Winter Maintenance Budgeting Based on the Relationship between Winter Severity and Historical Costs

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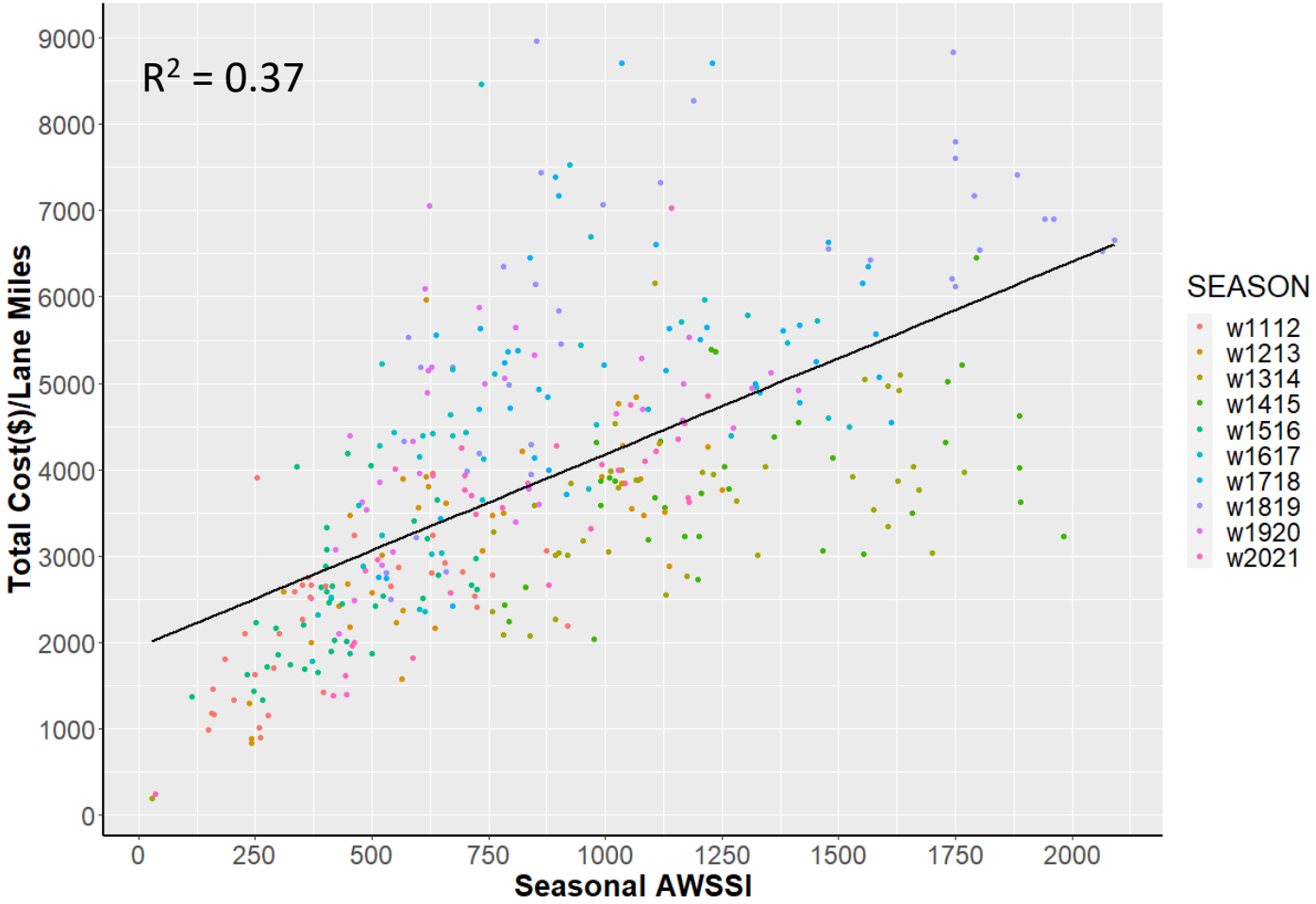
THE UNIVERSITY OF VERMONT
TRANSPORTATION
RESEARCH CENTER

AWSSI Winter Severity Scoring

Points	Daily High Temp		Daily Low Temp		Daily Snowfall		Snow Depth	
	Min	Max	Min	Max	Min	Max	Min	Max
0	33 and above		33 and above		0	0.1	0	1
1	25	33	25	33	0.1	1	1	2
2	20	25	20	25	1	2	2	3
3	15	20	15	20	2	3	3	4
4	10	15	10	15	3	4	4	6
5	5	10	5	10			6	9
6	0	5	0	5	4	5	9	12
7	-5	0	-5	0	5	6	12	15
8	-10	-5	-10	-5			15	18
9	-15	-10	-15	-10	6	7	18	24
10	-20	-15	-20	-15	7	8	24	36

Temporal Resolution



Seasonal Analysis

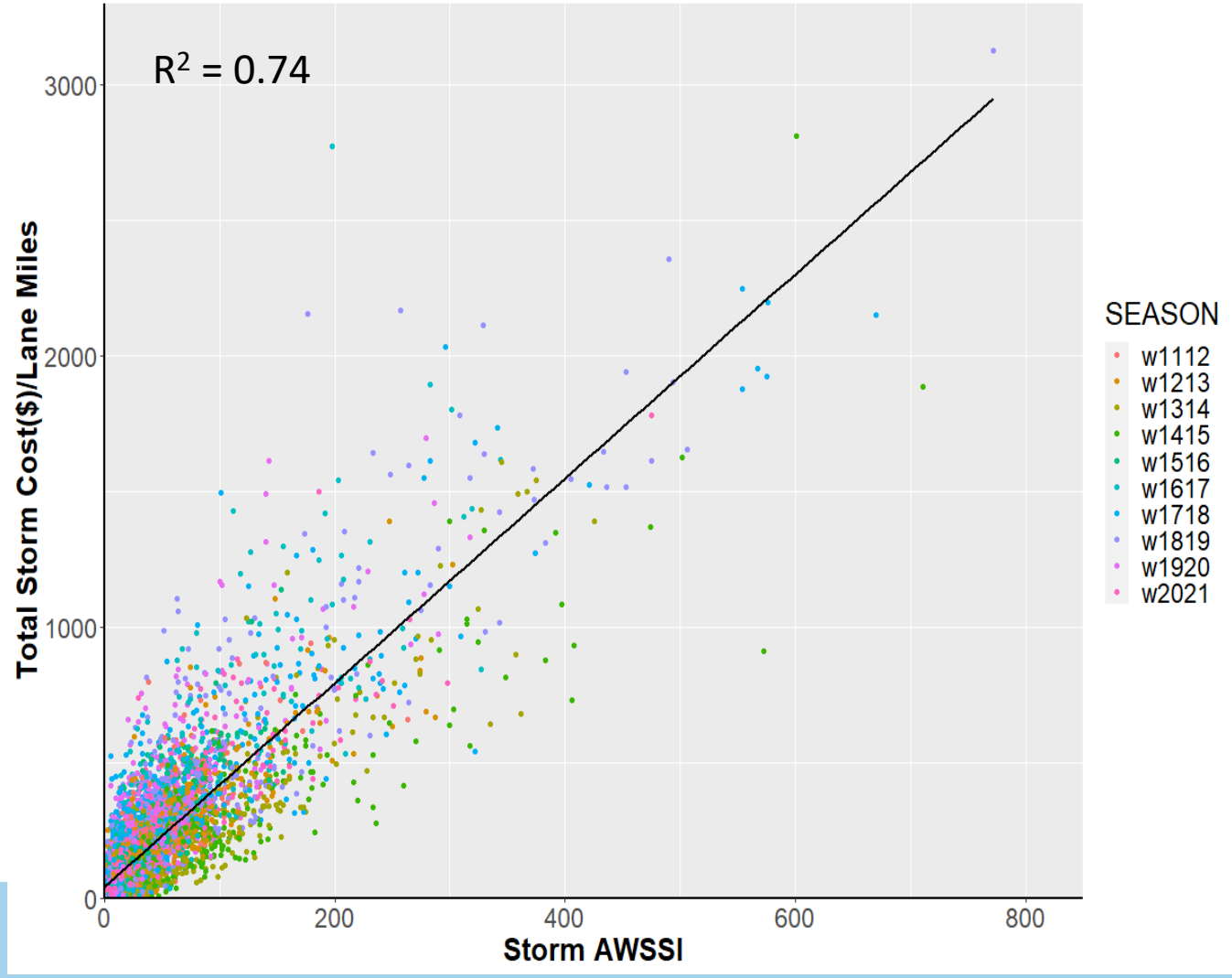
- Initial seasonal analysis for the AWSSI measures only showed modest predictive power
- Each point shows the total seasonal cost and seasonal AWSSI for a single garage, color coded by season

Temporal Resolution

Storm-Event Analysis

- Limit comparison to days with RSIC activity, grouping consecutive days with activity into “storm events”
- Captures pre- and post-precipitation RSIC costs
- Aligns cost and severity of storms that cross multiple days
- Eliminates days with AWSSI points but no snowfall
- Captures higher costs associated with multiday events due to overtime etc.
- Helps smooth minor daily irregularities in the cost data

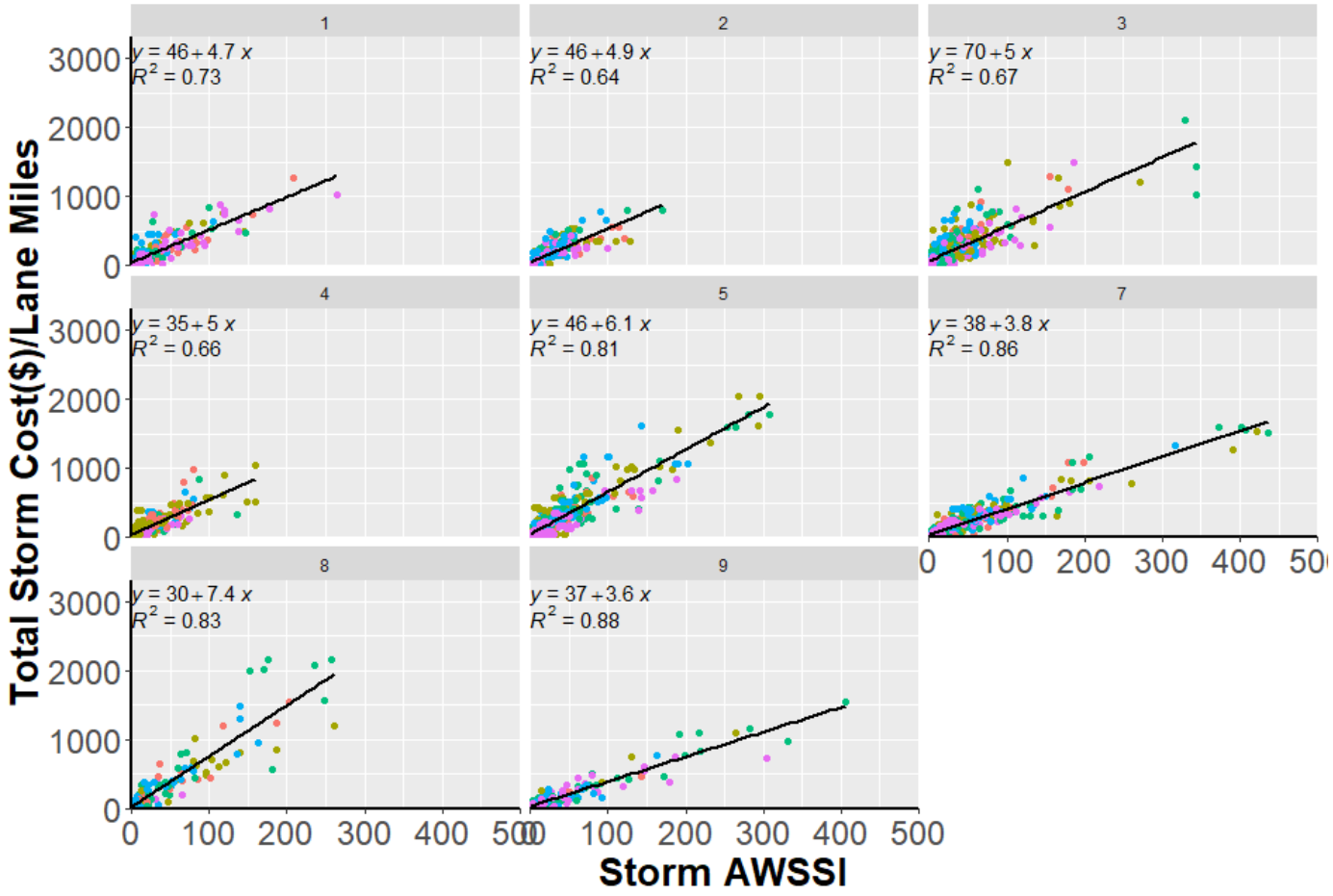
Temporal Resolution

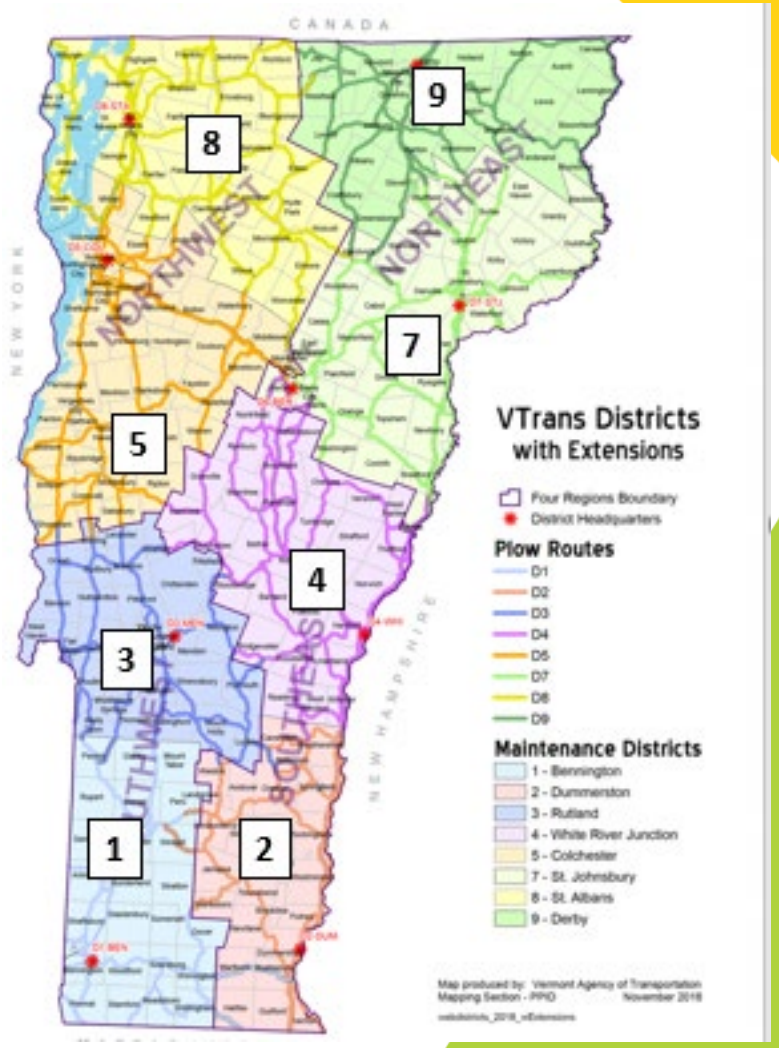


Storm-Event Analysis

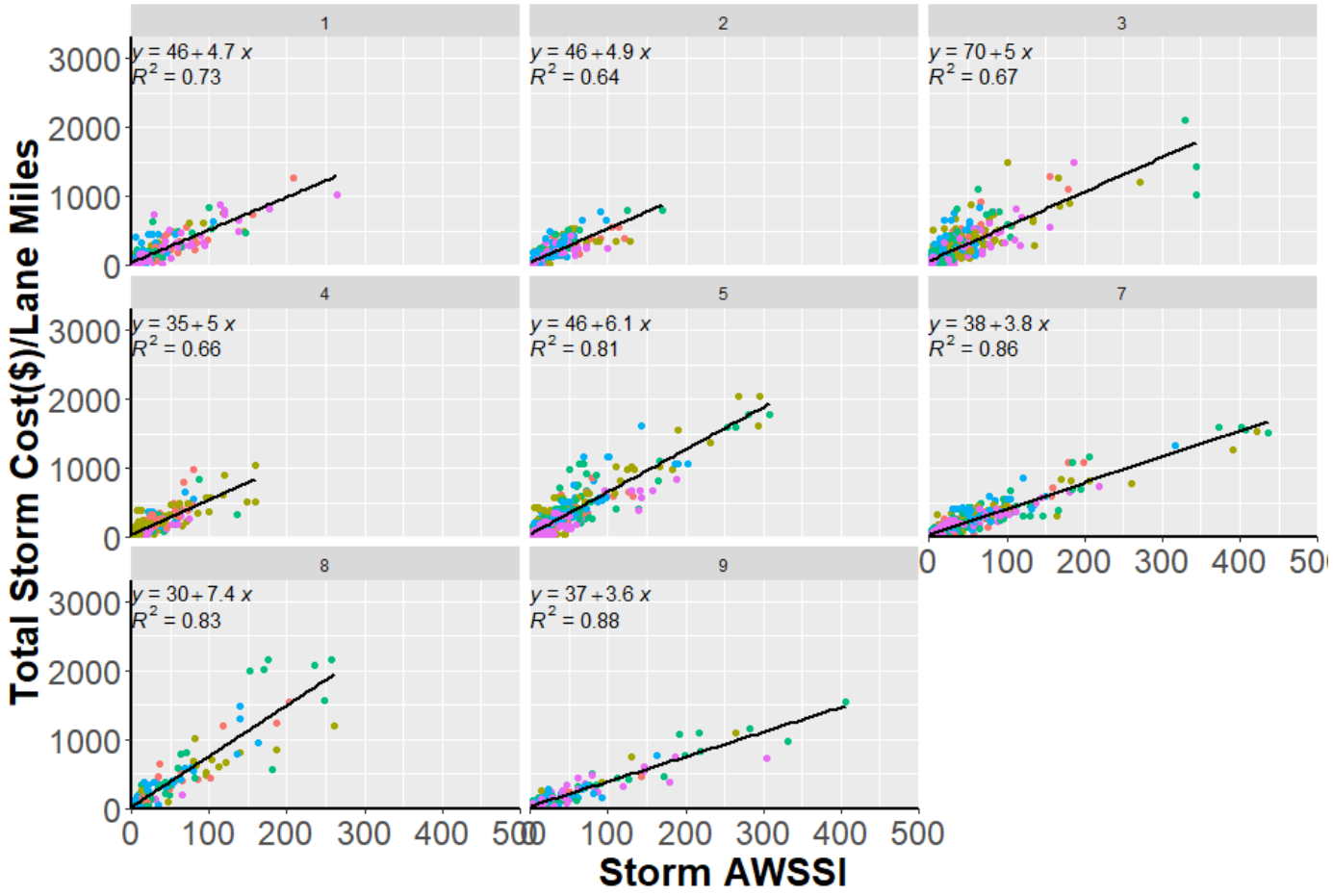
- High predictive power
- Each point shows the total cost and AWSSI score for a single garage for consecutive days of RSIC activity

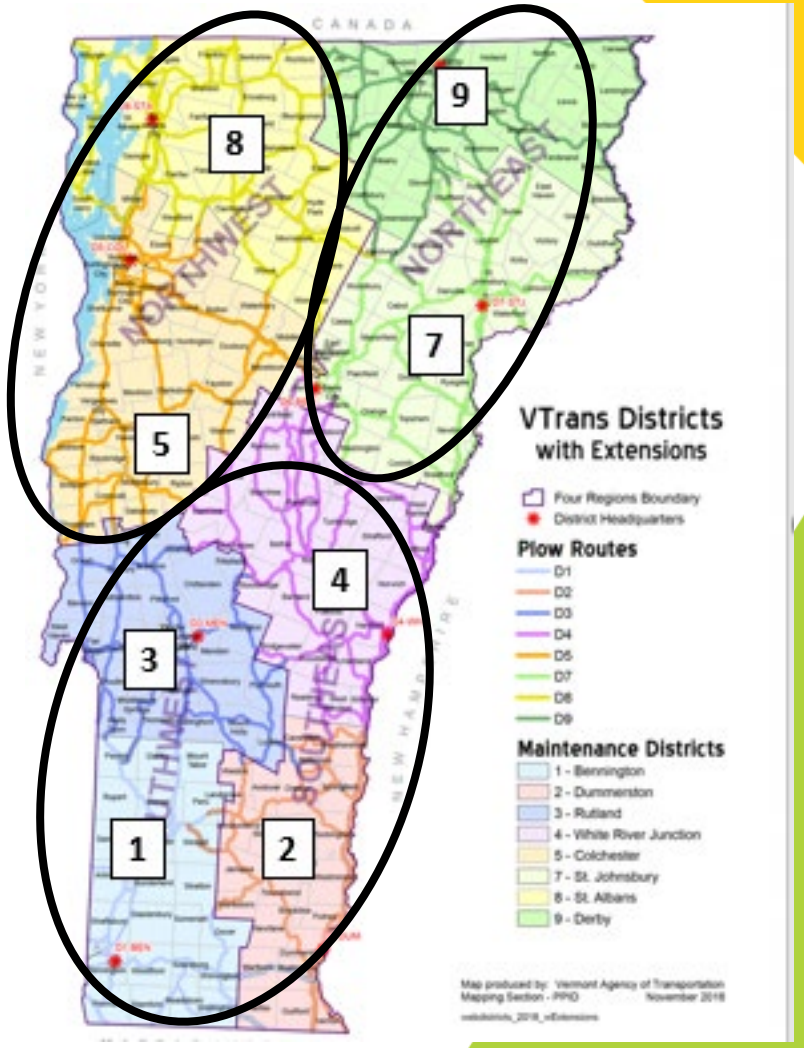
Spatial Resolution



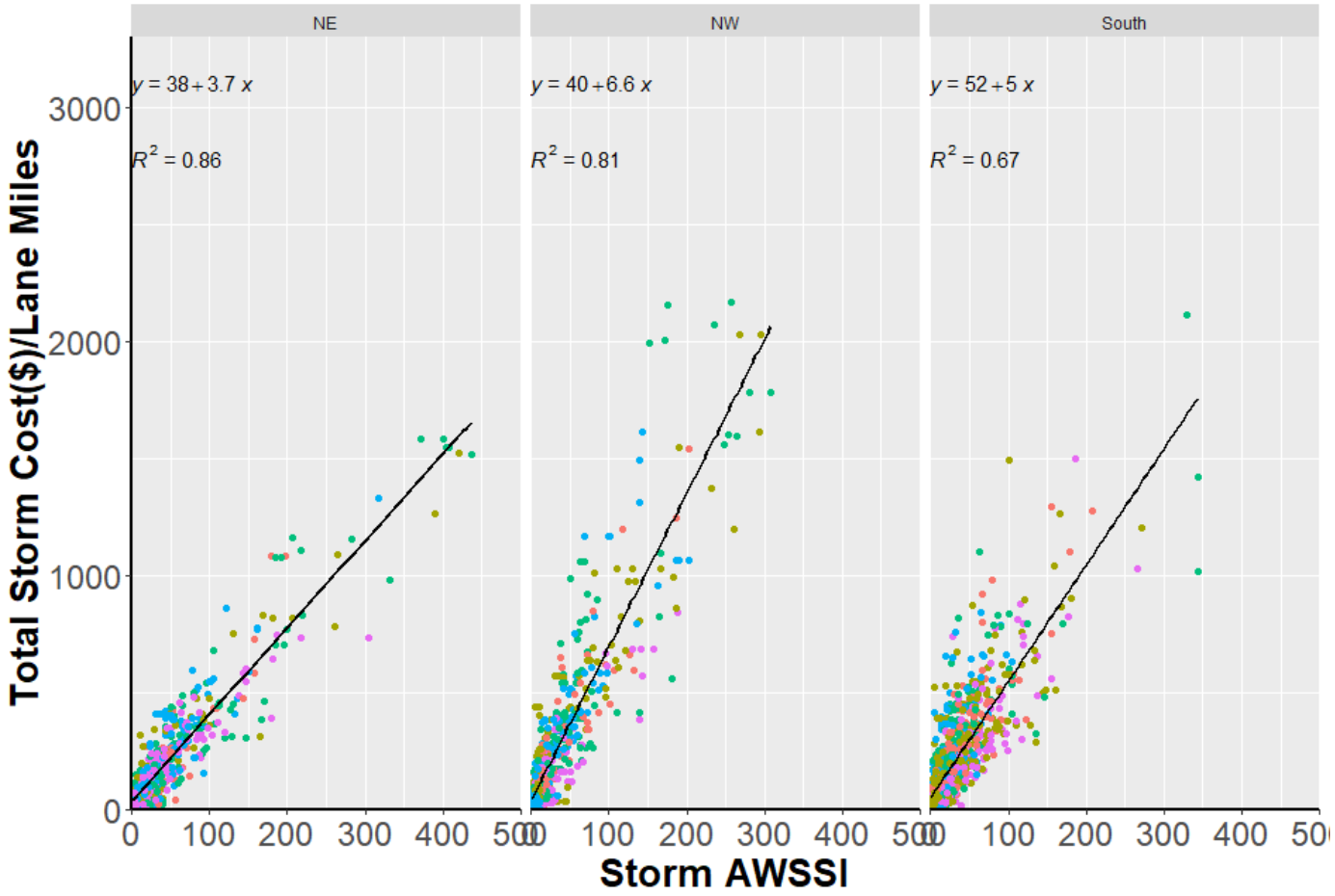


Spatial Resolution





Spatial Resolution



Forecasting Tool

Welcome to the VTrans Winter Simulation and SIC Cost Estimating Tool

Developed by the University of Vermont Transportation Research Center

Description		User Specification	Instructions and guidance
Geographic Extent	Garage or Region	District 7	k the garage or region you are interested in from the list
	Lane-Miles	909.1	is the no. of lane-miles associated with this garage or region
Winter Season Severity	Number of Storms	50	27 is the typical historical number of storms in a season for this geographic
	Average Storm AWSSI	20	44 is the historical average AWSSI for this geographic extent
	Std Dev of Storm AWSSI	40	62 is the historical std. dev. of the AWSSI for this geographic extent
	Max AWSSI	521	is the historical maximum AWSSI for this geographic extent
	Min AWSSI	1	is the historical minimum AWSSI for this geographic extent

Run Simulation

Instructions:

1. Select a garage or region from the dropdown list (in yellow)
2. Enter the frequency and severity of the winter storms for the simulation (light green)
3. Click the "Run Simulation" button and 10,000 winter seasons are simulated according to your specifications.
4. You will be taken to the resulting cost estimates on the "Results" sheet

Forecasting Tool

Estimated Winter Season SIC Costs				
Snow Region	**Average**	**Upper 75th %**	**Lower 25th %**	**Sub-Region**
Northeast	$ 6,558,437	$ 8,422,544	$ 3,792,989	Statewide
Northwest	$ 7,881,269	$ 10,824,219	$ 3,514,716	Statewide
South	$ 14,262,229	$ 18,355,336	$ 8,189,973	Statewide
Statewide Total	$ 28,701,934	$ 37,602,099	$ 15,497,678	

Estimated *Per Lane-Mile* Winter Season SIC Costs				
Snow Region	**Average**	**Upper 75th %**	**Lower 25th %**	**Sub-Region**
Northeast	$ 3,627	$ 4,658	$ 2,098	Statewide
Northwest	$ 4,937	$ 6,780	$ 2,202	Statewide
South	$ 4,852	$ 6,244	$ 2,786	Statewide
Statewide Average	$ 4,524	$ 5,927	$ 2,443	

Notes:

Northeast snow region includes Districts 7 and 9

Northwest snow region includes Districts 5 and 8

South snow region includes Districts 1, 2, 3 and 4

Estimates include an added factor of 2.3% for administrative costs and transfers