PAGplus

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Acting on behalf of the Trunk Roads Network Management
Directorate of Transport Scotland

REPORT ON WINTER SERVICE PROVIDED BY BEAR ON M8, M9 AND M876 BETWEEN 4 AND 5 JANUARY 2011

1. Executive summary

The purpose of this report is to investigate BEAR Scotland's (BEAR) winter service performance in the South East Unit between 4 and 5 January 2011 following closure of sections of the M8, M9 and M876 on the morning of 5 January 2011.

Overall, based on the forecast information available, BEAR's initial decision making on 4 and 5 January 2011 was acceptable. Planned treatments were in accordance with the treatment matrix currently being used across Scotland. The actual road surface temperatures recorded were broadly in line with the forecast road surface temperatures.

BEAR's Duty Officer noted the frost warning, however did not instruct treatment following a review of other data across the area. Information on BEAR's response to a rain warning from the M8 Duntilland sensor, just following its first treatment, showed that the situation was being monitored but no further action was required as the sensor returned to normal.

It should be noted that the road sensors only give information of road conditions in the immediate vicinity of the sensors. As such, it is possible there may have been localised showers which could have caused ice to form on the carriageway at locations remote from the sensors. There were no records of showers from sensors on the network, other than briefly at M8 Duntilland at 01:40hrs.

Following notification of the first M8 accident at 05:10hrs BEAR's subsequent visual checks on the actual route indicated no ice was present at that time on the road surface. The first Police report of ice on the M8 was at 05:49hrs.

The calls from the police about black ice on the M8 occurred as the gritters were about to start their planned 06:00hrs standby patrol with drivers on a new shift. Although the gritters were slightly later in getting out on their standby patrols than originally planned, it is not possible to say whether an earlier start would have resulted in any different outcome.

BEAR's records show that actual initial treatments commenced generally as planned, apart from one route on M9 which started earlier. Secondary treatments were carried out from 06:20hrs onwards on M8, M9 and M876 and continued through the morning. BEAR may wish to review whether a driver shift change at 06:00hrs allows for the optimum treatment to be carried out on routes ahead of rush hour traffic.

Records indicate that BEAR used more de-icing material on its planned treatments than was required by the treatment matrix. Further treatment was carried out in response to conditions.

Given the longer duration of the second ice / frost warning at the faulty M8 J4 sensor from 04:20hrs to 08:20hrs, with hindsight BEAR could perhaps have chosen to send out a patrol gritter to check conditions, however this would not have been normal practice as no ice was indicated. It should, however, be noted that BEAR deployed an Emergency Support Unit to the M8 during this period and it reported no ice.

Notwithstanding the above, and from the information reviewed, there is nothing to suggest BEAR was not carrying out its winter service in accordance with the Contract requirements.

2. Introduction

Following closure of sections of the M8, M9 and M876 on the morning of 5 January 2011 PAGplus investigated the winter service performance of BEAR from 4 to 5 January 2011 focussing on these routes which were closed during the morning rush hour.

3. Information reviewed

BEAR's Winter Service Plan (WSP) sets out how it provides and records its winter service in the South East Unit.

Records of weather forecasts provided by MeteoGroup, planned and unplanned actions, Vaisala (provider of BEAR's computerised road weather information system) sensor records, gritter records and Duty Officer Logs were reviewed by PAGplus for 4 and 5 January 2011.

Sensor information was reviewed at three sensors located on M9 at Linlithgow, Polmont and Bannockburn. M8 sensors reviewed were at J3 Livingston, J4 Whitburn and Duntilland. The A985 Kincardine Bridge sensor (nearest sensor to M9 J8) was also reviewed.

At the M8 Whitburn weather forecast station the Road Surface Temperature (RST) sensor did not appear to be functioning, although the station was recording all other relevant data. This was subsequently noted as working on 6 January 2011. Vaisala was aware of this intermittent fault and was scheduled to repair the sensor in the next few weeks.

The sections of **M8** reviewed are within climatic **Domain 6** and the sections of **M9** and **M876** reviewed are within climatic **Domain 7**.

There is no contractual requirement to patrol M8, M9 or M876.

Precautionary treatments for the sections of M8 maintained by BEAR are undertaken primarily via spreader routes 9 and 10 and routes 11, 12 and 13 for the M9 and M876.

Route no	Base depot	Route details
9	Chryston	A8 Baillieston to M8 J3 Livingston (Main Carriageway Westbound and Slip Roads Eastbound)
10	Chryston	A8 Baillieston to M8 J3 Livingston (Slip Roads Westbound and Main Carriageway Eastbound)
11	Burghmuir	M9 Pardovan to Keir (Main Cway NB and Slip Roads
12	Burghmuir	M9 J4 to J7; M876 and A876 (Various Main Cway and Slip Roads)
13	Burghmuir	M876 from M9 J7 to M80; M80 from Haggs to M9 Pirnhall

In preparing this report we had co-operation from Strathclyde Police and Central Police, particularly in the context of the records they hold for these events.

4. PAGplus review

4.1 4 January 2011 12:00hrs to 5 January 2011 12:00hrs

4.1.1 Weather forecast

Full details of the weather forecast information, which MeteoGroup provide to BEAR, are contained in Appendix A

PAGplus comments on forecast

- Rain was forecast to die out from 02:00hrs
- BEAR commenced treatment of Domain 6 routes 9 and 10, which covers the A8 Baillieston to M8 J3 Livingston, from just before midnight, possibly to ensure treatment before forecast RSTs dropped below freezing at 02:00hrs. No heavy rain to cause wash-off of de-icing material was forecast or recorded.
- Domain 7 routes 11, 12 and 13 planned treatments were from 02:00hrs in advance of forecast RST's dropping below freezing at 04:00hrs. However, Route 11's actual treatment commenced at 00:15hrs.
- There was high confidence of no heavy rain in Domains 6 and 7.
- There is an element of ambiguity between the general synopsis, hazards and temperatures table and the snow summary in terms of snow likelihood.

The snow summary forecast, as noted in Appendix A, was *rain will turn increasingly to snow overnight. The heaviest snow will be over 100m, where accumulations of 1-3cm are likely widely with up to 5cm over the highest routes. It will become predominantly dry from 0200, but there could be further isolated snow showers through the rest of the night and for much of the morning.*

The evening update, the time of which is not recorded, states *No significant changes. RSTs falling below zero just about everywhere and snow may become widespread for a time.*

Following the severe winter conditions in January 2010, guidance was developed, based on research undertaken by the Highways Agency and others on treatment levels which would ensure the most efficient use of salt stocks. This advice was issued to all Highways and Roads Authorities by the UK Roads Liaison Group (which was responsible for the 2009 salt review); similar advice was also issued by Transport Scotland and the Highways Agency to their respective contractors. The advice includes a treatment matrix which determines the amount of salt to be applied based on predicted conditions.

BEAR's treatment followed this revised guidance.

Domain 7 had a high confidence of ice and snow above 50 metres elevation. From OS maps the sections of M9 and M876 reviewed which were closed are <50 metres elevation. Ignoring the snow forecast, as the elevation is <50 metres, and for information purposes only, the interpretation in accordance with Schedule 7 Part 2, Annex 7.2/J, Table 7.2/J/2 of the South East Unit Contract, of the relevant precautionary treatment spread rate is 10 to 20 g/m^2(template category B3).

For Domain 7 BEAR instructed a 10 g/m^2 treatment. In addition, BEAR's proposed treatment required all routes to have gritters on standby on the network from 06:00hrs to cover the rush hour period.

Domain 6 had a high confidence of hoar frost and ice and a low confidence of no snow. The low snow confidence contradicts the snow summary which states *The heaviest snow will be over 100m, where accumulations of 1-3cm.* Although M8 East of J3 Livingston is between 50 and 100 metres elevation, M8 west of J3 Livingston is >100 metres elevation. For information purposes only, there were 3 potential interpretations of the matrix in Schedule 7 Part 2, Annex 7.2/J, Table 7.2/J/2.

- For hoar frost the relevant precautionary treatment spread rate is 20g/m^2 (template category H3).
- For ice the relevant precautionary treatment spread rate is 10 to 20 g/m^2 (template category B3).
- For snow accumulations up to 3cm depth, west of J3 Livingston, the relevant precautionary treatment spread rate is 40 g/m^2(template category K3).

For Domain 6 BEAR instructed a 10 g/m^2 treatment. As with Domain 7, gritters were to be on standby on the network from 06:00hrs.

In practice, the actual spread rate applied by BEAR in Domains 6 and 7 was approximately 15g/m^2.

4.1.2 Treatment decisions

Full details of BEAR's planned and actual treatments for 4 to 5 January 2011 are given in Appendix B. The Duty Officer log, contained in Appendix C, was also reviewed for the discussion below.

Treatment records

BEAR's records show that precautionary treatments commenced generally as planned, apart from route 11, M9 Pardovan to Keir (Main Cway NB and Slip Roads), which started earlier. Spreaders were also planned to standby on the network at 06:00hrs.

The actual action records show that these spreaders went back out on their routes from around 06:20hrs onwards, following a driver shift change at 06:00hrs. Generally this was slightly later than planned, although for the M8 eastbound (Route 10) treatment commenced at 07:14hrs. The table in Appendix B shows further information received from BEAR on all treatments carried out from midnight onwards with times of treatment and tonnages spread.

The records also show that BEAR spread more de-icing material than the planned 10 g/m^2 on all routes.

OCs are required to react to callouts for emergency treatments and commence treatments within 1 hour and to complete route treatments of the route within 2 hours. The first callout for a report of ice on the M8 was at 05:49hrs. The treatment commenced on the westbound carriageway at 06:30hrs, meeting the target response time of 1 hour.

At 06:45hrs the DO log notes Police closed the M8 westbound at J5, to enable further treatment. We understand from Police records that the actual closure took place around 07:30hrs following a request at 06:45hrs.

As outlined above, treatment of the eastbound M8, which remained open, commenced at 07:14hrs.

There were callouts due to ice on the M9 and M876 and patrols were already on the routes when the calls were received.

Amey treatment comparison

A brief review of Amey's planned treatments for the adjacent section of the M8 from J8 to 13 in the South West Unit was carried out. Amey similarly instructed 10 g/m^2 treatments commencing at 23:00hrs on 4 January 2011 and 05:00hrs on 5 January 2011. The first treatment time was to coincide with the predicted end of precipitation around midnight. The second treatment was planned for ahead of peak traffic and ahead of predicted snowfall.

Amey's actual treatment records indicate that the initial treatment was delayed until midnight whilst awaiting rain to clear. A second treatment was planned and carried out at 05:00hrs approximately ahead of peak traffic in anticipation of predicted 2cm of snowfall for domains 7 and 8. Amey's DO log indicates that there was heavier rain than forecast causing wash-off and leading to re-treatments.

An early morning second treatment was not planned by BEAR for Domain 7. However, BEAR had pre-treated from 00:15hrs to 03:44hrs on Domain 7 and another treatment may not have been required. The BEAR DO log does not report any occurrences of heavy rainfall.

Duty Officer (DO) log extract for 4 and 5 January 2011

Relevant extracts for the M8, M9 and M876 are given in Appendix C.

PAGplus comments on DO Log

There is no record in the DO log of recognition of or action taken following the ice / frost warning which occurred at M8 J4 Whitburn at 02:20hrs and 04:20hrs (there was also a rain warning just before 04:20hrs), or the rain sensor warning on M8 Duntilland between 01:40hrs and 02:00hrs.

PAGplus queried with BEAR why no action had been taken on the ice / frost warning and the following response was received:

Extract from email from BEAR's Duty Officer to one of its management team members:

I checked the graphs throughout the night and did notice a frost warning at Junct 4 Whitburn, however due to the rest of the M8 looking ok on Vaisala and the road surface being dry at Whitburn, wrongly I didn't think too much of it. The first indication that there may be problems was when I got a call from TRCC (CALL CENTRE AT AIRDRIE) at 05:10 hrs stating vehicle had come off road at Junct 5, Burghmuir ESU was deployed and did not come back with any problems on the road re ice, neither did the police on the scene. The next call that came in was at 05:49 from Strathclyde stating that Junct 4-5 on the M8 was like a skating rink, at this time there was no point phoning gritters as they were already on their way into the Depot.

This shows that BEAR did not take immediate action on the ice / frost warning at the M8 J4 sensor. An Emergency Support Unit vehicle was sent after the first incident at 05:10hrs which allowed a check of the road surface condition, which indicated no problems. BEAR explained that the gritters were on their way into the depot to change-over drivers at the end of their shift at 06:00hrs. PAGplus can confirm that the M8 J4 sensor road surface sensor was showing dry from 12 noon on 4 January 2011 to 12 noon on 5 January 2011.

Similarly, PAGplus queried with BEAR why it appeared no action had apparently been taken on the rain warning at M8 Duntilland sensor between 01:40hrs and 02:00hrs, following the first treatment.

BEAR explained that the rain warning at the M8 Duntilland sensor appeared briefly for 20 minutes just after treatment was complete on this section of M8. Due to treatment having just been completed it was not considered appropriate to act upon it immediately, but to continue monitoring. The alert returned to normal after 20 minutes and no further action was required at that time. BEAR confirmed that if a rain warning did continue over a longer period then action would be taken as appropriate.

Overall, relevant notes in the DO log broadly compare with records held by the Police, although there were some differences in logging the precise location of incidents on M8.

Summary of sensor alerts

Route	M8	M9	M876
First Police report of ice	05:49hrs	06:30hrs	06:56hrs
Sensor alarm times	**M8 Duntilland.** Rain warning from 01:40hrs to 02:00hrs indicating the weather station has detected rainfall and the road surface temperature is at or close to zero. There is therefore a high possibility of ice forming. **M8 J4 Whitburn** Rain warning from 03:20hrs to 04:00hrs. Ice / frost warning 02:20hrs to 02:40hrs and from 04:20hrs to 08:20hrs indicating surface is close to freezing or ice and or frost formation will occur within a given period if the current trend continues. **M8 Livingston**. No alarms.	**M9 Polmont.** Rain warning at 03:22hrs indicating the weather station has detected rainfall and the road surface temperature is at or close to zero. There is therefore a high possibility of ice forming. Ice / frost warning at 07:42hrs to 08:03hrs indicating surface is close to freezing or ice and or frost formation will occur within a given period if the current trend continues. **M9 Bannockburn**. Rain warning at 04:22hrs but surface state shows wtrd - no ice present. Ice / frost warning at 08:02hrs to 08:21hrs and 08:41hrs to 09:41hrs **M9 Linlithgow**. No alarms	**A985 Kincardine Bridge** (nearest sensor M9 J8). No alarms
Conclusion	There were no ice alarms.	There were no ice alarms	There were no ice alarms

Other than notification by the Police, there were no sensor alarms to alert the Duty Officer of ice formation apart from the M8 Whitburn sensor where there were ice / frost warnings at 02:20hrs and 04:20 hrs. There were no ice / frost or other warnings on the adjacent M8 sensors at Livingston and Duntilland over the period. Rain warnings were shown on some sensors.

Full details of the Vaisala sensor records are contained in Appendix D.

There are no records of the actual depth of snowfall. However, BEAR has subsequently stated that although snow fell on higher sections of the single carriageway routes such as the A68 and A702, no snow fell on the motorway network.

5. Key Findings

- BEAR's initial decision-making based on the information available to it from the forecaster at 12 noon was acceptable, although it was the minimum treatment level.

- All planned treatments commencing around 00:00hrs were carried out.

- The first callout for a report of ice on M8 was at 05:49hrs. The treatment commenced on the westbound carriageway at 06:30hrs, meeting the target response time of 1 hour. M8 westbound carriageway from J5-6 was closed by Police at approximately 07:30hrs, following an initial request at 06:45hrs.

- All planned patrols on the network were carried out, albeit slightly later than the planned 06:00hrs start with the exception of M8 eastbound patrol, which commenced at 07:14hrs.

- In our review, the Police noted that all incidents on M8 occurred on the westbound carriageway. The M8 eastbound carriageway remained open.

- There were callouts due to ice on M9 and M876 and patrols were already on the routes when the calls were received.

- There were no sensor alarms to alert the Duty Officer of ice formation, apart from the M8 Whitburn sensor where there were ice / frost warnings at 02:20hrs and 04:20 hrs. BEAR's Duty Officer noted the frost warnings, however did not instruct treatment following a review of other data across the area. Following notification of the first M8 accident at 05:10hrs, BEAR's subsequent check on the actual route indicated no ice was present at that time on the road surface. The only notification of ice was by the Police reports.

- BEAR monitored the M8 Duntilland sensor following a rain warning. The sensor returned to normal after 20 minutes and no further action was required.

- At the M8 Whitburn weather forecast station the Road Surface Temperature (RST) sensor did not appear to be functioning, although the station was recording all other relevant data. This was subsequently noted as working on 6 January 2011. As all other sensors were indicating results inline with forecasts, it is not clear if this would have had an impact on decision-making. Vaisala was aware of this intermittent fault and was scheduled to repair the sensor in the next few weeks.

- BEAR should recheck sensors to ensure that they are accurate given that ice formed but the sensors did not record it. All sensors were calibrated in 2010 before the start of the winter season and mid-season calibration checks are required to start in January 2011.

- Records indicate that BEAR used more de-icing material on its planned treatments commencing around 00:00hrs than was required by the treatment matrix. The planned patrols carried out further treatments in response to conditions.

6. Conclusion

Overall, based on the forecast information available, BEAR's initial decision making on 4 and 5 January 2011 was acceptable. Planned treatments were in accordance with recently issued guidance advice currently being used across Scotland.

The actual road surface temperatures recorded were broadly in line with the forecast road surface temperatures.

There were small indications of possible changes in road conditions from sensors. The information from the sensors, together with other information being monitored was reviewed by the BEAR team and using its professional judgement reasonable decisions were taken.

The calls from the police about black ice on M8 occurred as the gritters were about to start their planned 06:00hrs standby patrol with drivers on a new shift. Although the gritters were slightly later in getting out on their standby patrols than originally planned, it is not possible to say whether an earlier start would have resulted in any different outcome.

BEAR may wish to review whether a driver shift change at 06:00hrs allows for the optimum treatment to be carried out on routes ahead of rush hour traffic. In winter, temperatures are often their lowest around dawn and falling snow can also cause major problems with the volume of traffic on the network that builds up from as early as 06:30hrs.

It should be noted that the road sensors only give information of road conditions in the immediate vicinity of the sensors. As such, it is possible there may have been localised showers which could have caused ice to form on the carriageway at locations remote from the sensors. There were no records of showers from sensors on the network, other than briefly at M8 Duntilland at 01:40hrs.

Given the longer duration of the second ice / frost alert at the faulty M8 J4 sensor from 04:20hs to 08:20hrs, with hindsight BEAR could perhaps have chosen to send out a patrol gritter to check conditions, however this would not have been normal practice, as no ice was indicated. It should, however, be noted that BEAR deployed an Emergency Support Unit to the M8 during this period and it reported no ice.

Notwithstanding the above, and from the information reviewed, there is nothing to suggest BEAR was not carrying out its winter service in accordance with the Contract requirements.

PAGplus/AIJ/ EJM/BDL/DCB
16 February 2011

Appendix A – Weather Forecast

The chart below taken from Vaisala's records show the weather forecast for 4 to 5 January 2011 for Domains 6 and 7.

24 HOUR SUMMARY FORECAST FOR BEAR SE UNIT
FORECAST FOR TUESDAY 04/01/2011 12:00 TO WEDNESDAY 05/01/2011 12:00

Headline	EVENING UPDATE: No significant changes. RSTs falling below zero just about everywhere and snow may become widespread for a time.
Confidence	HIGH

General Synopsis
This afternoon will be cloudy with showers becoming widespread. Overnight the showers will merge into a longer spells of rain in most places. The rain will turn increasingly to sleet and snow, particularly over the higher routes. It will become largely dry from around 0200 onwards, although further occasional sleet or snow showers cannot be ruled out. RSTs will fall below zero as the night progresses with ice and hoar frost becoming widespread. Tomorrow morning will be bright but sleet and snow showers will become quite widespread towards midday.

Hazards and temperatures

	BEARSE WEST LOTHIAN DOMAIN 6		BEARSE CENTRAL DOMAIN 7	
Readiness Colour	RED		RED	
Hoar Frost	**02-09**	HIGH	N	HIGH
Ice	**03-09**	HIGH	**04-07**	HIGH
Snow	N	LOW	**06-07**	HIGH
Snow Level (m)	N/A		**50**	
Drifting	N	HIGH	N	HIGH
Heavy Rain	N	HIGH	N	HIGH
Fog	N	HIGH	N	HIGH
Freezing Rain	N	HIGH	N	HIGH
Minimum Air Temp	0.5		1.0	
Min RST	-1.0		-0.5	
RST period < 0	02-09		04-07	

Snow Summary
The rain will turn increasingly to snow overnight. The heaviest snow will be over 100m, where accumulations of 1-3cm are likely widely with up to 5cm over the highest routes. It will become predominantly dry from 0200, but there could be further isolated snow showers through the rest of the night and for much of the morning. The snow showers may become quite widespread from 1000 onwards, with further accumulations of up to 1cm by midday.

Appendix B – Treatment Records

BEAR SCOTLAND Daily Winter Action Plan (Planned)

Forecast Data

Domain	Min. Air °C	Min. RST °C	RST < 0°C	Hoar Frost	Ice	Heavy Rain	Fog	Freezing Rain	Snow	Snow Level	Drifting
6	0.5	-1	02:00-09:00	02:00-09:00	03:00-09:00	-	-	-	-	-	-
7	1	-0.5	04:00-07:00	-	04:00-07:00	-	-	-	06:00-07:00	50	-

Action Plan

Depot	Domain	Route		First Action & Time			Second Action & Time		
		No.	Description	Action	Start	End	Action	Start	End
Chryston	6	9	A8 Ballieston to M8 Jcn 3 Livingston (Main Cway WB and Slip Roads EB)	T1	00:00	02:00	S	06:00	08:00
Chryston	6	10	A8 Ballieston to M8 Jcn 3 Livingston (Slip Roads WB and Main Cway EB)	T1	00:00	02:00	S	06:00	08:00
Burghmuir	7	11	M9 Pardovan to Keir (Main Cway NB and Slip Roads)	T1	02:00	04:00	S	06:00	08:00
Burghmuir	7	12	M9 Jcn 4 to Jcn 7; M876 and A876 (Various Main Cway and Slip Roads)	T1	02:00	04:00	S	06:00	08:00
Burghmuir	7	13	M876 from M9 Jcn 7 to M80; M80 from Haggs to M9 Pirnhall	T1	02:00	04:00	S	06:00	08:00
Additional Comments		Domain 3 - forecast air temp to be -0.5 not -5 as shown. All routes to have front line gritters on standby on routes from 0600 to cover rush hour period							

KEY TO PLANNED ACTION

T1 - Pre-treatment 10gms/sq.m	TE - Pre-treatment Ethylene Glycol	PO - Patrol
T2 - Pre-treatment 20gms/sq.m	T*P - Pre-treatment Part route, *=1,2,3,4 or E	TF - Plough/Salt Whole Route
T3 - Pre-treatment 30gms/sq.m	S - Standby in Depot	TP - Plough/Salt Part Route
T4 - Pre-treatment 40gms/sq.m	NA - No Action	

The table below contains information taken directly from driver and datalogger records.

Actual treatment and de-icing material spread

Route	Treatment noted by Driver (g/m^2)	Approx Left Depot	Datalogger Treatment Times	Approx Returned to Depot	Actual Tonnage Used	Target Tonnage
9	10	23:45	00:03-01:13	01:45	5.28	5.48 / 4.98*
9	10	06:30	06:30-08:44	09:20	6.68	
9	20	09:30	09:45-12:19	12:00	9.27	
10	10	23:40	00:01-01:30	01:48	6.4	4.69
10	20	06:45	07:14-09:50	10:15	8.3	
10	20	10:55	10:46-12:20	12:35	3.4	
11	T1	N/A	*00:15-01:45*	N/A	7.38	5.73
11	10 (as necessary)	06:20	*06:20-07:50*	07:50	1.18	
11	10	08:00	*08:00-10:45*	11:00	11.58	
12	T1	N/A	*02:00-03:15*	N/A	6.22	4.9
12	TF	N/A	*06:30-08:40*	N/A	7.57	
12	20	09:10	*09:15-10:05*	10:10	4.86	
12	20	10:15	*10:15-11:45*	12:08	5.46	
13	T1		01:10-03:44		7.1	5.73
13	15 (part of route)	06:10	06:04-09:10	09:00	4.48	
13	20	09:40	09:40-12:05	12:10	10.23	

* BEAR's winter service plan for M8 Route 9 at $10g/m^2$ has a target tonnage of 5.48t based on an 11m average spread width. Detailed examination of BEAR's records of this route showed an actual spread width of 10m giving a revised target of 4.98t to still achieve $10g/m^2$. This revised width still covers all traffic lanes and is in line with salt conservation measures.

Target tonnages were not available from BEAR for the later treatments, as some were patrols. Treatment times in italics are from drivers' logs and T1/TF1 treatments were what was planned on certain routes.

Appendix C – Duty Officer log extracts

ID	Date	Caller	Route	Location	Call Type	Call Details
33495	04/01/2011 13:30	Transport Scotland			General	Colin called to ask for gritters and back up gritters to be on the network in the morning as he has been advised of snow on the M8.
33499	04/01/2011 23:00	Meteo Group			Winter	Meteogroup advising they have updated graphs, Abington, Soutra and West Linton as temps have stayed up longer than expected. Also advising that snow will hit in the morning however this should not be until 0900 hrs after rush hour traffic.
33501	04/01/2011 23:30	BEAR	8		Winter	Neil reporting heavy rain in area
33502	04/01/2011 23:30			Kier	Winter	Light snow and rain warning showing on Kier sensor, also RST dropped to 0.2.
33504	05/01/2011 01:05	BEAR	11	M9 Kier	Winter	Scott put out early for grit due to low temps and snow in area.
33510	05/01/2011 05:10	Member of Public	M8	Just after Junct 4 W/bound	Emergency	AA have called TRCC advising vehicle has come off road at Junct 4 gone through barrier and into field. Vaisala showing RST: -0.9, Air temp: 0.5, Surf State: Dry. Silver Mercedes, VRN: XXXXXXX
33511	05/01/2011 05:49	Police	M8	Junct 4-5	Winter	Police requesting gritter out in area asap due to black ice on carriageway and 2 vehicles coming off road at that location.
33513	05/01/2011 06:30	Police	M9	E/bound West of Newbridge	TRISS	Car has skidded off road at this location and is sitting in live lane, requesting gritter to area as black ice on roads

33527	05/01/2011 06:45	Police	M8	Junct 5 W/bound	Winter	Road now closed at this location
33516	05/01/2011 06:45	Police	M876	Junct 2 slip off N/bound	Emergency	Chips/stones on road at this location, request area be swept
33517	05/01/2011 06:50	BEAR	M9	Junct 5 N/bound	Winter	Flood water at bottom of slip has frozen in lane 1, blasted with grit at moment but could do with ESU putting out salt at this location
33518	05/01/2011 06:56	Police	M876	Kinnaird Junct 9	Winter	Police reporting black ice at this location
33519	05/01/2011 07:00	TRISS 1	A720	Straiton	Winter	Triss reporting black ice on A720 and vehicles skidding
33520	05/01/2011 07:19	Police	M876	off slip N/bound Junct 2	Emergency	Police calling to advise slip closed due to black ice
33512	05/01/2011 07:25	BEAR			Winter	Due to reports of black ice and accidents all routes to be treated with 15g as soon as possible. Marc Mitchell reports of no issues on DBFO, no requirement to treat - Gritter to be sent to M8 to assist.
33514	05/01/2011 07:25	BEAR			Winter	Due to reports of black ice and accidents all routes to be treated with 15g as soon as possible. Marc Mitchell reports of no issues on DBFO, no requirement to treat - Gritter to be sent to M8 to assist.
33521	05/01/2011 07:50	TRISS 2	M9	Junct 2-1a M/P 16/2	TRISS	Triss 2 attending RTA, Silver Pugeot 406, VRN: XXXXXX has skidded off road on black ice, Police have now closed road and will not reopen until gritter has been in area
33515	05/01/2011 07:55	BEAR			Winter	All routes from Chryston, Burghmuir and Bilston to be treated with T2 as per K Campbell Instructions after T1.5.
33522	05/01/2011 08:12	Police	M876	Junct 2 slip road	Winter	Gritter has already gritted off slip at this location,

						however requesting he attend and grit again as road is still slippery
33523	05/01/2011 08:20	Police	M9	N/bound Junct 8-9 M/P 45/2	Emergency	Police have closed road due to black ice and multiple vehicle pile up on road, requesting BEAR attend with signage at moment also gritter required for area
33525	05/01/2011 08:40	TRISS 2	M8	E/bound M/P 8/3 Junct 2-1	TRISS	BDV, Red Ford Focus, VRN: XXXXXXX loss of power, lone female in vehicle
33529	05/01/2011 09:54	Police	M876	M9 Jct7 - M876Jct3 N/b	Emergency	Pol. requesting closure.
33530	05/01/2011 09:55	TRISS 2	M8	e/b mp8/1 Jct2-1	TRISS	bdv red Honda CRV reg XXXXXX, loss of power. Recovery on route.
33531	05/01/2011 10:05	Police	M9	Jct 8-9	Winter	RE previous RTA. R11 gritter has done Jct 8-9. Requested to go back around and re-do J8-9 concentrating on Lane 2.

Appendix D – Vaisala sensor records

Vaisala sensor records for 5 to 6 December 2010

The graphs below show Vaisala records for the relevant sensors on M8 , M9 and M876

Legend as follows:

Graph colour legend: Red = RSTs; Blue = Air temperature; Green = Dewpoint

Dewpoint – temperature to which air needs to be cooled to commence condensation. The temperature must fall below the dewpoint for condensation to take place. If the road temperature is above freezing the condensation will take place as dew and the road surface will become wet. If the road temperature is below freezing then the condensation takes place as hoar frost.

Surface States of Vaisala Road Sensors

State	Physical Meaning
DRY	The road surface is dry, no ice or snow either
MOIST	Little moisture in the road surface, no de-icing chemical
WET	Liquid water on the road surface, no de-icing chemical
FROST	Frost on the road surface
ICE	Ice on the road surface, not formed as frost, no snow
SNOW	Snow on the road surface
WTRTD	Liquid water containing de-icing chemical on the road surface, no ice
TRACE	Road surface moist and there is de-icing chemical

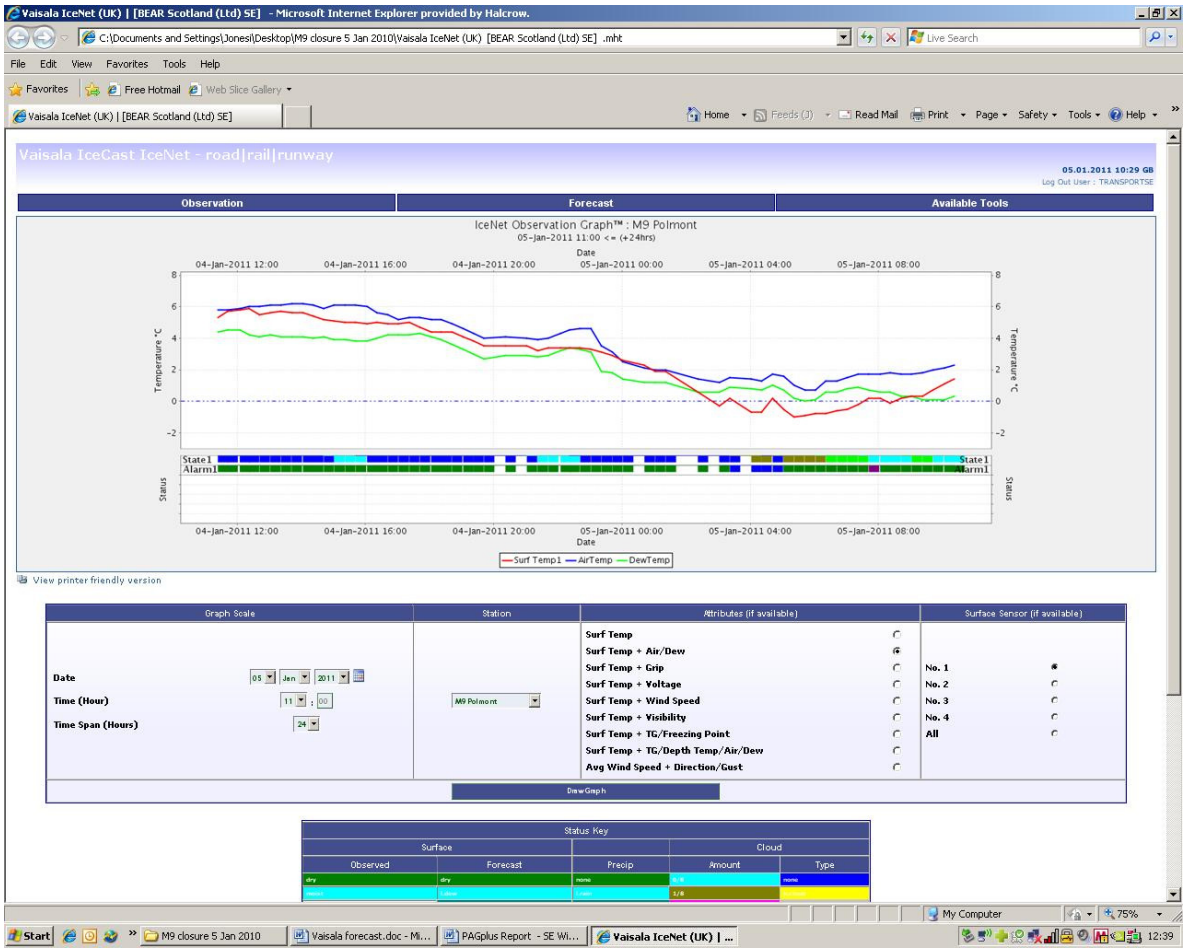
Alarm states

Green - No alarm

RAINW – Rain Warning - The weather station has detected rainfall and the road surface temperature is at or close to zero. There is therefore a high possibility of ice forming.

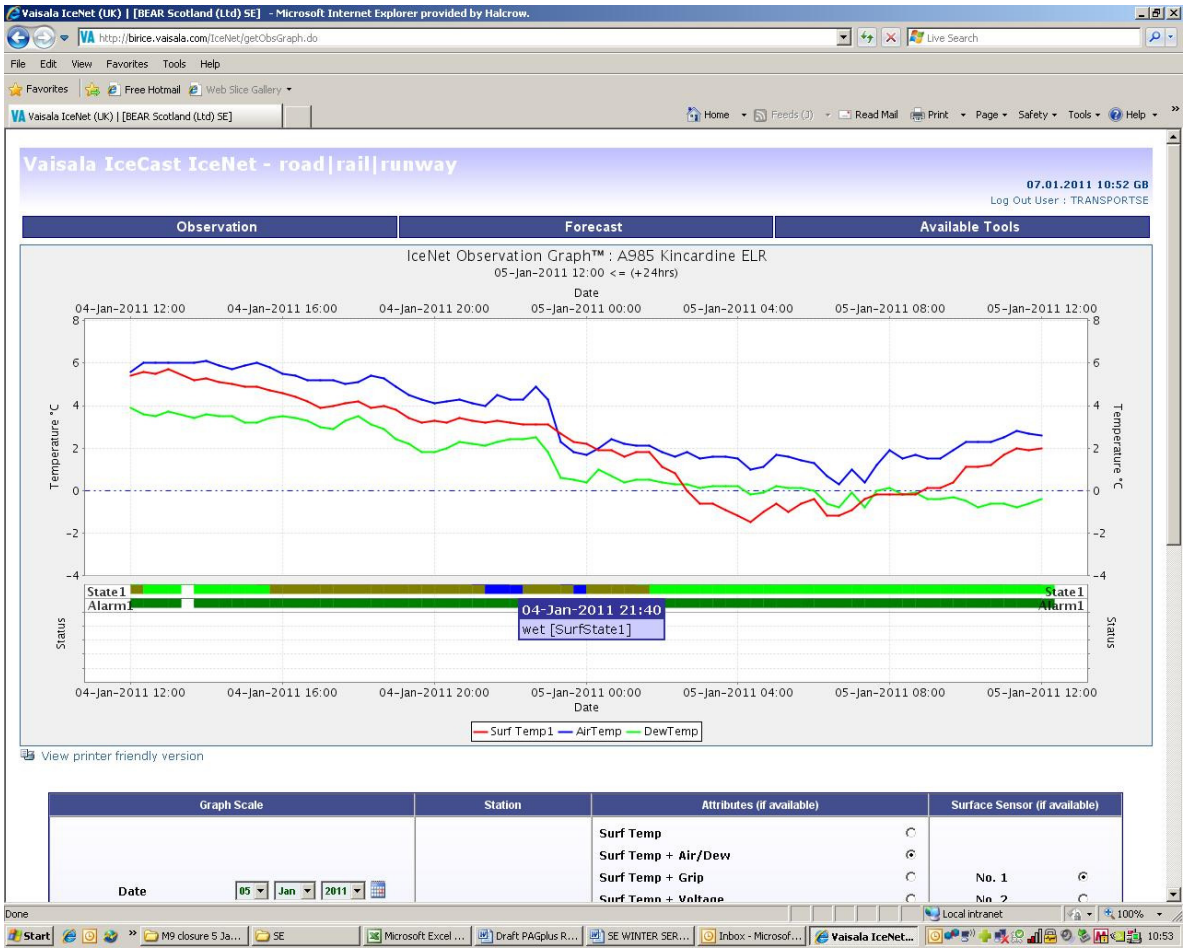
WARN - Ice Warning - Surface is close to freezing or ice and or frost formation will occur within a given period if the current trend continues.

ALARM - Ice Alarm - Surface at or below freezing point; either there is ice / frost already or there will be very soon.


Vaisala IceNet (UK) | [BEAR Scotland (Ltd) SE] - Microsoft Internet Explorer provided by Halcrow.
Vaisala IceCast IceNet - road|rail|runway
Observation
Forecast
Available Tools
IceNet Observation Graph™ : M9 Polmont
05-Jan-2011 11:00 <= (+24hrs)
Surf Temp1
AirTemp
DewTemp
View printer friendly version
Graph Scale
Station
Attributes (if available)
Surface Sensor (if available)
Surf Temp
Surf Temp + Air/Dew
Surf Temp + Grip
Surf Temp + Voltage
Surf Temp + Wind Speed
Surf Temp + Visibility
Surf Temp + TG/Freezing Point
Surf Temp + TG/Depth Temp/Air/Dew
Avg Wind Speed + Direction/Gust
Date
Time (Hour)
Time Span (Hours)
M9 Polmont
No. 1
No. 2
No. 3
No. 4
All
DewGraph
Status Key
Surface
Cloud
Observed
Forecast
Precip
Amount
Type


Vaisala IceNet (UK) | [BEAR Scotland (Ltd) SE] - Microsoft Internet Explorer provided by Halcrow.
http://birice.vaisala.com/IceNet/getObsGraph.do
Vaisala IceCast IceNet - road|rail|runway
05.01.2011 12:48 GB
Log Out User : TRANSPORTSE
Observation
Forecast
Available Tools
IceNet Observation Graph™ : M9 J9 Bannockburn
05-Jan-2011 13:00 <= (+24hrs)
Date
04-Jan-2011 12:00
04-Jan-2011 16:00
04-Jan-2011 20:00
05-Jan-2011 00:00
05-Jan-2011 04:00
05-Jan-2011 08:00
05-Jan-2011 12:00
Temperature °C
State1
Alarm1
Status
Surf Temp1
AirTemp
DewTemp
View printer friendly version
Graph Scale
Station
Attributes (if available)
Surface Sensor (if available)
Surf Temp
Surf Temp + Air/Dew
Surf Temp + Grip
No. 1
Date
Local intranet
75%
Start
Vaisala IceNet (UK) | ...
12:48


Vaisala IceNet (UK) | [BEAR Scotland (Ltd) SE] - Microsoft Internet Explorer provided by Halcrow.
Vaisala IceCast IceNet - road|rail|runway
Observation
Forecast
Available Tools
IceNet Observation Graph™ : M9 (J3) Linlithgow
05-Jan-2011 13:00 <= (+24hrs)
Temperature °C
State1
Alarm1
Status
Surf Temp1
AirTemp
DewTemp
View printer friendly version
Graph Scale
Station
Attributes (if available)
Surface Sensor (if available)
Surf Temp
Surf Temp + Air/Dew
Surf Temp + Grip
No. 1
Date


Vaisala IceNet (UK) | [BEAR Scotland (Ltd) SE] - Microsoft Internet Explorer provided by Halcrow.
Vaisala IceCast IceNet - road|rail|runway
07.01.2011 10:52 GB
Log Out User : TRANSPORTSE
Observation
Forecast
Available Tools
IceNet Observation Graph™ : A985 Kincardine ELR
05-Jan-2011 12:00 <= (+24hrs)
Date
04-Jan-2011 12:00
04-Jan-2011 16:00
04-Jan-2011 20:00
05-Jan-2011 00:00
05-Jan-2011 04:00
05-Jan-2011 08:00
05-Jan-2011 12:00
Temperature °C
Status
State1
Alarm1
04-Jan-2011 21:40
wet [SurfState1]
Surf Temp1
AirTemp
DewTemp
View printer friendly version
Graph Scale
Station
Attributes (if available)
Surface Sensor (if available)
Surf Temp
Surf Temp + Air/Dew
Surf Temp + Grip
Surf Temp + Voltage
No. 1
No. 2
Date
05
Jan
2011

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Vaisala IceNet (UK) | [BEAR Scotland (Ltd) SE] - Microsoft Internet Explorer provided by Halcrow.
Vaisala IceCast IceNet - road|rail|runway
Observation
Forecast
Available Tools
IceNet Observation Graph™ : M8 Jct3 Livingston
05-Jan-2011 14:00 <= (+24hrs)
Date
Temperature °C
Status
State1
Alarm1
Surf Temp1
AirTemp
DewTemp
View printer friendly version
Graph Scale
Station
Attributes (if available)
Surface Sensor (if available)
Surf Temp
Surf Temp + Air/Dew
Surf Temp + Grip
No. 1


Vaisala IceNet (UK) | [BEAR Scotland (Ltd) SE] - Microsoft Internet Explorer provided by Halcrow.
http://birice.vaisala.com/IceNet/getObsGraph.do
Observation
Forecast
Available Tools
IceNet Observation Graph™ : M8(J4) Whitburn
05-Jan-2011 14:00 <= (+24hrs)
Date
04-Jan-2011 16:00
04-Jan-2011 20:00
05-Jan-2011 00:00
05-Jan-2011 04:00
05-Jan-2011 08:00
05-Jan-2011 12:00
Temperature °C
State1
Alarm1
Status
Surf Temp1
AirTemp
DewTemp
View printer friendly version
Graph Scale
Station
Attributes (if available)
Surface Sensor (if available)
Surf Temp
Surf Temp + Air/Dew
Surf Temp + Grip
No. 1
Date


Vaisala IceNet (UK) | [BEAR Scotland (Ltd) SE] - Microsoft Internet Explorer provided by Halcrow.
Vaisala IceCast IceNet - road|rail|runway
Observation
Forecast
Available Tools
IceNet Observation Graph™ : M8 Duntilland
05-Jan-2011 14:00 <= (+24hrs)
Temperature °C
Status
State1
Alarm1
Surf Temp1
AirTemp
DewTemp
View printer friendly version
Graph Scale
Station
Attributes (if available)
Surface Sensor (if available)
Surf Temp
Surf Temp + Air/Dew
Surf Temp + Grip
No. 1
Date

Comparison of Forecast vs Actual RSTs

Sensor	Min RST actual	Domain	Time /date of actual RST	Forecast RST
M9 Polmont	minus 1 degree C	7	05:22hrs	minus 0.5 degrees C from 04:00hrs to 07:00hrs
A985 Kincardine Bridge (nearest sensor M9 J8)	Minus 1.5 degrees C	7	04:20hrs	
M9 Bannockburn	minus 1 degree C	7	04:01hrs	minus 0.5 degrees C from 04:00hrs to 07:00hrs
M9 J3 Linilthgow	minus 1.2 degrees C	7	04:20hrs,05:20hrs and 06:04hrs	minus 0.5 degrees C from 04:00hrs to 07:00hrs
M8 J3 Livingston	minus 0.3 degrees C	6	04:20hrs and at 05:10hrs	minus 1.0 degrees C from 02:00hrs to 09:00hrs
M8 J4 Whitburn	No RST readings	6		
M8 Duntilland	minus 0.5 degrees C	6	03:40hrs	minus 1.0 degrees C from 02:00hrs to 09:00hrs