MODERN WINTER SERVICE IN SWITZERLAND – RESULTS AND EXAMPLES OF SWISS EXPERT COMMISSION OF VSS-RESEARCH AND STANDARDIZATION IN THE FIELD OF ROAD AND TRANSPORTATION

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ABSTRACT

The Swiss expert commission EK 6.02 of VSS is responsible for research and standardization in the field of winter maintenance in Switzerland. The commission is also working on the level of European Standardization. The special situation in Switzerland is in preparing standards and requirements for a practical winter service under a wide range of circumstances that means from big cities like Zurich or Basel with high traffic volumes to small touristic villages with special traffic restrictions, from lowland regions as the Rhine valley to mountainous regions with pass roads.

Generally the major goals of road operations are safety, environmental protection, economics and the necessary optimisation of these issues in delivering high quality winter maintenance services for the user of the infrastructure. For increasing road safety and optimizing traffic flow the needs are high quality prediction and sensor technologies as well as appropriate winter service treatments at the right time. Because of the complexness of meteorological, traffic and winter service processes, winter service in the Swiss topography needs a matrix of different winter service treatments and organisational requirements to increase road safety and improve traffic flow and environmental protection.

This paper will explain the way of a modern winter service in Switzerland and will show innovative winter service treatments and examples of winter measurements under special conditions. A selection of these examples is the following:

- Special winter service in pass opening (Grimsel pass, Susten pass,…)
- Use of wood chips on pedestrian ways
- Complex inner-city junction Bern Wankdorf with high traffic volume
- Use of molasses in winter service on highways (see presentation of Pablo Julia, ASTRA)

1. INTRODUCTION

Major goals of road operations are safety, environmental protection, economics and the necessary optimisation of these issues in delivering quality winter maintenance services. For increasing road safety the needs are high quality prediction and sensor technologies as well as appropriate winter service treatments at the right time. Next to road safety mobility is an important factor in local economies; uninterrupted traffic is a basic requirement. As a consequence, the standards of winter maintenance have become very high.

The Swiss expert commission EK 6.02 of VSS is responsible for research and standardization in the field of winter maintenance in Switzerland. The commission is also working on the level of European Standardization. According to that, the Swiss expert

commission is actually working on standards for general requirements for winter service organisation and management.

The special situation in Switzerland is the wide range of circumstances that means from big cities with high traffic volumes to small touristic villages with special traffic restrictions, from lowland regions to mountainous regions with pass roads. This paper will show the way of a modern winter service in with innovative winter service treatments and examples of winter measurements under special conditions.

2. CLIMATIC DIFFERENCES

According to topography with high mountains, valleys and lowlands the meteorology of Switzerland is quite complex for managing winter service. Here for example you can find a comparison between Kloten (canton Zurich) with 450 m over MSL and Davos (canton Graubünden) in mountainous region with 1560 m over MSL.

In canton Zurich winter service do often have the situation of wintry road conditions because of changing temperatures between + 5°C and – 5°C. Often changing temperatures around 0°C several times a day makes decisions more complicated. In Davos the general temperature level is much lower, that means also winter service treatments and decision making is different.

The following figure shows meteorological data from 2003 – 2012 for Kloten and Davos.

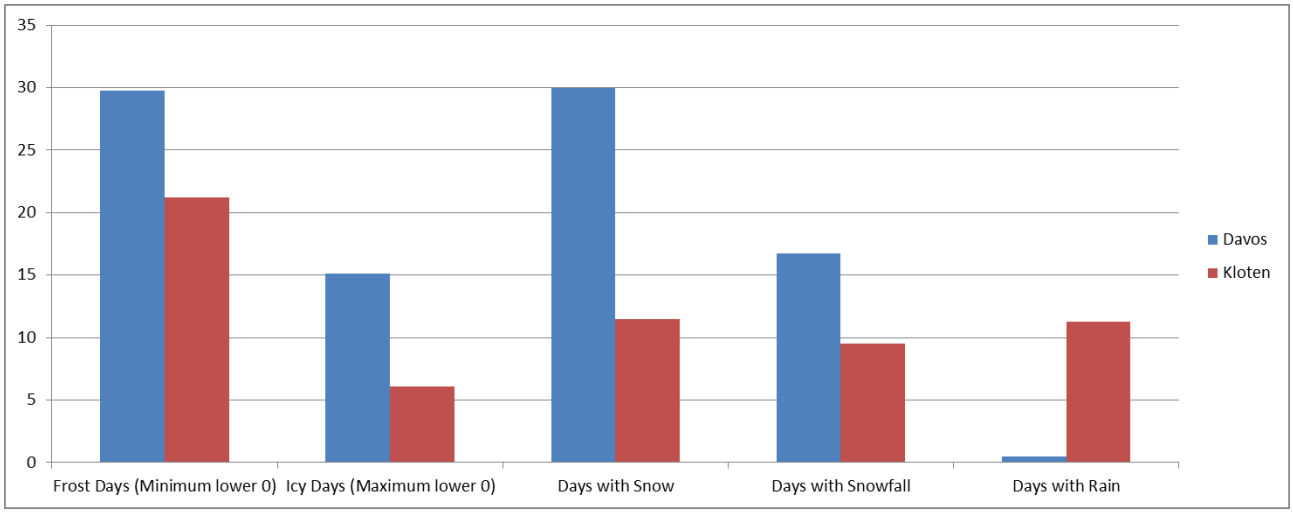

Figure 3 - Winter service on motorway in WinterthurComparison of Kloten and Davos (source Sadro Auer)

Figure 1 shows data of winter months December until February. In Davos nearly every day are temperatures below 0°C, in Kloten are only two third of days with temperatures below 0°C. Half of the days in Davos are icy days that mean temperatures remain below 0°C, in Kloten only 5 days of a month are icy days.

The same situation can be seen according precipitation. Days with precipitation in Davos are almost only snowfall; normally there are no rainy days in Davos in winter. In Kloten it is divided half in half in rain and snowfall. Davos is over the whole winter snow covered, in Kloten only one third of the time. That means that in certain situations it is more difficult for winter service to make the right decision, if and what kind of turnout is at what time necessary.

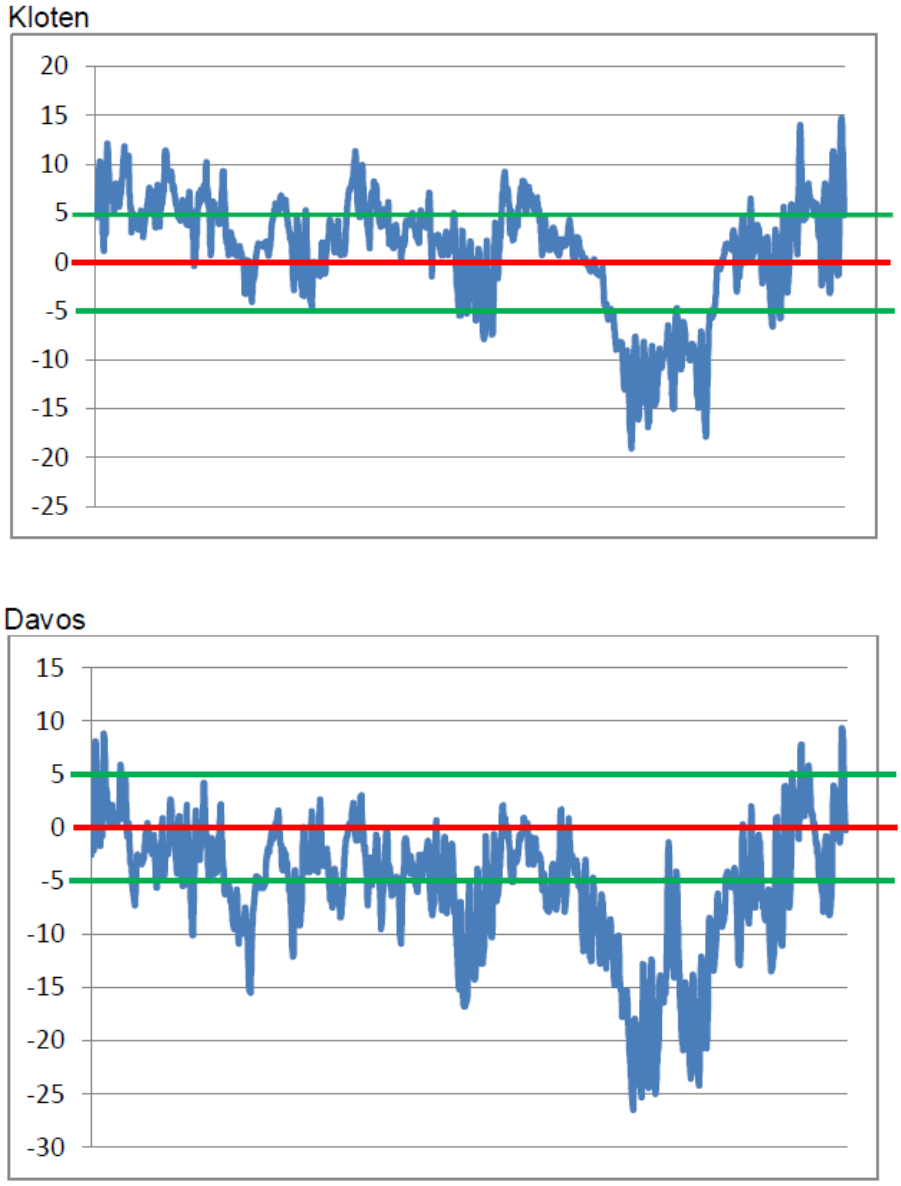

Figure 3 - Winter service on motorway in WinterthurTemperatures December – February in Kloten and Davos (source Sadro Auer)

Figure 2 shows the Temperatures in December 2011 until February 2012 in Kloten and Davos. The temperature data have a one hour resolution.
In the lower region Kloten temperatures are mainly between + 5°C and – 5°C and often crossing 0°C. In Davos over 85% are temperatures below 0°C, in Kloten only 30%.

These figures show clearly the different circumstances for decision making in winter maintenance. It is necessary by comparing winter service strategies to include meteorological data. And furthermore a differentiated knowledge about traffic flows under wintry road conditions is necessary to use those measures efficiently.

Figure 3 - Winter service on motorway in Winterthur

Figure 4 - Optimized salt loading in Pfäffikon

3. WINTER SERVICE TREATMENTS IN SWITZERLAND

This chapter will show innovative winter service treatments and examples of winter measurements under special conditions.

3.1 Pass Opening

A special winter service is the yearly opening of passes in Switzerland. For example the Grimsel Pass in Berner Oberland is today an important alpine road. The Grimsel Pass is passing a height of 2.164 m over sea level. The pass opening is normally in late spring in May / June. The snow depth can be over 10 m.

There are special plans of procedure to avoid any risks while and after pass opening. The opening is organized in collaboration with different authorities as for example the Institute for Snow and Avalanche Research.

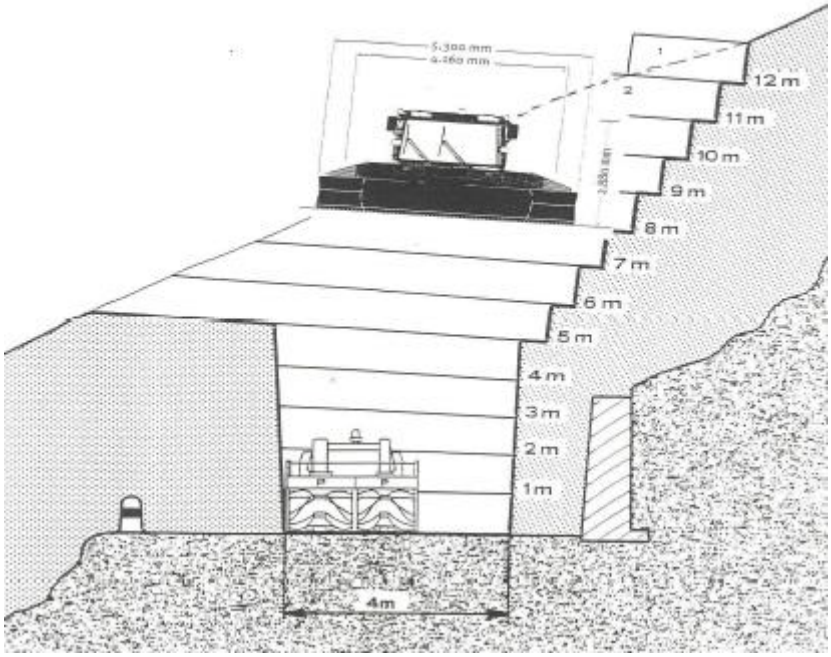

Figure 5 - Procedure of pass opening

3.2 Use of wood chips on pedestrian ways

Public works of the City of La Chaux-de-Fonds, in Switzerland, developed an ecological material, intended mainly for the winter treatment of the pedestrian surfaces (sidewalks, trails, public places…). It can also be used on circulated roads, with light traffic (entries of garage, residential zones…).

This product is non-skid, which makes pedestrian trails and surfaces safe. The intention is to offer an alternative to the use of salt and fine mineral gravel, for the treatment of snow-covered or icy surfaces.

The product is made of wood chips, 5 to 20 mm long and few millimeters thick. These chips are impregnated of a brine (normally containing Magnesium chloride), and then dried before conditioning. However, the water content of the conditioned product is over 40%,

which confers a fast reactivity in contact with the snow-covered or icy pavement, in order to ensure fast incrustation.

Figure 6 - Treated wood chips on snow-covered surface

The product, which is internationally patented, offers the following significant advantages:

- Long-lasting action, in absence of snow precipitations: even during few precipitations, treated wood chips dissolve snow, above them. Thanks to its low apparent bulk density, wood chips tend to stay on the surface.
- Comfort and safety: the shape of the chips ensures an excellent stability and adherence to the pedestrian. The salt, impregnated in the chips, makes it possible those to be encrusted in snow or ice. Thus, they do not roll nor slip under the feet (or wheels of vehicles).
- Easy use: Chips can be spread with traditional mechanical means (gravel or salt spreaders). The material is easy to handle, while light.
- Small environmental impact: the product does not generate dust during spreading. It is biodegradable. The brine used for chips impregnation, usually magnesium chloride, has a neutral pH. It is thus little corrosive. As the content of salt in the chips is low, volume of the rejections in nature is low too. Sweeping of the chips projected in gardens, flower beds or road shoulders, under the action of the snowploughs or the snow-blowers, is not required.
- Respectful of our domestic animals: the shape of the chips (flat), the nature of the material (wood) and the small percentage of salt, do not wound the legs of the domestic animals.

(Turtschy/Mucaria, 2010)

3.3 Complex inner-city junction Bern Wankdorf with high traffic volume

The junction at Bern Wankdorf is a complex inner-city junction with high traffic volume. The planning of the renewing the junction has had following goals:

- Avoiding of congestions to the motorway
- Avoiding traffic through residential zone

The average daily traffic at Bern-Wankdorf is around 65.000 – 70.000 vehicles.

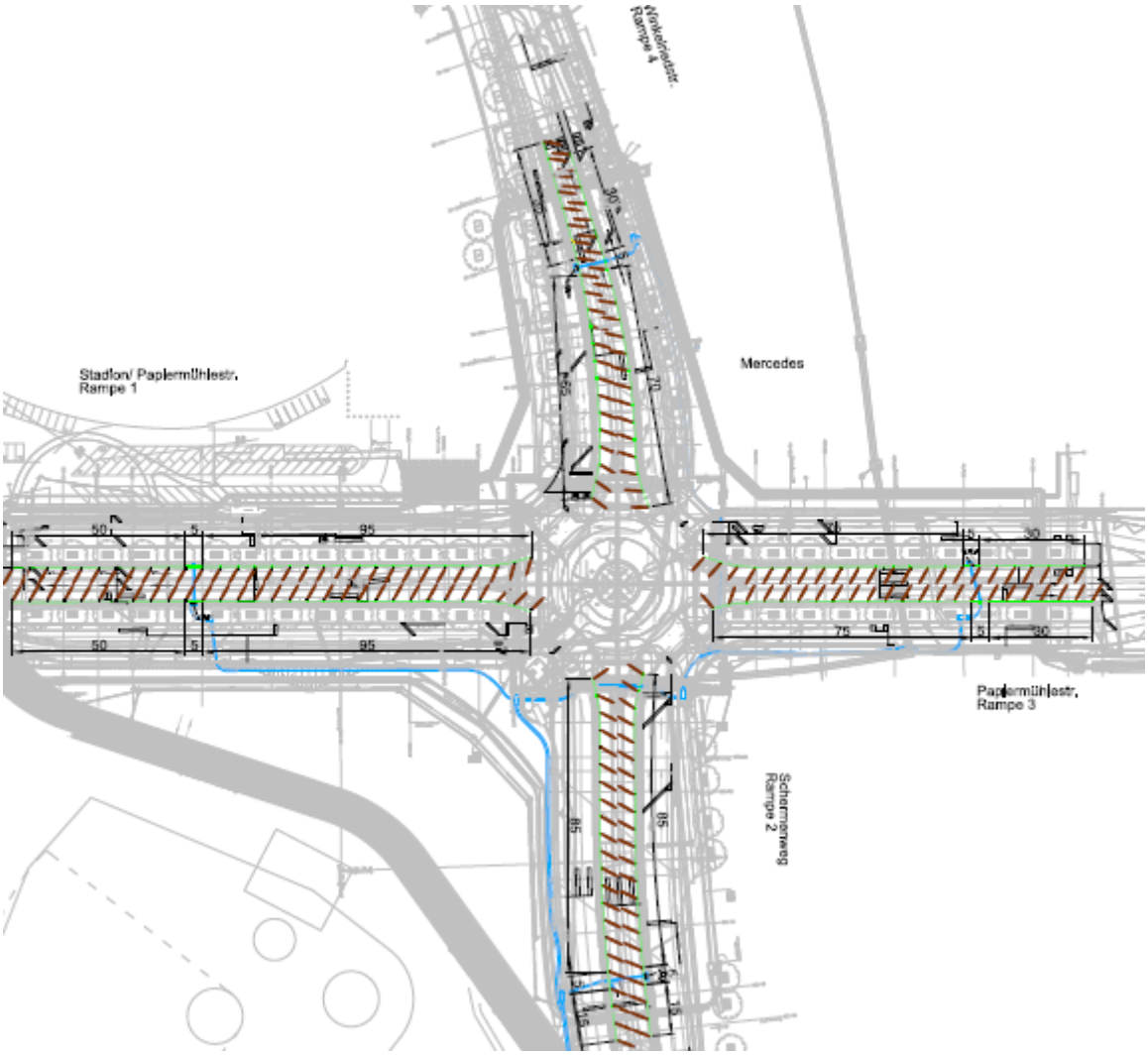

Figure 7 - city junction Bern - Wankdorf

Because of the importance of this junction it is absolutely necessary to avoid any kind of traffic restrictions, for example because of wintry road conditions. Therefor a FAST (Fixed Automated Spray Technology) System was installed at all ramps of this junction.

Fixed Automated Spray Technology Systems (FAST) are a proven method of increasing road safety and improving the flow of traffic in critical areas. A particular benefit is the reduction of ice-related accidents.

Fixed Automated Spray Technology Systems are automatically controlled by ice early warning systems (RWIS) and they spray the road surface with a deicing agent before ice can form. During snowfalls, this prevents the accretion of snow in a compact layer on the road surface; in other words, the snow remains sufficiently soft for removal during standard winter maintenance operations.
The spraying period can be adjusted as required (from 30 seconds to 3 minutes), thus ensuring that the optimum amount of de-icing agent is applied. With various spraying

programs, a number of spray nozzles or multiple spraying operations, the system can be perfectly adapted to suit the existing conditions. This guarantees the efficient, cost-effective and ecological spreading of the de-icing agent, which can be triggered manually, by remote control or automatically via measuring stations in the event of an icing hazard.

The principal application for Fixed Automated Spray Technology Systems is on bridges, slopes, stretches of road covered with open-pore asphalt (OPA), places showing cases of ice formation (areas in shadows, roads, on embankments or flyovers), construction site or ramps to multi-storey car parks.

Numerous studies have also confirmed the economic efficiency of Fixed Automated Spray Technology Systems

Figure 8 - Spay head of FAST-System (left) and situation after spraying at Bern-Wankdorf in Dec. 2012 (right)