economy

In the heart of Europe, France is at a cross-roads linking highly industrialized and urbanized regions that are far apart and even sometimes beyond its boundaries.

Figure 1, which compares the densities of the road networks in EEC countries, reveal France's delay in covering its territory with motorways compared with its European neighbours who have similar economic importance (OECD, 1989).

The original French development policy, in view of the EEC market of 1993, has given preference to the linking of major European centres (toll motorways) and the opening up of isolated regions (four-lane motorways or roads).

#### Traffic

Road traffic is concentrated on the motorway network (see Fig. 2), mainly due to the transportation of

TABLE 1  
Climatic zones in France

| Zone | Location  | Climate                | No. of days<br>N1 + N2 | Winter          |
|------|---|------------------------|------------------------|-----------------|
| H1   | Western and Mediterranean coastal regions   | Oceanic, Mediterranean | <10                    | Mild            |
| H2   | West and north borders of the Massif Central, Loire River Valley, Rhone River Valley, centre of the Parisian Basin        | Oceanic tendencies     | 10-30                  | Not very severe |
| H3   | North-eastern zone of the Parisian Basin, east border of the Massif Central, Saone River Valley                           | Continental tendencies | 30-50                  | Quite severe    |
| H4   | All mountain massifs, the Alps, the Pyrenees, the Massif Central and the Morvan, the Vosges, the Jura and bordering areas | Mountainous            | >50                    | Severe          |

N1: Number of days during which there was a snowfall (number of days with snow)

N2: Number of days during which there was ice not counting the days when there were also snowfalls.

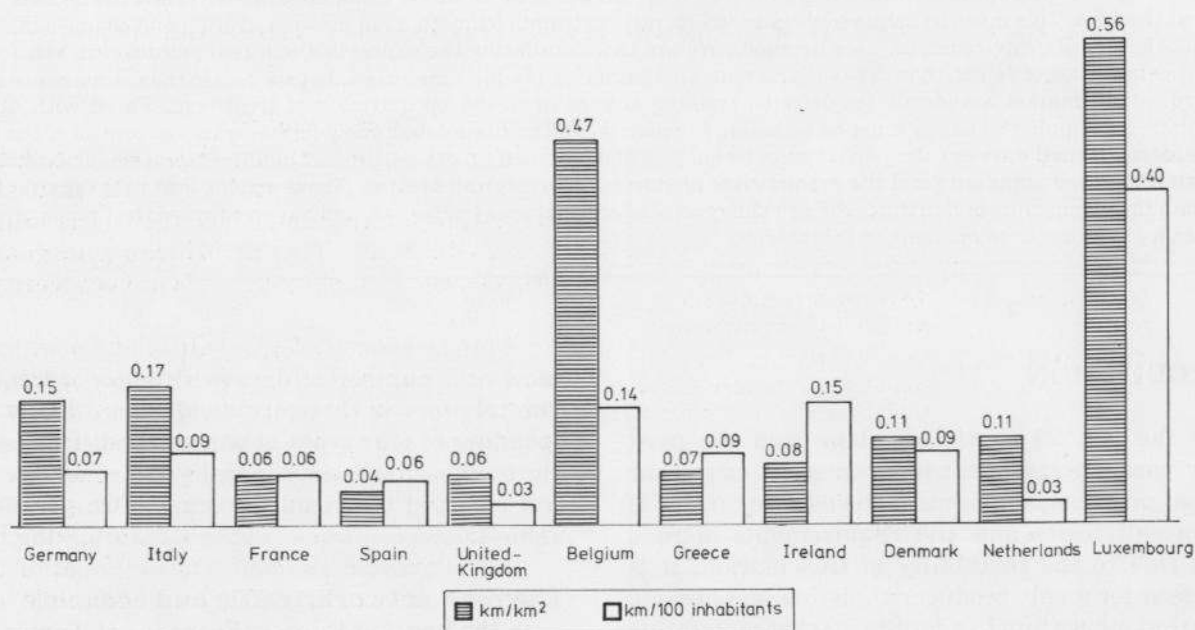


Fig. 1. Road network density of EEC countries (motorways and national roads).

goods (Faure, pers. commun., 1988). Economic exchanges (people and goods) depend on the viability of the roads in winter, all the more because traffic is evenly spread out during the year, without seasonal fluctuations. As a consequence, winter services are an essential constituent of the administration and of local services. In fact, a comparison between road network maps and climatic zones shows that road traffic uses mainly low altitude regions (< 800 m) with little snow covering. Therefore, the major road danger in a large part of the French territory is, on the one hand, ice and on the other, the phenomenon of occasional snow showers in areas that are badly equipped for such unusual meteorological conditions.

These almost catastrophic conditions for road traffic and for the security of people and goods are relatively frequent (15 occurrences since 1950).

### Statutes

#### Winter services

The importance of winter maintenance in economic life makes the setting up of a winter service indispensable. At the same time, for budgetary reasons, the winter service is modulated according to the significance of different road sections (the importance of traffic and the nature of connections) and

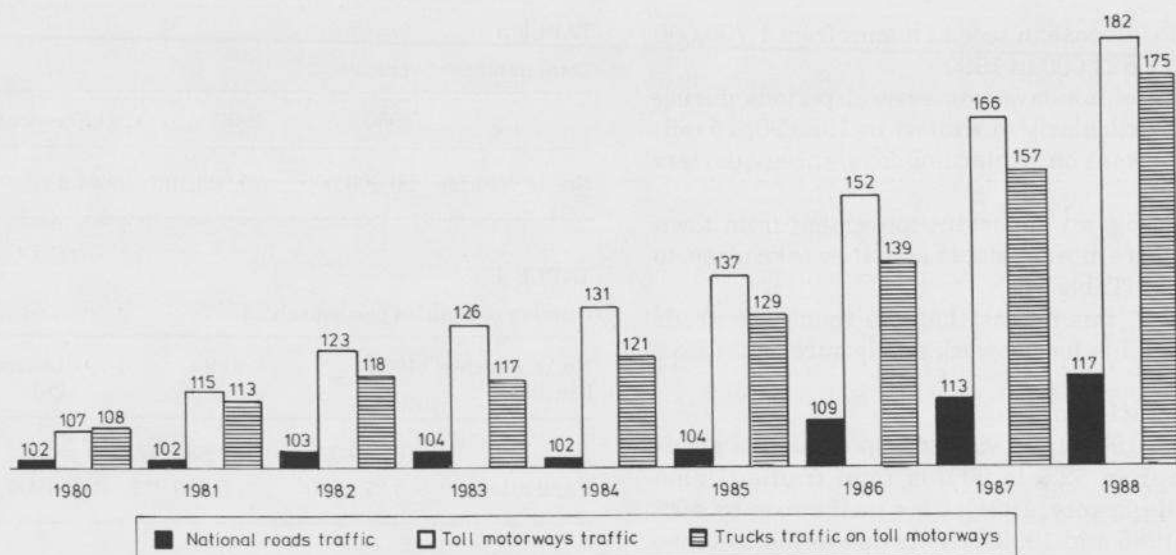


Fig. 2. Traffic of all vehicles on national roads and toll motorways. (Index number in 1979: 100).

TABLE 2

Winter service principles

| Level of service | Quality                 | Targets of the service   |
|------------------|-------------------------|--|
| S1               | Continuous and priority | To retain acceptable traffic conditions in better time   |
| S2               | Not permanent           | To retain acceptable traffic conditions for specific hours in the day or during a period already defined |
| S3               | No constraint           | To restore acceptable traffic conditions as soon as possible   |

gives priority to routes that are directly concerned with trade.

The fundamental principles of this service were specified in 1971 and reviewed in 1978 by a ministerial circular on organization and the implementation of winter services (Ministère de l'Intérieur, Ministère des Transports, 1978).

The system is divided into three sections S1, S2 and S3, with graduated targets (Table 2). In the beginning, the range of application of the S1 level covered the motorways (4,600 km in 1978) and according to their traffic or the nature of the links, the national roads and a few sections of viable secondary roads (13,000 km in 1978). These services ensured that the roads were fit for traffic in winter by coordinating the choice of methods used, the procedures and recommendations, and decisions to intervene.

### Discharge of responsibilities

The authorities can guarantee the procedures but not the results. Snow and ice create natural risks that can be forecast and which road users must take into consideration. The authorities cannot guarantee the possibility of using the roads under severe winter conditions.

There is, nevertheless, a situation for which they are fully responsible, i.e. in the case of frequently used roads (mainly motorways) where there is often ice and where appropriate safety measures have not been taken to limit the consequences or where motorists have not been warned of the danger.

In the case of towns, a very old law (dating back to 1851 for Paris) also refers to the inhabitants' duty to clear the pavements. The basic principle obliges every owner or resident to clear away snow or ice on the pavement in front of their property and for a given width. The means are neither defined nor imposed; however, it is strictly forbidden to "melt snow or ice by using salt on tree-lined pavements".

### LATEST DEVELOPMENTS

#### Driving and drivers

Several parameters illustrate the increase in user demand:

(a) Total number of vehicles (Table 3).

(b) Number of vehicles per household (Table 4).

This reflects the distribution of housing and the increase in the number of working women (37.1% of the working population in 1975 and 45.8% in 1989).

(c) Reasons for the increase in car journeys

Trips for short stays during weekends as can be

seen in the increase in second homes from 1,700,000 in 1976 to 2,822,000 in 1990.

Splitting of holidays into several periods during the year, particularly in winter. In 1989/90, 15 million people went on winter holidays, three-quarters of by car.

Commuting: an important movement from town centres, where most business activities take place, to the suburbs (Table 5).

In reality, this means that the road user needs regular mobility for his work and leisure activities.

#### Transportation of goods

Between 1980 and 1990, transportation of goods has risen from 52% to 69% of total traffic (Union Routière de France, 1991). This traffic rose by 40% between 1985 and 1990, largely due to the increase in the use of motorways: +75% in 10 years.

The combination of these factors results in the use of only 4% of the network (32,000 km) by 40% of road traffic (see Fig. 2).

#### Road surfaces and car equipment

Progress in car technology as far as safety and quality are concerned (anti-rust treatment, lighting, special tyres), combined with better road conditions (surfaces and road signs), lead to a considerable increase in the possibility of using roads, even under bad weather conditions.

#### Ecological awareness

Excessive salt spreading, following exceptional weather conditions, as in January 1987, has led to public awareness of the need to protect the environment. This awareness was propagated by political circles and the media. A debate ensued on the consequences to the environment of the use of road deicers: deterioration of road surfaces and bridges, effects on roadside vegetation and on tree-lined pavements, and the effects on ground-water and rivers.

#### Use of deicers and management of the winter service budget

The use of salt (which has become widespread in France since the Grenoble winter Olympic games in 1968) depends on winter weather conditions and on the severity of succeeding winters. Some exceptional years remained memorable (1,400,000 tons in 1985) while administrative and financial structures were being modified due to the enforcement of the so-called "1982/83 Decentralization Laws". Their aim was to transfer the executive power from the State to the French Departments with the effect that local Administrations (General and Provincial Councils)

TABLE 3

| Total number of vehicles |            |            |                |
|--------------------------|------------|------------|----------------|
|                          | 1980       | 1990       | Difference (%) |
| No. of vehicles          | 20,990,000 | 30,269,100 | +44.2          |

TABLE 4

| Number of vehicles per household |            |            |                   |
|----------------------------------|------------|------------|-------------------|
| No. of vehicles/<br>household    | 1982       | 1990       | Difference<br>(%) |
| 1                                | 10,599,392 | 10,885,969 | +2.7              |
| 2 and more                       | 3,273,860  | 5,389,911  | +64.6             |

TABLE 5

| Business activities transfer to suburbs |            |            |                   |
|---|------------|------------|-------------------|
|   | 1982       | 1990       | Difference<br>(%) |
| Live and work in<br>same city           | 11,237,800 | 10,677,900 | -5                |
| Live and work in<br>different cities    | 10,454,150 | 11,701,660 | +11.9             |

became more aware of the importance of the expenditure to be faced each year for the practicability of winter traffic.

In effect, this has led to the regions paying three-quarters of the total cost of road serviceability (8 billion FF). Of this, winter serviceability represents 0.7 billion FF, which is equivalent to the maintenance costs of secondary roads.

This average cost varies widely, depending on the region. In mountainous areas, winter maintenance costs represent up to 20% of the budgets.

Salt is the major expense in winter serviceability cost (estimated at 25-35% of the budget).

#### CHANGES TO BE TAKEN INTO ACCOUNT

The authorities have had to supervise the use of deicing agents more closely. This is partly due to awareness of the high cost of these consumable products and of labour and equipment costs when using them. The other reason for this clamp down is the negative impact that deicing agents have on the environment when used excessively or inappropriately.

## Better management of purchases

### *Schedule of conditions and standardization*

Local authorities used to use the system of invitation to tender which was drawn up individually by each person in charge. Under the aegis of road management, a system was put together that would facilitate the setting up of a market for suppliers of deicers. The aim of these terms of reference is to clarify and to specify a region's needs for deicing agents and thus to facilitate the signing of contracts with suppliers. This came about as a result of discussions that have been going on since 1988 between suppliers and users of deicing agents.

### *Management of the budget*

As from 1st January 1991, an important change took place in the management of departmental organizations. They switched over to the "trades account" system which assimilates them with loans and services. This leads to the use of financial and accounting procedures which increase the departmental manager's awareness and sense of responsibility. After a transition period, this system should greatly modify the policies of buying, stocking and using deicers.

## Better management of implementation

In practice, the requirement was divided into two sections: to increase awareness of the engineering constraints in the traditional use of the salt (only coarse salt spreading) and globally to improve the winter service by rationalizing its cost.

### *Setting up a nationwide educational program on winter maintenance*

The relevant authorities and satellite public organizations, have directed their personnel to follow a nationwide educational program which promotes a better control of winter maintenance. (In 1987/1988: "Just enough salt and not too much". Since 1989: "Ice, instruction booklet"). All these operations consist of a first step involving the elaboration of educational tools (technical files and videotapes combined in a "training case") and a second step of training the regional leaders who are responsible for strengthening this training program among all local personnel. The specific tools for these operations are supplemented by the regular publication of notices and technical guides.

### *Planning of winter maintenance — technical control of interventions*

This takes place according to two main criteria:

(a) Improvement of the conditions leading to the interventions:

– Closer ties between the local equipment supplier's authority and the national weather service, with the creation of an actual road weather service.

– Development of meteorological forecasting equipment (handling thermo-hygrometers) and of decision-helping systems in winter serviceability such as ice warning systems.

(b) Treatment optimization:

– The adaptation of treatments to weather conditions: generalization of use of wet salt.

– Adaptation of equipment for these new techniques: brine and coarse salt spreaders that have their distribution related to their speed.

### *User information*

The aim in informing users is to avoid traffic congestion and to improve driving comfort and user safety. This information must be rapidly transmitted and updated, according to the changes in traffic conditions. It allows the user to have all the necessary information available before his departure, as well as during his journey: temporary road signs, visual display devices with changing messages and local radio broadcasts.

### *Winter maintenance planning*

Following the operation "Just enough salt and not too much", the organization's effort to increase winter maintenance centred on the elaboration in each region of a plan of winter maintenance interventions. This plan makes an inventory of the human resources and equipment available, and it defines action to be taken against snow and ice, specifying deicing conditions of secondary roads for a normal as well as an exceptional winter.

In the case of an exceptional winter, the plan creates a specific organization containing a "crisis group", which operates 24 hours a day and which coordinates the winter maintenance operations throughout the region, mobilizing all available means and acting as go-between with the political and prefectural authorities (plan ORSEC = rescue organization).

The majority of these actions need to be put into practice, during normal and severe winters, before they truly reveal their worth. In fact, it has been clearly proven that greater efficiency at the lowest cost is the result of the control of the timing of intervention and the choice in the type of treatment to be used.

## SUPPLIER'S ADAPTATION TO MARKET CHANGES

### *Technical adaptation*

In the early 1970s, the Compagnie des Salins du

Midi et des Salines de l'Est (CSME) developed a series of techniques and methods to optimize treatments:

- using (a) sodium chloride brine, (b) salt and brine, (c) deicing agents in solution;
- measuring sodium chloride residues on road surfaces.

These developments have led to the following patents:

Patent no. 70.46.442, 72.46.019, 78.03.878: Road deicing process using wet salt, deicer mixtures in solution and mixtures of deicers in solution or solid form.

Patent no. 71.00.366: Apparatus for spreading of deicing agent.

Patent no. 76.32.003: Process and composition to approximate quantity of chloride ions present on a surface, in particular on road surfaces.

Patent no. 78.04.360: Vehicle for spreading ionic de-icing agents.

Patent no. 79.29.895: Apparatus for a precise potentiometric measure of the quantity of chloride ions that are present on a surface.

Patent no. 84.16.275: Treatment process for an ultra-fine alkaline chloride in suspension in an alkaline chloride solution or in an alkaline-earth solution.

This fundamental work was completed after technical advice on the definition and realization of unloading salt storage facilities and sodium chloride dissolving equipment.

These techniques were first put into practice in the early 1970s, in particular by the toll motorway companies because of the high level of service that they provide. Their use gradually spread to main and secondary roads and to some large cities, often related to the renewing equipment and confirmation of the advantages in using these processes (decreasing use of deicing agents, optimizing the treatments and reducing their negative effects). These techniques and processes are now widely employed.

### Quality improvement

The CSME has constantly improved and adapted the quality of deicers, especially in the last decade. The following are some examples.

- Redefinition of existing granulometric standard (1987-1991): reduction of very fine and very coarse elements.

- The creation of new products suited to resolving specific problems concerning winter serviceability: deicing agents effective at very low temperatures to be used directly or to be mixed with sodium chloride (in 1985 launching of NEVE-MAG — 30% magnesium chloride solution of marine origin); the particu-

lar winter behaviour of certain types of road paving — special salt for porous asphalt tested since 1989.

- Marketing of dry rock salt in 1990 and complete discontinuation of wet rock salt in 1991. This voluntary policy anticipates the development of salt shelter building in regions and towns, to ensure continuity of the dry salt chain from production site to customer site. We can therefore hope that the final result will be a significant contribution to the protection of the environment. This will be due to the elimination of pollution caused by open air storage and to better spreading control by using salt perfectly adapted to modern salting techniques (improvement of pourability).

- Proposing to other producers (within the framework of the French Salt Producers Committee) the initiation of a normative procedure to specify the different types of road salt: sea salt, rock salt, vacuum salt and salt that is the residue of potash extraction. An AFNOR committee has drawn up a plan on the norms and this is due to be published in 1992.

After Great Britain, France is the second European country to lay down norms on deicing salt use.

### Technical assistance

The development of these techniques and processes primarily concerns the most motivated users (motorway companies) and equipment manufacturers through changing practice depending on the target audience (decision-makers or operators), within the framework of proper training courses.

The increased need for training winter maintenance personnel and the direct management of this training by those concerned, has led CSME to transmit know-how and experience to the users in partnership with some specialized snow-fighter training schools.

### Logistic adaptation

During winter, the demand for deicers is characterized by large fluctuations depending on the severity and location of bad weather conditions. Experience shows that this demand is limitless, all the more because the prefectural authorities can requisition salt supplies. In this case, it is necessary to over-estimate production storage and dispatching capacities in order to avoid the loss of sales and customer dissatisfaction.

- Availability of deicing salt in each production site: sea salt (7 sites), rock salt (1 site), vacuum salt (2 sites).

- Creation of intermediate storage: sea salt (15 locations), rock salt (5 locations) (see Fig. 3).

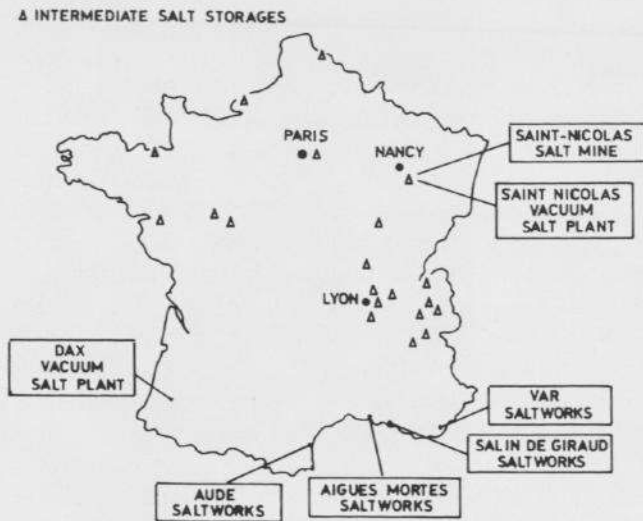


Fig. 3. Salt production sites and intermediate salt storage.

– Instantaneous production capacities allied with the despatch of stored salt (at high rate) allow the shipment of up to 30,000 t per day from the production sites and 15,000 t per day from storage sites.

– Management of exceptional situations. Each time that the existing means prove to be insufficient, a special procedure known as the "Snow Plan" is activated. This real emergency plan allows rapid use of supplementary means while giving a qualified team the power to make decisions relating to: extending loading time (24 hours a day, including Saturdays and Sundays); reducing administrative procedures (loading without order); answering telephones to direct customer's demands; free communication between motorway managers and production sites.

Such an operation ("the Olympic games salt") has been organized for the XVI Winter Olympic Games in Albertville (Savoie), in collaboration with the French railway company to ensure free access to the Olympic sites.

#### Media adaptation

The development of the power of the media and the implications for the image of salt necessitate a

strenuous programme of action to educate the opinion-makers. The French Salt Producers Committee and the ASSELVIA association (deicing agents producers association), allied with a communication agency, perform this function which has the Parisian Press and the specialized Road Press as targets. A press file has been made and is reviewed annually, making it an accessible tool for journalists.

At the regional level, there is direct contact with regional television broadcasting stations and newspapers in order to channel and satisfy the demand for information, which is important, particularly when bad weather conditions occur.

#### CONCLUSION

The management of the deicing market is subject to some specific constraints: climatic dependence, vital implications for the safety people and goods safety, unpredictability and extreme variability of need level, ecological risks, and high media sensitivity.

During recent years, user requirements have focused on salt use optimization in the search for cost reduction and service quality improvement. In this context, the French example is particularly representative. It shows that salt producers are compelled to adapt themselves rapidly and to anticipate.

CSME, continually adjusting its services and products, is encouraging salt use and the promotion of its image in the public arena.

#### REFERENCES

- Bessemoulin J., 1979. Atlas climatique de la France. Ministère des Transports, Direction de la Météorologie, Paris, 36 pp. (in French).
- Faure, M., pers. commun., 1988.
- Ministère de l'Intérieur, Ministère des Transports, 1978. Directive pour l'organisation et l'exécution du service hivernal, Paris, 47 pp (in French).
- Report prepared by an O.E.C.D. scientific expert group, 1989. Curtailing usage of de-icing agents in winter maintenance, O.E.C.D., Paris, p. 15
- Union Routière de France, 1991. La circulation routière: faits et chiffres: p. 16 (in French).