Costs and Benefits in Winter Maintenance

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Overview

- Benefits of Winter Maintenance
- Costs of Winter Maintenance
- Constraints in Winter Maintenance
- How on earth do we balance it all out?

Why Do We Do Winter Maintenance?

Two primary reasons, both well established by research

Safety – Marquette University study showed proper use of road salt resulted in:

Why Do Winter Maintenance?

1,300 killed, 116,800 injured annually on snowy, slushy, or icy pavements

544 million vehicle hours of delay due to snow and ice annually, about a quarter of all non-recurrent delays

Not Just Safety - Mobility

Study by Global Insights looked at the impact of a one day shutdown for a State due to a winter storm. They found:

Winter Maintenance Goals and Constraints

- Provide **safety** and **mobility** to road users
- Do this without negatively impacting the **environment**
- Do this within budget
- Provide the right **level of service**
- Address the **social expectations** of our community

- Must be a systems-based approach
- Every step along the way requires attention
- Needs cooperation and collaboration between all stakeholders
- Sustainability requires such cooperation to be effective

Levels of Service

- They are at the center of winter maintenance and drive all our actions (ideally)
- Different roads receive different levels of effort
  - Road types often differentiated in terms of Average Daily Traffic (AADT)
  - Priority Levels Assigned
- Because they are central, important they be created properly and then followed

Suitable Levels of Service

- Very location specific – what works in Illinois would not work in Georgia!
- Road type specific – residential streets should not receive the same efforts as Interstates
- Possibly time of day specific – major commuter routes should have higher priority in the few hours leading up to rush hour…

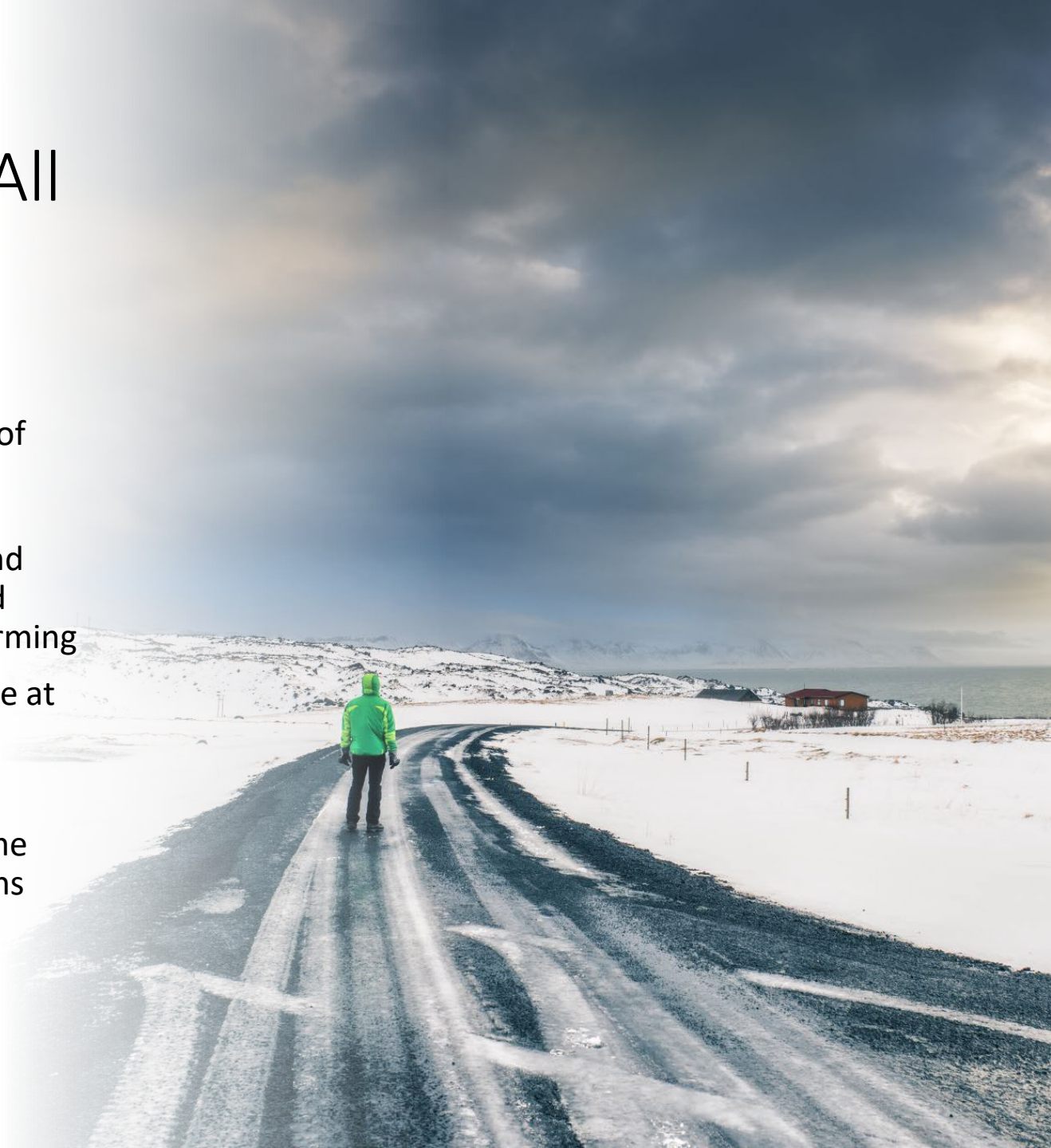

THIS IS A LEVEL 5 ROAD
All of Larimer County's roads are categorized by the level of snow and ice removal efforts which will be devoted to them. The various levels of service, the roadways which fall within that level and the degree of service which will be devoted to snow and ice removal operations on each level are identified below.
LEVEL ONE: This level includes all county roads (not including sub-division roads) that are school bus routes. During school days, Level One roads will be plowed and sanded to accommodate school bus schedules. Plowing and sanding operations will normally be carried out between the hours of 4:00 A.M. and 6:00 P.M. during school days. On days other than school days, plowing and sanding operations will be completed by 5:00 P.M.
LEVEL TWO: Level Two roads include all county roads (not including subdivision roads) that are U.S. rural mail routes. During mail delivery days, Level Two routes will be opened in time to accommodate mail delivery schedules. Plowing and sanding operations on Level Two routes will normally be carried out between 7:00 A.M. on mail delivery days. On days other than mail delivery days, plowing and sanding operations will be completed by 5:00 P.M.
LEVEL THREE: Level Three roads are the remaining mainline county roads (not including subdivision roads) which are not included in Level One and Level Two above nor in Level Five and Level Six below. Level Three roads will be plowed and/or sanded after the resource requirements for Level One and Level Two roads are met. Plowing and sanding operations on Level Three roads will normally be completed by 5:00 P.M.
LEVEL FOUR: Level Four roads are those roads located within rural subdivisions. Level Four roads will be plowed and/or sanded as needed after the needs of Levels One Two and Three roads are met.
LEVEL FIVE ROADS: Level Five roads are those county roads which will be plowed and/or sanded only after the needs of Level One through Level Four roads have been made and resources are available to open these roads.
LEVEL SIX ROADS: Level Six roads are those county roads which are not plowed or sanded during winter months.

So How Does Salt Help Us?

- The purpose of salt in winter maintenance is to **break the bond** between snow (or ice) and pavement
- It is **NOT** to melt the snow or ice
- We get rid of the snow or ice with a plow, we make that removal easier with road salt to **break the bond**
- Typical road salt application melts a few thousandths of an inch of snow/ice…
- "Chemical plowing" is **inefficient, wasteful, hugely expensive, and poor environmental stewardship**

What Does All This Mean?

- Get the right quantity of material onto the road surface
  - To prevent the bond between snow and pavement from forming
- Keep the material there at the interface
- Allow it to do its work
- All of which brings some operational implications with it



How Much is “The Right Quantity?”

It depends!

On what we are trying to achieve…

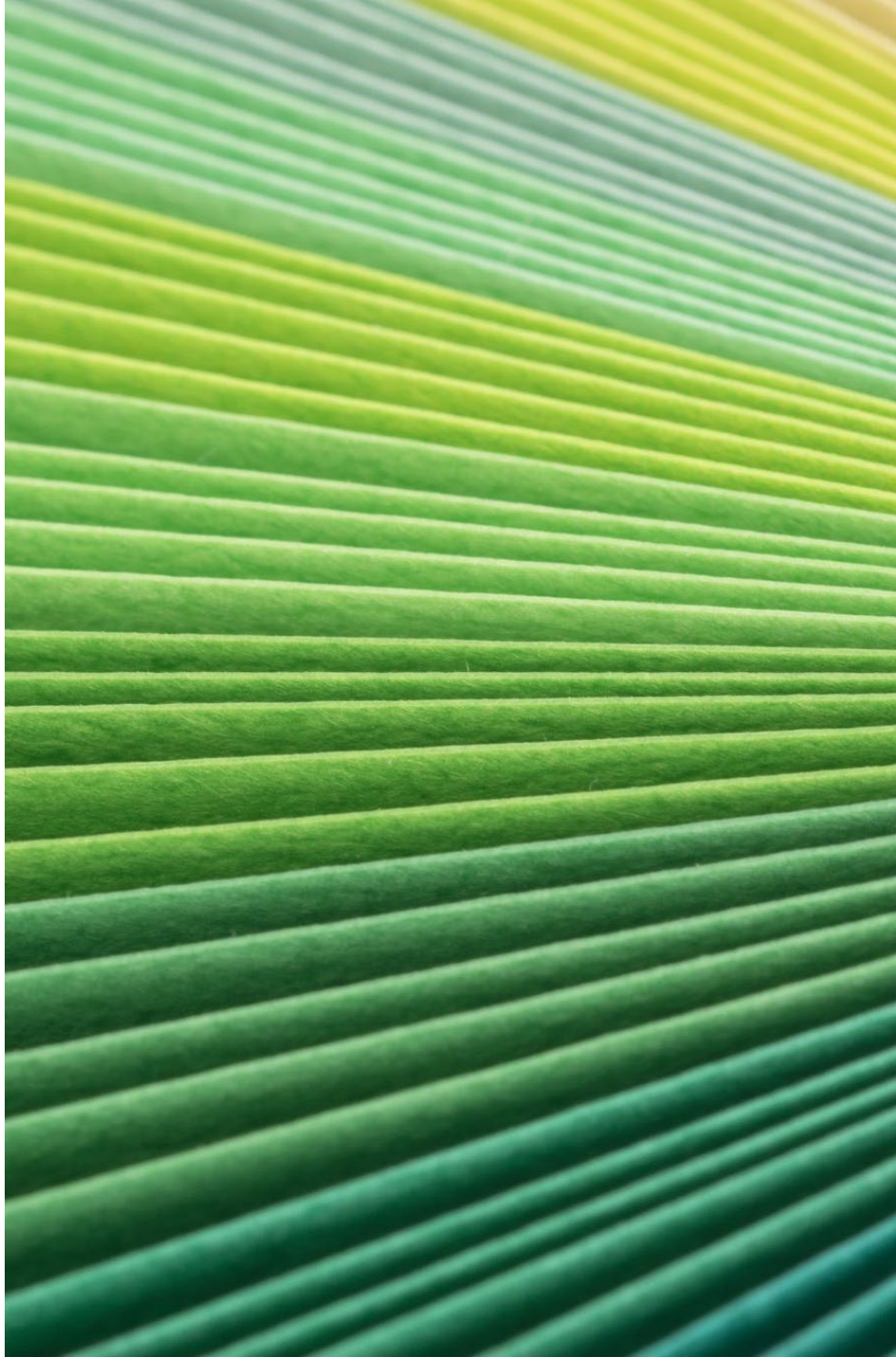
On pavement temperature

On moisture content

- Or storm type

On time till the next application

- Or cycle time



Typical Application Rates

- Hugely variable between agencies
- A step toward uniformity in the FHWA Manual of Practice for an Effective Anti-Icing Program
- Variations as functions of storm type, road surface temperature, and route cycle time
- Refined by experience and becoming incorporated into MDSS type solutions

Salt Application Rate Guidelines

Prewetted salt @ 12' wide lane (assume 2-hr route)							
Surface Temperature (º Fahrenheit)		*32-30*	*29-27*	*26-24*	*23-21*	*20-18*	*17-15*
lbs of salt to be applied per lane mile	Heavy Frost, Mist, Light Snow	50	75	95	120	140	170
	Drizzle, Medium Snow 1/2" per hour	75	100	120	145	165	200
	Light Rain, Heavy Snow 1" per hour	100	140	182	250	300	350

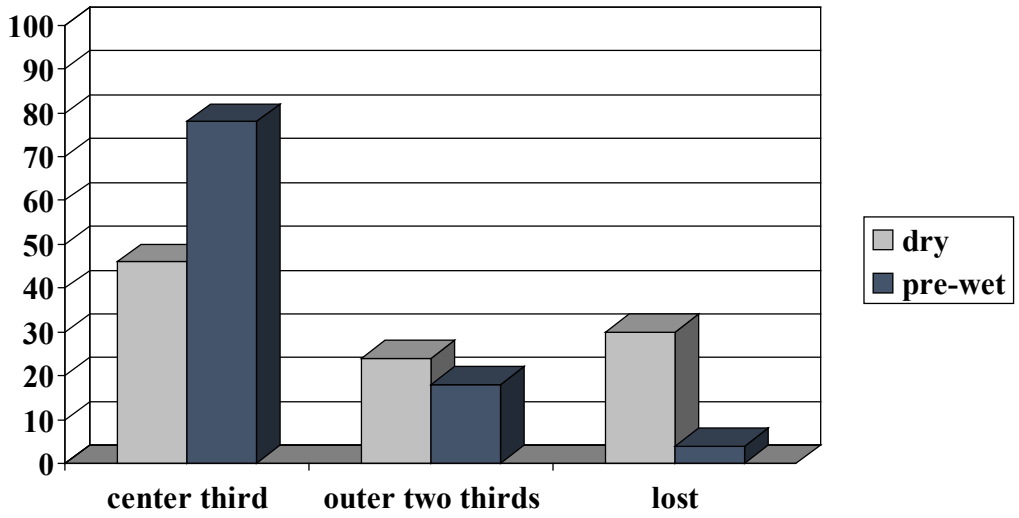
Prewetted salt @ 12' wide lane (assume 3-hr route)							
Surface Temperature (º Fahrenheit)		*32-30*	*29-27*	*26-24*	*23-21*	*20-18*	*17-15*
lbs of salt to be applied per lane mile	Heavy Frost, Mist, Light Snow	75	115	145	180	210	255
	Drizzle, Medium Snow 1/2" per hour	115	150	180	220	250	300
	Light Rain, Heavy Snow 1" per hour	150	210	275	375	450	525

What Are We Trying to Achieve?

- Level of service goals
- Should drive everything
- Should reflect the priorities of the road system for your community
- There is not a “one size fits all” solution here, and there should not be!

How Do We Keep the Material in Place?

- Mix itwith a liquid brine
- Ideally at the back of the truck
- Rates of about 10 gallons per ton
- Reduce bounce and scatter
- Stop 30% going into the ditch right away
- Or, to put it another way, get the same result with 30% less salt applied



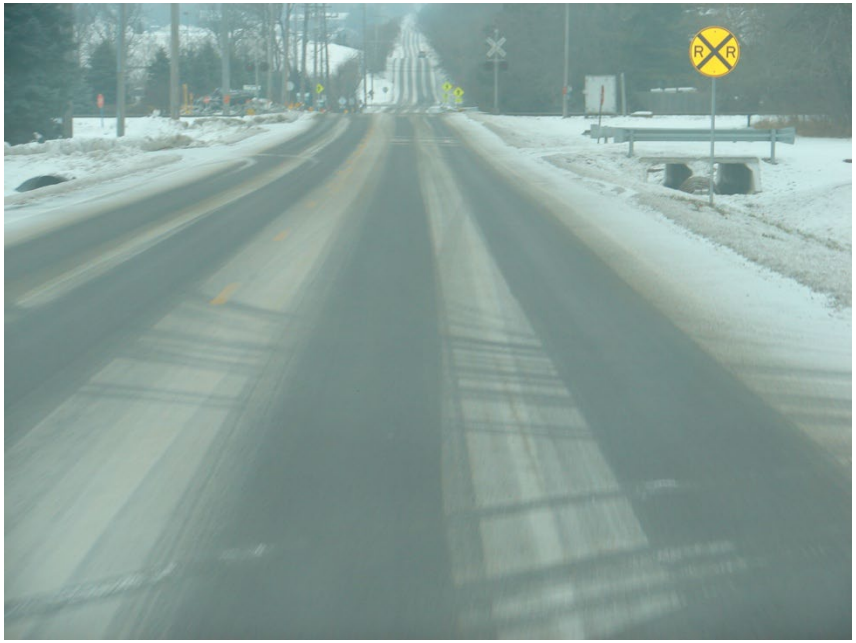
It’s Better When It’s Wetter!!!

- It really is…
- If you decide on wetting on the truck, you will need liquid storage and transfer capability as well as equipment on the truck
- Treating the stockpile can be effective, but limits how wet you can get…

Know Your Pavement Temperature

- Why – well that is where the salt works
- And the warmer it is, the less salt you need
- Is every storm the same? Of course not…
- So why should you always apply material at the same rate…

Treated vs. Untreated



Know your Expectations

So Where Does This Take Us with New Technology?

- Does it address pain points?
- Does it make our operations more effective?
- Are we more efficient because of the new technology?
- Is our road system more resilient because of the new technology?
- Are our operations more sustainable because of the new technology?
- How disruptive will the new technology be?
- How much change will be needed to make the new technology work?
- What are the capital and operational dollar costs of the new technology?
- How long before it is fully implemented?
- Do we have the stomach to make the change?

Consider an Example – Pre-Wetting

- Yes, this is not new, but it may be familiar!
- Pain points, effective, efficient, resilient, sustainability?
- Disruption, change in operational patterns, capital and operational costs, time to fully change, stomach!

On the Benefits Side

- Pain – material in the ditch – greatly reduced by this
- Effective – the pre-wetting helps to activate the salt, so it can be effective more quickly and at lower temperatures
- Efficient – less salt is wasted, so less salt is needed from the back of the truck (but we must make that change ourselves) – and more distance on one truck load
- Resilient – Not a huge benefit, but may help reduce snowpack build-up in marginal storms
- Sustainable – less total salt, so a win here (if implemented properly)

On the Costs Side

- Disruption – need tanks on all trucks, changed application rates, learning about liquids…
- Change – got to store, transfer, and apply liquids – could be a pain…
- New equipment (liquid storage, possibly brine maker, transfer to trucks, storage on trucks, pumps on trucks, all capital costs)
- Operational costs – time to load liquid, cost of liquid itself, maintenance of pumps, transfer, storage, brine making, etc.)
- How long to put on all trucks?
- Things will go wrong – will we push through?

The Golden Rule of New Technology…

Any new technology requires change to be effective

If you are not willing or able to change your operations, do not waste your time and money on the new technology

Harsh, but true…