Training Workbook

2018

www.smartaboutsalt.com

Module 1: Smart About Salt Council (SASC) Overview

About the Smart About Salt Council (SASC)

The Smart About Salt Council is a registered not-for-profit corporation operated largely by volunteers, established by industry and local government to encourage the adoption of leading winter maintenance practices to reduce the use of road salt while maintaining safety. Our thousands of Members and other stakeholders include the general public, winter maintenance professionals, government and government agencies and professional associations and organizations from across North America. The Smart About Salt Council provides training to improve winter salting practices at facilities and recognizes industry leaders through certification including a program that certifies winter maintenance contractors.

Mission: To protect freshwater from winter salt applied on facilities

Vision: All facilities professionally designed and managed to improve winter safety and reduce salt use

Smart About Salt Council (SASC) Program Objectives

1. To maintain safe conditions
2. To reduce salt use by:
    a. Reducing icing conditions
    b. Promoting best management practices
3. To reduce liability through:
    a. Improved salt management
    b. Better record keeping

Making a Difference with Stakeholders

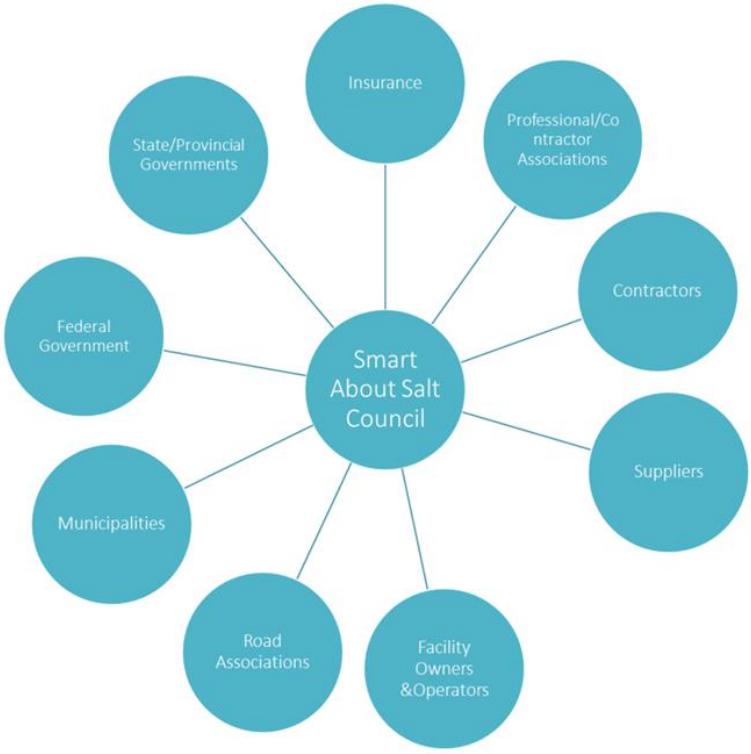


Figure 1: Illustration of the many collaborative partnerships the Smart About Salt Council enjoys.

Impacts of over-salting

What are some of the ways salt is causing problems?

Module 2: Salt and the Environment

Salt Harms the Environment

- Soils
- Vegetation
- Wildlife
- Streams and aquatic life
- Groundwater (drinking water)

Over-Applications of Salt

Share two examples of places you've seen more salt than was needed.

Why do you think too much salt was applied? What would you have done differently?

More with Less

What can be done to maintain safe properties with less salt?

Module 3: Weather

Weather Conditions to Monitor

- Air Temperature
- Cloud Cover
  - The amount of cloud cover affects many things including air and pavement temperatures and the amount of precipitation
- Precipitation
  - The timing, path and intensity of precipitation can be monitored using radar.
- Dewpoint Temperature
  - Potential source of moisture (and ice) even on clear days
- Barometric Pressure
  - Changes in barometric pressure signal when fronts and high and low-pressure systems move in and out.
  - A rise in pressure generally signals improving weather
  - A drop-in pressure generally signals poor weather coming
- Winds (speed and direction)
  - Just like barometric pressure, a change in wind direction can indicate when a storm is coming or ending
  - Winds (above 15 km/hr or 9 m/hr) can also produce drifting, a real problem even between storm events
- Visibility
  - Poor visibility is not only hazardous for drivers but for snow plow operators as well
  - Poor visibility can indicate that a storm is approaching or intensifying or that the winds have picked up and drifting has become an issue
- Pavement Temperature
  - Salt is less effective at colder temperatures
  - Ice also tends to form first on bridges and in low-lying areas

The Weather Network Precipitation Forecast for Brampton

Issued at Mon, Dec 05, 2011 15:00 EST

NO ENVIRONMENT CANADA WARNINGS IN EFFECT FOR MISSISSAUGA - BRAMPTON AT TIME OF ISSUE

MONDAY Cloudy with showers in the morning, light rain developing in the afternoon, probability of precipitation 80%. Winds westerly 10km/h shifting to northerly 20km/h. Cloudy with light rain in the evening, mixed precipitation overnight, probability of precipitation 80%. Winds northerly 20km/h.
TUESDAY Cloudy with a few breaks in the afternoon. Winds northerly 25km/h becoming 15km/h. Cloudy with a few flurries during the night, probability of precipitation 40%. Winds light.

Click for Expanded forecast

Day	Mon, Dec 05 2011								Tues, Dec 06 2011																Wed, Dec 07 2011														
Period	Afternoon			Evening					Overnight						Morning					Afternoon					Evening					Overnight						Morning					Afternoon		
Local Time [24hr]	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Rain	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X																																	
Snow								X	X	X	X	X	X	X	X																																	
Flurries																												X	X	X	X	X	X	X	X	X	X											
Sky Condition	CLOUDY			CLOUDY						MAINLY CLOUDY															CLOUDY											CLOUDY PERIODS										
Sunshine (% period)	0			0						10															0											50										
Local Time [24hr]	15 - 18			18 - 21			21 - 0			0 - 3			3 - 6			6 - 9			9 - 12			12 - 15			15 - 18			18 - 21			21 - 0			0 - 3			3 - 6			6 - 9			9 - 12			12 - 15		
Rainfall (mm)	2.0			2.5			1.9			0.9			0.2			0.0			0.0			0.0			0.0			0.0			0.0			0.0			0.0			0.0			0.0			0.0		
Snowfall (cm)	0.0			0.0			0.6			0.9			0.2			0.0			0.0			0.0			0.0			0.2			0.3			0.3			0.1			0.0			0.0			0.0		
POP (%)	80			80			80			80			70			30			30			30			30			40			40			40			40			30			10			10		
Air Temperature (°C)	4			3			1			0			1			0			1			2			2			0			1			0			-1			-2			0			2		
Dew Point (°C)	4			2			1			0			-1			-2			-3			-2			-2			-2			-3			-3			-3			-5			-5			-5		
Relative Humidity (%)	100			93			100			100			86			86			75			75			75			86			75			80			86			80			69			60		
Wind Direction (8-pt)	N			N			N			NE			N			N			N			N			N			N			NW			W			W			W			W			W		
Wind Speed (km/h)	15			16			20			18			20			23			20			15			9			9			7			7			11			16			20			23		
Wind Gusts (km/h)							30						32			35			32																							32			35		
Wind Chill (*)	1			-1			-4			-5			-4			-6			-4			-2			-1			-3			-1			-2			-5			-6			-5			-3		

WEDNESDAY Mainly sunny with cloudy periods during the day. Winds westerly 20km/h becoming 25km/h. Variably cloudy during the night. Winds westerly 25km/h becoming 30km/h. High 2, Low -3.
THURSDAY Variably cloudy during the day. Winds westerly 25km/h. Cloudy with a few flurries during the night, probability of precipitation 60%. Winds southwesterly 25km/h. High 2, evening Low of -2 warming to -1 overnight.
FRIDAY Cloudy with a few flurries ending in the morning, variably cloudy in the afternoon, probability of precipitation 60%. Winds westerly 25km/h. Variably cloudy in the evening, becoming mainly clear with cloudy periods overnight. Winds westerly 20km/h. High 1, Low -3.
SATURDAY Mainly sunny with cloudy periods in the morning, becoming variably cloudy in the afternoon. Winds westerly 25km/h. Variably cloudy during the night. Winds westerly 25km/h becoming southwesterly 30km/h. High 0, Low -3.
SUNDAY Variably cloudy in the morning, becoming mainly sunny in the afternoon. Winds southwesterly 30km/h becoming 25km/h. Clear during the night. Winds southwesterly 20km/h. High 2, Low -1.

Forecast provided by The Weather Network Commercial Services © 2011

Figure 2: Example of a Value-Added Forecast (Source: The Weather Network, 2011)

NO ENVIRONMENT CANADA WARNINGS IN EFFECT FOR KITCHENER - CAMBRIDGE - REGION OF WATERLOO AT TIME OF ISSUE

THURSDAY Mixed precipitation in the morning, light rain in the afternoon, probability of precipitation 90%. Winds increasing to easterly 40km/h. Rain in the evening, tapering to light rain overnight, probability of precipitation 90%. Winds easterly 35km/h shifting to southerly 30km/h.
FRIDAY Mixed precipitation during the day, probability of precipitation 70%. Winds northerly 20km/h shifting to northwesterly 35km/h. Mixed precipitation in the evening, a few flurries overnight, probability of precipitation 70%. Winds northwesterly 45km/h.

Click for Expanded forecast

Day	Thurs, Dec 20 2012																								Fri, Dec 21 2012																	
Period	Overnight						Morning						Afternoon						Evening						Overnight						Morning						Afternoon						Evening					
Local Time [24hr]	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Rain																	X	X	X	X	X	X	X	X	X	X			X						X	X	X	X	X	X	X	X	X					
Showers								X	X							X											X	X																				
Snow																													X			X	X			X	X	X	X	X	X	X	X					
Flurries																															X			X	X													
Freezing Rain								X																																									
Sky Condition	VARIABLY CLOUDY						CLOUDY												CLOUDY						CLOUDY						CLOUDY												CLOUDY					
Sunshine (% period)	0						0												0						0						0												0					
Local Time [24hr]	0 - 3		3 - 6				6 - 9		9 - 12				12 - 15			15 - 18			18 - 21			21 - 0			0 - 3		3 - 6				6 - 9		9 - 12				12 - 15			15 - 18			18 - 21			21 - 0		
Rainfall (mm)	0.0		0.0				0.2		0.1				0.0			3.1			6.5			4.2			1.6		0.3				0.1		0.0				0.3			0.4			0.1			0.0		
Snowfall (cm)	0.0		0.0				0.0		0.0				0.0			0.0			0.0			0.0			0.0		0.0				0.2		0.2				0.2			0.3			0.1			0.0		
POP (%)	20		20				40		40				30			90			90			90			90		80				60		60				70			70			70			30		
Air Temperature (°C)	-2		-1				0		1				2			3			2			2			4		2				1		1				2			2			1			0		
Dew Point (°C)	-3		-3				-2		-2				-1			0			1			2			3		1				-1		-2				0			0			-1			-3		
Relative Humidity (%)	93		86				86		80				80			81			93			100			93		93				86		80				87			87			86			80		
Wind Direction (8-pt)	E		E				E		E				E			E			SE			SE			SE		SW				S		SE				N			NW			NW			NW		
Wind Speed (km/h)	10		17				24		30				39			38			34			31			29		26				20		14				15			29			42			43		
Wind Gusts (km/h)			30				39		50				59			57			53			47			44		39				33									50			63			65		
Wind Chill (*)	-5		-6				-6		-5				-5			-3			-4			-4			-1		-3				-4		-3				-2			-4			-6			-8		

SATURDAY Mainly cloudy with a few flurries ending in the morning, variably cloudy in the afternoon, probability of precipitation 60%. Winds northwesterly 45km/h becoming 40km/h. Variably cloudy during the night. Winds northwesterly 35km/h becoming 25km/h. High -2, Low -4.
SUNDAY Variably cloudy during the day. Winds northwesterly 25km/h. Variably cloudy during the night. Winds light. High -1, Low -6.
MONDAY Variably cloudy during the day. Winds easterly 15km/h becoming 25km/h. Variably cloudy during the night. Winds easterly 25km/h. High -2, Low -7.
TUESDAY Variably cloudy in the morning, becoming mainly sunny with cloudy periods in the afternoon. Winds easterly 25km/h becoming 20km/h. Mainly clear with cloudy periods during the night. Winds light. High -3, Low -5.
WEDNESDAY Mainly sunny with cloudy periods in the morning, becoming cloudy with sunny breaks in the afternoon. Winds easterly 25km/h becoming 35km/h. Mainly cloudy with a few flurries in the evening, tapering to a chance of flurries overnight, probability of precipitation 90%. Winds northeasterly 35km/h. High -1, Low -5.

Figure 3: Example of an government issued weather forecast (Source: Environment Canada, 2011)

Forecast Exercise

What kind of weather are you expecting?

What's your level of confidence in the forecast?

How does this impact your operation?

Module 4: Principles of Ice Formation

Dew Point

The temperature when water vapor in the air will condense to a liquid. When the dew point is:

- Above 0C (32F) it can result in: _____
- Below 0C (32F) it can result in: _____

Black Ice

Forms when water droplets fall onto frozen pavement and can flow together before it freezes.

Conditions necessary for black ice include:

Pavement temperature is: _____ C _____ or _____ F _____ than the dew point

Dew point and/or air temperature _____ or _____ C or F

Pavement Temperature versus Air Temperature

Pavement temperatures are often _____ than the air temperature

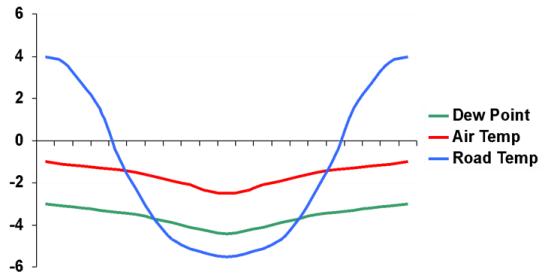
Sources of Ice

_____

_____

_____

What pavement conditions should you expect? (Please assume pavement is dry)

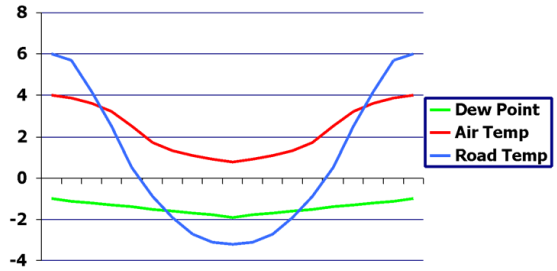


At A: _____

At B: _____

At C: _____

At D: _____

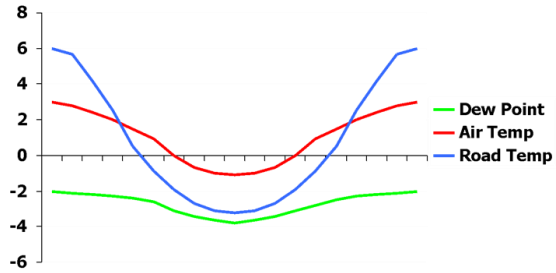


At A: _____

At B: _____

At C: _____

At D: _____



At A: _____

At B: _____

At C: _____

At D: _____

Module 5: Salt Science

Why Salt (NaCL) is Used?

"Salt" may refer to all of the chlorides: sodium chloride (NaCL), calcium chloride ($CaCl_2$), potassium chloride (KCl) or magnesium chloride (Mg_2Cl)

Salts are used to prevent or break the bond between snow and the pavement so that snow can be removed mechanically

Most widely used is sodium chloride because it's:

- Less expensive versus other products
- Readily available
- Works well at average local winter temperatures

The purpose of salt is to form brine between the surface and snow/ice to make plowing easier

Figure 4: Different forms of commercially available salt.

Freeze Point Depressant

A substance that when added to water reduces its freezing point. Examples include anti-freeze, windshield washer fluid and salt

Chemistry Terms

Effective temperature: The lowest temperature in which the cost off the application is justified by the results obtained

Eutectic temperature: The temperature at which a liquid freezes in a concentrated solution in laboratory conditions

Viscosity: The quality or property of a fluid that causes it to resist flow

Exothermic: A chemical reaction that gives off heat. MG_2Cl gives off heat, which makes it less reliant on-air temperature and therefore can work at lower temperature ranges

Endothermic: A chemical reaction that absorbs heat. NACl absorbs heat bun in doing so reduces its effective operating temperature

Understanding Phase Diagrams

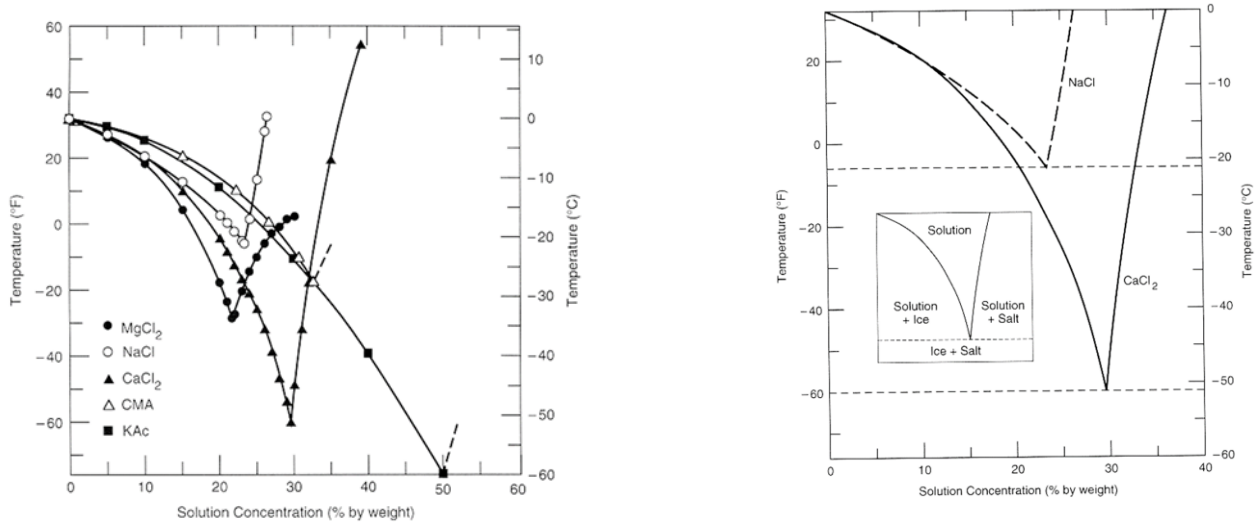


Figure 5: Phase diagram comparing different salts

Module 6: Site Assessment

Assessing the Site

- Work as a team: Facility management + contractors/vendors
- Identify service area(s) + locations that will be closed
- Calculate area to be serviced
- Identify/fix drainage issues
- Identify/fix drifting problems
- Identify/fix snow storage areas
- Prepare/approve a site plan

Creating a Site Plan

- A site plan should include:
- Areas to be serviced
- Salt/environmentally sensitive areas
- Emergency exits
- Walkways, doorways
- Snow storage location(s)
- Hazard areas (man-made vs. natural ice)

Estimating Material Needed Per Site Visit

Material Needed = Application Rate x Surface Area
Kg or lbs) = (Kg/m^3 or lbs/yrd^3) x (m^2 or yd^2)

Calculating Site Area

Formulas to calculate area

- Square or rectangle: length x width
- Triangle: base x height/2
- Circle: radius x radius x Π (pi or 3.14)

Identifying Potential Hazards

Watch the Water. Stop the Source.

Rainy day activity. Look at the habits of water on a rainy day to identify possible ice issues and document:

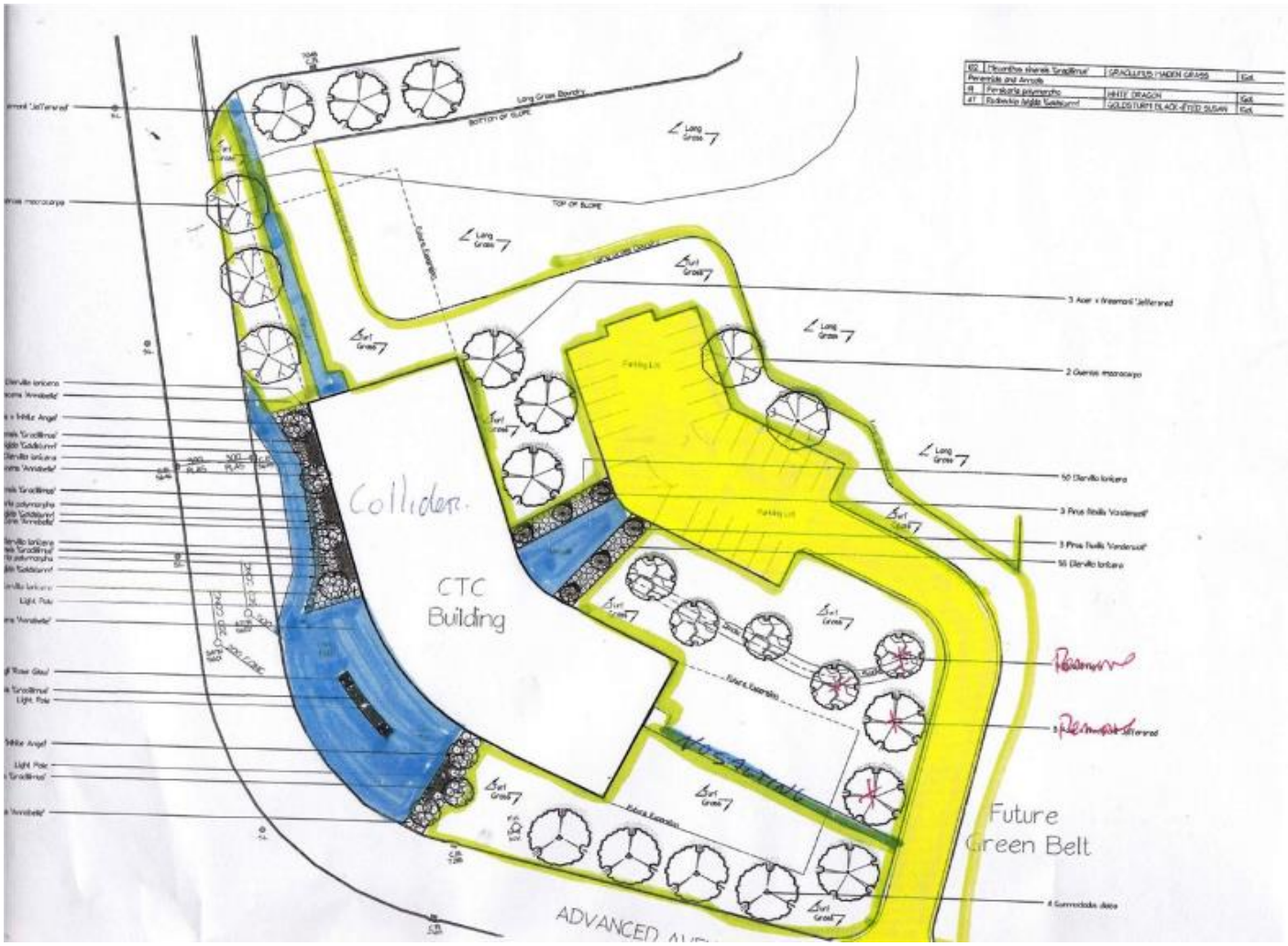


Figure 6: Sample site map.

SITE INFORMATION SHEET

OWNER _____
SITE NAME _____
LOCATION **Street** _____
City _____ **Postal Code** _____
SITE CONTACT **Name** _____ **Phone** _____

AREA NO:	LOCATION		AMOUNT OF MATERIAL		
	TYPE	AREA	LOW	MEDIUM	HIGH
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Location Types = S=Sidewalk, R=Road, L=Lot St=Steps

SPECIAL AREAS

AREA NO:	LOCATION		COMMENTS
	TYPE	AREA	
A			
B			
C			
D			
E			
F			
G			
H			

CALL OUT ARRANGEMENT

Figure 7: Sample site information sheet.

Module 7: Mechanical Snow Removal

Role of Mechanical Removal

Your First Line of Defense!

Shovel or Plow First!

Considerations for Mechanical Removal

- Benefits
  - Most cost-effective
  - Least environmental impact
  - Reduces salt
  - Maintains high level of service
- Decisions
  - Choose the right equipment for the job
  - Store snow away from drains and downhill to prevent melt-water
- Protect yourself. Shovel safely
  - Lift with your knees, not with your back
  - Use the right shovel. Find a shovel that fits you
  - Before you begin to shovel warm-up/stretch
  - Pace yourself
  - Stay hydrated
  - Avoid twisting
  - Listen to your body

What are some different types of plow blades?

What are the pros and cons?

Module 8: Liquids

Comparing How Liquids Are Used

Material	Advantages	Disadvantages
Pre-mixing (liquid added to the salt or sand stockpile)	• Makes it or buy it • Homogenized mix of salt • Liquid coats all salt • No special equipment needed • Works at lower temperatures • Works faster • Leaves more residual	• More expensive • Hard to make smaller batches • Not readily available • Potential to leach • Challenge to store
Pre-wetting (liquid added to the salt or sand at the spinner)	• Works at lower temperatures • Works faster • Leaves more residual	• Doesn't coat all the salt • Special equipment is needed • More expensive • Require liquid storage
Anti-icing (liquid applied directly to bare surface)	• Proactive • Applied before a storm • Prevents ice from bonding • Makes plowing easier • Less chloride being applied • Works at lower temperatures (premium liquids) • Doesn't get plowed off	• Need special equipment • Need to know surface temperatures • Additional training required • Requires liquid storage with secondary containment • Not readily available (premium liquids)
De-icing (liquid applied to snow or ice)	DISCOURAGED. SHOULD BE AVOIDED.	

Different Liquid Materials

- Salt Brine (Sodium Chloride) (23.3%)
- Magnesium Chloride (various concentrations)
- Calcium Chloride (36.0%)
- Agricultural blends mixed with above liquids
- Sugar beets (exclusively mixed with salt brine)
- Corn (mixed with Magnesium Chloride)

Caution! May Refreeze! What your Concentration

Working and Eutectic Temperature of Liquids

Material	Working Temperature (C/F)	Eutectic Temperature (C/F)
Sodium Chloride(NaCl)	-7/19	-21/6
Magnesium Chloride (Mg_2Cl)	-15/5	-33/-27
Calcium Chloride (CaCl)	-29/-20	-46/-51
Potassium Acetate ($C_2H_3KO_2$)	-30/-22	-60/-76
Calcium Magnesium Acetate ($C_{12}H_{18}CaMg_2O_{12}$)	-7/19	-28/-18

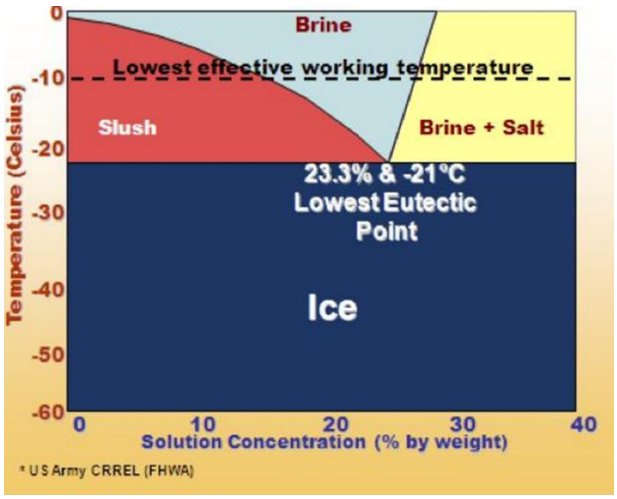


Figure 8: Phase diagram for liquids (Source: US Army, 2011)

- The concentration of the brine in relation to the pavement temperature should remain in the light blue area to be effective
- The most effective brine concentration is at the bottom point of the light blue area (23.3%) called the lowest eutectic point
- Higher concentrations consisting of low concentration brine and solid salt moves into the yellow area (dangerous). The salt precipitates out and the low concentration brine freezes
- Lower concentrations result in a slush as the brine freezes (moves into the red area) (extremely dangerous)
- The lowest effective working temperature for brine is about -10C (14F) (pavement temperature)
    - Below -10C (14F) the brine dilutes quickly and freezes
    - Below -10C (14F) consider using sand or a chemical with a lower working temperature

Anti-icing/Direct Liquid Application (DLA)

When to use DLA:

First in a series of strategies

Prior to forecasted event

During times when traffic and parking lot use is low

When pavement temperatures are at or above -6C (21F) for Sodium Chloride brine) can be colder for enhanced brines

Prior to frost, light sleet and light or moderate snow events (<2.5 cm/ hr or 1 in/hr))

When not to sue DLA:

Prior to forecasted rain or freezing rain event

When snow is blowing and drifting

When pavement temperatures are colder than -6C (21F) (Sodium Chloride brine)

When pavement temperature is predicted to drop sharply

Making Your Own Liquid

Materials and equipment:

• Salt • Water • Open top mixing tank	• Storage/holding tank • Pump • Salimeter	

Procedure:

Step 1: Create the brine

Fill tank with salt at 0.45 kg (1lb) per 1.5 L (0.3 gal) of water (equivalent to 250lbs of salt/100 gallon tank of water or 333lbs per 500L tank of water)

Add salt then water slowly from the bottom outlet of your storage tank. This will allow the water to filter or pass through he salt and move into the storage tank. You can also add a pump that continuously circulates the water or an agitator as well to help speed up the process

Step 2: Check the concentration

Once the brine has flowed into the storage tank, check for concentration. You can manually check the concentration with a salimeter or have a floating hydrometer or salimeter in your holding tank. Your salt to water concentration should be 23.3%

Figure 7: Illustrations of common salimeters.

Step 3: Complete your documentation

Create a document that tracks and records your brine making operations, including:

- Date the batch as to when created
- Time
- Concentration level
- Who checked each level

Keep these records for a minimum of four (4) years in case of litigation

Figure 9: Illustration of brine mixing and storage tanks.

Module 9: 5Rs of Salt Management

Right Material

- Do you require an abrasive material (e.g. sand) for traction?
- Do you need to melt ice with a chemical?
- Is there a correct chemical for the job?
- What form and size of the chemical is right for the conditions?

Right Time

Reactive **Break** the ice/pavement bond
Proactive **Prevent** the ice/pavement bond

Right Amount

- Factors affecting where to place material:
  - Pavement temperature(s)
  - Snow accumulation (don't apply salt to melt snow; plow and shovel first!)
  - Desired level of service
  - Time required to level of service
  - Material being used
- See chart of amount of salt required to melt ice

Right Place

- Under the snow…not on it!
- Factors affecting where to place material:
  - Precipitation type
  - Surface type
  - Pedestrian/traffic flow
  - Facility type and location
- Placement techniques:
  - Spot-treating: Apply to icy areas
  - Broadcasting: Spread over the entire surface
  - Windrowing: Spread on high spots, brine flows to low spots

Retain It To Work

Salt needs time to work
Do not plow/shovel too soon
Pre-wet to activate the salt so it will work faster

Material	Advantages	Disadvantages
Sodium Chloride(NaCl)		
Magnesium Chloride (Mg_2Cl)		
Calcium Chloride (CaCl)		
Agricultural blends		
Sand		

Module 10: Application Rates

Using Multiple Application Rates

List the reasons why it's good to have multiple application rate, e.g. low, medium and high:

Putting It Into Practice

Review the scenarios and determine how to respond.

Scenario 1: Parking lot is open twelve (12) hours per day. Forecasted temperature is -20C (-4F). Snow accumulation is 10cm (4in). Pavement temperature is -25C (-13F)

Scenario 2: Parking lot is open twenty-four (24) hours per day. Forecasted temperature is -4C (25F). Snow accumulation is 2.5cm (1in). Pavement temperature is -2C (28F)

Scenario 3: Parking lot is open twenty-four (24) hours per day. Forecasted temperature is -1C (30F). No snow accumulation but freezing rain is in the forecast

Module11: Calibration

Calibration: The process of testing and adjusting spreaders to determine specific settings to assist with achieving desired product application rates

What to Calibrate

List the types of equipment that should be calibrated:

Simple Calibration Process

1. Measure out an area and mark it off
2. Apply material at a constant speed
3. Record speed and spreader settings
4. Determine salt spread width
5. Sweep up and weight the product (salt)
6. Repeat at different speeds

You Can't Manage What You Don't Measure

Application Rate Formula for Calibration

Solid material: weight/test area=application rate

Liquid material: volume/test area = application rate

When to Calibrate

Beginning of the Season: The calibration of all equipment should be checked and verified at least annually, usually in the fall before the winter season starts

During the Season: Calibration should be part of the regular maintenance routine for equipment

After Service: Whenever the equipment requires service you will need to recalibrate

Calibration Records

Use this space to create a chart that will capture the information you need:

Module 12: Materials Storage and Handling

Salt Handling Procedures

- Monitor deliveries and get the salt undercover quickly
- Carefully load spreaders
- Clean-up spills immediately
- Manage wash water
- Don't overload loaders or spreaders
- Spread only what is needed
- Return extra storage

Salt Storage – Solid Material

- Impermeable floor
- Roof or cover to keep salt dry
- Located away from drainage
- Properly sized and oriented to protect stored salt from elements (wind, rain, snow)
- Easy access for equipment

Salt Storage – Liquid Material

- Use secondary containment
- Double-walled tanks
- External containment
- Minimum 100% capacity
- Bollards around tank
- Labelled contents
- Tamper proof
- Locks on nozzles
- Locate away from wells, catch basins and surface water

Good Housekeeping Practices

- Keep salt dry
- Clean up spills
- Conduct regular storage inspections
- Repair any damage
- Use the oldest bags of salt first (to keep them from getting hard)

Module 13: Risk Management and Record-Keeping

Know Your Legal Risks

- Public safety: Slips, trips and falls
- Operator/employee safety
- Damage to property
- Damage to equipment
- Traffic accidents
- Negligence

Manage Your Risk

- Know your role
- Know the expectations
- Know the equipment
- Know the material(s)

Keeping Good Records

List the reasons why you should keep good records:

_____

_____

_____

_____

Keep Concise and Accurate Records

Daily Winter Log Sheet

Shift	Start Time:	End Time:														
Date											Company Name					
Truck											Staff Member	Name:				Initials
Location		Time In	Time Out	Material Used		Services Performed					Pavement Condition	Weather Observations		Comments		
No.	Address			Type	Amount	Lot	Road	City Walk	Internal Walks	Unit Drive/ Steps		Type	Amount	(Note any unsafe property and site conditions, and unusual circumstances.)		

CODES				
Materials	S=Salt	G=Grit/Sand	M=Melter	L=Liquid
Services	P=Plow	Sh=Shovel	N=None	
Pavement Condition	C=Clear	SC=Snow Covered (Depth)	I=Icy	
Weather	CL=Clear	R=Rain	FR=Freezing Rain	
	SN=Snow	(L/M/H)	DR=Drifting	

COMMENTS ON ANYTHING UNUSUAL THAT HAPPENED DURING THE SHIFT

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Figure 10: Sample Daily Winter Log Sheet

Module 14: Putting It All Together

Steps to Good Winter Operations

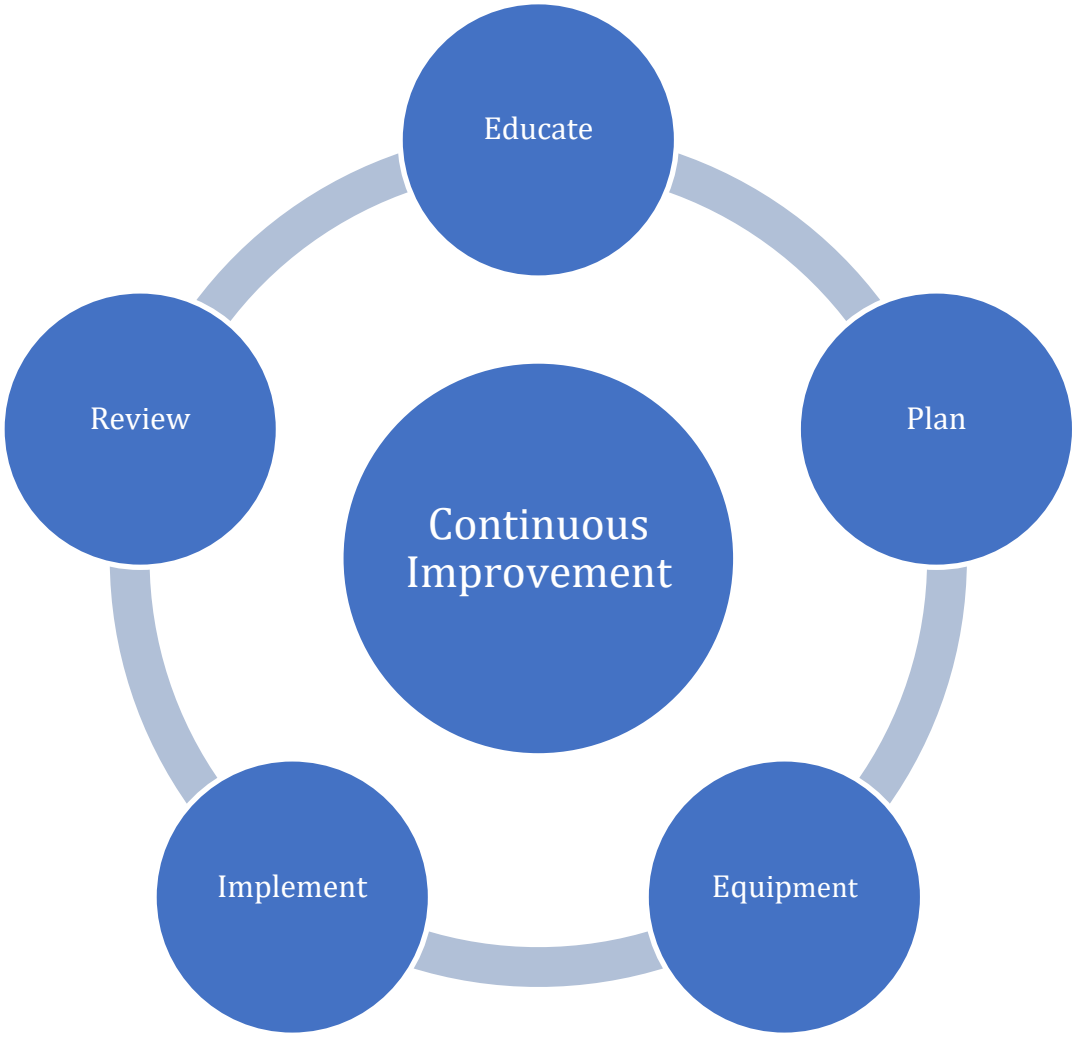

Figure 11: Model of superior winter maintenance operations.

What are three (3) things you will do in the next year to ensure continuous improvement in your winter maintenance practices?