



Rapid road deicing and preventive maintenance with integrated services guarantee safe winter mobility to mountain communities and road management administrations.

FOR SNOW AND ICE: PREVENTION AND FULL SERVICE

by Giancarlo Dolcetti*

Travelling the roads in winter is increasingly problematic and involves risk, as drivers must take into account the potential danger of weather conditions. Sudden drops in temperature cause roads to ice over quickly and snowfalls can make the roadways impracticable. Snow removal operations must be programmed in tandem with the effective and wide-ranging action of salt spreaders.

The territory must adopt prevention programs in town centres, even those not necessarily located in the mountainous but that are subject to rigid temperatures in winter. To now this aspect has perhaps received less attention than warranted, although the inherent hazards and high costs in terms of road accidents exist, resulting in significant damage to the economy. Autostrade and other large road management administrations can now rely on services focusing on prevention, but it is necessary that they be extended to other regions as well, since snow and ice are factors that even relatively mild climates can experience.

Large cities, metropolitan areas, mid-sized and small towns, mountain communities and consortiums of municipalities are more than ever forced to handle winter emergencies.

For example, one large municipality in northern Italy monitored over the past few years 75 "risk" points for mobility which, given the presence of rivers, streams and special environmental conditions, are subject to the "verglas" effect.

Experience has shown how useful it is to think in terms of an inter-municipality cooperation so that the thousands of commuters travelling to the workplace arrive safely.



A 100-km commuting stretch

In a mountain community that groups 21 municipalities, a study was made to build a state-of-the-art self-service facility for the storage and dispensing of de-icing salt.

The administrators were illustrated the guiding principles, reason for the prevention action and the safety advantages for the citizenry. They were given an outline of the organisation of the service, with special attention paid to the vigilance of meteorological data in real time, mapping of the territory to define the risk points, and the definition and optimisation of the routes followed by the vehicles. A discussion then followed on the characteristics of the quarry salt and its utilisation.



The public awareness campaign



Winter maintenance centre for the city of Turin, 1994



Winter Roadway Safety

This led to the proposal to install a self-service facility for the storage of salt, with the decisions taken by other administrations to adopt similar facilities.

The administrators were convinced of this service for several reasons, among which:

- ♦ Salt no longer exposed to the elements (it is even when covered by a tarpaulin), avoiding contamination of the environment and heavy losses of material with consequent disintegration of the salt;
- ♦ A considerable reduction in the time taken for maintenance during snowfalls;
- ♦ Greater effectiveness of the treatment thanks to prompt road maintenance;
- ♦ Economic advantages because the procedure to discharge the salt requires no personnel to be present at the facility;
- ♦ Verification of who unloaded the salt and in what quantities, with the possibility of determining the cost and assigning the debits to the municipalities that used it, in addition to the preparation of statistical reports for organisational purposes;
- ♦ The certainty of a marked reduction in the accident rate.

The facility includes a silo and tanks for the storage of the solution.

Due to the distances involved and in order to create an effective distribution of the service there may be a need to set up other sites bordering adjacent mountain communities.

Storage facilities boasting advanced technologies and self-service management systems that meet the requirements we have mentioned have been in operation for several years with the provincial administrations of Bolzano and Trento.

The road service section of the autonomous Province of Bolzano commissioned a planning study for the installation of self-service salt storage facilities that would meet the various needs of the six road service offices in the area overseeing management of the provincial road network.

The planners worked out a strategy in successive stages in order to spread out the investments over several financial years and to draw upon the experiences of the initial installations.

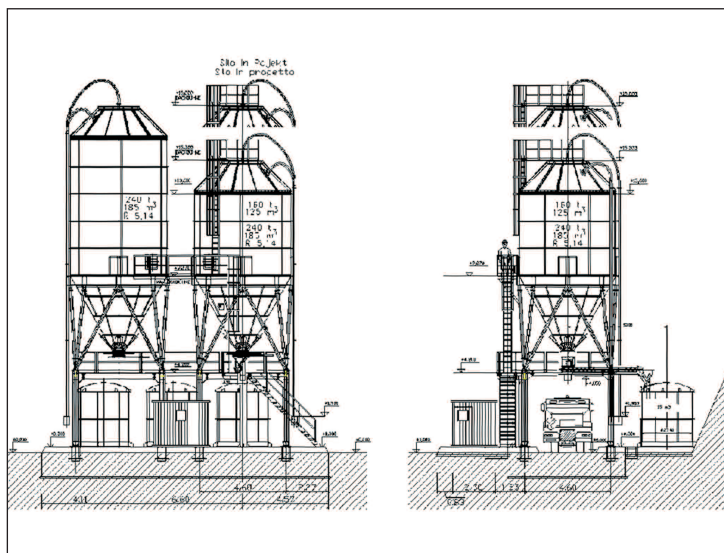


The Lana site (first phase)

The first phase provides for the construction of a facility with a capacity of 160 tonnes (whose load bearing structure is calculated to provide for later expansion to 240 tonnes) outfitted with a system for the automated preparation of saline solution, with a dissolution tank of 15 cu m and storage tank of 15 cu m.

The second phase provides for a second facility to be built next to the first with a capacity of 240 tonnes and eventually a supplementary 15 cu m storage tank connected hydraulically to others installed in the first phase to maintain a correct proportion between the solid and liquid deicers stored.

Such an organisation allows for winter Maintenance Centres to have large salt storage systems (480 tonnes maximum) and saline solutions (45,000 litres maximum) for the spreading of humidified salt on the road.



The conclusive study of the Maintenance Centre at full operation (designed by Arch. Pierantonio Battiston)



PROJEKT PROGETTO

SILO FÜR TAUSALZE SILO PER SALI DISGELANTI 1

H = 15,47 m

FEINES SALZ FÜR SALZLÖSUNG
SALE FINO PER SOLUZIONE SALINA

FASSUNGSVERMÖGEN CAPACITÀ	m ³ 125 m ³ 125
FASSUNGSVERMÖGEN von NaCl {1300 kg/m ³ } CAPACITÀ di NaCl {1300 kg/m ³ }	kg 162 000 kg 162 000
FASSUNGSVERMÖGEN von CaCl ₂ CAPACITÀ di CaCl ₂	kg 112 000 kg 112 000
SALZLÖSUNG – VORBEREITUNG SOLUZIONE SAUNA – PREPARAZIONE	m ³ 15 m ³ 15
SALZLÖSUNG – LAGERUNG SOLUZIONE SAUNA – STOCCAGGIO	m ³ 15 m ³ 15
FERTIGHAUS m 2,90x2,30x2,45H BOX PREFABBRICATO m 2,90x2,30x2,45H	m ³ 17 m ³ 17

ZUKÜNFTIGE ERWEITERUNG FUTURO AMPLIAMENTO

SILO FÜR TAUSALZE SILO PER SALI DISGELANTI 2

H = 18,33 m

KORNSALZ
SALE IN GRANI

FASSUNGSVERMÖGEN CAPACITÀ	m ³ 185 m ³ 185
FASSUNGSVERMÖGEN von NaCl {1300 kg/m ³ } CAPACITÀ di NaCl {1300 kg/m ³ }	kg 240 000 kg 240 000
FASSUNGSVERMÖGEN von CaCl ₂ CAPACITÀ di CaCl ₂	kg 165 000 kg 165 000

Salt storage

The ideal storage management takes place as follows:

- ◆ A 160 tonne silo is connected to a dissolution tank: salt in soluble granules at 99.9% are used prevalently for the saline solution and for the direct spreading on the road in an emergency;
- ◆ A 240 tonne silo contains salt in granules without special need for solubility (economical but guaranteed for ensilage purposes) used exclusively for the direct spreading on the road.

Project characteristics

Project features include:

- ◆ Silos and tanks built entirely in material resistant to physical and chemical aggression of saline deicers (sheet steel vitrified internal and externally) which guarantee an extended, maintenance-free life;
- ◆ Weighing systems featuring high-precision double bending load cells;
- ◆ Self-service salt management system by means of operating and accounting software designed for the special requirements of the provincial administration;

- ◆ A reduced environmental impact;
- ◆ A patented system for the automatic preparation of saline solutions at the required concentrations.

Advantages of the service

AuThe results obtained as a result of these technologies include:

- ◆ Rapid discharge using only one operator: loading of the salt spreaders is very rapid (less than two minutes for a 9 cu m spreader) and the operations can be performed by the driver of the vehicle, stored by the system and printed out;
- ◆ This signifies quick, highly effective road maintenance essential to roadway safety during a snowfall. It also allows a reduction in the consumption of salt, with positive economic and ecological effects;
- ◆ Automatic preparation of saline solutions: thanks to the patented dissolution system a large quantity of saline



Section plane of the patented dissolution equipment



Detail of the dissolution system with automatic salt metering screw



The facility during the automatic discharge phase

solution can be prepared within a short period of time (10,000 l/h of NaCl solution).

It is now universally recognised that the use of humidified salt, especially for preventive operations, leads to significant reductions in the use of road deicers and a greater effectiveness of the maintenance;

♦ A drastic reduction in personnel: the advanced technologies used for the facility, together with extremely simple procedures, enable the driver of the salt spreader (or non-expert outside personnel) to perform the salt unloading operations directly.

♦ An improvement in workplace safety: avoiding the manual handling of sacks, loaders in the stock yards or industrial sheds eliminate all risks deriving from their use and raises safety levels to optimum standards.

♦ Automatic and precise management of salt and solution consumption: the precision weighing system using load cells and the management software for the facility enable all salt handling operations, both during loading and discharge, to be stored into memory. The result is a correct statistical management of all the events, useful also in case of a dispute or petition for damages. Facilities with these characteristics, installed in strategic positions and sized appropriately, can conveniently replace storage at industrial sheds with much larger capacities, because the constant monitoring of quantities at the facility and the communication to remote offices of the quantities stocked and alarms triggered allows stocks to be kept at a maximum. Hence, during the course of a winter a silo can rotate (thanks to the loading from the top and discharge from the bottom) quantities of salt 2-3 times its capacity, guaranteeing a constant turnover of salt.

Also to note is that because the silo is airtight, the salt can be stored for years, maintaining its original particle size and sliding properties and therefore causing no problems for its use in later years.



The remote control software

The province of Trento has also adopted these systems at its Maintenance Stations in Sindech (where the environmental impact had to be taken into due consideration because of the adjacent tourist area of the Folaria plateau) and near the Maintenance Station of Borgo Valsugana on the state road 47 (Trento-Padua).

These are facilities with a capacity of 120 tonnes and a total height of only 11 m, remote controlled from stations such as the area office as well as the central office at the Trento administration headquarters.

Smaller than the motorway type, these facilities still boast advanced technologies use for their construction, so they can be adopted by road management authorities (provincial administrations, mountain communities, consortiums of organisations, etc.) that need guarantee of a competent, yet economically viable winter road maintenance service. Currently under study is the possibility of a full-service

that meets the total challenge of winter road maintenance and management. This complete package will solve all problems related to salt storage, its efficient spreading, snow removal, as well as the placement of vehicles and the remote controlled management of events. In short, it is an organic service in which the facilities, vehicles and equipment are coordinated and managed by one efficient organisation in order to obtain optimised winter roadway safety.

* Architect and organisational expert



The site at Borgo Valsugana



The site at Sindech