Enhancing New Hampshire's Road Infrastructure Management Through SADES RSMS: A GIS-Based Road Surface Condition Assessment and Forecasting Program

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National Pavement Preservation Conference
nppc23
IMPACTS AND BENEFITS FROM PAVEMENT PRESERVATION
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MICHIGAN STATE UNIVERSITY

Overview

- What is SADES?
- Development of SADES Road Surface Management System (RSMS)
- RSMS Process
- Next Steps
- Questions and Discussion

What is SADES?

- Statewide Asset Data Exchange System
- Started in 2014 as a partnership between the University of New Hampshire and the NH Department of Transportation
- Collaboration with other State, regional, and local angencies

What is SADES?

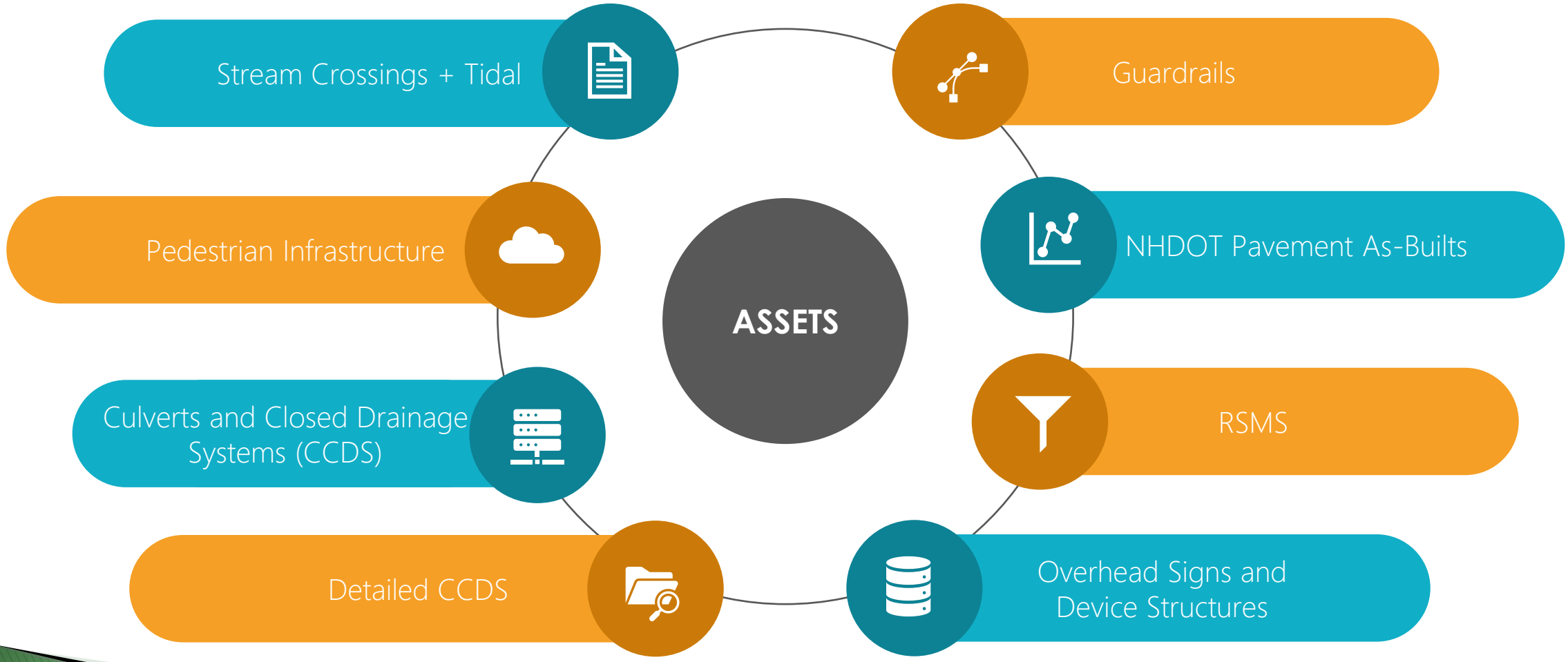
- Funded through NHDOT, 2 year grant cycle
- Develops, hosts, and manages roadside asset inventories.
- Leverages use of mobile/field GIS applications

What is SADES?

- Key Benefits of the SADES Program

  - Reduces duplication of efforts
  - Increases efficiency
  - Supports collaboration
  - Provides sustainability to data storage

What is SADES?



Development of RSMS

- Key Reasons to Develop SADES RSMS

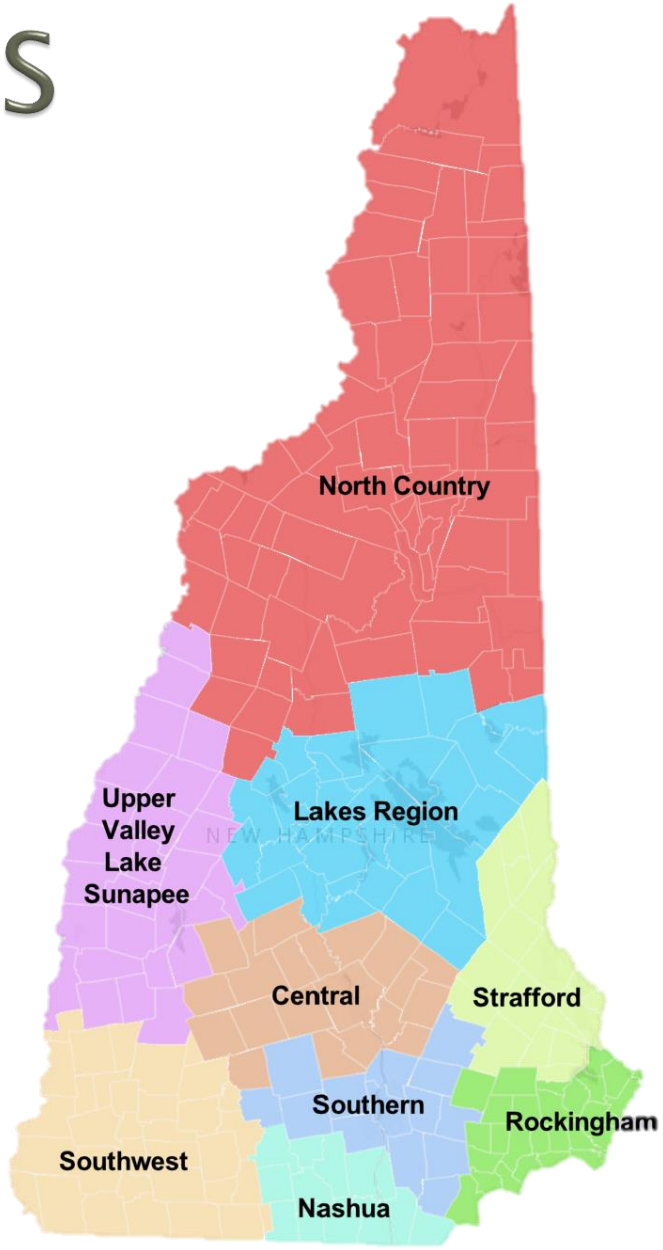
  - Private consultant software
  - Varying other software options
  - Minimal support options
  - Lack of standardization
  - Minimal GIS integration

Development of RSMS

- In 2017 NHDOT funded the development of a standardized RSMS program for all NH communities
- Model built around leveraging the NH Regional Planning Commissions (RPC's) relationship with municipalities
- Add another tool/service for the RPC's to offer the towns

Development of RSMS

- 9 Regional Planning Commissions



Development of RSMS

- Each RPC chose one of their member towns to perform a complete RSMS Assessment
- UNH created the standardized GIS centerline road layer for RPC's to use for collection
- ¼ mile segments for all roads

RSMS Process

COLLECTION

Local Network Inventory and Condition Assessment

- Office verification of local road network
- Field review of road condition assessment
- Based on ¼ mile segments
- Assessment of Severity and Extent of major, regionally significant road surface defects
- All collected on the same Statewide GIS Road network layer

FORECASTING

Forecast Road Repairs and Budgets

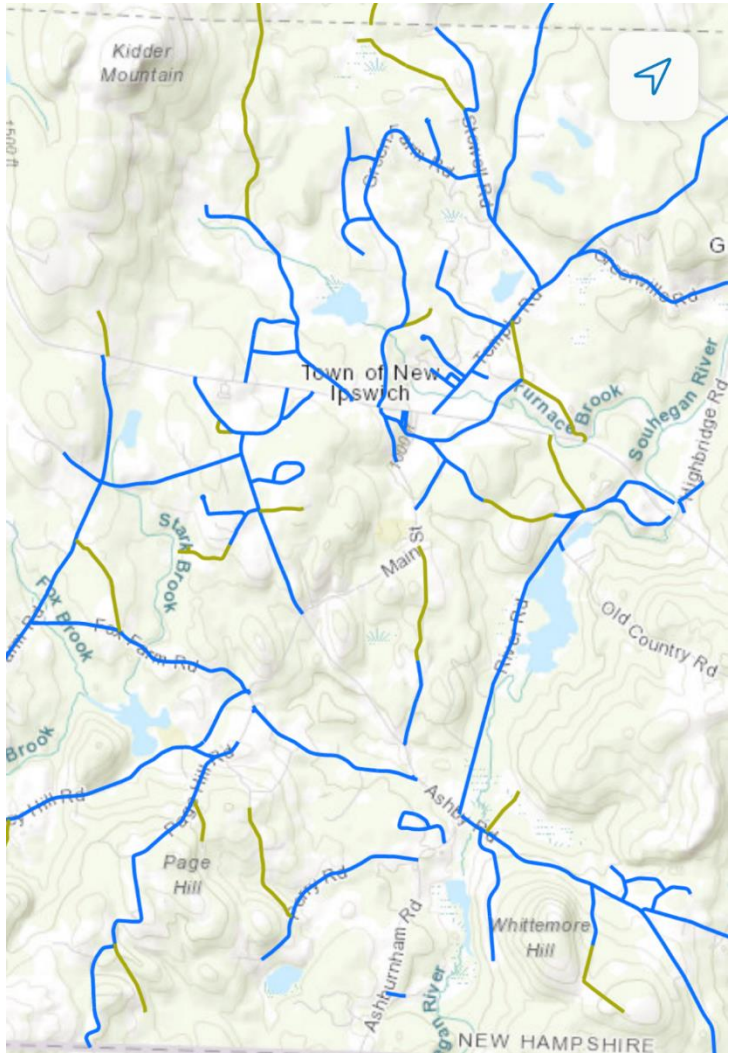
- Perform QA/QC of road network field data
- Export from ArcGIS Online into the SADES RSMS Forecasting program
- Perform up to 10 year road maintenance repair forecasting and associated repair costs
- Compare multiple different plans/scenarios and present options to town/town councils/road agents etc.
- Export reports and figures for presentations and/or final reports

RSMS Process

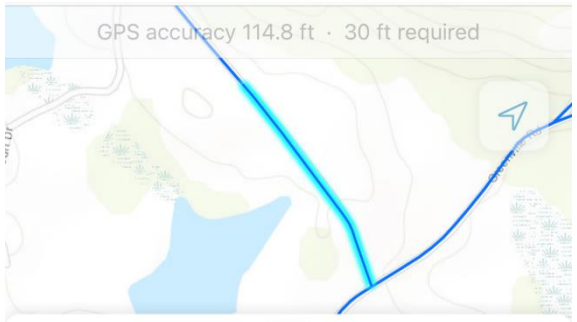
COLLECTION

GIS Assessment

- Using ArcGIS Field Maps, field crews connect directly to the Statewide local road network and complete assessments on mobile tablet for each ¼ mile segment
- Color symbology helps teams keep track of progress and plan future sections
- Multiple passes per ¼ mile segment is recommended to capture all the necessary information including one pass at the posted speed limit



RSMS Process



SADES_RSMS_2017_No_Z: NEW I...
Length 1,321.2 ft
1,130.5 mi

Date
December 14, 2021

Observer/Organization
AS TA SWRPC

Road Name
Temple Rd

Name - Sort
Temple Rd - 5

Road Alias
-

Town Name
NEW IPSWICH

SADES_RSMS_2017_No_Z: NEW I...
Length 1,321.2 ft
1,130.5 mi

Long/Trans Crack Severity
Medium

Long Trans Extent
Low

Alligator Crack Severity
No Defect

Alligator Crack Extent
-

Edge Crack Severity
No Defect

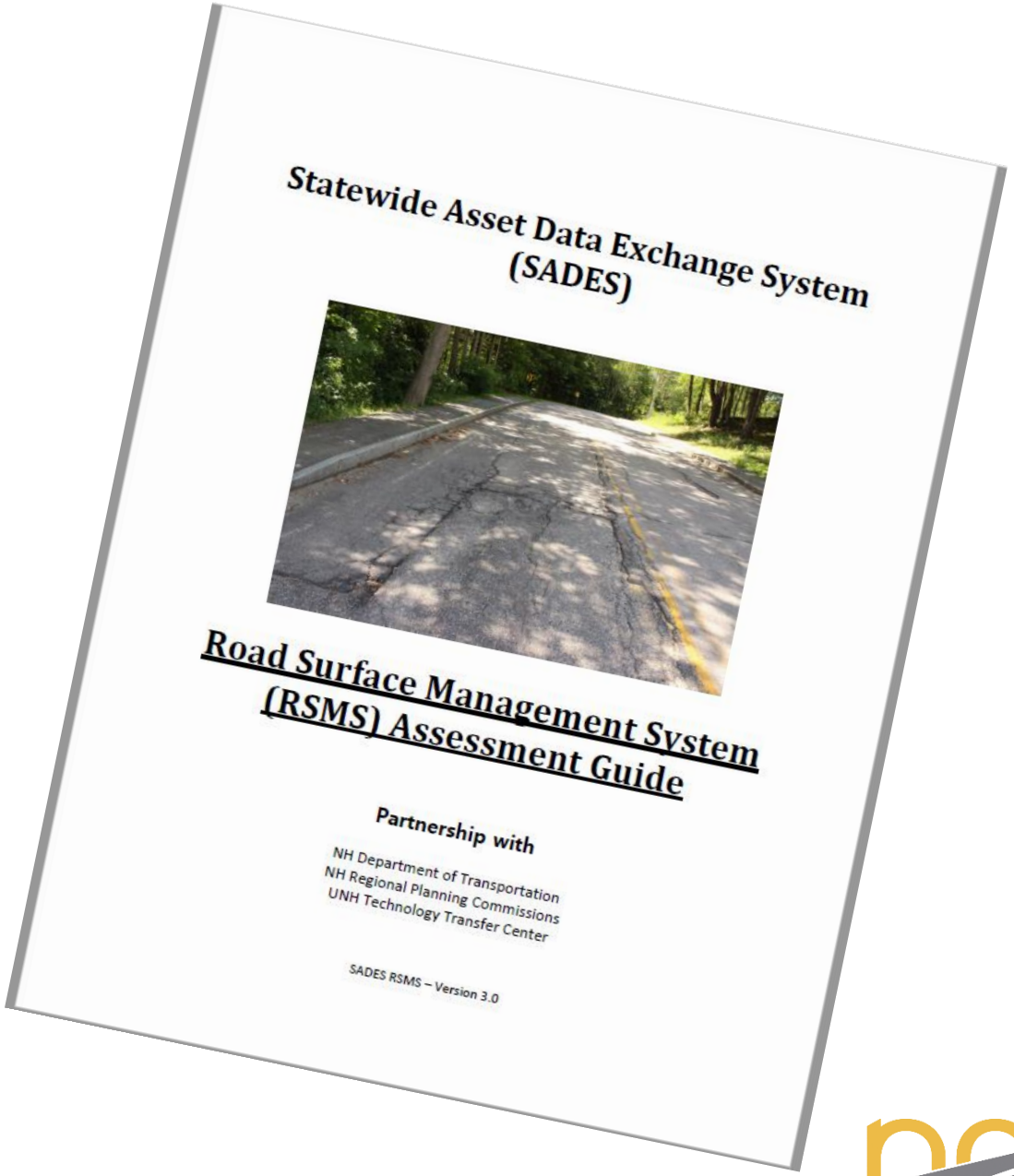
Edge Crack Extent
-

Patching/Potholes Extent
No Defect

Drainage Condtion
Good

RSMS Process

- UNH facilitates all training sessions
- We hold 2-3 training sessions each spring
- We cover:
  - How to properly assess distresses
  - How to use the ArcGIS Field Maps App



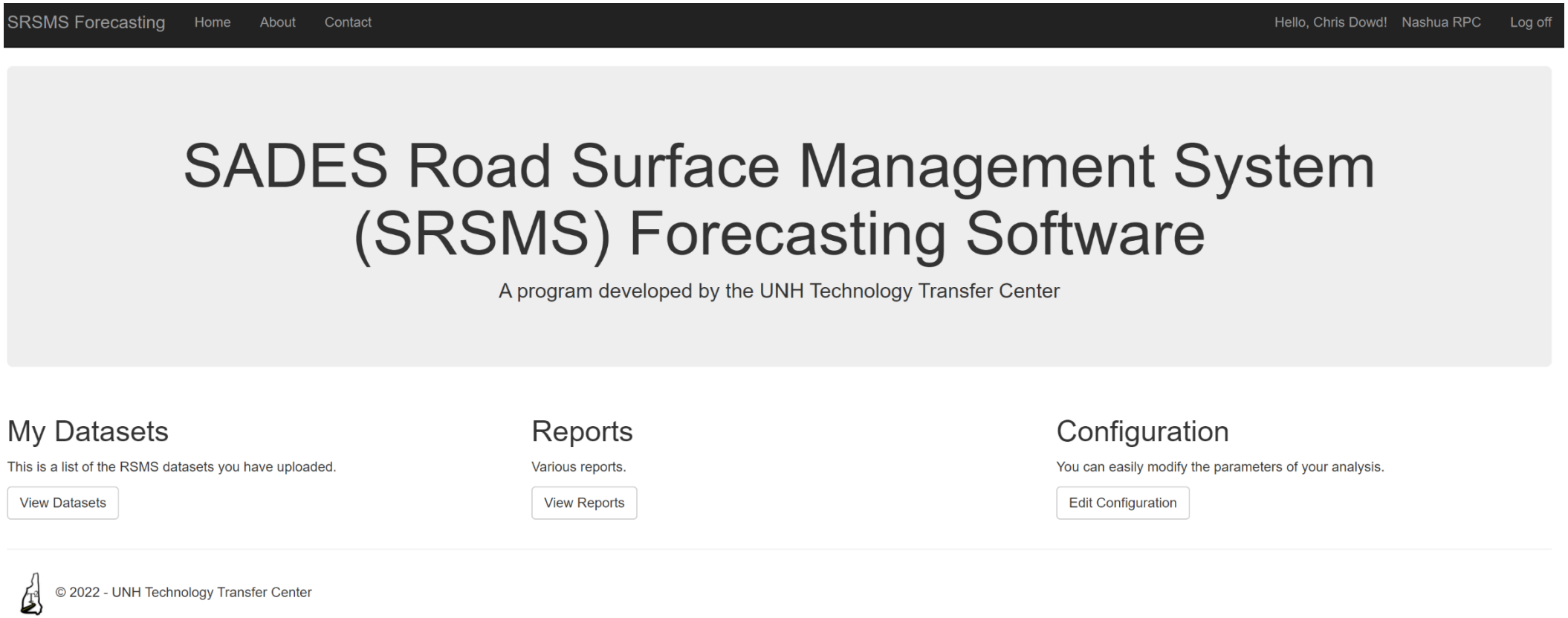
RSMS Process

FORECASTING

Customized Local Road Plan

- Customization of road repair types and unit costs
- Customization of treatment strategies and plans
- Directly linked to ArcGIS Online data, makes for easy exporting/joining for further mapping/analysis
- Comprehensive reports for summarization of analyses
- Web-based program, accessible from any PC, shared accounts withing organizations

RSMS Process



ncpp National Center for Pavement Preservation

npoc23

Analysis

Mason NPPC - Town of Mason - Scenario 1

Filter By Street: Townsend Rd Filter By Surface Type: Paved **Show Selected Segments Only** Clear Selection Show Map Close

Priority	PCI	Street	SADES ID	SRI	Order	Length (ft)	Width (ft)	Lanes	Surface Type	Shoulder Type	Selected Repairs	Selected	
71	88	Townsend Rd	35077	L2930106__	1	1317.696	23	2	Paved	None		☐	Details
72.25	83	Townsend Rd	35070	L2930106__	2	1318.939	23	2	Paved	None		☐	Details
70.5	90	Townsend Rd	35386	L2930106__	3	1319.694	23	2	Paved	None		☐	Details
72.5	82	Townsend Rd	35383	L2930106__	4	1319.582	23	2	Paved	None		☐	Details
71.75	85	Townsend Rd	35939	L2930106__	5	1319.611	22	2	Paved	None		☐	Details
70.75	89	Townsend Rd	36146	L2930106__	6	1318.319	23	2	Paved	None		☐	Details
79.25	83	Townsend Rd	35669	L2930106__	7	1319.92	24	2	Paved	None		☐	Details
78.75	85	Townsend Rd	35289	L2930106__	8	1320.652	23	2	Paved	None		☐	Details
80.25	79	Townsend Rd	34100	L2930106__	9	1970.568	23	2	Paved	None		☐	Details

Previous 1 Next

Network PCI and Repair Cost	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Average PCI Before Repairs	79.14	76.37	73.70	71.12	68.63	66.23	63.91	61.67	59.52	57.43
Average PCI After Repairs	79.14	76.37	73.70	71.12	68.63	66.23	63.91	61.67	59.52	57.43
Total Repair Cost (inflated)										
Total Miles Treated	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

RSMS Process

PCI	Street	SADES ID	SRI	Order	Length (ft)	Width (ft)	Lanes	Surface Type	Shoulder Type	Selected Repairs	Selected	
	Gulf Rd	21181	L1850080__	7	1178.233	17		Unpaved			☐	Details
	Gulf Rd	35969	L2790102__	5	831.9373	17		Unpaved			☐	Details
	Gulf Rd	35972	L2790102__	3	1468.009	17		Unpaved			☐	Details
	Gulf Rd	35974	L2790102__	2	1019.807	17		Unpaved			☐	Details
	Mountain Rd	37589	L2790061__	14	1603.477	20		Unpaved			☐	Details
	Mountain Rd	37592	L2790061__	13	1322.522	20		Unpaved			☐	Details
72	Center Rd	37543	L2790041__	5	1319.798	21	2	Paved	None	2023: 2" Overlay - Lyndeborough 2027: Crack Seal - Lyndeborough 2021	☐	Details
79	Center Rd	37545	L2790041__	4	1319.922	21	2	Paved	None	2023: 2" Overlay - Lyndeborough 2027: Crack Seal - Lyndeborough 2021	☐	Details
81	Center Rd	37187	L2790041__	9	1318.921	21	2	Paved	None	2024: 2" Overlay - Lyndeborough 2028: Crack Seal - Lyndeborough 2021	☐	Details
82	Center Rd	37194	L2790041__	7	1320.378	21	2	Paved	None	2024: 2" Overlay - Lyndeborough 2028: Crack Seal - Lyndeborough 2021	☐	Details
85	Center Rd	37191	L2790041__	8	1319.8	21	2	Paved	None	2024: 2" Overlay - Lyndeborough 2028: Crack Seal - Lyndeborough 2021	☐	Details
85	Center Rd	37590	L2790041__	2	1320.307	21	2	Paved	None	2023: 2" Overlay - Lyndeborough 2027: Crack Seal - Lyndeborough 2021	☐	Details
85	Center Rd	37645	L2790041A_	13	1319.865	22	2	Paved	None	2028: 2" Overlay - Lyndeborough	☐	Details
87	Center Rd	36431	L2790041A_	12	1319.682	22	2	Paved	None	2024: 2" Overlay - Lyndeborough	☐	Details
87	Center Rd	37197	L2790041__	6	1321.219	21	2	Paved	None	2023: 2" Overlay - Lyndeborough 2027: Crack Seal - Lyndeborough 2021	☐	Details
90	New Rd	36988	L2790072__	12	1792.817	19	2	Paved	None	2022: 1.5" Overlay - Lyndeborough 2025: Crack Seal - Lyndeborough 2021	☐	Details
90	New Rd	36990	L2790072__	11	1319.4	19	2	Paved	None	2022: 1.5" Overlay - Lyndeborough 2025: Crack Seal - Lyndeborough 2021	☐	Details
90	Center Rd	37141	L2790041__	11	1279.74	21	2	Paved	None	2024: 2" Overlay - Lyndeborough 2028: Crack Seal - Lyndeborough 2021	☐	Details
90	Center Rd	37638	L2790041A_	15	1045.401	22	2	Paved	None	2028: 2" Overlay - Lyndeborough	☐	Details
90	Center Rd	37642	L2790041A_	14	1319.89	22	2	Paved	None	2028: 2" Overlay - Lyndeborough	☐	Details

RSMS Process

Year	Street	Order ID	Repair Category	Repair	Miles Treated	Cost
2022	2Nd Nh Tpke	1	Overlays	1.5" Overlay #2 - Lyndeborough	0.25	$21,528
	2Nd Nh Tpke	2	Overlays	1.5" Overlay #2 - Lyndeborough	0.25	$21,531
	2Nd Nh Tpke	3	Overlays	1.5" Overlay #2 - Lyndeborough	0.25	$21,488
	2Nd Nh Tpke	4	Overlays	1.5" Overlay #2 - Lyndeborough	0.25	$21,490
	2Nd Nh Tpke	5	Overlays	1.5" Overlay #2 - Lyndeborough	0.26	$22,608
	Mountain Rd	15	Rehabilitate and Rebuild	FDR + 2" Pave - Lyndeborough	0.20	$30,145
	New Rd	11	Overlays	1.5" Overlay - Lyndeborough	0.25	$17,989
	New Rd	12	Overlays	1.5" Overlay - Lyndeborough	0.34	$24,444
	Osgood Rd	1	Crack Sealing	Crack Seal - Lyndeborough 2021	0.14	$808
	Osgood Rd	1	Overlays	1.5" Overlay - Lyndeborough	0.14	$12,550
				Total for Year 2022	2.32	$194,582
2023	Center Rd	1	Overlays	2" Overlay - Lyndeborough	0.25	$27,543
	Center Rd	2	Overlays	2" Overlay - Lyndeborough	0.25	$27,590
	Center Rd	3	Overlays	2" Overlay - Lyndeborough	0.25	$27,582
	Center Rd	4	Overlays	2" Overlay - Lyndeborough	0.25	$27,582
	Center Rd	5	Overlays	2" Overlay - Lyndeborough	0.25	$27,579
	Center Rd	6	Overlays	2" Overlay - Lyndeborough	0.25	$27,609
				Total for Year 2023	1.50	$165,484
2024	Center Rd	7	Overlays	2" Overlay - Lyndeborough	0.25	$28,695
	Center Rd	8	Overlays	2" Overlay - Lyndeborough	0.25	$28,682
	Center Rd	9	Overlays	2" Overlay - Lyndeborough	0.25	$28,663
	Center Rd	10	Overlays	2" Overlay - Lyndeborough	0.25	$28,666
	Center Rd	11	Overlays	2" Overlay - Lyndeborough	0.24	$27,812
	Center Rd	12	Overlays	2" Overlay - Lyndeborough	0.25	$30,046
				Total for Year 2024	1.49	$172,564
2025	Citizens Hall Rd	1	Overlays	1.5" Overlay - Lyndeborough	0.12	$11,784
	Glass Factory Rd	1	Rehabilitate and Rebuild	FDR + 2" Pave - Lyndeborough	0.25	$34,915
	Glass Factory Rd	2	Rehabilitate and Rebuild	FDR + 2" Pave - Lyndeborough	0.21	$29,622
	New Rd	11	Crack Sealing	Crack Seal - Lyndeborough 2021	0.25	$1,303

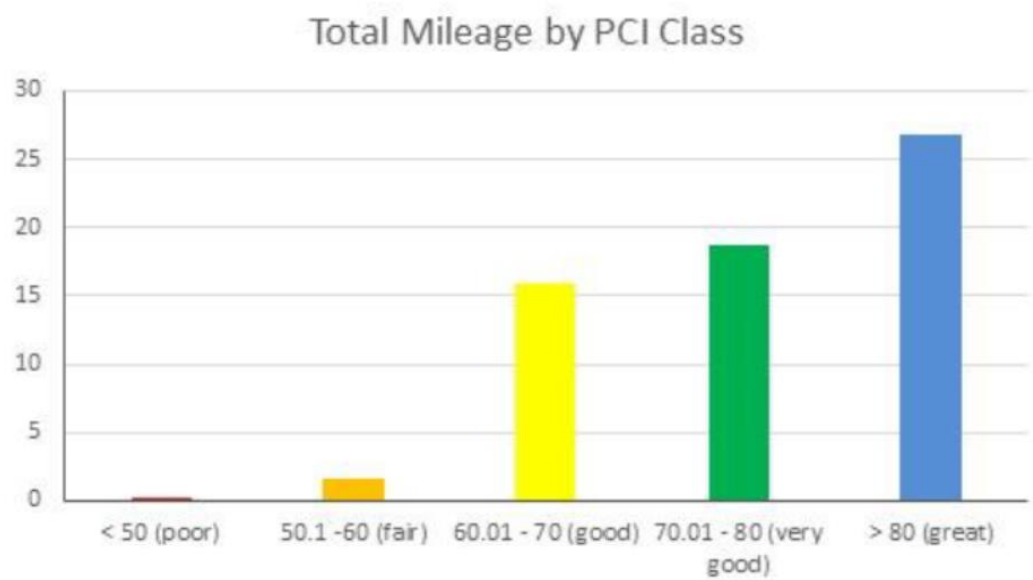
Report Examples

6.0 RSMS SOFTWARE & PAVEMENT CONDITON INDEX

The RSMS software uses inventory information and field data to assign an overall rating of pavement condition that is referred to as the pavement condition index (PCI). Roads scored with a PCI of greater than 80 are considered "great". Roads with a PCI less than 50 are considered "poor". All other values represent "fair", "good" or "very good" conditions. According to the PCI, a significant percentage of Litchfield's pavements are in "great" condition. At the time of assessment, 26.8 miles (42.4%) were in "great" condition. Less than 1 mile (0.3%) "poor" condition, 1.6 miles (2.6%) were in "fair", 15.9 miles (25.1%) were in "good" condition and 18.7 miles (29.6%) were in "very good" condition.

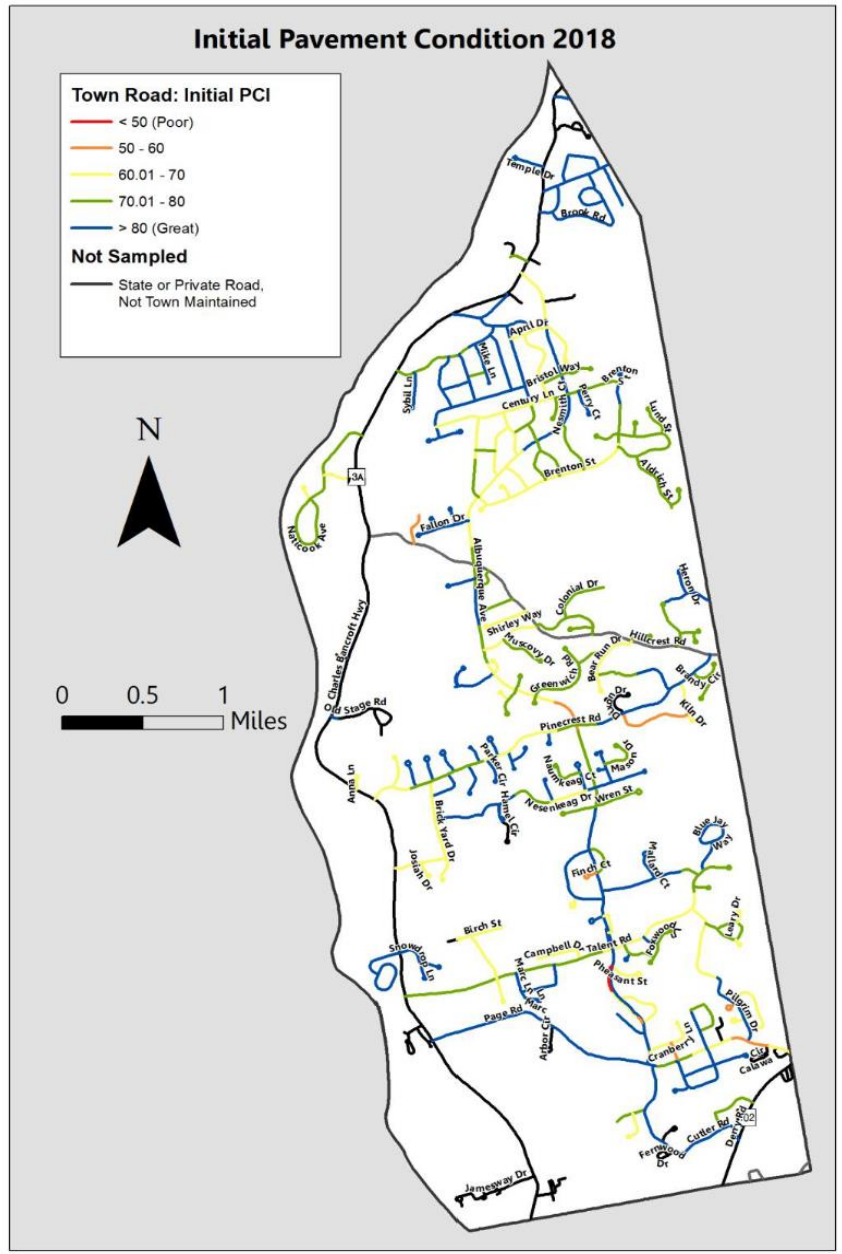
PCI Class	Total Mileage by PCI Class	%
< 50 (poor)	0.2	0.3%
50.1 -60 (fair)	1.6	2.6%
60.01 - 70 (good)	15.9	25.1%
70.01 - 80 (very good)	18.7	29.6%
> 80 (great)	26.8	42.4%
Total	63.2	100%

FIGURE 3: INITIAL PAVEMENT CONDITION CATEGORIES BY MILEAGE



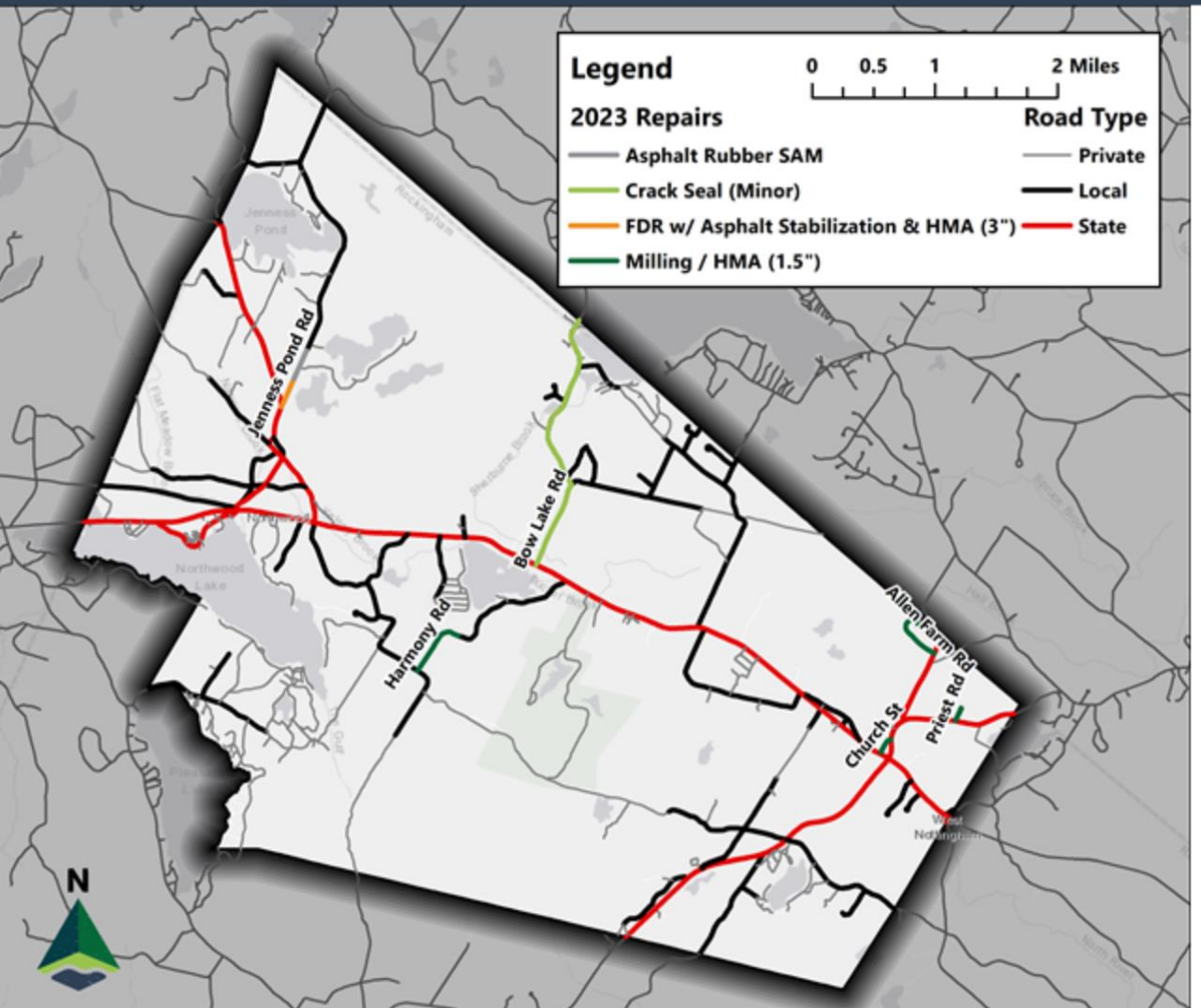
7.0 PAVEMENT CONDITON MAP

FIGURE 4: INITIAL PAVEMENT CONDITION MAP



STRAFFORD
Regional Planning Commission

2023



Average PCI After Repairs	80.15
Average PCI Without Repairs	71.57
Total Miles Treated	4.10
Total Repair Cost	$213,730

Crack Seal (Minor)	$4,922
FDR w/ Asphalt Stabilization and HMA	$51,395
Milling / HMA (1.5")	$134,162
Asphalt Rubber SAM	$13,079
Total	$213,730

Roads Treated:

Allen Farm Road
Bow Lake Road
Church Street
Harmony Road
Jenness Pond Road
Priest Road

Since 2017:

- 64 towns have participated in a RSMS study
- All 9 RPC's are currently active participants
- Over 2,200 miles of local road have been assessed

- 8 towns have had reassessments performed

Next Steps for SADES RSMS

Statewide ArcGIS Dashboard Application

- Currently in a pilot test stage for RPC's to use for town meetings or data review

- Live demo:
  - https://nhsades.maps.arcgis.com/apps/dashboards/a187b498796b4758beb67913a56f7c35

SADES RSMS Dashboard

Filter by Town
WILTON

Filter by Roadway Distresses

Longitudinal/Transverse Crack Extent
None

Alligator Crack Extent
None

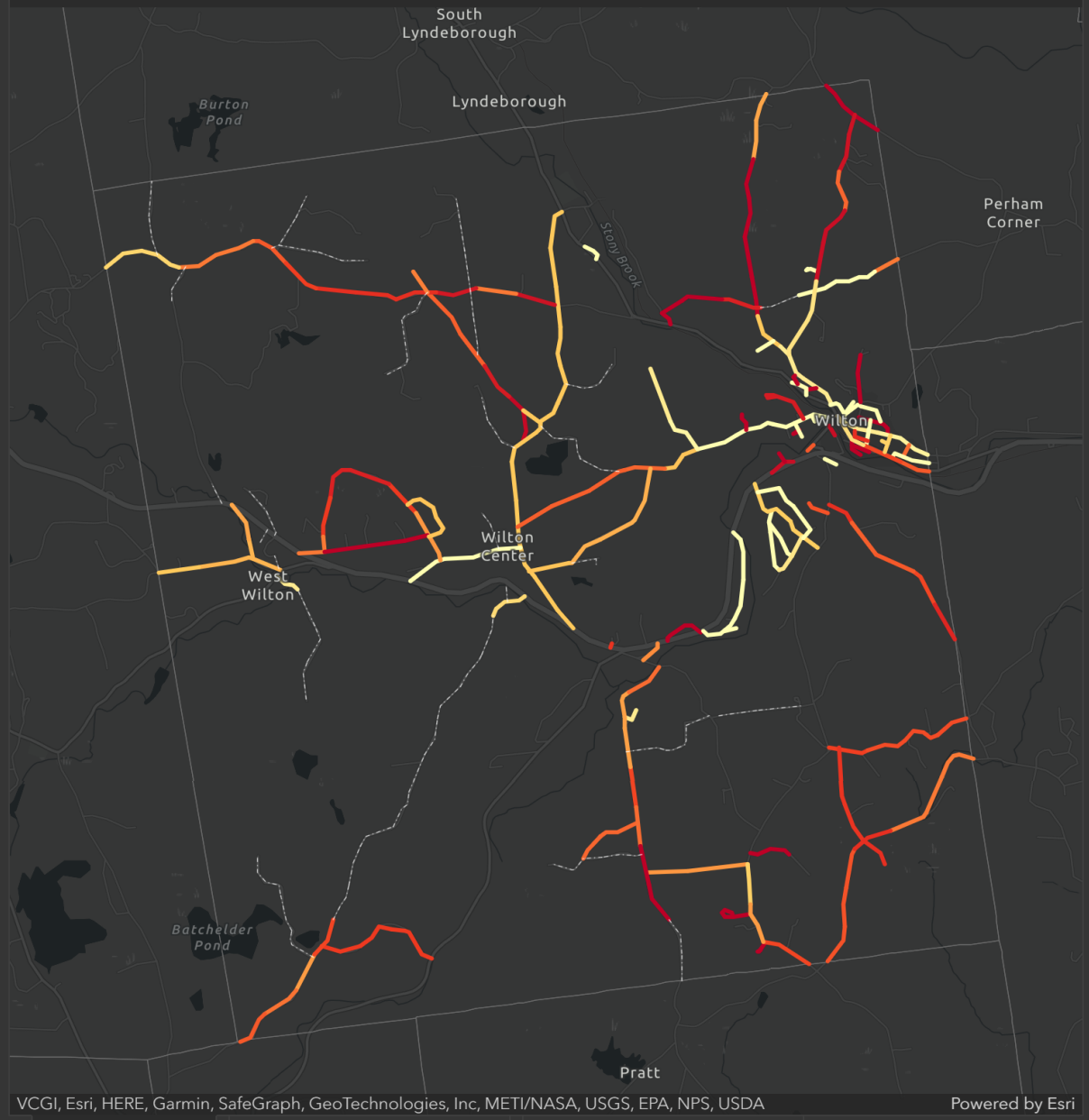
Edge Cracking Extent
None

Rutting Extent
None

Roughness
None

Drainage Condition
None

Select a Town in the top right corner to display RSMS Data



Condition Map | Condition Charts (Page 1) | Condition Charts (Page 2)

Street Name	Road Surface Width	Long/Trans Crack Severity	Long Trans Extent	Alli
Abbot Hill Acres Rd - 1	23	Medium	Low	M
Abbot Hill Acres Rd - 2	23	Medium	Low	M
Abbot Hill Rd - 1	23	Low	High	N
Abbot Hill Rd - 2	23	Medium	Medium	Lo
Abbot Hill Rd - 3	23	High	Medium	M
Adams Dr - 1	25	No Defect		N
Adrian Ave - 1	18	No Defect		N
Badger Farm Rd - 1	20	Medium	High	M
Badger Farm Rd - 2	20	Medium	High	M
Bales Hill Rd - 1	17	No Defect		N
Burns Hill Rd - 1	24	Medium	High	M
Burns Hill Rd - 2	24	Medium	High	M
Burns Hill Rd - 3	24	Medium	High	M
Burns Hill Rd - 4	24	Medium	High	M
Burns Hill Rd - 5	24	Low	Medium	Lo
Burns Hill Rd - 6	24	No Defect		N
Burns Hill Rd - 7	24	No Defect		N
Burns Hill Rd - 8	24	No Defect		N
Burton Hwy - 1	22	Medium	High	N
Burton Hwy - 10	23	High	High	M
Burton Hwy - 11	23	Medium	Medium	M
Burton Hwy - 12	23	High	High	M
Burton Hwy - 2	22	Medium	High	N
Burton Hwy - 3	23	Medium	High	M
Burton Hwy - 4	23	Medium	High	M

SADES RSMS - Paved

New expression
> 100
75
< 50

41
Miles of Paved Road

12
Miles of Unpaved Road

SADES RSMS Dashboard

Filter by Town
WILTON

Filter by Roadway Distresses

Longitudinal/Transverse Crack Extent
None

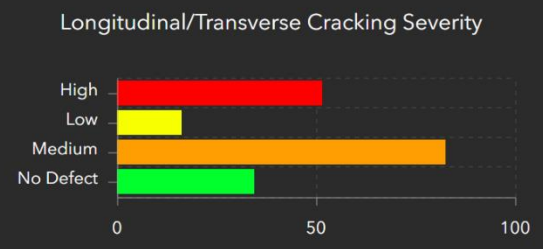
Alligator Crack Extent
None

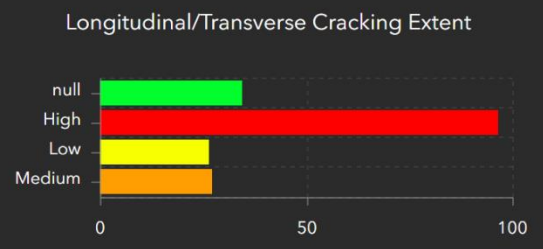
Edge Cracking Extent
None

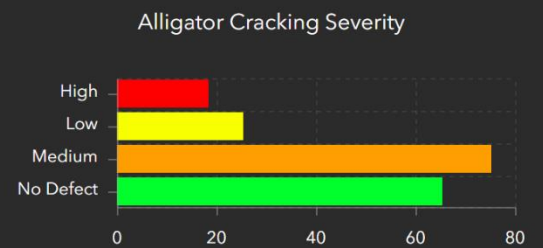
Rutting Extent
None

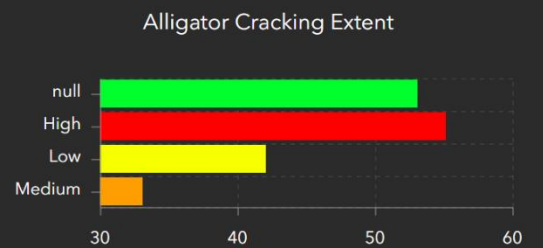
Roughness
None

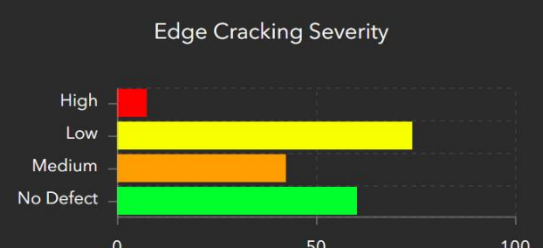
Drainage Condition
None

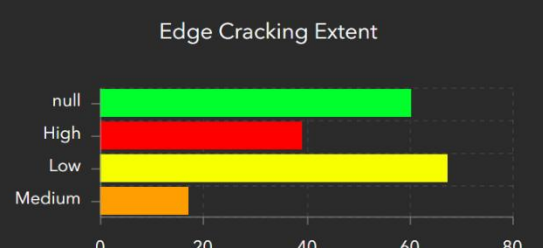


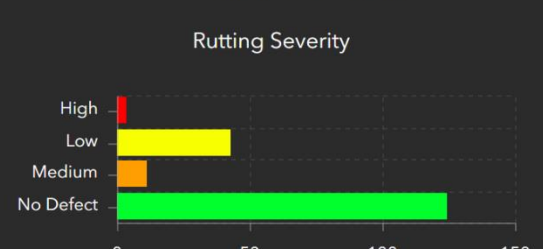


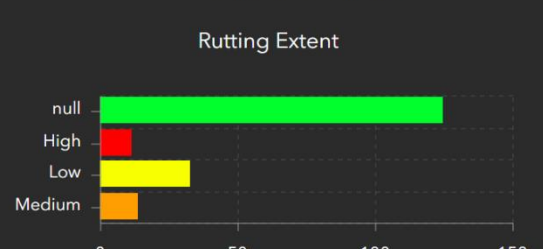












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Burns Hill Rd - 6	24	No Defect		N
Burns Hill Rd - 7	24	No Defect		N
Burns Hill Rd - 8	24	No Defect		N
Burton Hwy - 1	22	Medium	High	N
Burton Hwy - 10	23	High	High	M
Burton Hwy - 11	23	Medium	Medium	M
Burton Hwy - 12	23	High	High	M
Burton Hwy - 2	22	Medium	High	N
Burton Hwy - 3	23	Medium	High	M
Burton Hwy - 4	23	Medium	High	M

SADES RSMS - Paved

New expression
> 100
75

41
Miles of Paved Road

12
Miles of Unpaved Road

Smoother ArcGIS Integration

- Currently a “clunky” process to get data from ArcGIS Online to the Forecasting program
- Connection to the ArcGIS Rest API to make a more seamless process

Unpaved Roads

- SADES RSMS currently only supports condition assessment and repair forecasting for **paved** roads
- 34% of all NH locally maintained roads are unpaved
  - Over 4500 miles
- Working with a small working group to determine needs and next steps

Conclusion

- Achieved standardized local road assessment and forecasting program
- Provided our communities with a cost effective tool to manage their road networks

Questions/Discussion

Thank you!

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