WGTRMM 2016 ISSUE 2 (09 AUGUST 2016)

WELSH GOVERNMENT TRUNK ROAD MAINTENANCE MANUAL 2016 (WGTRMM 2016)

Part 2.2:22 WINTER AND ADVERSE WEATHER SERVICE

CONTENTS

2.2.22.1 Statement of Service

2.2.22.1.1 Objectives

1 The Welsh Government aims to provide an Adverse Weather / Winter Service which as far as reasonably practicable allows the safe movement of traffic on Motorways and Trunk Roads throughout Wales and keeps to a minimum delays and accidents caused by adverse weather conditions.

2 Priority is given to the Motorway and to the extra priority all purpose Trunk Roads listed in **Section 2.2.22.4.1.** A maximum 1 hour response and 2 hour target treatment time for those roads will apply. Other Trunk Roads shall be given at least the same priority as the most important County roads. In the event of unforeseen adverse weather and weather related incidents outside the winter season, a 2 hour maximum response time will be provided.

3 The Service Provider shall undertake the operational management of the service and provide the necessary labour, plant and materials except for the specialised Winter Service Motorway plant provided by the Welsh Government.

4 The Service Provider will prepare an Adverse Weather Plan in a format to follow the Template provided at Appendix A to contain the information and details specified for acceptance by Welsh Government.

2.2.22.2 Adverse Weather

2.2.22.2.1 Adverse / Severe Weather Warning Systems and Definitions

The National Severe Weather Warning System (NSWWS)	
Regional Advisory of Severe or Extreme Weather Warning(Advisory)	Advisories are issued by 1100 daily as routine and indicate confidence of expected severe or extreme weather. Early and flash warnings supersede advisories when confidence levels are 60% or greater.
UK Advanced Warning of Severe Weather (Early Warning)	An early warning of severe weather will normally be issued up to several days in advance whenever the overall risk of widespread disruption in any UK region is 60% or greater.
Regional Severe Weather Warning (Flash Warning)	Flash warnings of severe weather are issued when confidence of an event reaching specified criteria is above 80%, and should give a minimum of two hours notice. Warnings are issued for every affected county or unitary authority.
Flood Forecasting Centre (EA/NRW/Met Office) Hydro Forecasting Services	
Extreme Rain Fall Alert	The ERA Service is designed to alert emergency responders in England and Wales to the possibility of urban surface water flooding as a result of extreme rainfall
The Environment Agency (EA) Natural Resources Wales (NRW) - Flood Warning System	
Flood Watch	Flooding of low lying land and roads is expected. Be aware, be prepared, watch out
Flood Warning	Flooding of homes and businesses is expected. Act now!
Severe Flood Warning	Severe flooding is expected. There is extreme danger to life and property. Act now!.
All Clear	Flood Watches or Warnings are no longer in force for this area

Adverse Weather Definitions

Weather	Definition
Heavy Snow	More than 20mm per hour of snow for at least 2 hours (ie >40mm)
Blizzards/drifting snow	a. Moderate or heavy snow combined with winds of 30mph or more with visibility reduced to 200 metres or less or:- b. Drifting snow giving rise to similar conditions
Very heavy snowfall, blizzards or drifting snow	Expected to give depths of 150mm or more potentially resulting in widespread dislocation of communications. Blizzards are severe when visibility is reduced to near zero.
Freezing rain or fog / widespread icy roads	Generally occurs when rain or fog freezes on contact with road surfaces
Heavy rain	a. Expected to persist for at least 2 hours and to give more than 15mm of rain within a 3 hour period or:- b. More than 25mm per day on already saturated ground.
Severe Gales	Repeated gusts of 70mph or more over inland areas, with a risk to high-sided vehicles being blown over.
Storms	Repeated gusts of 80mph or more over inland areas, which could cause cars to be blown out of their lane on the carriageway.
Fog	The official definition of fog is visibility of less than 1000 metres. Whereas for a motorist; visibility of less than 200 metres is more realistic. Severe disruption to transport occurs when the visibility falls below 50 metres.
Heat wave	When there is an 80% chance of extremely high temperatures on at least two consecutive days, a heat wave warning is issued. The temperature thresholds vary by region, but an average threshold temperature is 30°C by day and 15°C overnight. (Source Heat-Health Watch, which operates in association with the Department of Health and the Welsh Government).

Severe Weather types and their expectant risk periods.

Weather Type	Risk Periods (months)
Snow	November through to March
Floods, Heavy Rain	January through to December
Gales, Wind	January to June, September to December
Fog	October, November, December and January
Heat wave, High Temperatures	June, July and August

2.2.22.2.2 Road Network

Features

1 The network features listed and detailed below are susceptible to the effects of adverse weather and are specific to adverse weather operations only. Details shall be included within the adverse weather/winter service and contingency plans and shall include environmental and ecological considerations where appropriate..

Rivers, Streams, Brooks, Culverts and Ground Water.

2 Service Providers shall complete the following table highlighting the location of rivers, tributaries, flood plains and other features which historically have caused flooding on the network or affected the structural integrity of the network (this includes land slides, erosion and subsidence). Details of water courses and areas subject to flooding from seepage of water onto the carriageway from adjacent land should also be included. Where none exist a positive statement to that effect should be included here.

Road	Location	Type
[M4]		
[A55]		
[A]		

Coastal Defence

3 Service Providers shall complete the following table highlighting the location of coastal areas that are subject to flooding or affect the structural integrity of the network (this includes erosion and subsidence). Where none exist a positive statement to that effect should be included here.

Road	Location	Type
[M4]		
[A55]		
[A]		

Bridges, Open Areas and Forest Areas

4 Service Providers shall complete the following table highlighting the location of forests and areas of trees most susceptible to high winds that exist on the network. Details of bridges and open areas subject to strong cross winds should also be included. Where none exist a positive statement to that effect should be included here.

Road	Location	Type
[M4]		
[A55]		
[A]		

2.2.22.2.3 Operations

1 Service Providers attention is drawn to the need to provide a consistent and effective service throughout the year and have in place robust procedures and contingency plans to deal with incidents and events that may arise from Adverse Weather conditions. The hierarchy op plans is shown below:-

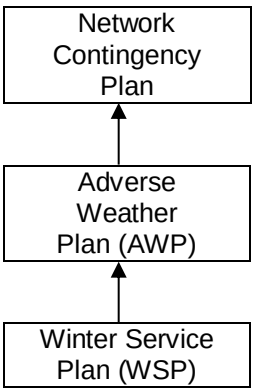


Fig 2.2.22.2.3 Plan Hierarchy

2 When developing Winter Service Plans and Contingency Plans due regard must be given to Adverse Weather and the consequential effects this may have on the operation of the Road Network.

3 The effects to the road network resulting from adverse weather maybe localised or more wide spread and have significant implications in strategic terms for the effective operation of the road network.

4 This section of the adverse weather plan contains requirements for Service Provider detailed operational procedures and actions in the event of adverse weather on the network. In addition this includes requirements and implementing arrangements for liaison and co- operation with adjacent providers to promote delivery of a consistent and co-ordinated service across all boundaries. The Welsh Government and Service Provider are responsible for arranging both strategic and tactical diversion routes and media liaison.

5 Problematical sites that have identified maintenance requirements or require measures to be undertaken to address recurring issues shall be evaluated and included within future works programmes where appropriate.

6 Some locations may however, require the implementation of a programme of scheduled inspections throughout the year in advance of forecast or as a result of adverse weather/flooding.

7 Service Providers are to include operational activities as detailed below. Service Providers to include area specific introduction as appropriate, including reference to ‘Contingency Plans’ and escalation procedures in the event of severe weather.

8 Service Providers shall include operational considerations for each severe weather type

as appropriate e.g. treatment of special structures, treatment during peak traffic flow periods, road works, treatment within tunnels, road over road bridges, operations near railways and innovative trials. Service Providers to make reference to any additional operational plans (i.e. M4 / A48 Briton Ferry, M48 Severn Crossing, Menai Bridge, A55 Penmaenbach Headland, A470 Llanrwst) specific to dealing with adverse weather.

2.2.22.2.4 Early Warning / Forecasts

1 Service Providers shall detail what alerts/forecasts they will use to provide early warning of forecast adverse weather (i.e. EA / NRW Flood Watch/Warning, weather forecast, Patrol/inspection etc)

2.2.22.2.5 High Winds / Gales Operation Considerations

1 Service Providers shall include full detailed arrangements and procedures in the event of high winds/gales to include picking up debris, signage, and location of meteorological equipment.

2.2.22.2.6 Floods

1 Service Providers are to develop a schedule of known sites and areas of high risk from flooding together with details and procedures for Pumping, Jetting & Clearance Techniques and Operational Considerations

2 Consideration shall be given to any identified areas to which floodwater can be pumped.

3 Consideration shall be given for the treatment of carriageway, footways, cycle tracks and pedestrian areas where appropriate, together with the clearance of mud and other debris.

4 Service Providers shall include operational considerations as appropriate e.g. maintenance and clearance of drainage systems liable to flooding and operations near railways.

5 Service Providers to include details for follow up treatments and after care to the network including footways, cycle tracks and pedestrian areas where appropriate.

2.2.22.2.7 Fog

1Specific measures that shall be considered by the Service Provider include:

- Where available fixed or mobile Variable Message Signs shall be used to warn road users of the hazard. The existing established procedures for requesting VMS settings to be made shall be followed well in advance. The following legend is currently the most appropriate to use – 'FOG SLOW DOWN'. This will require arrangements and protocols to be established.
- Contact and liaison with Service Providers and Welsh Government Press Officers in order that the local media can be advised as necessary.
- Where available use of variable mandatory speed limits shall be considered. This will require arrangements and protocols to be established with the appropriate Police Control office and/or WG as part of the advance planning procedures.

2 Service Providers to include area specific introduction and list the procedures in place for warning road users (i.e. use of fog detection / CCTV systems if available, signage)

2.2.22.2.8 Heat wave

1 In the event of a heat wave where vehicles and occupants are static on the motorways and trunk roads for long periods of time, the Service Provider shall provide support and assistance to the Police and Unitary Authority Emergency Planning Teams as requested.

2 Service Providers shall include details and procedures for the treatment of melted asphalted carriageway surfaces including bridge decks.

3 Details shall be provided regarding what alerts/forecasts will be used to provide early warning of forecast adverse weather (i.e. weather stations, road sensors, inspections, weather forecast etc)

2.2.22.3 Winter Service

2.2.22.3.1 Winter Service Season

1 Weather is unpredictable and the occurrence and extent of wintry conditions vary considerably through the season and from year to year.

2 Nevertheless, operational Winter Service periods need to be defined to ensure the cost effective provision of sufficient cover. To plan resource needs regularly on the assumption of a long severe winter, would lead to unnecessary expense. But to plan regularly on the assumption of a short, mild winter could lead to a lack of adequate cover at certain times. Normal planning should therefore be between these extremes but with adequate contingency to react to unforeseen circumstances.

3 Three Winter Service periods are defined for normal operational

purposes:-

i.	High Period	December, January, February - when severe conditions might reasonably be expected.
ii.	Low Period	November, March - when severe conditions may occur.
iii.	Marginal Period	October, April - when severe conditions are generally not to be expected.

4 It is not uncommon for wintry conditions to be experienced as early as mid September and as late as mid April. Service Providers must therefore ensure that adequate facilities and resources are available to react to these events should the need arise.

5 Where local experience indicates that any of these periods may not be appropriate, adjustments can be made with the agreement of the Welsh Government.

2.2.22.4 Resources and Operational Arrangements

2.2.22.4.1 Motorways and Extra Priority All Purpose Trunk Roads

1 The extra-priority all-purpose trunk roads which are to have the same importance as motorways for Winter Service are:-

i. A40/A449 from English border to M4 Junction 24 at Coldra Interchange.

ii. A48 between Junctions 41 and 42 of the M4.

iii. A470 Cardiff -Merthyr Tydfil.

iv. A465 Heads of the Valleys Road.

v A55 English Border - Bangor.

vi. A550/A494 English Border to A55 Ewloe

2 It is important for the travelling public to be able to rely on a consistent level of service across Service Providers boundaries. Neighbouring Agents / Service Providers shall therefore liaise closely and facilitate the exchange of information regarding the intended Winter Service activities to be undertaken to ensure a reasonable continuity of treatment and timing throughout the winter months. Potential manning arrangements shall be defined as follows:-

i.	Normal shifts	compound/depot manned normal working hours as determined by national or local agreement;
ii.	Continuous shifts	24-hour manning at the compound/depot;
iii.	Stand-by	personnel available at the compound / depot no more than 1 hour after being called out from elsewhere or from home;
iv.	Call-out	off-duty personnel available outside normal shifts, (combined response / treatment time for Low Period not exceeding 3 hours).

Only Winter Service personnel shall be employed outside normal shifts.

3 For precautionary salting during the high period, essential operatives may be employed on continuous or normal and stand-by shifts to ensure that treatment of top priority roads starts immediately, or no later than 1 hour after personnel have been called out if on stand-by. During severe conditions, such as snowfall, and until such conditions subside, personnel may be employed on continuous shifts to ensure an immediate response and a maximum target treatment time of 2 hours.

4 During the low period, normal and stand-by, or normal and call-out shifts shall operate to ensure that treatment starts within one hour of any decision to salt. Occasions may arise when conditions are so severe that high period arrangements are needed. Any such arrangements shall be reported to Welsh Government as soon as possible.

5 During the marginal period, normal and call-out shifts shall operate. Occasions may

arise when conditions are bad enough for other period arrangements to be implemented. Any such changes shall be reported to the Welsh Government as soon as possible.

6 When severe weather conditions are forecast or continue during the High and Low periods the combined target response / treatment time for anti-icing or de-icing treatment shall not exceed 2 hours or 3 hours during all periods when normal precautionary anti-icing treatment is undertaken or unexpected reactionary de-icing treatment is required.

7 Service Providers are to propose their methodology to deliver the service requirements above within the Winter Section of their Adverse Weather Plan for acceptance by Welsh Government.

8Plant shall be held available in compounds and depots during all 3 periods. Some vehicles may be removed for annual servicing commencing in April, but enough vehicle cover shall remain to carry out precautionary salting in the required 3 hour response treatment time. Manning during that period shall be as **Sections 2.2.22.4.1** & **2.2.22.4.2** but precautionary salting will not often be needed.

2.2.22.4.2 All Purpose Trunk Roads

1 There should be not normally be a need for continuous 24-hour shifts or stand-by cover on the remaining all purpose trunk roads comprising the network. In this context levels of service are more closely comparable to adjacent local road networks. Arrangements however, shall be both adequate to enable efficient response to road condition warnings and occurrences outside normal working hours, and flexible enough to ensure adequate coverage and resource availability during exceptionally severe conditions or extended periods.

2 Manning arrangements shall take full account of the distance essential operatives live from the compound or depot. Continuous shifts shall only be operated during the High Period, and then only where essential operatives cannot be ready to start treatment within an hour of being called from home.

3 Where a Service Provider works from a number of compounds or depot and because of the reasons given in above operates continuous shifts, both continuous and stand-by shifts may only be necessary initially from selected compounds or depots. As conditions deteriorate, however, the remaining compounds maybe brought into operation as necessary to achieve the required treatment times and efficiently undertake the required activities.

2.2.22.4.3 Equipment

1 Purpose-built winter service equipment complying with BS 1622 offers the opportunity to achieve a substantial saving in both labour and material costs. In particular, the use of powered control systems to control salt spreading eliminates the need for a second man in the cab during precautionary salting. The use of a driver and mate shall be restricted to occasions when a snow plough is fitted and to other occasions when conditions are hazardous. Instances include, when precautionary or emergency salting is required on particularly isolated stretches of road, when difficult manoeuvres are unavoidable, when visibility is poor or where weather conditions may affect the salt and is likely to lead to blockages requiring manual attention to salt distribution mechanism. In compounds and depots where hoppers are provided, vehicles can be loaded by their drivers. Additional personnel are not specifically required for this purpose unless snow ploughs are also intended

to be fitted.

2 Service Providers are required to adopt the arrangements defined in this section. 3 3 Modification can be approved by the Welsh Government where justified by local conditions.

2.2.22.5 Salt

2.2.22.5.1 Action of salt

1 There is a common misunderstanding that de-icers should melt all ice and snow on the road. Their individual de-icing properties and costs vary, as do the quantities needed to be used to be effective for differing situations. They can also have potential harmful effects on the environment.

2 The key function of the de-icer is to melt the ice, penetrate it and undercut the ice to break the bond between the road surface and the overlying ice. Passing traffic then breaks up the loosened ice or snow and disperses it from the trafficked area of the road.

3 An even more efficient use of de-icers is to apply it as a preventive treatment (anti-icing), so that the ice/pavement bond does not form. In marginal climates, such precautionary treatment can significantly reduce the amount of de-icer needed to keep roads free of ice and snow.

4 Salt (sodium chloride) will in theory melt ice and snow at temperatures as low as -21°C. However, below -10°C the quantities of salt required increase to a point where its use becomes environmentally and economically undesirable.

5 In Wales, where the temperature seldom falls below -5°C for sustained periods of time, salt only shall be used for winter Service operations. When temperatures do fall below -5°C for sustained periods of time, additives may be mixed with the salt as specified.

6 To prevent the formation of ice or frost or to melt existing snow, the salt must first form a brine solution (dissolution). Therefore, after spreading the salt, there is a time lag before it becomes effective. The length of the time required is dependent upon a number of factors (e.g. the size of the salt grains, availability of moisture, humidity) but where moisture and humidity levels are low, the time required is increased.

7 Precautionary treatment should ideally be completed no later than 1 hour before forecasted freezing temperatures or weather event where practical, which would allow sufficient time for the salt to enter into solution and complete the treatment in advance of earlier than predicted / forecast freezing temperatures being experienced locally.

8 Consideration may need to be given to the timing of such action where peak time traffic flows or, precipitation occurring at the intended time of treatment may make it impractical to do so. Treatment before the forecast time of freezing should be the objective in any event.

9 Salt grain sizes of 3mm will adsorb moisture twice as fast as a grain 6.3mm in size and 4 times more quickly than a 10mm grain after one hour under the same conditions. Potential problems may arise regarding the effects of wind turbulence from the spreading vehicle and passing traffic blowing the smaller grains of salt into the verge areas until sufficient time has elapse to allow the salt to enter into solution.

10 During the time lag before the salt enters into solution, the salt grains are subject to the effects of wind and traffic and it is recognised that a proportion of the salt grains will be removed from carriageway surfaces by these effects before they become effective. This is more of a problem when salt is spread on dry road surfaces in advance of precipitation known commonly as precautionary (preventive)

salting.

11 The rate of salt loss is dependant on various factors which include:

i) The traffic flow and the types of vehicles,

ii) The movement of salt grains or salt in solution on vehicle tyres,

iii) Runoff of salt in solution from the road surface.

iv) Climatic conditions – precipitation, wind etc.

v) Characteristics of the surfacing material.

vi) Humidity, dampness of road surface.

12 Where treatment is undertaken on a dry road surface with low humidity and heavy traffic volumes, a larger proportion of the salt would be lost when in solid form compared to salt in solution (brine) due to the effects of traffic and insufficient time being available for the salt to enter into solution.

13 In such conditions where treatment is undertaken using salt in solid form, salt loss could potentially be 50% after 2 hours and by as much as 90% after 24 hours of the quantity applied.

14 Where weather forecasts and/or weather station data indicate that freezing conditions will exceed 12 hours in duration from the start time of the initial treatment or a change in weather such as precipitation, hoar frost or high winds etc is forecast during this period, a further treatment may be necessary and should be programmed accordingly.

15 The timing of any subsequent treatment should take account of the forecast weather event, duration, residual salt levels, road conditions, traffic volumes and availability of resources / equipment.

16 Residual salt levels are higher when the salt has sufficient time to enter into solution utilising moisture on the road surface or humidity in the atmosphere to produce brine which is less susceptible to the effects of traffic and consequential salt loss.

17 The loss is considered important in assessing the optimum grain size and moisture content of the salt and the treatment frequency.

18 The maximum size of a salt grade should be selected to ensure that grains could enter into solution within an hour. Sizes above 6.3mm are unlikely to fulfil this requirement unless the grains are pre-wetted and/or traffic flows are sufficiently high to crush the salt under the vehicle tyres. However larger grain sizes do provide a delayed and longer term treatment provided the larger grains of salt remain on the carriageway.

19 The most appropriate product grading would depend on the specific local weather conditions prevailing, width of spreading, characteristics of the road and

suitability of equipment being utilised. It is therefore important that the grading and moisture content of the product used must be capable of producing the optimum distribution.

20 Service Providers should consider standardising on the salt grading as 6.3mm Rock Salt to BS 3247, which may provide a more acceptable compromise regarding uniformity of spread pattern, reaction time entering into solution within an hour, providing longer-term melting action, environmentally acceptable and economies associated with the storage of a single grading of salt.

2.2.22.5.2 Specification

1 Rock salt complying with British Standard 3247 Table Part 1 shall be used for the Winter Service treatment of the Motorway and Trunk Road Network. The Standard specifies its essential properties and includes details of test procedures for determining those properties. It is recommended for use on all other roads where traditional dry salting techniques are employed.

2 British mined rock salt, complying with BS3247: Table Part 1 is treated with sodium hexacyanoferrate (II) or suitable alternative as an anti-caking agent. Rock salt from alternative sources may not be so treated and may solidify giving rise to storage, loading and spreading difficulties. In addition, some imported salts from less reliable quality assured sources may have inferior melting properties due to lower levels of purity; they could potentially choke spreading equipment and form slippery deposits on roads. The quality and properties of these salts should therefore be fully assessed and considered.

3 Salts complying with BS3247: Table Part 2 (salts other than rock salt) or similar are not recommended for use on trunk roads. They may potentially have unsatisfactory storing properties and due to their smaller particle size will quickly adsorb moisture and enter into solution, thereby, not providing the long-term melting action required. The quality and properties of these salts should therefore be fully considered together with the addition of an acceptable anti-caking agent. Where such salt is intended to be used the source of supply and quality of the product including moisture content at time of delivery should be fully considered.

4 Periodic sample checks shall be carried out to check the conformity to BS3247, including moisture content, particularly where the source is doubtful. Salt shall be stored in a manner suitable to maintain the optimum moisture content approaching but not exceeding 4% preferably under cover to lessen the problem of caking normally associated with salt storage, and reduce the consequential operational difficulties arising concerning the loading of hoppers and vehicles.

2.2.22.5.3 Salt stock levels

1 The management of salt supplies including specifically the monitoring of stock levels and initiating replenishment is an essential element of effective winter service.

2 Simple internal stock level monitoring and robust reporting system procedures shall be implemented by Service Providers and applied throughout the winter season to monitor salt usage and reserves held within the Motorway Maintenance Compounds and Service Provider Depots, thereby ensuring an effective winter service is provided.

3 The objective of the reporting system is to provide local and national monitoring of salt stock levels by Service Providers / Local Highway Authorities, thereby

providing an early warning system to allow critical stock levels to be identified and where necessary arrangements made for replenishment to be undertaken.

4 Minimum threshold levels shall apply to salt stocks controlled by Service Providers and their supply chains to ensure adequate stocks are available and maintained for the continuation of the motorway and trunk road network winter service until salt stocks are replenished.

Capability Assessment

5 The methodology for the monitoring is based on an assessment of capability and reporting is undertaken against a reasonable defined threshold capability level. These levels need to be determined and established on an area basis but Service Providers may wish to examine capability at a compound level, although reporting to the Service Providers may only be by Area.

6 The methodology for calculating capability is not intended to provide an indicative or typical treatment regime but simply provides a common basis on which capability information can be calculated and reported thereby assisting in any co-ordination between Service Providers and their supply chains regarding salt reserves and respective capabilities.

7 Capability is expressed in days (heavy salting level) and is: **the number of days of continuous treatment across all routes, assuming six treatments per day at 20 g/m^2, and also assuming no re-supply.** (Normal salting being calculated on the basis of 2 treatments at 20g/m² throughout a 24 hour period).

8 It is not suggested that this is a typical or common treatment regime but it does provide a worst-case scenario against which a standard capability measurement can be derived and assessed throughout Wales and the UK as a whole. The maximum capability is the capability of an area assuming all salt storage facilities are full to capacity, this includes barns and other buildings being utilised together with any open storage facilities.

9 The threshold capability, used for reporting purposes, is a level assessed and defined by individual Service Providers. However, the minimum level required has been specified by the Welsh Government, individual Service Providers should however retain responsibility to assess and take account of local circumstances in defining any appropriate increase to the minimum threshold level specified. Climatic conditions, storage capabilities and desires, availability of haulage services, established mutual aid arrangements, and the proximity of the source of supply are all key considerations in defining appropriate threshold levels.

10 Consideration also needs to be given to historical usage levels and existing re- supply arrangements in setting an appropriate threshold level. It should be noted that this threshold capability level is for reporting purposes only and may be different from stock level thresholds used for initiating re-supply by Local Highway Authorities.

11 Threshold capability levels are likely to vary during the season and therefore the threshold capability profile should be defined accordingly to take account of expected worst-case scenario during the specific periods. Lower threshold levels are likely to be applicable towards the end of the season.

12 The threshold profile should be reviewed on a regular basis and, if necessary, should be adjusted. Where adjustments are made the Winter Service

Plan must be amended to reflect the change.

13 For simplicity, it is suggested that threshold levels are presented in tabular form as follows:

Service Provider		**Unitary Authority or Area**
Maximum Capability:		- *days*
Month	Week Number	Threshold Capability
*September 20***	*Week 37*	- *days*
	Week 38	- *days*
	Week 39	- *days*
*October 20***	*Week 40*	- *days*
	Week 41	- *days*
	Week 42	- *days*
	Week 43	- *days*
	Week 44	- *days*
*November 20***	*All weeks*	- *days*
*December 20***	*All weeks*	- *days*
*January 20***	*All weeks*	- *days*
*February 20***	*All weeks*	- *days*
*March 20***	*All weeks*	- *days*
*April 20***	*Week 14*	- *days*
	Week 15	- *days*
	Week 16	- *days*
	Week 17	- *days*

14 The above routine monitoring and reporting profile is provided as an example only and Service Providers may choose to develop a more, or less, sophisticated profile to ensure adequate salt stock levels are maintained. For example, threshold capability could be profiled on a daily rather than weekly basis during the critical months mid winter season.

15 Operational experience and review of historical treatment frequency through previous winters will assist in determining stock levels and when increased stock levels would be advantageous to improve resilience. Stock levels shall be sufficient to maintain the minimum level of resilience for the specific month(s) taking into account expected salt usage and confirmed timing of any salt deliveries to maintain minimum stock levels.

Advice on assessment of Salt Stock 'Capability' Levels

16 The approach of using defined capability allows the Service Provider to implement a robust and meaningful reporting system without being prescriptive about stock levels in individual areas or compounds.

17 Service Providers may want to assess respective Unitary Authority / Service Provider threshold levels at specific depots or areas. Where these levels are perhaps felt to be unrealistic discussions shall be held regarding revised profiles that may need to be agreed or arrangements implemented to ensure salt replenishment is maintained throughout the winter season.

In general, a risk-based approach shall be taken when assessing capability levels and the following factors should be considered.

Climate

18 The climatic conditions within the Area need to be considered and taken into account, particularly the severity of weather events generally and locally together with the likely number of continuous days that treatment may be required.

Time of Year

19 Replenishment of salt stocks is best achieved during the summer months taking advantage of cheaper seasonal rates. Storage facilities should be fully stocked for the start of the season.

20 The time of year has a significant bearing on capability levels and a lower capability may be appropriate in the low risk winter periods. Stock holdings could potentially be reduced towards the end of the season to avoid carrying excessive stock during the summer months.

21 However, care must be taken to ensure that the reduction in stock levels does not result in threshold capability levels that are inappropriate in the later winter months, when regular and reliable supplies may become difficult to obtain.

22 In addition to consideration of the winter risk periods, the Christmas and New Year break also needs to be taken into account where difficulties may be encountered replenishing stocks during or immediately after this holiday period.

Proximity of Supply

23 The proximity of point of supply for salt is a significant factor in considering required capability levels. Clearly the nearer to the point of supply the lower the risk of securing re-supply and therefore the capability threshold can be lower than in an area that is more distant from the point of supply and potentially more difficult to received deliveries due to adverse weather.

Availability of Haulage Facilities

24 The ability of a Service provider or local Highway Authority to provide its own haulage for salt may be taken into account when assessing threshold capability levels. However, the availability of vehicles, and drivers, may be limited during periods of severe weather or Christmas/New Year Holiday period and this will need to be taken into account.

Mutual Aid Arrangements

25 Existing arrangements with other organisations such as adjacent Service Providers and Local Highway Authorities can be considered when assessing capability thresholds. It should be noted however that these arrangements might not be very effective during times of prolonged severe weather when all Highway Authorities and Agencies may be suffering from similar high demand and re-supply problems.

Stock monitoring and re-supply arrangements

26 The contractual arrangements that the Service Provider / Local Highway Authority has in place with their salt supplier can be taken into account when considering the threshold capability level. For example, a supply contract, which includes guarantees and associated penalties, offers a lower risk to the Service Provider and therefore a lower threshold could be set. It should be noted that, unless the penalty charges are significantly greater than the additional transport costs salt suppliers may incur when using prime haulage, the penalties are likely to be ineffective.

27 In addition, the use of more sophisticated and robust monitoring procedures as part of a supply management system may also decrease the risk of supply problems. For example frequent small deliveries that maintain a high level of capability compared to infrequent larger deliveries.

Other considerations and further advice

28 There are other less significant factors that may be considered but the key factors remain the climatic conditions and the proximity of point of supply. Care must be taken not to include demand (salt usage) and 'reserves' as these are already taken into account in the capability calculation.

29 When considering threshold capability levels the existing contractual requirements for stock levels should be taken into account. The capability level can be easily calculated from the defined stock level using the information on salting routes / usage detailed in the relevant Winter Service Plans.

30 It is a requirement that the minimum capability threshold levels of salt specifically allocated for exclusive use on the trunk road network held by Service Providers and the supply chain will be as follows:

> Minimum allocated stock level at the beginning and maintained throughout the month, sufficient to provide daily heavy levels of salting (6 x 20g/m²) expressed in days-

Start of Season	-	Fully Stocked
SEPTEMBER	–	12 DAYS
OCTOBER	–	15 DAYS
NOVEMBER	–	15 DAYS
DECEMBER	–	16 DAYS
JANUARY	–	15 DAYS
FEBRUARY	–	15 DAYS
MARCH	–	12 DAYS
APRIL	–	8 DAYS

31 Motorway Depot minimum salt stock levels at the beginning of the winter season shall be agreed with the Welsh Government. Monitoring and reporting of

usage and stock levels shall be undertaken throughout the season.

32 If the stock level for any Motorway Depot falls below the minimum threshold level or difficulty experienced in obtaining salt supplies this must be immediately brought to the attention of the Welsh Government and situation updates provided to assist liaison and resolution/ management of the situation

33 Depending upon supply conditions, this could include managing supplies with suppliers and authorities to ensure continuity and adequacy of stocks to Authorities depots across wales albeit at reduced levels.

34 Welsh Government National Strategic Salt storage facilities and stocks of salt held within shall be managed by the Service Providers for WG. Salt stocks shall be managed and accounted for separately from normal operational stocks. They are to be accessed at times of national need or in managing the facilities and rotating stocks.

35 It is strongly recommended that the Local Highway Authorities / supply chain work towards achieving improved levels of resilience either by adoption of the above levels of resilience or ensuring that stock levels are one and a half times the average of the salt used over the preceding 6 winter periods, whichever is the greatest, for the local road network resilience.

2.2.22.5.4 Purchasing of salt stocks

1 Stocks of salt used on trunk roads shall be ordered and paid for by Service Providers / Local Highway Authorities in the first instance. This means that salt is initially owned by the Service Providers / Local Highway Authorities, and subsequently recharged to the Welsh Government at replacement cost. The replenishment of salt used from the Motorway Depots to treat the Motorways is purchased by the Service Providers on behalf of the Welsh Government who retain ownership of the salt stocks.

2 Some suppliers of rock salt offer price reductions if firm orders are placed at certain times of the year (summer months), suppliers shall be asked about such arrangements and full advantage taken of them. Full advantage shall also be taken of the benefits that may arise from bulk purchases undertaken as a consortium to maximise discounts and value for money.

Pre-wetting - Brine Saturator Replenishment.

3 At operational motorway depots, saturators have been installed for the production of brine, consisting of a saturator tank where fully saturated brine is produced and the associated storage tank.

4 Brine produced in the saturator is filtered through a gravel filter bed at the base of the tank whilst being gravity fed into the storage tank. If the gravel filter bed becomes contaminated it will significantly affect the performance of the saturator and quantity of brine being produced. In such instances the saturator will require complete emptying of the contents and new filter bed installed together with the restocking of salt and water.

5 Mined salt can contain up to 8% of insoluble impurities that would significantly affect the performance of the saturator, particularly during periods of high demand. In order to minimise the need to undertake extensive maintenance, only the most pure salt should be used, this is currently pure dried vacuum (PDV) salt, which is blown into the saturator via the restocking filler tube.

6 Salt is normally delivered via tanker that can hold up to 29 tonnes (in three

compartments), the tanker can have onboard weighing equipment that can assist in measuring actual part loads delivered to the various depots as required. Refilling is undertaken by the tanker connecting to the saturator filler tube and blowing the required quantity of salt into the saturator tank.

7 Any type of pure salt can be used for the production of brine, but must be suitable in size and have a low moisture content to allow the salt particles to be blown into the saturator. Alternatively Service Providers would need to devise a suitable method of manually filling the saturator using the access/inspection openings at the top of the tanks and arrange for any urgent repairs to be undertaken. Service Providers are responsible for the monitoring of the salt usage and subsequent replenishment which can be required frequently depending on the level of demand for brine.

8 It has proved beneficial in the past to operate a “milk round” system whereby one or more tankers supply replenishment salt as needed to each depot in turn, an initial cumulative estimate must be derived so that the quantity ordered is realistic and can be taken by the saturators.

9 Salt supply arrangements shall be such that quick deliveries can be obtained, with the possibility of taking supplies from the company if their other local customers are unable to take the full load which has been ordered by them, thereby possibly obtaining a discounted rate.

10 The Service Provider must ensure that whatever arrangements are made “best value for money” is achieved, this may for example include a consortium with adjoining Authorities that also have a need for such salt.

Note, in order to provide the required space in the saturator for the salt replenishment, the water level in the saturator tank must be lowered by switching off the water supply whilst still continuing to draw brine from the storage tank as required for periodic winter service operations thereby reducing the water level in the saturator.

2.2.22.5.5 Effect on vegetation and water courses

1 A strong solution of salt in ground water can affect the properties of soils resulting in dehydration of plants. However, provided the rate of spread is not greater than those specified, the resulting salt solution will not be strong enough to adversely affect roadside vegetation.

2 Although the sodium hexacyanoferrate (II) anti-caking inhibitor is not itself toxic, it can be converted into toxic cyanide by the action of strong sunlight occurring over a long period which is most unlikely in this country. Nevertheless heavy run-off from large stockpiles shall not be allowed to drain directly into fishing waters or water courses to which livestock have access. The risk can be avoided altogether if the salt is delivered reasonably dry and kept covered or preferably stored in salt barns.

3 Discharge licences are required for all depots and facilities used for salt storage.

4 Attention is drawn to The Design Manual for Roads and Bridges, Vol 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 10 HA 45/09 Road Drainage and the Water Environment.

2.2.22.5.6 Effect on structures

1 Exposure to air, water and salt can lead to corrosion of structural steelwork and the disintegration of concrete and subsequent corrosion of reinforcing steel. Protection can be provided by coating or by lining with impervious sheeting.

2 Prior to restocking, advantage must be taken of the opportunity to inspect concrete and steelwork to assess the condition. Routine maintenance works shall be programmed for periods when salt stocks are minimal (late spring / early summer) thereby allowing reasonably unrestricted access and time to complete the works before salt stocks are required.

2.2.22.5.7 Effect on winter service vehicles

1 The corrosive nature of salt makes careful maintenance of spreading vehicles essential. Vehicles shall be washed down and lubricated as detailed.

2 Attention is drawn to the corrosive and environmental damage that may be caused as a consequence of concentrated solutions of brine being produced as a consequence of vehicles being washed down, and lack of adequate precautions and facilities to minimise such damage.

3 Vehicles must be washed down using copious amounts of water to remove deposited salt, this is especially necessary where pre-wetted salt systems are used.

4 High pressure washing if necessary, shall be restricted to the final cleaning operation, which will minimise the abrasive action of the salt on protective coatings and paint systems.

5 Particular care shall be exercised when using such equipment, to minimising damage to bearings and guides or cause salt particles to be forced into these or other undesirable areas.

2.2.22.5.8 Preservation of salt stocks

1Prolonged cold weather and difficulties experienced obtaining sufficient quantities of salt for stock replenishment may necessitate that consideration needs to be given to salt conservation measures being implemented throughout Wales. **The measures identified below shall ONLY be implemented in times of salt shortage and specifically instructed to be implemented on the Motorway and Trunk Road Network by the Welsh Government.**

2 Whilst these are recommended conservation measures, some may not be fully appropriate due to different circumstances. Service Providers shall therefore consider and advise which of the measures are being implemented.

1. Service Providers, supply chain and Unitary Authorities to undertake dynamic calibration check (visual) of all spreaders to ensure they are correctly calibrated i.e. spread pattern, width and quantity. If in doubt undertake full Static and dynamic calibration.

2. Ensure spreaders are set to the correct width to avoid wastage of salt onto verge areas and adjust accordingly to ensure salt is applied to the carriageway.

3. Do not treat hard-shoulders and hard strips.

4. Where facilities are or can be made available consider using Pre-wetted salting

for precautionary treatment (spread rate of 20g/m² = 14g dry salt plus 6g brine of which 1.4g is brine salt hence total salt applied is 15.4g). Do not use on ice which is being trafficked.

5. Review frequency of treatment; salt is effective down to -8 deg C but could still work down to -10 deg C but very slowly.

6. Unitary Authorities to consider reducing spread rates and frequency of treatment.

7. At low temps on low speed/county roads consider 50/50 of salt and clean sand/grit mix, grit will provide grip at low temps and salt will become active as temperatures rise.

8. Avoid unnecessary repeated treatment of access roads etc to and from Depots, only treat when necessary.

9. When undertaking two treatments reduce spread rate from 2x20g/m^2 to 2x15g/m^2 or 1x 20g/m^2 plus 1x10g/m^2 precise order and spread rate depends on road and weather conditions.

10. Take greater account of residual salt in marginal conditions and consider reducing spread rates accordingly.

11. Ensure that when ploughing is undertaken the salt applied during each ploughing operation is no more than 20g/m^2 or preferably less depending on road conditions, residual salt levels, rising temperatures and restricted to the newly ploughed running lane.

12. Avoid salt wastage in snow conditions, it is better to apply small quantities frequently than large quantities which will be ploughed onto the verge. Apply treatment to the lane being ploughed as necessary.

13. When restricting any salting to the ploughed lane, the remaining snow shall be monitored to ensure that it is still slushy from residual salt and thereby preventing the snow from bonding to the road surface. Periodic full width treatment maybe required to assist subsequent ploughing operations.

14. If patrolling only spot treat areas required and do not leave the spreader running over long lengths wasting salt.

15. Ensure treatment is undertaken at the most appropriate time in advance of the forecast weather event to minimise prior salt loss and maximise the effectiveness of the treatment undertaken.

When specifically instructed to implement these measures, Service Providers shall advise on what other measures are being considered or instigated by Service Providers and Unitary Authorities to conserve salt. Such additional measures may be considered for implementation on the Motorway and Trunk road Network and disseminated more widely as appropriate.

2.2.22.5.9 Storage of Salt

1 If salt stocks are stored in the open and exposed to the elements without adequate protection, the target spread rates will be hard to achieve. The cost of the salt and damage to the environment will increase because the resulting consistency of spread and controlled distribution of the salt onto the road surface will not be effectively controlled.

2 To lessen the risk to the environment and to keep salt at the optimum moisture content (approaching but not exceeding 4%) it is important that salt is stored correctly.

3 Salt stockpiles shall not be sited within the rooting area of trees or within 4.5 metres of hedges. Stockpiles within 15m of tree rooting areas shall be on impermeable foundations.

4 Salt shall not be stored on bases made of earth, rubble, clinker or spent tarmac as these materials can become mixed with the salt. The base shall be sufficiently strong to support delivery, spreading and loading vehicles. Preferred construction is of high quality air entrained concrete which is more resistant to salt-induced spalling.

5 Correct drainage of salt storage sites is essential. Ideally the salt base should be encircled by a cut-off drain. Run-off from other parts of the site shall not under wash the pile. It is important that the water content of a stockpile is not increased by ground water rising into it. The centre of a pile shall be higher than its perimeter so that any moisture draining will flow to the outer edges and away. The surface of piles shall be convex and shall be limited in height and slope to avoid the creation of steep faces liable to sudden collapse. Where there are several stockpiles closely sited, provision shall be made for adequate drainage between them.

6 Any runoff of excess moisture / water from the stockpile should ideally be controlled by discharging it into a purpose-built drainage system.

7 Salt should always be covered wherever and whenever possible. An exposed stockpile will form crusts on the surface. Wet salt in an exposed pile subjected to prolonged low temperatures may also solidify as a result of the formation of chloride dehydrates. Run-off creates a risk of contamination at distances from the stockpile.

8 Salt may be covered with either black polythene sheeting (0.2-0.3mm thick) or black butyl rubber sheeting (0.7-0.8mm thick). Polythene is normally available in 7.2m widths and butyl rubber in 6m widths (cheaper substandard grades are adequate). Polythene can be obtained with strengthening tapes at the edges and may be joined by stapling. Butyl rubber may be joined by placing edges in a C section plastic moulding and then 'zipping in' around rubber section to lock the sheets together.

9 Butyl rubber costs a great deal more than polythene and it shall be used only in the most exceptional circumstances, e.g. on exposed sites where polythene may be torn by wind action.

10 Sheeting shall be placed over the pile in manageable sections and all joints shall be overlapped by about 2m. Sheeting shall be arranged to encourage excavation from one end only in order to limit moisture absorption.

11 Sheeting shall be-held down by covering with a net of about 150mm mesh. Weights, such as old tyres or railway sleepers, shall be placed on top and around the base, leaving adequate drainage paths. Netting shall be in a state of uniform tension, keeping the sheet tightly in place even if the pile settles. A wall around the pile will facilitate the hanging of weights upon the netting.

12 The storage of salt in barns has clear advantages over salt stacking in the open. No salt is lost to rainfall (on large open salt piles of typical shape the loss per annum is in the order of 0.125% of the initial salt stock piles weight for each inch of rainfall)

13 Depending on stockpile exposure to the weather this may equate to 5-10% of the salt stock being lost. Maintaining the salt in a dry condition has clear

advantages, whereby subsequent drainage and pollution problems are reduced and equipment operational difficulties are minimised.

14 A greater volume can be stored in a given area and labour involvement is reduced to a minimum. The cost of providing barns can be kept down by careful design and the use of proprietary building systems.

15 A salt hopper provides a rapid means of loading salt into winter maintenance vehicles and facilitates their quick deployment in bad conditions. Experience has shown that due to infrequent use and unfavourable environment, mechanical conveyor hoppers compare unfavourably with gravity or shelf types and can be unreliable and costly in maintenance.

16 Whatever method of storage is chosen, all Health and Safety and Environmental guidelines should be followed. Discharge licences are required for all depots and facilities used for salt storage.

17 Attention is drawn to The Design Manual for Roads and Bridges, Vol 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 10 HA 45/09 Road Drainage and the Water Environment.

2.2.22.6 Application of Salt

2.2.22.6.1 Precautionary salting

1 Precautionary salting is to be based on the Road Weather Information System utilising monitoring equipment and weather forecasts. This can reduce unnecessary salt spreading to a minimum.

2 The decision to salt shall be qualified by factors such as local knowledge, geographical idiosyncrasies, humidity measurements, wind speeds, and residual salinity observations. If a warning is not available, precautionary salting shall be carried out when falling temperatures reach plus 1°C provided the prevailing humidity, residual salinity and cloud cover warrant the decision.

3 Precautionary treatment should ideally be completed no later than 1 hour before forecasted freezing temperatures or weather event where practical, which would allow sufficient time for the salt to enter into solution and complete the treatment in advance of earlier than predicted / forecast freezing temperatures being experienced locally.

4 Consideration may need to be given to the timing of such action where peak traffic flows would make it impractical to do so or precipitation occurring at intended time of treatment.

5 For frost and light snow, precautionary salting shall be carried out at a specified spread rate of 10g/m^2 to 20g/m^2 for thin surfacing materials. Minimum spread rates for porous asphalt and those surfacings with a high hydraulic conductivity (porosity) shall be considered based on operational experience as indicated within the Treatment Matrix (Table 1.1.22).

6 Salt spread rates for precautionary and other prevailing conditions shall be in accordance with Table 1.1.22 of WGTRMM Part 1 Service Code : Performance Requirements

7 Where weather forecasts and/or weather station data indicate that freezing conditions will exceed 12 hours in duration from the start time of the initial treatment or a change in weather such as precipitation, hoar frost or high winds are forecast during this period, a further treatment may be necessary and should be programmed accordingly.

8 The timing of any subsequent treatment should take account of the forecast weather event duration, residual salt levels, road conditions, traffic volumes and availability of resources/equipment.

9 When freezing conditions are expected immediately after rainfall, precautionary salting rates shall be increased and may be undertaken as two treatments appropriate for the amount of moisture / surface water present on the road surface or forecast temperatures. Salting shall be delayed as long as possible to reduce the subsequent loss of salt by water runoff, unless freezing conditions coincide with rainfall.

10 When continuous snow is forecast, precautionary spreading rates shall be increased accordingly for the actual or anticipated conditions (15g/m^2 to 40g/m^2) and may be undertaken as two treatments appropriate for the anticipated severity of the snowfall or actual conditions. The presence of salt will melt the initial snowfall and provide a wet surface beneath subsequent snowfall thus easing the work of ploughing operations.

11 During periods of continuous snowfall, ploughing operations shall be combined with salting activities to ensure that the snow does not become packed and ease ploughing operations. Where practical the ploughed lane should be salted to avoid wastage that will result from subsequent snow ploughing operations.

12 When restricting any salting to the ploughed lane, the remaining snow shall be monitored to ensure that it is still slushy from residual salt and thereby preventing the snow from bonding to the road surface. Periodic full width treatment maybe required to assist subsequent ploughing operations.

13 Occasionally snowfall may be experienced whilst road surface temperatures are above freezing either as a result of traffic volumes or air temperature. In such instances careful consideration needs to be given to the benefits that maybe obtained from undertaking any salt treatment to minor accumulations or snow that is already melting naturally.

14 Where road and / or air temperatures are above freezing or temperatures are rapidly rising above freezing, snow would naturally melt and be dispersed by the action of traffic. In such instances ploughing may only be required or if necessary a reduced salt spread rate of 10g/m^2 may be sufficient and more appropriate, particularly if there is residual salt present on the road surface.

15 Elevated parts of the highway (including bridges) and sections lying in low ground are more prone to freezing and may require special attention.

16 Precautionary salting shall be applied to hard shoulders, hard strips, cycle tracks that are incorporated within the carriageway and right turn facilities located within central reserve areas.

17 Where there are Service Areas with an Exit (deceleration) slip and entry (acceleration) slip road within the highway boundary these shall be treated in conjunction with the main carriageway.

18 Treatment of the slip roads shall be undertaken by adjusting and increasing the spread width accordingly to treat both the carriageway and slip road approximately 100 metres in advance and continued until the end of the entry slip road. Once both slip roads have been treated the spread width shall be adjusted accordingly for the relevant carriageway width.

19 The treatment of the slip roads would however also affect the splitter island between them, whereby salt would be spread onto the verge area/visibility splay. Such areas should be inspected to determine whether there would be any undesirable effects on vegetation within these areas. Liaison shall be undertaken where necessary.

20 Liaison shall be undertaken to identify any road works or incidents that may have an impact on the effective treatment of the road network for example, contra flows, resurfacing works or lane restrictions that would prohibit or restrict access to such areas for the spreading equipment. In such instances arrangements shall be made to ensure that such areas are effectively treated well in advance of being reopened to the public.

21Roads having features such as traffic calming measures, central pedestrian refuges/islands and overrun areas on tight bends / small roundabouts may require higher quantities of salt to be applied enabling traffic to redistribute this salt into difficult inaccessible treatment areas or widths of spread increased so that these areas are treated accordingly.

22 Due to the porous nature and negative texture depth of porous asphalt or thin surfacing with a high hydraulic conductivity, salt is retained within the material thereby reducing the action and effects of vehicular traffic in the longitudinal movement of the salt along the carriageway. Residual salt levels may increase or decrease from one material to another or general differences in the rates of runoff / porosity and salt retention characteristics of the surfacing material. Particular attention should therefore be given to transitional areas from one surfacing type to another.

23 In such instances the spread rate should be increased to the higher spread rate being applied along the route. For example; where a combination of 10g/m^2 and
15g/m^2 is being applied along the route length a spread rate of 15g/m^2 should be applied at the approach to and departure from the change in surfacing material. (The suggested distance being a minimum of 200m depending on operational experience).

24 Treatment frequencies may need to be adjusted for low and high traffic flows, for different salt grain sizes and different surfacing material characteristics.

25 Porous Asphalt and thin Surfacing Material with a high hydraulic conductivity (porosity) may require more frequent treatment and shall be monitored accordingly.

26 Performance characteristics of the spreaders and, at the time of spreading, the state of the de-icer products and the weather conditions should govern which treatment frequencies to apply.

2.2.22.6.2 Effectiveness of salt after rainfall.

1 On a well drained road surface during and after rainfall the thickness of the water film typically varies between 0.08 and 0.50mm.

2 Once rain has ceased, the action of traffic quickly reduces the water film thickness. Without precautionary treatment being undertaken, the residual surface water may subsequently freeze, resulting in the formation of a film of ice, which is usually less than 0.25mm thick.

3 The table below provides general advice regarding the effectiveness of salt treatment at a spread rate of 10g/m^2.

WATER FILM THICKNESS (mm)	FREEZING POINT. (10g/m^2 Salt).
0.25	**-2.4ºC**
0.30	**-2.0ºC**
0.50	**-1.2ºC**

4 In order to ensure that the precautionary treatment is and remains effective, it is therefore important to delay treatment until rainfall has ceased and the action of traffic has reduced the water film thickness, unless other factors warrant urgent and immediate treatment.

5 By delaying the undertaking of the precautionary treatment, generally the water film thickness should not be greater than 0.25mm once rainfall has ceased and the application of 10g/m2 should remain effective to temperatures as low as –2.4ºC.

6 Should lower temperatures or greater film thickness be anticipated at the time of treatment, the appropriate spread rate shall be selected and be used. Increased spread rates may be appropriate for highly porous thin surfacing courses and porous asphalt as a result of operational experience.

7 A spread rate of 20g/m2 will prevent a water film thickness of 0.25mm from freezing at temperatures as low as –4.8ºC or a film thickness of 0.5mm freezing at –2.4ºC.

8 It is therefore recommended that during such conditions where the film thickness maybe greater than 0.25mm or rapidly falling temperatures experienced, the spread rate will need to be carefully considered.

9 To ensure that sufficient salt remains on the road surface during such conditions, treatment shall be undertaken at the appropriate time and using the most appropriate treatment method to ensure that the necessary brine is produced utilising the available water on the road surface / precipitation.

10 Where treatment is delayed by 1 hour after rainfall has ceased, it is estimated that the water film thickness on a well-trafficked road would be 0.05mm, however, on a lightly trafficked road the water film thickness would be 0.1mm.

2.2.22.6.3 Low Temperatures Combined with Low Humidity Conditions

1 Dry Sodium Chloride (NaCl), usually in the form of naturally occurring mined rock salt (initial moisture content when mined of 0.5%), has a natural moisture content of less than 2% when delivered. Because rock salt is a hygroscopic material, it absorbs moisture even when stored in covered barns. The salt will continue to absorb moisture up to a natural content of 3% to 4%, this is approaching the optimum moisture level at which the salt should be spread on the road surface and be effective (less than 4%).

2 The level of moisture can be a critical issue affecting the value and effectiveness of rock salt as an anti-icing agent. This is because dry rock salt (primarily NaCl) has no direct melting action; melting occurs only after the salt forms a solution by absorbing moisture from the atmosphere or from the road surface to be treated (dissolution). Below an atmospheric relative humidity level of about 80 per cent, the absorption of moisture by rock salt decreases rapidly and, at low levels of relative humidity, salt particles remain inert and ineffective.

3 Low humidity combined with low temperature can result in conditions that present difficulties in carrying out effective winter maintenance treatments. It is therefore important that Service Providers take careful note of the information supplied to them by their Road Weather Forecast Provider regarding temperatures and levels of humidity, and be able to recognise and be well-prepared to deal with them.

4 Low humidity and low temperature conditions are most likely to occur in December and January at about the time of the winter solstice (December 21st). The conditions have, however, been reported throughout the normal winter maintenance season Service Providers should always be alert to the likelihood of them occurring.

5 It appears that low humidity and low temperature conditions are more likely to occur when the general weather pattern is dominated by cold and relatively dry air masses, usually coming from northerly or easterly directions. These general weather features can be accompanied by winds between 15 and 30 mph. Whilst these features have been observed to be associated with low humidity conditions they are not regarded

as the only ones.

6 Slippery road surfaces can also arise due to the formation of hoar frost. This occurs when air with a dew-point below freezing is brought to saturation by cooling. This leads to the condensation of the water vapour directly as ice on the road surface. It appears that in these conditions sufficient water vapour may be available for the formation of hoar frost, but not necessarily to enable the anti-icing salt to go fully into solution. The phenomenon may also be due to temperature differences between the rock salt and the road surface.

7 The precise reasons for the formation of ice on a road surface (either as a result of hoar frost or precipitation) despite the presence of an anti-icing treatment are not necessarily clear, but there are general factors that may often contribute to the situation. These include:

i) Dry road surface;
ii) No precipitation;
iii) Road surface temperature $\leq 0^{o}C$;
iv) Road surface temperature $\leq$ Dew point temperature;
v) Relative humidity < 80 per cent;
vi) Closeness to winter solstice (21st December).

8 It has also been observed that low traffic flows and high winds may also prove significant in reducing the effectiveness of an anti-icing treatment.

9 The primary method of preventing the formation of hoar frost and ice on road surfaces before the conditions develop, is to spread granular rock salt usually at or approaching its natural optimum moisture content of 4%, having a dry appearance and known as ‘dry salting’.

10 Low temperature and low humidity followed by rain can result in conditions becoming particularly more difficult.

11 To prevent the formation of and melt existing snow and ice, salt must first enter into solution (dissolution) and thermal energy must be available for the salt to dissolve. Therefore, after spreading the rock salt there is a time lag before the salt enters into solution and becomes effective.

12 Salt is relatively slow at entering into solution. Other chemicals, such as Calcium
Chloride ($CaCl_2$), enter into solution much more readily and therefore become more effective as an anti-icing agent. However, $CaCl_2$ is highly corrosive and shall only be used with extreme caution near structures or sensitive apparatus on the road network.

13Service providers shall consider the need to carry stocks of alternative de icing materials such as $CaCl_2$ as a contingency provision for when temperatures fall below $-10^{o}C$ at susceptible network locations.

14In conditions where low relative humidity is accompanied by low road surface temperatures, the quantity of dry salt required to melt ice can become uneconomic.

15 Dampening the material with water or other wetting agent prior to spreading can accelerate the process of dissolving salt particles. By increasing the moisture content from about 4% to 5.5%, a significantly shorter time is required for a solution to be

formed. Therefore the increased moisture content assists the melting process, however, to minimise loading and spreading problems a moisture content greater than 6% should be avoided.

16 The following hierarchy of treatments maybe of assistance when low temperature combined with low humidity conditions occur. It should be noted however, that there could be substantial differences in the performance of the various options. Service Providers should not automatically assume that a treatment lower in the list is an acceptable alternative to one higher in the list. Where doubt exists, a check should be made where practical to confirm that the treatment is effective in the prevailing conditions at that time.

17 Treatments in order of expected effectiveness where brine solutions are not available are:

i) Full pre-wetted 6.3mm salt using a proprietary brine pre-wetting system;
ii) Full pre-wetted 10mm salt using a proprietary brine pre-wetting system.
iii) 6.3mm pre-coated with Agricultural by Product (3% addition by weight).
iv) 10mm pre-coated with Agricultural by Product (3% addition by weight).
v) 6.3mm dry salt with added water in the stockpile and thoroughly mixed
vi) 6.3mm dry salt with added water in the hopper;
vii) 10mm dry salt with added water in the stockpile and thoroughly mixed;
viii) 10mm dry salt with added water in the hopper;
ix) 6.3mm dry salt
x) 10mm dry salt.

18 In order to ensure that a treatment is effective, the anti-icing agent must adhere to the road surface and, additionally, enter into solution (dissolution) before ice is forecast to form on the road surface. Under low temperature and low humidity conditions, these requirements become increasingly difficult to meet, especially when the conditions become more extreme and moisture is not readily available from the road surface or the atmosphere.

19 The simplest form of wetting of the anti-icing agent could be achieved by simply adding water to the stockpile, loading hopper or vehicle hopper before the spreader begins its salting run. A second stockpile of salt, specifically for use in low humidity conditions, could be located at the depot.

20 The amount of water added shall be calculated to raise the overall moisture content of the salt to a level not exceeding 6% and shall be well distributed throughout the stockpile or hopper. Before adding water, Service Providers must assess the total weight and moisture content of the salt being wetted and then add sufficient water to raise the overall moisture content to the desired level. In broad terms, 10 litres of wetting agent would raise the moisture content of one tonne of salt by about 1%.

21As a general guide;

i) New salt stock moisture content less than 1% - add 45-50 litres of water per tonne.
ii) One year old salt stock moisture content 2.5-3% - add 25-30 litres of water per tonne.
iii) Two year old salt stock moisture content 3-3.5% - add 20-25 litres of water per tonne.
iv) Older salt stock or exposed to the weather, moisture content 3.5-4% - add 15-20

litres of water per tonne.

v) Salt stored poorly and subject to frequent exposure to moisture to be assessed to determine whether any additional water is required particularly if the salt is of a damp appearance. In such instances simply mixing the salt will redistribute the moisture throughout the salt and potentially raise the moisture content to the required level without the addition of further water.

22 Adding water to the hopper of the spreading vehicle is not generally a recommended practice for pre-wetting the salt, it is difficult to achieve uniform water dispersal within the load. 'Clumping' of the salt particles may occur in the chute feeding the spinner and be discharged erratically from the spinner leading to a non-uniform distribution on the road surface.

23 However, the technique may be considered as a short-term measure where specialist pre-wetting or other facilities are not available to accelerate the process of dissolving the salt grains.

24 Increasing the moisture content potentially causes the salt grains to travel further and the salt to be deposited outside the target width thus encouraging wastage, the appropriate spreader calibration and settings must therefore be used.

2.2.22.6.4 Residual salt.

1 With increasing desires and requirements to minimised environmental effects and avoid excessive use of salt, consideration shall be given to residual salt levels where treatments have been undertaken over a number of consecutive days as a result of prolonged periods of freezing temperatures and the continued potential need for further treatments.

2 It should be noted that both active and passive road condition/weather sensor systems require the presence of moisture to determine either the concentration of an anti-icing chemical on the road surface or the freezing point temperature of the solution present on the road sensor and hence difficulties arise in the determination of residual salt levels.

3.In sustained low temperatures and low humidity conditions, an accurate indication of the residual salt levels maybe difficult to obtain. In such conditions and where treatment has been undertaken over a number of consecutive days, residual salt levels could potentially be sufficiently high enough to provide the necessary anti-icing effect required for the forecast weather conditions.

4 The rate of salt loss and remaining residual salt level at a particular time is difficult to assess accurately and is dependant on a number of factors and variables.

5 Where treatment is undertaken on a dry road surface with low humidity and heavy traffic volumes, a larger proportion of the salt would be lost when in solid form compared to salt in solution (brine). This is due to the effects of traffic and there being insufficient time available for the salt to enter into solution utilising any available moisture, and thereafter adhere to the road surface.

6 In such conditions where treatment is undertaken using salt in solid form, salt loss could potentially be 50% after 2 hours and by as much as 90% after 24 hours of the quantity applied.

7 As a procedural guide to assess the likely residual salt levels, consideration needs to be given to the treatments/actions undertaken over the preceding 5 days (120

hours) together with climatic conditions.

8 If the weather conditions have been dry with no precipitation experienced (snow, sleet, hail, rain) or ground water seepage and no strong winds it is possible to estimate the residual salt levels.

9 Based on the total quantity of salt applied over the **preceding 5 day period (120 hours)** it is reasonable to assume that 10% of this quantity would remain on and within the carriageway surface.

10 Treatments to be included within the assessment are those that have been commenced and completed within the previous 120 hours from the intended time of the next treatment under consideration.

11 Therefore for example; if 2 treatments where undertaken each day at 15g/m^2 over 4 days and 2 treatments at 10g/m^2 for 1 day the total quantity applied to the road network or specific route would be (2x15g/m^2x4 days) + (2x10g/m^2x1 day) = 140g

12 Based on these previous actions it is a reasonable estimate that 10% of this quantity would be remaining either on the road surface or within the voids i.e 14g/m^2

13 If the intended action is to undertake treatment at 15g/m^2 or higher then it is unlikely that there would be sufficient residual salt remaining and therefore salting should be undertaken at the required spread rate of 15g/m^2.

14 If the intended action is at 10g/m^2 as a precautionary treatment over a marginal period of time, it is more than likely that sufficient residual salt is remaining on the carriageway surface and within the surfacing voids / negative texture to provide the required level of anti-icing action required.

15 Any precipitation that occurred within the previous 5 days (120 hours) may be of sufficient quantity to wash any prior residual salt off the carriageway, therefore this needs to be taken into consideration.

16 Where precipitation (snow, sleet, hail, rain) has occurred the assessment should be based on any subsequent treatments undertake after the precipitation.

17 Any treatment undertaken during or immediately after this precipitation (snow, sleet, hail, rain) should **NOT** be included within the assessment.

18 In such instances the period of time where residual salt levels are assessed could for instance reduce to only 1 or 2 days as a result of precipitation and / or high winds.

19 Where treatment has been undertaken within 24 hours of any proposed treatment, consideration should be given to any increase in the residual salt level.

20 Salt loss could potentially be 50% after 2 hours and by as much as 90% after 24 hours. If treatment has been undertaken within 15 hours of any proposed salting action being considered, an appropriate allowance should be made.

For the purposes of assessment a figure of 50% residual salt should be used if treatment is undertaken within 6 hours of the previous treatment.

21Where the previous treatment was undertaken between 6 and 15 hours before the intended treatment, the residual salt level would equate to approximately 30% remaining, **for the purposes of assessment a figure of 25% should be used.**

22 Where it is evident that residual salt levels are high or treatment has been undertaken over a prolonged period of time an assessment shall be made to determine the likely residual salt levels.

23 It is recommended that salt use is monitored throughout the winter season and where the combined salt quantities over a 5 day period (120 hours) reach 100g/m^2 or more an assessment of residual salt levels shall be undertaken.

24 Where an assessment has been undertaken for a domain, area, salting route or part of a route it shall be recorded and fully documented for future reference.

25 If after assessment it is considered that a further treatment is not required at the intended time, **increased monitoring of road conditions, weather forecasts and actual road conditions shall be undertaken, until such time that the potential hazard has ceased and be fully documented accordingly.**

26 During prolonged periods of cold weather where frequent treatment is being undertaken, the above process would assist in reducing the environmental effects of the salting actions and avoid wastage of the salt. It is expected that there would be an overall reduction in the number of occasions where treatment is undertaken, particularly during marginal periods.

27 Where operational experience has identified a need for revision, either local or area wide, this shall be advised to the Welsh Government for consideration and subsequent approval.

28 Where it is evident that there are high levels of salt on the carriageway this may be dealt with in a number of ways;

i) Sweep the carriageway at higher risk areas; for example approach to and around any roundabouts, traffic signals, sharp bends, junctions and steep gradients. Precautionary treatment may then be undertaken subsequently in advance of any forecast weather event.

ii) In actual freezing or in advance of forecast freezing conditions an application of brine may be undertaken at these higher risk locations using M4 winter service vehicles or other suitable method of application.

iii) Where there is not an immediate risk of freezing the application of water may be undertaken either using the M4 winter service vehicles or other suitable method. Precautionary treatment may then be undertaken subsequently in advance of any forecast weather event.

iv) Assessment of residual salt levels and evaluation of the need to either not undertake the next treatment or undertake treatment at a reduced spread rate.

v) Consider treatment using a 50/50 mix of sand/salt or application of sand only at a reduced spread rate. Where sand is intended to be used, this should be discussed and agreed with Welsh Government in advance.

29 Full documentation and records MUST be kept regarding inspections, evaluation of alternative treatments, risk assessments, actions undertaken together with normal winter service records and approval from Welsh Government.

2.2.22.6.5 Freezing Rain

1 Freezing rain in this country is not a common occurrence but an exceptionally dangerous condition. Freezing rain usually occurs along the line of an incoming warm front, when rain falls through a layer of cold air near to the surface. The precipitation can begin as either rain and / or snow but becomes rain when it passes through a warm layer. The rain then enters a very cold layer of air close to the surface. It does not freeze immediately but forms 'black ice' on contact with any road surfaces that are below freezing temperature.

2 It is recognised that the prediction of freezing rain is difficult and the action necessary to deal with it is problematic but Service Providers need to consider and plan any reasonable actions that can be taken when such events occur. It is important that all details of the actions intended for dealing with the phenomenon of freezing rain are documented in Winter Service Plans and good records of actions taken are kept.

3 Measures for dealing with freezing rain fall into three main areas: advance planning, operational arrangements, and hazard mitigation. These measures are considered in further detail as follows:

Advance Planning

4 Advance planning includes consideration of the potential impact of freezing rain and development of contingency arrangements to mitigate the effects. These contingency arrangements shall be documented in the Winter Service Plan. Other aspects of advance planning include training and exercises.

Specific measures that need to be considered include:

i) Prior to the commencement of the winter season, agreement should be reached with the Local Police and, where applicable, the Traffic Management Centres (North and South Wales) on procedures for dealing with occurrences of freezing rain and any incidents that may occur during or following such conditions.

ii) Outline operational arrangements shall be developed and documented within the Winter Service Plan and / or Contingency Plan. Although the adverse effects of freezing rain can impact across any part of the road network particular consideration shall be given to those parts where the impact may be more significant such as on gradients or difficult alignments.

Operational Arrangements

5 Operational arrangements shall include details of treatment regimes. In general, freezing rain shall be treated in a similar manner to snow, i.e. treatment in advance of (and during the event where practical and safe to do so) and then treatment following as required.

6 Specific measures that need to be considered include:

i) If the condition of freezing rain is anticipated contact with the Police, Traffic Management Centres, adjoining Agents / Service Providers and Local Highway Authorities is to be made to acquaint them of the possibility and the proposed action to be undertaken thereby assisting in the co-ordination of actions.

ii) Prior to the arrival of the freezing rain a pre-treatment is to be made in the same manner as would be made prior to snow falling (spread rate of 15g/m^2 to 40g/m^2 which may be applied as two treatments depending on the predicted intensity of rainfall). Where reasonably practical this shall be completed 2 hours before the expected rainfall, thereby allowing sufficient time for the salt to enter into solution and be evenly distributed across the carriageway.

iii) Constant monitoring of the situation is to be undertaken and where practical and safe an additional precautionary treatment is to be carried out immediately the rain commences and continued until such time that the rain has ceased or the temperature of the road has risen above freezing. Spread rates may need to be adjusted accordingly to ensure that an adequate quantity of salt remains on the carriageway during the subsequent surface water runoff.

iv) To ensure maximum effectiveness of the salt, the advance precautionary treatments should be made in the same direction and immediately in advance of the incoming warm weather front where practical. Use should be made of weather radar where available, to help determine the timing of the treatment. Consideration should be given to stationing vehicles at the point on the route where the weather front will first hit in order to assess and report on the road conditions and when necessary undertake timely treatment where practical and safe.

v) It is inevitable that some salt will be lost during and following treatment and therefore careful consideration needs to be given to the feasibility and practicalities of undertaking continued successive treatments to replenish salt lost from the carriageway.

vi) Specific training of Winter Maintenance operatives and drivers of hazards in working under such conditions.

Hazard Mitigation

7 Considering the limitations in the effectiveness of treatments in dealing with freezing rain both forecast and unexpected, it is essential that all reasonably practicable measures be implemented where feasible to provide warning to road users of the hazardous conditions.

8 The very nature of freezing rain means that treatments will have initially virtually no effect and ice will form on the carriageway. Mitigation of the hazard is therefore a significant aspect of the actions taken in response to freezing rain. The main action is to inform road users of the hazard when practical, but more pro-active measures might be required. For example, consideration may need to be given to closing the road as the rain arrives and holding the traffic (rather than diverting) until such times as it is deemed safe to proceed. Such considerations shall be undertaken through liaison with the Local Police and where reasonably practical and necessary the Local Highway Authorities regarding such measures intended on a local basis taking into account local circumstances.

9 Specific measures that may need to be considered include:

i) Where available fixed or mobile Variable Message Signs shall be used to warn

road users of the hazard. The existing established procedures for requesting VMS settings to be set by the Traffic Management Centre should be followed well in advance. The menu of legends and where appropriate pictorial signage that would be advantageous in these circumstances should be agreed in advance with the Traffic Management Centre and the Welsh Government.

ii) Welsh Government and Traffic Wales should be contacted in order to determine whether it is appropriate and necessary for the local media to be advised.

iii) Where available, the use of variable advisory and mandatory speed limits shall be considered. This will require arrangements and protocols to be established with the appropriate Police Control Office (PCO) or Traffic Management Centre as part of the advance planning procedures.

iv) Consideration may need to be given to the feasibility and practicalities of the use of rolling blocks and convoy arrangements to either hold or slow traffic down both just prior to and during the event. This will require arrangements and protocols to be established in advance with the appropriate Police Authorities and Traffic Management Centre Operations Managers as part of the advance planning procedures.

10 In addition to the arrangements made in respect of advance planning, operational procedures and hazard mitigation, it will be necessary to consider the arrangements to be implemented should any incidents occur as a result of the freezing rain, as contained in the Contingency Plan, and the Adverse Weather Plan. This may, for example, include liaison with the Police and Traffic Wales to provide advance warning to recovery companies. Procedures for giving such advance warning will need to be established in advance through liaison and documented accordingly.

2.2.22.6.6 Treatment of Ice

1 The precise reasons for the formation of ice on a road surface despite the presence of a de-icing treatment are not necessarily clear, but there are general factors that may often contribute to the situation. These include:

i) Dry road surface;
ii) No precipitation;
iii) Road surface temperature $\leq 0^{o}C$;
iv) Road surface temperature $\leq$ Dew point temperature;
v) Relative humidity < 80 per cent;
vi) Closeness to winter solstice (21st December).

2 To ensure rapid ice melt from the road surface, salt shall be spread at a rate of
$15g/m^2$ to $40g/m^2$ and may be applied as two treatments depending on the severity and amount of ice to be removed and the air temperature (rising / falling). Refer to Treatment Matrix.

3 Constant monitoring of the situation is to be undertaken and where necessary an additional treatment is to be carried out and if necessary, continued until such time that ice has been effectively treated or the temperature of the road has risen above freezing thereby assisting in the de-icing process.

4 Spread rates / frequency of treatment shall be adjusted accordingly to ensure

that adequate salt remains on the carriageway during the subsequent surface water runoff to continue the de-icing process.

5 It is inevitably that some salt will be lost during and following treatment and therefore careful consideration needs to be given to the requirement for continued successive treatments.

2.2.22.6.7 Treatment of snow

1 The maximum salt spreading rate recommended for melting up to 40mm of fresh snow at O°C is 40g/m^2 and may be applied as two treatments. Repeated applications of salt can assist in removing heavy accumulation of snow. This can be a useful method of operation in urban and heavily developed areas where conditions make the use of snow ploughs difficult and snow removal impracticable.

Where conditions allow, ploughing shall be undertaken as soon as snow depths exceed 30mm. Each pass of the plough may be supplemented by salt spreading at the rate of 10g/m^2 to 20g/m^2 Refer to Treatment Matrix.

2 Where minor accumulations of snow remain, a further application of salt maybe necessary at the rate of 10g/m^2 to 20g/m^2 depending on the type of road surfacing, climatic conditions and amount of snow remaining.

3 Consideration shall also be given to road surface temperatures, air temperature and rapid temperature rises that may facilitate the natural melting of the snow.

4 Such action will prevent isolated and minor depths of snow from compacting and so ease the passage of the ploughs.

5 Should the temperature significantly drop and the need for ploughing continue, it is important to monitor the air temperature so that spread rates can be increased if necessary up to 40g/m^2 this may be undertaken as two treatments. This is best done by using thermometers located at suitable open sites in depots, real time weather station data and weather forecast updates. Vehicle-mounted thermometers are useful indicators but may be inaccurate and should not used for this purpose.

6 Lighter falls may call for ploughing where local drifting has occurred. Ploughing may be required to remove snow not dispersed by traffic, e.g. in cases where there is reluctance by motorists to use the fast lanes or where the traffic is light (at night for instance).

7 During prolonged and heavy falls of snow it will be beneficial to plough continuously from the onset to prevent build-up and compaction by traffic. Such ploughing shall be combined with simultaneous salting at 15g/m^2 to 20g/m^2. Refer to treatment Matrix.

8 Where practical, the ploughed lane should be salted to avoid wastage that will result from subsequent snow ploughing operations.

9 When restricting any salting to the ploughed lane, the remaining snow shall be monitored to ensure that it is still slushy from residual salt and preventing the snow from bonding to the road surface. Periodic full width treatment maybe required to assist subsequent ploughing operations.

10 However, once snow depths of 120mm have been reached, when

tackling snowdrifts or where vehicles are operating in severe conditions / gradients, it may be desirable to continue ploughing without salting and employ 4x4 or 6x6 vehicles. In those conditions the weight of the salt load will aid vehicle traction, once ploughing operations have been completed the appropriate quantity of salt can be spread and conditions monitored accordingly to determine whether further action is required

11 The clearance of defined routes shall not be abandoned for the sake of concentrating vital resources at one or two problem locations. Where conditions demand that more resources are deployed in a specific area, this will be achieved by calling out a reserve vehicle.

12 In heavy snow conditions, accessibility of the network by emergency and essential services vehicles is of key importance. In this respect, limited accessibility for these purposes following the termination of a snow event should be established and maintained within the following maximum time frames on a prioritised needs basis:-

Motorways and Extra Priority All Purpose Trunk Roads	2-3 hours
All other Trunk Roads	5-8 Hours

2.2.22.6.8 Treatment of hard-packed snow and ice

1 If the recommendations are followed hard-packed snow and ice should be rare. However, if those conditions form at temperatures down to minus 5°C and provided they are no more than 20mm thick, removal is possible by using a single treatment at a spread rate of 15g/m² - 20g/m^2.

2 At lower temperatures and greater severity of hard-packed snow and ice a higher spread rate of 15g/m² - 40g/m² using a single or successive treatment may be appropriate.

3 In particularly severe conditions where gradients are a problem, consideration should be given to the short term employment of 4x4 or 6x6 vehicles until conditions improve.

4 At particularly low temperatures below minus 5°C and where the hard-packed snow or ice is more than 20mm thick, the use of salt alone will result in an uneven and slippery surface. In those exceptional circumstances a single-sized abrasive aggregate / sharp sand of particle size 5mm – 6mm having low fines content can be added to the salt.

5 The particles should be angular in shape, but not sharp enough to cut vehicle tyres.

6 The prior approval of the Welsh Government is required before an abrasive is used in it's equipment.

7 Cinders are suitable, but shall be free from chemicals, such as sulphates, which may damage concrete. Reversion to salt only shall be made as soon as possible since abrasives contribute little to the removal of the snow and ice and may block drains and gullies on thawing.

8 In extreme conditions consideration may need to be given to the closure of the road until such time that the hazard has been adequately dealt with or removed.

2.2.22.6.9 Sustained low temperatures

1 Sustained low temperatures are rare in Wales. For each degree drop in temperature below O°C the amount of salt needed to maintain the equivalent melting effect increases by about 14g/m^2. However, where the road is subjected to traffic, little or no increase is required until sustained temperatures below minus 10°C are reached. At that stage the amount of salt required increases significantly and the addition of
calcium chloride to the salt may be considered. However this additive is costly and as it absorbs air moisture freely its storage represents problems.

2 Calcium chloride is usually supplied in flake form contained in plastic bags. A mixture of 4 parts salt to 1 part of calcium chloride should suffice on the very rare occasions and in the very few isolated sites where a need may arise.

2.2.22.6.10 Road Surface Types

2.2.22.6.10.1 Thin surfacing materials

1 The current types of thin surfacing systems are categorised as Paver-laid surface dressings, thin asphalt concretes, thin stone mastic asphalts, multiple surface dressings and micro-surfacings (although these categories are not given on the BBA certificates).

2 The first three categories are hot mix asphalts that have a "negative" texture whereby the texture is formed primarily by indentations into, rather than by extrusions from, the nominal surface. Multiple surface dressing is the repeated application of separate layers of bitumen and aggregate. Micro-surfacing is a development of slurry seal that is a polymer-modified cold-mix paving system. Specification requirements for thin surface course systems are set out in Clause 942 of the Specification (MCHW 1) with accompanying Notes for Guidance in NG 942 (MCHW 2).

3 Winter Service treatment of thin surfacing systems is different to that required for conventional and historical surfacing. They have different surface texture characteristics that often require different anti-icing / de-icing techniques to those employed on traditional dense road surfacing (e.g. hot rolled asphalt [HRA]).

4 During the application of salt, the resulting solution either drains away or is trapped in the voids, this residue solution is withdrawn onto the surface by the action of tyres over the surface.

5 On a heavily-trafficked carriageway, a reasonable degree of residual anti-icer / de-icer will remain on the surface of the carriageway to combat the formation of ice. On lightly-trafficked carriageways, however, the anti-icer / de-icer is retained in the 'negative' texture and the surface may lack the required amount of anti-icer / de-icer residue to prevent the formation of ice. This is of particular concern when the presence of moisture is limited and hence the salt has difficulty entering into solution and being subsequently withdrawn back to the surface.

6 Dry rock salt (typically 6.3mm, but occasionally 10mm) pre-coated and pre-wetted salt are suitable for use on thin surfacing systems.

7 Because there are differences in characteristics between different proprietary products within each generic group, a general spread rate should be used to provide an acceptable treatment rate for all the generic types. More detailed information is contained within the Treatment Matrix.

8 The skid resistance of the negatively-textured surfacing types improves with age as the binder is stripped off the aggregate surface due to the action of traffic. Through time the pores and voids inherent in the material close up through secondary compaction from the effects of traffic and detritus.

9 The spread rate on newly-laid surfacing may need to be adjusted and be monitored for a period of 2 years, depending on operational experience, these identified areas and other areas requiring special consideration may require further treatment, different spread rates or techniques to be employed.

10 Spread rates and techniques employed may need to be adjusted to take account of special conditions which include:

i) Areas prone to surface water
ii) Low levels of traffic
iii) Cold spots (such as bridge decks)
iv) Different adjoining surface types
v) Local climatic variation.

11 Practical application of an anti-icer / de-icer to a thin surface course system depends on the achievable spread rate from each spreader. If a spreader cannot deliver a particular spread rate (e.g. 12g/m^2 or 16 g/m^2), then it should be increased to the next highest pre-set value.

12 Recent experience with regard to the performance of thin surfacing materials particularly those with a high hydraulic conductivity (porosity) during winter months, would suggest that they may have similar characteristics to porous asphalt, which cool faster and warm up slower than dense surfacing material.

13 The level of similarity is dependant on various factors such as the actual material laid, how recently it was laid, depth of the surfacing, climatic conditions and the degree of porosity / negative texture depth.

14 It will therefore be beneficial to monitor such locations, and review if necessary the treatment procedures, this is particularly relevant to newly laid surfacing in the first 2 years.

15 Generally, however, such treatment found necessary would be similar to that applicable for porous asphalt i.e. possibly slightly higher spread rates and applied more frequently.

16 The use of thin surfacing materials particularly at known hazardous areas in winter months particularly in remote areas should be carefully considered, and if necessary winter Service operations reviewed and amended as a result of operational experience.

2.2.22.6.10.2 Treatment of Porous Asphalt and Road Surfaces with a High Hydraulic Conductivity

1 Porous asphalt (and other surfacing material with a high porosity) tends to freeze earlier, remain at a lower temperature and warm (or thaw) later than dense asphaltic surfaces. It remains damp for longer periods and therefore is more susceptible to the formation of ice.

2 Ice is more likely to occur where the pavement has limited super elevation, is on a shallow incline or is wide, due to multiple traffic lanes. In freezing conditions, these characteristics may result in an increased tendency for ice to form because the water cannot drain freely. Because of this, as much as twice the normal rate of application of de-icing agent may be required.
Spread rates need to be adjusted to take account of special conditions as above.

3 Greater attention is required for the practical application of an anti-icer / de-icer

than for comparable conventional and historical road surfaces. This is due to different characteristics in respect of surface temperature, road humidity and the ability to retain salt on the surface.

4 In general, more salt or increased frequency of treatment is required than for a dense asphaltic surfacing material (HRA).

5 At high traffic intensities the behaviour barely differs from that of dense asphaltic road surfaces. At low traffic intensities however the loss of thawing agent into the voids of results in a greater likelihood of freezing in the event of only a small amount of precipitation (condensation, freezing fog) and greater quantities of thawing agent being required to treat heavy precipitation.

6 Inadequate super-elevation or gradient can also be more critical. Precipitation may collect and be retained in the voids of the material at certain locations. The road surface thus remains damp and more likely to freeze in these areas. This action is exacerbated by the differing response to temperature change; the temperature of the road surface falls below freezing point more quickly than a dense road surface and rises above freezing more slowly.

7 A minimum spread rate of 12g/m^2 for marginal conditions shall be applied increasing to 15g/m^2 where road surfaces are wet, the area shall be monitored and a further treatment applied as necessary. Refer to Treatment Matrix.

8 Prompt snowploughing is recommended, but care is required to avoid damaging the surface. Ploughs shall be fitted with rubber skirts on the blades.

2.2.22.7 Winter Service Operations.

2.2.22.7.1 Spreading Equipment

1 To provide an effective winter maintenance service, salt shall be spread as evenly and accurately as possible at rates suitable for the prevailing and predicted weather conditions at the most appropriate and reasonable time. Spreading shall be undertaken by automatic machines and BS1622 gives details of such equipment together with their calibration.

2 Because of difficulties with calibration, there is a tendency for some salt to be spread beyond the edges of the carriageway (or distributed unevenly across the carriageway width). This salt is wasted in terms of de-icing the carriageway, and adjacent verges can be subject to environmental damage.

3 In circumstances where footways and cycle routes border the carriageway, this overspreading of salt can be beneficial to pedestrians and cyclists, however, higher rates of spread shall be avoided. It is unnecessary, wasteful and can be environmentally harmful. Care shall be taken to ensure that spread widths are appropriate.

4 Better control of salt spreading will decrease the quantity of chloride and sulphate ions being released into the environment causing corrosion and minimise the amount of Sodium Chloride reaching watercourses, soil and vegetation.

5 Sometimes, significantly more salt is delivered to one lane than to the other(s), and the wastage outside the target area is greater beyond the most heavily salted lane. For any given setting, salt particles will travel further from the spreader the larger the salt grains and greater their moisture content.

6 Within the spreader's limitation, it shall be calibrated to deliver similar amounts of salt to each lane without excessive wastage. Particular care is needed when calibrating spreaders for spread widths of 2 lanes plus hard shoulder or three lanes because there can be a tendency to overspread some lanes in order to achieve a sufficient level of salt in the other(s). A balance must be achieved with regard to the vehicle's capabilities and settings together with consideration of the effects and action of traffic crushing and redistributing the salt over the full carriageway width.

7 It is important that spreaders are calibrated for the type, grading and moisture content of the salt they are to spread to ensure that a consistent and uniform salt spread pattern is achieved. Results from performance trials suggest that many spreaders used by Authorities are not calibrated correctly, whereby the specified quantity is not achieved or a high proportion is spread onto verge areas or only part of the carriageway.

8 In many cases the actual spread rate in the target area (carriageway) is less than the target spread rate specified in the TRMM or in the case of Unitary Highway Authorities that may be using advice given in the "Well Maintained Highways - Code of Practice".

9 A spread rate no less than half the target rate may be sufficient to prevent winter related accidents in most conditions, knowingly under-salting the target area may

leave a Highway Authority vulnerable to litigation particularly when there is a history of winter related accidents.

10 Under-salting may increase the risk of accidents at low temperatures, and the treatment frequency may need to be increased to maintain the necessary residual salt levels to prevent ice formation and thereby potentially increasing operational costs.

11 A static calibration should be performed at the start of each winter season and whenever it is identified or suspected that the weight of salt actually discharged differs from the theoretical amount that should have been discharged by more than plus or minus10 per cent.

12 Salt discharge rates will vary depending on the quantity of salt in the body hopper. Static calibration shall be undertaken with a full load and a tenth of a load to determine the worse case scenario as the salt load decreases. Calibration shall be undertaken such that the quantity of salt applied throughout the reducing hopper load does not fall below the intended minimum spread rate.

13 The calibration for all necessary spread rates will therefore, either be based on the worse case of a full load or a tenth of a hopper load.

14 Static calibration is not solely adequate to determine the likely performance and achieve the best efficiency from the equipment and de-icer products. Regardless of the type of spreader used, it is crucial that each spreader is calibrated in static and dynamic mode (Asymmetric and Symmetric) for the intended anti-icer / de-icer product, with the fines content (i.e. less than 2-3mm grain size) and moisture content consistently monitored.

15 Static and dynamic re-calibration is necessary if any of the properties of the spreader and/or products change (moisture content and/or the grading of the de-icer product), where necessary specialist advice and assistance should be sought from the supplier of the equipment.

16 A dynamic calibration should be performed to determine the equipment's performance with regard to the even distribution of the salt within and beyond the target spread width and consistency of the quantity of salt spread. This includes the gate settings, conveyor belt speed, spinner speed and the spread configuration and settings (asymmetric and/or symmetric).

17 Once the vehicle has been statically calibrated it shall be dynamically assessed with regard to its operational spreading performance in asymmetric and symmetric operation. Assessment shall be undertaken from a following vehicle, if necessary actual measurement or detailed visual assessment undertaken regarding the salt distribution achieved within and outside the target area.

18 Whenever a new product or supplier is used or there is reason to believe that the moisture content has increased above the upper limit of BS3247, the spreader shall be re-calibrated to determine its correct settings.

19 The moisture content of less than 4% in BS 3247 should be adhered to (unless specifically increased for low temperature and humidity conditions) and salt should be stored in barns or other suitable arrangements made to ensure that a consistent moisture content is maintained throughout a winter season.

20 The controls and settings of such equipment shall be calibrated and clearly

marked for distinct rates of spread up to a maximum of 40g/m^2.

2.2.22.7.2 Pre-wetting of salt

1 Pre-wetting assists with the retention of salt on the carriageway longer, hence reducing the quantity and frequency of treatment, and provides the essential brine required to improve the speed of thawing action. As a result of a more even and consistent spread of salt and brine solution being dispersed over the carriageway width, a more distinctive white salt “bloom” can be observed on the road surface when rapid evaporation occurs.

2 Due to the particularly corrosive nature of the system on equipment and environmental considerations associated with the production of brine solutions, attention is drawn to **Section 2.2.22.5.7.**

3 Where pre-wetting operations are undertaken on the Motorway or Trunk Roads the percentage of brine added to the dry salt during the spreading operation shall not exceed 30% without prior approval of the Welsh Government.

4 Currently both 6.3mm and 10mm graded salt is used with fully or partly saturated brine solutions, fully saturated solutions (25%) being used when lower temperatures or severe weather are experienced. Service Providers should be aware that at extreme cold temperatures the dissolved salt / brine may be subject to crystallisation, where deposits are formed on equipment, which is extremely difficult to remove, hence potentially causing problems with the equipment’s operation.

5 Within Wales it is unlikely that these extremes of temperature i.e. lower than minus 21.2°C being the eutectic point of salt re-crystallising will be experienced.

6 In cold conditions wind chill factors may need to be considered to determine whether the saturated brine solution (25%) should be diluted by the addition of 15% (150 litres) of water per 1000 litres of brine accordingly, thereby reducing the brine concentration to approximately 20% and reducing the likelihood of the brine/salt solution re-crystallising.

7 As an alternative, some of the water may be substituted with Agricultural by Products (ABP’s), the addition of ABP’s should not exceed 10% of the total brine solution i.e. 100 litres per 1000 litres of brine.

8 The addition of 10% ABP’s will provide the equivalent of 3% by weight ABP’s in total quantity terms as normally provided with pre-coated salt, this combined solution can be used as precautionary pre-wetted salt treatment or dilution of the brine in extreme cold weather.

9 The addition of any water or ABP’s should be undertaken in a manner that will ensure that the water/ABP’s and brine are thoroughly mixed to produce a consistent concentration of brine.

10 Where vehicles are fitted with a number of brine tanks difficulties may be experienced in achieving a consistent mix, in such instances it may be more appropriate and beneficial to add the required quantity of water/ABP’s first and then fill the tanks with pumped brine.

11Note: that the addition of brine to the ABP using a pumped system will cause the resulting mixture to foam, unless the supplier of the product has added or provided an anti-foaming agent, this may prove problematical if the mixing operation is undertaken away from the vehicle. ABP can also be supplied with reduced fibre content.

12 It is advisable that the vehicle filling operation is closely monitored and where necessary the storage tanks may need to be vented accordingly. If mixing is required externally from the vehicle it may prove beneficial to slowly add the ABP's to the brine and thereby reduce the amount of subsequent foaming.

2.2.22.7.3 Brine Solution treatment.

1When using brine only as a treatment, the following information should be borne in mind;

i) Brine is best suited for preventative measures on thin ice (black ice) or on rime. It can be spread uniformly on the road surface and has a long and effective action suitable for precautionary treatments.

ii) Brine should not be used on thick ice or snow. Where no alternative treatment method is available, (dry or pre-coated) for the removal of large areas of packed snow and ice **the road must be closed to traffic** until the hazard has been removed.

iii) Brine is effective immediately after spreading on a damp road (not effective on wet roads), in very cold weather with a reasonable volume of traffic its is improved.

iv) The quantity of salt in a brine solution should be in the range 20 – 25% by weight of sodium chloride (NaCl) and 26 – 33% by weight of calcium chloride ($CaCl_2$). If the salt concentration is above the maximum, hydrates may possibly form and the road could potentially become slippery. The brine solution also becomes too thick for the spray bar to dispense satisfactorily.

2.2.22.7.4 Non-salt products

1 Agricultural by Products (ABPs) were first introduced around fifteen years ago and now there are a number of proprietary products designed specifically for the de-icing market. They are used as liquid anti-icers / de-icers or as an additive to other salt products for the purpose of pre-wetting and pre-coating.

2 The two main Suppliers produce either a proprietary product blended from co-products from the sugar, starch, cereal carbohydrate and distillation industries or is composed of liquid co-products from food manufacturing with the additive, magnesium chloride. The high concentration of more than 60 per cent solids, comprising a variety of water soluble small organic and inorganic molecules produces a large number of solutes which result in a reduction in the freezing point of water.

3 A more detailed description of each product can be found on the respective material safety data sheets available on the Suppliers' websites. These products have been used both as a 3 per cent by weight added solution to dry salt stockpile (pre-coated) to act as a pre-wetting agent and as an additive to the brine solution used in pre-wetting the dry salt.

4 Because of the very nature of the blended products they may contain a 60 per cent proportion of fibrous content which has the potential to clog filters and spray systems when spread as a liquid anti-icer / de-icer. Suppliers of such products can supply ABP's that have substantially reduced solids content and an anti-foaming agent. Care must therefore be taken to ensure that the liquid is free flowing through the spray jets, nozzles and filters.

5 Spreading equipment must be calibrated statically and dynamically to ensure spread rates and settings are correctly set and monitored accordingly. Recent research would indicate that spread rates increase by approximately 5% when salt is pre-coated with such products and the salt distribution / width alters accordingly.

Important note.

1 The use of Agricultural by Products (ABP's) is permitted on Trunk Roads and Motorways within Wales, such use by Service Providers and those Authorities (supply chain providers) undertaking the winter service activities is conditional on the following;

i) Service Providers and their supply chain shall fully consult with the local EA / NRW and jointly identify any particularly sensitive areas that may require special consideration and treatment. Where necessary liaise and provide EA / NRW with the opportunity for them to monitor and evaluate any impact and effects.

It is further recommended that consultation with Natural Resources Wales is undertaken together with appropriate liaison with other interested parties that may have an interest in the winter service activities intended and any subsequent environmental and ecological effects these activities may have.

ii) Spread rates for pre-coated salt applied to the Motorway and Trunk Roads shall not be reduced from that currently recommended and specified.

iii) There shall be no increase in overall salt costs or winter service activities associated with the use of pre-coated salt or ABP's chargeable to the Welsh Government.

2 Safety must be the primary concern and until specific evidence is available that would justify further reductions in the spread rates specified in the Treatment Matrix, spread rates should be continued as specified on the Motorway and Trunk Road Network.

3 Service Providers intending to use such products are required to confirm the cost issues (no premium/increase in costs will be paid) and also to submit the EA's / NRW written site agreement / confirm approval for the products use.

4 Consideration should also be given to the precautionary measures associated with the products storage, handling and use and other safeguards that maybe appropriate.

5 Any queries should be directed to the Welsh Government.

6 Attention is drawn to The Design Manual for Roads and Bridges, Vol 11 Environmental Assessment, Section 3 Environmental Assessment Techniques, Part 10 HA 216/06 Road Drainage and the Water Environment.

2.2.22.7.5 Operational use of ABPs

1 Pre-coated salt having the addition of 3% by weight ABP in the form of liquid increases the moisture content to around 6% and therefore can provide additional benefits to that of conventional dry salting, particularly when conditions of low temperature and low humidity are encountered or forecast.

2 The addition of ABP to the salt improves the speed of dissolution (brine) at lower temperatures assisting in the de-icing process. The spreading technique employed and characteristics of the anti-icer / de-icer are similar to pre-wetted salt and are therefore suitable for use as, precautionary and reactive treatment at the rates specified.

3 Spreading equipment shall be specifically calibrated (static and dynamic) and correctly adjusted for use with the pre-coated salt. Actual spread rates will vary as the hopper load diminishes and therefore the equipment should be initially calibrated with a full load and rechecked and adjusted accordingly once the hopper is 10% full.

4 A minimum measured spread rate of 10g/m^2 shall be achieved throughout the spreading calibration operation when calibrated for 10g/m^2.It is recommended that the calibration be undertaken for a range of spread rates 10g/m^2 minimum, 15g/m^2 and 20g/m^2 being normally the maximum, to confirm that the required actual measured spread rates are not less than that intended.

2.2.22.7.6 Alternative Anti-icing / De-icing materials.

1 Alternative anti-icing/de-icing materials are usually more expensive than salt. It is recommended that their use should be restricted to isolated locations and specific circumstances for example structures susceptible to corrosion to be economically viable.

2 Potassium Acetate salts in solution is one such product that is effectively non-corrosive compared to salt and is safe to aquatic life, the solution can be sprayed directly onto the road surface, however, it is approximately 30 times more expensive than salt.

3 Acetate salts having a specific gravity of 1.25 may be applied either by spray bar or utilising the spinner and has an immediate action and may remain active for up to 48 hours at temperatures as low as –15 ºC depending on weather conditions and other factors.

4 Spread rates range from 10 g/m^2 to 40g/m^2 depending on the intended treatment requirements, traffic volumes and climatic conditions.

5 The skid resistance of a wet road is not significantly affected by the precautionary/reactionary treatment.

6 The product solution is relatively safe to handle requiring gloves and eye protection.

7 Any use of alternative anti-icing / de-icing materials must be approved by Welsh Government.

2.2.22.7.7 Vehicle Routes

1 However vehicle operational salting routes are planned, a certain amount of wasteful duplication ('dead mileage') is unavoidable because of network complexities and the siting of compounds and depots.

2 Routes shall be subject to regular review and further consideration of route optimisation in order to achieve best economic value and compromise regarding treatment times.

3 When undertaking route optimisation assessments a spread rate of 20g/m² should be used that would reflect the worse case scenario and avoid situations where vehicles may need to return to the depots to be refilled to complete the route in snow conditions etc.

4 Service Providers shall ensure that adequate reserves of resources can be maintained and called upon as the need arises.

5 Service Providers shall endeavour to identify through liaison, any sections of the salting routes that could be more economically treated by adjoining Agents / Highway Authorities / Service Providers to ensure best value is obtained, a partnership approach should be adopted to achieve the desired level of winter service provision.

2.2.22.7.8 Snow Ploughing

1 In the interests of traffic safety it is necessary to have a clearing policy which is readily understood and acted upon by all staff. That is of particular importance to snow ploughing. The basis of approach is 'clearance by lanes'.

2 It is dangerous to make ploughing passes which leave traffic guided by irregular windrows of snow which weave from one lane to another. It is also undesirable to leave only half lanes clear as drivers will be tempted to overtake by squeezing past.

3 The ploughed windrow of snow should form a smooth and continuous line without sudden encroachments into the cleared path. On motorways, windrows can be left on hard shoulders but there should be intermittent clearings to provide refuge for broken-down or abandoned vehicles.

4 The ultimate aim is to clear all lanes and hard shoulders as soon as conditions permit, and clearance work shall proceed continuously to this end. If clearance is stopped or the road closed to traffic during a snowfall the resultant build up takes disproportionately longer to clear. Packed snow, glazed by the wind, can be particularly difficult to remove. Care must be taken during snow ploughing to avoid damage to road surfaces, road studs and roadside structures.

5 Because of differences in local weather conditions, snow depth, snow wetness and road topography, it is difficult to be precise on the order of lane clearance.

Local traffic densities and movements differ from day to day and within a day and affect lane clearance priorities.

6 More than 2 lanes ploughed on to the central reservation could prove to be hazardous to traffic since snow build up could lead to flooding when temperatures rise. It is suggested that for a three-lane carriageway with hard shoulder the following approach is adopted:-

Firstly Plough lane 2 (centre lane) snow to left-hand lane;

Secondly Plough lane 1(left-hand) lane to hard shoulder;

Thirdly Plough hard shoulder snow to verge;

Fourthly Plough lane 3 (right-hand lane) snow to central reservation.

7 An alternative approach is to plough the left-hand lane (and slip road) snow to the hard shoulder first. That may have particular merit when snowfall is heavy and persistent but stationary vehicles can easily force plans to change to a 'centre lane first' approach.

8 Similar techniques can be applied to two-lane carriageways, commencing with clearance of the nearside lane to hard shoulder.

9 When sufficient numbers of vehicles are available, echelon ploughing (2 or more vehicles moving in the same direction one behind the other in adjacent lanes) enables rapid clearance to be carried out even in the worst conditions. This technique may be particularly beneficial in areas where vertical barriers have been installed and the storage of snow on the outside lane or adjacent to the barrier is undesirable.

10 Any such areas shall be identified and procedures developed through liaison with the Welsh Government and Traffic Wales and included within the Winter Service Delivery Plan..

11 During ploughing operations motorway warning signals shall be displayed. Police co- operation and liaison is essential to ensure that an efficient and co-ordinated approach is achieved.

12 When ploughing operations are undertaken particular care must be exercised to minimise damage to the carriageway surface and associated carriageway road markings and road studs.

13 It is therefore beneficial to use a rubber skirt on the plough blade, and if necessary fit castors which will need to be suitable for the various vehicular movements and ploughing operations, ploughs should therefore be adjusted to ensure that the rubber skirt has a clearance of 25mm above road surface level.

14 Where specifically designed rubbers for use directly on the carriageway surface are fitted, the plough shall be set to black top in float position, castor wheels where fitted shall be set accordingly.

15 When conditions are particularly severe close liaison should be undertaken with the relevant Police Authority, and if necessary Police assistance requested and utilised. For particularly difficult salting and ploughing operations the employment of

4x4 or 6x6 vehicles should be considered.

16 In heavy snowfall or severe conditions where there are multiple lanes, motorists shall be advised and directed to use one lane where such signage facilities are available. The concentration of traffic in a single lane will assist in maintaining the operation of the road and ensure traffic flows are maintained. Snow clearance and treatment can be continued using this trafficked lane during the most severe weather, and when practical additional lanes brought back into operational use utilising that lane.

17 Some major maintenance schemes require the installation of temporary vertical concrete / other solid barriers on the road network, at other locations permanent concrete barriers may be installed which can pose problems regarding snow clearance and ploughing operations.

18 Service Providers shall consider and identify any locations where lanes may need to be abandoned for operational and practical reasons during periods of prolonged heavy snowfall.

19 When conditions dictate it is recognised that it is necessary to plough snow from lane 2 to the right and sacrifice one or more running lanes in order to facilitate the stacking of snow, thereby keeping the maximum number of lanes operational and available to traffic.

20 Service Providers must produce a schedule identifying the locations of vertical concrete / other solid barriers on their network and a clearance plan for each location to be included within the Winter Service Delivery Plan. This schedule should also be cross referenced to the Contingency Plan. Alternatively, the schedule may form part of the Route Schedules.

21Service Providers must give special consideration to snow clearance where solid vertical barriers are present and the co-ordination of activities required in order to inform motorists that a lane is closed using VMS and Matrix signage.

Solid Vertical Barrier Schedule and Clearance Plan

Solid Vertical Barrier Location Schedule

Solid Vertical Barrier Reference Number: [Reference to network map]	
Location	[Location in relation to: marker posts for Motorways/ relevant landmarks for Trunk Roads]
Cross Sectional Position	[Location in Verge or Central Reserve]
Distance from Adjacent Running Lane	[Distance from Barrier to nearest running lane]
Construction of Adjacent Verge	[Grass / Hardened / Filter Drain / V-Channel etc.]
Number of Running Lanes	[Number of Running Lanes adjacent to barrier]

Hard Shoulder Details	[Details of any hard shoulder present – Width, any other features]
Slip Roads Present	[Details of any diverging/merging slip roads present at the location]
Large Hatching Areas	[Details of any large hatching areas present - for example near diverge/merge tapers]
Resources Required for Echelon Ploughing	[Resources required for echelon ploughing including any plant required for bulk clearance]
VMS Available	[Details of VMS present - Mobile VMS required or barrier in location with permanent VMS]
Additional Non-Dedicated Vehicles	[Details of non-dedicated vehicles that will assist in clearance]
Assistance from External Sources	[Details of assistance required from such entities as, Police, TMC's etc.]

2.2.22.7.9 Abandoned Vehicles

1 Where snow clearance operations are hampered by the presence of abandoned vehicles their removal may be necessary.

2 Wherever possible the owner of the vehicle should be contacted and requested to remove or make alternative arrangements if they are unable to attend for the quick removal of the vehicle and thereby facilitate the continuation of snow clearance operations.

3 Only Police Officers have the authority to move a vehicle in these circumstances and therefore contact will be made through normal liaison arrangements to request the vehicle(s) removal.

4 Requests for any vehicle(s) removal shall be accompanied by specific details of the vehicle (including registration numbers for each vehicle) their location and reasons why the vehicles need to be moved, a detailed log shall be kept of all communications and requests.

5 Where owners do leave information regarding their contact details and whereabouts with the vehicles, this information shall be obtained and provided to Traffic Wales.

2.2.22.7.10 Rises in temperature

1 Water from thawing windrows of snow can spread over the carriageway and subsequently freeze, particularly at night. Additional salting may be necessary to deal with this.

2 To assist in the drainage of the carriageway and reduce the possibility of freezing, hard shoulders, hard strips and cycle tracks where they are incorporated within the carriageway, shall be treated at the same time as the carriageway.

3 Attention may also be necessary to central reserve areas which incorporate drainage facilities that left untreated may not provide adequate drainage, this is particularly important near vertical barriers where snow is stacked from ploughing operations.

2.2.22.7.11 Slip roads and interchanges

1 It is important to maintain the free flow of vehicles at interchanges. At least one lane of each slip road shall be cleared as soon as possible together with appropriate links on all-purpose road interchanges.

2 Bulk removal of snow from multi-level interchanges (or even some conventional interchanges) may be necessary on occasions.

3 Suitable disposal areas shall be identified to facilitate the disposal of this snow within the locality of any identified sites.

4 Where snow has built up as a result of ploughing operations across Service Area entry and exit slip roads and it is evident that motorists are experiencing difficulty utilising these facilities the snow should be cleared.

5 Clearance of any snow at these Service Area slip roads should be limited to the immediate area of the interchange/gyratory. Maintenance and clearance of the access roads into the site, service roads and car parks within the privately owned land is the responsibility of the service operator / land owner.

2.2.22.7.12 Use of central reserve crossovers

1 Under the provisions of Section 15(e)(i) of the Motorway Traffic Regulations 1959, the restriction on the use of central reserve crossovers is relaxed where it is necessary to carry out maintenance and clearance of part of a motorway. However, in practice that is a highly dangerous manoeuvre and all drivers of winter maintenance vehicles shall be instructed not to use the central reserve crossovers and to proceed to motorway interchanges. The only possible exception is when conditions are such that there are no other moving vehicles on both carriageways and urgent action is required to get traffic moving again.

2 Similar limited U-turning movements on all-purpose trunk roads shall only be carried out without risk to winter maintenance vehicle drivers and other road users.

2.2.22.7.13 Safety and level crossings

1 Drivers shall be instructed to take all possible precautions to protect their own safety and the safety of other road users at all times.

2 Service Providers must ensure that the strictest safety precautions are taken when winter maintenance vehicles are negotiating level crossings. When snow ploughing care shall be taken that snow does not build up across the tracks or against gates, barriers, bridge parapets, fences and walls, on completion of the snow ploughing operation the area should be inspected to ensure that no solid objects have been deposited on the rails.

3 Close co-operation and liaison with Rail Operators is therefore essential to ensure the safe undertaking of winter Service operations and confirmation that the operation has been completed.

4 Snow blowing equipment shall not be used at level crossings where there is a risk of the lower guide or rotation drum being caught on the rails.

5 Snow ploughing shall also not be undertaken at locations where the rails protrude above the carriageway surface and may therefore suffer damage as a consequence of ploughing operation. Ploughs shall have rubber skirts fitted to them and be in good serviceable condition.

6 Service Providers shall ensure that an inspection be undertaken at each level crossing location to determine its suitability or otherwise for ploughing operations where there is any concern.

2.2.22.7.14 Snow Fences

1 Powers to erect snow fences and to secure easements are provided in the Highways Act 1980 where Sections 102, 249, 251, 291 and 292 are relevant.

2 Negotiations of terms for the grant of easements by landowners and tenants shall be undertaken by Service Providers in consultation with the Welsh Government. Cases on which agreement cannot be reached shall be referred to the District Valuer.

2.2.22.8 Treatment of footways, cycleways and other areas

1 In order to assess the likely hazard that users will be exposed to whilst using the facilities, a Hazard Rating Analysis has been formulated for the various combinations.

2 To avoid abortive work in undertaking these assessments, Service Providers shall carry out a review to indentify which routes/areas/locations have the highest risk and are likely to meet the criteria for Priority 1A, 1 and 2. An assessment shall be undertaken of these routes/areas/locations to indentify whether they qualify. If they do not meet the criteria then no further assessment is required for those with a lower risk that would also not qualify.

3 Footways, cycleways and other areas being assessed have been categorised into 3 broad groups representing the general environments that they pass through, these being rural, semi-rural and urban.

4 A rural environment is classed as predominately open countryside with a few individual dwellings.

5 Semi-rural is classified as small villages.

6 An urban environment is classed as a large village, town or city.

7 For each combination of options a hazard Index Assessment has been calculated and tabulated based on the potential usage (likelihood) against the potential duration of injuries suffered as a measure of (severity).

8 Certain assumptions have been made in the formulation of the Hazard Index Ranking Assessment Matrix enabling any area or length to be assigned a hazard ranking value as follows;

a) The potential severity of injuries suffered by pedestrians is minor.
b) The potential severity of injuries suffered by cyclists is to incapacitate them for less than 3 days.

c) The severity of injury increases to incapacitation for a period greater than 3 days for accidents relating to steep inclines / and or steps associated with the use of footbridges or subways.
d) For very exceptional high risk areas the severity of injury increases to incapacitation for a period not greater than 3 weeks, For accidents relating to falls from a height, fast flowing rivers where multiple injuries maybe sustained and other areas where there are no hand rails or other means of restraint. Such areas would normally be very lightly used.
e) Rural pedestrian facilities are lightly or occasionally used.
f) Semi-rural pedestrian facilities range from occasional to frequently used.
g) Urban pedestrian facilities range from frequent to heavy usage.

2.2.22.8.1 Hazard weighting

1 Each pedestrian/cyclist facility or other area under consideration can be further refined by the application of the weighting for the various hazard factors identified.

2 Hazard factor 1 relates to the type of surfacing material, weightings to be applied depend on the surface texture (slipperiness) of the pavement material. This ranges from x 1.5 for an untextured surface, e.g. paving slabs, to x 0.5 for a well textured surface.

3 Hazard factor 2 is associated with the proximity of the pedestrian / cycle facility to the carriageway. There is a much greater risk of serious injury if there is the possibility of slipping and falling onto the carriageway. Therefore, the weightings range from x 1.25 for sections which are adjacent to the carriageway to x 0.75 for sections which are remote from the carriageway or are offered protection by a physical barrier such as guard railings.

4 Hazard factor 3 identifies access routes where the potential users may be more at risk. Locations categorised include primary routes in close proximity to hospitals, sheltered housing/accommodation and other facilities for those less active, schools, shops, crossing points, Railway Stations, bus stops, industrial areas and inter village routes, These routes are weighted appropriately for the vulnerability of the likely users and range from x 2 for primary routes in close proximity to a hospital and sheltered housing / accommodation, to x 1 for inter village routes.

5 Exceptional hazard factor 4 is applicable only if the area under consideration is adjacent to a road having a speed limit of 50mph or greater and no protection or segregation by the use of a physical barrier such as guard railings or narrow verge etc is present.

6 This is particularly relevant if there is a possibility that passing traffic travelling at higher speeds may throw accumulated snow or surface water across and along the area under consideration.

7 Exceptional hazard factor 5 relates to other significant hazards such as steep gradients and slopes, steps and poor horizontal alignment. **(Note, these hazards have already been included for footbridges and subways).**

8 Exceptional hazard factor 6 is applicable to the climatic variations and required a high level of local knowledge and experience to apply. Circumstances where this factor will be applied are for areas that are known to retain icy conditions for longer periods than adjacent areas due to being shaded or sheltered from sun light / warming influences. There may however, be areas that are known to retain higher

temperatures than surrounding areas e.g. city centres and coastal areas.

9 Each area / length under consideration may be divided into sections to accurately reflect the various risks applicable for each variation to the hazard factors, or assessed as a route length for strategic or logistical purposes.

10 The weightings from hazard factors 1, 2 and 3 and exceptional hazard factors 4, 5 and 6 if applicable are applied to the generic ranking from the Hazard Assessment Matrix. The sum of the Hazard Factors determines the rating for each identified section or length under consideration and ultimately the treatment priority ranking determined.

11 Although this method will assist in determining a numerical value for each section or length under consideration, other factors may not be fully considered and reflected in the assessment result.

12 Liaison shall be undertaken with the relevant Local Highway Authorities to ensure consistency of treatment, co-ordination of activities and specific arrangements for undertaking timely treatment (eg Safe Routes to Schools).

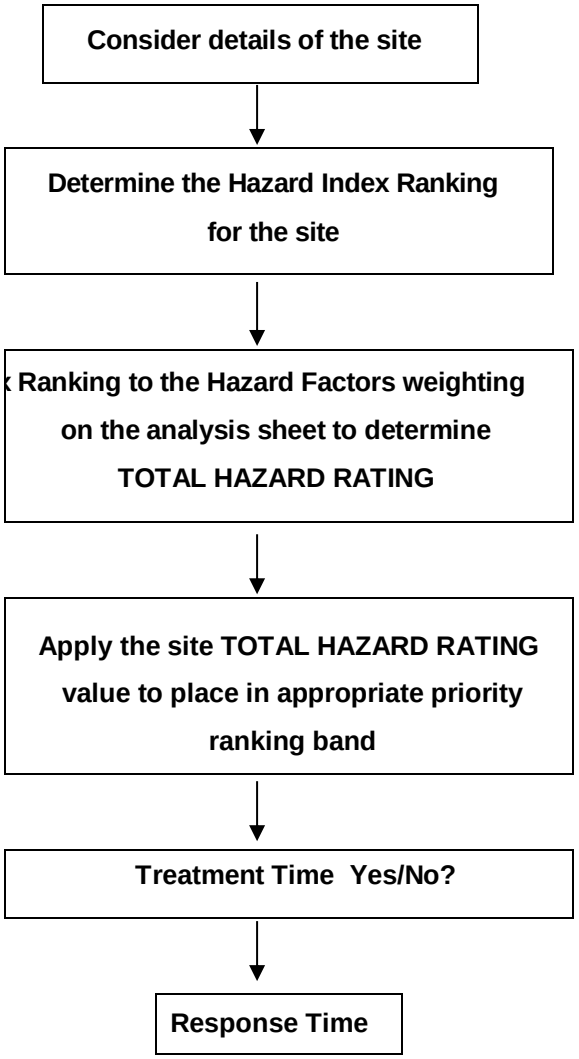
13 Treatment priorities may also be determined as a result of a Policy decision or approval granted for a specific area or length, thereby allowing classification at a higher or lower treatment priority to ensure continuity and consistency of treatment undertaken.

14 Liaison shall therefore be undertaken with the Welsh Government concerning the calculated priority ranking or variations as necessary.

15 In order to facilitate integration of service with Local Highway Authorities, Service Providers shall be aware of the footway hierarchies described in the (CSS) Roads Liaison Group document, Well Maintained Highways – Code of Practice for Highway Maintenance. This categorisation is defined in the following table.

Category No	Category Name	Brief Description
1a	Prestige Walking Zone	Prestige Areas in towns and cities with exceptionally high usage, such as Piccadilly in Manchester and Oxford Street in London
1	Primary Walking Route	Busy urban shopping and business areas, and main pedestrian routes linking interchanges between different modes of transport, such as railways and underground stations, and bus stops etc
2	Secondary Walking Route	Medium usage routes through local areas feeding into primary routes, local shopping centres, large schools and industrial centres etc.
3	Link Footway	Linking local access footways through urban areas and busy rural footways
4	Local Access Footway	Footways associated with low usage, short estate roads to the main routes and *culs de sac*

2.2.22.8.2 Process to determine the treatment of footways, cycleways and other areas



2.2.22.8.3 Hazard Index Ranking Assessment Matrix

HAZARD ASSESSMENT			RANGE OF RISK FOR AREAS UNDER CONSIDERATION.			
			pedestrian area, layby footway, picnic/rest area,	cycleway, bridleway,	subway, footbridge,	Very exceptional high risk areas.
USAGE	VERY HEAVY	5	5	7.5	10	12.5
	FREQUENT	4	4	6	8	10
	MODERATE	3	3	4.5	6	7.5
	OCCASIONAL	2	2	3	4	5
	LIGHT	1	1	1.5	2	2.5
Calculatedrisk - multiplyingassessed usageandseverity.			**1**	**1.5**	**2**	**2.5**
			MINOR INJURY	< THREE DAYS	> THREE DAYS	< THREE WEEKS
			INJURY SEVERITY			

2.2.22.8.4 Typical Hazard Index Ranking Values

Single carriageway Rural	Footway (foot)	**1**	Footbridge (f/b)	**2**
	Cycleway (cycle)	**3**	Subways (sub)	**2**
	Bridleway (bway)	**1.5**	Picnic / Rest Area (pr)	**2**
	Layby	**2**	Pedestrian Area (ped)	**2**
Single carriageway Semi-Rural	Footway (foot)	**2**	Footbridge (f/b)	**4**
	Cycleway (cycle)	**3**	Subways (sub)	**4**
	Bridleway (bway)	**1.5**	Picnic / Rest Area (pr)	**2**
	Layby	**2**	Pedestrian Area (ped)	**3**
Single carriageway Urban	Footway (foot)	**4**	Footbridge (f/b)	**6**
	Cycleway (cycle)	**6**	Subways (sub)	**6**
	Bridleway (bway)	**1.5**	Picnic / Rest Area (pr)	**2**
	Layby	**2**	Pedestrian Area (ped)	**4**
Dual carriageway Rural	Footway (foot)	**1**	Footbridge (f/b)	**4**
	Cycleway (cycle)	**3**	Subways (sub)	**4**
	Bridleway (bway)	**1.5**	Picnic / Rest Area (pr)	**2**
	Layby	**2**	Pedestrian Area (ped)	**2**
Dual carriageway Semi-Rural	Footway (foot)	**4**	Footbridge (f/b)	**6**
	Cycleway (cycle)	**6**	Subways (sub)	**6**
	Bridleway (bway)	**1.5**	Picnic / Rest Area (pr)	**2**
	Layby	**2**	Pedestrian Area (ped)	**3**
Dual carriageway Urban	Footway (foot)	**5**	Footbridge (f/b)	**8**
	Cycleway (cycle)	**6**	Subways (sub)	**8**
	Bridleway (bway)	**1.5**	Picnic / Rest Area (pr)	**2**
	Layby	**2**	Pedestrian Area (ped)	**5**
Motorway Rural	Footway (foot)	**0**	Footbridge (f/b)	**4**
	Cycleway (cycle)	**0**	Subways (sub)	**4**
	Bridleway (bway)	**0**	Picnic / Rest Area (pr)	**0**
	Layby	**0**	Pedestrian Area (ped)	**0**
Motorway Semi-Rural	Footway (foot)	**0**	Footbridge (f/b)	**6**
	Cycleway (cycle)	**0**	Subways (sub)	**6**
	Bridleway (bway)	**0**	Picnic / Rest Area (pr)	**0**
	Layby	**0**	Pedestrian Area (ped)	**0**
Motorway Urban	Footway (foot)	**0**	Footbridge (f/b)	**8**
	Cycleway (cycle)	**0**	Subways (sub)	**8**
	Bridleway (bway)	**0**	Picnic / Rest Area (pr)	**0**
	Layby	**0**	Pedestrian Area (ped)	**0**

2.2.22.8.5 Hazard Rating Analysis Sheet

Road Number / name / description			
Road Category	Single carriageway	dual carriageway	motorway
Environment	rural	semi-rural	urban
Section No. (unique ref. No.)			
Length of section	Metres		
Average width of section	Metres		
Location			
Description of facility / area			
RANK from Hazard matrix			**HAZARD RATING**
	Weighting	**Hazard**	
Hazard Factor 1 (select one only) *Pavement Material*			(RANK X weighting)
Untextured surface (e.g. paving flags)	X 1.5		
Textured Surface (eg bituminous)	X 1		
Well textured surface	X 0.5		
Hazard Factor 2 (select one only) *Proximity to running lanes*			
Adjacent to carriageway	X 1.25		
Narrow verge to carriageway	X 1		
Remote from carriageway	X 0.75		
Protected by physical barrier	X 0.75		
Hazard Factor 3 (select one only)*At risk access routes*			
To hospital	X 2		
Sheltered accommodation / facilities for those less active	X 2		
To Railway station	X 1.75		
To school	X 1.75		
To shops	X 1.5		
To crossing point	X 1.5		
To bus stop	X 1.5		
Promoted and signed route	X 1.5		
To industrial area	X 1.25		
Inter village route	X 1		
Exceptional Hazard Factor 4 (select one only if applicable) *Higher traffic speeds*			
70mph	X 1.25		
60mph	X 1		
50mph	X 1		
Exceptional Hazard Factor 5 (select one only if applicable) *Other hazard*			
steps	X 2.5		
Gradient >5%	X 2		
Gradient >3%	X 1.5		
Poor horizontal alignment	X 1.5		
Exceptional Hazard Factor 6 (select one only if applicable) *Regional climate*			
Sheltered / shaded area	X 1.5		
Exposed area	X 1.5		
Average climatic conditions	X 1		
Warm spot/area associated with town centres etc.	X 0.5		
TOTAL HAZARD RATING			
Route Manager / Engineer Assessment			

2.2.22.8.6 Priority Rankings

1 Based on the Total Hazard Rating from the Analysis Sheet assessment process the areas / lengths shall be categorised as follows;

Priority 1A : Priority Areas and special events requiring priority treatment.

Priority 1: Hazard Rating of greater than 50

Priority 2: Hazard Rating of greater than 42 to 50

Priority 3: Hazard Rating of greater than 34 to 42

Priority 4: Hazard Rating of greater than 26 to 34

Priority 5: Hazard Rating of 26 or less

2 It should be noted that footways and cycleways on trunk roads are generally associated with low usage and will therefore usually fall into Category 3 or lower. Category 1A, 1 and 2 priorities will not be commonplace on the trunk road network.

3 Footway and cycleway facilities that are specifically promoted shall be included within the higher priority categories.

4 Consideration shall be given to facilities that, for example, are promoted within route management strategies and Local Transport Plans or have specific signing schemes in place. Such routes shall only be re-categorised where they serve business, commercial or educational facilities. Promoted routes that are recreational in nature would not normally merit re-categorisation.

5 For guidance, 'specific signing schemes' refers to signed 'routes' rather than the normal signing of facilities dedicated to pedestrians or cyclists. For example, signed and marked cycle crossings on dual carriageway slip roads would not be considered as a specific signing scheme.

2.2.22.8.7 Decision Making for Treatment of Footways, Cycleways and Other Areas

1 The decision to treat specific areas or lengths is based upon the weather forecast information and roadside facilities available for the monitoring of the road network conditions.

Priority	Over night frost conditions. Over night forecast temperatures below zero but not expected to extend beyond 8am.	Day time frost conditions Overnight forecast of frost with temperatures below zero and extending beyond 8am.	Extended period of frost conditions Forecast of frost and temperatures remaining below zero throughout daylight hours.	Snow Events
1A	Precautionary treatment		Monitor and further treatment as required	Snow removal / treatment will commence when resources become available from carriageway treatments. Endeavours will be made to complete clearance / treatment within 12 hours of cessation of snowfall, subject to availability of resources
1	No treatment	Reactive treatment as required by 8am of that day	Monitor and further treatment as required	Snow removal / treatment will commence when resources become available from carriageway treatments. Endeavours will be made to complete clearance / treatment within 24 hours of cessation of snowfall, subject to availability of resources
2	No treatment	Reactive treatment as required by 8am of that day	Monitor and further treatment as required	Snow removal / treatment will commence when resources become available from carriageway treatments. Endeavours will be made to complete clearance / treatment within 48 hours of cessation of snowfall, subject to availability of resources
3	No treatment	No treatment	Reactive treatment as required by noon of the following day.	Snow removal / treatment will commence when resources become available from carriageway treatments. Endeavours will be made to complete clearance / treatment within 5 days of cessation of snowfall, subject to availability of resources
4	No treatment	No treatment	Reactive treatment not normally undertaken other than in response to localised very exceptional circumstances. Treatment completed 48 hours after being made aware of the problem, subject to availability of resources.	Snow removal / treatment will not normally be undertaken except in response to localised very exceptional circumstances and only when resources become available. Reasonable endeavours will be made to complete treatment of any localised specific areas within 5 days of cessation of snowfall, subject to availability of resources
5	No treatment	No treatment	Reactive treatment will not be undertaken other than in response to localised very exceptional circumstances. Treatment completed within 4 days after being made aware of the problem, subject to availability of resources.	Snow removal / treatment will not be undertaken except in response to localised very exceptional circumstances and only when resources become available. Reasonable endeavours will be made to complete treatment of any localised specific areas within 7 days of cessation of snowfall, subject to availability of resources

2 During prolonged periods of ice, frost and snow where temperatures remain low, any available surplus resources may be deployed on the treatment of Priority 3, 4 and 5 areas.

3 Resources shall not however, be taken away from areas with a higher priority ranking that could potentially compromise those levels of treatment and safety reasonably expected.

2.2.22.8.8 Response Times

1 The salting start time is based on the commencement time for the road network and is obviously weather dependant, but would not normally commence until after the evening peak period.

2 It may however be possible for treatment of the footway / cycleway network and other areas to be commenced before this time possibly as soon as the instruction is received and weather conditions permitting.

3 Treatment times for completing the treatment of the Footway / cycleway networks and other areas are as follows;

Priority 1A: Priority treatment commenced as soon as practicable and completed within 6 hours of the treatment commencement time, but no later than 8.00am.

Priority 1: Reactive treatment normally undertaken within 6 hours of the treatment commencement time and completed no later than 8.00am.

Priority 2: Reactive treatment undertaken and completed by no later than 8.00am.

Priority 3: Reactive treatment undertaken within 24 hours and completed by no later than noon on the following day.

Priority 4: Untreated, except in response to localised very exceptional circumstances and only where the availability of resources permits, treatment completed within 48 hours of being made aware of the problem.

Priority 5: Untreated, except in response to localised very exceptional circumstances and only where the availability of resources permits, treatment will be completed within 4 days of being made aware of the problem.

4 The timing and type of treatment shall be coordinated wherever possible with Local Highway Authorities to ensure that footways and cycleways are treated consistently along their length.

5 Agreement of this policy with Local Highway Authorities must be based on the principles contained within the Treatment Table but variation from the defined treatments is acceptable on a local basis subject to liaison with Welsh Government. However, where a Local Highway Authority has chosen not to undertake any treatment at all, it is not acceptable to follow their approach.

6 Where a footway or cycleway facility is wholly within the trunk road and there is no interface with the local highway authority network the requirements within the Treatment Table will apply.

2.2.22.8.9 De-icing materials

1 10mm rock salt is generally inappropriate for use on footways and cycleways due to the larger particle size taking longer to enter into solution and potential trip, slip and fall hazard from such coarse material.

2 6.3mm graded salt maybe used, however, it would be preferable to use a graded salt of maximum size 3mm supplied as rock salt or marine salt if available, with a moisture content of 4% or if used in low humidity conditions a maximum of 6% moisture content.

3 An alternative such as brine maybe used which is more user friendly and would provide a more consistent and uniform spread if the necessary items of equipment were available.

4 Pre-coated salt having the addition of ABP's is permitted for use on the Trunk Road Network,

5 The use of other products as an alternative or additive to sodium chloride (salt) will require prior approval for use on the Trunk Road network by Welsh Government.

2.2.22.8.10 Treatment

1 Indicative spread rates are as follows;

2 Precautionary (dry, pre-coated and pre-wetted) salting shall be undertaken using available resources and equipment so that a minimum average spread rate of 15g/m² is achieved over the area being treated. The salt being distributed as evenly as reasonably possible within the limitations of the equipment and / or method employed.

3 As an alternative, brine maybe applied at a rate of 20g/m² and distributed as evenly as possible within the limitations of the equipment and / or method employed. Brine shall not however be applied to compacted snow or ice unless the area is closed to the public until the treatment is effective.

4 Spread rates maybe increased at specific locations where there are known hazards such as ground water seepage, logistical reasons where resources are limited to undertake frequent / subsequent treatment or snow is expected or present but treatment rates should not exceed 40 g/m².

5 Increasing the spread rates for brine may not be practical due to the loss of brine applied through run off, or logistical reasons associated with providing the quantity of residual sodium chloride required prior to or during periods of snow.

6 When practical, the treatment of a footway or cycleway maybe undertaken concurrently with the salting of the adjoining carriageway as a combined spreading operation. This method of combined treatment shall not be employed where there is a possibility that adjacent planted areas or environmentally sensitive areas maybe affected such as verges.

7 Where such methods are under consideration to be employed, the areas shall be inspected and assessed immediately after a trial of the equipment to determine the practicality and standard of treatment applied. Where necessary the equipment shall be adjusted accordingly to ensure consistency of treatment and target spread rates are achieved.

8 Whenever a motorway or trunk road structure has been identified as requiring treatment, liaison should be undertaken with the respective Welsh Government Structural Engineer and advice obtained regarding the most suited and appropriate method of treatment to be used.

EXAMPLE (1) OF HAZARD RATING ANALYSIS SHEET

Road Number / name/ description			
Road Category	Single Carriageway	**Dual Carriageway**	**Motorway**
Environment	Rural	Semi Rural	**Urban**
Section No (unique ref no)	Assessment of worst case for combined route, coastal area		
Length of section	2,000 Metres adjacent to east and west bound carriageways		
Average width of section	2.0 Metres, 70mph speed limit		
Location	Combined and segregated footway and Cycleway		
Description of facility / area	Footway / Cycleway / footbridge and carriageway segregated by grass verge		
Rank from Hazard Matrix	**8 (Footbridge)**		Hazard
	Weighting	Hazard	Rating
Hazard Factor 1 (select one only) *Pavement Material*			(Rank x weighting)
Untextured surface (e.g. paving flags)	X 1.50		
Textured Surface (eg bituminous)	X 1	8	8
Well textured surface	X 0.5		
Hazard Factor 2 (select one only) *Proximity to running lanes*			
Adjacent to carriageway	X 1.25		
Narrow verge to carriageway	X 1		
Remote from carriageway	X 0.75		
Protected by physical barrier	X 0.75	8	6
Hazard Factor 3 (select one only) *At risk access routes*			
To hospital	X 2		
Sheltered accommodation / facilities for those less active	X 2		
To Railway station	X 1.75		
To school	X 1.75		
Shops / pedestrian area	X 1.5		
To crossing point	X 1.5		
To bus stop	X 1.5	8	12
Promoted and signed route	X 1.5		
To industrial area	X 1.25		
Inter village route	X 1		
Exceptional Hazard Factor 4 (select one only if applicable) *Higher traffic speeds*			
70mph	X 1.25		
60mph	X 1		
50mph	X 1		
Exceptional Hazard Factor 5 (select one only if applicable) *Other hazard*			
steps	X 2.5		
Gradient >5%	X 2		
Gradient >3%	X 1.5	4	6
Poor horizontal alignment	X 1.5		
Exceptional Hazard Factor 6 (select one only if applicable) *Regional climate*			
Sheltered / shaded area	X 1.5		
Exposed area	X 1.5		
Average climatic conditions	X 1		
Warm spot/area associated with town centres etc.	X 0.5	8	4
TOTAL HAZARD RATING			**30**
Route Manager / Engineer Assessment			**30**

EXAMPLE (2) OF HAZARD RATING ANALYSIS SHEET

Road Number / name/ description			
Road Category	**Single Carriageway**	Dual Carriageway	Motorway
Environment	Rural	Semi Rural	**Urban**
Section No (unique ref no)	A494 Rhos Street and Mold Road Ruthin		
Length of section	1000 metres north and south bound serving 3 schools		
Average width of section	2.0 metres maximum width of footway		
Location	North and South bound footways serving three schools		
Description of facility / area	A494 footway serving 3 schools in close proximity		
Rank from Hazard Matrix	**4**		Hazard
	Weighting	Hazard	Rating
Hazard Factor 1 (select one only) *Pavement Material*			(Rank x weighting)
Untextured surface (e.g. paving flags)	X 1.50		
Textured Surface (eg bituminous)	X 1	4	4
Well textured surface	X 0.5		
Hazard Factor 2 (select one only) *Proximity to running lanes*			
Adjacent to carriageway	X 1.25	4	5
Narrow verge to carriageway	X 1		
Remote from carriageway	X 0.75		
Protected by physical barrier	X 0.75		
Hazard Factor 3 (select one only) *At risk access routes*			
To hospital	X 2		
Sheltered accommodation / facilities for those less active	X 2		
To Railway station	X 1.75		
To school	X 1.75	4	7
Shops / pedestrian area	X 1.5		
To crossing point	X 1.5		
To bus stop	X 1.5		
Promoted and signed route	X 1.5		
To industrial area	X 1.25		
Inter village route	X 1		
Exceptional Hazard Factor 4 (select one only if applicable) *Higher traffic speeds*			
70mph	X 1.25		
60mph	X 1		
50mph	X 1		
Exceptional Hazard Factor 5 (select one only if applicable) *Other hazard*			
steps	X 2.5		
Gradient >5%	X 2		
Gradient >3%	X 1.5	4	6
Poor horizontal alignment	X 1.5		
Exceptional Hazard Factor 6 (select one only if applicable) *Regional climate*			
Sheltered / shaded area	X 1.5		
Exposed area	X 1.5		
Average climatic conditions	X 1	4	4
Warm spot/area associated with town centres etc.	X 0.5		
TOTAL HAZARD RATING			**26**
Route Manager / Engineer Assessment			**26**

9 Full details of footway and cycleway treatments and procedures, including the prioritisation methodology, should be set out in the Service Providers Adverse Weather Plan / Winter Service Delivery Plan

2.2.22.9 Management and maintenance of Welsh Government Vehicles

2.2.22.9.1 Introduction

1 Welsh Government owns the operational and reserve salt spreading/snow plough vehicles and snow blowers for the provision of winter Service operations on the motorways. The Welsh Government is responsible for the annual allocation of the operational vehicles and specifies the particular motorway compound / Unitary Authority depot from which they are to be operated, and sections of motorway to be covered. Reserve vehicles are strategically placed in compounds along the motorway network for speedy deployment and when necessary redeployment into other areas.

2.2.22.9.2 Responsibility for vehicles

1 Responsibility for Welsh Government vehicles shall rest with the Service Provider from the time that they are delivered to their respective motorway maintenance compounds / depots until they are withdrawn for their annual summer servicing. During that period Service Providers shall have full responsibility for their day to day routine maintenance and repair. In the event of vehicle breakdown or malfunction the repair of which the Service Provider is unable to undertake, liaison with Welsh Government shall be undertaken to identify a suitable company or specialist that can undertake such work required. The vehicle' if not operational, shall be withdrawn from operational use and arrangements made for repairs to be undertaken by a private contractor or specialist and returned to operational use as soon as practical.

2.2.22.9.3 Operational vehicle use

1 The operational vehicles are those which are allocated for routine use on particular sections of motorway. Because that is an overriding priority they shall not be used on trunk or Unitary Authority roads. The Welsh Government is, however, prepared to consider specific requests for the relaxation of that requirement where it can be shown that precautionary salting of limited sections of trunk and/or principal roads can be advantageous. The short term redeployment of the Welsh Government reserve operational vehicles onto sections of trunk road either for operational use or stand-by must have prior approval from Welsh Government. Approval would not be unreasonably withheld, provided it could be shown that the proposal would not delay or otherwise adversely affect route treatment of the motorway.

2.2.22.9.4 Reserve Vehicles

1 The Welsh Government provides a number of vehicles as a reserve for use as emergency replacements when operational vehicles are out of service, or to assist on the motorway in times of severe weather conditions. In addition, some reserve vehicles are available to supplement the resources of highway authorities in times of exceptionally severe snowfalls; they comprise snow plough vehicles and rotary snow blowers. The snow plough vehicles are fitted with angled snow ploughs and are not suitable for use on narrow country roads. The rotary snow blowers have greater flexibility for dealing with heavy snowfalls. The high capacity snow blowers are intended primarily for use on motorways or trunk roads.

2 Reserve vehicles are provided at strategic locations in South Wales. Those vehicles that are located in compounds and depots along the motorway network are not specifically allocated for use within any specific county/area.

3 Additional snow blowers are located at other strategic points in Wales. They must not be removed from allocated tasks or transferred to other areas without the prior permission of the Welsh Government.

4 Reserve vehicles shall be rotated with operational vehicles in consultation with WG.

2.2.22.9.5 Issue of Reserve Vehicles

Prior authorisation shall be obtained by Service Providers before using a reserve vehicle for any purpose whatsoever that is not winter Service related. Such authorisation shall also be sought from the Welsh Government before deploying a Welsh Government vehicle onto a Trunk Road route that is not normally treated using such a vehicle or carrying out operations on the County Roads.

2.2.22.9.6 Vehicle Hire Rates

1 On the occasions where it is necessary to use any of the Welsh Government's vehicles on Local Highway Authority roads, Service Providers shall credit to Welsh Government a hire rate for such use. The hourly hire rate will be advised by Welsh Government.

2.2.22.9.7 Housing of vehicles and availability for inspection

1 The Welsh Government's vehicles (including snow plough blades and Snow Blowers) shall be housed under cover at the maintenance compounds/ Unitary Authority depots to which they have been allocated and be available for inspection by Welsh Government staff at all reasonable times without prior notice.

2.2.22.9.8 Heavy goods vehicle driver licence requirements

1 Drivers of Welsh Government salt spreading/snow plough vehicles shall hold Class 2 HGV licences in accordance with the "Heavy Goods Vehicles (Drivers Licences) Regulations 1969" (SI 1969/903), as amended. Drivers of Welsh Government rotary snow blowers are required to hold only the ordinary driving licence for motor cars. Service Providers shall arrange and undertake an inspection of the Driving Licence and Training Certificates held by all actual or proposed operatives / drivers of the Welsh Government equipment.

2 Where Driving Licences contain endorsements as a result of serious motoring offences or total more than 6 points, or no relevant Training Certificates are held, this shall be drawn to the attention of the Welsh Government for consideration and subsequent approval of the driver concerned. Where such instances arise, Service Providers shall provide comments regarding any factors or details that should be known together with their recommendations that should be taken into account and considered. Inspections shall be undertaken at a frequency not exceeding 12 months, and preferably inspected prior to the commencement of the winter Season.

2.2.22.9.9 Use of vehicles for HGV driver training

1 Where an Service Provider / Unitary Authority has no suitable Class 2 HGV vehicles of its own, it may apply to use one of the Welsh Government's vehicles for training purposes during the months of April to October provided that training is confined to prospective drivers of these' vehicles. Applications shall be made annually in writing to the Welsh Government indicating the registration number of the vehicle preferred. Vehicle insurance cover shall be provided by the Welsh Government on approval being granted (see **Section 2.2.22.9.11** below under Vehicle Insurance).

2.2.22.9.10 Operator training

1 Vehicles shall be operated only by trained staff and for that reason the Unitary Authorities should arrange instructional courses to train operators during each autumn. Difficulties in providing such training should be advised to the Welsh Government Service Providers.

2 Operators shall have undertaken and passed comprehensive training courses appropriate to the tasks that they are expected or are likely to be required to undertake.

3 Such training shall be to City and Guilds 6159 standard (including unit 14 that specifically relates to Welsh Government owned spreading vehicles if appropriate) or equivalent levels of training including Health and Safety.

4 Training should be available annually to take account of required driver training, revised or updated units and refresher courses for those already trained.

5 Due to the similarities of the controls and operation of the Snow blowing equipment to excavator equipment, consideration should be given to restricting or extending the operation of this equipment to staff that have JCB or similar experience and as necessary appropriate training provided.

2.2.22.9.11 Vehicle insurance

1 Welsh Government vehicles are deemed to be on Crown duty when operating on motorways and all-purpose trunk roads, when travelling to and from such roads for operational use, when making servicing / maintenance journeys, or when on stand-by at their authorised station. When on Crown duty the vehicles are exempt from the compulsory insurance requirements of section 143 of the Road Traffic Act 1988 in accordance with section 183(1) of that Act. The Crown accepts liability for third party claims or damage to the vehicles when they are on Crown duty.

2 Welsh Government vehicles are not considered to be on Crown duty when operating on county roads or when being used for HGV driver training or assessment unless such training or assessment has been agreed in advance or specialist training has been specifically provided by the Welsh Government.

3 Where approval has not been sought in advance and obtained, the Welsh Government will not meet any such claims arising from such uses and Service Providers / Unitary Authorities shall ensure that they have adequate insurance cover to meet any claims for which they may be liable.

4 For clarification and the avoidance of doubt, this exemption relates only to the statutory requirement for third party insurance and **in all other respects** Service Providers are responsible for vehicles in their care and control.

2.2.22.9.12 Reporting of vehicle accidents

1 Service Providers shall report all accidents involving Welsh Government vehicles to Welsh Government. A fatal or serious injury accident shall be reported immediately by telephone. A driver of a Welsh Government vehicle involved in an accident whilst engaged on Crown duty or non-Crown duty shall complete a Traffic Accident Report, a copy of which shall be kept in the cab of each vehicle. The form shall be completed so far as is reasonably practicable at the scene of the accident. The driver shall also make out a written statement of the circumstances of the accident and sign it. The completed form, together with the driver's signed statement and any signed statements which have been obtained from witnesses, shall be forwarded immediately after the accident to the Welsh Government. Service Providers shall ensure that drivers are familiar with these instructions. It is essential that all relevant information including an estimate of the cost of vehicle repair is provided as soon as possible.

2.2.22.9.13 Need for winter grade fuel

1 In order to minimise the risk of vehicle immobilisation due to diesel engine derv fuel waxing in low winter temperature conditions, it is essential for Welsh Government vehicles to be fuelled with winter grade derv. However, since even winter grade fuels wax at minus 9°C, it is also essential to avoid vehicles being left standing in the open for longer than is absolutely necessary.

2 On the rare occasions that Welsh Government vehicles are subjected to exceptionally low ambient temperatures, the mixing of kerosene with the fuel at the rate of 2 pints of kerosene per one gallon of derv will effectively lower the waxing points of the fuel to minus 15°C.

In no circumstances shall this ratio of kerosene to derv be exceeded since engine damage could result.

3 It should be noted that Welsh Government vehicles are fitted with fuel line and fuel filter heaters and when temperatures warrant their use they should be switched on.

2.2.22.9.14 Use of rebated fuel

1 Rebated fuel oil shall be used whenever possible in Welsh Government vehicles. Vehicle are entitled to exemption from excise duty under either S4(1)(i) or S7(3) of the Vehicles (Excise) Act 1971 the use of rebated oil as road fuel is permitted by HM Customs and Excise. It should be noted, however, that fully licensed goods vehicles employed on winter Service work must use un-rebated fuel at all times. Rebated fuel, when used, shall conform to Class Al of BS2869 (Specification for Petroleum Fuels for Oil Engines and Burners).

2 Service Providers using Motorway Compounds shall provide regular reports regarding the level of all fuel stocks held at the compounds and ensure that adequate levels of fuel are held throughout the winter season and identify ownership of the fuel.

The frequency of the reports shall be as

follows:

i. Initial stock levels - late August.

ii. Stock levels for winter season - late September.

iii. Running stock levels - every 2 weeks during October to February inclusive.

iv. End of season stock levels - end of March.

These reports should be provided in conjunction with salt stock levels. Refer to **Section 2.2.22.5.3**

2.2.22.9.15 Axle weighing equipment

1 The management of salt supplies, including specifically the monitoring of stock levels and initiating replenishment, is an essential element of effective winter service. Motorway Compound stock levels shall be monitored and regular reports provided to Welsh Government every 2 weeks during the winter season. Service Providers are to ensure that adequate stock levels exist for the winter season and there shall be sufficient reserves available for the most severe of winters.

2 To assist in the monitoring of salt deliveries and usage, vehicle weighing and recording equipment is installed at all operational/storage compounds which will automatically record information regarding vehicles and weights for those vehicles fitted with transponder tags.

3 Therefore, all vehicles that either deliver or use salt for winter service operations shall be weighed on each occasion that they enter and leave the compound and where necessary the vehicle registration number shall be entered. Vehicles based at these Motorway Compounds are linked to an automatic vehicle recognition system, other vehicles such as delivery vehicles will need to be recognised and recorded either by registration and / or company for stock control purposes.

4 Axle weighing equipment shall be serviced and calibrated for salt stock delivery/collections and monitoring winter service activities throughout the winter months.

5 Salt stock records shall be provided at the same frequency as fuel stocks. Refer to **Section 2.2.22.5.3.**

6 The brine production saturators provided at the operational motorway depots will require close monitoring particularly during periods of high demand and immediately prior to forecasted prolonged periods of cold weather, and replenished with salt by the Service Providers to ensure that they remain fully operational.

2.2.22.9.16 Spreading operations

1 Welsh Government's vehicles are fitted with two stage speed limiters, these being set at 56mph (90kph) for normal driving when the vehicle is not in operational use and a maximum speed of 35mph (56kph) when the vehicle is undertaking

salting operations.

2 Spreading operations should be undertaken at a speed not exceeding 30mph where reasonably practical and safe to do so.

2.2.22.9.17 Snow ploughing operations

1 The ploughs fitted to Welsh Government's vehicles are of a curved design, to assist in the rapid removal of snow of varying depth.

2 Depending on the speed of the vehicle and the angle setting of the plough, snow can be deposited at a considerable distance away in large quantities. The speed and setting of the plough shall therefore be appropriate for the prevailing conditions and adjusted accordingly, to ensure that ploughed snow is deposited in the intended location without causing damage.

3 When conditions are particularly severe close liaison shall be undertaken with the relevant Police Authority, and if necessary Police assistance requested and utilised for particularly difficult salting and ploughing operations.

2.2.22.9.18 Parking and Security of Vehicles

1 Salt spreading / snow plough vehicles have added security fitted in the form of a passive alarm system, i.e. automatically alarms the vehicle when not in use, the system consists of ultrasonic sensors and immobilisation of the vehicle.

2 When vehicles are returned to the compound after use, the auxiliary heater controller positioned behind the driver's seat shall be removed. This in effect will ensure that the heater is not operated on the timer or left running whilst the vehicle is parked, the cabs shall be locked and the keys plus controller shall be locked away securely.

2.2.22.9.19 Starting of vehicles

1 In the event of difficulties being experienced with regard to flat batteries **the vehicles shall not be jump or boost started by any means other than the vehicle to vehicle jump lead facility. This facility is provided for each vehicle, and is located on the near side behind the cab.**

2 Specific battery chargers have been provided at each operational motorway depot, the charging of the vehicles batteries can be undertaken by simply connecting the charger to the jump lead facility.

3All vehicles shall be routinely charged to ensure that the batteries fitted are fully charged regardless of whether the vehicle is first line or reserve.

Warning the use of any high powered charger or mains booster equipment may cause damage to the vehicle electronics.

2.2.22.9.20 Safety covering for spinner disc during training and maintenance runs

1 When vehicles are used on the highway for training or maintenance runs, the spinner disc at the rear of the vehicle shall be covered with sacking or similar material so that damage by sharp edges in the event of an accident is

reduced to a minimum.

2.2.22.9.21 Maintenance and Repair of Welsh Government Vehicles and Plant

1 Service Providers shall arrange for the carrying out of the day to day routine maintenance and repair of the vehicles allocated to them by the Welsh Government as instructed in the Service and Maintenance booklets.

2 Service Providers shall also arrange for the allocated vehicles to be annually fully serviced to manufacturer's specifications and standards during the summer months as advised by Welsh Government, together with all the preventative maintenance in the form of paint repairs and application of protective treatments.

3 Each spreading vehicle once serviced (cab/chassis, body and plough) shall be subject to VOSA inspection and a certificate of "Road Worthiness" obtained. Prior to operational use the spreader bodies shall be fully calibrated for the salt stock held at each respective depot and include calibration for pre-wetted salt method of treatment.

4 First line vehicles must be ready for operational use before the winter season commences and the reserve vehicles must be ready by 1st October at the latest.

5 For operational reasons it is preferable that no more than half the vehicles from each depot is serviced at any one time to ensure that operational cover is maintained in the event that vehicles are late returning to operational use.

6 Servicing of the JCB Loadalls and snow blowers to manufacturers standards and specification together with preventative maintenance can be undertaken at the depots or at alternative facilities, all work however must be completed in advance of the winter season.

7 A minimum of one complete set of booklets and other reference information has been issued for all types of vehicles, viz:-

i) Scania 6X6 / Schmidt spreader and snow plough.
ii) Schmidt Snow Blowers
iii) Rolba Snow Blowers.
iv) JCB Loadalls.
v) Land Rover Freelander – Operated by Welsh Government.
(Servicing to be arranged by Service Provider in future years as instructed).

8 These booklets shall be kept in the vehicles cabs and shall be kept up to date at all times. Vehicle Inspectors/mechanics are to be available for visits and provide advise on vehicle care and maintenance. Costs for this work shall be charged to the Motorway Winter Current Account.

9 Service Providers shall maintain a record of drivers and their times for each vehicle used. Drivers shall be instructed to provide details on the record sheets of any defects found prior to commencement or during / on completion of the vehicles operation.

10 All vehicles shall be subject to rotational use, in order to ensure that all vehicles are utilised and any operational defects identified during operational use and thereafter rectified at the earliest opportunity.

11 Any defects other than normal wear and tear/routine replacement items notified by the drivers or as a result of maintenance inspections shall be copied to Welsh Government.

12 Each vehicle shall be driven once every two weeks when not subject to operational use, for a minimum distance of 20km. Safety inspections shall be undertaken at a frequency not exceeding six weeks which may be combined with the routine two week maintenance runs.

13Spreading equipment fitted to the vehicles shall not be operated when the vehicle is being driven at normal speeds. Any testing of the equipment shall be confined and undertaken in the compounds. Where specific testing is required on Public Roads not being subject to precautionary salting, prior approval shall be obtained from the Welsh Government.

14 The operational life and condition of winter service vehicles and associated equipment can be extended when particular attention is given to cleaning and general maintenance including repair to damaged paint systems.

15 Such equipment shall, at the earliest suitable opportunity after operational use, have any deposited salt removed and be thoroughly washed down.

16 Attention is drawn to the corrosive and environmental damage that may be caused, as a consequence of concentrated solutions of brine being produced when washing vehicles down, and lack of adequate precautions and facilities to minimise such damage.

17 Service Providers should ensure whenever possible that the vehicle wash down area is either drained to the foul sewer (for which a discharge licence will be required) or to a separator/storage tank with sufficient capacity which is regularly emptied or recycled into brine tanks for winter service use.

18 Whilst undertaking cleaning and washing down operations, specific attention should be given to areas that may suffer or be vulnerable to damage or loss of lubrication thereafter requiring additional greasing or preventative maintenance to be undertaken.

19 Removal of any wax/oil treatment applied to the vehicles should be avoided when washing down, especially when using high pressure equipment. On completion of the cleaning operation it would be beneficial if an application of a combined wash and wax detergent was applied periodically using a dispenser fitted to the hose, the frequency of which would depend on the level of usage of the equipment.

20 The suitability and use of any combined wash and wax detergent must be considered with regard to existing drainage arrangements at the Depot, i.e. availability of an available foul sewer, effect on oil separators and watercourses together with any other environmental factors.

2.2.22.9.21 Salt loading equipment

1 Welsh Government is responsible for arranging the inspection of and any necessary repairs to the structure of the salt hopper loading equipment. Service Providers are responsible for the routine maintenance of the equipment as instructed in the Service and Maintenance booklet.

2 During April or at the end of winter use Service Providers shall empty and clear away all salt from the hopper loading equipment and adjacent area. The equipment shall be washed down thoroughly and lubricated and a detailed examination arranged. Any apparent structural defects found during that examination shall be reported to the Welsh Government.

3 Welsh Government delegates the summer servicing of salt loading hoppers to Service Providers. Service Providers have advised Welsh Government in writing whether and to what extent they are able and willing to undertake the work. Service Providers wishing to vary those arrangements shall apply in writing by 31 December in the preceding year to the Welsh Government. Welsh Government shall organise any work not undertaken by the Service Provider accordingly.

2.2.22.9.22 Other Plant

1 Service Providers shall also be responsible for arranging the maintenance and repair of all motorway compound plant and equipment such as the saturators and axle weighing equipment, except where special maintenance arrangements are specified as the responsibility of the Welsh Government.

2.2.22.10 Flood Patrols

1 The flood patrol service enhancement is intended to be in addition to the requirements outlined in WGTRMM Part 1 Safety Patrols, which identifies the need for additional safety patrols to be undertaken before (in the case of forecast conditions), during and immediately after periods of heavy/prolonged precipitation to identify areas which may be prone to flooding.

2.2.22.11 High Winds/Gales

2.2.22.11.1 Operational Considerations

1 Issues such as picking up debris, securing highway signage etc arising as a result of high winds will be dealt with through the Service Providers Emergency Response process.

2 Guidance and procedures for the implementation of road closures during high winds at the request of the Police are included in the Service Providers Network Contingency Plans. The procedure outlines the role of the Service Provider in implementing such a closure and the instructions given to the Service Provider in implementation of traffic management and diversion route signing.

2.22.12 Liaison and Communications

2.2.22.12.1 General

1 Road conditions in winter can change very quickly over relatively short distances. This stresses the importance of effective liaison and communications between Service Providers, Local Highway Authorities, Police, Media, Emergency Services, Public Transport Operators, freight transport and haulage and automobile associations.

2 Service Providers shall develop direct personal contact with such agencies and avoid extended chains of information.

In extreme conditions, the assistance and resources of the Welsh Government and Unitary Authority Emergency Planning / Resilience facilities maybe required for the central co-ordination and management of such instances, whereby additional resources are necessary or the deployment of special facilities and resources such as catering (food / drinks) is necessary.

3 Service Providers shall therefore undertake liaison with relevant Emergency Planning Units and Officers (Central Government via Welsh Government) to agree procedures and protocols to be adopted and implemented in the event that such instances arise.

4 These procedures and protocols are to be developed and agreed with all relevant parties and thereafter incorporated into the Emergency and Contingency Plans.

5 Police highway patrolling provides the opportunity for additional surveillance of road conditions. Service Providers are advised to discuss with their local Police Chiefs, ways of formulating guidance on the reporting of road conditions for police patrols. Close liaison between Service Providers and the Police and the resulting mutual understanding of respective problems will enable Service Providers to take full advantage of police observations and reports.

6 In view of the advantages to be gained by broadcasting information about snow, ice and frost on roads, Service Providers should make full use of existing opportunities available at both national and local level. In particular local radio offers the facility of communicating emergency information of a purely local nature to the community with speed and directness.

7 Liaison shall be undertaken with Welsh Government to further develop appropriate procedures and format for the provision of information to the Welsh Government Communications Division for subsequent release to the media during periods of extreme weather or resulting situations that may arise.

8 Service Providers shall liaise with their local Police and where convenient arrange for information to be passed to broadcasting authorities through Police channels. It is suggested that these arrangements could usefully be reviewed and consideration be given to the Police broadcasting liaison officer for the area being nominated as the source of such information together with the Traffic Management Centre and the Welsh Government Communications Division.

9 Local press, radio and TV reports or complaints about severe road conditions, blockages on motorway and trunk roads, and serious accidents shall be reported to the Welsh Government.

10 Welsh Government shall designate an Adverse Weather Duty Officer during periods of severe weather that shall be on call for the full 24 hour period. The principal function shall be to co-ordinate the organisation and deployment of the Transport Departments reserve vehicles during an emergency which cannot be dealt with using only the operational vehicles allocated to the Service Provider / Unitary Authorities concerned.

11 The Welsh Government provides specialist technical advice and assistance concerning Winter Service issues.

12 Co-ordination of activities with adjoining Service Providers and Unitary Authorities together with the dissemination of information should be collated through the weather forecast service provider's website Bulletin Board facility.

13 Where difficulties arise concerning access to a suitable Broadband Service, details can be verbally reported by phone to the Traffic Management Centre for inclusion on the system.

14 Service Providers should however, maintain adequate records of sufficient detail on the WG IRIS system for future auditing or reference purposes.

Annex A – Welsh Government Vehicles

Vehicle Movement Sheet

Service Provider**: ..... DEPOT: .....**
REGISTRATION NO: .....
DESCRIPTION:

.....

Date	Time out	Time return	Driver(Print name and Company if applicable)	Reason for Vehicle Movement	Vehicle released by (print name)	Approval given by whom in Welsh Government Transport, (what form? letter, fax, telephone)	Date Approval Given

Annex B MOTORWAY DEPOTS - LOCATION AND ACCESS

South Wales Trunk Road Agency Tel 01792 325900 (Updating required)

Wilcrick

Tel	Magor (01633) 880228, 88l083
Access	Interchange No.23 - Leave motorway and take B4245 - turn first left and again first left for depot entrance.
Servicing	Has full servicing facilities and workshop.

Malpas

Tel	Newport (01633) 852378, 852374
Access	Leave motorway at Interchange No.26 and take A4042 towards Cwmbran, Pontypool. Turn first right (Rogers Garage on corner) into Old Malpas Road. Depot entrance on left..
Servicing	Has minor servicing facilities only (wheel change, greasing, etc).

Coryton

Tel	Cardiff (02920) 617489, 615299, 621450
Access	Leave motorway at Interchange No.32. Depot is situated on Coryton roundabout western boundary.
Servicing	Has minor servicing facilities only (wheel change, greasing, minor rectifications only).

Pencoed

Tel	Bridgend (01656) 861174. 862427, 864068
Access	Leave motorway at Interchange No.35. Depot entrance at north-western boundary of roundabout. Located one mile from Bridgend CC main plant depot at Waterton Cross.
Servicing	Minor servicing facilities only available.

Margam

Tel	Port Talbot (01639) 881531, 890l78
Access	Leave motorway at Interchange No.38. Take A48 towards Bridgend and turn right. Depot entrance on left.

Servicing — Has minor servicing facilities only (wheel change, greasing, minor rectifications, etc). Major works assistance and staff available at Ynysforgan).

Ynysforgan

Tel — Swansea (01792) 781296, 799567

Access — Leave motorway at Interchange No.45. Depot entrance at foot of' westbound off-slip.

Servicing — Has full servicing facilities and workshop.

Pont Abraham — Unmanned - No vehicles

Access — Leave motorway at Interchange No.49. Depot entrance on left of A48 access adjacent to motorway service area.

Servicing — **This is a salt storage area only** but has garaging facilities.

GENERAL NOTES

All depots, apart from Pont Abraham and Margam, are suitably manned for day/night immediate winter service response from 1 November to 28 February annually. Beyond this period night staff may be employed at discretion of WG, should conditions warrant it.

Motorway Depot Salt Storage Capacities.

DEPOT LOCATION	CAPACITIES
Wilcrick Ω #	**3000** Tonnes - Single Barn.
Malpas Ω #	**2000** Tonnes - Single Barn.
Coryton Ω #	**3000** Tonnes - Single Barn.
Pencoed Ω #	**3000** Tonnes - Single Barn.
Margam	**3000** Tonnes - Single Barn – Operational Reserve Salt Stock.
Ynysforgan Ω #	**2700** Tonnes - Single Barn.
Pont Abraham #	**2700** Tonnes - Single Barn.

Note. Depots with pre-wetting facilities available indicated by Ω**.**

Axle weighing facilities available indicated by #.

STRATEGIC SALT STORAGE FACILITIES (To be Listed)

Annex C MONITORING - INFORMATION REQUIRED

C.1 Service Providers

1. During periods of adverse winter weather conditions general road situation reports, in the approved format, are to be provided and sent by e-mail, by no later than 10.00am on each day that the situation persists, should difficulties arise this information could be alternatively sent by fax (029 20 823792), by no later than 10.00am on each day that the email situation / difficulty persists.

   Situation Reports shall be provided by each Service Provider whenever a severe weather event occurs within Wales that may or may not be restricted to any particular Service Provider area.

   E-mail reports shall be copied to Welsh Government.

   Notwithstanding the above, Welsh Government may during periods where severe weather warnings have been issued, or adverse weather conditions are known to exist in neighbouring Agency / Local Highway Authority areas, request additional condition reports. (Refer to **Section 2.2.22.5.3**).

2. Fuel and salt stock reports for Motorway Compounds shall be provided at generally fortnightly intervals. (Refer to **Sections 2.2.22.9** & **2.2.22.5** regarding frequency).

3. Motorway Compound Health and Safety review reports shall be copied to the Welsh Government within one week of such inspection taking place and be notified of the intended date(s) of future inspections.

4. Confirmation is required that an inspection has been undertaken of the Driving Licences and Training Certificates held by the actual and proposed drivers / operatives of any Welsh Government vehicles / plant.

   Where and when necessary any matters identified in Section 2.2.22.9 should be drawn to the attention of WG.

5. On completion of precautionary salting actions and reactionary treatments and actions, Service Providers are required to report as soon as practical, details of these actions through the Reporting System and the Weather Forecast Service Providers website Bulletin Board.

   Where difficulties arise concerning access to a suitable Broadband Service, details can be verbally reported by phone to Traffic Wales for inclusion on the system.

   Service Providers should however, maintain adequate records of sufficient detail for future auditing or reference purposes.

C2 Police Authorities

1. General situation report on traffic movements on (a) Trunk Roads (b) County Roads by no later than 10.30am daily until the end of the emergency conditions.

2. Situation report on access to key locations, hospitals etc.

3. Situation report on abandoned vehicles.

4. Situation report on vehicle stacking arrangements. (Above 2-3 where critical conditions are imminent)

C3 CONDITION REPORT CHECK LISTS

Condition Report Check Lists for Service Providers listed below are produced on the following pages.

Day:	**Date:**	**Time:**
	Prepared by:	
Weather conditions:		
Precautionary treatment and resource preparations:	.	
Reactive treatment and actions undertaken		
Utilisation of Route Stewards, Traffic Officers and Other Resources:		
Salt usage on Trunk Roads and time of assessment:		
Salt usage on Motorways and time of assessment:		
Welsh Government salt stock remaining:		
Weather outlook:		

Special measures in place, advice to travellers, information to travellers (TW website, Inrix etc):	
Intended Treatments / Instructions to Service Providers where known:	
Media Interest or Issues arising:	

Motorway Conditions and Trunk Road Conditions: ** Region**		
Route/Section	Clear	Alternative Advice & Comment

All Wales Summary Report

Time/Date:

Weather experienced across Wales since previous evening:	
Weather expected/forecasted for next 10 hours (up to midday…….):	
Status of roads and transport networks (closed, partially open, passable with care, any suspended services):	
Accidents/incidents occurred/on-going:	

Special measures in place, advice to travellers:	
Risks /issues identified:	

Appendix A Adverse Weather Plan Template