



Winter Road Condition Classification and Reporting – A Risk Based Approach

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Outline of Presentation

- ❑ Introduction
- ❑ Winter Road Condition Classification and Reporting Practices
- ❑ A Risk Based Approach
- ❑ Applications
- ❑ Conclusions

Winter Challenges in Cold Countries

Safety



Mobility



Road Maintenance



Road Surface Condition (RSC) Reporting

RWIS

















Patrol Reporting



Winter RSC Classification and Reporting Practice



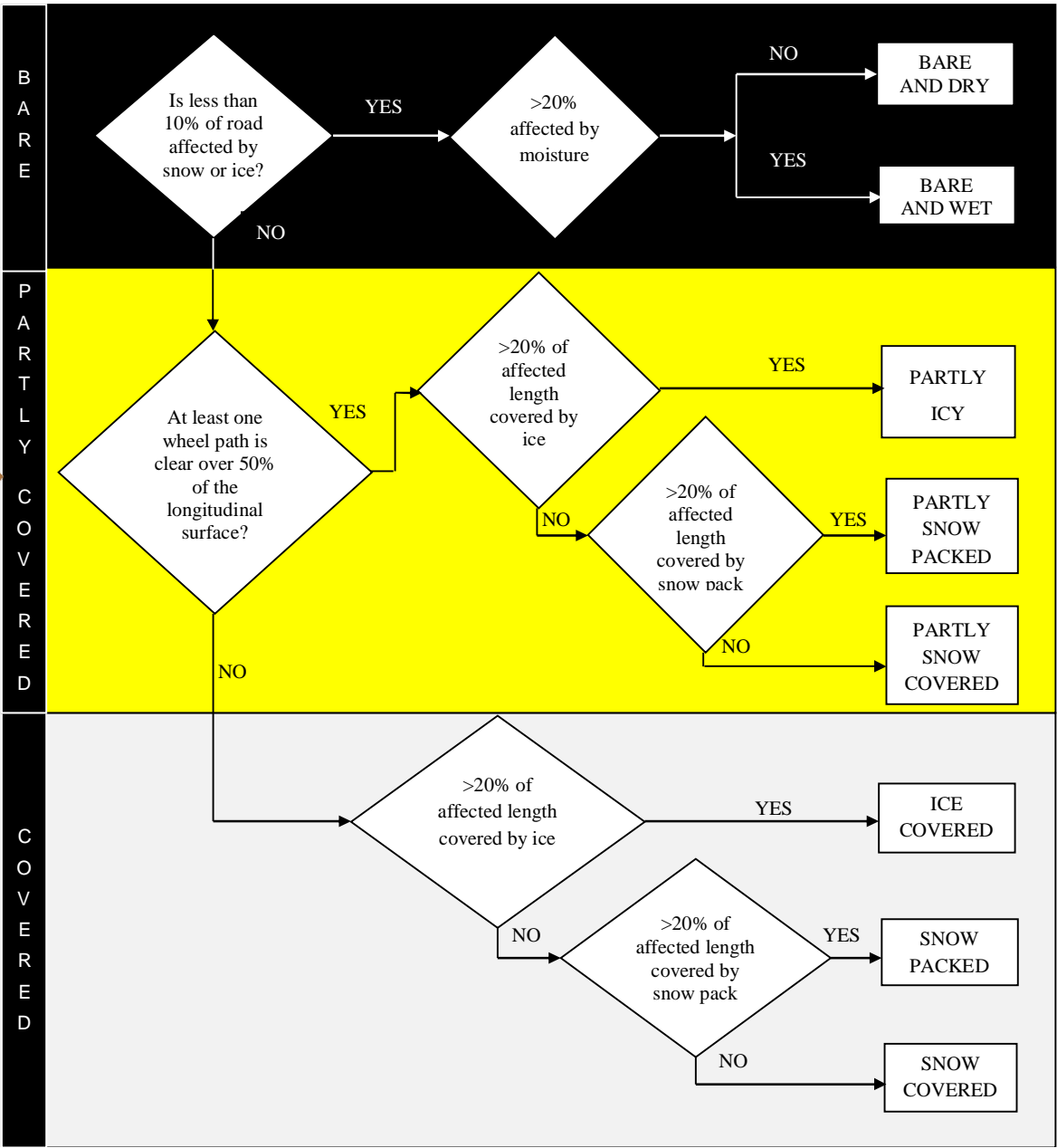
Winter RSC Classification and Reporting Practice

North Dakota									
	Compacted snow	Snow covered	Ice	Scattered snow	Frost	Wet/Slush	Dry		
	Missouri								
		covered		Partly covered		Wet	Dry		
		Ontario							
			Covered		Partly covered		Dry		

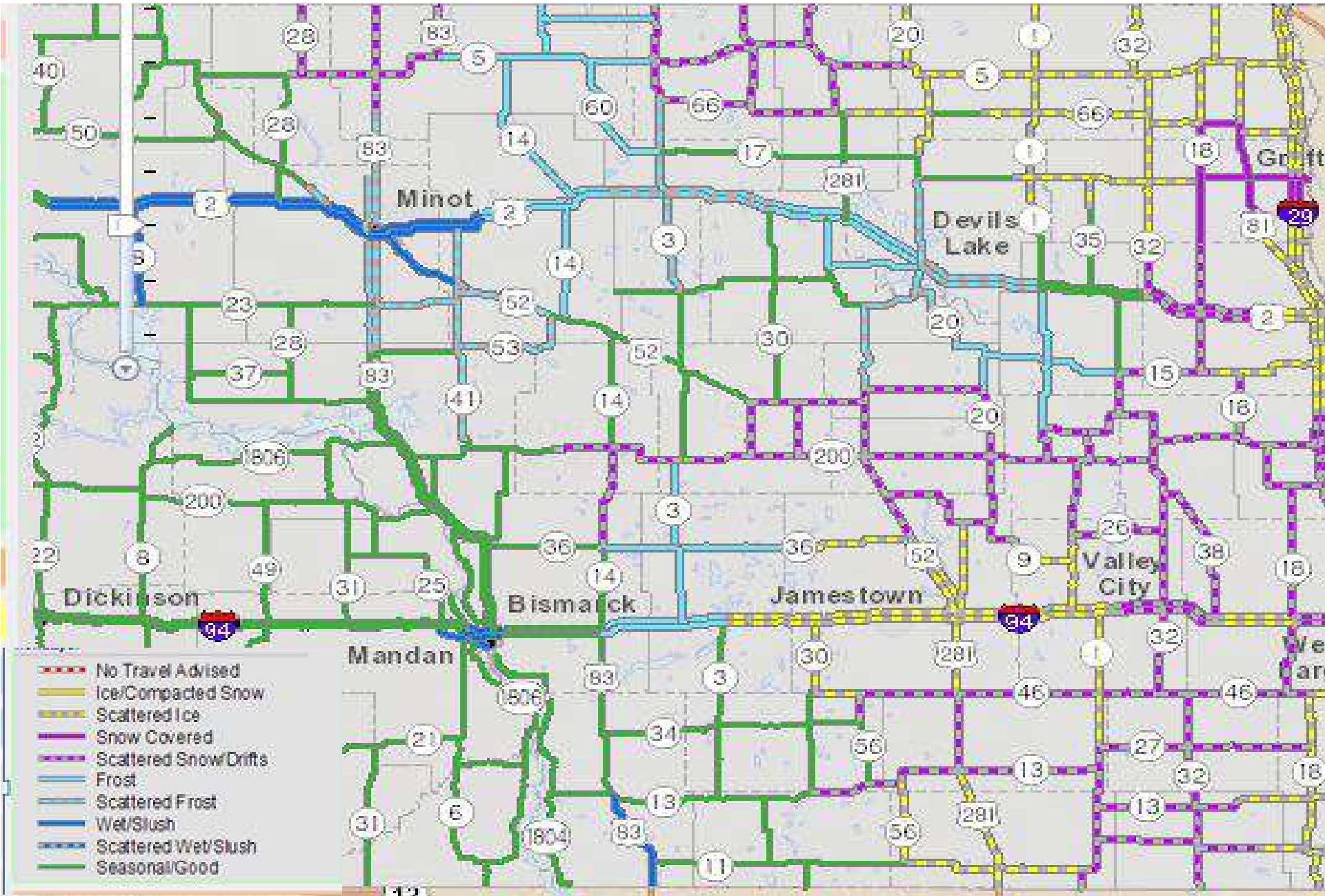
RSC Reporting for Travelers - Ontario



RSC Reporting Scheme
(TAC guideline)



RSC Reporting for Travelers- North Dakota



Limitations

- ❑ Present Road Surface Condition (RSC) classification practices are based on heuristic approach.
- ❑ No risk level is identified for each class of RSCs.
- ❑ Risk levels associated with multiple weather factors are not explained.



Proposed Classification Method

- ❑ **A Risk-based Approach**
- ❑ **Based on a safety model**
- ❑ **Safety model as a function of weather factors, RSC, and traffic level**
- ❑ **Two methods proposed for classifying the overall RSC**

Relative Risk Index (RRI)

Actual condition



RRI =

Good/base condition

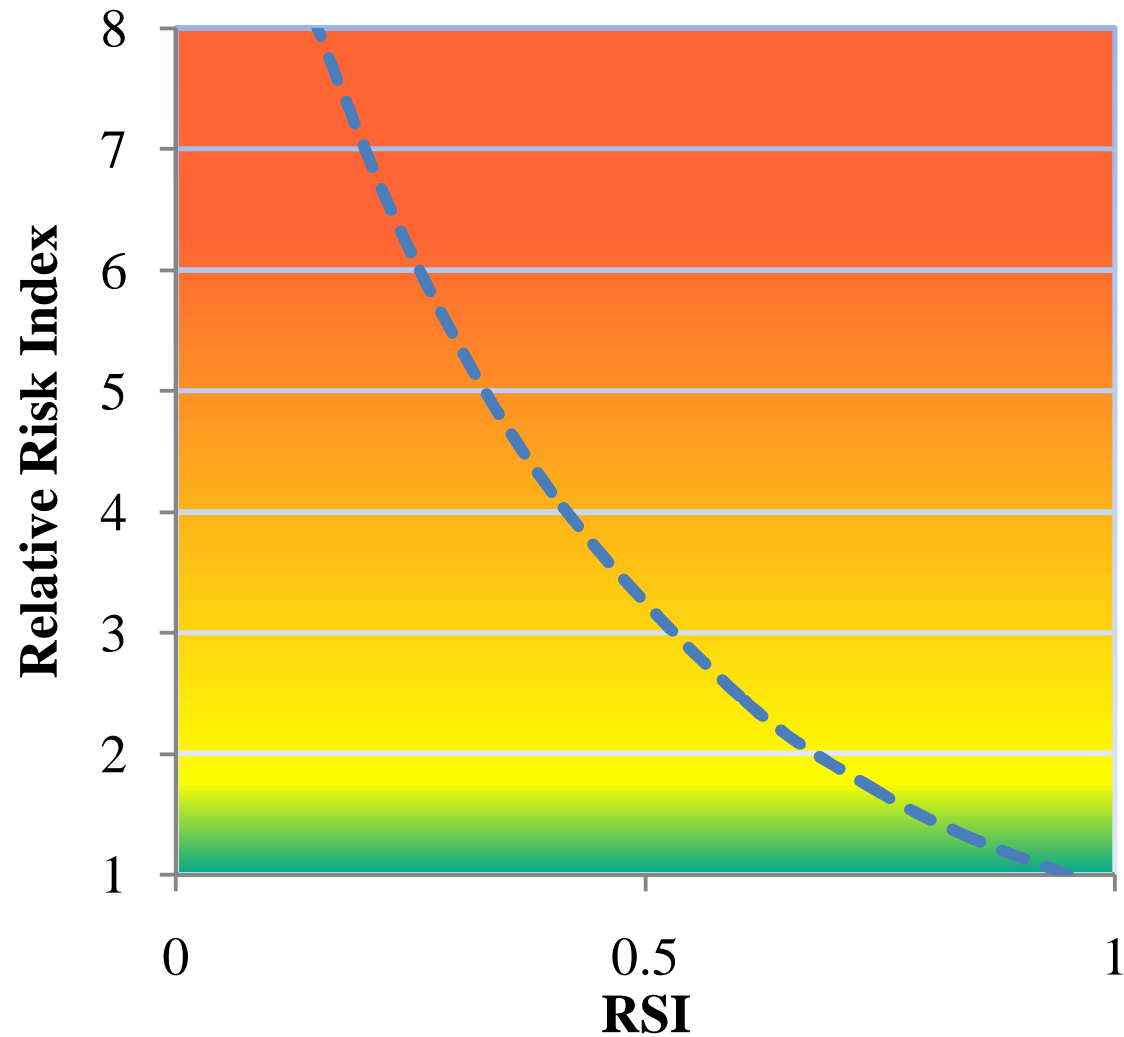


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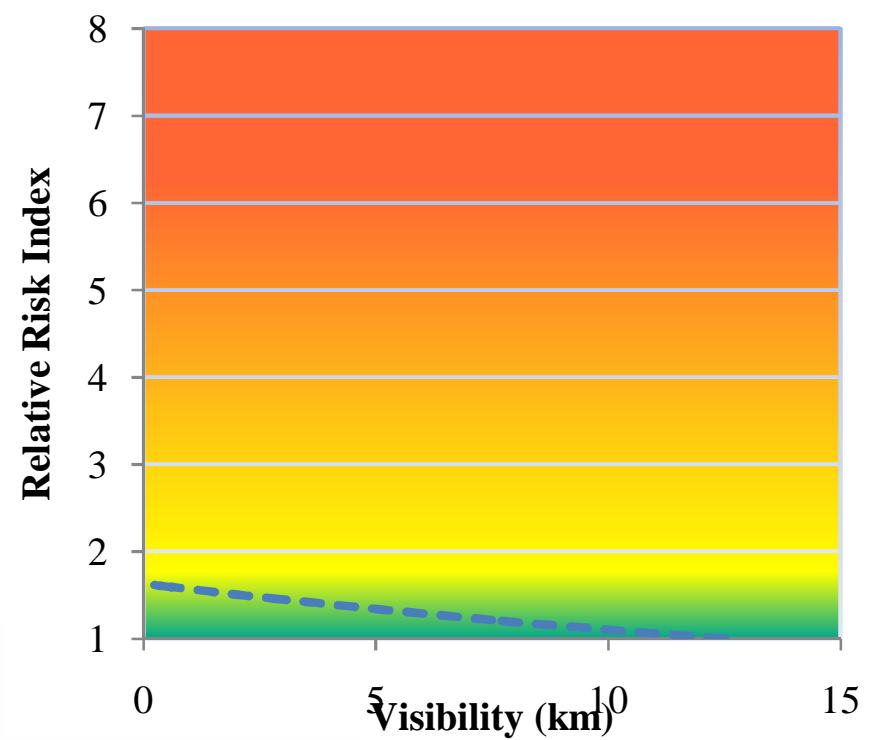
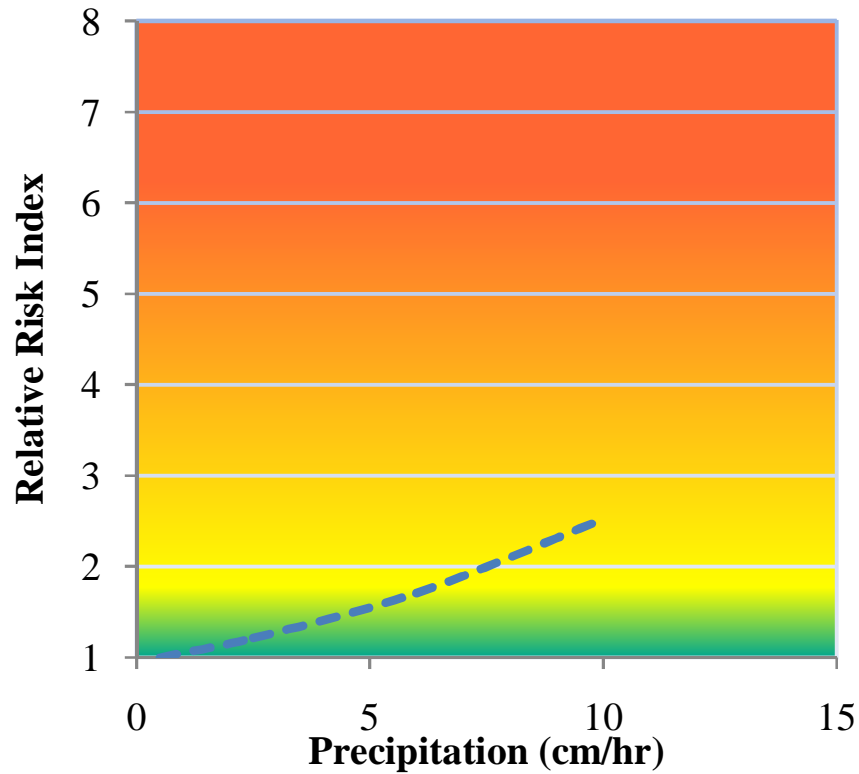
Expected collisions in
a given condition

Expected collisions in
a good condition

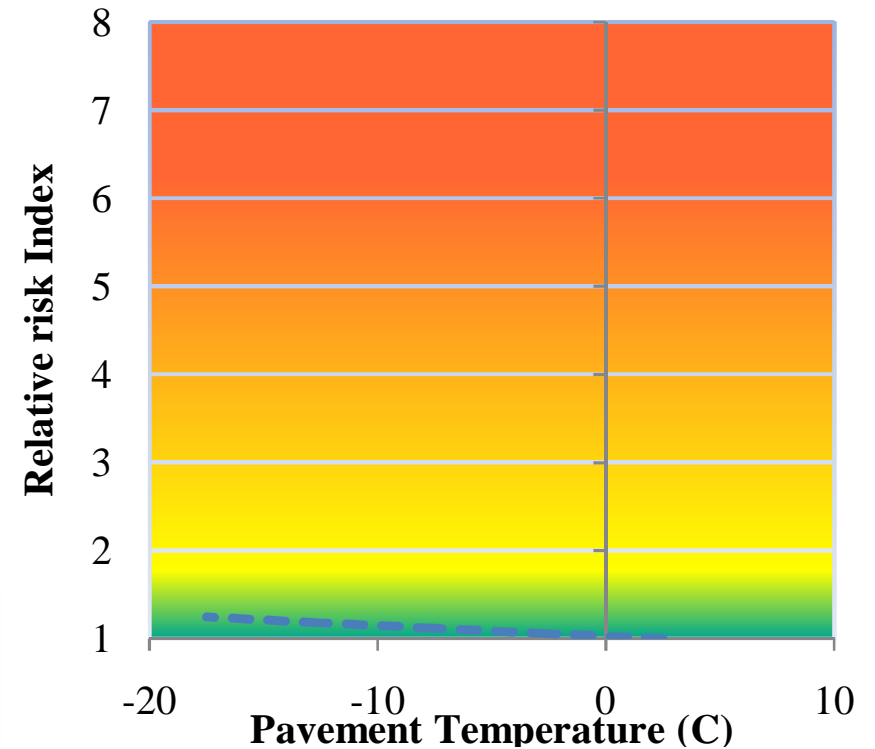
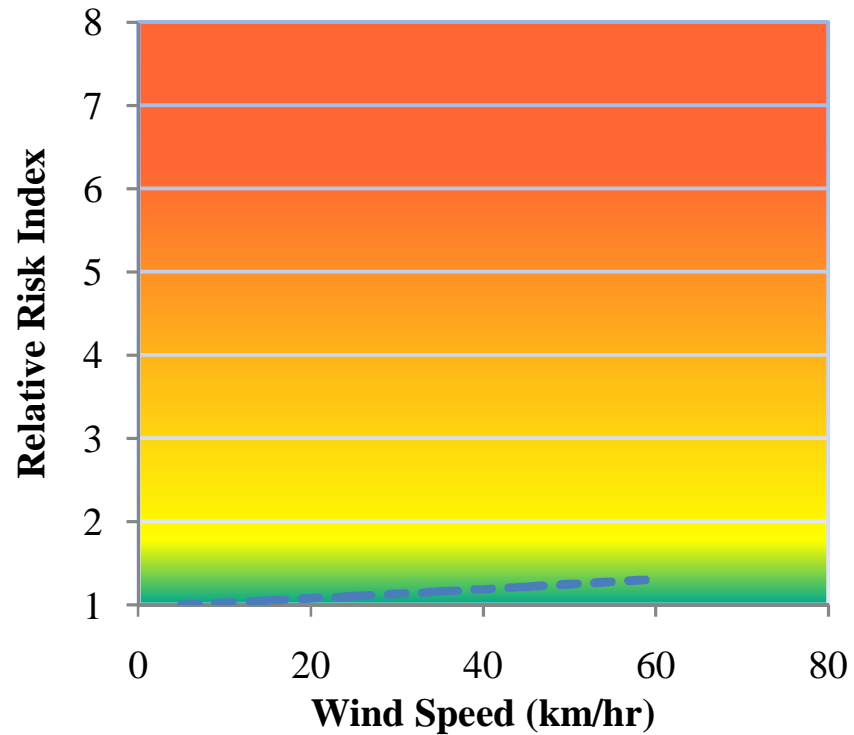
RRI: Road Surface Condition



RRI: Precipitation and Visibility



RRI: Wind Speed and Temperature

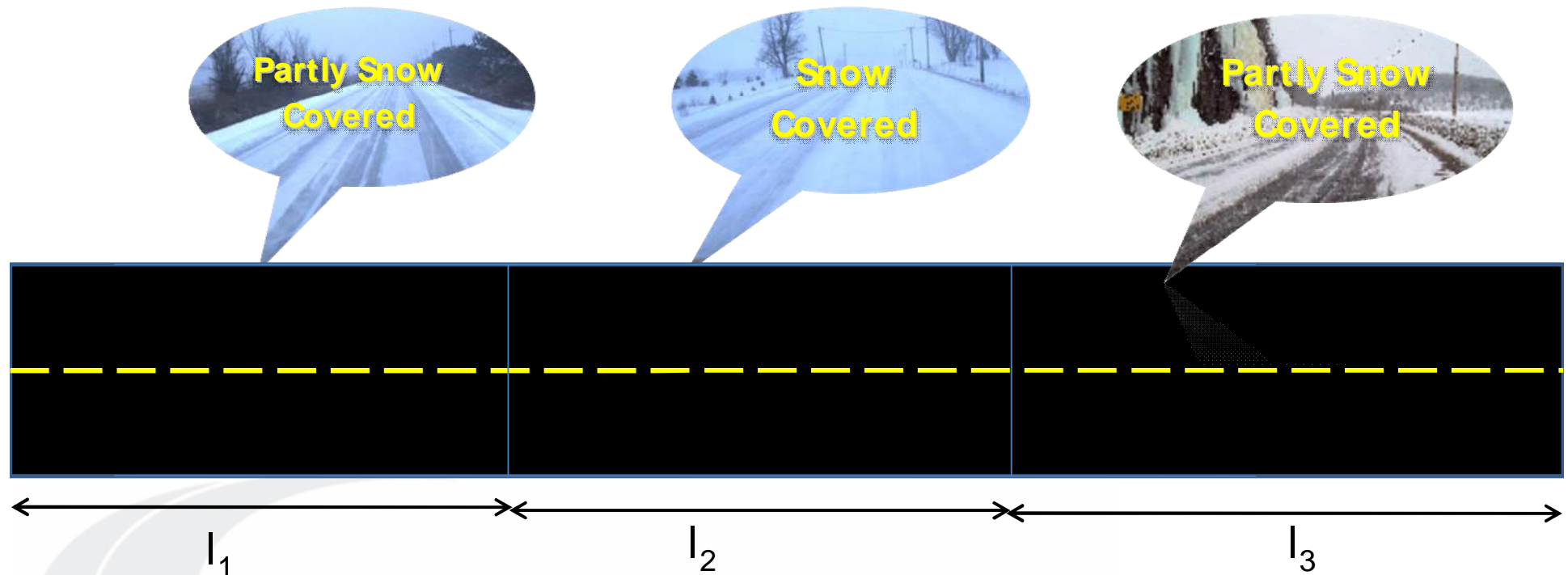


Road Classification Approach for overall Route

- ❑ **Two methods are proposed to compute overall RRI of a route.**
- ❑ **Based on overall RRI of a route, RSC type is identified.**

Road Classification Approach for overall Route

Method 1

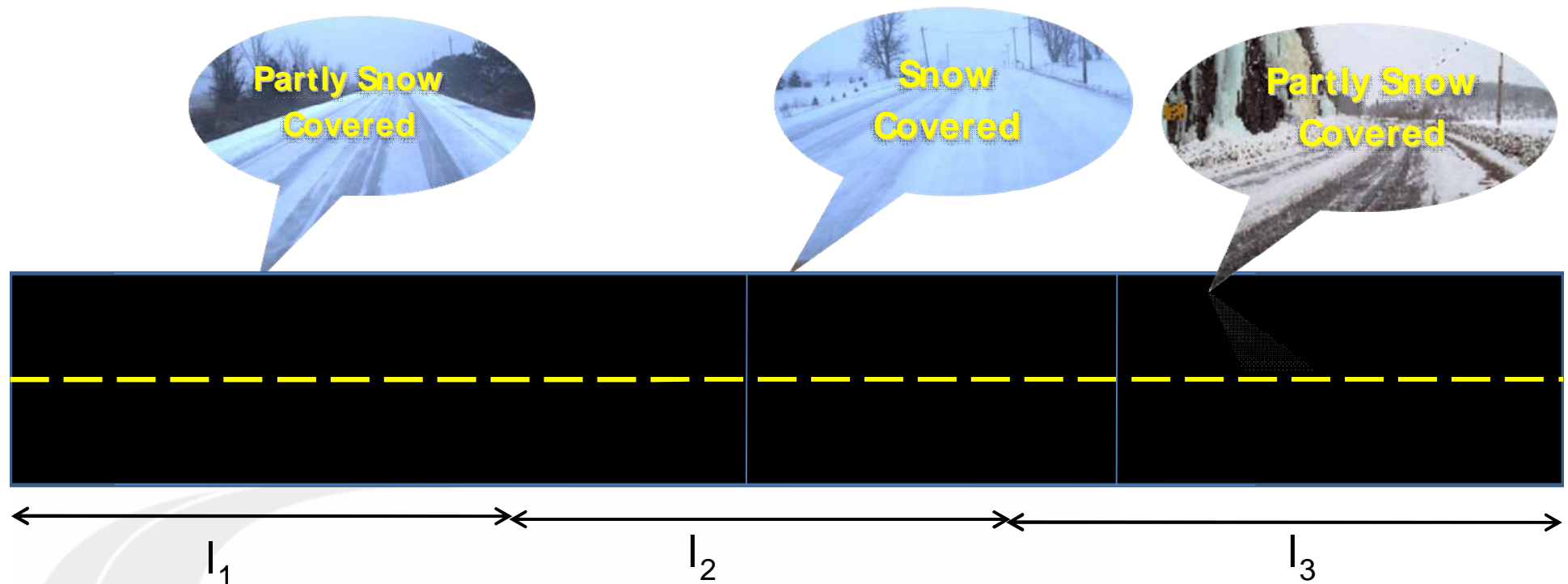


RRI is the length weighted average of all subsections

$$\overline{RRI} = \frac{\sum RRI_i \cdot l_i}{\sum l_i}$$

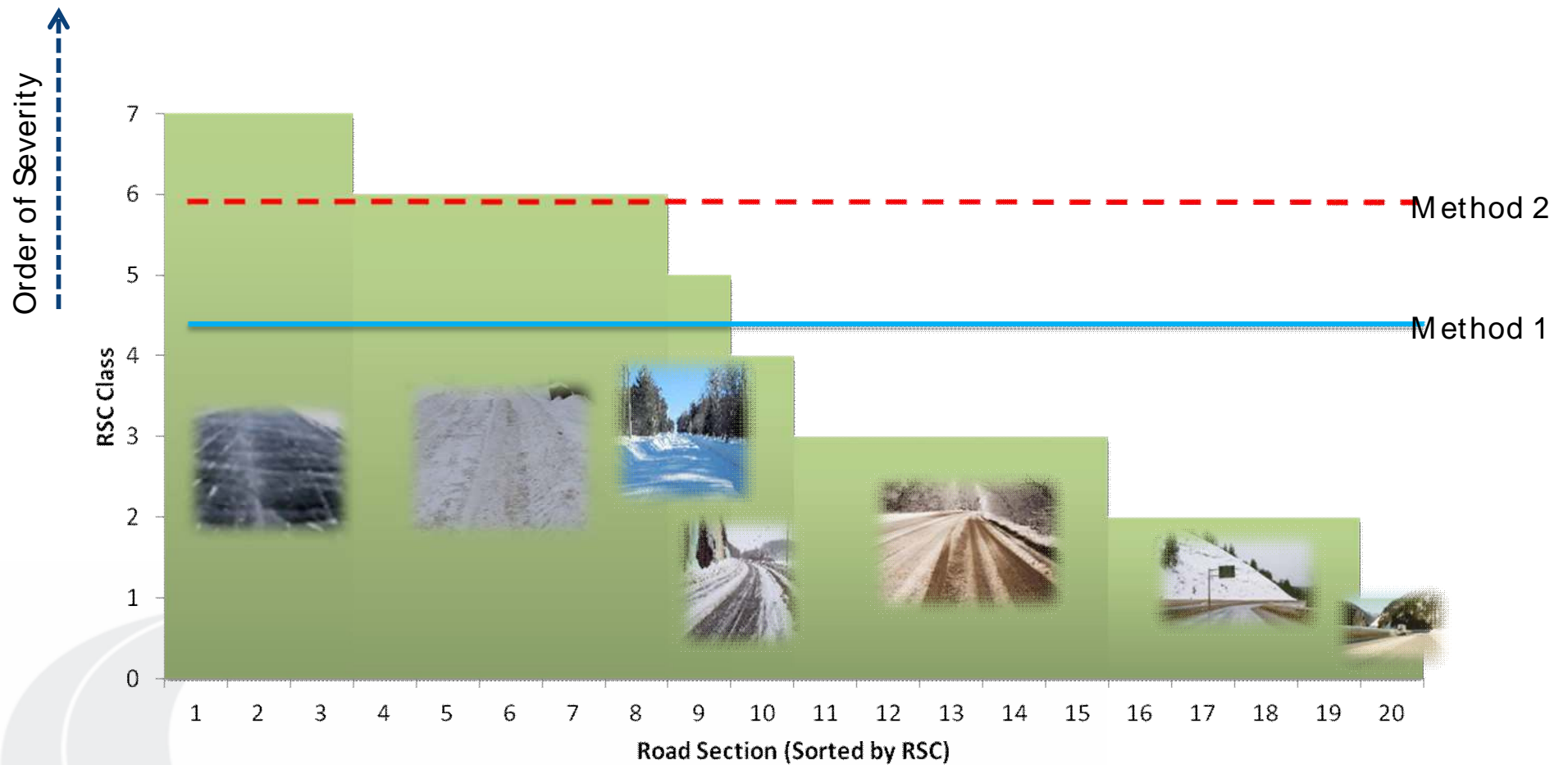
Road Classification Approach for overall Route

Method 2

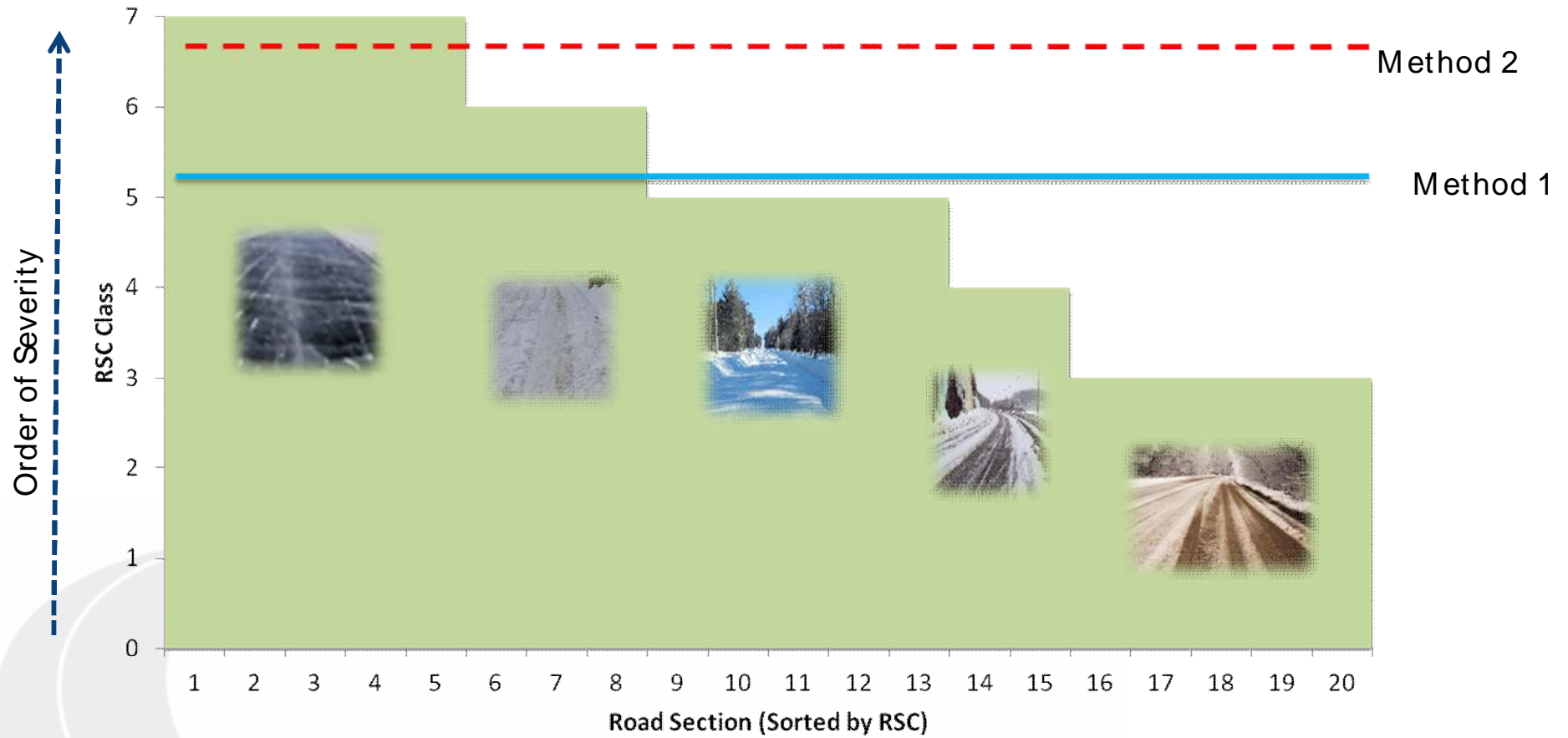


Overall RRI is measured as RRI of dominating subsection

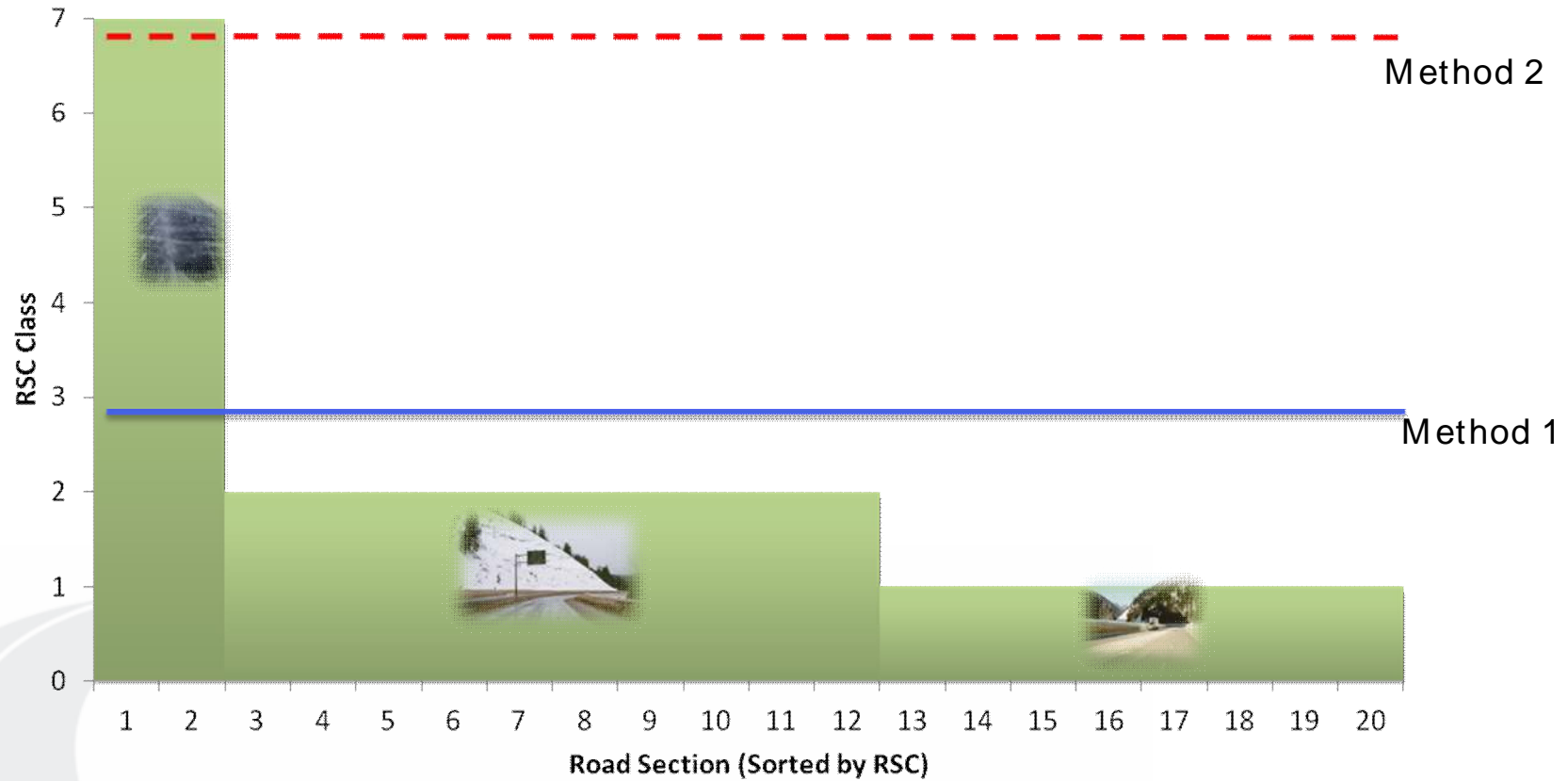
RSC Classification Examples



RSC Classification Examples



RSC Classification Examples



Conclusions

- **A Risk Based Approach** is introduced for classifying and reporting the winter RSCs.
- This proposed method **quantifies the risk** associated with each RSC.
- **Two approaches** are proposed to apply the RRI-based approach for classifying the winter RSC of a highway route.

Thank you!

RSC and corresponding RRI

RSC Type	Description	Road Surface Index (RSI)			Relative Risk Index (RRI)		
		Max	Min	Ave	Max	Min	Ave
1	Bare and Dry	0.9	1	0.95	1.14	0.88	1.00
2	Bare and Wet	0.8	0.9	0.85	1.48	1.14	1.30
3	Slushy	0.7	0.8	0.75	1.91	1.48	1.68
4	Partly Snow Covered	0.5	0.7	0.6	3.21	1.91	2.48
5	Snow Covered	0.3	0.5	0.4	5.40	3.21	4.16
6	Snow Packed	0.2	0.3	0.25	7.00	5.40	6.15
7	Icy	0.05	0.2	0.125	10.3	7.00	8.50