

MHCEA Fall Conference | October 10, 2024

Improving Winter Safety

Through Infrastructure Design & Winter
Maintenance Strategies

Presenters: Carolyn Dindorf & Connie Fortin, Bolton & Menk, Inc.

Salt Moves with Water

We use a lot of salt



Chloride: Permanent Pollutant

Toxic to aquatic life: 230 mg/L (U.S.EPA)
@ 250 mg/L affects taste in drinking water

Damages

- Infrastructure
- Soils
- Water
- Vegetation
- Wildlife
- Lake turnover



1 teaspoon of salt pollutes
5 gallons of water



Goal: Safety & Sustainability

Use the least amount of salt necessary to protect buildings, grounds and water while keeping pavement surfaces safe.



Salt Damage

Salt causes damages inside and outside your buildings



Each ton of salt creates \$1,700* - \$17,000* infrastructure damage

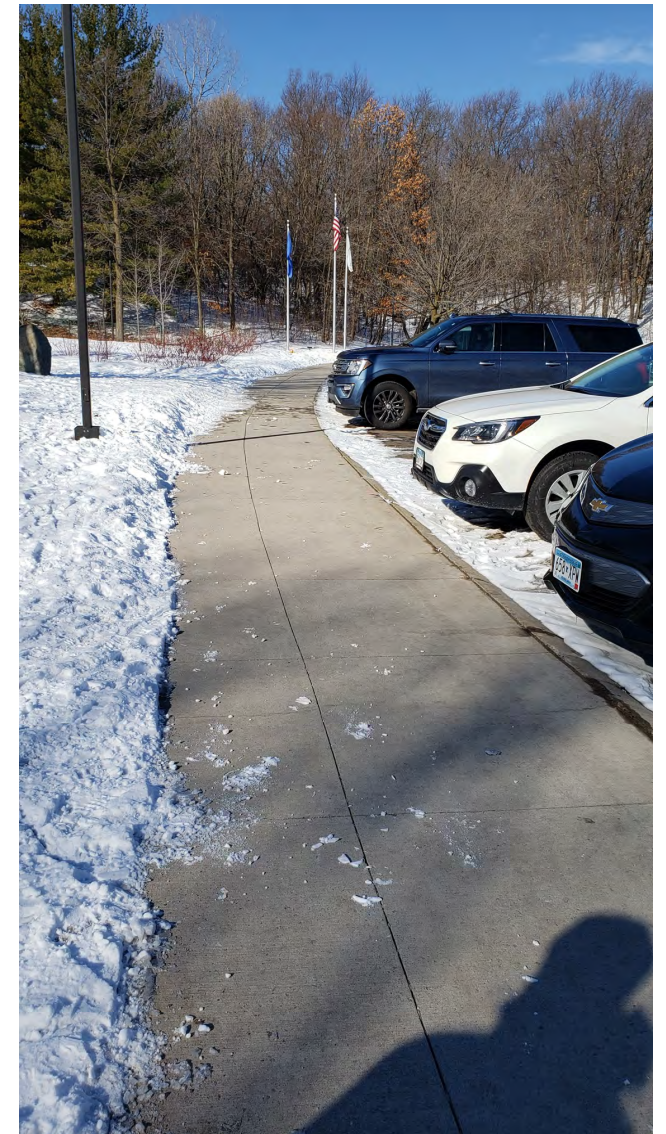
**Estimated values adjusted for inflation in 2023*

Winter Maintenance Policy

Create, implement, and
communicate winter
maintenance plan



What is your target LOS?



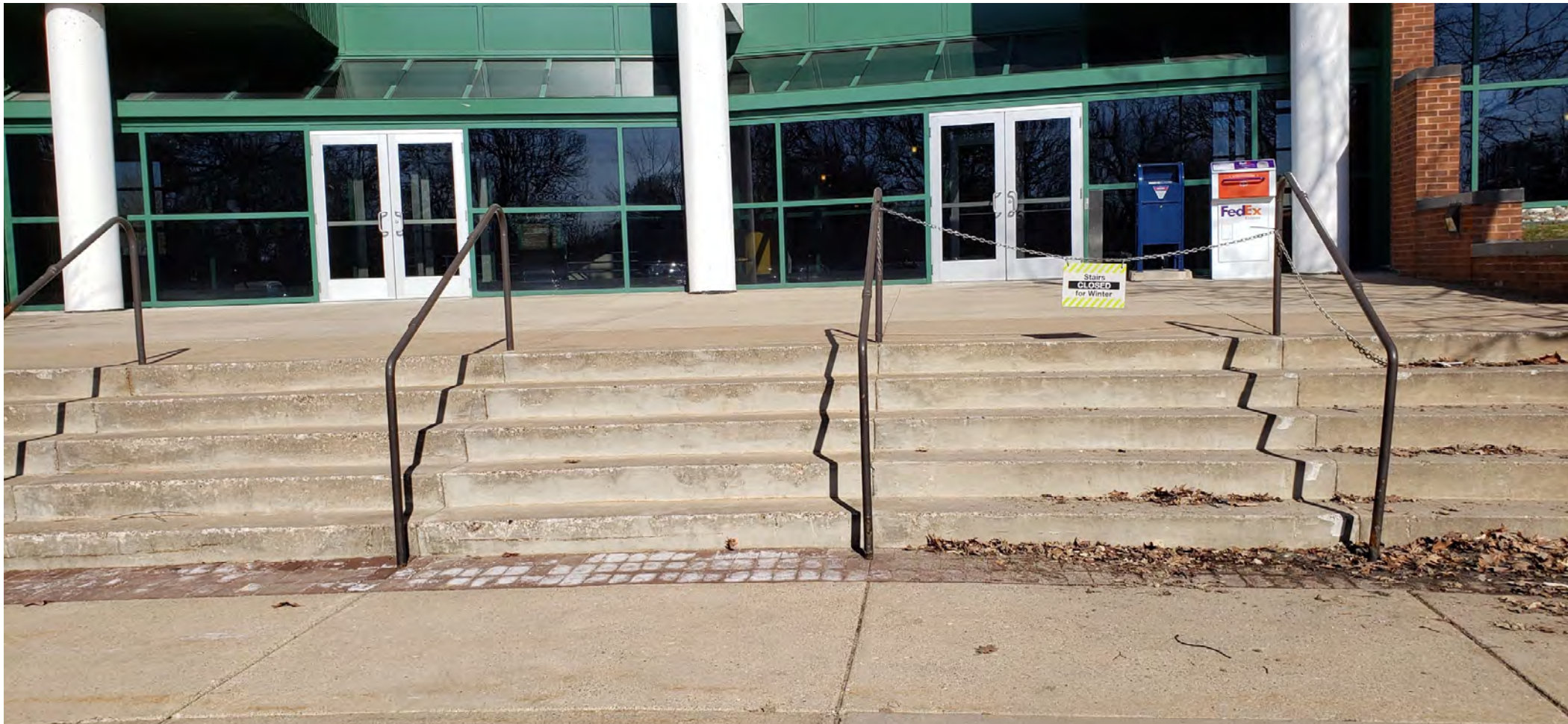
Images: Fortin Consulting



Best Practices

Salt Storage

Can You Close Areas During Winter?



Best Practices

Physical Snow & Ice Removal

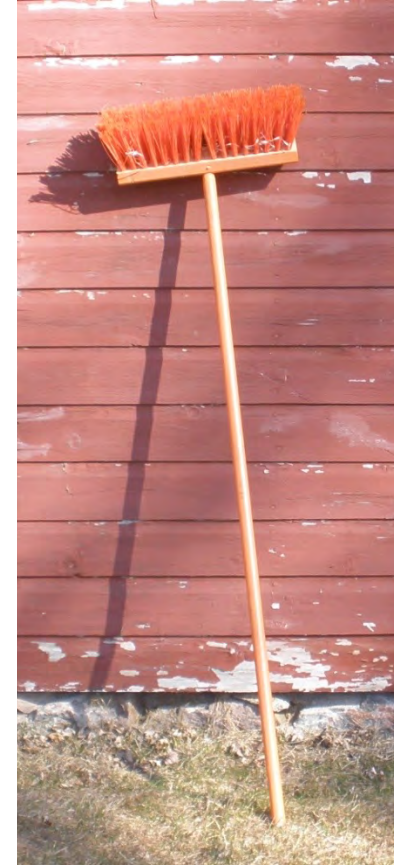




Mechanical Removal

Always remove snow before applying deicing material
Apply salt only if needed to break the bond

Physical Snow and Ice Removal Equipment





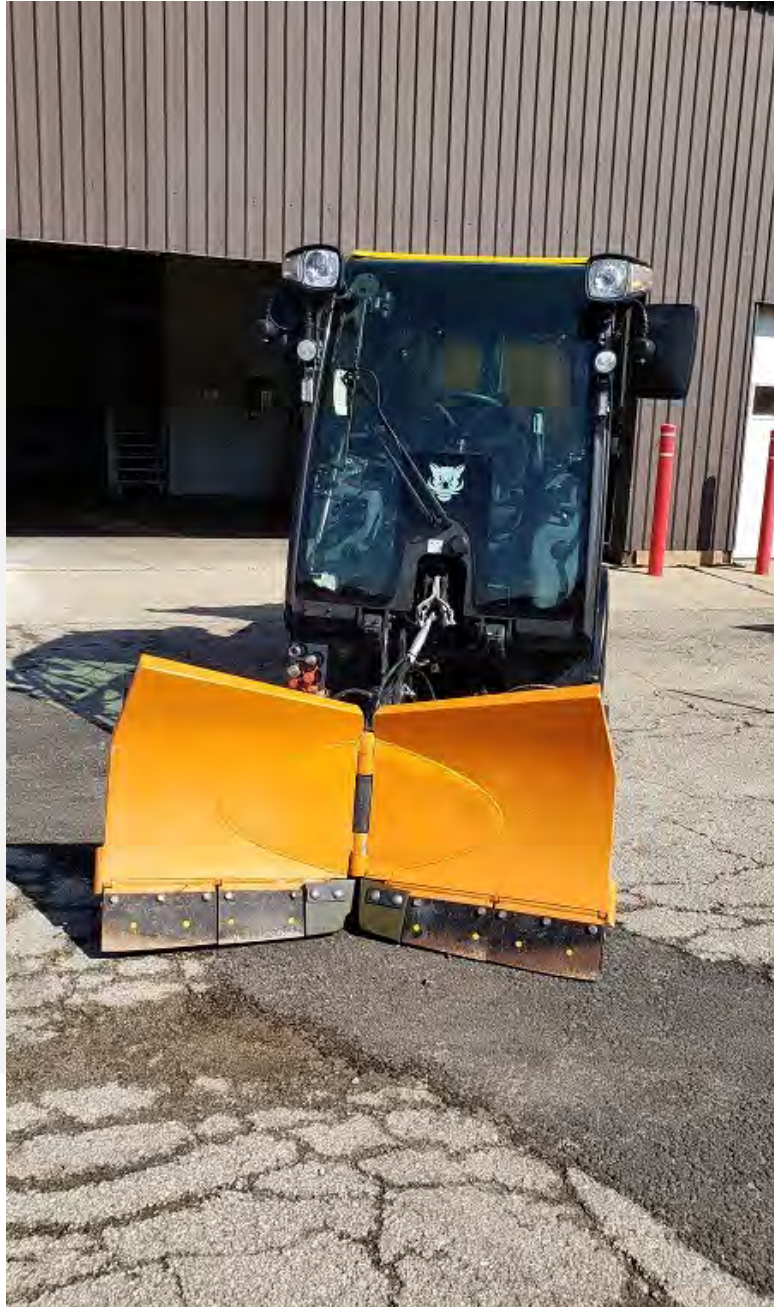
Cutting Edges

More flexibility contours to road.

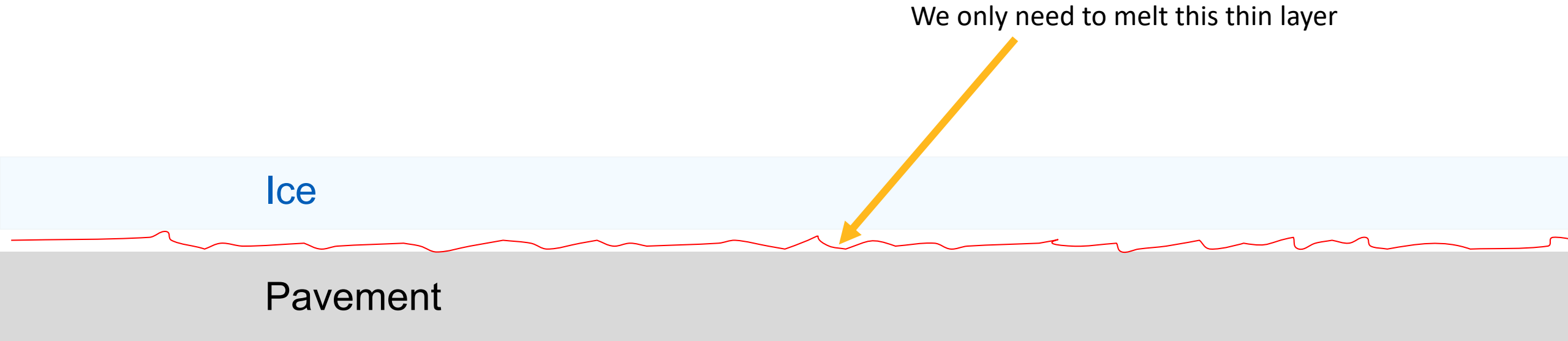
- Better snow removal, less chemicals
- Polar Flex, Joma, MetalPless, Kueper, Built Blades



Sidewalks



- Get out early
- Salt middle section
- Plow snow back a ways from edge



Use of Deicers

The purpose of deicers is to prevent or break the bond between the pavement and the ice, not to melt all the snow and ice!

How Salt Works

Deicers are freeze-point depressants

Salt loosens the bond between pavement and snow and provides:

- Fast melting on warm pavement
- Slow melting on cold pavement
- No melting on super cold pavements





No deicer will work in all conditions

Material Selection

Warm to average winter pavement temperatures (above 15 degrees):

- Sodium Chloride (rock salt)
- Urea
- Calcium Magnesium Acetate

Colder winter temperatures

- Magnesium chloride
- Calcium chloride
- Potassium Acetate
- Potassium Formate

All temperatures and Very Cold winter temperatures (below 0)

- Abrasives



Pavement Temperature

Select deicer based on pavement temperature and trend

- If pavement temperature is below 15° F, many deicers will not be effective



Limit Use of Salt During a Storm



Application Rates

Considerations:

- Pavement temperature
- Conditions
- Weather forecast
- Cycle time
- Deicer
 - Chemical type
 - Liquid or solid



Deicing Application

Rate Guidelines

Pavement Temp. (°F) and Trend (↑↓)	Weather Condition	Maintenance Actions	Application Rate in lbs./per 1000 square foot area			
			Salt Pre-wetted/ Pretreated With Salt Brine	Salt Pre-wetted/ Pretreated With Other Blends	Dry Salt	Winter Sand (abrasives)
>30°↑	Snow	Plow, treat intersections only	0.75	0.5	0.75	not recommended
	Frz. Rain	Apply chemical	1.25	1.0	1.5	not recommended
30°↓	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.5	1.25	1.75.	not recommended
25 - 30° ↑	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.5	1.25	1.75	not recommended
25 - 30° ↓	Snow	Plow & apply chemical	1.25	1.0	1.5	not recommended
	Frz. Rain	Apply chemical	1.75	1.5	2.25	3.25
20 - 25° ↑	Snow or Frz. Rain	Plow & apply chemical	1.75	1.5	2.25	3.25 for frz. rain
20 - 25° ↓	Snow	Plow & apply chemical	2.0	2.0	2.75	not recommended
	Frz. Rain	Apply chemical	2.5	2.0	3.0	3.25
15° to 20°↑	Snow	Plow & apply chemical	2.0	2.0	2.75	not recommended
	Frz. Rain	Apply chemical	2.5	2.0	3.0	3.25
15° to	Snow or Frz.	Plow & apply	2.5	2.0	3.0	3.25 for frz. rain

Smart Salting for Parking Lots & Sidewalks

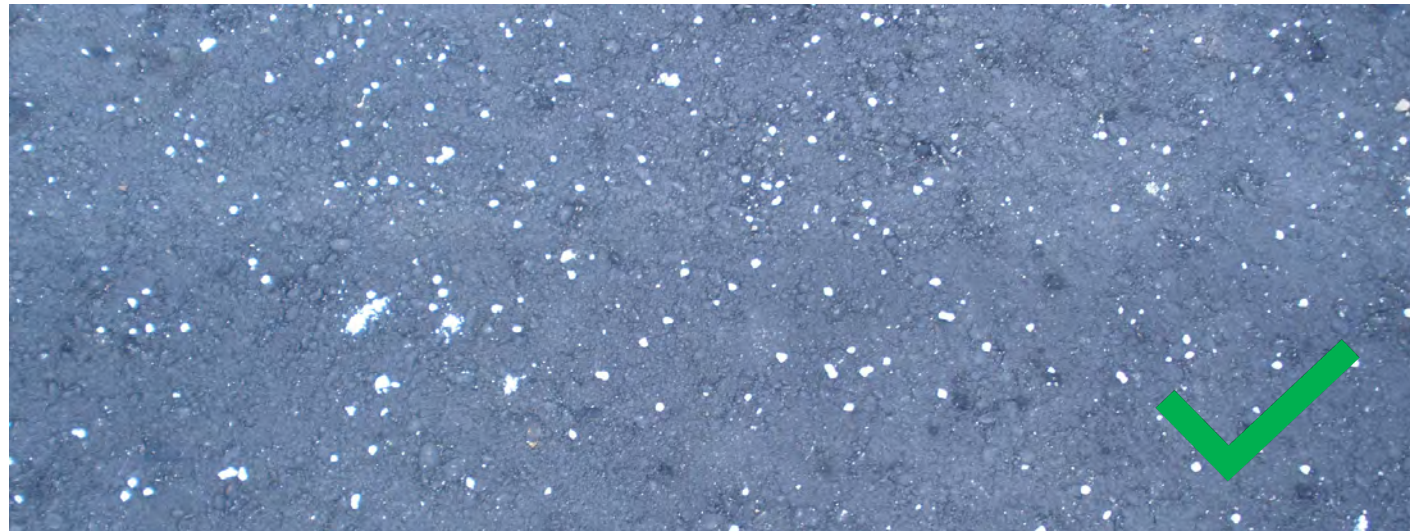


June 2021

mi MINNESOTA POLLUTION CONTROL AGENCY

How Much Salt to Use?

Use salt lightly and sparingly



Images: Fortin Consulting

Get Salt Wet

30% salt savings

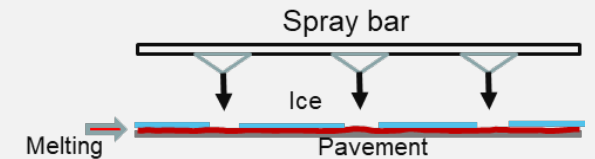
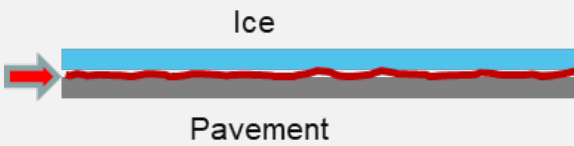
- Increases the speed of melting
- Salt works quicker because it's already going into solution
- Less bounce and scatter



Best practice? Use of liquids



Liquids Terminology



Anti-icing

Apply liquids **before the storm** to prevent bond (sometimes referred to as pre-treating)

Pretreated

Granular salt with liquid mixed in (can be purchased or mixed onsite)

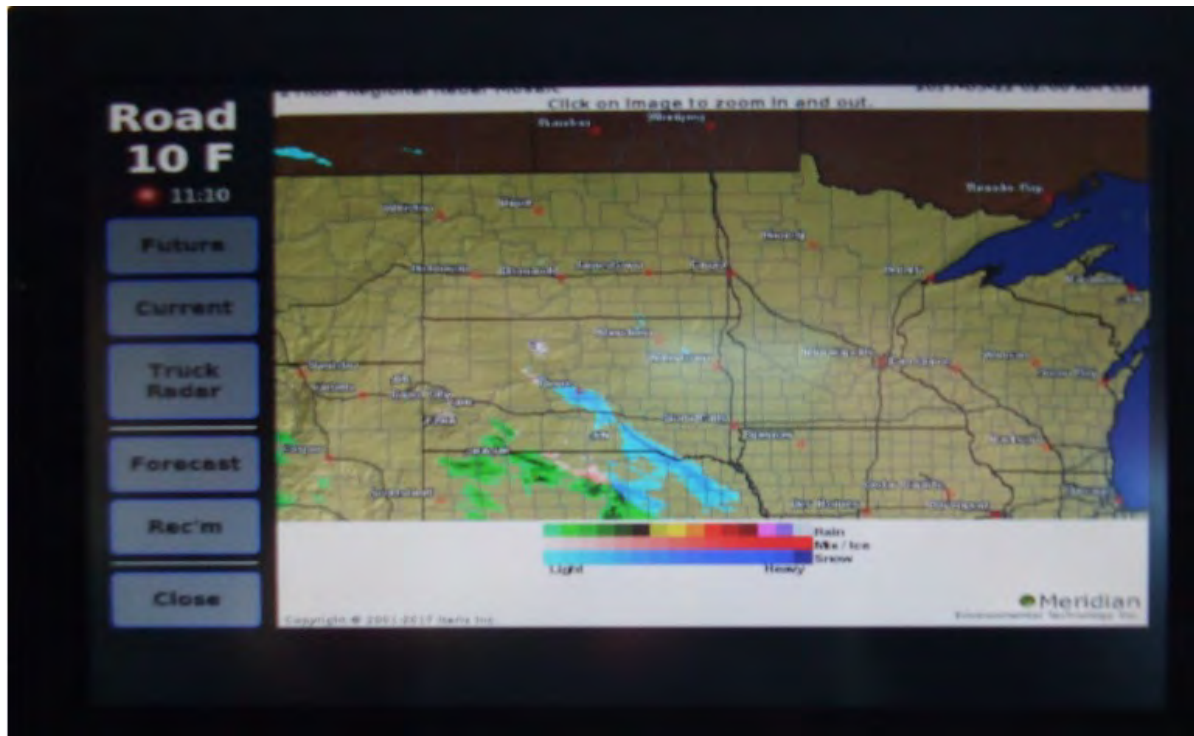
Prewet

Applying liquids to granular de-icers at the spinner or auger

Direct Liquid Application (DLA)

Overall term but often refers to application **during or after the storm** to break bond

Technology: Better Information = Better Decisions



Photos by MnDOT

A large, jagged iceberg floating in the ocean under a clear blue sky. The iceberg is the central focus, with its sharp peaks and deep crevasses clearly visible. The water is a deep blue, and the sky is a lighter, clear blue. The overall scene is serene and majestic.

After the Storm - Evaluate

- Accurately record your material use
- Attend a post-storm meeting to evaluate operations
- What went well, what can we improve

Get Maintenance Staff & Contractors Certified!

Smart Salting for Roads Manual



2023

mi MINNESOTA POLLUTION
CONTROL AGENCY

Smart Salting for Parking Lots
& Sidewalks



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CONTROL AGENCY

Smart Salting for Property
Management Manual



October 2020

Written and published by:
Minnesota Pollution Control Agency
and Fortin Consulting, Inc.



WINTER MAINTENANCE for Small Sites

Video funded: Mississippi Watershed Management Organization
and University of MN Landcare

Building Entrances Video

- Winter maintenance training for small sites: Part 1 (10:04)
- Winter maintenance training for small sites: Part 2 (9:30)

<https://www.pca.state.mn.us/business-with-us/smart-salting-training>

We Reduced Salt!

“Safe to say my salt reduction savings in product and labor is into the hundreds of thousands of dollars!”



Mayo Clinic 2018, All 3 crews trained
Winter 2018/2019

- Calibrated equipment
- Started using liquids properly
- Started using a non-chloride at some building entrances
- Didn't salt all the time, looked at weather forecast

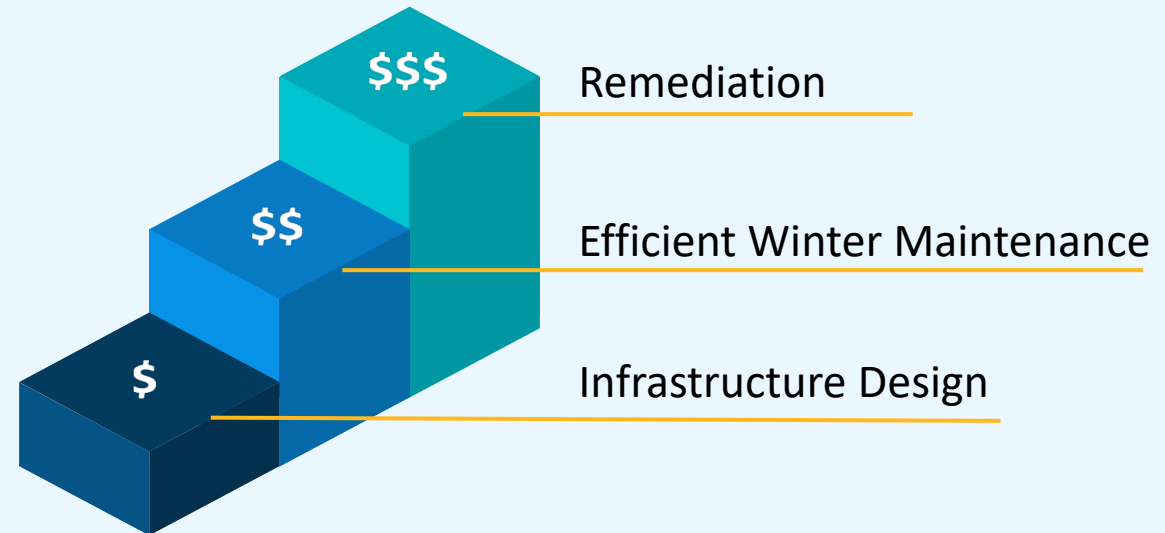


Controlling Chlorides

The best way to conquer the chloride problem is to reduce the need for it.

*MPCA Statewide Chloride Management plan 2021: requesting chloride reductions everywhere in MN

The Cost to Control Chlorides



An aerial photograph of a city, likely in a winter or snowy season, with a blue overlay. The text "The Vision" is written in white, bold, sans-serif font, underlined with a yellow line.

The Vision

Low Salt Design will help protect our beautiful communities from the damage caused by salt and will give our clients:

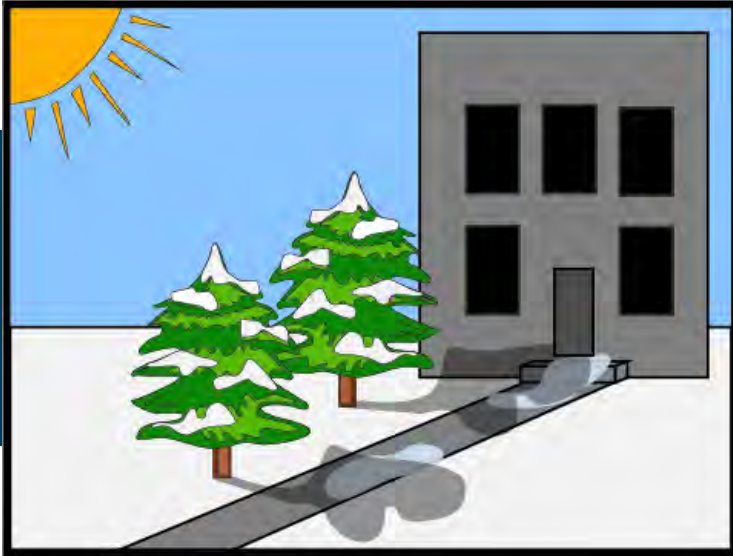
- Safer winter surfaces for pedestrian and vehicle travel
- Cost savings by reduced winter maintenance effort
- Longer life and lower repairs with less salted infrastructure
- Reduced chloride loading to the surface and groundwater
- Less salt toxicity to soils, vegetation and wildlife
- Compliance with Chloride Management Plans



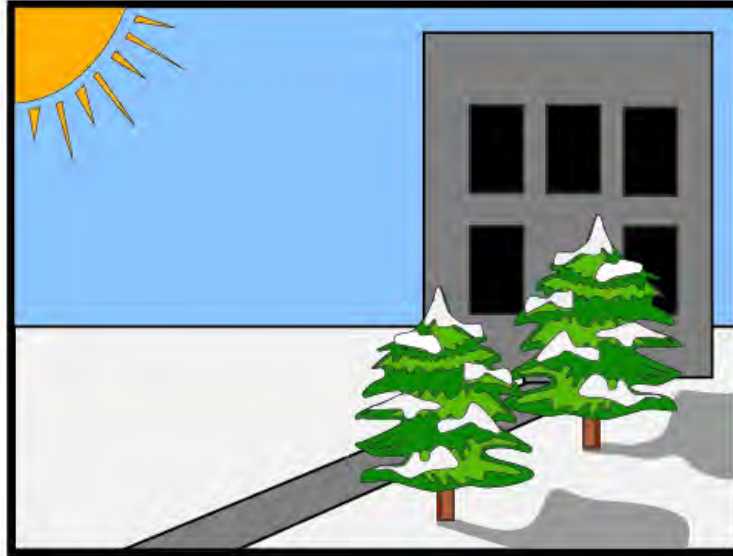


Use the Sun

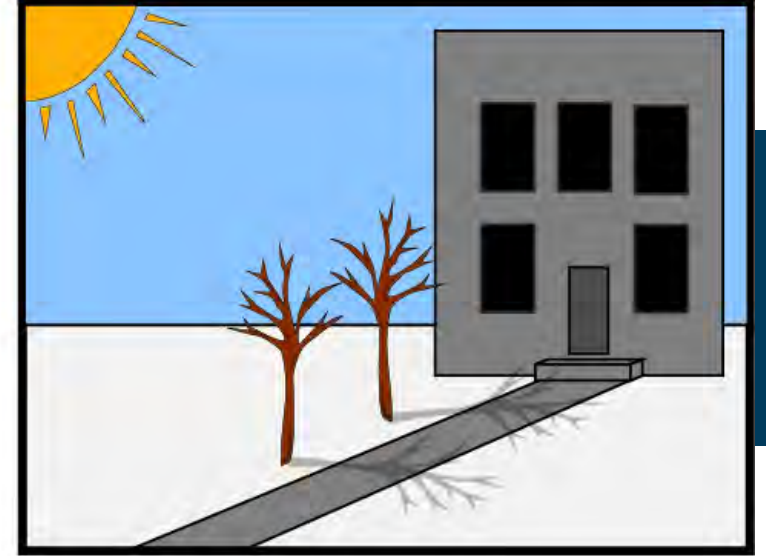
Use the Sun



HIGH SALT



LOW SALT



LOW SALT

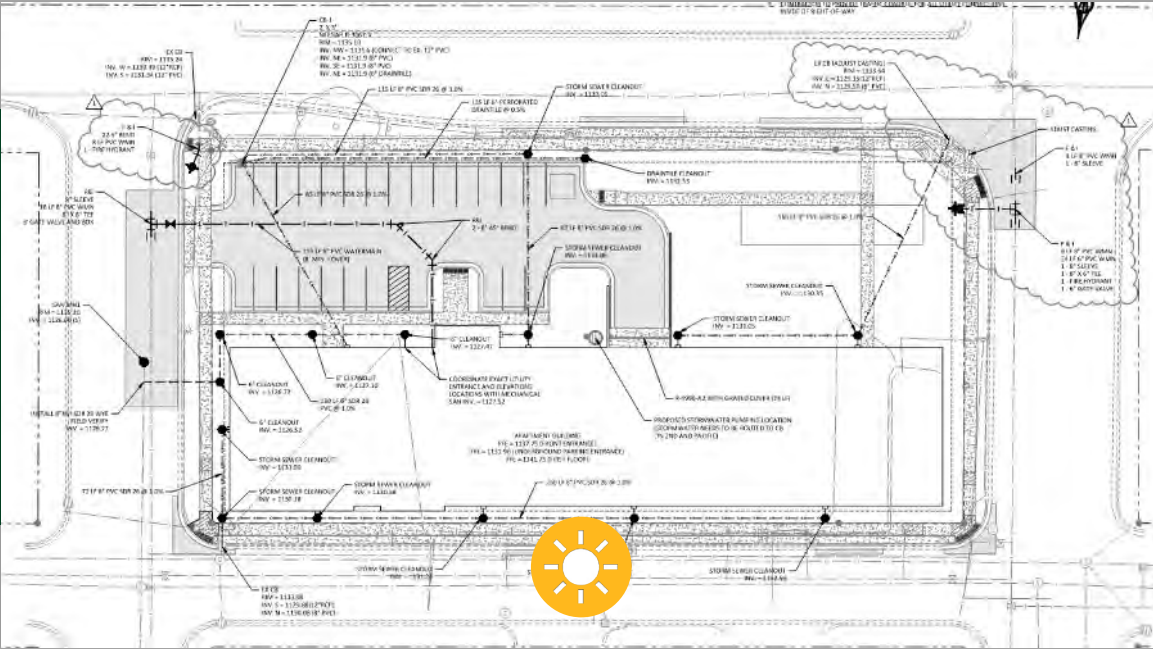




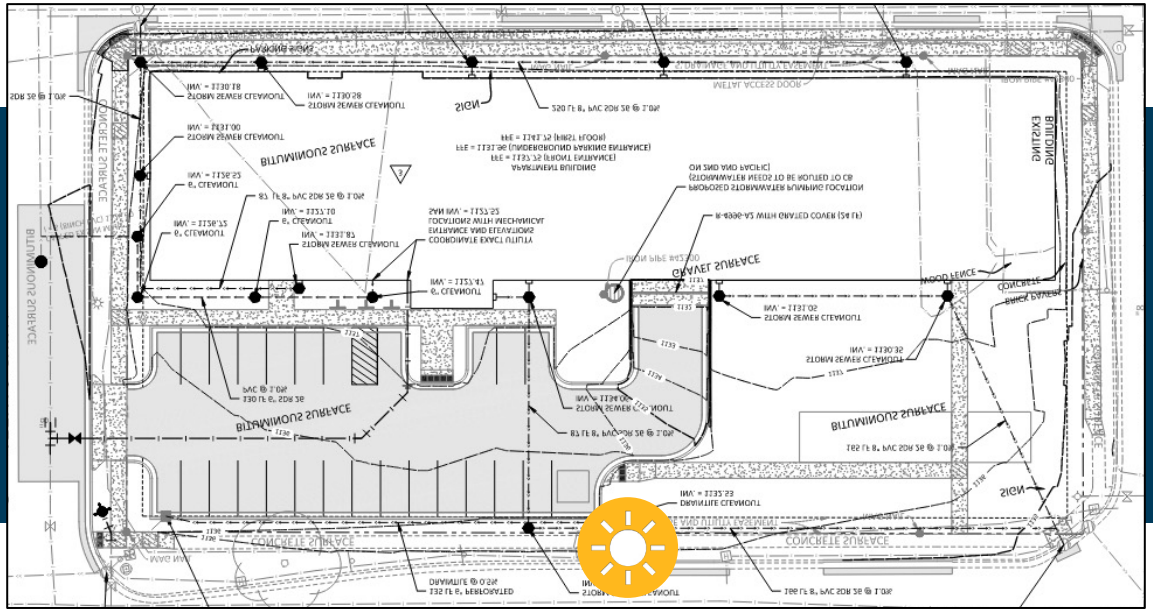
Use the Sun



Parking in the Shade



Parking in the Sun





Use the Sun

Use the Sun

Move low spot to the sun



High Salt



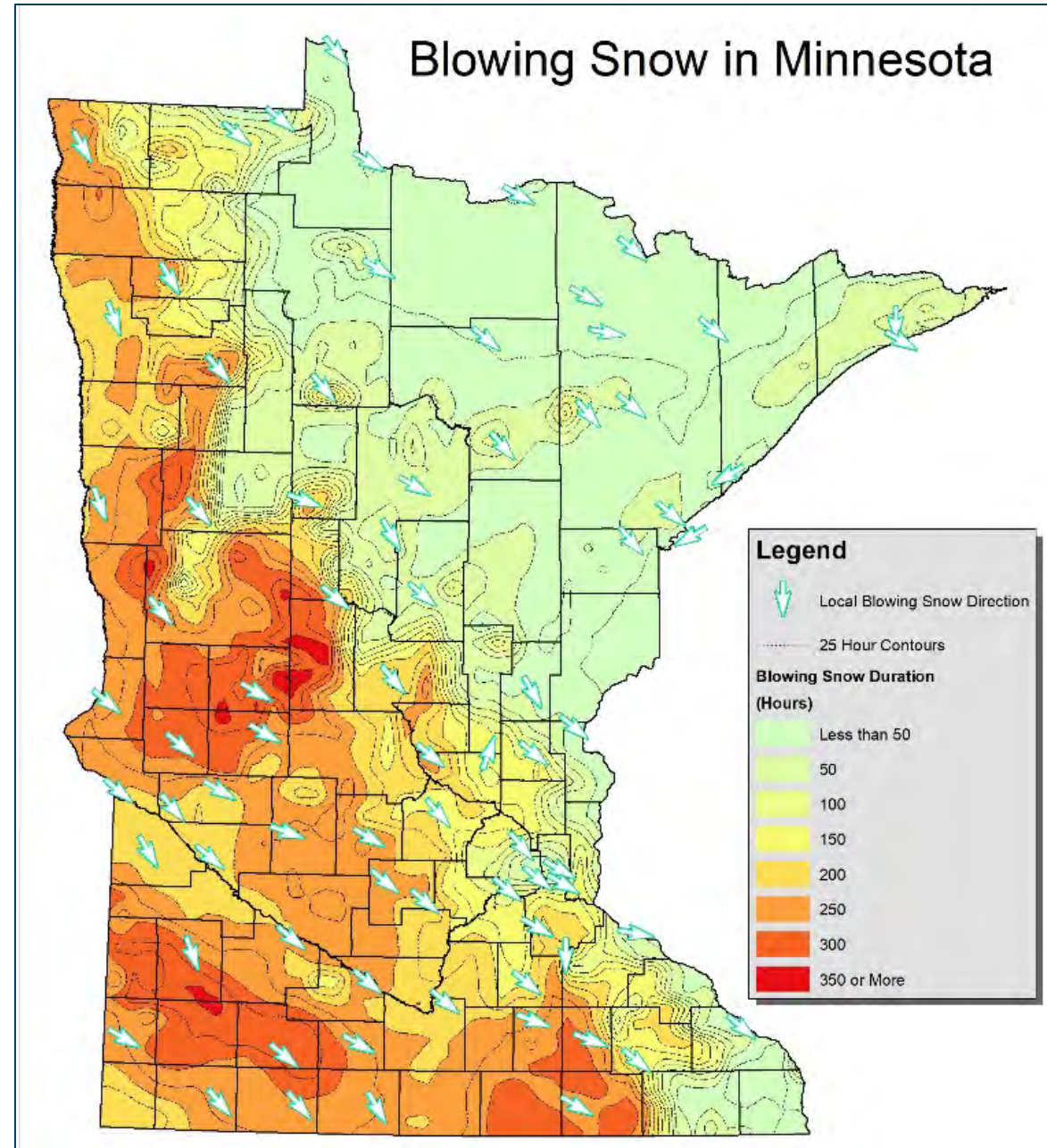
Low Salt





Outsmart the Wind

Outsmart the Wind





Outsmart the Wind

Intentional Snow Fence



Unintentional Snow Fence



High Salt



Low Salt

Snow Fences

Concat	Blowing Snow		Thaw-Freeze Transitions (Count)
	Primary Blowing Snow From Direction (Deg from North)	Blowing Snow Duration (hours above 15mph during winter)	
Medford, ND	337.0	313.5	46.8
Medicine Hill, ND	294.7	280.4	50.1
Medicine Lake, MN	315.5	80.4	47.0
Medina, MN	314.8	143.9	47.6
Medo, MN	299.8	254.0	53.3





Plow
Access

Snow Removal Made Easy





Snow Storage



Adequate space: 13 – 30% of plowed from our early analysis



Drainage

Horizontal Drainage

Reduce meltwater
footprint

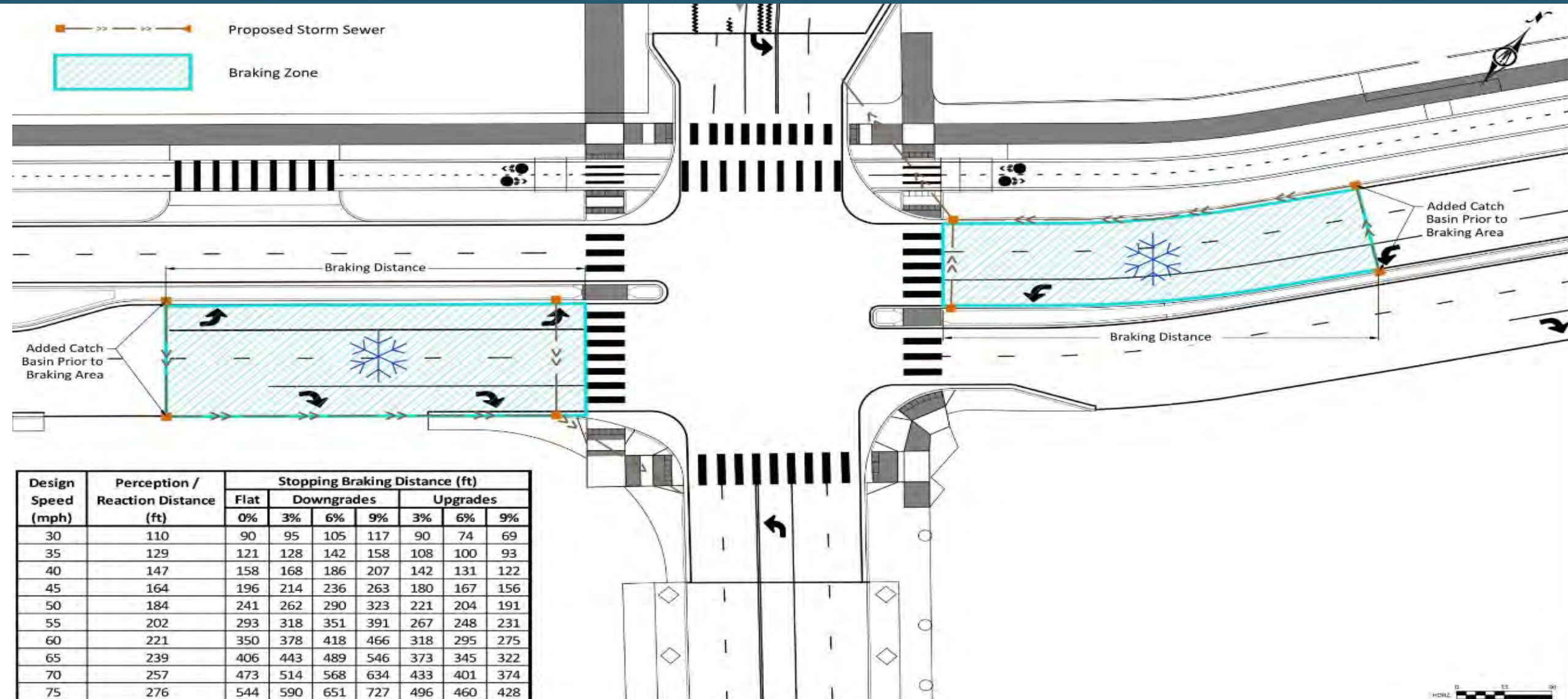
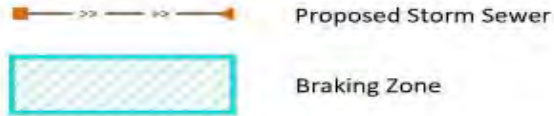


Meltwater Sprawl Overlooked in Design



St. Paul has roughly **48 Freeze/Thaw cycles** a year.
All are potential salting events!

Direct Meltwater Away from Braking Zone



Design Speed (mph)	Perception / Reaction Distance (ft)	Stopping Braking Distance (ft)						
		Flat	Downgrades			Upgrades		
			0%	3%	6%	9%	3%	6%
30	110	90	95	105	117	90	74	69
35	129	121	128	142	158	108	100	93
40	147	158	168	186	207	142	131	122
45	164	196	214	236	263	180	167	156
50	184	241	262	290	323	221	204	191
55	202	293	318	351	391	267	248	231
60	221	350	378	418	466	318	295	275
65	239	406	443	489	546	373	345	322
70	257	473	514	568	634	433	401	374
75	276	544	590	651	727	496	460	428



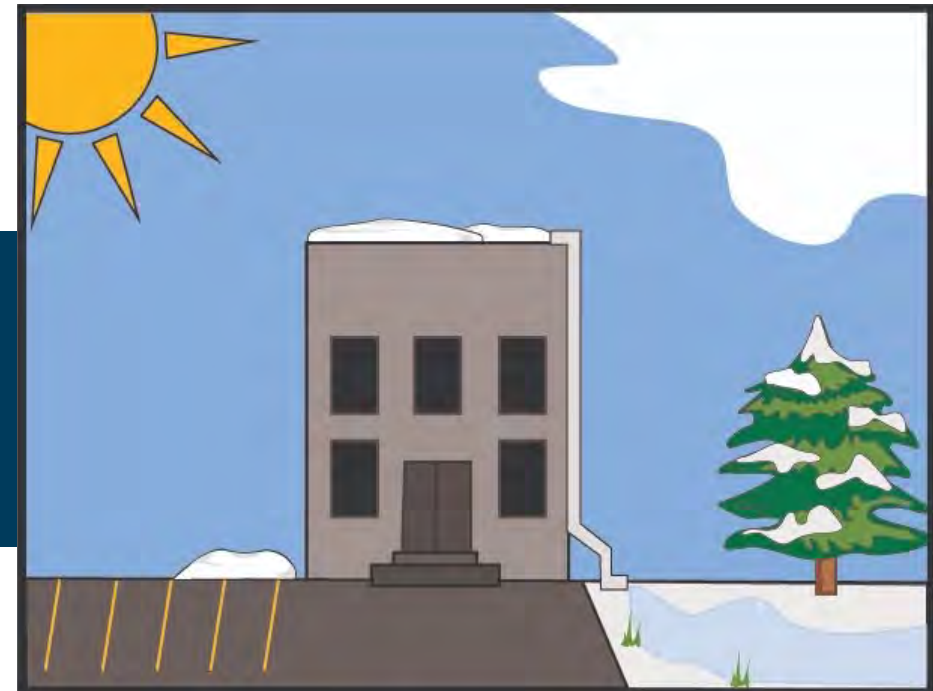
Drainage

Vertical Drainage

Direct meltwater away from salted surfaces

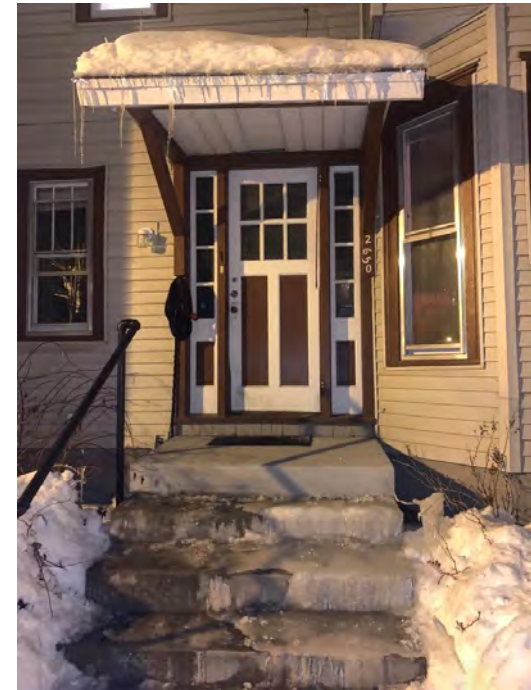
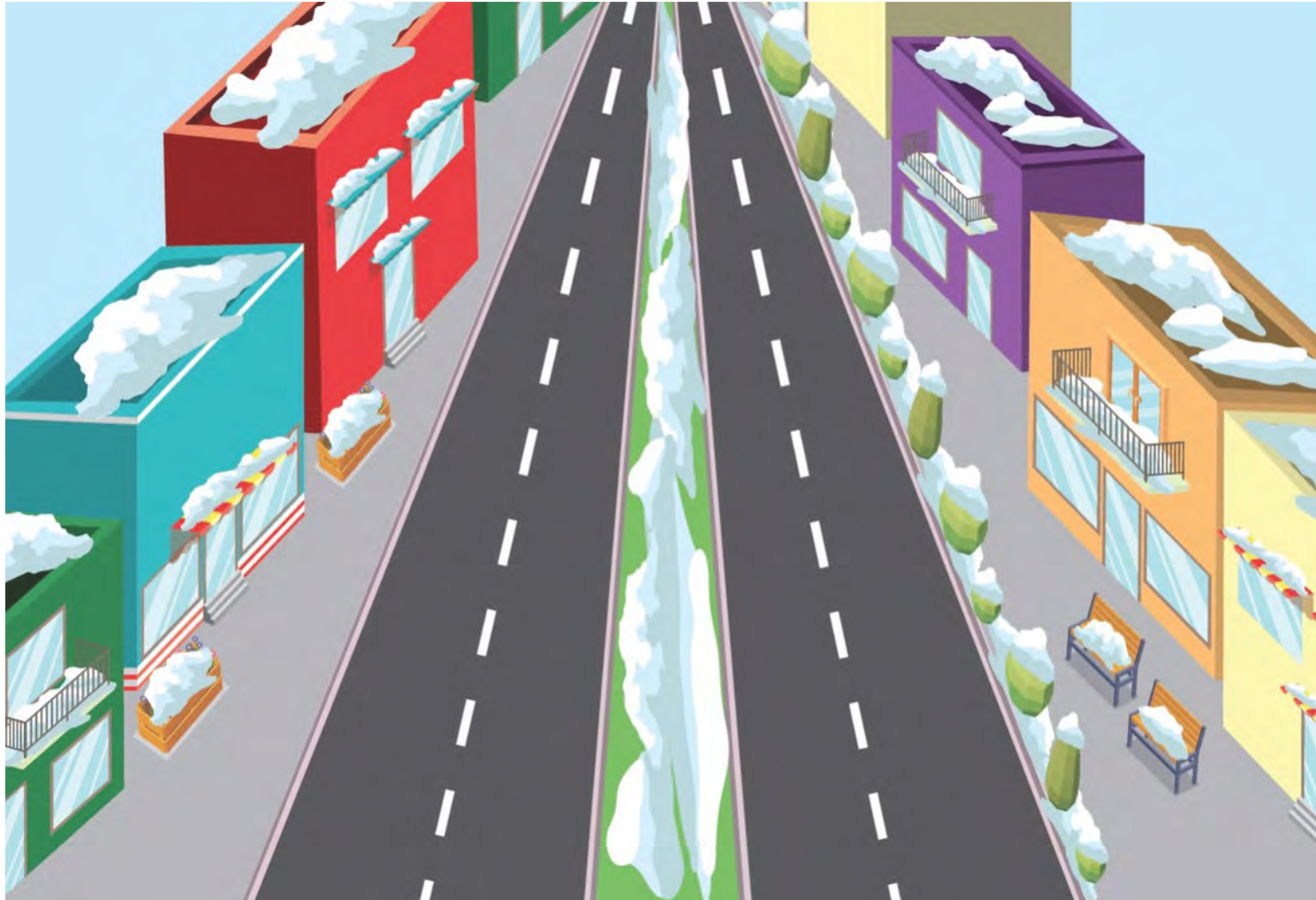


High salt



Low salt

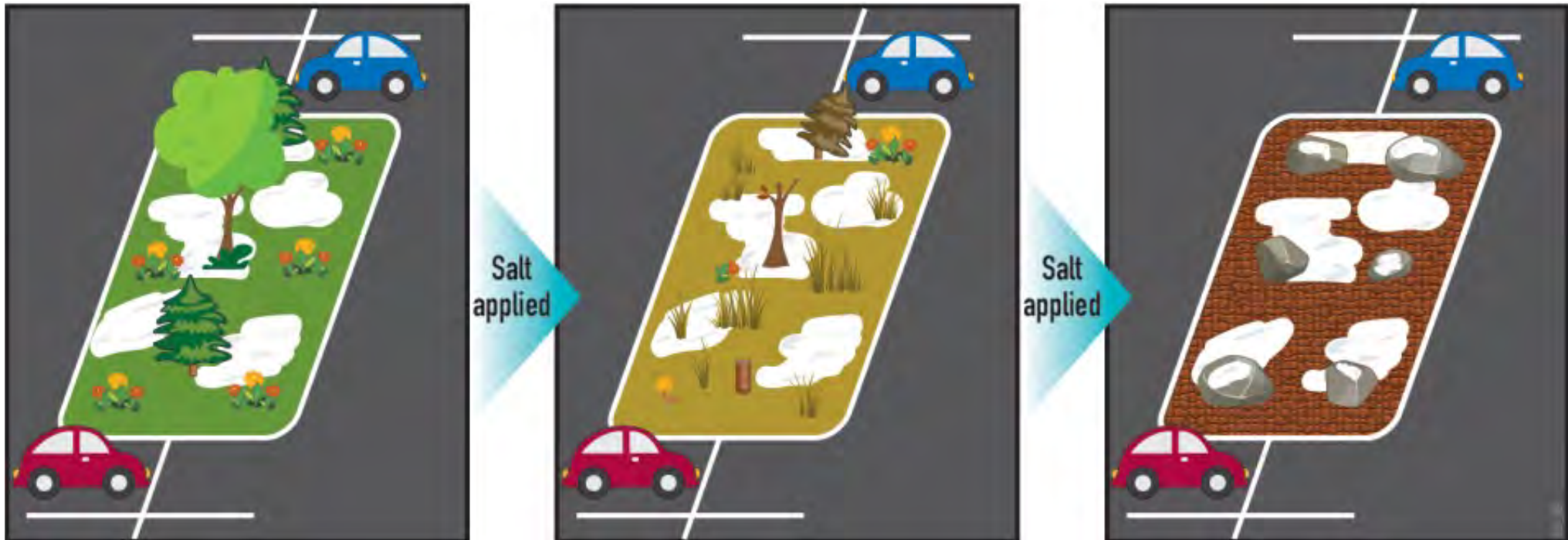
Vertical Drainage



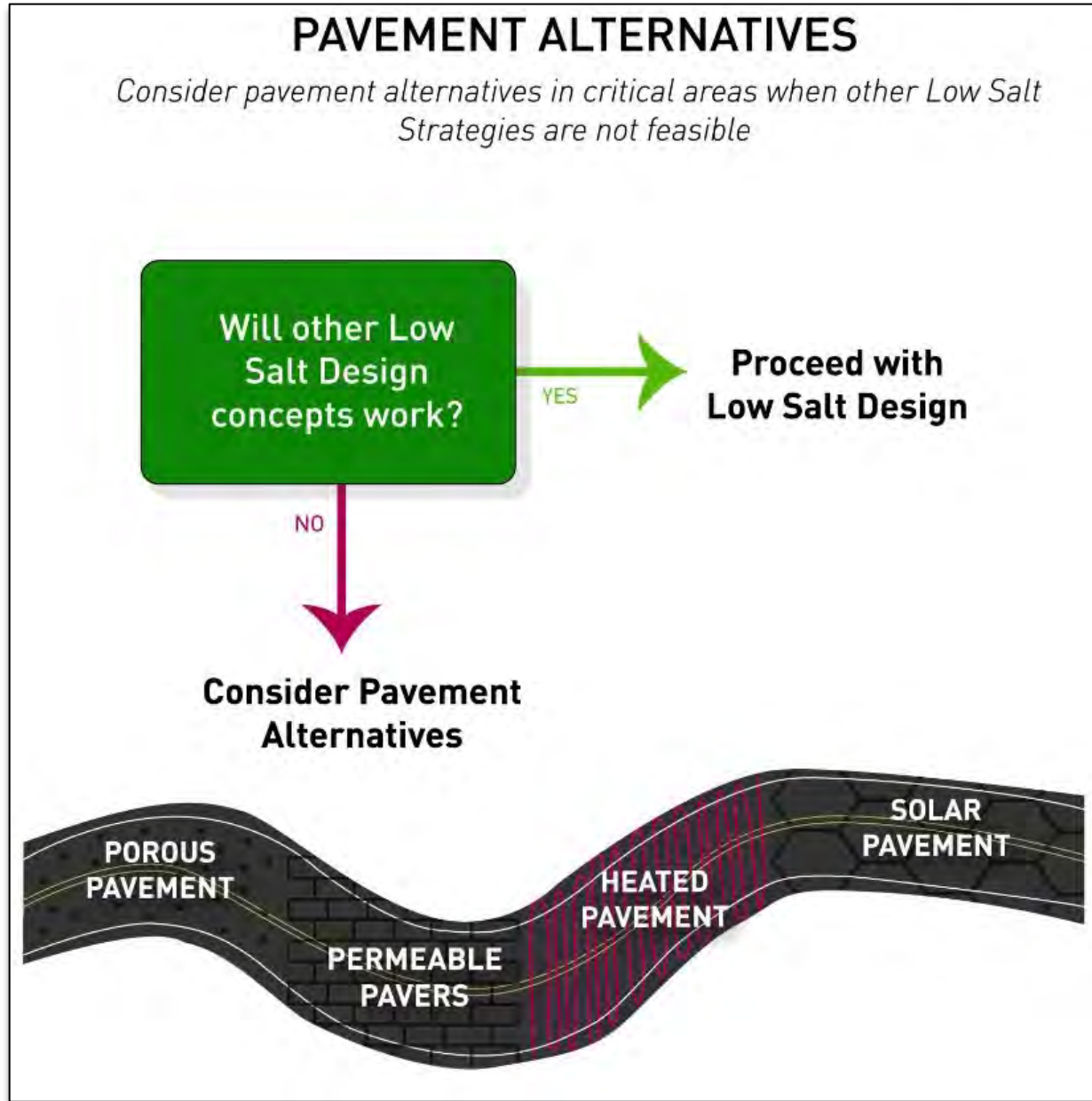


Evolution of Parking Lot Islands

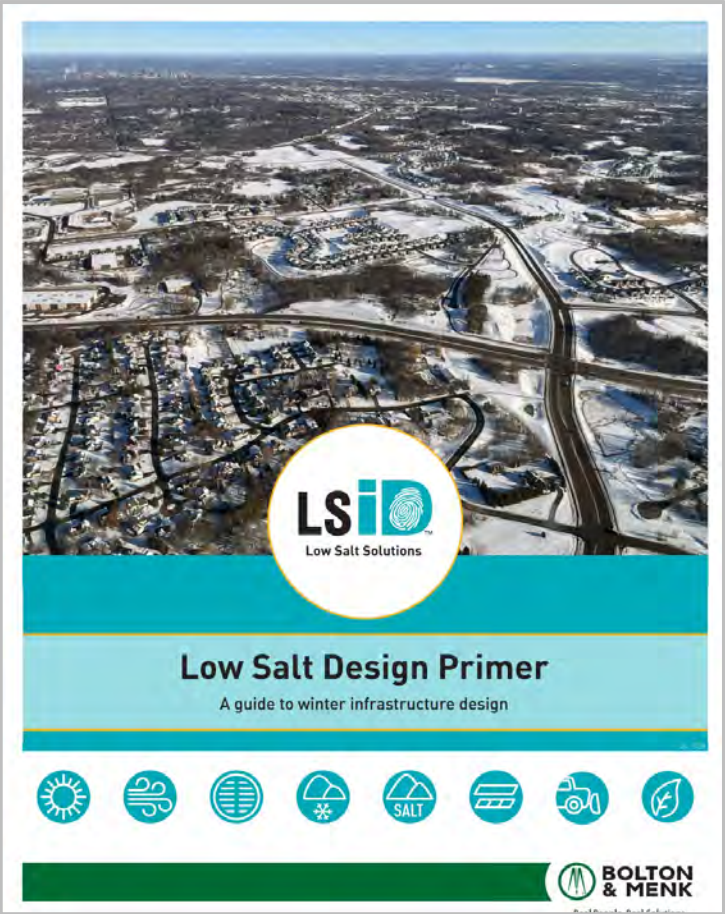
Good intentions, but didn't think about winter



Pavement Alternatives



Publications



High level overview of Low Salt Design concepts





Next Steps

- What Winter problems do you face?
- How might Low Salt Design or infrastructure retrofits help you?
- How might winter maintenance training help you?



Thank You!

We can outwit winter!



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