Gloucestershire County Council

Adverse Weather Plan

2018 - 2019

<table>
<thead>
<tr>
<th>Rev</th>
<th>Date</th>
<th>Status</th>
<th>Written By</th>
<th>Reviewed By</th>
<th>Authorised By</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>August 2018</td>
<td>Final</td>
<td>Jenny Goodson</td>
<td>Chris Riley</td>
<td>Kathryn Haworth</td>
</tr>
<tr>
<td>1</td>
<td>June 2018</td>
<td>draft</td>
<td>Jenny Goodson</td>
<td></td>
<td></td>
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28. Gloucestershire Constabulary - Police Control Room, Quedegeley
29. Highways Agency - South West Regional Control Centre, Avonmouth
30. Highways Agency - West Midlands Regional Control Centre, Quinton
1. **Introduction**

1.1 Following the release of the new Code of Practice “Well-managed Highways Infrastructure” our adverse weather plan now covers all weather impacts on the highway network and does not just concentrated on snow and ice. Sections include:

- Flooding
- High Winds
- Heat
- Cold temperature and snow

This document describes Gloucestershire County Council's arrangements for dealing with adverse weather on the highway. It also provides contact information for key personnel.

1.2 The plan covers arrangements for roads and structure in Gloucestershire that are the responsibility of Gloucestershire County Council. It excludes arrangements for roads that are the responsibility of the Highways England, i.e.

- A417/A419 from the county boundary near South Cerney to Zoons Court roundabout east of Gloucester
- A40 from the M5 west to the county boundary near Boxbush
- A46 from the M5 east to the county boundary near Teddington
- M5 and M50 motorways

1.3 **General description of service**

Gloucestershire County Council (GCC) is committed to providing a robust adverse weather service including responding to winter and other adverse weather conditions. The adverse weather service is provided on behalf of GCC by Amey Gloucestershire. The extent of the service provided will vary depending upon the severity and nature of adverse weather conditions and resources availability.

1.4 **Objectives**

In practice GCC aims to safeguard the travelling public from the hazardous effects of snow or ice or other adverse weather conditions so far as it is practicably able to with the resources available. Proactive winter maintenance and other emergency operations will normally be undertaken based upon available weather forecast information, knowledge of prevailing local weather conditions and resource availability.
2. **Flooding**

2.1 Gloucestershire County have experienced a number of flood events over recent years and these fit under two headings, either river or surface water flooding. Working closely with the Environmental Agency and other bodies in the county we have a good understanding of the impact of river levels on the county and the impact of intensive rain on surface water run off.

2.2 Gloucestershire hold a number of action plans for the impact of flooding on the county and many of these are well tested after the events back in 2007, 2012 and 2014. These action plans can be referred to in our Emergency Manual maintained by our Contractor Amey.

2.3 Tewkesbury Borough, Forest of Dean District, Stroud District and Cheltenham Borough Councils operate Flood Warden Schemes and we can access them through our Civil Protection Team.

3. **High Winds**

3.1 Gloucestershire County Council manages the impact of high winds and our emergency response is provided by our Contractor Amey Gloucestershire. The extent of the service provided will vary depending upon the severity and nature of high wind conditions and resources availability.

3.2 Amey Gloucestershire will have in house resources available and access to their supply chain to deal with any emergency situation which we are notified about.

3.3 Gloucestershire County Council has a tree policy (Link: [http://www.gloucestershire.gov.uk/media/2156/current_tree_inspection_policy_dec_2010-65673.pdf](http://www.gloucestershire.gov.uk/media/2156/current_tree_inspection_policy_dec_2010-65673.pdf)) which states the inspection period for the highway trees. These are the trees which GCC are responsible for. We react to other trees and obstructions of the highway in an emergency response in line with the highways contract.

4. **Heat**

4.1 Gloucestershire County Council monitors the weather throughout the year especially in times of prolonged periods of high temperatures when our carriageway surfacing could be affected as well as the delivery of our capital structural maintenance schemes.

4.2 Our Civil Protection Team and emergency management teams have access to the Met Office to provide weather warnings in period of high temperatures as this has an impact on other services provided by the Council. These weather warnings are circulated to the emergency works team.

4.3 An extended period of elevated temperatures can have a detrimental effect on the highway network.

   **Carriageway melting**

   Bitumen within the surfacing material can begin to melt, this can in extreme circumstances result in a reduction of skid resistance. The micro texture of the material becomes saturated. Remedial measures – Sites identified as becoming “soft” should be monitored throughout the period of elevated temperature. If the surface starts to appear “fatty” or polished the site should be dusted with 3mm to dust aggregate. This will restore skid resistance by both binding with the bitumen and aiding removal through abrasion. This process needs to be repeated until skid resistance is satisfactory.

   **Cracking due to shrinkage**

   Prolonged heat can cause rapid drying of subsoil leading to contraction, if the contraction is significant it can result in surface cracking and failure. Remedial measures - make safe and repair with safety defect procedure.
4.4 We monitor conditions and when trigger points are reached remedial actions are undertaken. Our process is reviewed and updated following any event or situation which highlights an improvement or an amendment that would benefit all.

5. **Cold Temperatures and snow**

This section of the document describes Gloucestershire County Council’s arrangements for dealing with ice, snow and other emergencies on the highway arising from adverse weather conditions.

5.1 Local self-help plays an important part in dealing with snow and other adverse weather conditions. Arrangements for work which may be carried out by Snow Wardens and Snow Plough Operators appointed by Parish Councils are included in this plan.

5.2 We have referred to the guidance set out in Well Managed Highways Infrastructure issued at the start of 2017. This document does not provide the level of guidance as the previous version of the Code of Practise but refers to details provided by NWSRG Practical Guide. Unfortunately at the time of preparing this document many of the sections are under review and we are waiting for the next versions of the documents to be published. Due to the guidance not being issued in time for inclusion in to this document we refer to previous guidance set out in Well Maintained Highways version of Chapter 13 and Appendix H which covers winter service, issued in September 2013. This guidance was taken from the first version of the NWSRG Practical Guide. The guidance has stated that “it is recognised that, in certain cases it could potentially take up to around 10 years or so for major programmes of change to be fully implemented”. With the large number of changes and additional information in the guidance we have reviewed our winter service and prepared an action plan to clearly show where we have more work to do to meet the new guidance. We have also worked with our neighbouring Local Authorities in the South West to benchmark ourselves and to adopt a similar strategy on maximum spreadrates for precautionary treatment. We have made improvements in line with the guidance for our salt storage and community resilience and these are also summarised in our action plan. Our action plan is included in Appendix 3.

5.3 **Strategy**

Our core winter period is from October to April and when icy road conditions are forecast during this period precautionary salting will be carried out on the strategic road network which comprises:

- Class A and B roads
- Roads leading to main hospitals, ambulance stations, police stations and fire stations
- Some strategic public transport routes
- Roads serving main shopping centres
- The majority of Secondary schools

The strategic road network covers approximately 29% of Gloucestershire’s total road network. We also refer to Strategic road network as our Primary or Key routes.

During prolonged severe winter weather conditions, when time allows and resources are available, salting may also be carried out on the secondary road network. The extent of the secondary road network to be treated will be determined at the discretion of the local Area Highways Manager and Amey Gloucestershire’s Principal Operations Manager on the basis of prevailing weather conditions and resource availability and may include:

- Major bus routes (operated every two hours or more frequently) not covered by the strategic road network
- Routes adjacent to major educational establishments (in term time) provided treatments can be completed by 0800 hrs using available spreading equipment
- Other locations where high traffic volume or local conditions dictate as well as access in to rural communities
It is recognised that during severe winter weather conditions, e.g. snowfall or freeze/thaw conditions, all available resources may be continuously employed in maintaining the strategic road network. In prolonged severe winter weather conditions Amey Gloucestershire will however work in partnership with local Parish Council Snow Wardens and Snow Plough Operators to establish local weather conditions and, where resources are available, arrange for snow clearance work on local roads.

If the country experiences prolonged periods of snow or extremely low temperatures which in turn causes problems with salt deliveries, then we will consider our actions within Gloucestershire to reduce salt usage through the introduction of our Resilience Network (Minimum Winter Network). We will also use our Resilience Network if weather conditions are extreme or if available resource is limited due to a pandemic.

5.4 Statutory responsibility

GCC is under a duty to ‘ensure, so far as is reasonably practicable, that safe passage along the highway is not endangered by snow or ice’ (Highways Act 1980 Section 41 (1A)). This duty is not absolute given its qualification of reasonableness and practicability.

5.5 Standards

The mobilisation time for precautionary salting will normally be one and a half hours. The completion time for precautionary salting routes will normally be three hours (from start of salting to completion of salting routes). Depending on forecast weather conditions and wherever reasonably practicable morning treatments will be completed before the start of the morning rush hour.

5.6 Operational management

The county is divided into three areas for normal operational purposes (West, Central and East) each under the control of an Amey Gloucestershire Operations Manager.

East Area is managed from Cirencester and Moreton Depots. Central Area including the Tewkesbury Borough is managed from Stroudwater depot and the West area, covering the Forest of Dean District is managed from Cannop Depot.

A network of weather stations is installed across the county to monitor weather conditions (location plan is attached in Appendix 5). Information from the weather stations is made available to Amey Gloucestershire and GCC staff via the Findley Irvine Icelert Weather Monitoring System. Weather forecast information is made available to Amey Gloucestershire and GCC staff by MetDesk.

Treatment decisions are made at an area level in accordance with the decision-making matrix shown in this document. During severe winter weather conditions activities are coordinated across the county by the Amey Gloucestershire Principal Operations Manager (Revenue) and GCC Area Managers working in partnership.

5.7 Treatment of Footways and Cycleways

Winter service is important to the County Council in improving road safety and preventing collisions, and ensuring that the effect of adverse weather on road users is minimised. Whilst some precautionary treatment of footways and cycleways would be desirable, precautionary treatment of footways and cycleways is not undertaken.

The policy is based on the level of risk (likelihood and impact) presented to drivers on carriageways; the level of usage of the County’s carriageways in comparison to its footways and cycleways; the complexity of treating footways and cycleways by mechanical or manual methods in relation to its comparative benefit; and the level of available resource to achieve winter operations, both within a narrow window for precautionary treatment and across a full winter season.
At the discretion of the Amey Gloucestershire Operations Manager and if time and resources allow we may undertake reactive treatment during periods of heavy snow or prolonged freezing temperatures at high priority locations following inspections or reports from the Police.

We have a large number of communities within the county with Winter Action Plans which identify local priority areas. These documents set out how they manage their response during winter conditions including the treatment of priority locations with either a hand salt spreader and/or the use of bagged salt to either replenish grit bins or deal with local problem areas, co-ordinating with their local Parish Snow Wardens and Snow Plough Operators. Each community have different availability and their plans reflect this and their commitment when resources are free.

5.8 Treatment of level crossings

Currently there is only one National Rail level crossing on our strategic routes and this is at Lydney and only on a limited number of our secondary routes. The secondary routes are salted infrequently, and the manual identifies that on pre salting operations salting is stopped before the crossing and restarting afterwards, however during snow conditions we would normally plough straight through but not salt.

5.9 Snow fencing

Consideration will be given to the erection of temporary snow fencing in certain circumstances to reduce the effect of drifting snow. This is dependent on local conditions and materials and resource to undertake this operation.

5.10 Communication

Where possible proactive communication with the emergency services and the media will be coordinated by Amey Gloucestershire’s Communication and Engagement Manager and GCC Central Area Highways Manager.

During periods of severe weather close coordination will be maintained with the police. The names and telephone numbers of appropriate GCC and Amey Gloucestershire personnel, including their deputies are on record in the Police Control Room.

We will provide information to the Town and Parish Councils as well as members of the public on our Winter Operations including the distribution of winter guidance on our website. We will continue to use the Twitter and Facebook sites to provide updates on winter operations and any emergency road closures (@GllosRoads). All our information directs the public to the Snow Code provided from on the DfT website (see Appendix 7) to provide self help where possible.

We provide details of our planned operations to our neighbouring authorities that we have agreements with to ensure we provide a consistent approach across boundaries.

5.11 Decision Making

Refer to the information provided in Appendix 1 for winter decision making guidance. This information is taken from the Well Maintained Highways, updated 18 September 2013 with minor amendments based on local experience including the benchmarking with the South West Local Authorities and information released from NWSRG. Full guidance to replace the Well Maintained Highways Code of Practice chapter has yet to be released by the NWSRG but we will continue to work with them to review and comment on the sections released and to incorporate guidance when appropriate.

6. Roles and responsibilities

6.1 The Highways Operations Manager for the Highway Authority and the GCC West Area Highways Manager are responsible for:
• Updating and providing the Adverse Weather Plan
• Salt Procurement

6.2 The Account Director in Amey and the Principal Operations Manager and their delegates are responsible for:

• Providing winter service in line with GCC Adverse Weather Plan
• Optimising the use of the available resources and co-ordinating actions across the county
• Undertaking an annual review of operational arrangements
• Assisting with the implementation of the winter service action plan and reviewing the Adverse Weather Plan
• Ensuring that in extreme conditions Area Offices are staffed at appropriate times to maintain communication with personnel and others on duty and relay instructions and situation reports
• Liaising with and coordinating the work of Snow Wardens and Snow Plough Operators
• Arranging where possible for the provision of roadside salt for self-help and working with communities to prepare and implement Parish Winter Action Plans and for local communities to hold a local stock of bagged salt to deal with local priorities

6.3 The Amey Principal Operations Manager (Revenue) and their delegates are responsible for working in partnership with GCC Area Highways Managers to:

• Managing winter maintenance and emergency operations in their areas in accordance with the Adverse Weather Plan
• Reviewing available weather forecasts and ice detection station information and determining appropriate actions
• Deploying available resources in their areas
• Coordinating arrangements for emergency responses to flooding and storm damage

GCC Area Teams will assist Amey decision makers this season in preparation for the decision making coming back in house for the next Contract from April 2019. Amey Principal Operations Manager (Revenue) and GCC Area Highways Manager, in the event a severe weather event (such as significant snowfall), will discuss the transfer of decision making and operational direction to GCC Area Highway Managers and their delegates to support the response during the agreed adverse weather event. Event triggers and the handover and handing back of operational decisions will be recorded on internal systems.

6.4 Snow Wardens and Snow Plough Operators

Appendix 8 provides details of the roles and responsibilities of the Parish Snow Wardens and Snow Plough Operators. Snow Warden’s main duties are to collate local weather information and co-ordinate the response of the snow plough operator within the Parish. In the rural areas we are very reliant on snow plough operators to keep the local routes clear of snow while we concentrate our efforts and resources to the strategic network.

6.5 Parish and Town Council Action Plans

We work closely with a number of our Parish and Town Councils to ensure action plans are in place to deal with local issues as well as promoting community self-help. More details on these action plans are available from the Local Highways Managers and each plan is specific to a Parish or Town Council.

7. Operational procedures

Amey Gloucestershire will provide a detailed Winter Maintenance Service Operational Plan and a summary is provided below, please refer to the Amey’s Operation plan for details including rotas and process maps.
7.1 Weather forecasting

Weather forecasts are made available to Gloucestershire by MetDesk as follows:

- 24-hour forecast (generally provided at 1200hrs and updated at 1800hrs)
- 2-5 day forecast (generally provided at 1200hrs)

A 24-hour consulting service is also provided by MetDesk to allow clarification of weather forecast information.

A network of weather stations are installed across the county at 12 locations and are detailed in the map in Appendix 5.

If the weather conditions changes from the forecast then MetDesk will contact the Amey Duty Supervisor (Green Man) out of hours and they will then review this information with the appropriate decision makers to decide on the action required.

7.2 Operational records

Records of winter maintenance decisions will be recorded on the Findley Irvine Icelert Weather Monitoring System by the Amey Gloucestershire Operations Manager or their delegate.

When emergency operations occur, Area Offices will maintain a diary of each emergency, with a running record of all reports, times and action taken and will report appropriately to the Amey Principal Operations Manager (Revenue) on actions and road conditions.

7.3 Standby arrangements for adverse weather and other emergencies

A 24-hour standby rota of staff will be maintained by Amey Gloucestershire with three duty supervisors and one countywide Escalation Manager. GCC staff will assist and support the decision making process. GCC staff will also assist in any emergency through the escalation process.

7.4 Salt stock

Road salt complying with the requirements of British Standard BS 3247:1991 will be provided through a contract between GCC and its salt supplier. Salt will be supplied by the salt supplier using a salt management system.

We have increased our salt stocks over the years with the construction of four salt domes across the county providing covered and improved salt storage as well as increased stocks. At the start of the winter period the maximum available stock level will be approximately 11,000T. Additional salt supplies will be ordered when stock levels fall below 80% of the maximum available stock level. We will endeavour to have full stock going in to the Christmas period.

<table>
<thead>
<tr>
<th>Depot</th>
<th>Maximum Stock</th>
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<tbody>
<tr>
<td>Cannop</td>
<td>3,700T Dome</td>
</tr>
<tr>
<td>Cirencester</td>
<td>2,000T Dome</td>
</tr>
<tr>
<td>Moreton</td>
<td>2,000T Dome</td>
</tr>
<tr>
<td>Stroudwater</td>
<td>3,700T Dome</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>11,400T</strong></td>
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APPENDIX 1: Winter Decision Making – extract from Well Maintained Highways September 2013, Appendix H

Precautionary Treatment Decision Matrix

H9.9  
A suggested decision matrix for precautionary treatments based on road surface conditions and predicted weather conditions is given in Table H9.

<table>
<thead>
<tr>
<th>Road Surface Temperature</th>
<th>Precipitation</th>
<th>Predicted Road Conditions</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Wet</td>
<td>Wet Patches</td>
</tr>
<tr>
<td>May fall below 1°C</td>
<td>No rain</td>
<td>Salt before frost (see note a)</td>
</tr>
<tr>
<td></td>
<td>No hoarfrost</td>
<td>Salt before frost (see note b)</td>
</tr>
<tr>
<td></td>
<td>No fog</td>
<td>Salt after rain stops (see note c)</td>
</tr>
<tr>
<td>Expected to fall below 1°C</td>
<td>Expected hoarfrost</td>
<td>Salt before frost, as required during rain and after rain stops (see note d and H11.35)</td>
</tr>
<tr>
<td></td>
<td>Expected fog</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expected rain before freezing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Expected rain during freezing</td>
<td></td>
</tr>
<tr>
<td>Possible rain</td>
<td>Salt before frost</td>
<td>Monitor weather conditions</td>
</tr>
<tr>
<td>Possible hoarfrost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Possible fog</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expected snow (See H11.35)</td>
<td>Salt before snow fall</td>
<td></td>
</tr>
</tbody>
</table>

The decision to undertake precautionary treatments should be, if appropriate, adjusted to take account of residual salt.

All decisions should be evidence based, recorded and require continuous monitoring and review.

Decision on treatment timing should account for traffic and road surface wetness at time of treatment and after, as well as forecast conditions.

Notes:

(a) Particular attention should be given to the possibility of water running across or ponding on carriageways and other running surfaces e.g. off adjacent fields after heavy rains, washing off or diluting salt previously deposited. Such locations should be closely monitored and may require treating in the evening and morning and possible other occasions. See Warning 6.

(b) When a weather warning contains reference to expected hoarfrost, considerable deposits of frost may occur. Hoarfrost usually occurs in the early morning and is
difficult to cater for because of the probability that any salt deposited on a dry road too soon before its onset, may be dispersed before it can become effective. Close monitoring is required under this forecast condition which should ideally be treated just as the hoarfrost is forming. Such action is usually not practicable and salt may have to be deposited on a dry road prior to and as close as possible to the expected time of the condition. Hoarfrost may be forecast at other times in which case the timing of salting operations should be adjusted accordingly.

(c) If, under these conditions, rain has not ceased by early morning, crews should be called out and action initiated as rain ceases.

(d) Under these circumstances rain will freeze on contact with running surfaces and full pre-treatment should be provided even on dry roads. This is a most serious condition and should be monitored closely and continuously throughout the danger period. Authorities should be aware of the health safety implications of ice forming during freezing rain events, both to the travelling public and winter maintenance personnel carrying out treatments. They should be prepared to make follow up treatments on any ice that has formed or to take suitable actions such as road closures.

(e) By using domain-based forecasting, consideration can be given to differing actions from each depot.

(f) Where there is any hint of moisture being present, a pessimistic view of the forecast should be taken when considering treatment to negatively textured surfaces. See Warning 6

(g) Spreading salt alone at temperatures below about -7°C (the lower of air or road surface at time of spreading) or below about -5°C in low humidity conditions (relative humidity less than 80%) may not be practically effective. High spread rates will be required and even then salt may not enter solution quickly enough to prevent freezing or be able to melt ice or compacted snow. Consideration should be given to spreading at least 2 hours before the temperature reaches these values to allow salt to enter solution, or the use of alternative de-icers. See Section H12.

Road Surface Wetness

H9.10 For the purpose of allocating treatments a distinction is made between dry, damp and wet road surfaces. Definitions for use when making treatment decisions are given in Table H10. These may be used in conjunction with direct measurements of water film thickness and data from weather forecasts to determine when a road is damp or wet.
Table H10 – Road Surface Wetness

<table>
<thead>
<tr>
<th>Definition</th>
<th>Description</th>
<th>Water film thickness (mm)</th>
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<tbody>
<tr>
<td>Dry road</td>
<td>A road that shows no signs of water or dampness at the surface but may be just detectably darker (however it may have moisture contained in pores below the surface that is not 'pumped' to the surface by traffic)</td>
<td>0 to 0.03mm</td>
</tr>
<tr>
<td>Damp road</td>
<td>A road which is clearly dark but traffic does not generate any spray. This would be typical of a well-drained road when there has been no rainfall after 6 hours before the treatment time.</td>
<td>0.03 to 0.05mm</td>
</tr>
<tr>
<td>Wet road</td>
<td>A road on which traffic produces spray but not small water droplets. This would be typical of a well-drained road when there has been rainfall up to 3 hours before the treatment time.</td>
<td>0.05 to 0.1mm</td>
</tr>
</tbody>
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H10 TARGET SPREAD RATES OF SALT FOR PRECAUTIONARY TREATMENT

General

H10.1 Key recommendations – Target spread rates for precautionary treatment:

- When precautionary treatments are carried out, sufficient salt should be spread, based on the forecast conditions, to prevent frost and ice formation and/or to prevent ice or snow from bonding to the carriageway

- Spread rates should be kept as low as possible for the forecast conditions, routes and road surfaces considered. This is in order to optimise salt usage, improve stock resilience, and reduce the impact of salt on vehicles, infrastructure and the environment

- (Recommendation RH.29)

H10.2 The majority of winter service treatments in the UK are precautionary in nature and in response to predicted frost and ice conditions.

H10.3 Those conditions where expected road surface temperatures are close to zero (just above or below) are termed marginal. In these situations significant salt savings can be achieved using the rates given in this guidance when:

- Spreader performance is good and in-calibration

- Salt is in good condition
- The type of salt is the same and salt moisture content is within 1.5% of that when the spreader was calibrated, and when this is also within the optimum range, see H7.23
- Salt distribution in the target area is within acceptable defined limits, see H7.18
- Losses during spreading and wastage are within acceptable defined limits

H10.4 Spread rates for precautionary treatments are given in this section for dry, pre-wetted and treated salting for a range of weather and road surface conditions.

H10.5 The use of pre-wetted or treated salt can provide salt savings compared to dry salting. Thus providing service efficiencies and increased resilience, whilst having less detrimental impact on the environment, vehicles and infrastructure.

H10.6 There are a number of key factors which determine appropriate treatment spread rates. This section provides guidance on how to consider each factor when deciding which spread rate to use. The key factors which determine the appropriate spread rate are:

- The type, grading and moisture content of the salt
- Whether the spreader is accurately calibrated for the salt being used
- The performance and serviceability of the spreader
- The type of salt and salting technology (e.g. dry, pre-wetted, treated salting)
- The weather forecast and forecast road surface conditions
- The weather and road surface conditions during and after spreading
- The residual salt levels on the highway
- The level of trafficking before, during and after spreading
- The type of surfacing
- Other factors associated with the nature of the local road network, such as the presence of slopes, and highway drainage provision, etc.

**Spread rate decision making**

H10.7 Recommended spread rates for dry, pre-wetted and treated precautionary treatments are provided in Treatment Matrices A to C. Authorities should select the appropriate Matrix column for each route based on an assessment of the following 3 factors as shown in Table H12:
- Salt distribution: Good/Fair/Poor
- Traffic level: Low/Medium or High
- Salt loss immediately after spreading: Normal or High

H10.8 The determination of these factors may vary for a number of factors, these include:

- different climatic domains,
- different routes,
- different spreaders,
- accuracy of calibration or time since last calibration,
- different salt types,
- different salt condition,
- different stocks/deliveries of the same salt type,
- time of spreading,
- traffic levels at time of spreading,
- traffic levels after spreading,
- road surface types.

Therefore a one size fits all approach will not provide the benefits outlined above.

H10.9 The final decision on the correct matrix column will be dependent on the factors above and others that must be confirmed, either as continuing from previous assessments or newly assessed, each time a new treatment is required. Prior to commencement of the winter season, assessment can be made of the spreader performance following calibration.

H10.10 The decision maker should recognise that circumstances or conditions may change following the original treatment decision for a single or multiple treatments and the decision making process should be revisited when necessary.

The Treatment Decision Making process

H10.11 The following checklists are designed as a quick reference for the delivery of the Treatment Decision. They should be read and used in conjunction with the detailed guidance and information given in this Appendix.

H10.12 Decision Making Checklist H1 “In advance of forecast” can be used to prepare for the winter season as well as be used in season to confirm that the data has not changed and take action where necessary outside of the individual treatment decision making process required for a weather event.
H10.13 Using this process, when the treatment decision is made it is only necessary to confirm that the base data/parameters, that may not change at each treatment decision (such as spreaders being in calibration and salt condition remains unchanged), need be confirmed.

H10.14 Furthermore, the number of treatment matrices and columns used within the matrix needed for a particular route can be identified possibly reducing to just one or two for most decisions.

H10.15 Decision Making Checklist H2 “At forecast” is the part of the decision making process which is reliant on the forecast and other current conditions such as traffic level, road wetness at time of spreading and wind.
<table>
<thead>
<tr>
<th>Item</th>
<th>Parameters</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following conditions and parameters</td>
<td></td>
<td>may be assessed/determined in advance of the treatment decision but must be confirmed within the treatment decision process for each</td>
</tr>
<tr>
<td>forecast</td>
<td></td>
<td>forecast</td>
</tr>
<tr>
<td>Spreader is allocated to route</td>
<td>Yes/No</td>
<td>Check spreader is able to spread de-icer allocated for the route – if not do not use or treat as poor spreading capability and increase</td>
</tr>
<tr>
<td></td>
<td></td>
<td>spread rate to next largest rate in appropriate matrix. Monitor route during and after spreading</td>
</tr>
<tr>
<td>Spreader is in Calibration</td>
<td>Yes/No</td>
<td>Use Poor Spreading capability if No providing spreader is capable of spreading de-icer to the minimum level required “1”. Use spread</td>
</tr>
<tr>
<td></td>
<td></td>
<td>rate matrix consistent with the actual technology to be used.</td>
</tr>
<tr>
<td>Is the same spreading technology used as</td>
<td>Yes/No</td>
<td>If No confirm spreader is capable of spreading de-icer to the minimum level required “1”. Use spread rate matrix consistent with the</td>
</tr>
<tr>
<td>when calibrated?</td>
<td></td>
<td>actual technology to be used.</td>
</tr>
<tr>
<td>Is de-icer the same type and grading as</td>
<td>Yes/No</td>
<td>Is spreader capable and calibrated for de-icer if Yes OK – if No do not use or treat as poor spreading capability (poor coverage) and</td>
</tr>
<tr>
<td>calibration (Normal and/or extreme cold</td>
<td></td>
<td>increase spread rate to next larger rate in appropriate matrix. Monitor route after during and spreading</td>
</tr>
<tr>
<td>alternatives need to be considered)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Has de-icer been tested within allowable</td>
<td>Yes/No</td>
<td>If No reduce spreading capability (coverage) to next lesser level of capability if above Poor Capability. Take remedial action where</td>
</tr>
<tr>
<td>period (Table H5)</td>
<td></td>
<td>salt exceeds maximum allowable moisture content</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is de-icer within 1.5% of calibrated m/c</td>
<td>Yes/No</td>
<td>If No reduce spreading capability (coverage) to next lesser level of capability if above Poor Capability. Take remedial action where</td>
</tr>
<tr>
<td>and not above maximum allowable m/c</td>
<td></td>
<td>salt exceeds maximum allowable moisture content</td>
</tr>
</tbody>
</table>

*1 Note the minimum requirements for spreading capability when using the spreading matrices in this guidance must be met at all times for the rates to be valid.
### Decision Making Checklist H2 – At forecast of frost or ice

<table>
<thead>
<tr>
<th>Item</th>
<th>Parameters</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following conditions and parameters are assessed/determined when the treatment decision is being made for the forecast conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Obtain forecast conditions (from forecast provider)</td>
<td>Temperature and precipitation</td>
<td>Use values to determine road surface wetness and appropriate row in spread rate matrix for salting technology for wetness and RST&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Assess salt distribution</td>
<td>Good/Fair/Poor</td>
<td>Use results of distribution assessment if known and spreader is in calibration. Otherwise use Poor – See Flowchart H1</td>
</tr>
<tr>
<td>Assess traffic level</td>
<td>High/Medium</td>
<td>Use known traffic levels at time of/immediately after spreading. If traffic levels are not known carry out the full decision making process for both High and Medium/Low traffic levels and take higher spread rate. See Table H11</td>
</tr>
<tr>
<td>Assess road surface wetness at time of spreading</td>
<td>Dry/Damp/Wet</td>
<td>See Table H10 and use appropriate value to determine both losses and spread rate for combined RST and wetness in appropriate decision matrix for salting technology used. For a very wet road (in excess of Wet as defined in Table H10 refer to Table H13 for appropriate action</td>
</tr>
<tr>
<td>Or Very Wet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess loss after spreading</td>
<td>High/Normal</td>
<td>Use Flowchart H2</td>
</tr>
<tr>
<td>Assess road surface wetness at forecast point</td>
<td>Dry/Damp/Medium</td>
<td>Assess from forecast of precipitation See Table H10</td>
</tr>
<tr>
<td>Assess road surface temperature</td>
<td>°C (from forecast) &lt;sup&gt;1&lt;/sup&gt;</td>
<td>Use along with road surface wetness to determine appropriate row in spread rate matrix.</td>
</tr>
<tr>
<td>Determine spread rate from appropriate spread rate matrix for technology and de-icer used</td>
<td>Using information assessed above</td>
<td>Use Table H12 to identify appropriate Matrix column. For normal or extreme cold conditions.</td>
</tr>
<tr>
<td>Check special conditions which may require increase in treatment rate, etc.</td>
<td>Surfacing, wind, traffic.</td>
<td>See Table H13</td>
</tr>
<tr>
<td>Record of decision process</td>
<td></td>
<td>Record all information and communicate to appropriate parties for service delivery, management and audit of the service.</td>
</tr>
</tbody>
</table>
– Forecast conditions may be modified by additional historical data, thermal mapping information, sensor information and other sources of local knowledge where these are available. This should only be done where well defined processes aligned with the Treatment Decision and understanding of the information along with its impact on the decision and associated risks are understood and risks mitigated.

**H10.16** Guidance is given in the following sections on how to assess all the factors required in the decision making process:

- Salt distribution (see Flowchart H1)
- Traffic level (see Table H11)
- Salt loss immediately after spreading (see Flowchart H2)

**Guidance on assessing salt distribution**

**H10.17** For precautionary treatments, the spread rates that can be used depend upon how accurately the spreaders can distribute the salt. A simple assessment of the salt distribution as **Good/Fair/Poor** should be made during calibration.

**H10.18** The decision on the salt distribution is based on the condition of the salt and the spreader performance, as well as the calibration of the spreader. The flow chart H1 below provides guidance on determining whether the spreading capability can be considered as Good, Fair or Poor. It asks a number of questions relating to the condition of the salt and the calibration and performance of the spreader.

**H10.19** The coverage should be reduced from ‘Good’ to ‘Fair’ or ‘Fair’ to ‘Poor’ when the wind speed is greater than 20mph and the spreader is not operated with wind compensation. In winds greater than 30mph, additional treatments may be necessary which may include continuous spreading. It is recommended that an assessment is made based on the spreader characteristics (e.g. susceptibility to poor distribution in winds or wind compensation providing ability to be set for effective asymmetrical spreading in windy conditions for the road layout and topography), road surface wetness (e.g. if the road is drying in the wind and further precipitation is not forecast, or the road is wet and the salt is less likely to be blown off the road) or the road surface is highly exposed to the wind. This assessment should firstly consider whether de-icer spreading is practical in the conditions and then consider whether an increased spread rate or continuous spreading is the appropriate decision when all circumstances are taken into account.

**H10.20** It is considered that ‘Good coverage’ will apply only to spreaders capable of high spreading accuracy and in good condition, that are correctly calibrated and whose performance is monitored regularly.

**H10.21** Ideally, a Service Provider would utilise the same spreaders on the same routes. It is acknowledged that this may not be practically achievable in all circumstances. However Authorities should as far as possible use spreaders with the same performance on each route. Where spreaders are allocated to a different route than the normal, one or backup spreaders are used they must be calibrated for the salt being used or allowances made for increasing the spread rate during the
decision making process.

The optimum moisture contents for typically used salt are:

- **Dry and treated rock salt** 1.5 to 4%
- **Dry and treated marine salt** (and other salts with a low fines content) 1.5 to 4%
  
When pre-wetting the salt, the lower limits do not apply.

It is important that the spreader has recently been calibrated, to help ensure the spreader is operating correctly over the full range of spread widths and spread rates.

Calibration should establish spreader settings for the specific salt types being. The moisture content of the salt being used must remain within the optimum range and not change by more than 1.5% from the moisture content at calibration.

Salt should be spread as near as possible to the target rate. This can be checked:

- As part of the calibration process, or
- From continuous monitoring of the amount spread during each treatment throughout the winter season, against the target amount for the route and spread rate.

Minimum spread rate in a lane:

- **Treated and pre-wetted salt**: Good 90%, Fair 70%, Poor 60%
- **Dry salt**: Good 80%, Fair 60%, Poor 50%

**Is the salt moisture within the optimum range?**

- **Yes**: Remedial Action 1
- **No**: Remedial Action 2

**Has the spreader been calibrated within the last 4 months?**

- **Yes**: Remedial Action 2
- **No**: Remedial Action 2

**Is the salt being spread the same as that used in the calibration?**

- **Yes**: Remedial Action 2
- **No**: Remedial Action 2

**Is the amount of salt discharged within 10% of the target amount?**

- **No**: Remedial Action 2
- **Yes**: Remedial Action 2

**Is the salt distribution Good/Fair/Poor?**

- **Good**
- **Fair**
- **Poor**

**Is the wind speed greater than 20mph?**

- **Yes**: Good
- **No**: Fair

**Good salt distribution**

- Provided minimum requirements are met

**Poor salt distribution**

**Note**: For wind speeds of 30mph or more refer to Section H10.19

Highlighted moisture content changed in line with latest NWSRG guidance – presented at Cold Comfort May 16th 2018.
Flowchart H1 – Salt Distribution Flowchart

H10.22 An Authority can improve its spreading capability by considering the remedial actions below.

Action 1

Mix the salt with drier or wetter salt (as appropriate to decrease or increase the moisture content). Use salt from the stockpile or from new deliveries.

A simple test for moisture is outlined in H6.69

Action 2

Calibrate the spreader using the salt being spread.

Guidance on assessing traffic levels

H10.23 Traffic levels are an important part of the treatment decision. Details are given in Section H8 and Table H11

<table>
<thead>
<tr>
<th>Table H11 – Traffic Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level</strong></td>
</tr>
<tr>
<td>Heavy</td>
</tr>
<tr>
<td>Low/Medium</td>
</tr>
</tbody>
</table>
**Guidance on assessing salt loss immediately after spreading**

The salt loss immediately after spreading should be assessed as normal or high loss:

- **Normal loss**
  Road surface is wet, or traffic is not heavy immediately after spreading

- **High loss**
  Traffic heavy immediately after spreading and road surface dry or damp, or
  If the moisture content of dry salt is less than 2% when dry salting

The flow chart H2 provides guidance on the decision making process to determine whether the salt loss immediately after spreading will be normal or high.
Flowchart H2 – Salt Loss Flowchart

Spread rate matrices

H10.24 Authorities should select the correct Treatment Matrix and matrix column from Table H12.

<table>
<thead>
<tr>
<th>Salt distribution</th>
<th>Traffic level</th>
<th>Losses</th>
<th>Treatment matrix column</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor</td>
<td>High</td>
<td>Normal</td>
<td>A</td>
</tr>
<tr>
<td>Poor</td>
<td>High</td>
<td>High</td>
<td>B</td>
</tr>
<tr>
<td>Poor</td>
<td>Medium/Light</td>
<td>Normal</td>
<td>C</td>
</tr>
<tr>
<td>Poor</td>
<td>Medium/Light</td>
<td>High</td>
<td>D</td>
</tr>
<tr>
<td>Fair</td>
<td>High</td>
<td>Normal</td>
<td>E</td>
</tr>
<tr>
<td>Fair</td>
<td>High</td>
<td>High</td>
<td>F</td>
</tr>
<tr>
<td>Fair</td>
<td>Medium/Light</td>
<td>Normal</td>
<td>G</td>
</tr>
<tr>
<td>Fair</td>
<td>Medium/Light</td>
<td>High</td>
<td>H</td>
</tr>
<tr>
<td>Good</td>
<td>High</td>
<td>Normal</td>
<td>I</td>
</tr>
<tr>
<td>Good</td>
<td>High</td>
<td>High</td>
<td>J</td>
</tr>
<tr>
<td>Good</td>
<td>Medium/Light</td>
<td>Normal</td>
<td>K</td>
</tr>
<tr>
<td>Good</td>
<td>Medium/Light</td>
<td>High</td>
<td>L</td>
</tr>
</tbody>
</table>

H10.25 The following points must be considered when using the spread rate matrices for normal conditions. If the minimum requirements set out below are not met then the service provider must take remedial action to ensure that the total amount of salt being spread is at least 90% of the target amount and wastage of salt spread outside the lanes is assessed to be less than 20% of the target amount.

1. The service provider must make adequate checks to ensure salt distribution is within 60% of target for treated and pre-wet spreading and 50% for dry salt, for each lane for the spread rate used and that there will be no tunnelling in the spreader preventing salt reaching the discharge mechanism.

2. The Matrices only relate to properly calibrated spreaders as outlined in Section H7.
3. Spread rates given in the Matrices are only appropriate when spreading takes place at temperatures that ensure the salt is fully dissolved before lower temperatures are reached. Generally this is at temperatures above -5°C in low humidity conditions (below 80%) and above -7°C in normal UK winter humidity conditions (80% and above). Temperatures below these have been defined as "Extreme Cold" in this guidance. While salt already in solution on the road can be effective at temperatures significantly below these values it is essential that spreading operations are undertaken before temperatures fall to these levels. The absolute value considered effective for sodium chloride brine solutions is -15°C.

4. In Extreme Cold conditions spreading should be completed at least 2 hours before the threshold temperatures of -7°C or -5°C are reached to enable the salt to enter solution provided conditions of road wetness and/or humidity are sufficient at the time of spreading to provide sufficient water. Roads should be closely monitored and consideration given to increasing the spread rate, making successive treatments or both.

5. In Extreme Cold conditions, where spreading cannot be completed in the above time-frame or in conditions when dissolution will not occur alternative de-icers should be considered. Also, where forecast temperatures will be below -15°C, alternative de-ices should be used. (See Section H12). Where alternative de-icers are not available consideration must be given to providing clear and frequent warnings to drivers of icy conditions or roads should be closed.

6. The spread rates are for sections of well drained roads without ponding or runoff from adjacent areas. Spread rates must be adjusted accordingly or other measures taken where appropriate.

7. The rates may be adjusted to take account of variations occurring along routes such as temperature, surface moisture, road alignment and traffic density. When single spread rates are used for each route/network (which is currently typical practice) the rates should reflect the expected conditions on all sections of that route/network.
8. The rates may be adjusted to take account of residual salt levels. However, it should be noted that residual salt levels will tend to be lower if lower spread rates are introduced. Residual salt levels are most likely to be significant on marginal nights after treatments on two or three successive days without precipitation in the intervening period.

9. On porous asphalt and on dense surfacing for 1km after a change from porous asphalt, spread rates should be increased by 50% on roads with medium traffic levels and by 25% on heavily trafficked roads.

10. Spread rates should be increased to a rate appropriate for the particular situation where negatively textured thin surfacings are poorly drained such that water can accumulate within the surface texture.

11. When the rates in the selected Matrices are significantly lower than those used previously, it is recommended that the reduction should be introduced in stages with the performance of spreaders and route condition monitored. In particular, checks should be made that the amount of salt discharged is within 10% of the target and that treatments are effective.

12. All decisions should be evidence based, recorded and require appropriate monitoring and review.

13. Where Authorities are confident of significant levels of residual salt, spread rates may be reduced by an appropriate amount based on local knowledge and experience. Care must be taken to identify any areas on a route where residual salt may not be present.

**Important notes**

- The spread rates for pre-wetted salt are for the total de-icer, i.e. the dry salt and the brine components.

- Matrices A to C provide the spread rates for UK Indigenous Rock Salt. Spread rates can be reduced by 5% for salts with a sodium chloride content of 99% or more such as marine salt when using spread rates of 20g/m² or above.

- It has been assumed that two treatments are required to achieve spread rates greater than 30g/m². It may be necessary and preferable to make two treatments to achieve spread rates greater than 20g/m².

- Spread rates should be increased from those given in the Matrices under the conditions shown in Table H13 below:
<table>
<thead>
<tr>
<th>Condition</th>
<th>Increase in spread rate or action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spreading when there is no or very little traffic</td>
<td>25%</td>
</tr>
<tr>
<td>Porous asphalt</td>
<td>25%</td>
</tr>
<tr>
<td>Dense surfacing after change from porous asphalt</td>
<td>25% for 1km</td>
</tr>
<tr>
<td>Areas prone to surface water</td>
<td>See Warning 6</td>
</tr>
<tr>
<td>Spreading in very heavy traffic (e.g. peak traffic times) if unavoidable</td>
<td>Consider treatment in 2 runs</td>
</tr>
<tr>
<td>Spreading in high winds (greater than 20 mph)</td>
<td>Increase the spread rate or consider</td>
</tr>
<tr>
<td></td>
<td>continuous spreading as detailed in Section</td>
</tr>
<tr>
<td></td>
<td>H10.19 and Flowchart H1</td>
</tr>
<tr>
<td>Concrete roads after prolonged cold spell</td>
<td>25%</td>
</tr>
<tr>
<td>Spreading in low humidity (less than 80%)</td>
<td>Consider an additional precautionary</td>
</tr>
<tr>
<td></td>
<td>treatment earlier in the day $^1$</td>
</tr>
<tr>
<td>Spreading in dry conditions in advance of heavy hoar frost</td>
<td>Consider an additional precautionary</td>
</tr>
<tr>
<td></td>
<td>treatment earlier in the day $^1$</td>
</tr>
</tbody>
</table>

$^1$ The treatment should be timed to allow the maximum time for dissolution taking into account the likely losses due to traffic especially when using dry salt only.
### TREATMENT MATRIX A
**DRY SALTING** (De-icer spread rates in g/m²)

<table>
<thead>
<tr>
<th>Frost or forecast frost</th>
<th>Column</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Surface Temperature (RST)</td>
<td>Cvrг</td>
<td>Traffic</td>
<td>Loss</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
<td>PC</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
<td>FC</td>
<td>GC</td>
<td>GC</td>
</tr>
<tr>
<td>and Road Surface Wetness</td>
<td></td>
<td></td>
<td></td>
<td>HT</td>
<td>HT</td>
<td>MT</td>
<td>MT</td>
<td>HT</td>
<td>HT</td>
<td>MT</td>
<td>MT</td>
<td>HT</td>
<td>HT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NL</td>
<td>HL</td>
<td>NL</td>
<td>HL</td>
<td>NL</td>
<td>HL</td>
<td>NL</td>
<td>HL</td>
<td>NL</td>
<td>HL</td>
</tr>
<tr>
<td>RST at or above -2°C and dry or damp road conditions</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>RST at or above -2°C and wet road conditions</td>
<td>10</td>
<td>13</td>
<td>13</td>
<td>16</td>
<td>8</td>
<td>11</td>
<td>11</td>
<td>13</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>RST below -2°C and above -5°C and dry or damp road conditions</td>
<td>15</td>
<td>20</td>
<td>17</td>
<td>20</td>
<td>13</td>
<td>17</td>
<td>14</td>
<td>17</td>
<td>10</td>
<td>13</td>
<td>11</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>RST below -2°C and above -5°C and wet road conditions</td>
<td>25</td>
<td>2 x 17</td>
<td>2 x 17</td>
<td>2 x 20</td>
<td>21</td>
<td>28</td>
<td>28</td>
<td>2 x 17</td>
<td>16</td>
<td>21</td>
<td>21</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>RST at or below -5°C and above -10°C *1 and dry or damp road conditions</td>
<td>29</td>
<td>2 x 19</td>
<td>2 x 16</td>
<td>2 x 19</td>
<td>24</td>
<td>32</td>
<td>27</td>
<td>2 x 16</td>
<td>18</td>
<td>24</td>
<td>20</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>RST at or below -5°C and above -10°C *1 and wet road conditions</td>
<td>2 x 4</td>
<td>2 x 32</td>
<td>2 x 32</td>
<td>2 x 39</td>
<td>2 x 20</td>
<td>2 x 27</td>
<td>2 x 27</td>
<td>2 x 32</td>
<td>30</td>
<td>2 x 20</td>
<td>2 x 20</td>
<td>2 x 24</td>
<td></td>
</tr>
</tbody>
</table>

Please see Table H13 for variations to the rates given above.

**Key:**
- **Cvrг:** PC = Poor coverage, FC = Fair coverage, GC = Good coverage
- **Traffic:** HT = High level, MT = Medium Level
- **Loss:** NL = Normal loss, HL = High loss

*1 Refer to Section H10.21 Notes 3, 4 & 5 when spreading at temperatures at or below -5°C

Please note Southwest Benchmarking exercise 20g per meter squared is the maximum spread rate in one operation.
H11 TREATMENTS FOR SNOW, ICE AND FREEZING RAIN

General

H11.1 It is impractical to spread sufficient salt to melt more than very thin layers of snow and ice. Ploughing is the only economical, efficient, effective and environmentally acceptable way to deal with all but light snow.

H11.2 Drainage should not be obstructed when ploughing snow. Windrows or piles of snow should be positioned to allow drainage system to function or be removed. Where necessary snow should be removed to prevent melt water overloading of drainage systems or running back into the carriageway.

H11.3 The salt distribution profile determined during calibration is most relevant to precautionary treatments when salt can bounce across the road surface. When slush, snow or ice is present, unless the spread width setting is increased, salt distribution will tend to be restricted to a narrower width as a result of the salt not ‘bouncing’ across the road surface. Therefore, when spreading on snow or slush, the spreader settings should be adjusted to achieve the required spread width.

H11.4 Providing space for ploughing of further snowfalls is important and may require windrows to be removed or ploughed further off the carriageway.

H11.5 Freezing rain occurs when droplets of water freeze upon contact with the ground and freeze instantaneously into ice, often forming ‘black’ ice. Freezing rain is difficult to forecast and can cause ice to build up very quickly on the road surface.

Preparation before ice, snow and freezing rain

H11.6 Key recommendations – Preparation before ice, snow and freezing rain:

- Forecasting and timing are critical to the efficient treatment of snow and freezing rain conditions. Decisions should be based on the best available forecast information and treatments carried out as close to the optimum time as is practicable

(Recommendation RH.30)

H11.7 When snow is forecast ploughs and snow blowers should be prepared and positioned in order that snow clearance can start without delay as and when required.

H11.8 To facilitate the breakup and dispersal of ice and snow by trafficking, treatments must be made before snowfall or freezing rain. This ensures that there is de-icer present on the surface to provide a debonding layer.

H11.9 Although it will increase salt usage, before snowfall and where practicable, consideration should be given to spreading salt on as much of the network as possible (i.e. beyond the normal precautionary salting network). This will provide a debonding layer and facilitate the breakup and dispersal of snow by traffic where subsequent treatments will not take place for a considerable time or at all.
H11.10 Spreading salt before freezing rain is necessary to provide a de-bonding layer but freezing of the liquid brine may occur on top of the salt. Authorities should be aware of this limitation and the health safety implications of this frozen layer during freezing rain events. They should be prepared to make follow up treatments on any ice that has formed or to take suitable actions such as road closures. Research into more effective treatments before, during and after freezing rain is currently on going and guidance will be updated to reflect the findings.

**Depths of snow (light, moderate to heavy snow)**

H11.11 This guidance defines two main snowfall categories – light snow and moderate/heavy snow. The differentiation is based on the amount of snow that a 40g/m² treatment of dry salt would adequately treat at freezing down to -2 °C. This relates to dilution amongst other factors and it is suggested that light snow relates to a snow depth with an equivalent depth of water of 1mm. Depending on the type of snow (dry (powdery), normal and wet) the depth varies. The forecaster should forecast the snow “wetness” factor. Figure H2 defines light and moderate/heavy snow

![Figure H2 – Snow definitions](image)

**Timing of different treatment types**

H11.12 Whenever possible, treatments should be made:

- Before snowfall and freezing rain (to provide a debonding layer and melt small amounts of snow).
- Depending on the prevailing conditions, subsequent treatments should be carried out as shown below:
Table H14 – Timing of treatments for snow and freezing rain

<table>
<thead>
<tr>
<th>Timing of treatment</th>
<th>Treatment type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before snowfall and freezing rain</td>
<td>• Salt spreading</td>
</tr>
<tr>
<td>During freezing rain, or where there are minor accumulations of ice</td>
<td>• Salt spreading</td>
</tr>
<tr>
<td>During snowfall</td>
<td>• Ploughing</td>
</tr>
<tr>
<td></td>
<td>• Salt spreading</td>
</tr>
<tr>
<td>After snowfall</td>
<td>• Ploughing</td>
</tr>
<tr>
<td>• When there is slush on the road</td>
<td>• Salt spreading</td>
</tr>
<tr>
<td>After snowfall</td>
<td>• Ploughing</td>
</tr>
<tr>
<td>• When there is compacted snow or ice on the road</td>
<td>• Salt spreading</td>
</tr>
<tr>
<td></td>
<td>• Salt and abrasive mixtures</td>
</tr>
<tr>
<td></td>
<td>• Abrasives only</td>
</tr>
</tbody>
</table>

Effect of trafficking on roads affected by snow

H11.13 Key recommendations – Effect of trafficking on roads affected by snow:

- The effect of trafficking should be considered when planning treatments relating to snowfall events as, depending on the prevailing conditions, it can be beneficial in aiding the melting or dispersing of snow or have the dis-benefit of compacting existing layers of snow making them harder to remove.

- For the above reasons careful consideration needs to be given to the closing of roads in snow conditions or the timing of closing and opening.

- If trafficking is not able to be accounted for, treatment rates should be those provided for light traffic conditions.

- When traffic levels are light, and where practicable, the number of trafficked lanes should be reduced, as this concentrates the traffic and helps to disperse the snow more rapidly.

(Recommendation RH.31)

H11.14 Traffic helps to melt and disperse snow, particularly at air and road surface temperatures at around 0°C or higher, and may be sufficient on its own to melt and disperse light snow. However, when snow is likely to settle (because the road and/or air temperatures are below zero) traffic will be more effective in dispersing.
snow when salt has been spread on the road beforehand.

H11.15 Where snow has settled on a road surface, traffic may compact the snow when air or road surface temperatures are below 0°C. However, when precautionary treatment has established a debonding layer, trafficking may help to break up compacted snow and ice. Increased trafficking also tends to disperse the debonding layer at the road surface more rapidly which may dictate further treatment is necessary where conditions require.

Ploughing

H11.16 Key recommendations - Ploughing:

- When snow is forecast, ploughs and snow blowers should be made ready to allow snow clearance to commence without delay as and when required.

- Drivers and staff required to carry out ploughing should be ready to start operations when needed and not be delayed due to travelling to depots etc. when snow has started to settle.

- When carrying out treatments after snowfall, as much snow and slush as possible should be removed from the road surface by ploughing, before the application of de-icer and/or abrasives

- During and after snowfall, for efficiency and environmental reasons it is best that only the ploughed lane is treated if other lanes have still to be ploughed. The spread width settings may be adjusted accordingly to maximise effectiveness

- Actions to remove snow should be taken as early as practicable to prevent compaction by traffic

- Subsequent ploughing can be carried out when necessary to prevent build-up of snow (this may require continuous ploughing in certain conditions)

- Ploughing is most effective when down to the road surface

- Ploughs are best operated at a steady speed which is effective for the plough and conditions

- Ploughing should be with a loaded vehicle, to aid traction and allow a steady ploughing speed to be maintained

- When fitted, a plough blade float mechanism should always be used

- If available, snow blowers can be used for particularly deep snow or where there is insufficient width at the side of the road to store the ploughed snow

- Snow ploughs should always be operated in accordance with the manufacturer’s instructions

(Recommendation RH.32)
H11.17 The purpose of ploughing is to move as much snow as possible away from the road surface. More than a few millimetres of snow cannot be treated with salt. Effective ploughing will:

- Remove as much snow as is practical for the given conditions, preferably down to the road surface.
- Reduce the likelihood of snow becoming compacted and bonded to the road surface.
- Reduce the amount of de-icer needed for subsequent treatments (these treatments may not be effective if much snow has fallen and not been removed by ploughing).

H11.18 Ploughing down to (or very close to) the road surface is very important as it improves efficiency and reduces salt usage. However, snow ploughs should be adjusted and/or operated to avoid risk of damage to the plough, the road surface, street furniture and level crossings.

H11.19 Ploughing with a loaded vehicle is recommended to improve traction and provide greater momentum. For this reason consideration must be given to the effect on traction and ability to plough deeper snow towards the middle and end of a route when ploughing and spreading at the same time.

H11.20 **Warning - Ploughing:**

- Records of raised manholes, traffic calming measures, and level crossings that may be damaged, or damage the plough, should be taken into account when ploughing.

*(Warning 7)*

**Types of plough**

H11.21 Key recommendations – Types of plough:

- Plough blades should be designed to minimise distortion during ploughing. They should have special wearing edges to prevent damage and ensure low friction.
- In addition to the spreader fleet, consideration should be given to the fitting of ploughs to other suitable vehicles.
- Authorities should consult manufacturers, to ensure that ploughs are suited to the operational conditions and requirements.

*(Recommendation RH.33)*

H11.22 A wide range of snow plough types are available, including those for mounting on spreading vehicles and other maintenance vehicles. It is recommended that ploughing should be carried out down to the road surface and snow ploughs are available that can allow this to be achieved without causing damage to the road surface.
H11.23 Important aspects to consider on a plough are:

- The material used for the wearing edge of the plough blade
- The construction of the plough
- The ease of mounting and removal (where applicable)

H11.24 Plough blades are available with different types of wearing edge material, including rubber, polyurethane, metal and composite materials. Rubber wearing edges can offer an effective ‘squeegee’ action that removes soft snow and slush. However rubber wearing edges are likely to be less effective than harder wearing edges at removing hard packed snow and ice. Ploughs specifically designed for removing compacted snow or ice will have metal cutting edges. Weak materials should not be used as wearing edges.

H11.25 The type of ploughs used on the highway network are typically straight bladed, and it is often possible to change the angle at which the blade is oriented to the left or right and the angle of the plough blade to the road surface.

H11.26 Steerable snow ploughs, in which the blade orientation can be changed automatically during clearing operations, provide even greater operational flexibility. For example, when clearing snow to the roadside with an angled plough, there may be occasions when it is necessary to alter the angle of the blade, for example to move snow along a road when there is insufficient room to the side, or there is a need to avoid blocking certain areas.

H11.27 The correct plough orientation should be used for the intended purpose:

- Straight blade angled to the road alignment - for displacing snow/slush to the roadside
- Straight blade perpendicular to the road alignment - for moving snow along a road
- V shaped – typically for displacing deep snow to both sides of the vehicle. Blades can be formed from several sections, mounted side by side, with each section able to move independently. This allows the blades to better adapt to the shape of the road surface. Some types of plough are constructed with a single section blade and these may be less effective in certain circumstances than multiple section blades.

H11.28 Ploughs should have effective systems to avoid damage to the machine, the road surface and the blade - for example spring mounted wearing edges which can deflect when an obstacle is encountered. A float mechanism enables the plough blade to automatically follow the changing longitudinal profile of the road, preventing the whole weight of the vehicle being applied to the plough and reducing wear to the plough blade.

H11.29 In addition to the spreading fleet, consideration should be given to fitting ploughs to other vehicles including those belonging to contractors or farmers. This will increase the capacity for ploughing on a Authority’s network and potentially free up salting vehicles to spread de-icer and/or abrasives to assist in providing a faster
and more effective service in snow conditions.

H11.30 For demountable ploughs the plough should be easily mountable, to minimise the time and manpower required to mobilise the plough, potentially shortening response times.

**Good ploughing practices**

H11.31 Key recommendations – Good ploughing practices:

- Plans should be drawn up for each ploughing route to inform drivers where ploughed snow can and cannot be moved to

- Snow should be ploughed to the low side of carriageways and the build-up of snow in the centre of a single carriageway should be avoided. This is to avoid the later run-off from windrows or piles of snow from entering the traffic lanes, where it may dilute treatments and/or refreeze

- Drainage should be kept clear, and windrows or piles of snow should be removed or be positioned to allow melt water to reach the drains

- Piles of snow should be removed, where possible, so that melt water does not overload drainage systems or run back onto the road

- Windrows must be avoided at level crossings. Before ploughing commences on roads that include level crossings, contact should be made with Network Rail.

- Windrows should be removed or ploughed back when further periods of heavy snow are anticipated. This will provide space to plough the further snowfalls

- Accumulations of snow at central reserves, especially those with vertical concrete barriers, should be cleared where they create a hazard or impede drainage

- Where possible, multi-lane dual carriageways should be ploughed in one pass, either by:

  - Ploughing just one lane

  - Ploughing all lanes using ploughs working in echelon formation

  - Appropriate traffic management should be considered

  *(Recommendation RH.34)*

H11.32 **Warning - Good ploughing practices:**

- Run-off from windrows and piles of snow may enter the carriageways and refreeze to form sheet ice, particularly where drainage is blocked or piles of snow are to the high side of the road.

  *(Warning 8)*
Precautionary treatments before snow or freezing rain

H11.33 Key recommendations – Precautionary treatments before snow or freezing rain:

- If light snow is forecast that will be of insufficient depth to require ploughing, then sufficient salt should be spread to melt the snow aided by the action of traffic

- If moderate or heavy snow is forecast, sufficient salt should be spread to provide a debonding layer

(Recommendation RH.35)

H11.34 Trafficking is important in the process of breaking up and removing ice and snow. When it snows, the temperature can hover around 0°C and rarely falls below -3°C. Calculations show that even when spread rates of 40g/m² are used the freezing point of water is only suppressed by a small amount (and rarely below -1.5°C) because of the diluting effect of the moisture provided by snow.

H11.35 Spread rates for precautionary treatments before snow or freezing rain are given in Treatment Matrix D

H11.36 The traffic levels are as assigned in Table H11 according to the vehicles/hour/carriageway
TREATMENT MATRIX D – Precautionary Treatments Before Snow Or Freezing Rain

<table>
<thead>
<tr>
<th>Weather conditions</th>
<th>Light or medium traffic</th>
<th>Heavy traffic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light snow forecast</td>
<td>Spread:</td>
<td>Spread:</td>
</tr>
<tr>
<td></td>
<td>• 40g/m² of dry salt, or</td>
<td>• 20g/m² of dry salt, or</td>
</tr>
<tr>
<td></td>
<td>• 40g/m² of pre-wetted salt, or</td>
<td>• 20g/m² of pre-wetted salt, or</td>
</tr>
<tr>
<td></td>
<td>• 30g/m² of treated salt</td>
<td>• 15g/m² of treated salt</td>
</tr>
<tr>
<td>Moderate/Heavy snow forecast</td>
<td>Spread:</td>
<td>Spread:</td>
</tr>
<tr>
<td></td>
<td>• 20-40g/m² of dry salt</td>
<td>• 40g/m² of dry salt, or</td>
</tr>
<tr>
<td></td>
<td>• 20-40g/m² of pre-wetted salt</td>
<td>• 40g/m² of pre-wetted salt, or</td>
</tr>
<tr>
<td></td>
<td>• 15-30g/m² of treated salt (see Note 1)</td>
<td>• 30g/m² of treated salt</td>
</tr>
<tr>
<td>Freezing rain forecast</td>
<td></td>
<td>40 or 2x20g/m² of dry salt, or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 or 2x20g/m² of pre-wetted salt, or</td>
</tr>
<tr>
<td></td>
<td></td>
<td>30 or 2x15g/m² of treated salt</td>
</tr>
</tbody>
</table>

Note 1: The lower rates (e.g. 20g/m² for dry salt) can be used if the snow is likely to settle quickly, e.g. when the road surface temperature is below zero, the road surface is not wet and the snow is not wet, and/or there is little traffic after snowfall begins and settles.

Note 2: Spreading salt before freezing rain can have a limited benefit and Authorities should be prepared to make follow up treatments on any ice that has formed.

Treatments during snowfall

H11.37 Key recommendations – Treatments during snowfall:

- Ploughing is most effective when started as soon as possible for the conditions and, where required, is continuous or sufficient to prevent a build-up of snow
- Salt spreading should be considered after ploughing to provide a new debonding layer to facilitate further ploughing of fresh snow and the break up and dispersal of compacted snow
- On heavily trafficked roads it is preferable (where practicable) to prevent a build-up of more than 10mm depth of snow. The build-up should be no more than 50mm in depth where there is a risk of compaction by traffic

(Recommendation RH.36)

H11.38 Ploughing and salt spreading are undertaken during snowfall to:

- Limit the accumulation of snow on the road surface, thereby reducing the amount of salt required for subsequent treatments
- Help the dispersal/clearing of the snow by traffic
- Prevent snow from being compacted

**H11.39 Warning – Treatments during snowfall:**

- Applying salt alone to compacted snow and ice can produce more dangerously slippery conditions if a weak brine film is formed on top of the ice/snow layer.

- De-icer should not be spread alone without abrasives to anything other than a thin layer of ice or compacted snow when snowfall has ceased or future snowfall will be less than 10mm.

**(Warning 9)**

**H11.40** Treatment Matrix E provides guidance on how to treat during snowfall.

**TREATMENT MATRIX E – Treatments During Snowfall**

<table>
<thead>
<tr>
<th>No ice or compacted snow on surface</th>
<th>Ice or compacted snow on surface (see Note 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To provide a debonding layer, spread:</strong></td>
<td><strong>Is traffic likely to compact subsequent snowfall before further ploughing is possible?</strong></td>
</tr>
<tr>
<td>- 20g/m² of dry salt, or 18g/m² of treated salt or 24g/m² of pre-wetted salt (See Note 1)</td>
<td><strong>YES</strong></td>
</tr>
<tr>
<td></td>
<td>To provide a debonding layer, spread:</td>
</tr>
<tr>
<td></td>
<td>- 20g/m² of dry salt, or 18g/m² of treated salt, or 24g/m² of pre-wetted salt (See Note 1)</td>
</tr>
</tbody>
</table>

Note 1: During and after snowfall, it is best that only the ploughed lane be treated if other lanes have still to be ploughed. The spread width settings may be adjusted accordingly.

Note 2: A de-icer should not be spread alone without abrasives to anything other than a thin layer of ice or compacted snow when snowfall has ceased or future snowfall will be less than 10mm. Applying salt alone to compacted snow and ice can produce more dangerously slippery conditions if a weak brine film is formed on top of the ice/snow layer.
Treatment of slush on the carriageway

H11.41 Key recommendations – Treatment of slush on the carriageway:

- If freezing conditions are expected, it is important to remove as much slush as possible by ploughing to reduce the amount of material available to form ice when temperatures drop, as well as to reduce the amount of salt required for subsequent treatments

- If freezing conditions are not expected and the slush will melt and be dispersed under the action of traffic, no action is required

(Recommendation RH.37)

H11.42 Treatment Matrix F provides guidance on how to treat slush.

<table>
<thead>
<tr>
<th>TREATMENT MATRIX F – Treatment For Slush When Freezing Conditions Are Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plough to remove as much slush as possible (ploughing is best when as near as possible to the level of the road surface).</td>
</tr>
<tr>
<td>After removing slush, spread:</td>
</tr>
<tr>
<td>- 40g/m² of dry salt, or</td>
</tr>
<tr>
<td>- 36g/m² of treated salt, or</td>
</tr>
<tr>
<td>- 48g/m² of pre-wetted salt</td>
</tr>
<tr>
<td>(See Note 1)</td>
</tr>
</tbody>
</table>

Note 1: After snowfall, and when there will be no further ploughing but some slush remains on the road surface, it may be necessary to change the settings normally used for precautionary treatment to ensure a satisfactory distribution is achieved over the target spread width.

Treatment of thin layers of ice (up to approximately 1mm)

H11.43 Warning - Treatment of thin layers of ice:

- Care is needed when salt is mixed with abrasives. Checks should be made that the mixture is free flowing, does not clump and can be spread effectively.

(Warning 10)

H11.44 Where a thin layer of ice forms, including after an instance of freezing rain, Treatment Matrix G provides guidance on how to treat thin layers of ice.
### TREATMENT MATRIX G – Treatment For Thin Layers Of Ice (Less Than 1mm Thick)

<table>
<thead>
<tr>
<th>Forecast weather and road surface conditions</th>
<th>Medium/Light Traffic</th>
<th>Heavy traffic</th>
</tr>
</thead>
</table>
| Lower of air or road surface temperature higher than -5°C | Spread: 
  - 40g/m² of dry salt, or 
  - 36g/m² of treated salt or 
  - 48g/m² of pre-wetted salt 
  - 40g/m² of salt/abrasive mix (see Notes 1 and 2) | Spread: 
  - 20g/m² of dry salt, or 
  - 18g/m² of treated salt or 
  - 24g/m² of pre-wetted salt |
| Lower of air or road surface temperature less than -5°C | Spread: 
  - 40g/m² of salt/abrasive mix (50:50) (see Notes 1 and 2) | Spread: 
  - 40g/m² of salt/abrasive mix (50:50) (see Notes 1 and 2) |

Note 1: Abrasives are ideally of 5-6mm and angular particles, but gradings down to 1-5mm may be reasonably effective. After abrasives have been used, drainage systems should be checked and cleared where necessary. Recovered material, which may be contaminated, must be disposed of safely.

Note 2: Care is needed when salt is mixed with abrasives with a high moisture content. Checks should be made that the mixture remains free flowing, does not clump and can be spread effectively.

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**Treatments of medium or thick ice and compacted snow**

H11.45 Key recommendations – Treatments of medium or thick ice and compacted snow:

- For high thicknesses of compacted snow and ice (i.e. greater than 5mm), treatments should be with salt and abrasive mixture or abrasive only. Treatments with a significant amount of salt should not be considered because they may leave the surface uneven. Any brine formed on the surface may collect in hollows and deepen them further, which can lead to a very uneven surface.

- When using abrasives alone, sufficient salt should be added to the abrasive to prevent freezing of the water within it. If the moisture content of the abrasive is 7%, 25kg of salt per tonne of abrasive is sufficient to prevent freezing if thoroughly mixed.

*(Recommendation RH.38)*
H11.46 For compacted snow, when no further snow is expected, salt and abrasive mixtures or abrasives alone can be applied to assist the action of traffic in breaking the layer.

H11.47 For compacted snow, when further snow is expected, salt and abrasive mixtures may be applied to provide grip as well as a debonding layer between the existing layer and any future snow to assist future ploughing operations. Salt should not be applied on its own as it may eventually form a weak brine solution which may re-freeze to form an ice or ice/brine layer.

H11.48 **Warning - Treatments of medium or thick ice and compacted snow:**

Applying salt alone to compacted snow and ice can produce more dangerously slippery conditions if a weak brine film is formed on top of the ice/snow layer.

*(Warning 11)*

H11.49 Where medium or thick (greater than 1mm thickness) has formed or snow has compacted to form ice the treatments suggested in Treatment Matrix H should be considered.
## TREATMENT MATRIX H – Treatment For Layers Of Compacted Snow And Ice

<table>
<thead>
<tr>
<th>Medium Layer Thickness (1 to 5 mm)</th>
<th>High Layer Thickness (greater than 5mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For initial treatment, spread:</td>
<td>For initial treatment, spread:</td>
</tr>
<tr>
<td>• 40g/m² of salt/abrasive mix (50:50) (see Notes 1, 3, 4 and 5)</td>
<td>• 40g/m² of abrasives only (see Notes 2, 3, 5 and 6)</td>
</tr>
<tr>
<td>For successive treatments, spread:</td>
<td>For successive treatments, spread:</td>
</tr>
<tr>
<td>• 20g/m² of salt/abrasive mix (50:50) (see Notes 1, 3, 4 and 5)</td>
<td>• 20g/m² of abrasives only (see Notes 2, 3, 5 and 6)</td>
</tr>
<tr>
<td></td>
<td>After traffic has started breaking up the layer, spread:</td>
</tr>
<tr>
<td></td>
<td>• 20g/m² of salt/abrasive mix (50:50) so salt can penetrate the layer and reach the road surface (see Notes 1, 3, 4 and 5)</td>
</tr>
</tbody>
</table>

**Note 1:** For medium thicknesses of compacted snow and ice, treatments without abrasives should only be used when earlier precautionary treatments have successfully established a debonding layer, and there is sufficient traffic to break up the layer of ice quickly.

**Note 2:** For high thickness of compacted snow and ice (greater than 5mm), treatments with a significant amount of salt should not be considered because they may leave the surface uneven. Any brine formed on the surface may collect in hollows and deepen them further, which can lead to a very uneven surface.

**Note 3:** Abrasives should ideally be of 5-6mm and angular particles, but gradings down to 1-5mm should be effective. After abrasives have been used, drainage systems should be checked and cleared if necessary. Recovered material, which will be contaminated with road oil, must be disposed of safely.

**Note 4:** Care is needed when salt is mixed with abrasives with a high moisture content. Checks should be made that the mixture remains free flowing, does not clump and can be spread effectively.

**Note 5:** When there are layers of snow, compacted snow, or ice of medium or high thickness on the road surface, it may be necessary to change the settings normally used for precautionary treatment to ensure a satisfactory distribution is achieved over the target spread width.

**Note 6:** Salt should be added to the abrasive to prevent freezing of the water within it. If the moisture content of the abrasive is 7%, 25g of salt per tonne of abrasive is sufficient to prevent freezing if thoroughly mixed.
H12 TREATMENTS FOR EXTREME COLD

General

H12.1 Spreading sodium chloride alone in extreme cold conditions may not be practically effective or economical. High spread rates will be required and even then salt may not enter solution quickly enough to prevent freezing or be able to melt ice or compacted snow.

H12.2 Extreme cold conditions for the spreading of salt (sodium chloride) without suitable additives are considered to be at or below -5°C at the time of spreading in low humidity conditions (below 80% relative humidity) and at or below -7°C in normal UK winter humidity conditions (at or above 80% relative humidity).

H12.3 When utilised without additives specifically designed for extreme cold conditions, sodium chloride should be spread at least two hours before temperatures reach -5°C to -7°C to allow the salt to enter solution and become effective as a de-icer.

H12.4 Salt already in solution before extreme cold temperatures are reached is considered to be effective down to -15°C for a fully saturated brine solution. Care must be taken where spreading is carried out before extreme cold temperatures are reached that the brine solution is not weakened by the ice and snow melted to a point where it is not effective in preventing freezing at the temperatures encountered.

H12.5 Alternative de-icers (to sodium chloride) can provide more effective and economical treatments than salt alone when spreading has to be carried out in extreme cold conditions. Some alternatives can be spread in conjunction with salt to make the salt more effective. Other alternatives can be used on their own without salt to melt ice and/or compacted snow. The ability to spread an alternative de-icer gives an option to Authorities for handling prolonged extreme cold conditions.

H12.6 While these de-icers provide benefits over sodium chloride in terms of effective operating temperature, they also may have disadvantages in terms of cost, corrosion, environmental impact and smell.

H12.7 Environmental impact may also be reduced by the use of some alternative de-icers either on their own or added to salt. This is because they may be less damaging than salt in the quantities used and may reduce the amount of salt that would be needed on its own.
## APPENDIX 2 - GCC Appendix H Review

<table>
<thead>
<tr>
<th>Item</th>
<th>Action required</th>
<th>Timescale</th>
<th>Updates</th>
<th>Status</th>
<th>Owner</th>
</tr>
</thead>
</table>
| Winter Service Standard – salt stock | Restock over summer to meet requirements: 48 runs at 20gm²  
48 x 210 = 10,080T   | Annually         | Summer restock complete  
Current salt stock just over 11,000T     | Green  | GCC                      |
| Salt Storage                      | Cover storage to be provided for all salt stock                                | Completed       | Four salt domes constructed to provide covered storage at our 4 winter operational depots  
(Cannop, Cirencester, Moreton and Stroudwater) | Green  | GCC                      |
| Stock Rotation                    | Undertake stock rotation in line with guidance in Appendix H Sept 2013         | Annually       | Review guidance and undertake stock rotation as required               | Green  | Amey         |
| Moisture Content                  | Undertake Moisture Content testing of salt monthly and use data to determine spreadrates | Monthly from September to April | Contract in place to undertake moisture tests and team will monitor and take appropriate action based on results | Green  | Amey         |
| Fleet Review                      | Current fleet leases are due to finish from April 2017.  
Fleet review and new requirements to be established to ensure we meeting guidance set out in Appendix H Sept 2013.  | Autumn 2016 - Completed | New Fleet in county.                                               | Green  | Amey/GCC    |
<table>
<thead>
<tr>
<th>Item</th>
<th>Action required</th>
<th>Timescale</th>
<th>Updates</th>
<th>Status</th>
<th>Owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gritter Calibration</td>
<td>Calibrations to be undertaken in line with Appendix H Sept 2013 so we have the information required to implement new spreadrate tables.</td>
<td>Annually</td>
<td>Amey have been tasked with reviewing current calibration against requirements in Appendix H Sept 2013 and the steps required to meet this guidance. This to be undertaken with new fleet.</td>
<td>Green</td>
<td>Amey</td>
</tr>
<tr>
<td>Route Optimisation</td>
<td>Phase 1 - Route Optimisation to be undertaken to review current network coverage. Phase 2 – to be reviewed and updated to tie in with new fleet requirements.</td>
<td>Phase 1 – May 2015</td>
<td>Phase 1 Completed Phase 2 Completed</td>
<td>Green</td>
<td>Amey</td>
</tr>
<tr>
<td>Traffic levels</td>
<td>To be undertaken once route optimisation has been completed.</td>
<td>Completed</td>
<td>Traffic levels have been assessed for each route in line with Appendix H September 2013.</td>
<td>Green</td>
<td>Amey/GCC</td>
</tr>
<tr>
<td>Training</td>
<td>1. Drivers 2. Decision Makers 3. Snow Desk exercise</td>
<td>Annually</td>
<td>1. All drivers have completed required training 2. Forecaster weather training to be undertaken for all new and existing decision makers 3. Snow desk exercise has been planned for the start of October 2018.</td>
<td>Green</td>
<td>Amey/GCC</td>
</tr>
<tr>
<td>Item</td>
<td>Action required</td>
<td>Timescale</td>
<td>Updates</td>
<td>Status</td>
<td>Owner</td>
</tr>
<tr>
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<td>-------------------------------------------------------------------------</td>
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<td>-------</td>
</tr>
<tr>
<td>Snow conditions</td>
<td>New guidance to be followed</td>
<td>Completed</td>
<td>Guidance provided in Appendix H Sept 2013 was incorporated in to GCC AWP 2014/15</td>
<td>Green</td>
<td>GCC</td>
</tr>
<tr>
<td>Extreme Temperature conditions</td>
<td>New guidance to be followed</td>
<td>Completed</td>
<td>Guidance provided in Appendix H Sept 2013 was incorporated in to GCC AWP 2014/15</td>
<td>Green</td>
<td>GCC</td>
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</table>
Appendix 3: Primary network - Central Area

Winter Season 2018
Central Area Primary Routes
Not to Scale

Appendix 3: Primary network - East Area
Appendix 4: West Resilience Network (Minimum Winter Network)
Appendix 4: Central Resilience Network (Minimum Winter Network)
Appendix 4: East Resilience Network (Minimum Winter Network)
Appendix 5: Contact Details

Gloucestershire County Council
Lead Officer for Winter: Jenny Goodson Area Highways Manager(West)

Amey Gloucestershire
Lead Officer for Winter: Leighanne James Principal Operations Manager (Revenue)

Communication and media contacts
Gloucestershire County Council
Martyn Midgley Area Highways Manager(Central)

Amey Gloucestershire
Lianne Bulter-White Communication and Engagement Manager

All contact should be directed through 08000 514 514

Depot Addresses:

<table>
<thead>
<tr>
<th>Cannop Highways Depot</th>
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<tbody>
<tr>
<td>Vallets Wood</td>
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<tr>
<td>Cannop</td>
</tr>
<tr>
<td>Coleford</td>
</tr>
<tr>
<td>Glos GL16 7EH</td>
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</table>

<table>
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<th>Moreton Highways Depot</th>
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<tbody>
<tr>
<td>Evenlode Road</td>
</tr>
<tr>
<td>Moreton in Marsh</td>
</tr>
<tr>
<td>Gloucestershire</td>
</tr>
<tr>
<td>GL56 0NG</td>
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<table>
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<tr>
<th>Cirencester Highways Depot</th>
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<tr>
<td>2 Love Lane</td>
</tr>
<tr>
<td>Cirencester</td>
</tr>
<tr>
<td>GL7 1YG</td>
</tr>
<tr>
<td>Gloucestershire</td>
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</table>

<table>
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<th>Stroudwater Highways Depot</th>
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<tr>
<td>Stroudwater Interchange M5</td>
</tr>
<tr>
<td>Frome Bridge</td>
</tr>
<tr>
<td>Whitminster</td>
</tr>
<tr>
<td>Glos GL2 7NJ</td>
</tr>
</tbody>
</table>

Contact for GCC Civil Protection Team – Duty Officer - cptdo@glosfire.gov.uk
Appendix 6: Weather Station Locations
Clearing snow and ice from pavements yourself

There’s no law stopping you from clearing snow and ice on the pavement outside your home or from public spaces. It’s unlikely you’ll be sued or held legally responsible for any injuries on the path if you have cleared it carefully. Follow the snow code when clearing snow and ice safely.

The snow code - tips on clearing snow and ice from pavements or public spaces

Prevent slips
Pay extra attention to clear snow and ice from steps and steep pathways - you might need to use more salt on these areas.
If you clear snow and ice yourself, be careful - don’t make the pathways more dangerous by causing them to refreeze. But don’t be put off clearing paths because you’re afraid someone will get injured.
Remember, people walking on snow and ice have responsibility to be careful themselves. Follow the advice below to make sure you clear the pathway safely and effectively.

Clear the snow or ice early in the day
It’s easier to move fresh, loose snow rather than hard snow that has packed together from people walking on it. So if possible, start removing the snow and ice in the morning. If you remove the top layer of snow in the morning, any sunshine during the day will help melt any ice beneath. You can then cover the path with salt before nightfall to stop it refreezing overnight.

Use salt or sand - not water
If you use water to melt the snow, it may refreeze and turn to black ice. Black ice increases the risk of injuries as it is invisible and very slippery. You can prevent black ice by spreading some salt on the area you have cleared. You can use ordinary table or dishwasher salt - a tablespoon for each square metre you clear should work. Don’t use the salt found in salting bins - this will be needed to keep the roads clear.
Be careful not to spread salt on plants or grass as it may cause them damage.
If you don’t have enough salt, you can also use sand or ash. These won’t stop the path icing over as well as salt, but will provide good grip under foot.

Take care where you move the snow
When you’re shovelling snow, take care where you put it so it doesn’t block people’s paths or drains. Make sure you make a path down the middle of the area to be cleared first, so you have a clear surface to walk on. Then shovel the snow from the centre of the path to the sides.

Offer to clear your neighbours’ paths
If your neighbour will have difficulty getting in and out of their home, offer to clear snow and ice around their property as well. Check that any elderly or disabled neighbours are alright in the cold weather. If you’re worried about them, contact your local council.
Appendix 8: Snow Wardens and Snow Plough Operator roles and responsibilities.

**Snow Wardens**

**General Duties & Responsibilities**

1. Snow Wardens are volunteers normally appointed by Parish Councils. Full contact details should be provided to the parish council and the parish clerk should be kept update on any changes.

2. During periods of severe winter weather, information regarding snow conditions should be provided to the Area Office by Snow Wardens each morning - ideally before midday. This will allow the Area Highways Manager to make a comprehensive review of weather and road conditions across each area of the county before the West Area Highways Manager considers countywide conditions. The information provided should include:
   - The extent and estimated depth of snow including degree and direction of snow drifts
   - Location of blocked roads
   - Progress already made in clearing blocked roads and snow drifts
   - Locations that are causing local communities the greatest problems

3. The primary objective of Snow Warden’s is to assist in making arrangements for the clearance of blockages on local roads and routes leading to villages and hamlets whilst GH’s resources are prioritised in maintaining the strategic road network.

4. The Area Office will request that the snow warden brings into operation any available local snow ploughs as necessary. In the event of extreme conditions the warden may initiate such operations as are appropriate to open a priority route to each community and to overcome emergency situations. Snow Wardens shall report emergency actions at the earliest opportunity to the Area Office.

5. Local self-help plays an important role in helping to deal with snowfall particularly when GH’s resources are prioritised in maintaining the strategic road network. Self help arranged by the Snow Wardens should be carried out in accordance with the DFT guidance document; “Snow Code”.

6. The aim of the snow warden is to foster and encourage local self-help from the voluntary spirit that is so apparent in emergencies to organise and direct local resources to best effect.

7. Prior to and during severe winter weather conditions wardens should establish contact with local Snow Plough Operators and with wardens of neighbouring Parishes. They should familiarise themselves with the geography and road system in the parish and with the normal routine of transport services such as school buses and milk tankers.

8. The Snow Warden should pass on to the Snow Plough Operator any advance adverse weather information received from the Area Team during the winter season. This is normally by telephone call following the lunchtime forecast update and would allow the plough to be prepared for action.

9. If a Snow Warden is unable to operate temporarily at any time during the period November to March (e.g. because of sickness or absence from home) a deputy should be appointed and briefed on the duties by the warden or by the Parish Council. The Area Office should be advised accordingly.
10. Where Parish Councils have accepted a locally controlled stockpile of salt from Area Team, the Snow Warden should co-ordinate the appropriate action of the volunteers by either salt spreading as previously agreed between Parish Council/Area Team and/or the replenishment of existing grit bins.

11. Where parish councils have not accepted a locally controlled stockpile of salt from the Area Team the Snow Warden should monitor existing grit bins and report to the Area Team if they require refilling or any misuse of the salt stock.

12. The snow warden should keep a record of all authorised snow plough activity and forward approved expenses claims from the Snow Plough Operators to the Area Team at the earliest opportunity. Where a Snow Warden is also the operator of plant it is essential that certification of records is made by an independent person able to agree on the work carried out from the local Parish Council. Any claims received directly by the Area Team will be checked against Area Team ploughing records or confirmed with the appropriate snow warden.

13. Records and claims for payment shall be submitted as soon as possible after completion of work (and not later than the end of March) using the form of invoice provided by the Area Team. [Document Reference – GHWI\N08]

14. The Snow Warden shall supply and keep up to date a list (or plan) of all grit bins located within the parish boundaries.

15. It is intended that Snow Warden will also operate in the event of widespread flooding and gale damage where traffic routes are disrupted. Emergency response activities during these conditions will be managed by GH's Area Highways Managers. Snow Wardens may be called upon to provide information on local conditions including blocked roads and recommended alternative routes.

16. Requests for assistance by Snow Wardens outside of the normal interests of GCC as a highway authority should be made directly to the police.
Snow Plough Operators

Operations

1. During periods of severe winter weather the Area Office will request that the Snow warden brings into operation any available local snow ploughs as necessary. In the event of extreme conditions the warden may initiate such operations as are appropriate to open a priority route to each community and to overcome emergency situations. Snow Wardens shall report emergency actions at the earliest opportunity to the Area Office.

2. Ploughing should ideally be commenced when traffic starts to have difficulty and when drifting begins, and should be continued as snow melts to remove the slush which otherwise may become compacted by traffic.

3. When heavy snowfall and drifting persists, efforts to clear certain lengths of road may become a ‘losing battle’ and operations should be diverted to an alternative route if that may be readily kept open. (Diversion signs should be arranged via the Area Office if resources are available).

4. Snow Ploughs and other equipment provided by GCC are solely for use on the public highway for the general community benefit. Other than in providing an essential route for community use and in providing assistance on request from the emergency services, requests for clearance of routes to individual premises and of private roads should be resisted and referred instead to private plant operators who can make their own arrangements with the individual requiring assistance.

5. GCC has no authority to deposit snow on private land. In exceptional circumstances when this action is unavoidable to enable an obstruction to be cleared Snow Plough Operators must take every care to minimise damage to private property. When fences, walls and other private property are damaged, whether by accident or by deliberate action, the details including the extent and reason for the damage shall be reported as soon as possible to the Area Office.

6. Snow Plough Operators should contact the area office prior to the start of ploughing giving details of their proposed route. They should contact the office again on completion of operations. In Parishes with more than one Plough Operator, the Snow Warden for that Parish can (by prior arrangement) notify the Area Office for all operating snow ploughs.

Payment

7. GCC will pay for equipment operated on the legitimate authority of a Snow Warden or Area Office at operation rates/prices based upon those fixed annually. GCC will not pay for any additional manual labour used without the prior agreement of the Area Office.

8. Records of all equipment and approved labour used by Snow Plough Operators shall be recorded on copies of the record sheets provided by the Area Team and passed to Snow Wardens for certification before forwarding to the Area Office. Where a Snow Warden is also the operator of plant it is essential that certification of records is made by an independent person able to agree on the work carried out from the local Parish Council.

9. Records and claims for payment shall be submitted as soon as possible after completion of work (and not later than the end of March) using the form of invoice provided Area Team. (GHWIN08 and 09)
10. The rates have been previously agreed between GCC and the National Farmers Union. The rates are inclusive of all bonuses, insurance, fuel and operator charges but exclude V.A.T. (GHWIN10)

**Inspections**

11. Periodic checks will be made as to the accessibility and condition of ploughs and tractors by area officers. Any change of tractor for which there is a snow plough ready should be notified to the Area Office so that a check can be made on the mounting/attachment. (Document Ref. GHWIN06 and 07)

12. Plough Operators will be issued with safe working practice guidance prior to the start of the Winter season. (Document Ref.GHWIN05)