

# Winter Service in Scotland



Improved Winter Resilience

Martin Thomson, Transport Scotland

29 February 2016

# Top Lines

Transport Scotland set out a programme to make its winter service more resilient following the challenging conditions experienced in December 2010, when Scotland was in the grip of the worst snow and ice conditions since the 1960s. That winter tested Scotland's preparedness to an unprecedented degree and although we had systems in place, these were tested beyond their limits.

Additional gritters, greater use of technology and getting information to people 'on the move' are just a few of the ways we have strengthened the **Winter Treatments**, **Decision Making** and **Communication with Road Users**. The enhanced preparedness is also beneficial outside of winter, as the procedures and practices such as the Multi Agency Response Team (MART) improve our resilience for other severe weather events and major events such as the Commonwealth Games Queens Baton relay and the 2014 Ryder Cup.

# **Winter Treatments**

# Treatments

Winter storms will cause disruption on our roads. No road authority can guarantee to keep roads free from ice or snow. With the actions we have taken and with people planning ahead, together we can get Scotland moving again.

From 1 October to 15 May, a 24-hour dedicated winter maintenance service operates on all Scotland's trunk roads.

To carry out winter service we have:

- 205 gritters and ploughs, averaging one gritter/plough per 17km of the trunk road network.
- 74% of the total winter fleet less than three years old.
- 46 depots providing winter service plant and facilities.
- 50 units for footways.
- 500+ Operating Company staff available to undertake winter service duties.



# Winter Patrols

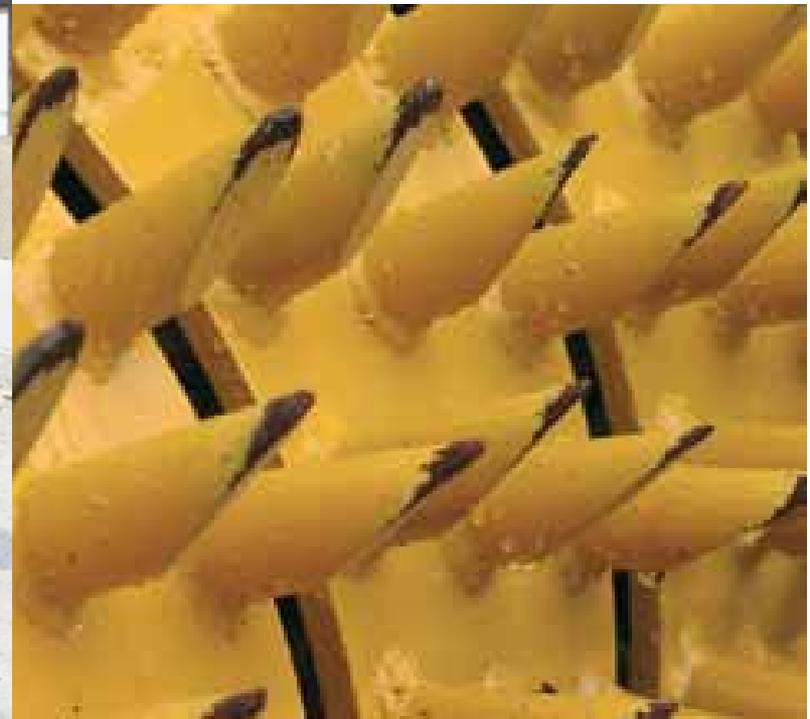
Winter Patrols were introduced to strengthen winter resilience through a variety of different ways.

- Reduce disruption from incidents by providing a 30 minute call-out.
- Reduce the likelihood of disruption by gathering real-time temperature data.
- Reduce the likelihood of disruption through the intelligent treatment of cold spots and inclines.
- 52 plough spreaders in 2015/16 carrying out patrols.



# Innovative Plant

Raiko Icebreaker is a freely rotating spiked roller system that fits to a spreader vehicle much like a snow plough would. In Scandinavia it is a proven tool for removing ice and hard packed snow from the road.





# Innovative Plant

**Tracked Snow Blower**



# **Decision Making**



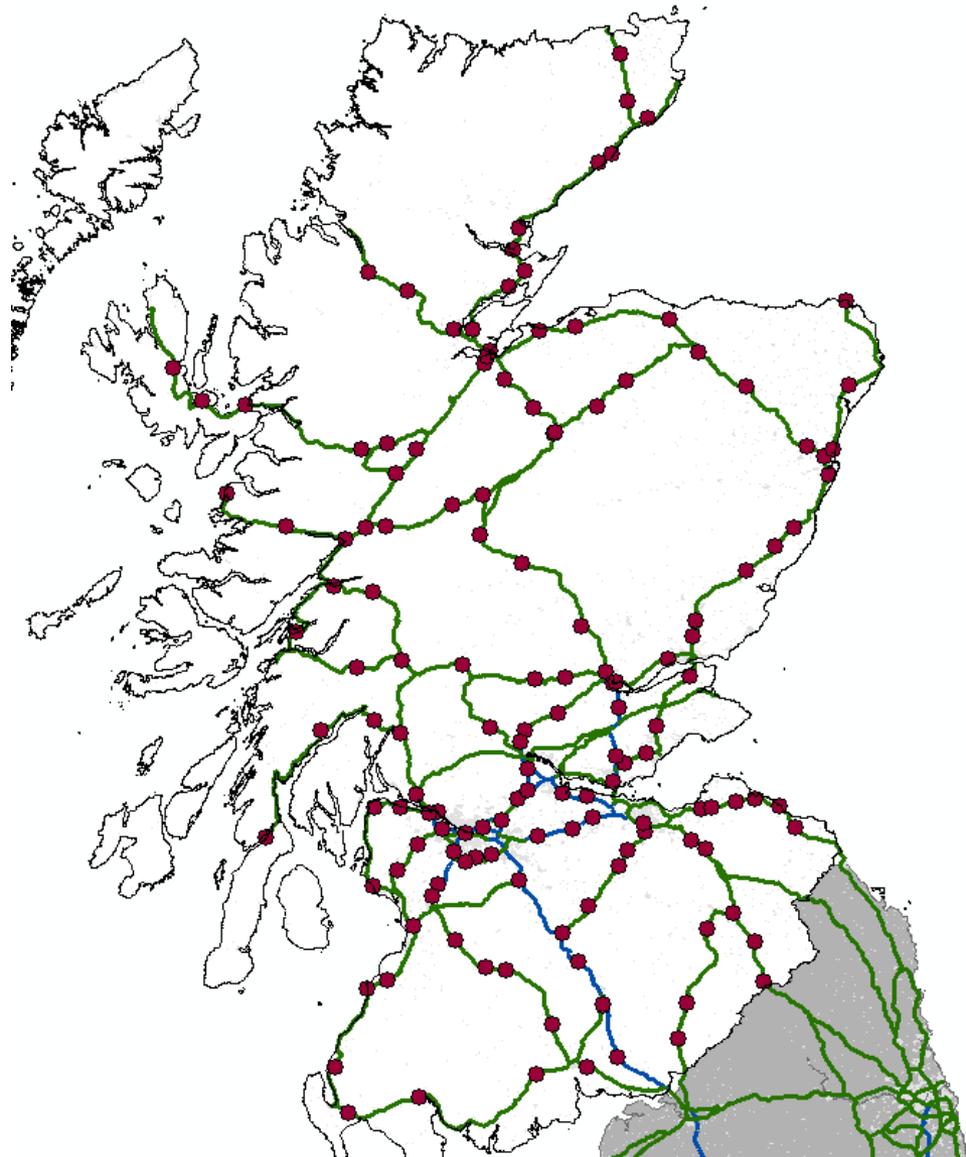
## Strategic Depots



M74 Depot, Polmadie – Oatlands House

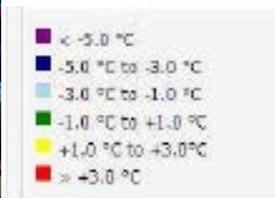
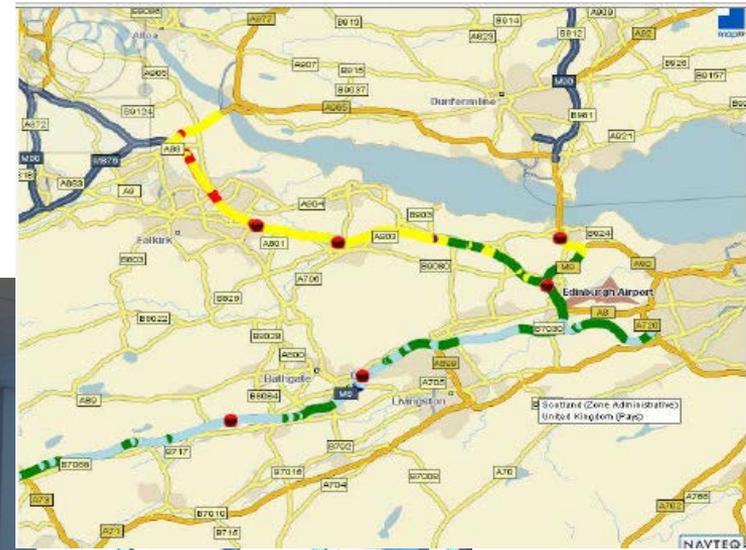
# Additional Ice Alert Stations

- 160 weather stations on the trunk road network.
- Annually review the existing weather sensor station network locations, spread, coverage and sensor configuration.
- Liaise with weather service providers and weather sensor station suppliers.





# Mobile Sensors



**Salt**



# Salt

- The winter service includes precautionary salting of all carriageways and the more important footways in advance of forecast ice and snow. Since 2007-08, pre-wetted salting has been used on all our Trunk Roads.
- A record 691,000 tonnes spread on Scotland's roads throughout the winter period of 2012/13 and 645,000 tonnes in 2010/11.

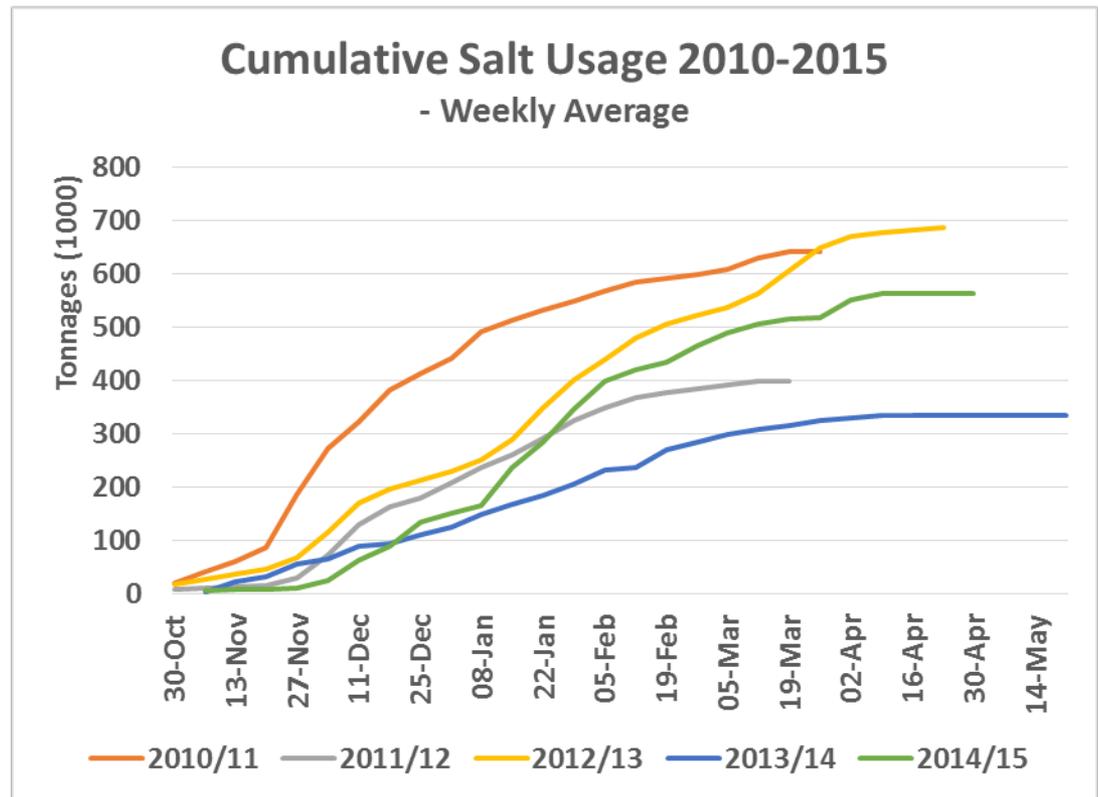
## **Salt Stocks**

- Total salt in stock in Scotland on 5<sup>th</sup> November 2014 was 617,100 tonnes.
- 85,000 tonnes of strategic salt in reserve; which was procured in 2011.

# Salt Usage

## Salt Usage (tonnes)

- 2010/11 – 645,000
- 2011/12 – 425,000
- 2012/13 – 691,000
- 2013/14 – 335,603
- 2014/15 – 563,201





## Alternative De-icing Materials

For Treatments in Extreme Cold, Transport Scotland developed guidance on the use of alternative de-icers that work at temperatures below which road salt (sodium chloride) becomes less effective; which is typically down to minus 7 or 8 degrees. The guidance provides advice the Trunk Road Operating Companies on the storage, management and application of a range of alternative de-icers.

TS has increased stocks of EcoThaw (25,000 litres, Safecote (44,000 litres) and Magnesium Chloride (76,000 litres) for the 2015/16 winter season.

No alternative de-icers have been required to be used to date.

# **Communications**

# Traffic Scotland National Control Centre

- Officially opened on 18<sup>th</sup> April 2013 by Deputy First Minister.
- Primary aim of the TSNCC is for closer working with other agencies such as Police Scotland and the Meteorological (MET) Office in a MART.
- Designated MET Office presence within the Control Room of the new TSNCC for the 2013/14 winter season.



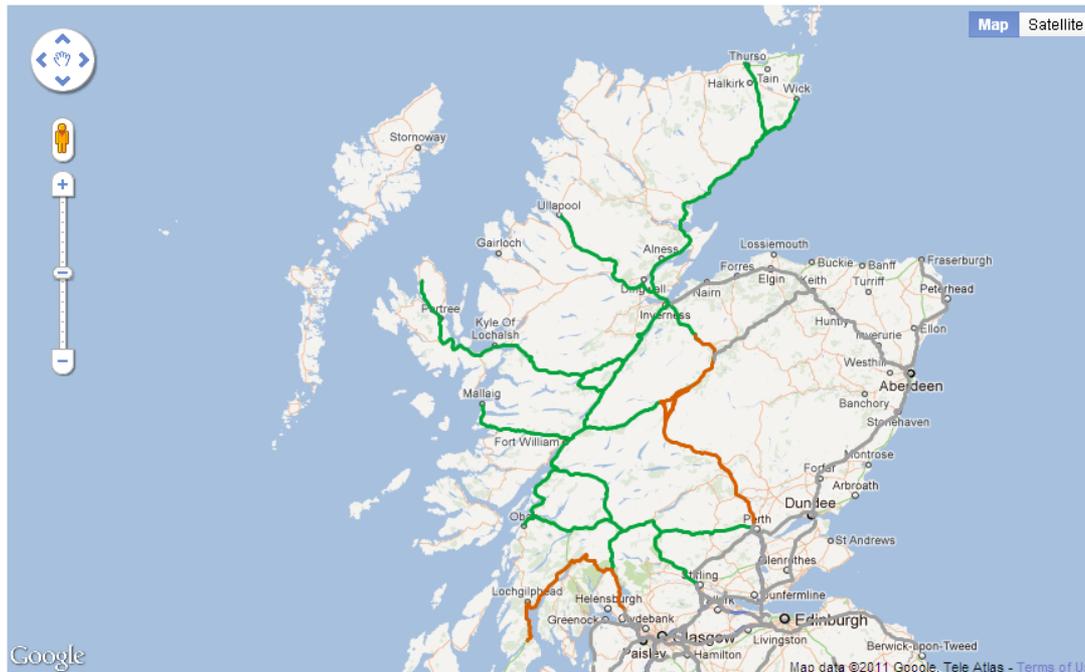
# Road User Information Services

## Gritters & Winter Salt Treatment

List View **Map View** Feedback

The Gritters & Winter Salt Treatment map view page provides details of planned winter salt treatment across Scotland following the mid-day forecast for that period. Using the layer options on the left it is possible to view all routes for which winter salt treatments are planned or not planned. Routes for which no treatment plan data has been provided can also be viewed.

Clicking on a route will provide further information. Further information is also available relating to the number of winter service vehicles currently active on the network. This information is updated daily.



## Gritters

Dependent on the forecast weather conditions, gritters are deployed to provide precautionary salt treatments to roads. Gritters are also deployed to patrol specific routes to monitor conditions and provide salt treatments as required.

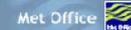
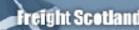
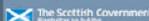
Gritters for Salt Treatment	17
Gritters for Winter Patrol	0
<b>Planned number of gritters to be deployed</b>	<b>17</b>

## Footway Treatment

Salting or other treatment of footways.

Footway Treatment	0
-------------------	---

**Disclaimer**  
Please note that this information is indicative only. The Winter Service decision makers continually monitor the weather forecasts and actual conditions. The actual treatments provided will be amended as forecasts and conditions change but this page will not be updated to reflect operational changes.





**BEAR Scotland**

@BEAR\_Scotland



#BEARwinter No action tonight.  
NE and SE Trunk Road  
temperatures above freezing. To  
learn more about winter service  
see [trafficscotland.org/  
wintertreatment](http://trafficscotland.org/wintertreatment)

1 day ago via web



Home



Connect



Discover



Me



# Publishing of Weather Sensor Station Data & Daily Action Plans

- Traffic Information
  - Current Incidents
  - Roadworks
  - Planned Roadworks
  - Journey Times
  - Planned Events
  - Park and Ride
  - Variable Message Signs
  - Weather
  - Weather Stations

- Layers
  - Current Incidents
  - Weather Incidents
  - Roadworks
  - Queue
  - Planned Roadworks
  - Current Events
  - Planned Events
  - Park And Ride
  - Weather Stations

Traffic Info Map

List View Map View **Google Map View**

Map Satellite Hybrid

Details Location

**Weather Station**

Name	A9 Slochd
Date Last Updated	26 Apr 2012 10:00
Road Surface State	Wet
Road Surface Temperature	6.5°C
Air Temperature	3.4°C

POWERED BY Google

2 mi / 5 km

Map data ©2012 Google - Terms of Use



Rolling travel news radio station containing:

- Current live traffic information
- Current live public transport information
- Planned roadworks
- Planned events

The radio station can be made available on various platforms:

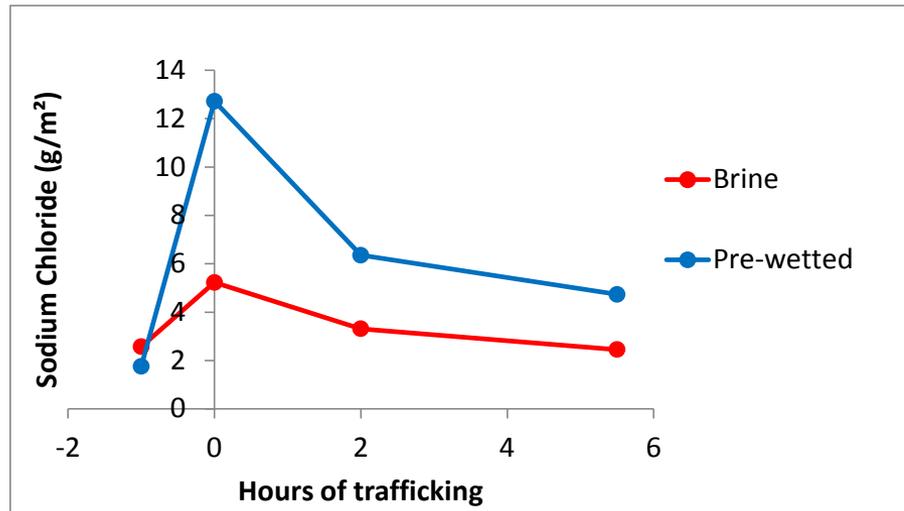
- Online via the Traffic Scotland Website
- Online via mobile phone applications
- Via standard telephone connection
- On FM and AM via community radio



# **Innovations & Research**

# Brine v Pre-Wetted Salt Trials – Phase 1

- For winter salt treatments, roads authorities in Europe and North America are increasing their use liquid only spreading to prevent ice forming on roads. In Scotland most authorities spread dry salt while the trunk roads are treated with a pre-wetted salt.
- Recent studies from Europe have compared the durability of liquid brine only spreading to pre-wetted salt. They concluded that for precautionary salt treatments, especially on dry and moist surfaces that sodium chloride brine only spreading requires less salt and stays longer on the surface.
- Transport Scotland have promoted this research, along with the Highways Agency, through the National Winter Service Research Group (NWSRG). Three live trials were undertaken in the UK during the 2014/15 winter season.
- Analysis of the trial results has recently been completed with the findings and recommendations published in October 2015.



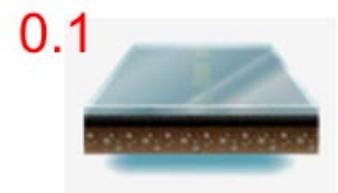
# Brine v Pre-Wetted Salt Trials – Phase 2

- Findings and recommendations from Phase 1 acknowledged that further work is required in order to examine the effectiveness of brine only treatments across a range of typical winter conditions.
- On this basis Transport Scotland are undertaking a second phase of live trials for the 2015/16 winter season; which will develop and enhance our research into understanding liquid performance on UK/Scotland's roads. These trials went live on Tuesday 9 February 2016 across three sites in Scotland.
- The A9 (HRA) and A77 (SMA) comprise sections of dual carriageway, where brine spreading and pre-wetted spreading will be carried out on adjacent carriageways.
- The A702 is a single carriageway section where brine and pre-wetted spreading will be carried out on adjacent sections under similar conditions.

# Idaho Transportation Department (ITD) Storm Performance Index

VAISALA		Storm Performance Index Report		Generation date 31-Oct-2012 09:03									
		24-Oct-2012 09:03 — 31-Oct-2012 09:03											
Storm Performance Index Legend													
0		Successfully treated											
0.00 - 0.30		Significantly accelerated grip recovery											
0.31 - 0.49		Some success at grip recovery											
0.50 - 0.69		Very little success at deicing											
0.70 -		Limited maintenance or no deicer success											
		Observation data / parameter missing or temp is below threshold											
Station	Date	Time Range	Event	Duration (hours)	Max Wind Speed (mph)	Max Ice Layer (mm)	Max Snow Layer (mm)	Max Water Layer (mm)	Min Surface Temp (°F)	Severity Index	Performance Index	Mobility Index	Comments
D5 - Malad Summit													
	26-Oct-2012	04:30 - 10:00	FROST treated	5.50	5.59	0.00	0.00	0.02	26.06	17.12	0	100%	
D6 - Idaho Falls													
	25-Oct-2012	02:45 - 04:45	GRIP< 6	2.00	3.80	0.14	0.87	0.21	30.56	14.49	0.14	38%	
	25-Oct-2012	04:45 - 06:00	TREATED	1.25	2.91	0.00	0.00	1.18	31.28	13.68	0		
D6 - Lost Trail Pass													
	24-Oct-2012	09:15 - 10:30	GRIP< 6	1.25	5.14	0.31	0.31	0.12	14.72	25.84	0.05	55%	
	24-Oct-2012	10:30 - 12:00	TREATED	1.50	5.82	0.15	0.04	1.15	19.76	22.15	0		
	25-Oct-2012	02:00 - 11:15	GRIP< 6	9.25	4.47	0.13	0.81	0.00	18.50	21.50	0.43		
	25-Oct-2012	11:15 - 14:00	TREATED	2.75	7.61	0.08	0.16	1.96	20.66	24.09	0	47%	
	25-Oct-2012	14:00 - 23:00	GRIP< 6	9.00	8.05	0.07	0.75	2.36	4.82	72.65	0.12		
	25-Oct-2012	23:00 - 12:45	TREATED	13.75	7.61	0.14	0.00	1.82	16.16	27.99	0		
	26-Oct-2012	15:00 - 16:00	TREATED	1.00	5.14	0.10	0.01	0.34	28.76	15.92	0	4%	
	26-Oct-2012	16:00 - 13:45	GRIP< 6	21.75	7.38	0.26	0.85	3.20	23.00	23.63	0.92		
	27-Oct-2012	16:30 - 17:30	TREATED	1.00	5.59	0.04	0.02	0.27	30.38	15.74	0	33%	
	27-Oct-2012	17:30 - 19:30	GRIP< 6	2.00	6.71	0.11	0.63	0.00	28.22	17.97	0.11		
	27-Oct-2012	22:45 - 06:15	GRIP< 6	7.50	7.83	0.06	0.82	0.00	28.58	19.15	0.39	0%	
	28-Oct-2012	08:15 - 09:15	GRIP< 6	1.00	4.92	0.04	0.78	0.00	28.94	16.07	0.08	0%	
	29-Oct-2012	23:00 - 05:00	TREATED	6.00	4.25	0.00	0.00	0.16	30.38	14.29	0		
	30-Oct-2012	05:00 - 10:00	GRIP< 6	5.00	5.59	0.15	0.05	0.01	27.68	16.58	0.30	57%	
	30-Oct-2012	10:00 - 10:30	TREATED	0.50	8.50	0.00	0.00	0.17	28.04	19.37	0		

GRIP



Example of the ITD Storm Performance Index as displayed in Vaisala RoadDSS software.

### Storm Performance Index Legend

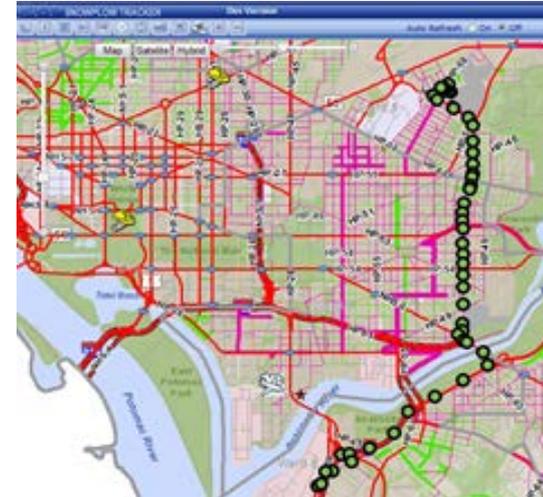
0	Successfully treated
0.00 - 0.30	Significantly accelerated grip recovery
0.31 - 0.49	Some success at grip recovery
0.50 - 0.69	Very little success at deicing
0.70 -	Limited maintenance or no deicer success
	Observation data / parameter missing or temp is below threshold



Legend of the ITD index showing how well each part of the event was treated.

# Innovation & Research

- We are currently investigating the feasibility of ‘live tracking’ of winter service plant and making the data available to the general public via the Traffic Scotland web-site. Proof of concept has been completed and hopefully trial before the end of this winter season.
- This coincides with further research where we are liaising with Iowa Department of Transportation to explore the possibility of utilising and adapting their “Plow Cam iOS App” or similar for use on our gritters.



# **Multi-Agency Response**

# MART History

- 6 December 2010: Game Changer
- Lack of intelligence on local conditions
- 6 Point Plan
  - Store salt/grit at key locations on trunk road network
  - Use traffic management to enable diversions
  - Adapt OC vehicles to deal with snow
  - Remove trunk/motorway central barriers
  - Work with Police on 'stacking' HGVs
  - Provide winter fleet with welfare kits e.g. blankets, chocolate and water
- Created end of winter 2010/11



# MART Role

- Joint process between Transport Scotland and Police Scotland. Requires the agreement of both to set up.
- Enables a strategic overview of event and incident handling on behalf of all the organisations involved.
- Works with TS Resilience Room to provide briefings directly to Scottish Ministers, and SGoRR (SG Resilience Room).
- Only has jurisdiction for transport modes covered by Transport Scotland i.e. trunk roads, rail etc. It does not cover local roads which are the remit of local authorities.
- The existing well-defined relationships between the partners will continue to deal with the incident-specific command and control.

# MART Partners

## MART Partners

- Police Scotland
- Met Office
- Road Operating Companies & DBFOs
- Network Rail
- Scotrail
- Freight Transport & Road Haulage Associations
- SCOTS
- CPT (Confederation of Public Transport)

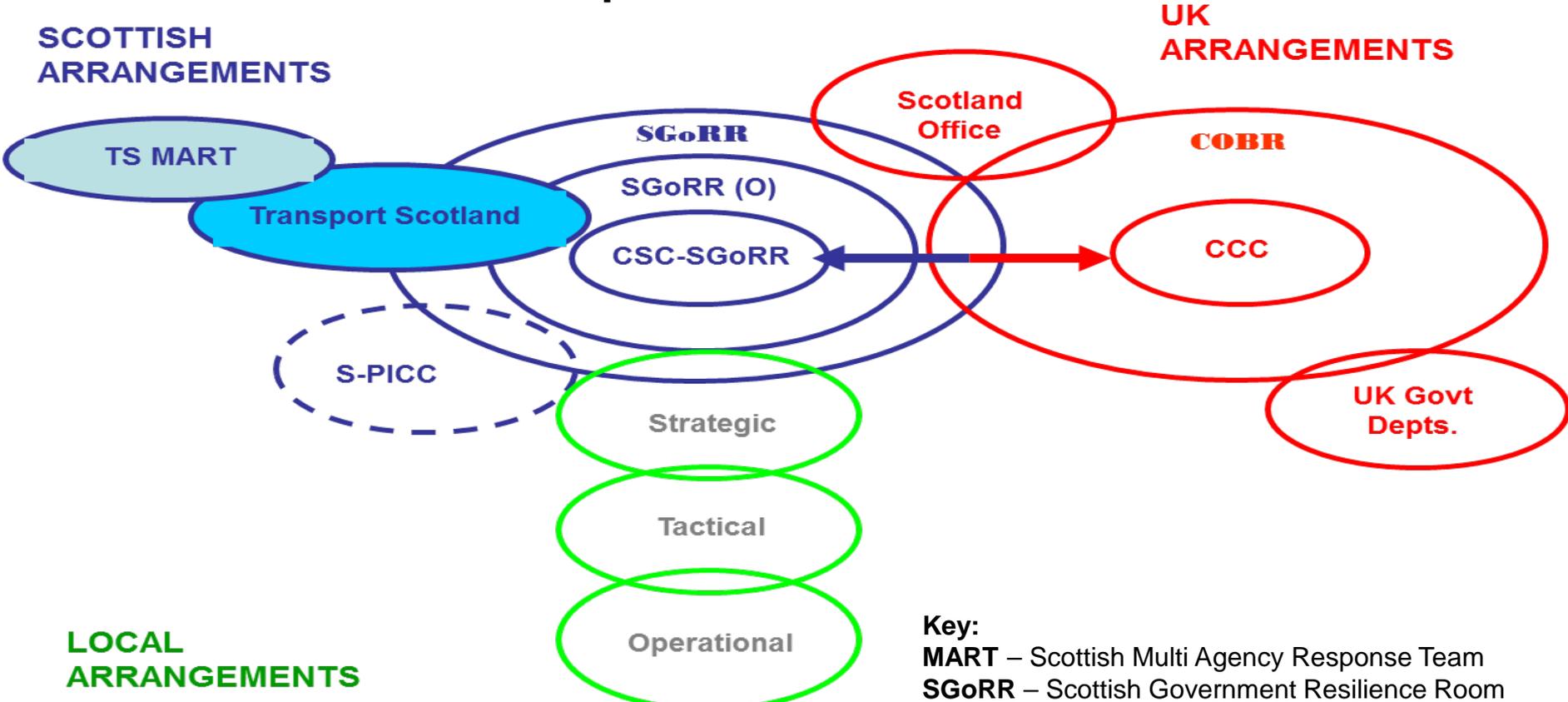


## External Engagement/Partners

- Scottish Government
- Scottish Local Authorities
- Police, Fire & Ambulance
- NHS Scotland
- Scottish Environment Protection Agency
- Power & telecoms utilities
- Scottish Water
- HSE
- Voluntary Sector



# Response Structure

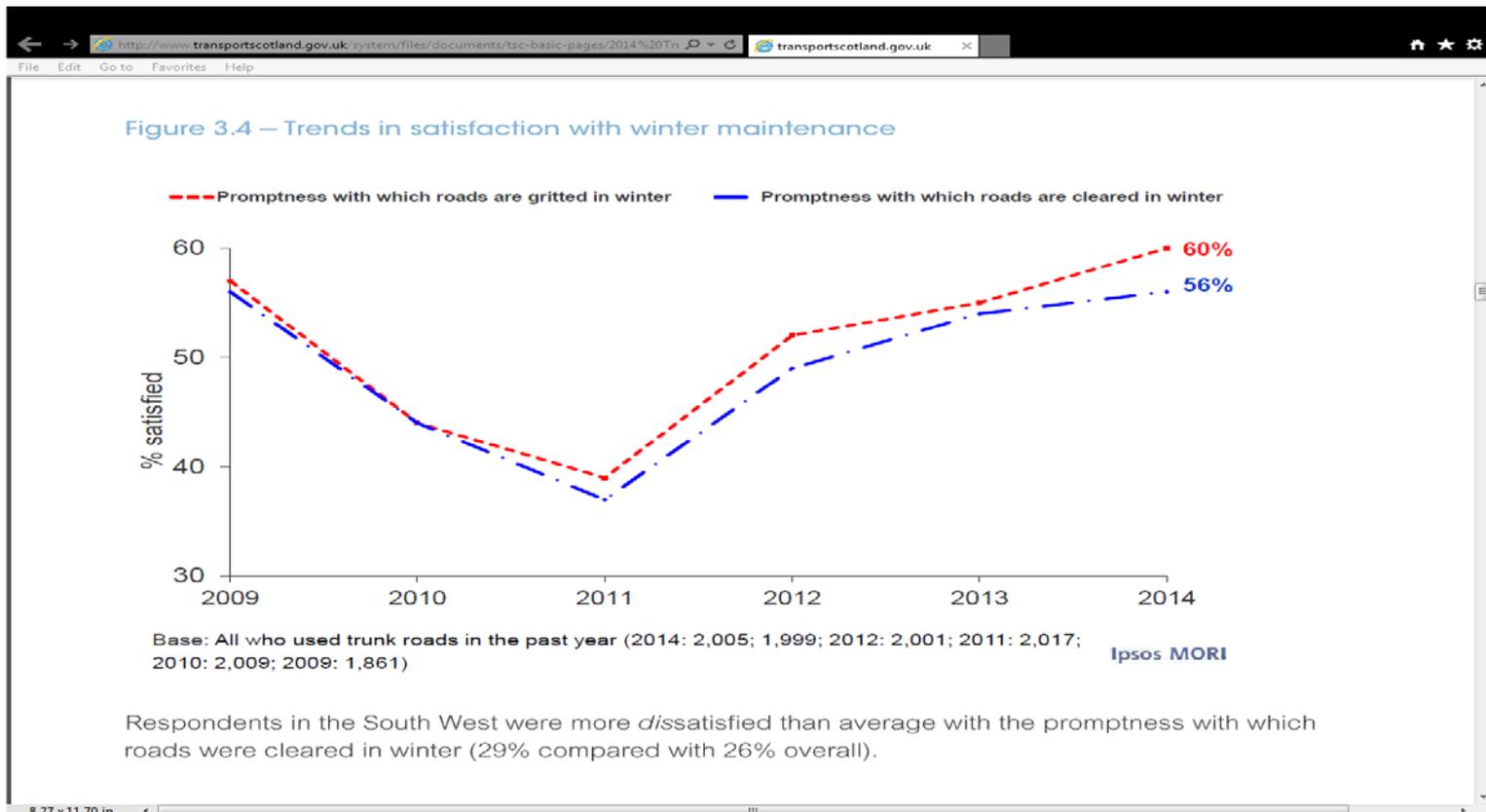


- Key:**
- MART** – Scottish Multi Agency Response Team
  - SGoRR** – Scottish Government Resilience Room
  - CSC** – Cabinet Sub-Committee
  - S-PICC** – Scottish Police Information and Co-ordination Centre
  - COBR** – Cabinet Office Briefing Room
  - CCC** – Civil Contingencies Committee

# **Public Perception of Winter Service?**

# Survey of Trunk Road Users

Every year since 2009, Ipsos MORI has undertaken a survey among trunk road users in Scotland. The aim of the survey is to examine users' views of the work and services provided by TS in relation to the trunk road network.



**Challenge**

5 January 2011 Last updated at 17:20



## Last December UK's coldest for 100 years



By Richard Black

Environment correspondent, BBC News

Last month was the coldest December documented for the UK since nationwide records began 100 years ago, the Met Office has confirmed.

For central England, it was the second coldest December since 1659.



fluid attractions

3 April 2013 Last updated at 02:37



## March weather was second coldest on record - Met Office

Freezing temperatures in March made it the UK's joint second coldest since records began more than 100 years ago, the Met Office has said.

The mean temperature was just 2.2C (36F) - more than 3C colder than the long-term monthly average.

Last month matched the average temperature in March 1947 - only March 1962 was colder at 1.9C (35F).

March was also much drier than usual with 62.1mm (2.4in) of rain, 65% of the historical average for the month.

Scotland was yet more parched with only 35% of its normal downpours.

The amount of sunshine was slightly down for the UK with 82.9 hours for the month which is 81% of the average.

Among the UK's nations, average temperatures in March were 2.6 °C in England, 1.3 °C in Scotland, 2.4 °C in Wales and 2.8 °C in Northern Ireland.

In what the Met Office described as an "unusual turn", March 2013 was colder than the three preceding winter months. This last happened in 1975.

Forecasters said the cold, dry conditions were set to continue for the time being - but milder and more unsettled weather was expected next



Snow and plunging temperatures have caused chaos through March

### Related Stories

Milder weather on the way?

Ill wind: Winter winners and losers

Rules on burial of animals relaxed

### Coldest March temperatures

- 1 1962 - 1.9 °C
- 2= 2013 - 2.2 °C
- 2= 1947 - 2.2 °C
- 4 1937 - 2.4 °C
- 5 1916 - 2.5 °C

30 December 2011 Last updated at 19:21



## 2011 is UK's second warmest year on record - Met Office

COMMENTS (238)

This year was the second warmest on record for the UK, the Met Office says.

Provisional figures show that only 2006, with an average temperature of 9.73C (49.5F), was warmer than 2011's average temperature of 9.62C (49.3F).

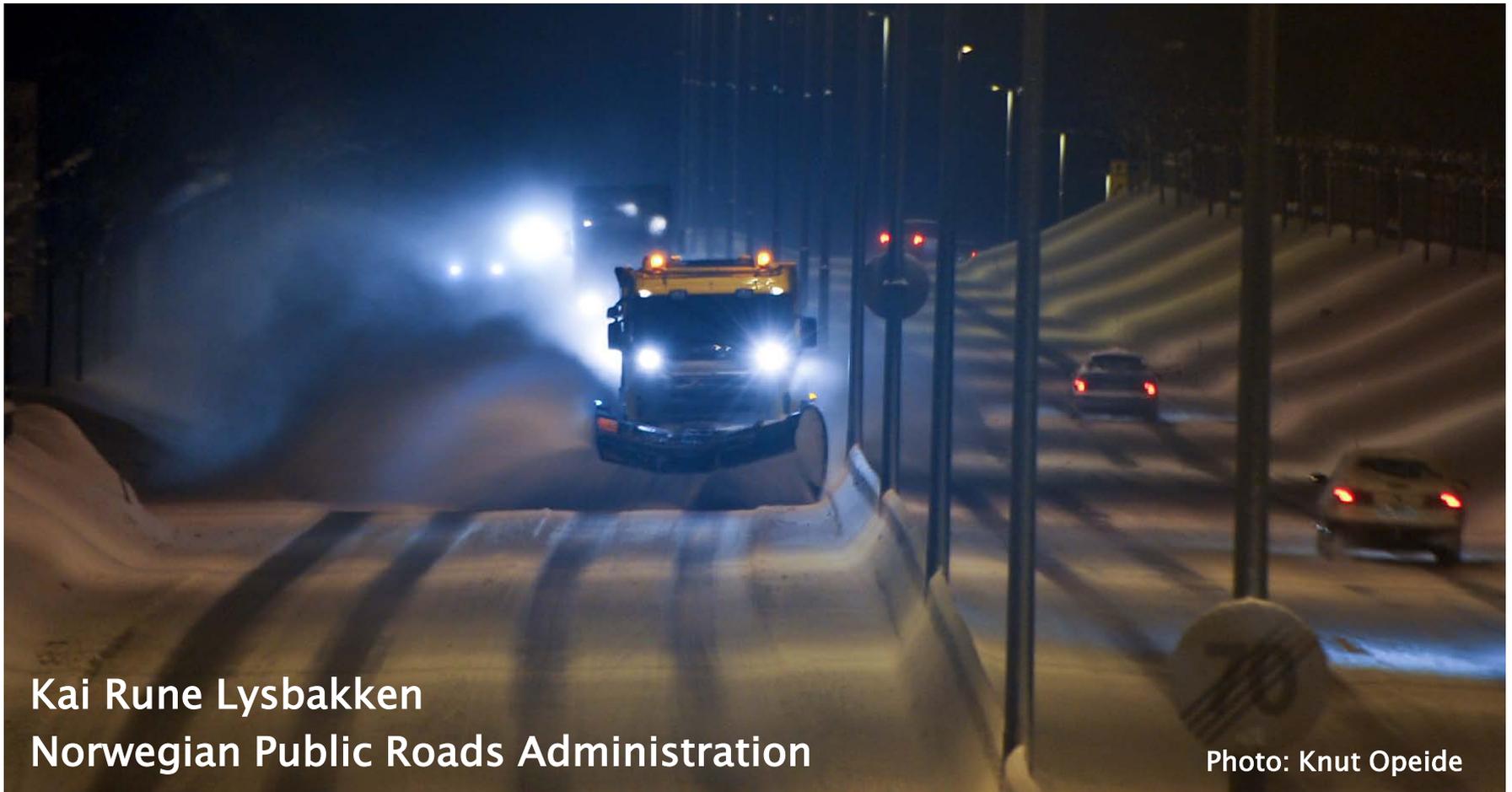
This year saw high temperatures for lengthy periods; including the warmest April and spring on record, the second warmest autumn and the warmest October day.



This year saw the second warmest Autumn on record

**Questions?**

**TRB Webinar: A Sampling of Winter Maintenance Best Practices in Europe**  
**Winter Chemicals and Application Strategies in Norway**



**Kai Rune Lysbakken**  
**Norwegian Public Roads Administration**

Photo: Knut Opeide

# Agenda

- The purposes of salt application
- Spreading methods and materials
- Salting in low temperatures

# The purposes of salt application

## Salt in winter maintenance

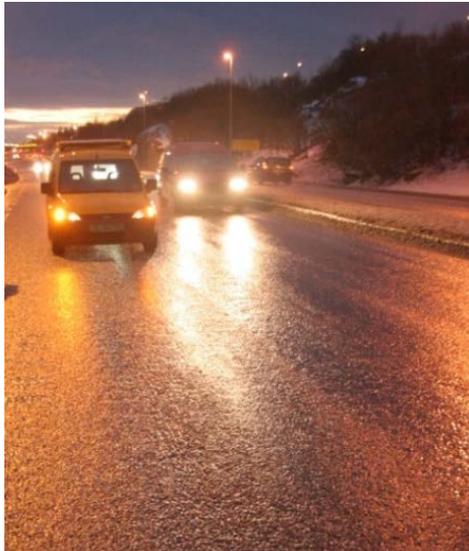
1. Anti-icing
2. Anti-compaction
3. De-icing

## Purposes of salt application

### Anti-icing

**Salt application to prevent formation of ice on a bare road surface**

- Freezing of a wet road surface
- Avoid hoarfrost (dew on a cold road surface)



Wet road surface



Hoarfrost

## Purposes of salt application

### Anti-compaction

Salt application before, during and after snowfall  
– to prevent snow compaction on the road surface

- To facilitate the mechanical removal of snow  
(not to melt snow)



Photo: Knut Opeide

## Purposes of salt application

### De-icing

**Salt application to melt/remove ice or compacted snow from road surface**

- Fully melt thin ice or hoarfrost
- Break up ice and ice/pavement bond to facilitate mechanical removal



Photo: Håkon Aurlien



Photo: Torgeir Vaa

# Spreading methods

- Dry salt
- Prewetted salt
- Fine graded prewetted salt
- Brine



# Spreading methods

## Fine graded prewetted salt

- Either purchase fine graded salt or grind down salt on the spreader
- Fine graded salt dissolves quicker
  - More rapid effect
  - Higher durability of salting actions
- Problems with caking of fine graded salt in stockpile and spreader



# Spreading methods

		Spreading method			
Purpose	Weather and road conditions	Dry salt	Prewetted salt	Fine graded prewetted salt	Brine
Anti-icing	Dry road surface	No	No	Can be used	Yes
	Moist road surface	No	Yes	Yes	Yes
	Wet road surface	No	Yes	Yes	Can be used
	Rain on cold road surface/super cooled rain < 1mm/t	No	Yes	Yes	Can be used
	Rain on cold road surface/super cooled rain > 1mm/t	No	Yes	Yes	No
Anti-compaction	Before snow, dry or moist road surface	No	No	Can be used	Yes
	Before snow, wet road surface	No	Yes	Yes	No
	During snow	Yes	Yes	Yes	No
	After snow	Yes	Yes	Yes	No
De-icing	Thin ice or hoar frost	No	Yes	Yes	Yes
	Thick ice ore snow pack	Can be used	Yes	Yes	No

# Spreading methods



# Spreading material

## Ordinary winter maintenance:

- Mostly sodium chloride
- Both rock and sea salt
- Requirements related to:
  - Grain size distribution
  - Purity
  - Moisture content
  - Content of anti-caking agent

## Some major cities:

- Magnesium chloride brine is used for dust control (dust from studded tires)
- Prewetting NaCl with  $MgCl_2$  brine for a combination of winter maintenance and dust control

# Salting in low temperatures



Photo: Knut Opeide

# Salting in low temperatures

**Temperature limit for NaCl depends on several factors:**

- Traffic volume
- Time period the temperature low (one night, one week...)
- Quantity of water, ice or snow on the road surface
- Precipitation

**Winter maintenance in low temperatures:**

- Roads with low traffic; mechanical methods
  - Plowing
  - Gritting
  - Graders
- What about roads with high traffic volume?

# Salting in low temperatures

Project: *Winter maintenance in low temperatures*

The project is in collaboration with the Swedish Transport Administration

## Project aims:

- Temperature limit for NaCl
- Factors that affects the temperature limit for
- Limitations for the use of sand or warm wetted sand
- Methods and chemicals for high volume roads in low temperatures

# Winter maintenance in low temperatures

## Project activities:

1. Survey of best practice in Sweden and Norway
  - Web based questionnaires
  - Interviews
2. Literature review
3. Case study
4. Field trials

# Winter maintenance in low temperatures

## Some results from survey of best practice

- NaCl can be used lower than guidelines ( $-12\text{ }^{\circ}\text{C}$ )
  - Sufficient traffic volume
  - Experienced personnel
- NaCl has been used in some areas down to  $-20\text{ }^{\circ}\text{C}$
- NaCl in periods with low temperatures
  - Increased spreading rate
  - Increased number of salt applications
  - More use of prewetted salt and increase the share of brine

# Winter maintenance in low temperatures

## Some results from survey of best practice

### Prewetting NaCl with MgCl<sub>2</sub> brine

- Used in Oslo during the whole winter season (dust control and winter maintenance)
- Experienced to have good effect during periods with low temperatures
- Requires:
  - Sufficient traffic volume
  - Experienced personnel



**Thank you for your attention**

# New Method for Slush Removal

Mr. Dagfin Gryteselv, Norwegian Public Roads Administration

# New Method for Slush Removal

- Background
- Previous equipment
- The new equipment
- Experiences in practical use and further work

## New Method for Slush Removal

# Background

- Salt SMART project in Norway (2007-2011) - One sub-project: Development and testing of equipment for reinforced mechanical removal of snow and slush (potential for reduced use of salt?)
- Four equipment's were tested on a field track in 2009:



- Jet Broom, "Slapsekaren", RSS 200 and Pon Cat Grader

## New Method for Slush Removal

# Field test – example of test conditions

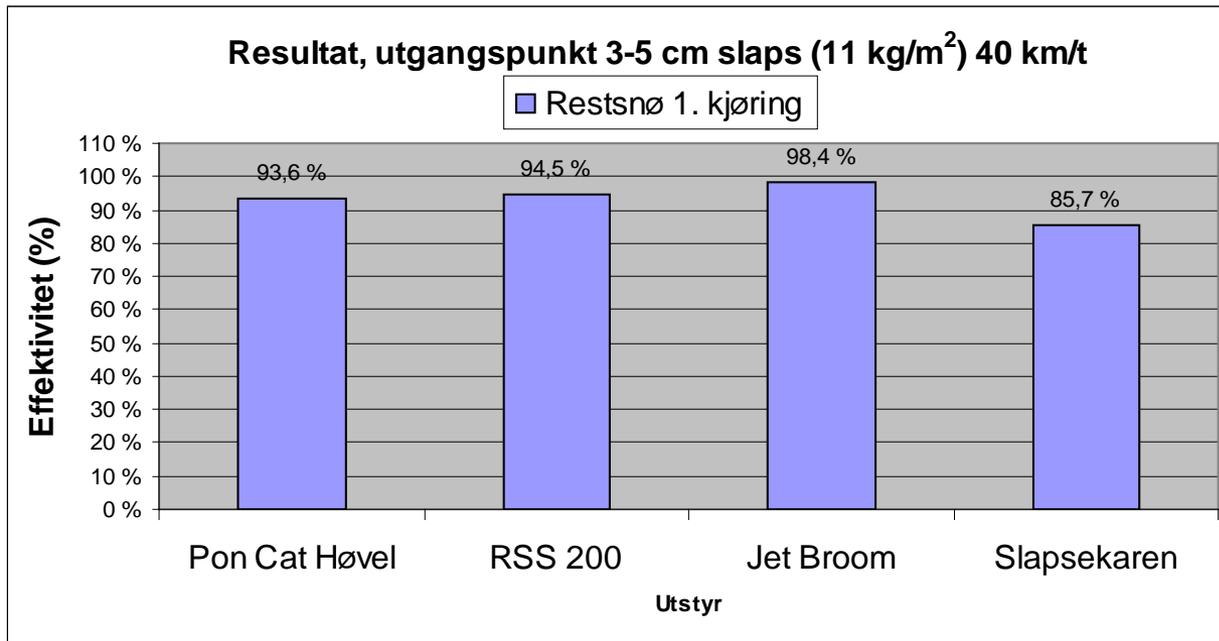


## New Method for Slush Removal

# Field test - Efficiency of tested Equipment

Pon Cat Grader (Pon Cat Høvel), clearing speed 40 km/t:

- Before: 3-5 cm slush  $\approx 11 \text{ kg/m}^2$
- After: 0,6 kg/m<sup>2</sup>
- Efficiency  $\approx 94 \%$



## New Method for Slush Removal

# Use in Road maintenance contract

- Two equipment were further used on specific road sections in two contract areas.
- One of them was the modified grader with a rubber slush gate, in combination with use of a front plow and salt water spreaders:



Photo: Anders Svaneil /  
Torgeir Vaa

## New Method for Slush Removal

### Use of grader with rubber slush gate was discontinued:

- New contract period – new contractor
- Use of a grader was not considered as a suitable machine (speed, maneuverability, etc.)
- **But** the equipment (rubber slush gate) has proved its potential for efficient slush removal in combination with front plow and salt spreader (three step winter maintenance equipment)
- Efficient snow/slush removal even on highly rutted pavement (studded tires in Norway is one of the main causes of rutting)
- Operational reliability was very good

## New Method for Slush Removal

# In 2015: New Equipment SRC-3000, Smart Road Clearing

- Slush gate installed underneath a trailer
- In combination with a combined spreader set up (liquid, pre wetted salt, dry salt and even sand)
- Front plow



Photo: Dagfin Gryteselv

## New Method for Slush Removal

# SRC-3000, Smart Road Clearing



Photo: Dagfin Gryteselv

## New Method for Slush Removal

# SRC-3000, Smart Road Clearing

- Rubber slush grade, fixed angle  $\approx 35^\circ$
- Three rows with independent, non fixed rubber elements,  $L \approx 30$  cm
- Clearing width  $\approx 300$  cm (Transport width  $\approx 250$  cm)



## New Method for Slush Removal

# SRC-3000, Smart Road Clearing

### Other equipment:

- Temperature and road condition sensor (Marvis from Luft)
  - two sensors: before and after the slush gate
- Termologic (Aebi-Scmidt) – Temperature based dosage of salt



Photo: Dagfin Gryteselv

## New Method for Slush Removal

# SRC-3000, Smart Road Clearing – In Action

- Before (without front plow):

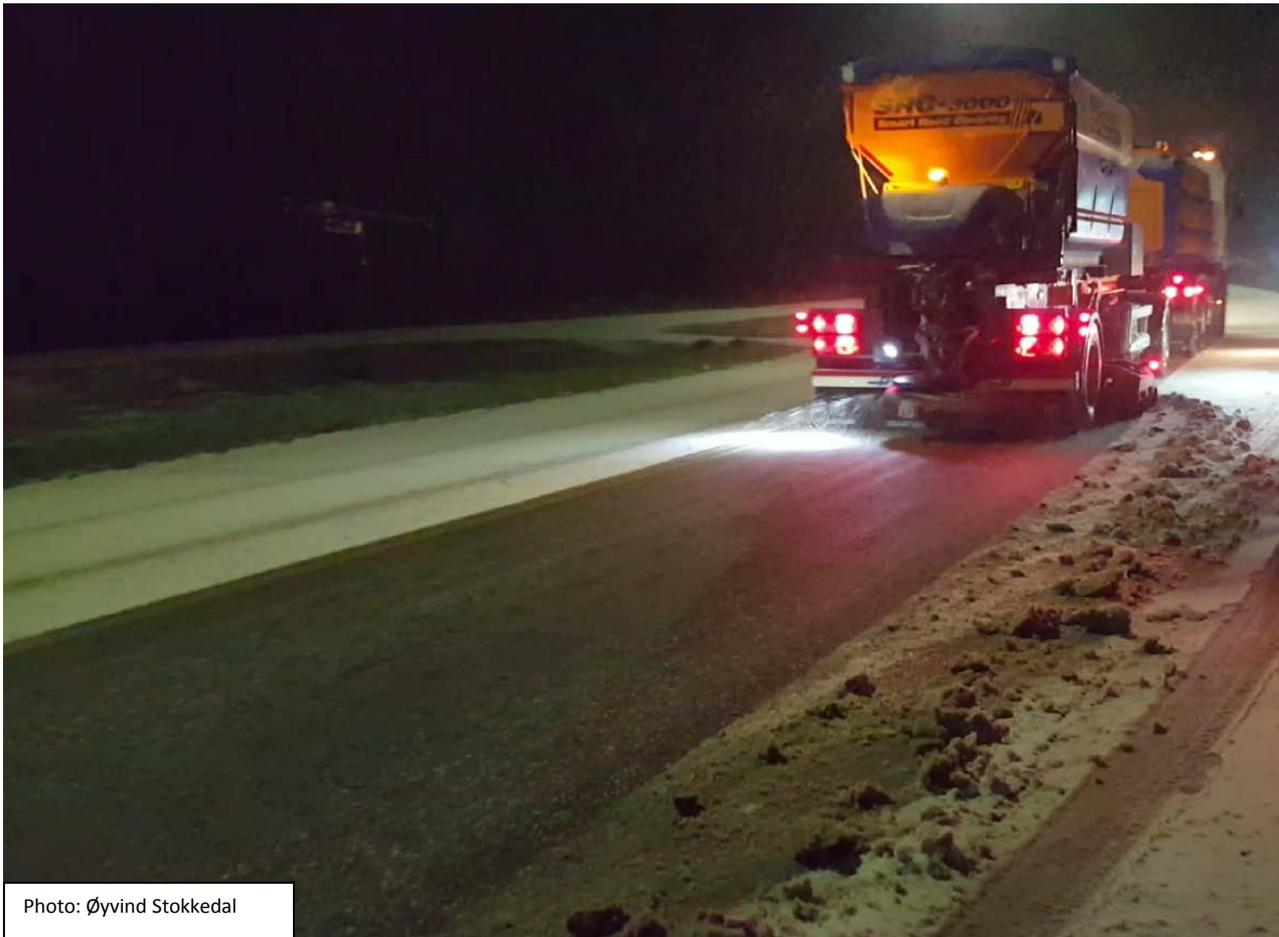


Photo: Øyvind Stokkedal

## New Method for Slush Removal

# SRC-3000, Smart Road Clearing – In Action

- After – excellent removal (even better result if front plow is used):



## New Method for Slush Removal

# SRC-3000, Smart Road Clearing

- Use in roundabout – maneuverability is quite good:



## New Method for Slush Removal

# SRC-3000, Smart Road Clearing

### **Experiences so far (December 2015 – February 2016) and what to come:**

- Efficient snow and slush removal – front plow must be applied when more than 3-4 cm of snow
- Apparently efficient moist/water removal – allows the road surface to dry up more rapidly
- More field tests and documentation will be accomplished the next winter seasons, concerning (i.a.):
  - Documentation of efficiency (especially water/moist removal)
  - Test of different types of rubber elements (harder / softer – wear)
  - Necessary vertical load / pressure (efficiency – wear – fuel consumption)
  - Optimal speed
  - Use of front plow
  - Use of sensors
  - Use on multi lane and high volume roads

## New Method for Slush Removal

# SRC-3000, Smart Road Clearing

### **In cooperation with:**

- Tellefsdal (Rubber slush gate and trailer)
- Aebi-Scmidt (Salt spreader)
- Veidrift (Maintenance contractor)
- Public Roads Administration