ODEMIE (Optimized Dosage of Spreaders by Software for the respect of environment)

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SUMMARY

In winter, great quantity of fondant is used to treat the roads. To reduce the impact of these fondants on the environment, it is important to spread accuracy, that is to say, control the quantity of materials used. To this end, the optimum setting spreaders is required. The new tool, ODEMIE (Optimized Dosage of Spreaders by Software for the respect of environment), control machines by determining the dosage of the material whether it is applied only salt or added salt brine. It has two receptacles: one for salt and one for brine. Associated software drives the test: storage of test parameters, acquisition, analysis and processing of data, presentation of the results and save the test in the folder. This software writes monitoring reports following tests selected by the user. All data stored on the hard drive of the computer can be read by software or transferred. It meets the requirements of the standard NF EN 15597-2. [1]

1. BALANCING THE SUSTAINABLE DEVELOPMENT AND VIABILITY OF WINTER ROAD NETWORKS

Photo 1 - Control of a spreader with the system

It is a fact that users of road networks want to move with equal ease in winter than during the rest of the year. To meet this demand the service in charge of road networks implements considerable resources, both human and material, to scrape the roads and deal with road icing if necessary.

The fondant used in winter maintenance are important overall tonnage of 400 000 tonnes for a mild winter to 1.7 million tonnes for a harsh winter, and sometimes beyond where natural phenomena combine ... Faced with these tonnages, it is essential that every action is based spreading responsible both economically and environmentally action. Control quantities that is spread is therefore essential.

"Controlling the quantities" implied: remove the best of snow by mechanical means (scraping), treat only the ground with the right quantities of fondant, follow the recommended dosages with properly adjusted equipment.

Do not take these rules to consequences both immediate and long-term:

• Additional consumption if you overdose, but sometimes also in the case of under-dosing as second treatment may be necessary to get the full effectiveness.
• Additional expenditure by consumption fondant and payment of avoidable work hours.
• Immediate and negative environmental impact in the area near the ground treated and possibly longer term across the road.
• Deterioration of surfaces and longer-term pavement structure, damage structure by alkali-silica reaction, corrode road equipment works.

We see the fondants are not inert materials. To ensure the sustainability of this technique winter maintenance of roads, it is important to implement with hardware functioning especially well adjusted.

2. ODEMIE, UNIVERSAL TOOL FOR ALL SPREADERS

European standardization in the field of materials winter maintenance of the road network has seen in recent years, major advances; now two standards influence the design and use of spreaders. The first of these standards, EN 15597-1 [2], is especially broad but includes a “control by users” component with maximum deviations of the determination of spread products. Thus, the mass of dosage should not deviate from the nominal dose plus or minus 6%. The second standard, EN / TS 15597-2 [1], is more for builders spreaders. It requires them to submit their new equipment tests under defined conditions before marketing, guaranteeing a certain quality to buyers in terms of metering accuracy and proper distribution of fondant on the ground. These two standards, with their measurement methods and their requirements are the basis for defining the monitoring tool to be used regardless of the material tested.

Under the leadership of the Department of Transport Infrastructure of the Ministry of Ecology, Sustainable Development, Transport and Housing, CETE Normandie Centre and groups CECP to design and SEMR [3] for the board and experimentation, have designed a new control device based on the method and requirements described in these two European standards.

This new device can control the dosage of fondant for only salt or with brine in the case of bouillie. Details and test conditions are described in the standards NF EN 15597-1 [2] and EN / TS 15597-2 [1].

3. SYSTEM DESCRIPTION

The equipment consists of two receptacles with their own independent weighing system. One can control the weight of salt grain and the other for brine.
It is possible to check the salt grains alone or synchronized with brine.
A software drives the system.

3.1. A device for weighing the salt grains

The salt is extremely corrosive element, a polyester - fiberglass receptacle is used. Durable, light and unalterable, that weighing receptacle is very rigid and receives ejected by the spreading disc salt. Its walls are smooth for easy cleaning and it is anticorrosion.
The weighing receptacle is made by three sensors placed on a frame, each with a range of 100 kg.

Photo 2 - salting the receptacle weighing

3.2. A weighing device of brine

Brine is circulated through a pipe, which is derived to a second weighing receptacle. For brine, it uses a cylindrical polyethylene container having a volume of 0.1 m3 (photo2).
The weighing receptacle is made by a single sensor with a range of 100 kg.

Photo 3 - Weighing brine

3.3. The acquisition software

The acquisition software runs on a dedicated laptop computer. It pilot entire testing: saving settings, receiving sensor data weighing, calculation and reporting of results.

Data weighing sensors are sent wireless to the acquisition computer ("Bluetooth" system) thereby reducing corrosion problems on the computer connectors, source of major dysfunction.
The acquisition software adapts to the type of test to perform, alone or with salt brine, offering different screen pages needed.

Beyond the acquisition and data processing system, the acquisition software offers a range of features that make it a tool for editing and formatting file. Thus, it prioritizes and backup controls of a machine in a specific folder. Testing of a machine can be a custom report that we have selected the items. By storing all the test data, the acquisition software is a representative report controls on the material.

ODEMIE is a mobile system. Its elements are separated and handled by one or two people; it can be easily transported in a van from one place to another control. Spreaders being disseminated based on the territory the system can be worn heart control needs of contractors.

4. PRINCIPLE OF MEASUREMENT

This is to determine the dosage of material spread on a road surface with a length of 200m and a spreading width chosen for each test corresponding to the width of the floor being treated. Control of a spreader is static, using it for the simulated speed housings of electronic or computer commands spreaders. The simulated speed is possible to operate the entire control channel of the machine without moving.

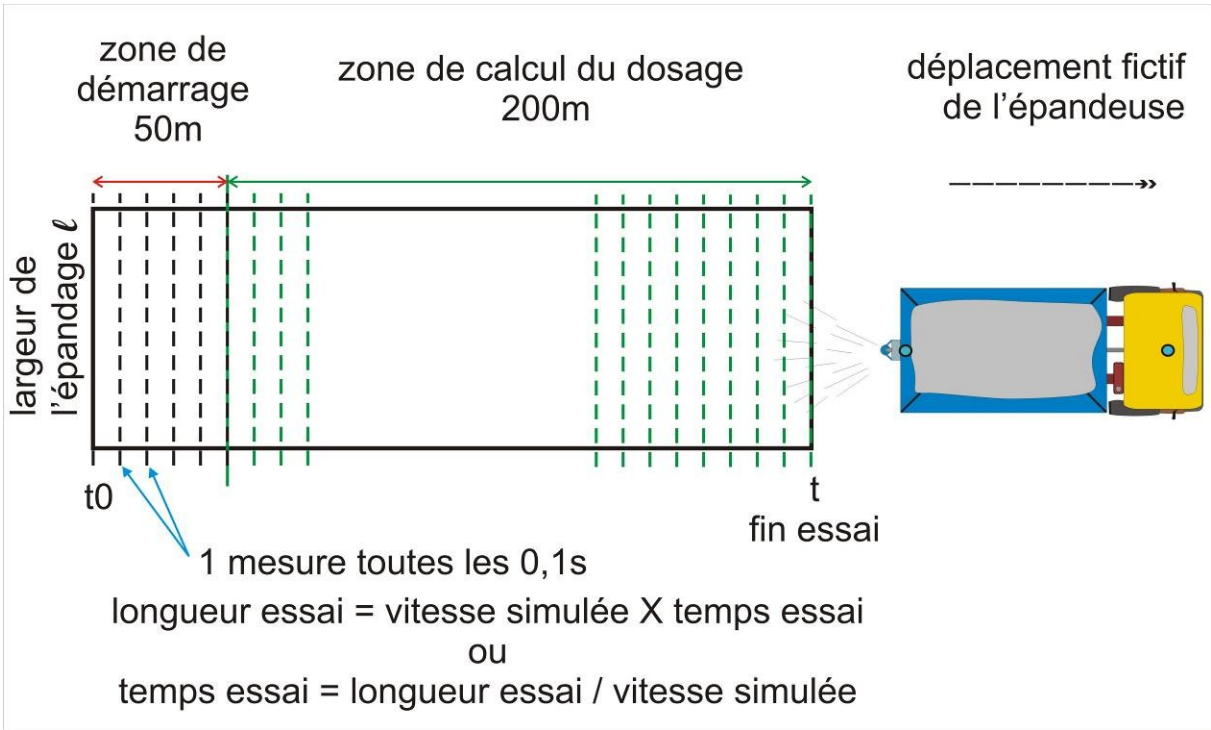

Figure 1 - Representation of the measurement performed by the system

A startup area of 50 m is added to the test of 200 m distance allowing the spreader, at the start-up, to have time to stabilize its operation (Figure 1). The acquisitions of the masses in bins are weighed at the start and finish at the end of the 250 m fictitious. The acquisitions are every 0.1 second (10Hz) according to DIN EN / TS 15597-2 [1]. The weights measured at the beginning and the end of the 200 m determines the average dosage of the machine.

Purchases of intermediate masses are used to calculate the dose on each sample of the 200 m. Assays of samples express the regularity of the machine, the more they are scattered over the machine is irregular. The new European standard EN / TS 15597-2 [1] defines the measurement method, considers that the correct operation of a spreader-icing, in terms of dosage and regularity of it, do must not exceed the following limits: Dosage using materials applied: ± 6% of the theoretical dose for fluxes. If the control is carried out with the brine, the ratio between the average dosage of granular salt and brine must be between ± 7% compared theoretical determinations;
Regularity of operation 90% of the measurement points (assays of samples) should be within a range between ± 40% of the previously calculated average dosage.

5. CONDUCT OF THE TEST

The spreader with its spreading disc reading is placed as close to the weighing receptacle salt. The centrifugal disc is then put in the working position in the weighing receptacle to receive the granular salt, a cover is arranged above the weighing receptacle. The injection pipe of the brine is derived from its normal point of injection to the weighing receptacle of the brine an extension may be required depending on the configuration.

The test parameters: strength, breadth of application, simulated speed are recorded by the acquisition software in the reference machine.

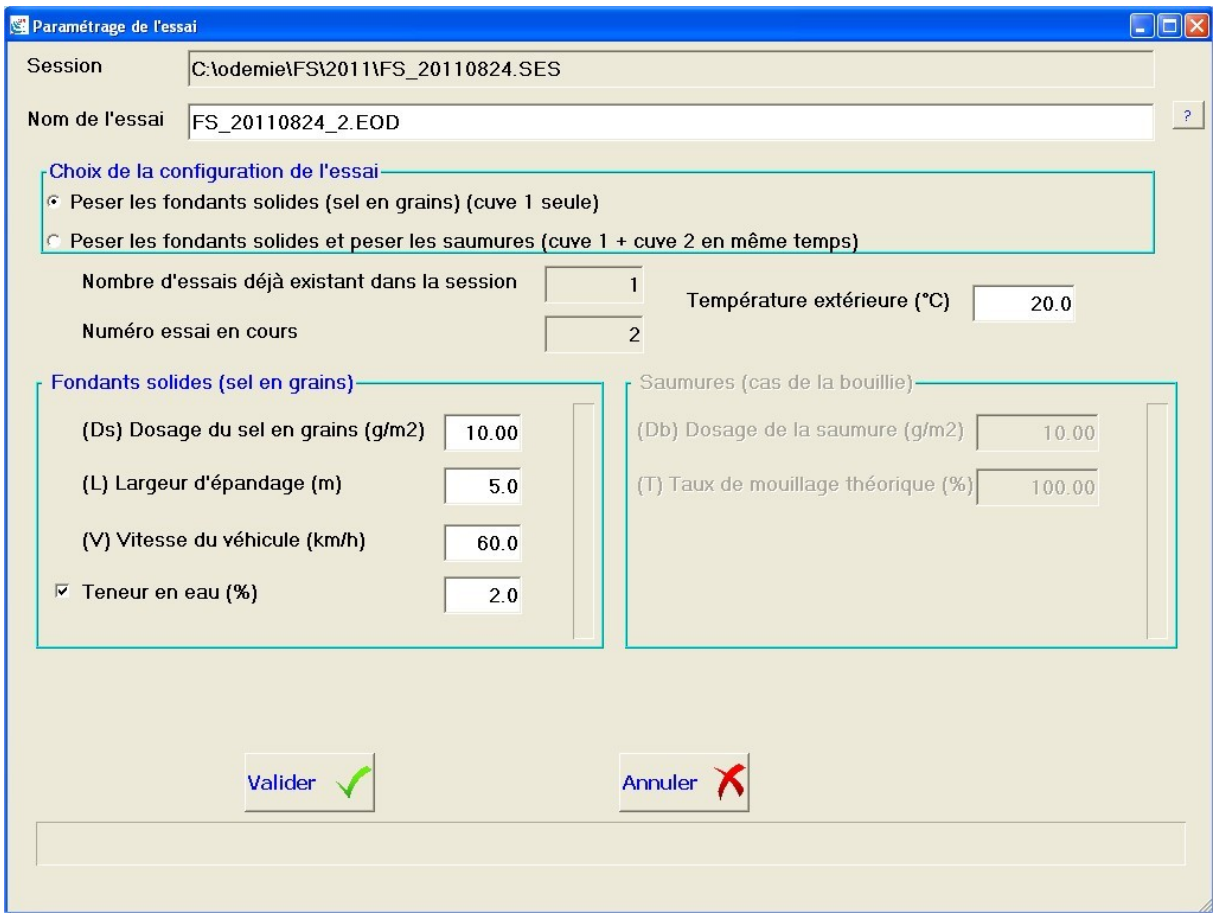

Figure 2 - The parameters of the test (here use granular salt)

The spreader is put into operation the melting and brine (if necessary) are ejected into the respective receptacle. Weighing receptacle is made at a frequency of 10Hz for the duration of application. At the end of the application data is collected, analyzed and various calculations. The results are displayed directly on the screen at then as graphs (Figure 3).

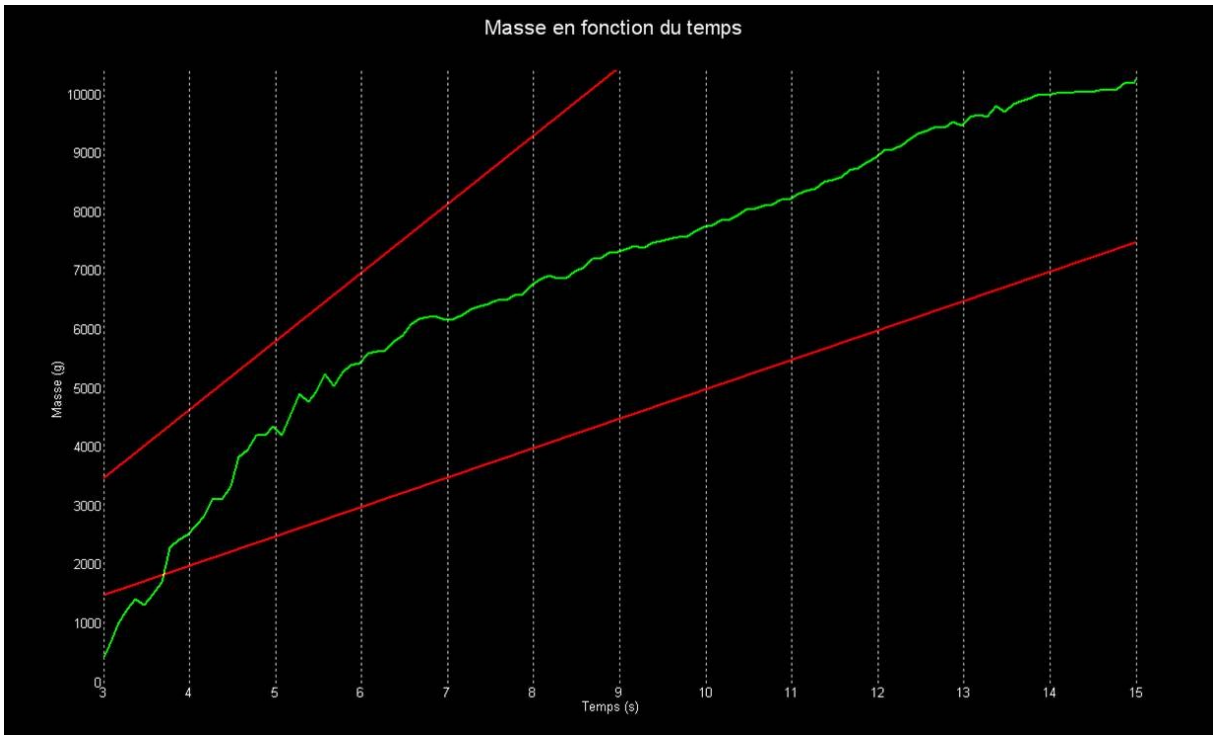

Figure 3 - Evolution of the mass of salt during a test

All test data is stored in the file on the spreader. Another test can then be performed with other parameters, if necessary. The data recorded in the machine file can be replayed or a posteriori be transferred to desktop tools. The acquisition software can print a test report with the various tests that you have selected.

6. CONCLUSION

The use of fluxes in large quantities each year requires them to be measured with the greatest precision possible in order to reduce their impact on the environment. It is therefore important to control the amount that is spread by controlling and adjusting spreaders-icing.

The ODEMIE equipment designed according to the requirements of the standard EN / TS 15597-2 [1] around elements of accurate weighing and powerful software used to verify the proper operation of spreaders fluxes in terms of dosage and regularity spread of materials. The software saves the results in machine records it produces test reports, it provides restitution and subsequent transfer of recorded data.

Suitable for all spreaders rotating disc it wants a universal tool for the control of these machines. Facilitating their adjustment at best, it perpetuates the processing technique of road networks with fluxing while preserving the environment.

[1] EN / TS 15597-2: Equipment viability winter-spreaders-Part 2: Requirements and test distribution
[2] EN 15597-1: Spreaders-Part 1: Requirements for metering and static testing on the dosage
[3] CETE : Centre d'Etude Technique de l'Equipement
CECP: Centre d'Etude et de Construction de Prototypes
SEMR : Station d'Essai de Matériel Routier